

Observations on the nature and treatment of fractures of the upper third of the thigh-bone, and of fractures of long standing.

Contributors

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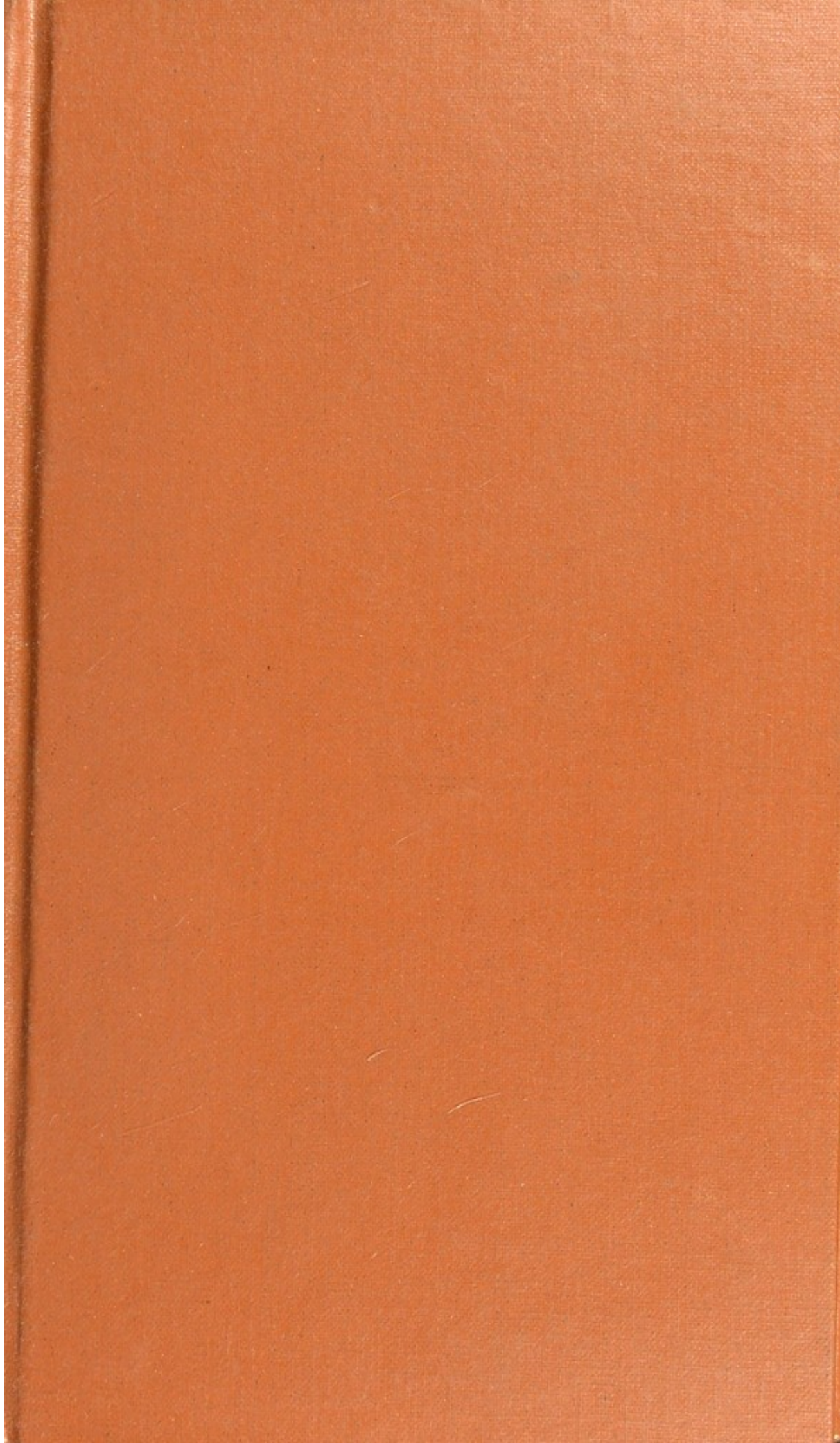
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OBSERVATIONS
ON THE
NATURE AND TREATMENT
OF
FRACTURES
OF THE
UPPER THIRD OF THE THIGH-BONE,
AND OF
FRACTURES OF LONG STANDING;

SHEWING THAT
FRACTURES OF THE NECK OF THE FEMUR
AND OTHERS WHICH OCCUR IN THE UPPER THIRD OF THIS BONE, ADMIT OF BEING
UNITED, SO AS TO RESTORE THE NATURAL POWERS OF THE LIMB,

Without Deformity or Lameness:

ALSO, THAT
THE PRINCIPAL CAUSE
WHICH PREVENTS FRACTURES OF THE LONG BONES FROM UNITING IS ATTRIBUTABLE
TO THE INADEQUACY OF THE USUAL MODES OF TREATMENT;

AND THAT
FRACTURES WHICH HAVE EXISTED MANY MONTHS
MIGHT GENERALLY BE UNITED BY
THE PROPER EMPLOYMENT OF MECHANICAL MEANS ALONE,
WITH ALMOST AS MUCH FACILITY AS SIMPLE FRACTURES IN THE
RECENT STATE.

ILLUSTRATED BY CASES OBTAINED FROM PUBLIC AND PRIVATE PRACTICE.

Second Edition, with an Appendix.

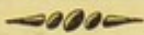
By JOSEPH AMESBURY,
CONSULTING SURGEON TO THE ROYAL UNION ASSOCIATION; SURGEON TO THE
SOUTH LONDON DISPENSARY; LECTURER ON SURGERY, ETC.

LONDON:
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1829.

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PREFACE.



IN this volume, I have entered, at some length, into the consideration of the nature and treatment of fractures of the upper third of the thigh-bone, and of fractures of long standing, which occur in the upper and lower extremities; and I have endeavoured to shew, that deformity and non-union are more to be attributed to the imperfect modes of treatment, still generally advised, than to any other cause.

The doctrines and plans which I have brought forward, I have attempted to illustrate by various cases; the treatment of many of which I have con-

ducted in public hospitals, through the kindness of the surgeons under whom they were admitted. Among these gentlemen I have had most frequently to notice Mr. Travers and Mr. Green, whose polite attention I have long experienced and most highly appreciate.

In the course of my enquiries, I have deemed it necessary to comment upon the most usual modes of treatment; and, in some instances, to condemn doctrines and plans now much recommended and pursued. I have done so, however, not from any disrespect or unfriendly feeling towards the gentlemen by whom they were introduced. I hope I might regard the surgeon as my friend, and, at the same time, oppose such of his principles and practice as seem to me objectionable. My motives have been profes-

sional advancement and public good; and in the attainment of these, it will be seen, that I have neither been intimidated by high and long-established authority, on the one hand, nor, I trust, misled by prejudice, on the other. I have brought to the investigation of my subjects, all the calmness and consideration which it was in my power to exercise; I have attempted to clear away some of the obscure notions by which they were surrounded; I have endeavoured to elicit truth; and, I am humbly of opinion, that I have, at least, succeeded in showing, that the field in which I have been labouring, though not of late neglected, still required culture.

Great Surrey Street,

October, 1828.

PREFACE
TO THE SECOND EDITION.

So short a period has elapsed since the publication of the First Edition of this Work, that I have had but little time to collect new matter for that which I now submit to the inspection of the Profession.

I am happy, however, to have it in my power to state, that my experience continues to add further support to the doctrines which I have endeavoured to inculcate, and also to the means which I have ventured to recommend.

82, *Great Surrey Street,*
February, 1829.

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PART I.

FRACTURES OF THE UPPER THIRD OF THE THIGH-BONE.

CHAP. I.

THE CAUSES, SYMPTOMS, AND NATURE OF FRACTURES OF THE UPPER THIRD OF THE THIGH-BONE.

SEC. 1.—*The Classification of Fractures of the Cervix Femoris.*

THE profession has, within these few years, been favoured with much important information upon fractures of the cervix femoris, to which I must frequently allude in the course of my observations upon this subject. Those points which, as far as I know, are original with myself, I shall incorporate with the observations of other surgeons, in order to place this, perhaps the most difficult, part of my undertaking, as clearly before the profession as circumstances will allow.

Mode of treating this subject.

Sir Astley
Cooper's divi-
sion of frac-
tures of the
neck of the
thigh-bone.

Sir Astley Cooper has divided fractures of the neck of the thigh-bone into two kinds, each dependent upon the situation of the fracture; those fractures which are altogether within the capsular ligament forming one kind, and those which are external to it the other.

The Author's
views on the
division of frac-
tures of the
neck of the
thigh-bone.

I agree with Sir Astley in the propriety of this division, as far as it goes; but I think it is of practical importance to consider fractures of the cervix femoris which occur within, and those which occur external to the synovial capsule, in the same manner as fractures in the middle or any other part of the bone, as far as respects the particular state and direction of the fracture. Hence it will appear, that according to the view which I take of fractures generally, each of the kinds mentioned by Sir Astley Cooper advantageously admits of a subdivision. Those fractures which occur entirely within the synovial capsule might be divided into fractures without any considerable laceration of the close coverings of the neck of the bone, and into fractures accompanied with an extensive laceration, or complete division of these coverings. Fractures external to the capsule might also be divided into two kinds, one of which is accompanied with little or no laceration of the investing soft parts, and the

other with great laceration, or complete division of them.

Fractures of the neck of the thigh-bone might be incomplete, by which I mean, as I have elsewhere described, that the bone is not entirely divided; or they may be complete, by which I understand a complete division of the osseous structure.

Division of fractures into incomplete and complete.

Incomplete or complete fractures might be transverse, oblique, or comminuted. Incomplete transverse fractures however, will probably be seldom met with in this part of the femur; but as the possibility of their occurrence cannot I think be doubted by scientific surgeons, I see no objection to the admission of such fractures in this arrangement. Incomplete oblique fractures are easily produced in recently dead bones, and though we might not be able to distinguish them, with certainty, during life from various affections of the hip-joint, they occasionally occur from the operation of causes which produce them in other situations. Incomplete comminuted fractures might also be easily produced after death, and they are sometimes occasioned during life, by the force of some projectile, as a musket-ball.

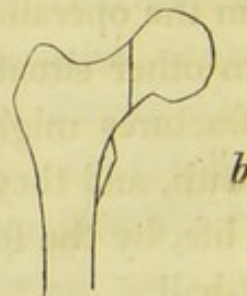
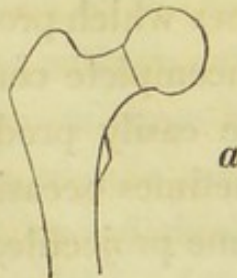
Varieties of incomplete and complete fracture.

I shall, for the present, pass over the further investigation of *incomplete* fractures of the cervix femoris, and enter at once upon the consideration of fractures which are *complete*, beginning with those which are situated within the synovial capsule.

SEC. 2.—*Fractures of the Cervix Femoris within the Synovial Capsule, unaccompanied with any considerable laceration of the investing Membranes.*

Complete fractures of this part.

When a complete fracture within the capsule of the joint is transverse, it is usually situated close up against the head of the bone, (*a*). When it is oblique, it might pass through the bone in different directions, but the most common direction that it takes is downward and outward, (*b*). Complete fractures of this part are sometimes comminuted.



Some surgeons might be inclined to doubt the possibility of fractures occurring within the synovial capsule, without any considerable laceration of the close coverings, in consequence of their tenuity. Sir Astley Cooper has admitted the possibility of such accidents; but I am not aware that he has stated, in any part of his work, that they actually do occur. I shall, however, endeavour to prove, that this opinion is not founded upon any hypothetical speculation, but upon the more solid basis of analogy, experiment, and fact.

Observations,
shewing that
such fractures
may occur.

From analogy, we are led to believe, that fractures of the neck of the thigh-bone within the capsule, may take place without any considerable division of the periosteum and reflected membrane, because we find, that fractures occur in other situations with but little laceration of the periosteum. The only thing which is to be observed between fractures of the cervix and those which occur in other situations, as far as regards this question, is, that the reflected membrane and periosteum covering the neck of the bone, will probably, in general, allow of being more easily lacerated than the periosteum covering the middle of the bone, in consequence of being unsupported by the attachment of muscles.

Analogical
proof.

Proof from experiment.

From experiment, we should conclude, that fractures of the cervix femoris might occur in the living, without any considerable laceration of the close coverings of this part of the bone, because we can readily produce them in bones recently dead.

Fractures of this description have been met with.

Facts, also, derived from actual inspection of the parts after death, might be adduced, to show that such fractures do actually occur. I have had an opportunity of witnessing this myself, in one instance, where the patient died from organic disease, a short time after the accident which occasioned the fracture.

The age of persons most subject to fractures within the capsule.

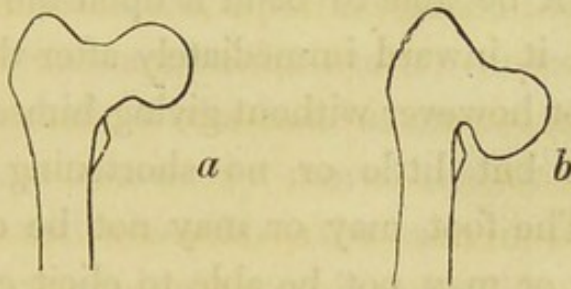
The fractures of which I am now speaking, in common with those accompanied with laceration of the close coverings, occur *principally* in people above the age of 50 years.

Predisposing causes.

Old people are particularly predisposed to fractures of the neck of the femur, especially within the capsule, in consequence of the change which it frequently undergoes, after the middle period of life. The internal part of the head and neck of the bone sometimes becomes of a loose cancellated structure, covered by a thin shell of bone; often so soft that it might be cut with a common knife.

Occasionally this altered condition leads to an unnatural direction of the cervix, with respect to the shaft of the bone, which facilitates still more the occurrence of fracture. The head of the bone, in some cases, is gradually driven down by the superincumbent weight of the body, so as to bring the neck to a right angle with the shaft, (*a*). Now and then, in very advanced age, the head of the bone is depressed, so as to occupy a situation even lower than that part of the neck which joins the trochanters, (*b*).

Unnatural direction of the cervix.



The immediate causes of fractures of the neck of the thigh-bone in old people, especially those which occur within the capsule, are often very slight, such as a slip of the foot from the curb-stone down upon the carriage road when the weight of the body is upon the slipping limb; slight falls upon the trochanter; trips in the act of walking, &c.

The immediate causes of fracture in this part.

The diagnosis of these fractures, when unaccompanied with laceration, is extremely diffi-

Diagnosis in fractures without laceration.

cult ; but as it is of great importance that this should be discovered, those symptoms by which, it seems to me, we should be guided, require our particular attention.

The symptoms of this accident not always strongly marked.

The symptoms which accompany these injuries, as far as I have been able to determine, are few, and these, I am sorry to say, are by no means prominent. Notwithstanding the existence of a fracture of this description, the patient might be able to exert considerable power in the limb. He might be able to bend it upon the pelvis, or to roll it inward immediately after the accident ; not however without giving himself pain. There is but little or no shortening of the limb. The foot may or may not be everted. We may or may not be able to elicit crepitus. Hence it will appear, that the two most striking symptoms which accompany a fracture of the cervix femoris *with laceration* do not exist, or at most very slightly, while the close coverings remain entire, and the neck of the bone continues of its natural length. The reason of this will immediately appear, when we consider, that the retentive power of the periosteum and reflected membrane being entire or nearly so, prevents the fractured ends from being much displaced, and, at the same time, in a very great measure, pre-

vents eversion of the foot ; and, in consequence of the great facility with which the head of the bone moves in the acetabulum, crepitus will seldom be produced. In order that the crepitus of fracture should be rendered evident, it is necessary that the broken surfaces should be made to rub upon each other. This cannot sometimes be done, in these accidents, without much difficulty ; for the head of the bone moves readily in the acetabulum, upon receiving the slightest impulse ; and this motion of the head of the bone cannot always be restrained, especially when the investing membranes are but little torn ; consequently, when the shaft of the bone is moved, the head of the bone commonly moves with it simultaneously ; and when this is the case, in the same relative degree, crepitation is never felt.

The symptoms of this accident, then, are confessedly obscure. We must depend, in a great measure upon the history of the case, into which we should inquire most minutely. A great and sudden diminution of power in the limb, referred principally to its upper and inner part, and occurring immediately after the infliction of an injury, of that description which usually produces fracture of this part, must be regarded as a symptom of considerable impor-

Those most to
be depended
upon.

tance. There is tenderness in the joint, and some pain experienced in the soft parts in the direction of the pectineus muscle and the tendon of the psoas magnus and iliacus internus, and sometimes in the hollow behind the trochanter. The patient may be able to turn the limb inward or outward; he may be able to bend it upon the pelvis, but not without pain, and a remarkable sense of weakness in the joint. The close coverings may yield so as to allow of slight eversion and slight shortening of the limb. The swelling in these accidents is not likely to be great, unless the surrounding parts are much injured by the blow, or other force, which occasioned the fracture. That which occurs is confined principally to the joint. When these symptoms exist, we might, I think, fairly suspect the existence of a fracture; but, in order to make ourselves more certain, we should examine the limb very attentively. This should be done, however, with the utmost caution.

Knowledge requisite to enable the surgeon to examine the limb with safety to the patient.

We must remember that the fractured ends of the bone, in this accident, are held together by the periosteum and reflected membrane, which are placed in close contact with the bone at the seat of injury. These are in extreme danger of laceration, if the limb be roughly

handled, or incautiously moved by the patient or his attendants. The periosteum and reflected membrane possess but little sensibility in the healthy state; hence it will appear that, before inflammation comes on, much mischief might be done to them, without a comparative expression of pain on the part of the patient. In order to guard against this evil, we should know in what position of the limb the periosteum and reflected membrane are most likely to be put upon the stretch. When we are in possession of this knowledge, the course to be pursued is simple and easy. The mode in which the manual examination is conducted, might materially influence the result of the case; and, as I am not aware that any author has given directions upon this subject, I shall be excused for dwelling a little upon it in this place.

When a patient is placed upon his back in the horizontal position, and has the limb, in a natural state, bent upon the pelvis, the superincumbent weight of the limb is thrown upon the acetabulum; but when a fracture exists in the neck of the bone, the weight of the limb is not propagated along the bone to the acetabulum uninterruptedly, as when the bone is entire, but is received by the close coverings of the

The effects of bending the limb upon the pelvis—of bearing upon it—of extending it.

cervix at the breach of continuity, from which it passes to the pelvic portion of the bone, and is then received by the acetabulum. Here we see that, when there is a solution of continuity in the neck of the bone and the limb is bent upon the pelvis, the principal part of the weight of the limb is thrown upon the periosteum and reflected membrane, before it reaches the acetabulum. These coverings are, therefore, put upon the stretch, and consequently pain is experienced by the patient, if the limb be strongly bent upon the pelvis. Again, when a fracture exists in the neck of the bone, without any considerable laceration of the close coverings, it acts upon these coverings with the advantage of a long lever; and, unless great care be taken, they are in danger of being completely divided. It is worthy of remark, that this stretching effect, experienced by the periosteum and reflected membrane, is produced quicker when the limb is bent upon the pelvis while it is inverted and adducted, than when it is everted and abducted. The reason of this is evident. In bending the limb, so as to make it form with the body an acute angle, it meets resistance quicker, or by moving through a smaller space in the first instance than in the second, because the upper and anterior part of the acetabulum forms a

fulcrum to the femur, which does not happen when the limb is bent upon the body in the abducted and everted position; and, hence we find, that a patient with a fracture of the neck of the thigh-bone, always experiences more pain when the limb is bent upon the pelvis, with the foot inverted and adducted, than when it is moved in any other direction. If the limb be forcibly extended, or the patient attempt to bear upon it, the close coverings are also stretched, and the patient consequently complains of an increased degree of pain, at the upper and inner part of the thigh.

Crepitus, which must be regarded as the most unequivocal sign of fracture, might or might not be produced; for, as I have said, the head of the bone moves so readily in the acetabulum, that the least impetus, even through the periosteum and reflected membrane, will cause it to move simultaneously with the shaft; and if it should do so in the same relative proportion, crepitus cannot be felt. If crepitus be not elicited by bending the limb upon the pelvis, the surgeon may try to produce it, by causing the limb to be *gently rotated*, while he endeavours to fix the head of the bone, by pressing it, with his fingers, back against the acetabulum.

Summary of
the symptoms
of this accident.

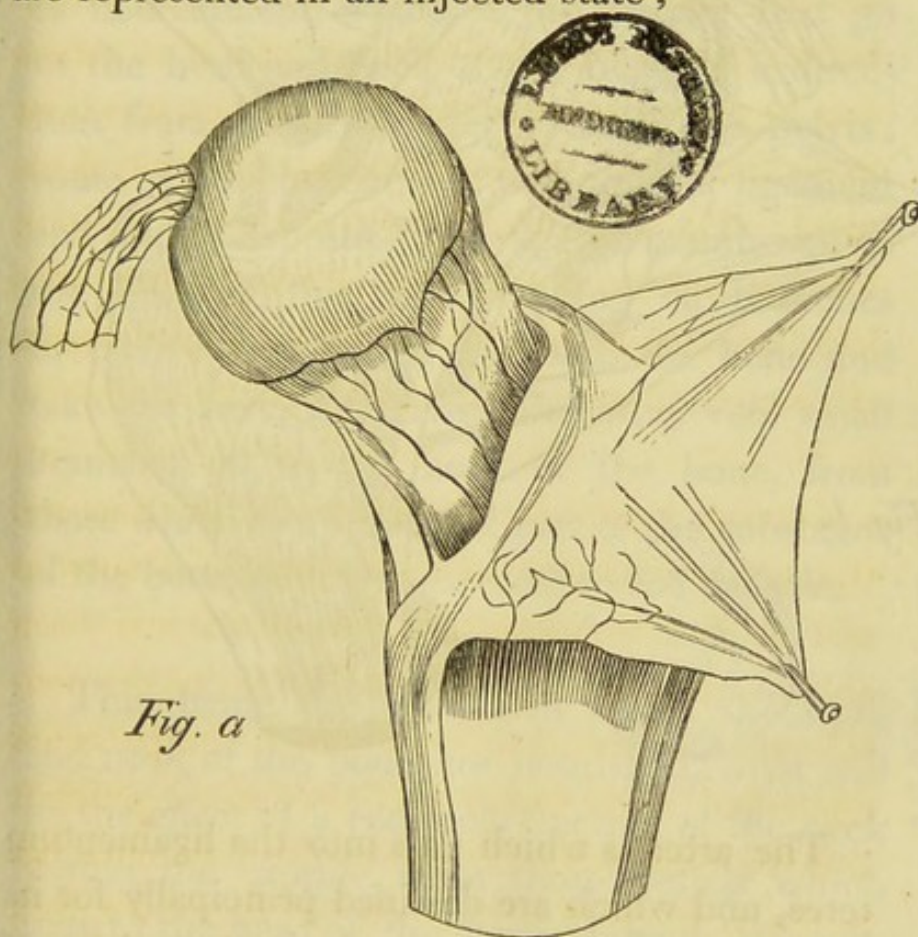
If I may be allowed to sum up the symptoms of this accident, I may state, as far as my observation will, at present, enable me to decide, that the patient feels, immediately after he has sustained this injury, a remarkable diminution in the powers of the limb. He feels pain at the upper and inner part of the thigh, especially in the line of the tendon of the psoas magnus and iliacus internus, which is increased when the limb is made to bear a part of the weight of the body; and sometimes when the limb is extended in a straight line with it; or when it is bent upon the pelvis, and at the same time rolled inward. He experiences tenderness in the joint when it is pressed upon. Crepitus is sometimes felt; and there is, occasionally, a slight degree of retraction and eversion of the limb.

Having mentioned the causes of this fracture, the age at which it most frequently occurs, as well as the symptoms, as far as I have been able to ascertain them, I shall go on to the consideration of the manner in which the parts are nourished, both before and after the accident; and shall endeavour to show the difference between a fracture of the cervix femoris within the synovial capsule, when unaccompanied with laceration of the close coverings, and a fracture

of the middle of the bone as far as it regards the reparative process.

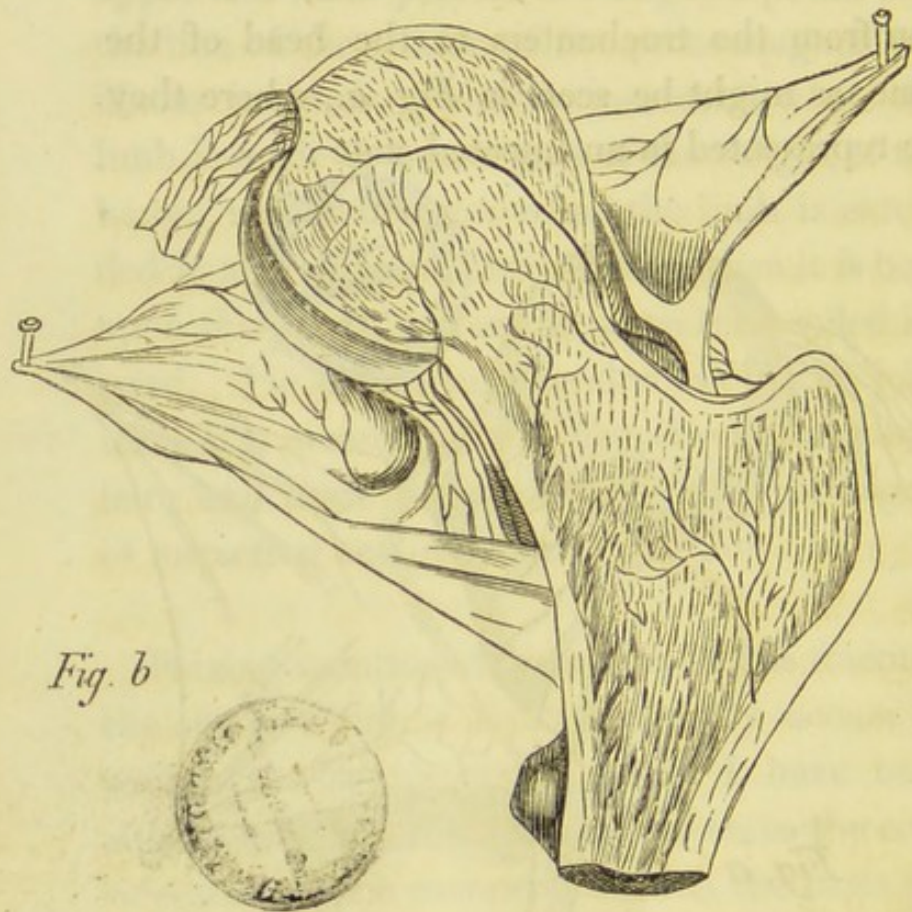
It will be recollected, that arteries supplying the head and neck of the bone with blood for their nourishment and reparation, ramify in the periosteum and reflected membrane, in a direction from the trochanters to the head of the bone, as might be seen in *Fig. a.*, where they are represented in an injected state ;

The manner in which the head and neck of the bone are nourished when in the natural state.



and that branches are sent into the bone from

the periosteum and reflected membrane, which take the same direction, *viz.* from the trochanters towards the head, as in *Fig. b.*, which represents a section of an injected femur, with part of its capsular and round ligament attached.



The arteries which pass into the ligamentum teres, and which are destined principally for its support, may convey a very small quantity of blood to the head of the bone; but they are

so extremely minute that we cannot suppose, that the head of the bone derives any considerable portion of its nourishment from this source. What, then, is the difference in the mode by which nourishment is conveyed to the head and neck of the thigh-bone within the capsule, and that by which the other parts of the bone are nourished? It will be seen that, if we leave out of our consideration the minute arteries of the ligamentum teres, we have only one source of nourishment, which is the arteries that go to the head and neck of the bone, in a direction from the trochanter towards the pelvis; some of which penetrate the capsular ligament and ramify beneath the reflected membrane to the head of the bone, sending off branches in their course, which pass into the bone and take the same direction; and other very small branches go to the neck of the bone, from those which ramify in that part of the substance of the bone, which is external to the capsule.

This being the manner in which the head and neck of the bone are nourished, what will be the effect of a complete fracture of the neck within the capsule, upon those vessels which pass to the head of the bone through the substance of the neck? It is evident, that the

The effect of fracture upon the vessels in the substance of the bone.

arteries which enter the bone on the trochanter side of the fracture, will be divided, as in *Fig. c.*; consequently, a very considerable portion of the nourishment, which would otherwise be conveyed to the pelvic portion, will be cut off.

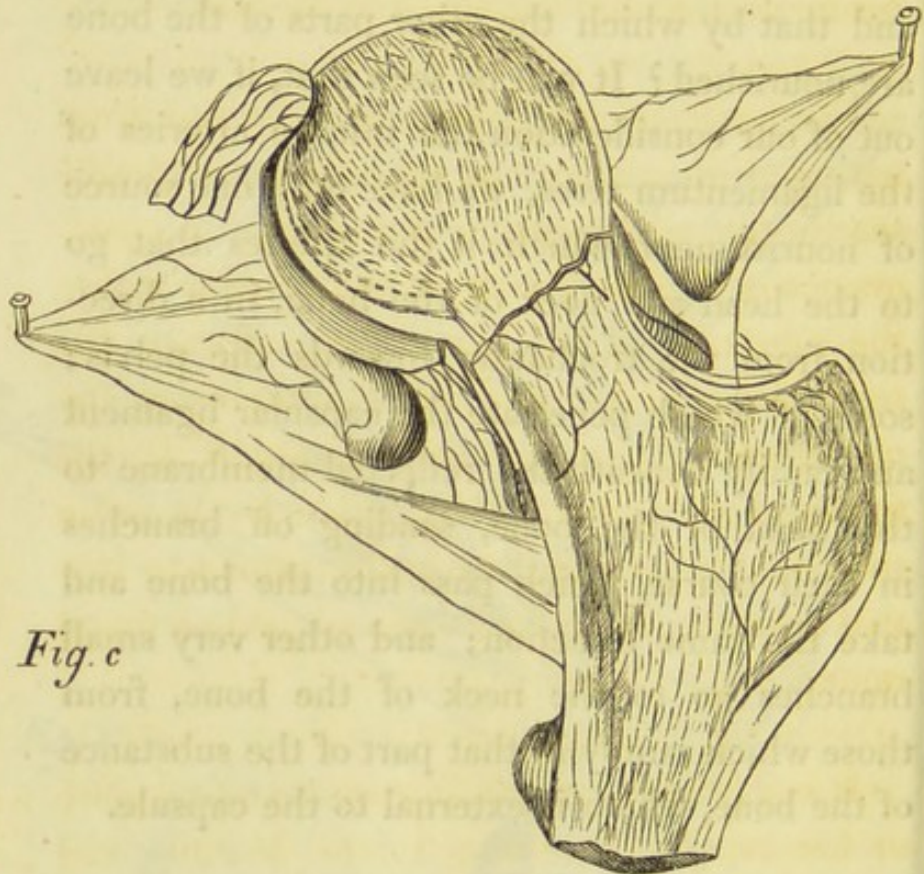


Fig. c

From this we see, that the pelvic end of the bone is placed under circumstances somewhat different from a fractured end of a bone in any other situation external to a capsule, even when the fracture is of the favourable kind, of which we are now speaking. In what respect? The

fractured ends external to a capsule are pretty equally supplied with blood, in consequence of arteries being equally distributed, or nearly so, through each of the fractured ends; which is not the case when a fracture of the neck of the bone exists, within the synovial capsule.

We have now to consider how far the diminution of the quantity of nourishment naturally sent to the pelvic portion of the bone, in consequence of the laceration of the arteries within the substance of the neck, may influence the reparative process; and whether there are any circumstances in the vital condition of the fractured ends, that render union by bone in such cases physically impossible; and why it is that fractures of this kind are so seldom found united.

It is a general law for fractures to unite, more or less rapidly, according to the quantity and capacity of the blood-vessels that supply the fractured parts. In the young, the arteries are large and numerous, and in them we find the union of a fracture speedily effected; in the old, they are smaller and much less abundant, and consequently, the uniting process in them is comparatively tardy. Let us apply this law in the

Is the division of these vessels sufficient to prevent osseous union?

kind of fracture which we are now considering. I have said, that the bones of old persons unite much more tardily than those of young ; occasionally they take double, sometimes treble the time in uniting, and that the cause of this, is the diminished quantity of blood sent to them. Now, the fracture of which we are speaking, occurs principally in old people, in whom the blood is scantily sent to the bones ; and the fracture renders this supply to the head of the femur still less, by tearing through a portion of the vessels, which go to the pelvic portion. What is the evident inference to be drawn from these facts ? That, as there is in the pelvic portion a less supply of the pabulum, which is necessary for the production of the uniting medium, the process of union must be retarded, as an edifice takes a longer period in building when the labourers are few, or the materials supplied but slowly ; but we must not consider from this, that a fracture thus situated, can never unite, any more than we may infer, that an edifice so circumstanced, could never be built. Notwithstanding the vessels in the substance of the bone are torn through, there are yet left entire the majority of those that pass over the fracture, as they ramify in the periosteum and reflected membrane, in their way to the pelvic extremity

or head of the bone; consequently, a considerable supply of blood is still sent to the pelvic portion. Here a question naturally arises—whether this supply, added to the small quantity which the head of the bone may derive through the arteries of the ligamentum teres, and that which it obtains by a renewed arterial communication between the fractured surfaces, be sufficient to produce a bony deposit from the fractured end of the pelvic portion? The number and size of these vessels would lead us to conclude, *à priori*, that they are sufficient for this purpose; and that they are so, is rendered evident by the appearance of the fractured end, which, after a time, becomes smooth, and also denser than natural.

There are other circumstances attending this variety of fracture, which, it might be said, have an influence in preventing the process of osseous union. The only one, however, which appears to me to bear upon the *physical* possibility of union is the effect of the synovia. If any portion of the periosteum and reflected membrane be torn through in the slightest degree, which it is probable they will be in every case, the synovia will get between the fractured surfaces of the bone; and it might seem, that its pre-

Is the presence of synovia between the fractured surfaces sufficient to prevent union?

sence would prevent the bony matter, thrown out from the opposing ends, from coalescing, and that, consequently, bony union would not take place, even though a large quantity of callus be deposited. Granting, however, that the synovia might have some effect in preventing union by bone; yet we have abundant evidence to prove, that its influence is readily overcome in other situations.

Its influence is readily overcome in other situations.

When a fracture extends in an oblique direction from the trochlea of the os humeri to just above the inner or outer condyle, the synovial membrane must frequently be more or less torn, and when it is lacerated, the synovia readily insinuates itself between the fractured surfaces; but we do not find that its presence in such cases prevents the fracture from uniting. The same might be said of fractures extending into the knee-joint, or into the ankle-joint; and I see nothing which would lead me to infer, that the influence of the synovia in fractures of the neck of the thigh-bone within the capsule, is such, as to make them of itself an exception to the law which is found to obtain in the union of fractures extending into other joints.

Inference respecting the

It appears to me that, as far as regards the

physical or vital condition of the parts, there is only one circumstance which in any way tends to make the prognosis more unfavourable in fractures of the neck of the thigh-bone, within the synovial capsule, when the close coverings are but little injured, than in fractures extending into other joints, which is the division of the arteries that go to the head of the bone, through the substance of the neck ; and this is not, in my opinion, sufficient to render it physically impossible that union should take place.

physical possibility of union by bone.

I am well aware that, under the ordinary treatment, the fractured ends are not kept in a state of quietude ; and that the degree of motion which is allowed to take place in these fractures, is often sufficient to prevent union in fractures much more favourably situated. It will, however, be perceived, that this impediment to union is referable to the imperfection of the mechanical means resorted to, rather than to the nature of the injury, for the cure of which they are employed. From the view which I take of this subject, the cause of want of union which is observed in these cases, is not physical, but mechanical ;—the fault lies at the door of surgery, and not in the nature of the accident.

The principal cause of non-union in these cases.

The close coverings are sometimes lacerated after the accident,

In the course of the preceding observations, I have laid great stress upon the importance of the periosteum and reflected membrane, as a medium through which nourishment is principally conveyed to the head of the bone when there is a complete fracture of the neck within the capsule, unaccompanied by any considerable laceration of these coverings; now it sometimes happens that, though these coverings shall not have been much lacerated by the accident, they are torn through after it, either by the incautious movements of the patient, or the improper handling of the attendants. This is likely to occur when the weight of the body is thrown upon the limb, as might be the case when this fracture happens to a person in a state of intoxication; or when the attendants are careless in removing the patient from place to place; or it might be produced even by the surgeon himself, if he be ignorant or incautious, in conducting his examination of the limb.

This has been observed by several surgeons.

That such an accident might occur must be evident, when we consider the thinness of these coverings, and the nature of the surfaces which are opposed to them—I mean the serrated edges of the fractured ends of the bone. The structure and state of the parts favour such an

opinion, and though we were less able to explain the fact, we should not, I think, be less constrained to receive it. Sabattier states, that he has seen this occur as late as the twenty-third day after the accident. I have seen three cases in which sudden retraction took place in a few days after the accident, in consequence of the incautious manner in which the parts were examined; which, in fractures within the capsule, can, it seems to me, only be accounted for upon the supposition that the investing membranes were then greatly lacerated, or entirely torn through.

I am disposed to believe, however, that the periosteum and reflected membrane are sometimes divided by the operation of causes which are not under the control of the patient; and which are quite independent of any awkward management on the part of the attendants. We know that when any part of the body is unnaturally pressed upon, and the pressure continued for a considerable period, it becomes thickened or absorbed; according to the degree of pressure exerted, and the power of the part to bear it. If the pressure be slight, and the power of the part strong, Nature builds up a barrier against the inconvenience; this we see

Division of the close coverings in consequence of absorption produced by pressure.

well exemplified in the formation of a common corn ; but, if the pressure be great, and Nature finds she cannot protect herself against it by adding layers of defensive matter, she effects the removal of a portion of the part, in order to facilitate her future operations. We see the pressure of tumours produce absorption of the bodies of the vertebræ of the ribs and other parts. May we not then, by a parity of reasoning, apply this law of nature with great propriety in the consideration of fractures of the neck of the thigh-bone ? We know that, in these cases, the keen and irregular edges of the fractured ends are constantly forced by the action of the muscles against the periosteum and reflected membrane, when they happen to escape laceration at the time of the accident ; what, then, should we infer would be the result of such constant pressure, as is kept up by those strong muscles which tend to retract the limb, and force the fractured ends against these coverings ? It seems to me, that if such pressure be allowed, it will be likely to effect a speedy absorption of the periosteum and reflected membrane in the situation of the fracture, and this absorption will be hastened by the friction which takes place when the patient moves ; and what would be the immediate consequence of a division of these

coverings thus effected? Retraction of the limb. This perfectly coincides with what takes place in other parts. If, in an oblique fracture of the leg, the bones are suffered to overlap, the riding is much greater a few days after the occurrence of the fracture, than within the first few hours. This difference arises from absorption, or from laceration of the contiguous textures after the accident, in consequence of the motion of the fractured ends of the bone; for the muscles very soon retract the lower portion of the bone, as far as the first laceration of the soft parts will allow, and then the ends of the bone are pressed by the action of the muscles against the contiguous textures, which must be frequently torn in parts by the ends of the bones, and in others are gradually removed by absorption; and the fracture rides in the same proportion, till the action of the muscles is resisted, and the ends of the bone prevented from any considerable extent of motion, by the adhesions which take place in the fracture, or by other means. One might at first suppose, that adhesions would as speedily take place in fractures of the neck of the thigh-bone within the capsule, as in those which are external to it; but, on further consideration, it will appear, that the adhesions which are produced between the fractured ends

of the cervix within the capsule, will be much more slowly effected, in consequence of the injured parts being so little assisted in producing them by those which surround the bone in this situation.

Inference.

Thus, then, we see that a fracture of the neck of the thigh-bone within the capsule, which at the time of the accident might have been of the most favourable kind for osseous union, may so far have the periosteum and reflected membrane injured by the improper management of the attendants, or by the motion of the broken surfaces arising from the movements of the patient, or by absorption in consequence of pressure, or by all these causes operating at one or at different periods, as to be converted into the state of a fracture, which, from the first, is of the most unfavourable kind for bony union, of which I shall treat in the next section.

SEC. 3.—*Fractures of the Cervix Femoris within the Synovial Capsule, in which the close Coverings of the Bone are nearly or quite divided.*

The causes of these fractures.

The predisposing and immediate causes of frac-

ture of the neck of the thigh-bone within the synovial capsule are the same, whether the fracture be or be not attended with a division of the periosteum and reflected membrane.

The symptoms of this accident, when accom-
 panied with a division of the close coverings,
 are much more strongly marked than in that
 where they remain nearly or quite entire; and,
 with few exceptions, are the same in all cases.
 When the fracture, of which we are now speak-
 ing exists, the retraction of the limb is usually
 from three quarters of an inch to an inch and a
 half; commonly, however, in the recent state
 of the injury, it is not more than an inch. There
 is eversion of the foot, attended with great
 diminution of the powers of the limb; the pa-
 tient, however, is still able to roll it inward, so
 far as to bring the foot from its everted position
 high enough to place the limb in that position
 which might be called supine, or in which the
 ball of the great toe and the superior anterior
 spinous process of the ilium are in a straight
 line with the long axis of the body. The pa-
 tient can also bend the limb a little upon the
 pelvis, but not without great pain, when the
 fracture is in the recent state. He experiences
 pain opposite the insertion of the *psoas magnus*

The symptoms.

and iliacus internus, which is increased when the limb is bent upon the pelvis, especially when it is, at the same time, adducted and inverted. The limb might be readily drawn down to its proper length, but, as soon as the extension is discontinued, it becomes again retracted; and might be passively moved in every direction, but not without producing pain. When the limb is rotated, the trochanter, instead of moving in a circle, is observed to roll, as it were, upon a pivot. Crepitus may generally be felt when the limb is drawn down, and then rotated, while the head of the bone is fixed firmly in the acetabulum, by pressing upon it with the fingers over the front of the joint.

The foot sometimes inverted.

It sometimes happens that this accident is accompanied by an inverted position of the foot. In the second part of the thirteenth volume of the Medico-Chirurgical Transactions, Mr. Stanley has mentioned a case, the only one, I believe, on record, in which there was inversion of the foot attending a fracture entirely within the capsule of the joint.

“ A middle aged man fell in the street, and his hip struck the curb-stone. The immediate consequences were, that the limb was inverted

and shortened to the extent of an inch, and no crepitus could be discovered. It was presumed that a dislocation had occurred, and accordingly an extension of the limb was made, and so great was the constitutional irritation occasioned by the repeated trials to reduce the supposed dislocation, that the man died about five months from the time of the accident. In the dissection of the hip a fracture was found extending obliquely through the middle of the neck of the femur, but entirely within the capsule. A portion of the fibrous and synovial membrane on the anterior side of the neck of the bone had escaped laceration.*

The foot is occasionally upright. I have seen only one instance of this, and am disposed to attribute the position which the limb assumed, in this case, to an entire state of a portion of the investing membranes on the anterior and posterior parts of the neck. These slips of the synovial and fibrous coverings might be separated from the bone sufficiently to allow of retraction to the extent of an inch or more, as

The foot is occasionally upright.

* The same position would be likely to occur if the fracture of the cervix, in this situation, were accompanied with a fracture separating the trochanters from the shaft of the bone.—*Author.*

might be seen in a preparation now in my possession.

No one position
constant.

Hence it appears that no one position of the limb can be considered as an invariable attendant on fractures of the neck of the thigh-bone, even when they are accompanied with laceration of the investing soft parts. Eversion of the foot, however, is almost always present when the fracture is in the neck only; and when the limb assumes any other position, it seems to me that it might be fairly attributed to the direction and seat of the fracture, and the peculiar laceration of the surrounding parts, which might take place at the time of the accident, or subsequently to its occurrence.

The cause of
the pain felt
upon rotating
the limb.

The increase of pain which is experienced on bending and rotating the limb, when the close coverings are torn through, arises principally from the friction of the serrated edges of the fractured surfaces against the loose and inflamed portion of the capsule of the joint; and not from any injury inflicted upon the synovial and fibrous membranes naturally investing the bone, as when these membranes are not divided.

Crepitus can-
not always be
elicited.

It often happens that crepitus is not disco-

vered, even when the other symptoms are so evident as to leave no doubt of the existence of a fracture. This is sometimes to be attributed more to the manner in which the examination is conducted than to the nature of these cases. I have frequently seen surgeons attempt to produce crepitus without drawing the limb down to its natural position; and, after twisting it about for a considerable time, they have pronounced that crepitus could not be felt. It is not to be expected that crepitus will be elicited by such a mode of examination. In order to enable us to produce crepitus, the limb should be first extended, with a view to bring the fractured surfaces in contact; and then rotated, while the head of the bone is fixed in the acetabulum by means of the fingers. The surgeon should place one hand upon the head of the bone and the other upon the trochanter major; and should press the head of the bone back against the acetabulum, while the assistant extends the limb and gently rotates it. As far as I can find, surgeons had overlooked the important advantage which is gained by fixing the head of the bone. I am not aware of any author who mentions it, nor of any surgeon who practises it, except those who have received the idea either directly or indirectly from myself. Still,

however, it must not be considered that crepitus might be discovered in every instance, even under the most judicious examination. For, in some cases, it is impossible to command the pelvic portion, so as to insure sufficient apposition of the fractured surfaces to allow of the production of crepitus. The head of the bone might be turned round in its socket, so as to place the fractured surface of the pelvic portion of the neck out of the way of that portion which is attached to the trochanter; and, when this happens, the latter will be brought into contact with a natural surface; and consequently, when the fractured surfaces are thus relatively placed, crepitus is not likely to be occasioned by rotating the limb, even when the head of the bone is prevented from moving. There is, then, in my opinion, two reasons to be assigned for the occasional absence of this symptom, even when the limb is judiciously examined: 1st. The great mobility of the head of the bone, whose motions cannot always be controlled, especially in fat persons; and, 2d. The contact of a natural and a fractured surface, which does not allow of the production of the crepitus of fracture.

Question as to
the possibility

It is a question at present agitated, whether

in this variety of fracture, union of the fractured surfaces can be effected, by the interposition of osseous matter? The opinion which now very commonly prevails, is, that a fracture of the neck of the thigh-bone, accompanied with considerable laceration, though it might not amount to a complete division of the close coverings, cannot be made to unite by bone. This opinion, promulgated by a gentleman whose professional acquirements I shall always respect, has led surgeons, in general, to abandon these cases to the operation of Nature, and hence we find, that a very numerous class of accidents—so numerous, indeed, that our hospitals are seldom free from them—are regarded as beyond the reach of surgery. As I cannot subscribe to this opinion, nor to the practice of leaving such patients to their fate, I shall, I hope, be excused for entering into this subject a little more minutely, and for investigating, somewhat critically, the arguments of that gentleman, who is the principal supporter of the doctrine of non-union.

of producing
bony union in
these cases.

When a fracture occurs in this situation, without laceration of the close coverings of the cervix, the arteries which go to the head of the bone through the substance of the neck, are, as

The mode in
which the head
of the bone is
nourished,
when the frac-
ture is accom-
panied with

laceration of
the investing
membranes.

I have said, torn through, and the vessels which principally supply the head, are, in such cases, conveyed to it over the fracture in the periosteum and reflected membrane; but, when the variety of fracture now under consideration exists, not only are the vessels which pass to the head of the bone through the substance of the neck divided, but also those which go to it in the periosteum and reflected membrane, in consequence of the laceration of these coverings. The state of the parts which is observed in these cases I have attempted to represent in the accompanying diagram. (*Fig. d.*)

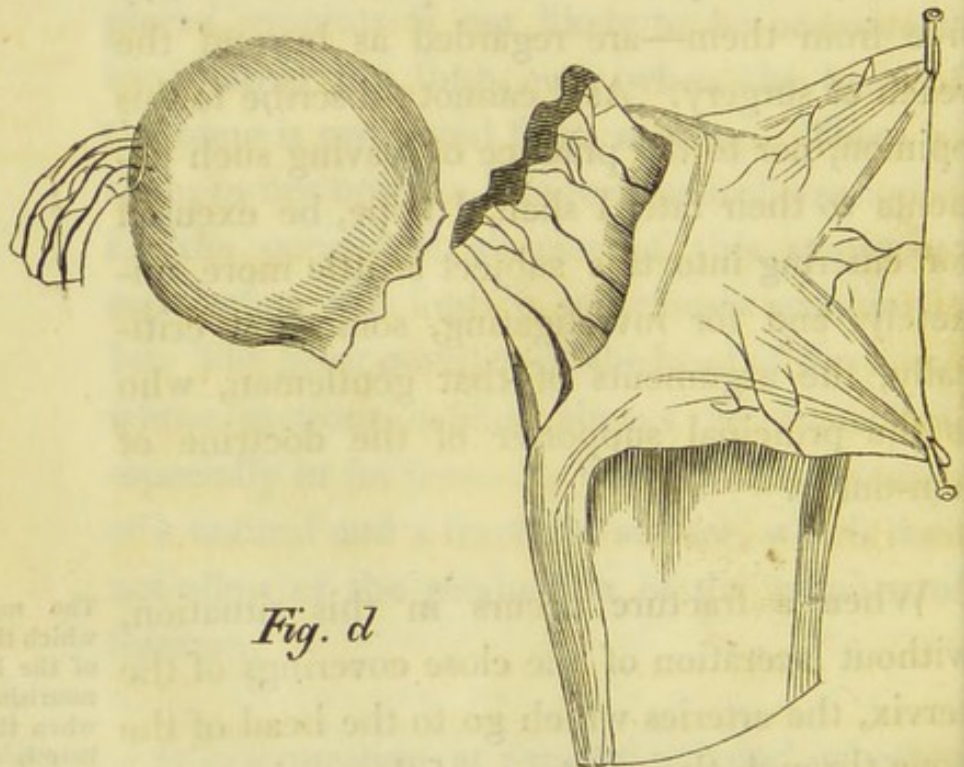


Fig. d

In fractures of this description, it is obvious, that the head of the bone is insulated from the shaft; and can only be nourished, while thus circumstanced, by the vessels which pass into it through the ligamentum teres. We should hardly suppose, *à priori*, that these vessels are sufficient to support the vitality of the head of the bone. Experience, however, proves that they are sufficient for this purpose, since I have never heard of more than one instance, and I am not aware of any on record, in which the head of the bone sloughed, in consequence of a simple fracture of the neck.*

We have here abundant evidence that the head of the bone receives a sufficient quantity of nourishment for its support; and the next point to be considered is, whether it receives enough for the production of an osseous union. If I properly understand Sir Astley Cooper, he believes it almost, if not quite, physically impossible, that bony union should be brought about in these cases; and his principal reason for this opinion is drawn from the manner in

The principal cause of non-union in Sir Astley Cooper's opinion.

* This was mentioned to me by Mr. Brodie. It occurred in a person whom he had an opportunity of examining after death.

which the pelvic portion is nourished, when there is a fracture of the neck in this situation, accompanied with extensive laceration of the close coverings of the bone. He says, "the principal reason which may be assigned for the want of union of this fracture, is the absence of ossific action in the head of the thigh-bone, when separated from its cervix, its life being then solely supported by the ligamentum teres, which has only a few minute vessels ramifying through it to the head of the bone."

The vitality of the head of the bone supported and a deposition of osseous matter produced.

The vessels, however, which enter the head of the bone in such cases, are not only sufficient to support its vitality, but are also adequate to the production of an osseous deposit; as is evinced by the state of the fractured surface of the pelvic portion, in many of these cases, a considerable period after the occurrence of the fracture.

Sir Astley Cooper's observations upon this subject.

Sir Astley Cooper, indeed, disputes this; but, in the very next paragraph, he says, "the cancelli are rendered firm and smooth by friction, as we see in other bones where their articular cartilages are absorbed, giving the surface the appearance of ivory."*

* In the fourth edition of his work on Dislocations, Sir

If this passage be strictly examined, I think it will appear that Sir Astley here admits all that is necessary for my present purpose, viz. that an osseous deposition does take place in the cancellous structure of the pelvic portion; otherwise we must infer, that friction alone is capable of increasing the density of bodies, so as to make those which are loose and cellular, like the neck of the thigh-bone, firmer than their natural structure. This, however, I believe, is not the case. I think it will be found that friction is as little capable of rendering the cancellated structure of the neck of the thigh-bone "firm and smooth," so as to "give it the appearance of ivory;" as it is of increasing the natural density of any other body whose parts are equally cellular and loosely connected. This

Observations
upon Sir Ast-
ley's state-
ments.

Astley states, that "there are upon the head of the bone very small white spots like ivory;" and, in the same edition, he says, "the fractured surface" of the pelvic portion "is sometimes partially coated with a ligamento-cartilaginous deposite." I give Sir Astley's expressions in the 1st and 4th editions of his work, because the ideas conveyed in both, upon this point, appear to me to be correct, though they differ a little from one another; for, in some cases, a great part of the fractured surface of the head of the bone has "the appearance of ivory," and in others, only "small white spots like ivory" are seen, and in some the surface is merely covered with a "ligamentous or a ligamento-cartilaginous deposite."

appearance of the fractured surface can only arise from a deposition of bone; which Sir Astley does not deny, by saying, that it is produced by the same cause as that which gives rise to it "in other bones," "when their articular cartilages are absorbed." I presume that few scientific surgeons will be disposed to dispute, that the dense structure which we see covering portions of the articular ends of a bone, in such cases, arises from an osseous deposition in the cancellated structure, and upon the surface of the denuded parts, from the arteries by which the bone is nourished; and, if this be the case, why should we assign the production of a similar appearance of the fractured surface of the pelvic portion of the cervix femoris to the operation of a cause which is incapable of producing it, when we see that it is effected in other situations by a natural process?

The vessels which enter the head of the bone might produce the appearance of ivory.

Independent of this fact, I see no sufficient reason to induce me to believe, that the same process which is accomplished on the articular surfaces, might not go on in the head of the thigh-bone when separated from the cervix, and only connected to the acetabulum by the intervention of the ligamentum teres, by an increased effort on the part of similar agents;

though it is probable that, this “appearance of ivory” will be more slowly brought about, in consequence of the vessels of the head of the bone being less numerous than those which supply the articular ends of the bone, where no fracture exists.

Let us pursue the arguments in favour of the physical possibility of union a little further. We see that splinters of bone which are insulated, will accept of union in the same way as other parts, provided they are not deprived of their vitality; and why should we deny this power to the head of the thigh-bone, which not only receives an adequate supply of blood for its support, but also for the production of an osseous deposition. Splinters of bone entirely detached, can only be passive in the process of bony union; and, consequently, are placed under circumstances much less favourable than the head of the thigh-bone, which it will be seen is able to assist in its accomplishment.

Further observations in favour of the possibility of bony union.

Sir Astley Cooper mentions two other causes, which also tend, though, in his opinion, in a *minor* degree, to prevent the consolidation of the fractured ends by the interposition of callus, namely, “want of proper apposition and the

Other causes of non-union.

absence of continued pressure;" to which he might have added a fourth cause, want of rest; but all these impediments are purely mechanical; and consequently do not influence the question respecting the physical possibility of bony union, but are referable to the treatment, the inadequacy of which, I shall hereafter attempt to demonstrate.

Sir Astley Cooper's statements, and the important fact derived from his investigations.

Sir Astley has shown that, these cases do not commonly unite by bone, indeed, so seldom does this take place, that he states, he has not yet seen a specimen sufficient to convince him that union by bone has ever been effected; but if a single case of bony union can be produced, the possibility of its occurrence, which is all I here contend for, will be, of course, at once established; and then we must consider, that the common results are principally to be attributed to the operation of causes, which are independent of the vital state of the fractured ends of the bone. It will then appear, that our eminent countryman has amassed evidence demonstrative of a most important fact, *viz.* that the usual modes of managing these cases are bad, and to their inadequacy we must principally refer the results which are usually observed. It will be seen that he has proved

a general law, that these fractures do not commonly unite under any of the ordinary plans of treatment; the whole of the cases he has brought forward, will serve to show this fact; but, it is not to be inferred from these cases, that these fractures cannot be united by bone under any treatment; nor should we do so, were he to add a thousand to the number; unless it were at the same time proved, that the mechanical impediments to union were effectually got over by the treatment adopted.

Though Sir Astley has not, I believe, yet seen a specimen sufficient to convince *him*, that this variety of fracture has ever united by bone, there are now four preparations which satisfy the minds of many other surgeons, that osseous union is occasionally produced. Different modes of treatment were resorted to in the management of the patients, from whom these preparations were taken, some of which, however, it might be easily shown, were very imperfect; but, notwithstanding this, the fractures were found united after death.

Specimens of
bony union.

The first case I shall mention, was a patient of Mr. Cribbs, Holborn, the history of which is given as follows, by Mr. Langstaff, who has the preparation.

The case described by Mr.
Langstaff.

The woman "was about 50 years of age when the accident occurred. The foot was everted, and there was shortening of the limb at this time, and, after death, it was shorter than the other full two inches and a half. She was confined to bed nearly twelve months; during the remainder of her life, which was ten years, she walked with crutches."

"This" says Mr. Langstaff, (alluding to the bone in question, *see Plate 1*) "is a specimen of fracture of the neck of the thigh-bone within the capsular ligament; the principal part of the neck is absorbed; the head and remaining portion of the neck were united principally by bone, and partly by a cartilaginous substance. The capsular ligament was immensely thickened and embraced the joint very closely. The cartilaginous covering of the head of the bone and acetabulum had suffered partial absorption; the internal surface of the capsular ligament was coated with lymph."

"On making a section of the bone, it was evident that there had been a fracture of the neck, within the capsular ligament, and that union had taken place by osseous and cartilaginous media. With a view of ascertaining

whether there was real osseous union, the bone was boiled many hours which discoloured it; but, by destroying all the animal matter, it satisfactorily proved the extent and firmness of the osseous connexion, and the vacant spaces which had been occupied with cartilaginous matter; these appearances are well exhibited in two drawings made shortly after the boiling.*

The particulars of Dr. Brulatour's case will also be found in the same volume of the Medico-Chirurgical Transactions, stated as follows:—

“Dr. James, an English physician, forty-seven years of age, in good health, was thrown from his horse on the 20th of March, 1826. He fell directly upon the right great trochanter, but got up and walked a step or two, which occasioned such acute pain in the hip-joint, that he instantly fell again.

Dr. Brulatour's case.

On examination immediately after the accident, Dr. Brulatour observed the principal signs of fracture of the neck of the femur, such as shortening of the affected limb; turning outwards of the foot; and a feeling of crepitation in the joint, when counter-extension was made.

* Medico-Chirurgical Transactions, Vol. XIII.

“ During the treatment of the case, the patient was confined to his bed for two months, and for the whole of that period, counter-extension was constantly kept up, so as to preserve the limb of its natural length.

“ On the 20th of May, the splints and bandages were all taken off, and on the 30th, the patient got up, and with the assistance of crutches, walked a little in the room. On the 20th of June the crutches were put aside, and he walked with only the assistance of a cane. In August he was able to walk without any assistance, and subsequently recovered the full use of the limb.”

Appearances
after death.

Dr. James died on the 22d of December, and upon inspecting the injured parts, the following appearances presented themselves. “ 1. The capsule a little thickened. 2. The cotyloid cavity sound. 3. The inter articular ligament in a natural state. 4. The neck of the femur shortened ; from the bottom of the head to the top of the great trochanter was only four lines, and from the same point to the top of the small trochanter six lines. 5. An unequal line surrounded the neck, denoting the direction of the fracture. 6. At the bottom of the head of the

femur, and at the external and posterior part considerable bony deposite had taken place. A section of the bone was made in a line drawn from the centre of the head of the femur to the bottom of the great trochanter, so as perfectly to expose the callus. The line of bone indicated by the callus was smooth and polished as ivory. The line of callus denoted, also, that the bottom of the head of the femur had been broken at its superior and posterior parts."

Mr. Chorley, of Leeds, kindly sent to me the following case, which was read, by his desire, at the London Medical Society.

Mr. K. aged 72, in descending four steps from a neighbour's door, came suddenly on the pavement, and fell against the curb-stone, and was instantly so much hurt as to be unable to move from the place.

Mr. Chorley's
case.

Upon examination, the limb was found shortened; the right knee and foot were turned outward; and the whole limb appeared loose, as if it had lost its support from the upper joint.

The patient was carefully removed to his room, and placed on the sound side. Pillows

being placed between the limbs, so as to support the leg and thigh, gentle extension was made, by means of a circular bandage confined to the limb immediately above the knee-joint, to which was attached a weight, so that it might act in a line parallel with the hip-joint. Soap plaster, a bandage, and splints, were applied to press the fractured surfaces together. The patient was kept in bed three weeks in this position, when, from excoriation, it became necessary to alter it. He was then placed upon his back, with the limb resting upon a double inclined plane. The dressings were occasionally tightened; and, at the end of six weeks, the inclined plane was removed, and the limb was laid in the straight position on a bolster. Soon after this, he was carried daily to another room, and laid on a sofa; in a little while, passive motion was allowed, the patient swinging the limb as he supported himself on crutches. This patient gradually regained the power of locomotion; and, at the expiration of seven months, walked so well that the "sceptical" thought that no such injury had taken place.

Appearances
after death.

This gentleman died, twelve months after the accident, from inflammation of the lungs, and on examining the hip, it was observed that the

synovial covering was united with the shortened neck of the bone, nearly at the head. Here Nature had also thrown out *broad ligamentous bands*, one on each side of the joint. These were firmly united to the head of the bone, and their breadth and extent may be distinctly traced on the head of the bone, (*see Plate II. Fig. I.*) by the brown appearances there observable. The subject of this accident was healthy.

The upper third of the femur was taken out ; and, when the soft parts were removed, the head of the bone was seen depressed in a line with the shaft. The fracture was slightly oblique, commencing at the upper part, close against the cartilaginous covering of the head of the bone, and extending downward and outward, so as to terminate in a point at the lower surface of the neck, one inch from the cartilaginous covering of the head. The posterior surface of the shell of the neck had the appearance of having been splintered, so as to make a part of the fractured end of the pelvic portion extend in one situation, a little external to the capsular ligament ; but it is worthy of remark, that that portion of the fractured end which might, by

some surgeons, be considered to have extended external to the capsule, *was not united*.

On making a longitudinal section of the head and neck of the bone, (*Fig. 2,*) the line of fracture was distinctly marked by the callus which now united the opposing surfaces. The pelvic portion had been excavated, and had received the lower portion of the shell of the shortened neck near the middle of its fractured surface, where it was firmly united by an osseous deposite.

The following case I had an opportunity of witnessing, during the life of the patient, through the kindness of Mr. Field.

Mr. Field's
case.

A woman, æt. 63, healthy, and with both limbs of an equal length, was pushed down, as she was walking in the street, on the 21st of October, 1825, and fell upon the left side. She was taken up unable to bear upon the limb, and carried to St. Bartholomew's Hospital; where she was admitted, it is believed, with a fracture of the cervix femoris, and placed in a common bed, in the horizontal position; but no attempt was made to unite

the bone. As soon as she was able to leave the bed, and walk with crutches, she was sent out of the hospital; as the surgeon, under whose care she was, did not expect any benefit would be obtained from the adoption of any of the usual modes of treatment. She now, five weeks after the accident, returned to the workhouse; in which she had lived for some time previous to its occurrence. After the lapse of several weeks, she was able to bear upon the limb, and could ultimately walk without support, having free motion in the joint; but, in consequence of the great retraction of the limb and eversion of the foot, she usually availed herself of the assistance of a stick, when in the act of progression.

On the 21st of December, 1827, she was again knocked down in the street, and now fell upon the *right* trochanter. She was carried to the workhouse, where I saw her with Mr. Field, three or four days after the accident; and, on examining the limb, we discovered a fracture of the neck of the right femur, with the limb retracted above an inch; which was ascertained by a peculiar mode of measurement. No attempt was made to unite the bone in this, any more than in the former instance. The woman

lay in bed in the horizontal position, and died 19th of February, 1828.

Appearances
after death.

I saw this patient only once before her death, but Mr. Field politely offered me the inspection of the body, which I did, in the presence of himself, Mr. Searle, and my senior pupil, Mr. Martin.

On cutting into the *right* hip-joint, a fracture of the neck of the femur was observed, with flakes of fibrin, coloured with the red particles of the blood, extending from one fractured extremity to the other. On opening the *left* capsule, it was thought that a similar injury had taken place in the neck of the left femur. The upper thirds of both thigh-bones were now taken out, connected with their acetabula; in order that the particular state of the parts, on both sides, might be minutely examined.

Upon carefully inspecting the parts taken from the *right* side, (see *Plate III. Fig. 1.*) I found several large flakes of fibrin loosely adhering to the sides of the opposing ends of the bone, so as to form a weak bond of connexion between them. In one part, this adventitious connecting medium had become strong,

but was still somewhat coloured with the red particles of the blood. The fracture extended through the neck of the bone, in a direction downward and outward, commencing at the upper part, where the head joins the neck, and terminating at the lower part in a point, about an inch from the cartilaginous covering of the head. In one part, a portion of the reflected membrane, about half an inch wide, remained entire; but was separated from the neck of the bone in such a manner, as not to prevent retraction of the limb. The head of the bone was somewhat excavated; and that portion of the neck, attached to the trochanter, was partially absorbed; especially where it was brought into contact with the internal surface of the upper part of the capsule. There was no soft substance between the fractured surfaces. When the two portions of the bone were placed together, it was observed, that the cervix assumed its natural oblique line with respect to the shaft; but, in consequence of the absorption which had taken place, the fractured surfaces could not be brought together at every point.

The neck of the left thigh-bone (*Figs. 2, 3, 4*) appeared to have been fractured within the capsule, but was now firmly united. The cervix

was nearly absorbed; and the head was depressed, so as to come within about two lines of the trochanter minor, to which it was united at its base by a small short crutch of bone. Strong broad bands of ligament (*Fig. 3*) were seen connecting the pelvic portion of the bone to the capsule, which had become thickened and much smaller than natural. There had been a longitudinal fracture of the trochanter major, but it was evident that this was quite independent of the fracture of the neck of the bone. The fracture of the trochanter was united without displacement, from which it might be inferred, that there was but little laceration of the contiguous textures; but the fracture of the cervix was united with the head, about two inches and a half below its natural situation; which renders it probable that the close coverings of the neck of the bone were nearly or quite divided at the time of the accident, or subsequently to its occurrence. The anterior part of the neck of the bone (*Fig. 2*) was rendered smooth by the action of the tendon of the psoas magnus and iliacus internus. A portion of the anterior part of the base of the neck had also the appearance of having been fractured, and was pushed backward by the mechanical action of this tendon upon it.

A longitudinal section of the head and neck of the bone, (*Fig. 4,*) showed, that the fracture had taken place close up against the head. The head of the bone, as in Mr. Chorley's case, was excavated, and received the lower portion of the shell of the neck, which was firmly united to it, near the middle of the fractured surface. The shell of the neck of the bone, which was united to the cancellated structure of the head, maintained its natural appearance and direction. The upper part of that portion of the neck attached to the trochanter, also preserved its natural oblique line with respect to the shaft; and, when the distance between the shell of the upper and lower portion of the neck was measured, it was found to give the natural thickness of the neck of the bone; which was ascertained by comparing it with the thickness of the cervix of the other femur at the same part. The callus, which united the opposing surfaces, had become cancellated in every part; but the direction of the fracture could be seen by the situation of the shell of the trochanteral portion of the neck, when examined in different parts of its circumference.

In looking at Mr. Chorley's preparation, some might be inclined to doubt, whether the

Observations
upon these
cases.

fracture was entirely within the capsule. I believe, however, that the splinter of the shell of the neck, which *is not united*, and which now occupies a space, in which it is probable, that a very small portion of it was external to the capsule at the time of the patient's death, was altogether within the capsule at the time of the accident; but the head of the bone having approached nearer the trochanters than natural during the treatment, this splinter, also became displaced outward, and was ultimately made to assume its present unnatural situation. But in the other preparations which I have mentioned, showing bony union, I am humbly of opinion, and, in this opinion, I am supported by several eminent anatomists and surgeons, who are not prejudiced in favour of any opinion upon this subject, that the breach of continuity took place entirely within the joint.

Opinions different from those which the author entertains respecting these specimens supposed answered.

Some gentlemen might argue, that the appearances which these preparations present, might be produced by disease.* I have not,

* It would seem, that some surgeons are determined not to admit, even the possible occurrence of osseous union in these cases. In a conversation with an eminent surgeon, who was a staunch supporter of the doctrine of non-union, I

however, seen any specimen which would incline me to favor such an opinion ; and I would enquire, if disease was ever known to produce, suddenly, in a person, in every respect previously healthy, the symptoms of fracture of the cervix femoris ?

Others will admit, that the bones were fractured in these specimens ; that the fractures were within the joint ; and that the fractured ends are now united by bone ; but will not allow, that the fractures were attended with a division of the close coverings of the bone.

said, suppose you were requested to see an old person who had met with an accident, such as we find commonly produces fracture of the neck of the thigh-bone, and upon very carefully examining the injured limb, you should observe retraction to the extent of an inch or more, with eversion of the foot and *all* the other signs, which are described by Sir Astley Cooper, as accompanying fracture within the capsule of the hip-joint ; and that this patient, after a reasonable confinement, in a position calculated to keep the fractured parts properly applied to each other and at rest, should recover the free use and natural power of the limb, without shortening or any deformity ; and that, after death, the femur should exhibit very strong signs of having been fractured within the capsular ligament and re-united by bone, what would you say had been the nature of the accident ? “ Why ” said he, “ I should say, *that the neck of the bone had never been fractured !* ”

Whether these coverings were completely torn through or not, it is impossible to determine, at this period; nor, is it probable that this circumstance will be proved by any specimen which might hereafter be brought forward; for, in some cases, retraction, to the extent of an inch or an inch and a half, might take place, without a complete division of the periosteum and reflected membrane. It seems to me, however, that this degree of retraction could not occur without considerable laceration of these coverings, and consequent displacement of the fractured portions of the bone. Now, considerable shortening took place at an early period, in all the cases from which these specimens of bony union were taken, and consequently, it might be fairly inferred, that the fractures were accompanied with great laceration, if not complete division of the periosteum and reflected membrane; and I think it will be found very difficult, if not impossible, to arrive at any conclusion, which would come nearer to positive proof, as to the extent of injury which might have been inflicted upon these coverings, in any future specimen of bony union, in this situation, that might be submitted to the inspection of the profession. If, in any case of fracture of the neck of the thigh-bone within

the capsule, there should be retraction to the extent of an inch, or an inch and a half, as the immediate consequence of the fracture, and union by bone should be afterwards brought about without shortening of the limb, or any other deformity, it might always be said, "it cannot be proved that the fracture was attended with a complete division of these coverings," for they would now be found entire. Hence, it will be seen, that we are not likely to obtain any better evidence upon this subject, for many years, than that which we at present possess.

If, in the course of time, it should be shown that, under the employment of means which are found sufficient to prevent the operation of those causes to which might be attributed, in a great measure, as I shall attempt to prove, the frequent occurrence of non-union, union by bone does not take place, where the periosteum and reflected membrane are divided, we might then say, that when the fracture is so circumstanced, osseous union cannot be effected ; but till then, I am of opinion, with due deference to Sir Astley Cooper and others, that we have no right to come to any such conclusion, even in these, which must be regarded as the worst, cases that occur in the neck of the femur.

The opinion,
that bony
union cannot
be effected not
justifiable.

It is probable that favourable results might generally be obtained with good treatment.

But, if the treatment be good, I am inclined to believe, a sufficient number of facts to prove that union cannot *generally* be produced in these cases, when properly managed, will never be obtained. I have been led to this opinion by the consideration that, though the periosteum and reflected membrane be completely divided, and the head of the bone consequently deprived of the principal part of the nourishment naturally sent to it; a vascular communication is again speedily re-established by the production of organized matter, which, after a time, has the resemblance of ligament connecting the fractured ends together. This ligamentous substance is often found extending, in broad bands, from the head of the bone, to that portion of the neck which is attached to the trochanters or to the capsular ligament, with which it becomes firmly united. This soft substance also frequently exists between the fractured surfaces, filling up, in a great measure, the breach of bony continuity; and thus, at the same time that it prevents their further separation, it assists in conveying nourishment to the pelvic portion. Where this soft union has taken place, it is probable that the head of the bone is nearly, perhaps quite as well nourished, as when a fracture exists without lacera-

tion of the periosteum and reflected membrane, before any other vascular connexion is established between the fractured surfaces, than that which is given by these coverings. And, therefore, if this be granted, as far as regards the supply of blood to the pelvic portion, fractures with laceration, very soon become placed under circumstances nearly as favourable for the production of callus, as where the close coverings are not much torn—a fact, which it appears, has been altogether overlooked by the supporters of the doctrine of non-union; and one which strongly militates against the opinion, that want of nourishment in the head of the bone, is the *principal* cause of these fractures having, hitherto, been so seldom found united.

It might be said, that if ligamentous matter be formed between the fractured surfaces, it will prevent the process of ossification. To this I would answer, that its presence is not more likely to impede the process of bony union in fractures of the cervix, than in those which are situated in the middle of the bone; where it commonly exists in a tender state, at an early period after the occurrence of the accident, between and around the fractured ends.

Objections to
this opinion.

Answered.

When the fracture is recent, and situated in the middle of the bone, this adventitious connecting medium is soon organized, but easily torn; and appears to be nothing more than recently organized fibrin, with a plentiful supply of vessels shooting into it from the surfaces of the bone, and from the periosteum and medullary membrane. This medium assists in fixing the fractured ends of the bone, in these cases; in forming a vascular communication between them; and seems, at the same time, the substance in which the callus is, in a great measure, ultimately formed. From this, it might be inferred, that the interposition of this substance, in the recent state, between the opposing surfaces of the bone, when the fracture is in the cervix femoris, is not likely to prevent or impede the process of bony union; but, on the contrary, to assist in no small degree, in closing the breach of continuity, by conveying nourishment to the pelvic portion; from which, and that which it derives through the vessels of the ligamentum teres, this portion is enabled to form an osseous deposition.

If the fractured ends are not prevented from moving upon each other, union by bone is not,

on some occasions, effected when the fracture is in the middle of the femur. In these cases, however, ligamentous, or ligamento-cartilaginous union is, as far as I can find, always produced, when there is not any other substance, as muscle, &c. placed between the ends of the bone, so as to keep them separated from each other; and I have abundant evidence to shew that, under proper management, this ligamentous matter is absorbed, or converted into a state capable of receiving callus; and, though many months may have elapsed from the time of the accident, bony union is readily accomplished. If, then, in the other parts of the bone, the ligamentous connecting medium does not, when it has become firm and tough, prevent the ossific process from being completed, can any reason be assigned why it should do so, in every instance, when the fracture is in the neck of the bone where the same powers might be made to operate, though, perhaps, not in so great a degree, to effect its alteration or removal? I think not; and, if I am right in this opinion, it seems to me we ought not, in the present state of our knowledge, to abandon these cases, without first trying to produce bony union, even though they should have existed several months.

Union should
be effected
when the frac-
ture is in the
recent state.

The treatment, however, is bad, which does not bring about union by bone, in the recent state of the injury, where the fracture is at a distance from any joint; when the system and the bone are healthy, and there is nothing existing between the fractured ends but the soft substance to which I have alluded; and, I think, we shall be obliged, ere long, to come to the same conclusion with respect to fractures of the cervix femoris within the capsule; as the soft medium formed between the opposite surfaces, does not, in my opinion, render these fractures essentially different from fractures which occur in other parts of the bone.

Inference.

The view, then, which I take of this subject, has led me to infer, that the physical condition of the fractured ends, upon which Sir Astley Cooper founds his principal argument in favour of the opinion which he entertains, is not in itself sufficient to account for the, hitherto, almost constant occurrence of non-union, when the fracture is within the capsule of the hip-joint.

Having attempted to shew, by cases and arguments, that there is no apparent physical cause sufficient of itself, to prevent the process

of osseous union in fracture of the cervix femoris within the capsule, I shall now consider, how far its accomplishment might be deemed advisable.

When the powers of the limb and the walk of the persons who have had fractures of the neck of the thigh-bone united by ligament, are observed, and compared with the powers of the limb and the facility of progression which are seen in those who have had union effected by the interposition of callus; doubts may arise in the minds of some surgeons, as to the propriety of attempting to produce bony union, in any case where the fracture is evidently within the capsule. We see, in some cases, in the former class, that the sufferers are able to walk, in the course of time, without any adventitious assistance, having that variety of lameness which is called a drop, when the weight of the body is thrown upon the injured limb; but even this degree of power is not obtained for a long period after the accident. In other instances, the functions of the limb are so much impaired, in consequence of the injury sustained in the neck of the bone and surrounding parts, that the patients are never after able to walk without support. These persons experience great diffi-

How far may it be deemed advisable to produce osseous union in these cases?

culty in the act of progression, and are commonly seen hobbling about with the assistance of crutches. So we have seen, that the persons in whom bony union had been produced a considerable period before their death, were also able to walk with different degrees of facility. Dr. James, whose case Dr. Brulatour has related, acquired the full use of his limb for a considerable time previous to his dissolution; which occurred about ten months after the accident. The gentleman from whom Mr. Chorley obtained his specimen, had also free motion in the joint, and was able to walk with a slight limp, soon after the bone was united. In these two cases, however, we see little more advantage obtained, than what we observe in some very rare instances, where the fractured surfaces are connected by short ligament. In the other two which I have related, less benefit was obtained. In Mr. Langstaff's case, the patient could not walk without the assistance of crutches, from the occurrence of the accident to the period of her death; which took place ten years afterwards. The woman, from whom my preparation, showing bony union, was taken, was able to move the limb with facility, notwithstanding the head of the bone was depressed, and so close to the shaft, as ac-

tually to rest, by the intervention of a very short crutch, upon the trochanter minor; but, in consequence of the retraction of the limb, which had taken place, she was unable to walk without great lameness, and never attempted to go far, without availing herself of the support of a stick. Thus, it might be seen that, the four cases of bony union above detailed, prove very little more than the physical possibility of union by osseous matter. The evidence which they offer in favour of the superiority of bony union over ligamentous, is so small, that it can hardly be considered sufficient to induce us to recommend our patients to undergo that degree of confinement, which might be necessary for its accomplishment.

But must we infer, from these cases, that no better results can be obtained? I think, when we enter into this subject a little further, we shall perceive that we have no right to come to this conclusion. What constitutes the imperfection in these cases? Evidently the deformity of the limb, which is partly occasioned by the absorption of the neck of the bone. Absorption of a great part of the neck of the bone is found to have taken place in all those cases of fracture where the patient survived for

Can no better results than those detailed be obtained?

a year or two after the accident; whether union had taken place by the intervention of ligament or callus.

Is shortening of the cervix to be considered a necessary consequence of fracture of this part?

Are we then to consider absorption of the cervix femoris, as a necessary consequence of fracture of this part? I presume not. I am strongly induced to believe, that shortening of the neck of the bone will be found to be the result of the irritation which is occasioned in the injured parts, by the frequent motion and unnatural pressure, which are allowed to take place in these cases; and which none of the usual modes of treatment is calculated to prevent. We find in other situations that, if the end of the bone projects in such a manner, as to be a source of constant irritation to the soft parts with which it comes in contact, it is generally acted upon by the absorbents, till the irritating points are removed, and the end of the bone rounded—in short, till it lies easily among the contiguous textures. This we observe in the sawn extremity of a bone, which is left after amputation. We see the same thing frequently in fractures of the middle of a bone, when the fractured ends overlap; and I cannot discover any reason sufficient to lead me to suppose, that the absorption of the neck of the

thigh-bone takes place from any other cause than that which we find gives rise to absorption of bone in other situations ; *viz.* the irritation which it occasions ; and which is kept up for a long, but indefinite period, in consequence of the frequent motion of the fractured ends upon one another ; and the unnatural pressure which they produce upon the surrounding soft parts for want of proper treatment. Hence we might infer, that the degree of absorption of the neck of the thigh-bone, will generally be in proportion to the degree and continuance of the irritation produced in the joint, by the motion and unnatural pressure of the fractured ends ; and as the trochanteral portion of the neck is capable of producing the greatest mischief, this portion always suffers most from the process of absorption.

If, then, I am right in the opinion, that absorption of the cervix femoris is not a necessary result of a fracture of this part, but is commonly produced, in consequence of the irritation which is kept up in the joint, especially, by that portion of the neck which is attached to the shaft, it will be seen that, if the fractured surfaces were brought together, and kept at rest, such irritation would not take place ; and, therefore,

The author's
opinion upon
this subject.

that absorption of the neck might be prevented by any contrivance, capable of fixing the broken ends of the bone, so as to prevent them from moving upon each other. According to this view of the subject, we might conclude, that absorption of the neck of the bone is probably referable to the imperfection of the treatment usually resorted to as a remote cause; and not to any law of nature peculiar to this part.

What is the cause of absorption where an osseous union is effected?

It might, in opposition, be argued, that if absorption of the neck of the bone takes place, in consequence of the irritation which it is allowed to keep up, how does it happen that there is, in some instances, as much absorption where union is effected by bone, as, where the parts are only connected by the intervention of ligament? In answer to this, I should say, that there is no proof that osseous union did not take place in all the specimens yet obtained, notwithstanding the resistance offered by motion and displacement; and, as there is reason to suppose that motion of the fractured parts was not prevented during the treatment of the patients from whom the specimens were taken, any more than displacement, it might be inferred that, as the same causes were allowed to

operate, they would be followed by the same consequences in these cases, as in those where union by bone has not been effected, till the parts became fixed upon one another, either by very short ligament, or by callus. Bony union might have taken place at different periods after the accident; and, in proportion to the duration of the interval between the occurrence of the accident, and the fixed condition of the fractured portions, we might expect would be, in most cases, the degree of absorption of the neck of the bone. We are not certain, however, what length of time elapsed in any of the four cases I have mentioned, before consolidation of the bone was completed; and, therefore, we cannot say how far the degree of absorption, which is observed in the different specimens, corresponds with the length of the periods in which relative motion of the opposing ends was allowed. I may or may not be right, in supposing that absorption of the cervix femoris is referable to the operation of the same causes, whether the fracture be united by a deposition of bone or ligament; but this is a point which future experience will probably decide. It also remains to be determined, whether absorption of the neck of the femur goes on after bony union is completed. We know it sometimes occa-

sions the removal of nearly the whole of the neck of the bone, where no injury has been sustained; and I see no reason to think, that it might not, now and then, do so after the union of a fracture of this part. From this, it will appear, that we are unable to state whether the absorption of the neck, in the examples of bony union adduced, took place subsequently to the completion of the ossific process, or before the fractured ends were fixed. I am rather inclined, however, to the latter supposition.

Inference.

After having considered this subject with much attention, I have not been able to discover any argument, which would militate against the opinion that I am disposed to entertain; *viz.* that absorption of the neck of the femur, which occurs after fractures within the capsule, is not a necessary consequence of a fracture of this part; but is, in the specimens already examined, bony as well as ligamentous, probably, to be attributed to the imperfection of the treatment adopted, rather than to any law of nature peculiar to the cervix of the femur. The accuracy or inaccuracy of this opinion, however, can only be shown by specimens procured from persons who have been treated in such a manner as to insure a perfect state

of quietude during the process of union ; for, if we have ever so many cases in which union has been produced without shortening or other deformity, we cannot determine this point by them during the life of the patient ; as we have still to learn the precise situation of the fracture, as well as the kind of union which had taken place ; which can only be ascertained by a minute inspection of the parts after death.

The absence of direct and convincing evidence upon this subject, it will be seen, is no argument against the propriety of attempting to unite any case of fracture of the neck of the femur ; for such is the nature of these injuries, that, I believe, it is sometimes impossible to discover the exact situation and direction of the fracture ; without subjecting the patient to such an examination as would be by no means warrantable. The strongest advocates for the opinion, that fractures of the cervix, within the capsule, will not unite by bone, when accompanied with laceration of the close coverings, readily admit that, if the fracture be external to the capsule, or partly within and partly without, osseous union might be produced ; and the patient recover with a useful limb. Unless, therefore, it can be shown that these three ac-

Fractures of the cervix femoris should not be abandoned till proper means have been employed.

cidents can be readily distinguished, in every instance, from one another, it is evident, from these gentlemen's own statements, that no fracture of the cervix should ever be abandoned till proper means have been employed, for a reasonable length of time, with a view to produce consolidation of the bone.

It is probable that bony union might be frequently produced.

It might be doubted, by some, whether union by bone, in a fracture of the cervix femoris, can take place, when frequent motion of the fractured parts is allowed. This, however, is nothing more than what we see in fractures situated in the middle of the bone. If the fractured ends did not commonly coalesce by the intervention of callus, in spite of this impediment, I believe, we should not, with the ordinary means, be able to produce union in one case out of fifty, even when the fracture is in the middle of a bone; but, as the parts are less perfectly nourished and supported by the surrounding textures when the fracture is in the neck of the femur, than when in the shaft, I conceive the influence of motion will be in the same proportion more injurious; and this appears to me to be the principal reason why we have hitherto so rarely met with union in fractures of the cervix femoris when situated

within the capsule. The fact that non-union occasionally occurs in the middle of a bone, as the result of motion of the fractured ends, is sufficient to show that the operation of the same cause alone might prevent union; and, under the peculiar circumstances of the parts, would be likely to do so, in most instances, when the fracture is in the neck of the femur; and the fact, which is abundantly obvious to my mind, of bony union having taken place in the neck, when the fracture was within the capsule, in opposition to the unfavourable nature of the treatment, tends strongly to prove, that if the fractured surfaces were kept in apposition and at rest, such union would be frequently obtained.

From what I have myself observed, and from what I have been able to collect from the observations of others, I am led to believe, that the causes of non-union, in fractures of the description above-mentioned, are four, three of which have been noticed by Sir A. Cooper: 1st. A diminution in the quantity of blood sent to the pelvic portion of the bone; 2d, absence of continued pressure; 3d, want of apposition; and, 4th, want of rest. The first of these is inseparable from the nature of these cases, but,

Causes of non-union in these cases, with observations.

in my opinion, is to be regarded as the *least important*; for, though this will have an influence in retarding the uniting process, as I have above stated, I believe that there is now sufficient proof to lead to the conclusion, that it is not in itself sufficient to prevent osseous union from being accomplished. The other three causes are referable to the treatment; and, if it can be shown that we are in possession of mechanical means, by the judicious employment of which, apposition, pressure, and rest, might be maintained for any length of time, these three causes, it is evident, will be at once removed; and, as union by bone now and then takes place, notwithstanding the operation of these three causes, we might, it seems to me, reasonably expect, that it will be very generally produced, where the treatment is such as to prevent their occurrence.

Unfavourable results might sometimes occur under the best treatment.

I do not wish it to be inferred, that we shall not sometimes meet with cases of non-union in the neck of the bone, even where the best means have been employed; but such instances, I think it will be found, will occur principally where the system is *extremely* weak, as we now and then see it in very old persons; or where the patient is unmanageable, and will

not steadily adhere to our directions ; where there is some disease of the constitution ; or disease of the bone, or of the soft parts by which it is surrounded. These causes, however, would operate against the production of osseous union in any other part of the bone as well as in the cervix.

Before I could become an advocate for the practice of abandoning fractures of the cervix within the capsule, surgeons, who support it, must prove satisfactorily that the patient can derive no advantage from mechanical means ; they must also show that there are unequivocal symptoms by which a fracture of this part of the bone might be distinguished, in every instance, from one external to the joint. If there be any such signs I have not been able to ascertain them. I know of none which are not occasionally fallacious, nor do I believe that any such exist ; or, at best, any sufficiently marked, to be, in every instance, palpable to the senses even of the most scientific and experienced surgeons. If this be the case—if surgeons, who support the doctrine of non-union, cannot point out some well-marked and infallible sign or signs which invariably accompany fractures within the joint, and are not

Ought these cases to be left to Nature ?

observed in those external to it, or in those which are partly within and partly external, their practice must be sometimes at variance with their principles—they must occasionally abandon cases which, from their own showing, admit of cure; and confine patients for whom, according to their reasoning, nothing beneficial can be done. Suppose, however, it were granted that fractures within the capsule can at all times be distinguished from all other fractures which occur in the neck of the bone; and that, when the fracture is within the joint, bony union cannot be produced under the most judicious employment of the best mechanical contrivances, is there any good reason why these accidents should be abandoned as entirely irremediable? If there be any, I confess I cannot see it.

Ligamentous
union.

For the last seven years, I have been accustomed to say in my lectures, and elsewhere, that the practice of leaving patients to their fate, who are supposed to have fractures of the neck of the thigh-bone within the capsule, is, in my opinion, bad. If these fractures could not be united by osseous matter, is there any reason why the apposing ends should not be connected by a layer of short liagment, extending from one fractured surface to the

other? When I had not evidence sufficient to convince me of the possibility of bony union being effected, I always endeavoured to inculcate, that a mode of treatment which would give the fractured surfaces a fair chance of coalescing, would be almost sure to benefit the patient; for, if bony union were not produced, union by short ligament would, in the worst cases, in all probability, be accomplished; and the patient so injured, would thus be enabled to get about with that degree of facility which we see in the most favourable results that have been obtained by any of the ordinary means. In corroboration of this opinion, I might state that, as far as I have been able to discover, those persons who have recovered sufficiently to walk with the assistance of a stick, and occasionally short distances without even this aid, have had union effected in this way, (*see Plate IV. Fig. 1*) or by a deposition of callus; but nothing has been said, that I know of, about the propriety of attempting to produce union of this fracture by short ligament, even by those gentlemen who contend that bony union never takes place. Hence, we find that the fractured surfaces are allowed to separate from one another, where the close coverings are divided, as far as the quadratus femoris will

allow ; and, though the fractured ends are connected by ligament in such cases, the ligament is commonly so long, that the limb is very little better than it would be were no connecting medium effused ; for, when the weight of the body is thrown upon the limb, it must necessarily drop towards the ground, till the muscle I have mentioned is put upon the stretch ; and, consequently, patients so circumstanced are rarely able to walk, during the remainder of their lives, without the assistance of crutches.

The advantages
of short liga-
mentous union.

If, on the contrary, the fractured surfaces were kept in close apposition, and at rest, it is probable that, in cases where osseous union could not be effected, the fractured surfaces would be firmly held together by a layer of ligamentous matter interposed between them instead of callus ; and if, in such cases, the patient were confined a sufficient length of time, this would acquire so much strength as to prevent the broken ends of the bone from separating in any considerable degree, even when the weight of the body is thrown upon the limb. Even supposing, then, it should, in the course of time, be found that bony union cannot generally be effected, if we can produce union by short ligament, what shall we gain ?

We shall prevent that horrible lameness which is the result of the worst of these injuries. I do not say that any patient, in whom short ligamentous union has been produced, will be likely to have the use of the limb as perfect as before the accident; but, I am disposed to believe that, we shall so far restore it, as to enable him to walk with but little impediment. The facility of moving the limb will be proportionate to the shortness and density of the ligament, connecting the broken ends of the bone; and, as these qualities will render the ligament proportionably strong, it is to be expected that the power of the limb will be in the same degree restored.

A great object in such cases would be, to have the ligament as strong as possible; and, for this purpose, it would be necessary to confine the patient nearly or quite as long as one might expect would be requisite in order to effect union by bone. The ligament which unites fractures of the patella is thin, and usually gives way a little when the patient bends the limb, even after a confinement of six or eight weeks; but this is more particularly the case if the patient is suffered to move the limb *too early*. The same thing occurs in fractures of the olecranon united by ligament; but in both these

The strength of the connecting ligament of great importance.

situations the ligament, though thin, is capable of resisting the ordinary action of the muscles. From this we should infer, that the ligament, which would be effused between the broken ends of the bone when the fracture is in the neck of the femur, would be able to support the weight of the body, and much more, without yielding ; for here we should find the ligament much larger than that which connects the two portions of a fractured patella ; it would also be acted upon in that manner which would enable it to oppose the greatest resistance to the superincumbent weight. The ligament, in some instances, is nearly equal in diameter to the neck of the thigh-bone, or rather to the surfaces between which it is placed ; and, as the weight of the body has no tendency to cause the ends of the bone to separate in a line with the neck, but to make them pass each other in the transverse direction, the ligament is situated in the most favourable manner to resist the forces that tend to make it yield. Hence we might infer, that a bone thus united would be nearly as strong, though not so steady and manageable, as it would be if the bond of union were osseous. By treating patients, therefore, in such a manner as would favour union by bone, we should give them every advantage

which it is in our power to offer ; for, in the worst cases, we might expect that, should bony union not take place, short ligamentous would be obtained, and thus they would, at all events, be much benefited by the judicious employment of proper mechanical contrivances.

From these considerations I conclude, that the practice of leaving fractures, which are supposed to be within the synovial capsule, to Nature, even presuming that they were easily ascertained, and could not be united by bone, is one which, in the present state of our knowledge, is not scientific ; and, therefore, ought not to be followed.

Inference.

By this conclusion, however, I wish it to be understood, that I am far from casting any blame upon those who have given an opposite opinion. Sir Astley Cooper has said, that he was induced to abandon the usual modes of treatment followed in cases of this description, because he had not met with any which, in his opinion, had been beneficial. He was led to do this the more readily from the belief, that the principal cause of failure was referable to the particular condition of the injured parts ; but as soon as it is shown that we have means, by

Sir Astley Cooper's reason for abandoning these accidents.

which the evils, accompanying the use of the old mechanical contrivances, can be prevented ; and that, whether the union effected be osseous or by the intervention of ligament, patients derive great advantage from the employment of the new ; he will feel himself justified, and I hope will be among the first, to recommend its adoption.

SEC. 4.—*Fractures of the Neck of the Thigh-Bone external to the Capsule, without any considerable Laceration of the Periosteum.*

Of two kinds.

Fractures of the neck of the thigh-bone external to the capsule might, as I have said, be divided into two kinds, dependent upon the degree of injury sustained by the soft parts attached to this part of the bone.

The age at which these fractures occur, and their causes.

Fractures external to the capsule occur most commonly in persons under fifty years of age, but they not unfrequently happen in old persons. Fractures within the capsule which are met with in old people, often result from very slight causes ; this may, also, happen in them, when the fracture is external to the



capsule; but those which take place external to the capsule, in persons under fifty years of age, whose bones have not become weakened by absorption, are usually produced by great violence; such as violent falls upon the trochanter major; the passage of laden carriages over the pelvis; or other forces, as blows, &c. operating indirectly upon this part of the bone.

When the fracture is not attended with laceration, the symptoms are so similar to those which are observed when the bone is broken within the capsule, without any considerable injury to the close coverings, that it will be found, in many cases, exceedingly difficult to distinguish them from one another. The best surgeons sometimes fail in their diagnosis as to the situation of the fracture; and I am not acquainted with any symptoms accompanying this accident which are, in every instance, sufficiently marked to enable the scientific surgeon to say that the fracture is external to the capsule. The symptoms of this injury are sometimes altogether very obscure. I have known it overlooked, and the patient considered to have laboured under the effects of a contusion of the soft parts in the vicinity of the joint. I was once present during the inspection of

Symptoms.

a man who died of disease of the heart, about two months after he received an injury at the upper part of the thigh, in whom there was found a fracture of this description, which was not discovered till after his decease; though the limb was several times examined by a very able surgeon in this town. The periosteum was torn only in a very slight degree; and, consequently, the fractured portions were held so close together, that the head and shaft of the bone moved simultaneously when the limb was rotated, therefore no crepitus was felt. There was a trifling difference in the length of the two limbs, and the foot was a little everted. The shortening which existed was produced by the alteration in the direction of the neck of the bone; which was slightly depressed, and driven a little way into the cancellated structure of the trochanter major. The tumefaction of the limb is usually greater than when the fracture is within the capsule; and there is sometimes ecchymosis. These are the only signs that I have noticed in this accident, differing from those which accompany similar injuries in the joint, and these will be found often fallacious.

Neck sometimes driven into the trochanter.

Sometimes the neck of the bone is broken off at its junction with the shaft, and driven, a

considerable way, into the cancellated structure of the great trochanter; (*see Plate IV. Fig. 2,*) and remains firmly locked there for a considerable time. The symptoms of fracture of the neck of the bone thus situated, are not such as will enable us to decide, with certainty, in all cases, upon what part of the cervix is broken. More or less shortening of the limb, pain at the upper and inner part of the thigh and behind the trochanter, more or less tumefaction soon after the accident, great diminution of power in the limb, and absolute lameness, are the only symptoms I have noticed, till the neck of the bone is disengaged from the trochanter, so as to move independently of it; and then the crepitus of fracture might, also, commonly be felt when the limb is rotated or bent upon the pelvis.

It appears to me, that the only way in which these fractures can be produced, so as to drive the neck of the bone into the substance of the shaft, is by falls upon the trochanter major, or by some force which will operate in the same direction.

Causes of this fracture.

I am disposed to think, that it is in these cases, or in those which are unattended with laceration of the contiguous texture, or where

Persons with fracture of the neck of the femur sometimes able to walk

without support.

the fracture is incomplete, that patients are able to walk immediately after the accident with some assistance ; such as the support of a stick or the arm of another person, or even, in some instances, without any adventitious aid, as occurred in the following case.

Case.

Mrs. Shaftoe, one of the sisters of Guy's Hospital, æt. 62, fell off the curb stone, as she was passing over London Bridge, on the 21st of December, 1822, and pitched upon the stones in the carriage-way. The force of the blow was principally received upon the outer and posterior part of the trochanter major. She was picked up by persons who saw the accident, and was able to walk, by holding a gentleman's arm, as far as the top of St. Thomas's Street in the Borough, (a distance of about three hundred yards,) but not without great pain and limping. From the top of St. Thomas's Street to the gates leading into Guy's Hospital (about one hundred yards) she walked *without assistance*. Here she found her limb give way, and she was unable to walk any further. She was carried from this into the hospital and placed in bed.

Mr. Key saw her immediately after she was

brought into the house, and examined the limb, but did not discover the fracture. Sir Astley Cooper examined the limb, also, on the next day, and was of opinion that there was no fracture. The whole of the inconvenience she felt was at this time referred to the upper and inner part of the thigh, and the hollow behind the trochanter major. She could bend the limb upon the pelvis; and though, when left to itself, the limb became slightly everted, she was able to roll it inward, so as to bring it to what might be called its supine position. As these gentlemen did not discover that there was a fracture, we might suppose that the usual strong signs of fracture of the cervix femoris, *viz.* eversion of the foot, retraction of the limb, and crepitus, did not exist, or, at least, were not strongly marked.

On the 7th of January, 1823, I examined the limb by her desire, and found that the bone was fractured through the neck; which I discovered by rolling the limb inward, and bending it upon the pelvis. In this way crepitus was now easily produced. Sir Astley Cooper saw the woman again the same day after me, felt the crepitus, and corroborated my opinion, as to the existence of a fracture in the cervix, but

considered that it was external to the capsule. She had been permitted to move about in bed, and to have her bed made at pleasure for seventeen days; which circumstances were sufficient to account for the alteration which had taken place in the condition of the fracture.

My notes do not state that any thing was done for this woman with a view to keep the parts quiet or in apposition, till the 17th of January—twenty-seven days from the date of the accident; but, if I recollect right, the limb was placed upon the common fracture-box for a few days after the fracture was discovered. This was removed, in consequence of the inconvenience which she experienced from it, and that which I invented for fractures, &c. of the lower extremities substituted. This apparatus, though not intended for fractures of the neck of the thigh-bone, promised more advantages in these cases than any contrivance that I had then seen employed.

Before the apparatus was applied, the limb was lying in the extended position, and retracted about an inch. The foot was everted. Crepitus could easily be produced. The limb could be brought down to its proper length with faci-

lity by extension, but it was again retracted as soon as the extending force was discontinued. The apparatus was worn, with the limb in the straight position, from the 17th January to the 12th of the following March. Its use was now discontinued, as I considered the fracture was united, though not without shortening of the limb.*

Occasionally, the cancellated structure of the trochanter major becomes absorbed subsequently to the injury; and afterwards the neck of the bone is partly received into the excavation. There is a case mentioned in Sir Astley Cooper's work, in which this took place. The fracture was produced by a twist of the limb without falling.

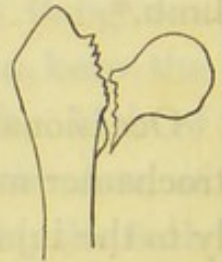
Neck of the bone sometimes received into a cavity.

* This woman lived several years after the accident; and was able to walk about with facility, without a stick or any other assistance, though not without limping, in consequence of the shortened state of the limb. After her death, Sir Astley Cooper obtained the upper part of the thigh-bone; and he has stated to me in conversation, that the bone is consolidated, that the cervix is absorbed, and, that there is no appearance of callus. From the last observation, I infer, that the callus has become cancellated. I have not learned at what part of the cervix the fracture appeared upon inspection to have taken place.

SEC. 5.—*Fractures of the Cervix Femoris, external to the Capsule, with great laceration of the surrounding Parts.*

Symptoms of
this accident.

The symptoms which accompany this variety of fracture, are much more strongly marked, than those which are observed when the fracture is not attended with any considerable laceration of the softer textures; and, for the most part are very similar in some instances, to those which accompany fractures of the cervix within the capsule, attended with laceration of the close coverings. The eversion and retraction of the limb are very evident; but the degree of shortening is usually proportionate to the degree of laceration; in this variety of fracture, however, it is commonly from half an inch to an inch—seldom exceeding an inch. The cause of the retraction being greater in fractures of this description, which occur within the capsule, than in those which are external to it, will probably be found to depend upon the state of the parts which surround the bone in the two situations. Within the capsule the bone is surrounded only by the periosteum



and reflected membrane ; but, at the root of the neck, where fractures external to the capsule usually occur, the bone is surrounded and protected by the dense fibres of the capsular ligament, which is inserted into it at this part, and is very seldom entirely torn through. In addition to the symptoms which attend a fracture *within the capsule* accompanied with laceration of the close coverings, *viz.* eversion of the foot—retraction of the limb, &c. we have in this variety, generally considerable tumefaction of the surrounding parts, accompanied with ecchymosis. This very rarely occurs when the fracture is entirely within the synovial membrane. Pain produced by rotating the limb is common to fractures within, and to those which are external to the capsule ; but it is much more severe when the fracture is external to, than when it is within the joint. The reason of this is evident. When the fracture is *external*, the broken ends of the bone prick and lacerate the muscles with which they come in contact, and which are exceedingly sensible when they are inflamed ; but when the fracture is within the ligament, the broken ends of the bone rub against the synovial membrane, which possesses much less sensibility than the muscles. The difference in the de-

gree of swelling, too, might be easily accounted for upon scientific principles. The force which produces fractures within the ligament is often trifling, when compared to that which usually occasions fractures external to it. The swelling which comes on in the first variety, is confined, for the most part, *within the cavity of the joint* ; but in the second, the swelling is diffused. Sometimes the whole of the thigh is much enlarged, in consequence of extravasation of blood, and in consequence of inflammation, accompanied with an effusion of fibrin and serum. These fractures, as I have said, occur most frequently in persons below fifty years of age, but they are not uncommonly met with in persons very far advanced in years; though, from the peculiar alteration in the structure of the neck of the bone, which frequently obtains in very old people, and, by which it is rendered weaker, especially near the head, the fracture of the cervix in them is usually within the joint. Crepitus, might almost always be felt with facility, when the fracture is external to the capsular ligament and loose; but, when it is entirely within, it cannot be elicited, sometimes, even by the most judicious surgeon.

Foot sometimes
inverted.

Fractures, external to the capsule, are occa-

sionally accompanied with inversion of the foot. In these cases the fracture of the cervix has been found complicated with fracture of the trochanter. Mr. Guthrie, in a paper published in volume xiii. of the *Medico-Chirurgical Transactions*, has detailed an instance, which tends to illustrate the causes which give rise to this position of the limb.

“Sarah Gibson, æt. 90, fell, on the 9th Janu- Case.
ary, from a high stool on which she was sitting, upon the left hip, and, being a heavy woman, suffered considerable injury. I saw her, two days afterwards, with Mr. Dillon of Judd Street, and found the marks of considerable contusion having been sustained by the part, which was very painful and swelled. The limb was rather more than half an inch shorter than the other, and the great toe turned inwards, in a manner sufficiently marked, although not quite so decidedly as in a case of dislocation. The limb was moveable in every direction, but these motions were attended by considerable pain, and it could be easily extended to the same length as the other. No crepitus could be distinguished. The patient died on the 22d February, forty-four days after the accident, and, on dissection, a fracture was discovered external to the capsu-

lar ligament. The little trochanter was broken off, and with it the attachment of the psoas and iliacus muscles. The head and neck of the femur were separated from the shaft by a diagonal fracture, extending from the upper and outer part of the trochanter major to the trochanter minor, so as to leave the insertions of the pyriformis, gemellus, obturator externus and internus, and quadratus, with the head and neck of the bone. The gluteus medius formed a bond of union at the upper part of the trochanter major, between the broken pieces retaining them in contact. The capsular ligament was not injured, and no steps whatever appeared to have been commenced to repair the mischief which had been committed."

Case.

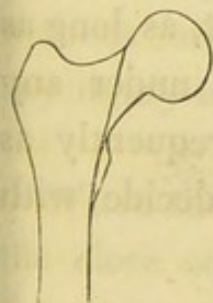
In the 25th volume of the Edinburgh Medical and Surgical Journal, Mr. Syme has related a case of fracture of the cervix, which was accompanied with inversion of the foot. In this case, which occurred in a man between 50 and 60 years of age, "the limb was shortened more than an inch, the knee being bent over the sound one, and the great toe resting on the instep of the other foot. The trochanter major was higher up and more forward than natural, and any movement excited excessive pain."

The injury was occasioned by a fall upon the side. The man died a fortnight after the accident, "in consequence of inflammation in the lungs, and most extensive sloughing on the sacrum."

"On dissection, I found the capsular ligament entire, but two fractures beyond ; one detaching the neck where beginning to spring from the shaft, the other running obliquely downward and inward through the trochanters, so as to detach the posterior part of the greater, and the whole of the lesser in one piece from the body of the bone."

The dissection of a case very similar to that which occurred to Mr. Syme, and which was also attended with inversion of the foot, is detailed by Mr. Stanley in Part ii. of Volume xiii. of the *Medico-Chirurgical Transactions*.

Fractures of the cervix femoris are very often partly within and partly external to the capsule ;



but the symptoms which denote the existence of fractures of this description are usually so vague, that the surgeon will often be obliged to confess himself unable to determine, as to the precise si-

Fracture partly within, and partly external to the capsule.

tuation and direction of the fracture. It is gratifying, however, to observe, that uncertainty in any case of fracture of the cervix need not influence the treatment, which it will be considered proper to adopt. But, though it will be seen that all fractures of the neck of the thigh-bone require the same mechanical treatment; yet, it is probable, that those which are external to the capsule, and those which are partly within and partly external to it, will be found to require less time for the accomplishment of osseous union, than those which are entirely within the synovial membrane. Hence it appears, that it will be advisable, in every instance, to investigate very carefully all the circumstances accompanying fractures of this part of the bone, in order to form an accurate diagnosis; for, if we are not satisfied as to the situation and nature of the fracture, the patient might be confined some time longer than necessary; or, on the contrary, he may be allowed to use his limb too soon. The latter evil should always be avoided, by confining the patient, as long as might be advisable for his safety, under any circumstances; and the first, as frequently as the symptoms will enable us to decide with certainty.

Occasionally, the irritation produced by fractures at the root of the cervix femoris, has, under the usual modes of treatment, destroyed the patient. The prognosis, however, in these cases, might almost always be favourable. If the treatment be good, fractures external to the capsule, and those which are partly within and partly external, unite readily by bone; and, I believe, might be made to do so without shortening, or deformity of any kind, except where the bone is much shattered.

Prognosis in fractures at the root of the cervix femoris.

SEC. 6.—*Fractures of the Trochanter Major.*

Fractures of the trochanter major are sometimes produced by falls upon it; by blows, &c.

Causes of fracture at this part of the bone.

The fracture is occasionally transverse; separating the trochanter close to its junction with the neck, without being accompanied with any injury to this part.



Transverse fracture of the trochanter major.

When there is no considerable laceration of the close covering of the bone, the fractured

Symptoms.

surfaces remain in contact, and consequently the symptoms are sometimes obscure crepitus cannot easily be felt; and the injury requires more minute investigation, in order to discover the existence of the fracture; but, if the fracture be attended with a division of the soft parts immediately surrounding the bone, the trochanter becomes drawn up upon the dorsum of the ilium, by the action of the gluteus medius and minimus muscles; and then the nature of the accident is very readily ascertained. The trochanter might be moved in different directions independently of the shaft; and when the fractured surfaces of the upper and lower portions of the bone are brought into contact, crepitus might be readily produced, by moving the trochanter, so as to make them rub upon each other. The surgeon might also elicit crepitus by holding the trochanter firmly in his hand, while an assistant rotates and moves the limb in different directions. The foot might or might not be everted in these cases, so that the position of the foot cannot be regarded as a symptom of any importance. The length of the limb is natural.

Oblique fractures of the trochanter might pass through the bone in different directions, and might also be accompanied with more or less laceration of the parts by which the bone is surrounded. Some difficulty has been experienced by very able surgeons in discovering oblique fractures of this part of the femur. I suspect, however, that this has arisen, more from the absence of any good report of the symptoms by which they are attended, than from the nature of these accidents.



Oblique fractures of the trochanter major.

When the fracture extends downward and backward, the broken portion is in some instances drawn backward towards the tuberosity of the ischium, where it might be easily felt through the integuments; if the fracture extends downward and forward, the broken part might be forced in the opposite direction; but, in whatever direction the separated portion is placed, it might be readily moved, independently of the shaft of the bone; and crepitus might be easily produced when the fractured surfaces are brought together, in the manner I have just described. If there be no laceration of the fi-

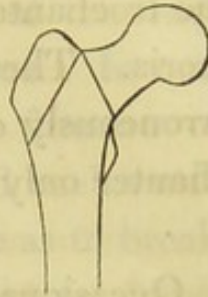
Symptoms.

brous covering, there will be no separation of the fractured portions; and consequently, in such cases, a more minute examination will be required, in order to discover the nature of the injury. In all cases, the degree of separation of the fractured surfaces will be influenced by the direction of the fracture, and by the degree of laceration of the softer textures, which surround the fractured parts. Numbedness of the limb is a symptom which is observed in some of these injuries. There is also pain referred to the seat of fracture, and more or less tumefaction of the integuments, occasioned by the mischief inflicted upon this part of the limb. The pain is increased by the sitting posture. Abduction, adduction, and rotation of the limb, also, in most instances, increase the patient's sufferings; and, if he be desired to perform these varied movements himself, he sometimes finds that he is incapable of moving the limb in any direction, without more or less additional pain. The foot may or may not be everted; but the limb is neither shortened nor lengthened in consequence of the existence of a fracture of the trochanter, unaccompanied with a fracture in any other part of the bone.

Fracture of
the trochanter

Fracture of the trochanter major might, as

has been said, be attended with a fracture of the neck of the bone, either within the capsule or external to it; or with a fracture which extends partly within and partly external to the capsule.



major, with fracture of the cervix.

When this happens, there are, in addition to those symptoms which are observed when the trochanter only is broken off, the signs which have been described as accompanying fractures of the neck of the bone. The symptoms which indicate the fracture of the cervix vary in some respects, according to its particular situation, and the state of the injured parts; and are also somewhat modified by the existence of the fracture of the trochanter. The patient has less power in the limb when both these injuries have been produced, than when either of them exists alone. The limb feels shattered about the joint, and when the fractures are attended with considerable laceration of the contiguous parts, he has scarcely power to move it at all. In one case which I saw, the trochanter was split into several pieces. The injury occurred in an old man, who died a few days after the accident, in consequence of the complicated mischief which he had sustained at the upper

Symptoms.

part of the limb, viz. a comminuted fracture of the trochanter, and a fracture of the cervix femoris. These injuries have been sometimes erroneously considered as fractures of the trochanter only.

Fracture of the trochanter below the neck.

Occasionally, fractures of the trochanter major pass through the femur, so as to divide the neck of the bone and the trochanter from the shaft, these two parts remaining naturally connected. In these cases, the fracture is situated between the trochanter minor and the lower part of the root of the neck, sometimes taking one direction, and sometimes another.



Symptoms.

When a fracture, thus situated, is accompanied with laceration, the lower portion might be considerably retracted, producing an appearance of shortening, more or less extensive. Crepitus might be easily produced by fixing the trochanter, while an assistant extends (if necessary) the limb, and rotates it. I think it will generally be found, that all power of bending the limb is lost; also of abducting and adducting it. If the fracture be downward and forward, and not attended with laceration, it occasionally

happens, that the patient is able to bend the limb considerably. This direction of the fracture I have seen only in one instance. In one of the cases I have met with, the fracture of the trochanter was produced by a fall backward; but in what way the force acted, so as to break the bone at this part, I am at a loss to determine. The man, who was 70 years of age, was in the act of drawing a sack of flour from a number of others, with a view to place it on the trucks, made use of to convey the replenished sacks from one part of the chamber to another, &c. and, while exerting himself for this purpose, his foot slipped, and he fell backward; the result was, an oblique fracture of the femur, above the small trochanter, which divided the large trochanter and neck of the bone from the shaft.

The prognosis in fractures of the trochanter major is favourable; whether attended with a fracture of the neck of the bone or not, they usually unite; and, where there is not comminution, I am of opinion, with proper management, union might be effected without deformity of the limb. Now and then, the injury sustained is so great as to destroy life, especially in old people.

Prognosis in
fractures of the
trochanter.

SEC. 7.—*Fractures just below the Trochanter Minor.*

Causes.

Fractures of the femur, just below the trochanter minor, like all other fractures external to the capsule of the joint, occur at all periods of life, and are produced by the same causes, variously applied, which give rise to fracture in other parts of the bone.

Symptoms.

When a fracture exists in this situation, the upper portion of the bone is commonly somewhat abducted; and is also drawn forwards, or, in other words, bent upon the pelvis; so much so, often in loose fractures, as to form nearly a right angle with the lower portion. The cause of this position of the upper fragment, is evidently the contraction of the flexors and abductors of the thigh. The lower portion of the bone is commonly drawn up beneath the upper, sometimes several inches, (*see Plate V. Fig. 2*) giving rise to the most distressing pain; and if the two portions are suffered to unite in these positions, the result is often one of the worst varieties of deformity that take place in consequence of fractures of the thigh.

When the fracture passes through the bone downward and backward, (*see Plate V. Fig. 1*) the deformity is not commonly so great as when it takes any other direction. In these cases, which are seldom met with, the lower portion of the bone lies anterior to the upper portion. Preternatural motion might be easily felt, also crepitus, when the fractured surfaces are brought together, and made to rub upon each other.

Fractures of the femur, in this situation, Prognosis. admit of being united with the greatest facility; and without the least deformity of any kind.

CHAP. II.

TREATMENT OF FRACTURES OF THE UPPER
THIRD OF THE THIGH-BONE.

Observations. In this chapter, I shall consider the treatment of the various fractures, the causes, symptoms, and nature of which I have endeavoured to lay before my readers in the preceding sections.

The modes of treatment that have been, from time to time, resorted to for the union of fractures of the upper third of the thigh-bone, are so numerous, that it would take volumes to give a particular account of them. It appears to me, however, that the different plans and contrivances now commonly advised, possess as many advantages as any which have been hitherto recommended. By giving some account, therefore, of these, I shall do all, upon this subject, that is likely to be useful to the practical surgeon; and all that is necessary to put the junior members of the profession in possession of a knowledge of the inadequacy of

the practice which is still recommended and pursued.

After what has been said, within these few years, upon the treatment of fractures of the upper third of the thigh-bone, I fear that any observations which I might be able to make upon it will not be favourably received. At the risk, however, of being thought tedious, I venture to bring this hacknied subject again under consideration; for, though it has occupied so large a share of the attention of scientific men, I find the usual results of these accidents are still opprobria to the profession. Every surgeon, who knows any thing of practice, is aware that patients, with fractures of the cervix within the capsule of the hip-joint, when managed in the ordinary way, almost always rise from their beds, often after many months of suffering and confinement, without union of the bone—generally without even the production of an useful ligamentous union; and are, for the most part, doomed, for the remainder of their existence, to hobble about, if at all, with the assistance of crutches, or some other mechanical support; that though union by bone often takes place when the fracture is in the neck external to the capsule, or at the inferior

part of the trochanter below the neck, or when it is just below the trochanter minor, yet the results are, after long and severe suffering, usually deformity of the limb, and consequent lameness. The deformity, in some instances, is not very great; but cases of union without deformity, when the fracture is in either of these situations, are very rarely seen. It might be said, that more or less deformity is a general occurrence. I have never seen an instance of fracture of the neck, or of the trochanter below the neck, accompanied with laceration sufficient to allow of the ends of the bone to overlap, united by the employment of any of the usual means, without considerable retraction of the limb; and, generally, more or less eversion of the foot. When the fracture is just below the trochanter minor, the retraction is sometimes not less than seven or eight inches; accompanied with an angular displacement of the fractured parts, now and then so great, that it has been deemed expedient, in order to enable the patient to walk again, to cut down upon and amputate the projecting end of the upper portion of the bone. It might be supposed, that such results happen only in the practice of surgeons who do not know their profession. This I deny. The worst case of deformity I

ever saw, after fracture below the trochanter minor, occurred in the practice of a surgeon in this town, who is well known to the public, and who deservedly stands very high in his profession. Speaking of this injury, Sir A. Cooper says, "it is a difficult accident to manage, and miserable distortion is the consequence, if it be ill treated." Not only, however, do we find non-union, great deformity, and consequent claudication, result from fractures of the upper third of the bone ; but, on some occasions, the irritation produced by the ragged ends of the bone, pricking and tearing the soft parts with which they come in contact, is so great as to destroy the patient. Surely these are evils, the causes of which require to be investigated a little more. Do they arise from the nature of these injuries ? or do they arise from the imperfection of the treatment resorted to for their cure ? Before these questions can be determined, it will be necessary to consider the usual plans of treatment, in order to ascertain how far they are capable of answering the indications which these accidents present ; and if it can be demonstrated that the different contrivances commonly employed do not answer them, it will be evident, that we ought not to expect, from their use, any other results than those which we observe ; and if

on the contrary, it can be shown that there are means in existence, by which union without deformity can easily be obtained; it will be seen, that the usual consequences of these accidents should not be attributed to any thing particular in the physical condition of the injured parts, but to the imperfection of the means by which their cure is attempted.

The treatment which the fractures I have mentioned require, in order to arrive at successful terminations, is so similar, in many respects, that I have been induced to arrange them under one head, *viz.* fractures of the upper third of the thigh-bone. The management of fractures of the cervix femoris, however, differs, in some minor particulars, from that which it will be advisable to have recourse to for fractures of the trochanter major, and for those which occur below the trochanter minor. I shall, therefore, first speak of the treatment of fractures of the cervix; and then proceed to point out the ordinary treatment and differences which it will be proper to observe in the management of fractures of the trochanter major; and those which are met with just below the trochanter minor.

SEC. I.—*Treatment of Fractures of the
Cervix Femoris.*

In the management of fractures of the neck of the thigh-bone, after the active inflammation is got under, internal medicines are not required, except with a view to remove disease, or to maintain the health of the patient. When there is much inflammation, aperient medicines, cautiously administered, assist very much in subduing it. During this state, topical bleedings and evaporating lotions may be sometimes resorted to with advantage; but great care should be taken not to reduce the action of the part too much, as this would only tend to retard the uniting process.

Constitutional
treatment.

The principal part of the treatment is mechanical; and this is the same, whatever may be the situation or nature of the fracture. The only difference to be noticed is in respect to the time which might be required for the completion of osseous union in the several varieties of fracture; and the degree of tumefaction, &c. that may accompany any individual case. In the present state of our knowledge, it cannot

Treatment of
fractures of the
cervix femoris,
within and ex-
ternal to the
capsule.

be determined with nicety how far it may be necessary, for the accomplishment of bony union, to persevere in our curative measures longer, in the treatment of fractures within the capsular ligament, than we should think it advisable in the management of those fractures which occur in the cervix external to the joint; but, as it is probable that the process of union will go on more slowly when the fracture is within the synovial membrane, for reasons which have been already mentioned, than when it is external, it will be prudent and safe, till further light is thrown upon the subject, to confine the patient ten days or a fortnight longer in these cases, than will probably be required for fractures situated at the root of the neck external to the capsule.

Indications.

The indications to be answered in the mechanical part of the treatment of fractures of the cervix femoris, whether within or external to the joint, are, 1st, to keep the limb of its natural length; 2d, to keep the limb in the bent position; 3d, to prevent eversion or inversion of the foot; 4th, to keep the trochanter a little raised; 5th, to keep the fractured surfaces in close apposition; 6th, to prevent the fractured surfaces from moving upon each other.

These indications are so self-evident, that I believe it would be superfluous to offer any comment upon them: they are so important, too, that, unless they are fulfilled, it will be in vain for us to expect that our cases will terminate favourably.

I shall now enquire, how far any of the modes of treatment, commonly resorted to, are capable of answering these indications. In performing this part of my duty, which I would willingly pass over, I would be understood not to contend against men, but against doctrines and plans, when they appear to me to be inconsistent with the soundest principles of surgical science.

I have seen the short splints, as they are called, sometimes employed in the treatment of fractures of the neck of the thigh-bone; but I cannot suppose that they are ever used, by persons who have any knowledge of the anatomy of the parts, with a view to benefit the patient; I shall, therefore, say nothing further respecting them in this place.

On the use of
the short
splints.

The double-inclined plane, or common fracture-box, is frequently made use of in the

On the use of
the double-in-
clined plane.

treatment of these injuries ; but I cannot help thinking, that this apparatus is wholly inapplicable in the management of such cases, if it be the surgeon's intention to benefit the patient by the employment of mechanical means.

When this apparatus is used, it is placed under the limb, upon the bed or mattress ; and made to retain the leg and thigh in the bent position, and to keep the foot upright. Thus, the whole of the limb, below the fracture, is effectually supported ; but what influence has this contrivance upon the upper portion of the bone, which moves simultaneously with the pelvis ?—does it prevent the movements of the pelvis ? No ; it has no influence upon this part of the body, which might be considered advantageous, consequently, none which is calculated to restrain the movements of the upper portion of the bone. The pelvis is allowed to move freely, independently of the apparatus and of the limb ; and, as long as this is permitted, the pelvic portion of the fractured thigh-bone cannot be kept at rest.

This apparatus not only does not prevent motion of the fractured parts, but also fails to prevent the fragments from passing each other ;

and, consequently, fails to prevent shortening of the limb. This will be immediately perceived, when it is considered that the nates sink into the bed or mattress; and, at the same time with the whole trunk, gravitate towards the foot, while the apparatus, and all that part of the limb below the fracture, remain stationary, or as they were first placed.

Again, this apparatus does not keep the fractured surfaces in close apposition; for, as the pelvis and the apparatus are unconnected, and as the pelvic portion of the bone moves simultaneously with the pelvis, there must, consequently, be a greater or less degree of separation produced between the broken ends of the bone in one direction or another, or more or less stretching of the soft parts by which they may happen to be connected; and this separation of the fractured surfaces, or this stretching of the soft parts, must be proportionate to the extent of motion given to the pelvis, from whatever cause that motion might be effected. It might be said, that a belt placed round the pelvis, or a splint applied to the outer side of the limb, would have the effect of keeping the fractured surfaces together. This would, indeed, be the case, if retraction

were prevented; but, as the fractured surfaces are allowed to pass each other, a belt or splint thus applied, would be likely to, and I have no doubt often does, force the serrated edges of the fractured ends against the inflamed capsule of the joint; and thus produce a degree of suffering, which can rarely be borne by the patient. The pain occasioned by these means, when the injury is in the recent state, is often very great; as I have repeatedly witnessed in the practice of surgeons who are accustomed to employ half measures.

Inference.

From what I have said, I think, it will appear, that the double-inclined plane, or fracture-box, is not calculated to answer the indications above-detailed. It does not afford a steady support to the trochanter, so as to keep that part of the limb in its natural position; it does not prevent retraction of the limb; it does not keep the fractured surfaces in close apposition; it does not prevent the fractured ends from moving upon each other; it gives the surgeon no command over the fractured ends of the bone; and, consequently, he who can obtain no better means, ought not to be considered answerable for the result of a single case, because his efforts are resisted by mechanical forces, over which he has no control.

There are two other modes of treatment, also, much resorted to, whose principal effects I shall now mention. One of these is recommended by Desault, and the other by Boyer. When the treatment, advised by either of these gentlemen, is adopted, the limb is placed in the straight position.

Desault's and
Boyer's splints.

When Desault's splint is employed, the band, (*a*, *Fig. b*, *P. 120*) which is intended to exert its influence upon the tuberosity of the ischium, shifts its situation, so as to lie between it and the upper part of the thigh, where it soon gets into a roll, which causes much pain; and, if its operation be continued in such a manner as to have the effect for which it is applied, it often occasions ulceration, and sometimes gangrene. The difficulty of acting upon the tuberosity is much greater in women than in men, in consequence of the greater quantity of cellular and adipose substance, which is generally found in females about this part. This band, when exerting its influence, acts upon the large vessels of the thigh, and gives rise to considerable tumefaction of the limb, unless great care be taken to support it by means of a bandage from the toes to the groin. It passes, too, over the fractured part, and during the inflammatory stage of the

Desault's
splint.

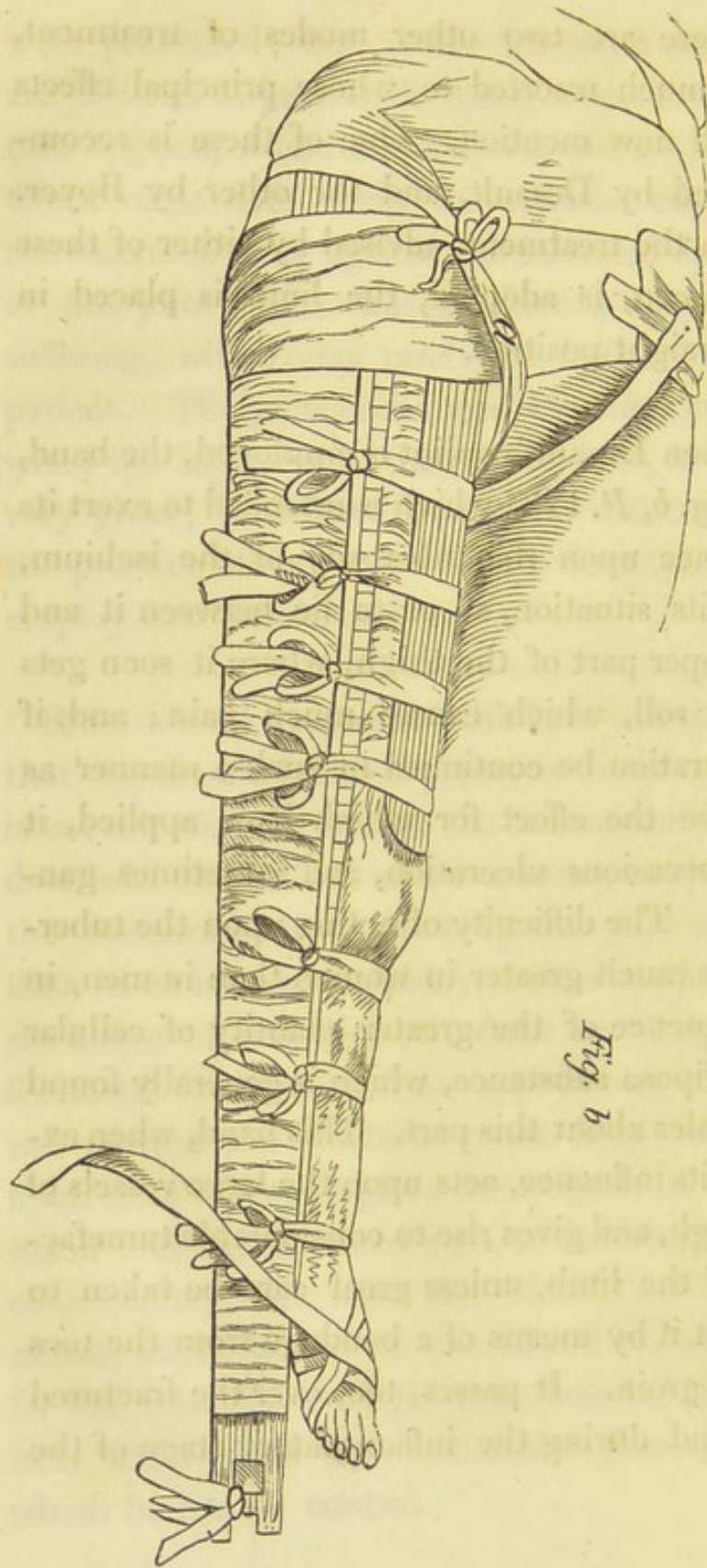
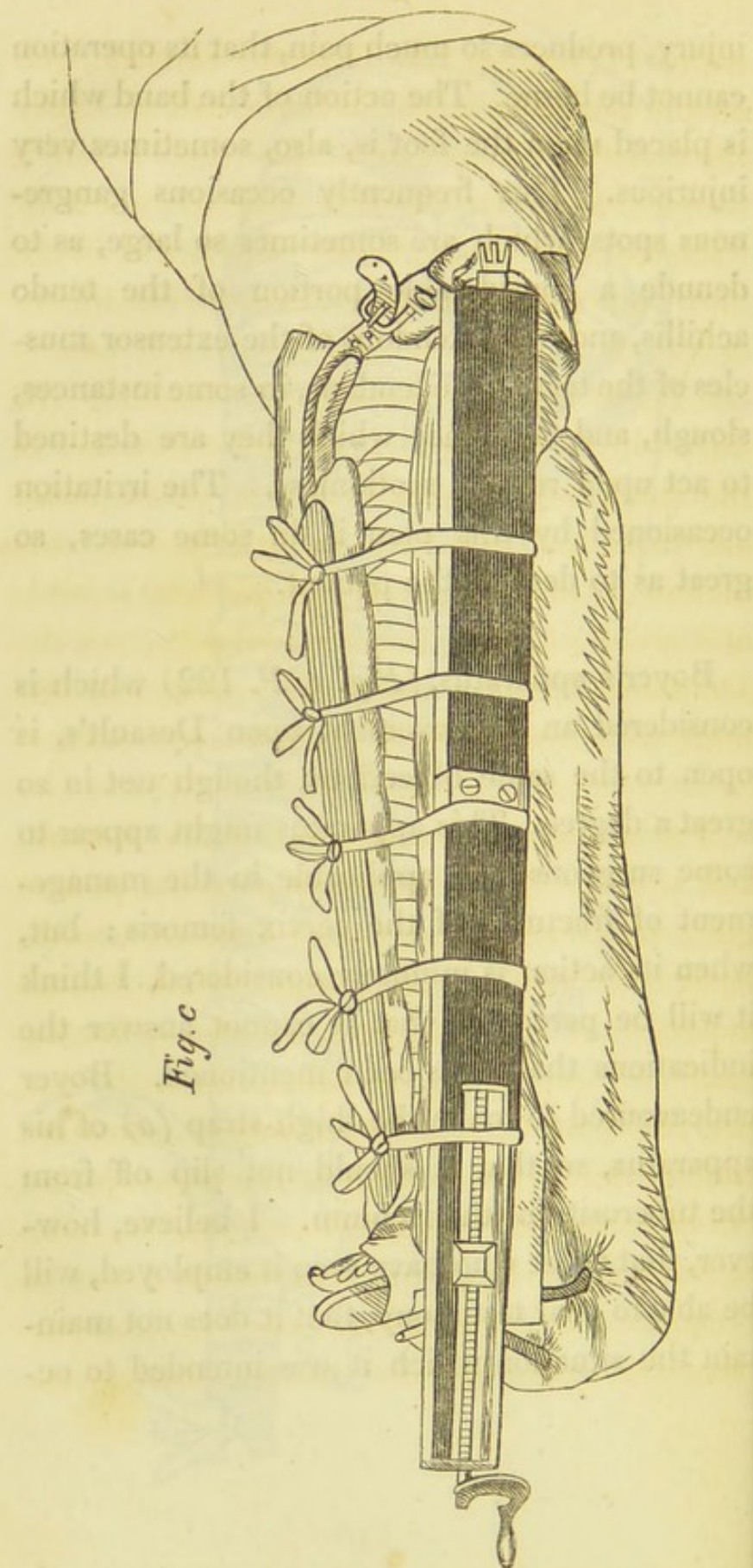


Fig. b

injury, produces so much pain, that its operation cannot be borne. The action of the band which is placed upon the foot is, also, sometimes very injurious. This frequently occasions gangrenous spots, which are sometimes so large, as to denude a considerable portion of the tendo achillis, and of the tendons of the extensor muscles of the toes. The tendons, in some instances, slough, and the bones which they are destined to act upon remain motionless. The irritation occasioned by this plan is, in some cases, so great as to destroy the patient.

Boyer's apparatus, (*Fig. c, P. 122*) which is considered an improvement upon Desault's, is open to the same objections, though not in so great a degree. This apparatus might appear to some surgeons very applicable in the management of fractures of the cervix femoris; but, when its action is minutely considered, I think it will be perceived, that it cannot answer the indications that have been mentioned. Boyer endeavoured to make the thigh-strap (*a*) of his apparatus, so that it should not slip off from the tuberosity of the ischium. I believe, however, that those who have seen it employed, will be able to bear testimony, that it does not maintain the situation which it was intended to oc-

Boyer's apparatus.



cupy. This strap, like Desault's bandage, gets off the tuberosity of the ischium, and lies upon the upper and inner part of the thigh, where it compresses the large vessels, and acts upon the fractured part. Hence arises tumefaction of the limb; and as long as there is any active inflammation in the seat of injury, so much pain is occasioned in the fracture, by extending the limb with this contrivance, that the influence of the thigh-strap cannot be borne, in a manner calculated to enable the surgeon to keep the limb of its proper length. Boyer was sensible of this evil; and he, therefore, recommends the adoption of means which do not extend the limb, while the fracture is in the recent state.

The contrivance recommended by Desault, and that by Boyer, not only give the patient great inconvenience, but are, also, very inefficient. It will be seen, that when Boyer's apparatus is employed, the counter-extending band or strap, acting obliquely upon the upper and inner part of the thigh, is calculated to force the pelvic portion of the bone upward out of its natural position; its action, too, tends to force the shaft of the bone outward, and to press the soft parts between the fractured surfaces. It might be said that the shaft of the

bone is not forced outward when Desault's splint is used, though the operation of this splint has a tendency to impel it away from the pelvis; because there is a bandage passed round the pelvis, which might be made to counteract this effect of the thigh-strap, and thus keep the shaft of the bone in a proper line; but though a bandage placed round the pelvis, in the manner pointed out by Desault, would counteract, in this respect, the oblique thigh-strap; yet, I presume, its operation would be seldom beneficial; for as the limb is not kept extended to its proper length, the fractured surface of the trochanteral portion of the neck would often be brought into contact with the soft parts; and, therefore, instead of assisting nature in the production of union, the bandage would have the effect of irritating the patient, without any probability of benefiting him, even, if he should be able to bear the pain which it occasions.

Inference.

Boyer's apparatus keeps the foot upright, but it does not properly answer any other indication; and I cannot perceive that this one, or any other which I have noticed, is effectually answered by the plan which Desault recommends. It seems to me, that any advantages

which are obtained by these modes of treatment, are more than counterbalanced by the evils which they occasion.

Such are the contrivances that are, at the present day, employed, with a view to restore to patients who have fracture of the cervix femoris, the use of their limbs. I have seen a great variety, but I am not aware of any splint or fracture-box, commonly resorted to, which offers more advantage than those I have mentioned. Is it, then, to be wondered at, that we meet with so many cases of non-union in this situation? I think, on the contrary, that it is rather surprising, that union takes place as frequently as it does, even in fractures external to the capsule.

Observations.

After trying unsuccessfully various splints and apparatuses, Sir Astley Cooper has come to the conclusion, that it is better, when the fracture is within the joint, to treat the patient in such a manner as to enable him to leave his bed, as soon as the inflammation occasioned by the accident has subsided, without any regard to the union of the bone. A conclusion, to which any surgeon was likely to arrive, who could obtain no better means to assist him in his curative intentions, than those to which I have alluded; and,

Sir Astley
Cooper's plan.

I am not sensible that Sir Astley was in the habit of employing contrivances, which could in any respect be considered more efficacious than the fracture-box, or Boyer's apparatus. If he had used better means, I presume we should have found them noticed in his book.

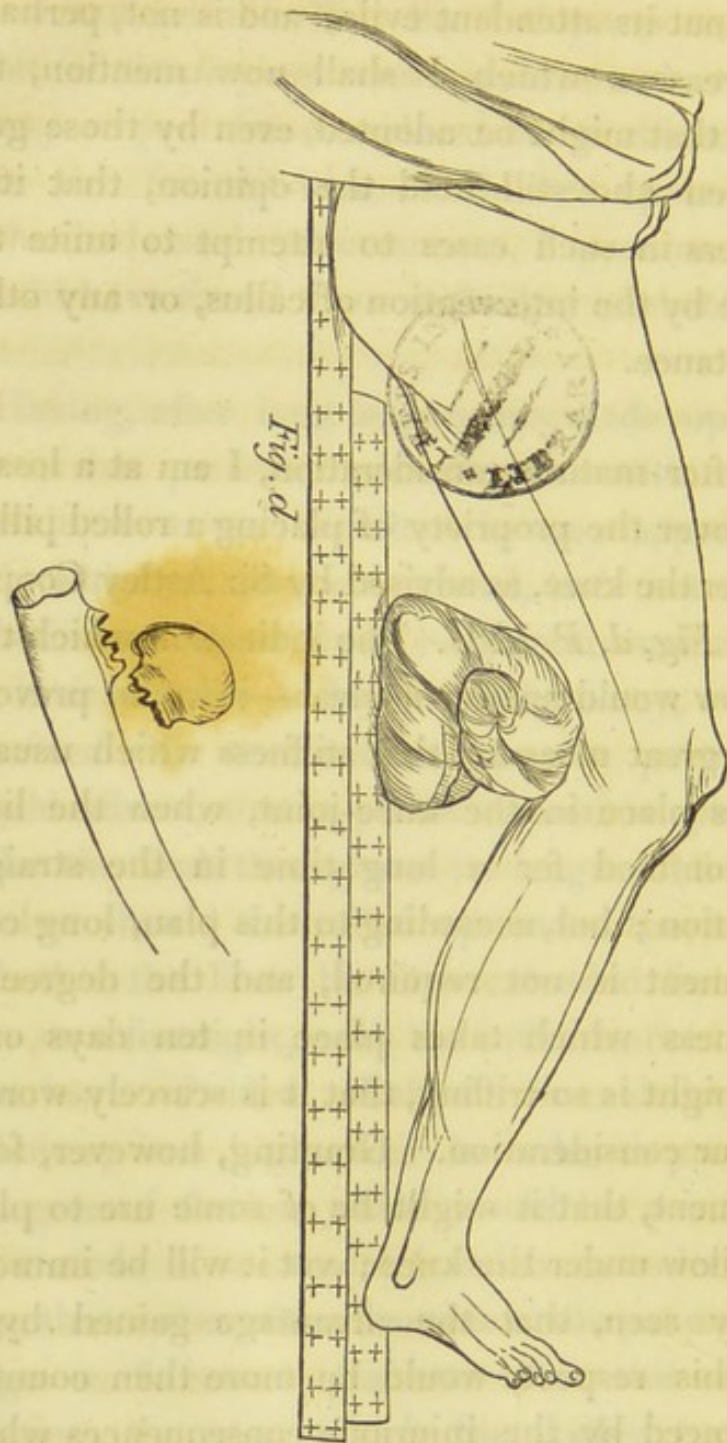
Sir Astley
Cooper's treat-
ment.

Having, after long experience, made up his mind, that patients, with fracture within the capsule, were not benefited by any apparatus with which he was acquainted, and that they sometimes suffered from long confinement under their use, Sir Astley was led to say, "if I sustained this accident in my own person, I should direct, that a pillow should be placed under the limb throughout its length, and that another should be rolled up under the knee, and that the limb be thus extended for ten days or a fortnight, until the inflammation and pain have subsided. I should then daily rise and sit up in a high chair, in order to prevent a degree of flexion which would be painful." This mode of treatment is advised, under the idea, that no benefit will accrue to the patient by longer confinement; but even under this consideration, the plan which Sir Astley has so strongly recommended, by stating that he would follow it in his own person, seems to me not

without its attendant evils; and is not, perhaps, for reasons which I shall now mention, the best that might be adopted, even by those gentlemen who still hold the opinion, that it is useless in such cases to attempt to unite the bone by the intervention of callus, or any other substance.

After mature consideration, I am at a loss to discover the propriety of placing a rolled pillow under the knee, as advised by Sir Astley Cooper, (*see Fig. d, P. 128*). The indication which this pillow would answer is clear—it would prevent, in a great measure, that stiffness which usually takes place in the knee-joint, when the limb is confined for a long time in the straight position; but, according to this plan, long confinement is not required, and the degree of stiffness which takes place in ten days or a fortnight is so trifling, that it is scarcely worthy of our consideration. Granting, however, for a moment, that it might be of some use to place a pillow under the knee; yet it will be immediately seen, that the advantage gained by it in this respect, would be more than counterbalanced by the injurious consequences which must arise from the practice.

Observations
upon.



The pillow is doubtless placed so as to support the limb, in the first instance, in a position

apparently the most comfortable to the patient ; but, is a pillow of a nature to maintain it so, or is it calculated to keep up extension of the limb ? To both of these questions I must give a decided negative. The pillow yields to the superincumbent weight, and what is the result ? In proportion as the pillow gives way, the limb gravitates towards the hip-joint, as is represented in the diagram where this mode of treatment is shown ; but here the limb has lost its natural support, in consequence of the fracture of the neck of the bone, therefore it continues to gravitate along the side of the pelvis towards the bed, till its further progress is arrested by the resistance of the soft parts. Thus, the soft parts are stretched ; and, if there were no reason to apprehend the occurrence of shortening from the nature of the accident, this is evidently a mode of treatment which is likely to effect it, even without the operation of any other cause. But there is another cause whose operation militates against this practice—I mean the gravitation of the body towards the foot of the bed. Thus, then, it will be seen that, under this treatment, there are two causes constantly tending to make the fractured surfaces pass each other, independently of the action of the muscles of the limb ; viz. the gravitation of the limb towards the pelvis,

and the gravitation of the trunk towards the foot of the bed. The ragged ends of the bone are in this way, constantly driven against the soft parts; and if we add to these forces the powerful contraction of the muscles which tend to retract the limb, we shall not wonder that it becomes retracted, but rather be surprised if we were to meet with a case, thus treated, not attended with considerable shortening; for if the investing membranes should not be torn through at the time of the accident, this method is likely to cause them to ulcerate.

Inference.

From the view which I take of this method, I should say, with every consideration of respect for Sir Astley's surgical acquirements, that the tendency of it is injurious, even if the patient be permitted to leave his bed at so short a period after the accident as he has recommended. It produces separation of the fractured surfaces, which might otherwise remain in tolerable apposition, and thus increases the claudication, which would otherwise supervene; it is, therefore, in my opinion, a plan of treatment which ought never to be advised.

Indications not answered.

I need not say any thing to shew the inadequacy of the pillows to keep the limb quiet; for, as no beneficial effect is expected to arise

from surgical treatment, except in the employment of means to subdue the inflammation, no attempt is made to secure the parts from motion, or to answer effectually any other indication that I have observed; but I hold it an axiom in surgery, that, if we are satisfied that no good can be obtained, we should be doubly careful that we do no mischief—an axiom which I cannot help thinking is overlooked when this plan of treatment is pursued.

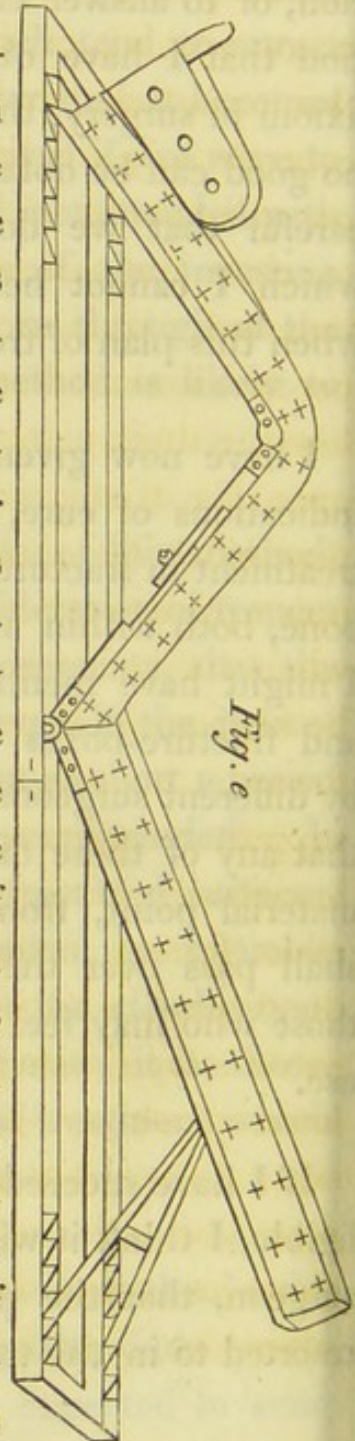
I have now given a concise account of the indications of cure, and of the usual plans of treatment in fractures of the neck of the thigh-bone, both within and external to the capsule. I might have mentioned various other splints and fracture-boxes that have been employed by different surgeons; but, as I cannot discover that any of these differ in their action, in any material point, from those I have noticed, I shall pass over them in silence, leaving it to those who may feel disposed to advocate their use.

If I have succeeded in making myself intelligible, I think it will be granted, by the candid surgeon, that the plans which are commonly resorted to in the treatment of fractures of the

cervix femoris, are not of a nature to assist us, in any considerable degree, in bringing about those results which it is our business to obtain.

Description of
the author's
fracture-bed.

I have attempted to supply the deficiencies which I had observed in these modes of treatment, in the construction of an apparatus which I employ in the management of fractures of the upper part of the thigh-bone, and for various other purposes. This apparatus (*Fig. e.*) I call a fracture-bed, which, when properly fitted up, consists of a frame which has a joint near the middle, and which is made to support four pieces of board, long enough, when connected, for an adult to rest upon in the extended position; of a foot-board, pelvis-strap, mattress, and a convenience to receive the fæces. The two pieces of board which form the middle plane, are made to slide



upon each other, so that this plane might be adapted and fixed by screws attached to it, with the greatest accuracy to the natural length of the patient's thighs. In this plane, there is an opening of a form and size to receive the receptacle for the fæces. When the receptacle is in the hole, it is retained in its proper position by a shelf, which shuts up so as to close the opening when the receptacle is removed. This plane is connected to the upper and lower planes by rule joints; which allow the three planes to be placed in connexion upon the frame, at any angles that might be required. The joint formed by the middle and upper planes rests upon the middle of the frame when the bed is used. The upper plane may be kept raised from the frame, so as to incline towards the foot of the bed, by means of a supporter appended to its under surface. The loose ends of this supporter are received in racks formed in the upper end of the sides of the frame. At the lower end of this plane the pelvis-strap is attached. The lower end of the lower plane is received in racks formed in the sides of the lower end of the frame, which support it so as to make it form with the middle plane any angle that the surgeon might deem advisable. The foot-board, which is connected

to the lower end of this plane, answers the double purpose of retaining the foot in its proper position, and of keeping the bed-clothes from pressing unpleasantly upon the toes. The mattress consists of two portions, which are sown together, so as to form a joint like that of a paillasse. The part upon which the trunk rests is double the thickness of that upon which the lower extremities are placed.

Observations
upon Mr.
Earle's frac-
ture-bed in
comparison
with Mr. Har-
rold's and the
author's.

The first fracture-bed that I know of, which was recommended with a view to fix the pelvis, is that invented by Mr. Harrold. Soon after Mr. Harrold published an account of his bed, Mr. Earle introduced the fracture-bed which bears his name. Mr. Earle has simplified the contrivance recommended by Mr. Harrold, but it does not appear to me, that he has added any thing to its efficiency; on the contrary, as far as I am able to judge, Mr. Earle's bed is less perfectly adapted to answer the indications which are noticed in fractures of the thigh than Mr. Harrold's. I need only allude to the mechanism of the middle plane in the two contrivances, in order to justify this remark. By referring to the published accounts, it will be seen, that Mr. Harrold's bed admits of being adjusted with nicety to the length of the thigh

without any adventitious support; but Mr. Earle's frequently requires the unstable and inconvenient assistance of wedges of wood, which he recommends to be placed beneath the calf of the leg, in order to make up for this deficiency in the construction of his fracture-bed. This mode of adapting the middle plane to the natural length of the limb, is, in my opinion, injudicious; and, though it might answer very well in the hands of Mr. Earle, I believe it will, in general, be found much less certain in its effects, and much more difficult to manage, than the method which Mr. Harrold has resorted to in the construction of the fracture-bed which he employed.

The fracture-bed which I have described differs, in several important particulars, from Mr. Earle's. In the only model of that gentleman's fracture-bed that I had seen, when mine was constructed, there was no contrivance for altering the length of the middle plane; consequently the bed appeared to me to be applicable only to limbs of one length. Mr. Earle has now imperfectly got over this evil, by making the middle plane so that it might be elongated or shortened, but not so as to admit of its being nicely adjusted to limbs of different lengths.

The least difference that can be made in the length of this plane, according to its present construction, is about an inch; so that if any space less than this is required, it must be obtained by the introduction of "wedges of wood," or some other means. This imperfection gives rise to injurious consequences, which, upon a cursory consideration, might not appear, but which, after further investigation, will be evident. For instance, if the limb be shortened half or three-quarters of an inch, there is no provision made for its elongation, in some cases, except by the introduction of pieces of wood under the calf of the leg. These are likely to produce very uncomfortable pressure at this part, upon which the extending influence is exerted. They sometimes, also, get out of place, and allow the limb to become again retracted. The plan which Mr. Earle has advised to fix the pelvis, cannot, it appears to me, be depended upon, and might be sometimes productive of mischief. For example, when the fracture is in the neck of the thigh-bone, the bandage, which he directs to be carried across the upper parts of the thighs and fastened to the bed, might act injuriously upon the shaft of the bone, forcing it from its natural relative line with the pelvic portion. I have also noticed, what appears to me, a great

imperfection in the construction of the mattress which Mr. Earle employs; which consists in its being of equal thickness throughout, and without a joint in the middle. The consequence is, that when the planes of the bed are bent upon one another, the mattress gets into folds just at the part where the pelvis rests. Such irregularity in the surface would be likely to produce painful pressure, even if the body were kept in the horizontal position; but, when the limbs and the body are raised upon the planes, so as to gravitate upon the pelvis, as is the case when this bed is employed, the pain, in some instances, at the posterior part of the sacrum, is too great to be borne with safety. The thickness of the mattress, also, at the angle, formed by the middle and lower planes, is such as to form a surface much too large to be well received in the ham, when the leg is bent upon the thigh; consequently, this part of the mattress has the effect of forcing the fractured end of the lower portion of a broken femur forward out of its natural line. These are the principal evils which I have observed to arise from the employment of Mr. Earle's bed, in the management of fractures of the thigh. But, independent of every other consideration, this bed, though more simple than Mr. Harrold's, appears to me to be

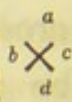
more complicated than is necessary for the successful treatment of fractures of the thigh. The indications I have noticed might be answered in a much better manner, with means far more simple in construction and in application; and, at the same time, much more portable, than Mr. Earle's contrivance.

The evils I have mentioned, and others of minor importance, led me to consider this bed as inadequate to answer the purposes which the surgeon should have in view, in the management of fractures of the cervix, or any other part of the femur. I was, therefore, led to turn my attention to this subject, in order to contrive some apparatus by which the indications I have detailed might be more effectually answered, than by any of the plans which I had seen. In my endeavours to accomplish this desideratum, I have succeeded beyond my warmest expectations, in constructing a fracture-bed, which has the advantages of being more simple, more portable, and, at the same time, more efficacious, than any other with which I am acquainted. I do not know any attainable indication in these cases, which it does not enable the surgeon to fulfil most effectually; but, how far I may have performed the task

which I imposed upon myself to the satisfaction of the profession, future experience will decide.

When it is intended to use this fracture-bed for fractures of the neck of the thigh-bone, within or external to the capsule, three boards should be procured, long enough to lie across a common bedstead, the sacking having been removed. One of these boards should be placed across the bedstead at the head, another about the middle, and the other at the foot. The frame of the fracture-bed should be placed upon these boards, so that the joint may be supported by that which lies in the middle. The planes of the fracture-bed should then be placed upon the frame, with the joint, formed by the middle and upper planes, resting upon the middle of the frame, in places made to support it. The upper plane should be raised to an easy position, and the lower and middle planes should be made to form a double-inclined plane; which is done by putting the lower end of the lower plane to rest in two of the notches of the rack, made at the sides of the lower end of the frame. I usually choose the second at each end. This being done, the mattress should be laid upon the planes, with the thick part upon the upper plane, and the thin part upon the middle and

Application of
the author's
fracture-bed,
as for fractures
of the neck of
the thigh-bone.

lower planes. The joint of the mattress should lie over the joint formed by the upper and middle planes, with the edges, which are sewn together, placed downward. A blanket and sheet should now be thrown over the mattress and tacked to its edges, so that they may be prevented from getting into folds under the patient. A hole must be made in the blanket and sheet to correspond with the hole in the mattress. This might be done by making a cross cut, thus, . The corners, *a*, *b*, *c*, *d*, should be turned down, and tacked to the sides of the hole in the mattress, so that there may be no seams to hurt the patient. The foot-board should now be placed in the hole made in the lower plane corresponding to the injured side, and the pad placed in the hole in the mattress.

These preliminaries being arranged, the fracture-bed might be considered ready for use. The patient should be placed upon it, so that the perineum might be opposite the hole in the mattress. As the patient lies upon the bed with the limbs over the middle and lower planes, and the nates resting in the angle formed by the middle and upper planes, the surgeon should measure both limbs from the anterior superior spinous process of the ilium to the

base of the patella ; and, if the injured limb be retracted, the middle plane should be elongated sufficiently to make this limb of exactly the same length as the other. This being done, this plane should be firmly fixed at its proper degree of elongation by the retaining screws which pass through the two portions of it. The limb, having a spiral bandage round it, neatly applied from the toes to the knee, should now be fixed upon the planes with the foot between the legs of the foot-board. This is done by means of another portion of bandage, which is carried twice round the ankle, the two ends are then crossed upon the instep, and passed under the legs of the foot-board, brought together, and tied at the bottom ; so as to keep the leg and thigh firmly fixed upon the respective planes of the bed. While this is being done, the surgeon should take care that the patient does not shift the pelvis. Thin pads should be placed between the sides of the sole of the foot and the legs of the foot-board, to keep the foot upright. A thin pad should also be placed between the upper part of the back of the thigh and the mattress, to raise and support the trochanter major. The limb ought now to be of *exactly the same length as the sound one, and the foot perfectly upright*. This having been ascertained, the

surgeon places a splint padded on the outer side of the thigh, long enough to extend from the knee to the pelvis; and then buckles the pelvis-strap round the pelvis, just below the superior anterior spinous processes of the ilium; having previously carried the end of the strap on the injured side over the upper end of the thigh-splint. The degree of tightness of this strap should be regulated, at all times, by the particular state of the fracture. The splint should be fixed to the thigh, at the other end, by a bit of bandage passed lightly round the thigh over it. When the limb is thus secured, all the indications I have noticed are most fully answered. The limb is supported in the bent position, which is the easiest position, and also prevents that long-continued stiffness of the knee which is observed to arise from keeping the limb for a long time straight. The limb is maintained of its natural length. The foot is kept upright, and fixed in such a manner as to prevent the limb from moving; and the pelvis being, at the same time, fixed by the pelvis-strap, the fractured ends of the bone are kept perfectly free from motion. The trochanter is supported, and the fractured surfaces having been brought together, are maintained in close apposition by the pelvis-strap; which, at the

same time that it fixes the pelvis, passes over and acts upon the upper end of the splint; which is placed along the outer side of the thigh, so as to be the medium through which the pelvis-strap presses the trochanter major towards the pelvis; and with it, of course, the fractured surface of the trochanteral portion of the bone.

The following cases will shew with what facility fractures of the neck of the thigh-bone are managed by the use of this fracture-bed.

A bricklayer's labourer, about 40 years of age, was brought to St. Thomas's Hospital, in consequence of an injury which he had received in the upper part of the right thigh. He stated that he fell from the wheel of a cart three days before his admission into the hospital, in such a manner as to strike the trochanter major forcibly against the ground. He got up, and walked about twenty yards, and then worked at making mortar for two hours; in the course of which he lifted two buckets of water without suffering severely. The limb had now become stiff and very painful, so that he was obliged to leave his work; but the inconvenience he experienced was not so great as to prevent him from walking, with the assistance of a stick, up-

Case unaccompanied with laceration.

wards of half a mile to his lodging; but the limb felt very weak, and the pain which he experienced in the groin, thigh, and knee, during this exertion, was extremely severe.

The professional gentleman who saw this man a short time after the accident, informed me, that he complained very much when the limb was examined; but there was no crepitus perceptible, nor was the limb at all shortened.

He was brought to the hospital on the third day after the accident, and I had an opportunity of examining the limb the moment after he was warded. There was now severe pain in the hip-joint, apparently dependent, in a great measure, upon inflammation of the capsule, which was considerably distended; as was evinced by a prominent fluctuating swelling in the front of the joint. He had, also, great pain in the knee, and the whole limb was weak and useless. The pain in the groin and knee was much increased when the limb was moved, especially when it was rotated inward. There was no swelling perceptible, except that which appeared in the groin. The limb was everted but not shortened. The eversion, however, had existed for a long time, and was produced by a former injury in the

joint, or its vicinity ; it did not, therefore, tend to throw any light upon that, under which he was at this time labouring.

The history of the case altogether, led me to suspect the existence of a fracture of the cervix femoris, unattended with laceration of the surrounding parts, and I, consequently, examined the limb very cautiously, with a view to elicit crepitus ; but I did not succeed in producing it. In my attempts to discover this symptom, I carefully abstained from any violent measures, in order that the close coverings might not be lacerated. I mentioned my feelings respecting this case to Mr. Green, under whose care the man was admitted ; and he saw the patient immediately, had him placed in a common bed, and ordered twenty leeches to the groin. The leeches were applied, but they had but little effect in reducing the inflammation ; the same number was, therefore, repeated four times within the first twelve days after he came to the hospital. At the end of this time, the inflammation and pain had greatly subsided ; and, on the fifteenth day, the limb was again carefully examined by Mr. Green and myself, in company with many of the gentlemen attending the hospital. It continued everted, but no retraction

had taken place. If there were any difference in the length of the two limbs, it was certainly in favour of that which was injured. The crepitus of fracture, however, discovered by rotating the limb, was very evident; but the part of the cervix that was broken could not be precisely determined. Still, as the symptoms which often accompany fractures of the cervix external to the capsule, namely, ecchymosis and diffused swelling, were not present, and as the inflammation appeared to be confined to the joint, we thought it probable that the fracture was principally within the capsule.

The man was now placed upon my fracture-bed, where he remained three weeks. At the end of this time, the limb was again examined, and the bone appeared to be united; he was now placed upon a common bed, where he continued only for a few days.

At the end of a month from the time he was taken from the fracture-bed, he was able to walk the wards with facility; without any assistance whatever, and with only a slight limp. There was no shortening of the limb; and it is worthy of remark, that the foot, which was much everted before the accident for which he

was admitted into the hospital, was now brought to its natural position.

It was intended to keep this man upon the fracture-bed another fortnight, but finding his limb strong, he determined not to remain in one position any longer. His leaving the bed so early was considered an imprudent step, as the union might have given way, but by doing so, he brought to light a most important fact; *viz.* that fractures of the neck of the thigh-bone sometimes unite very rapidly under proper management, when the investing membranes are not much torn. Remarks.

Geo. Franks, *æt.* 30, was admitted into St. Thomas's Hospital with a fracture of the neck of the thigh-bone, which had been just produced by a fall upon the trochanter. On his admission, the most prominent signs of fracture of the neck of the thigh-bone; *viz.* eversion and retraction of the limb and crepitus, were not present. He had, however, considerable pain at the upper and inner part of the thigh, which came on immediately after the accident, and was accompanied with great diminution of power in the limb. He could move it in different directions, but not without increasing his suffer- Case with laceration.

ings. There was slight tumefaction at the upper part of the thigh, but no ecchymosis. He was placed upon a common bed, in the horizontal position, but no apparatus was employed.

A fortnight after the accident, *retraction of the limb suddenly took place to the extent of an inch and a half*, which was ascertained by means of a graduated measure, carried from the superior anterior spinous process of the ilium to the base of the patella; the foot was everted, and all the other signs of fracture of the neck of the thigh-bone, which are usually described, and which I have said accompany fractures of this part, when attended with considerable laceration, were very strongly marked; with the exception of crepitus, which was never distinctly felt, either before or after the retraction was observed.

Mr. Travers, under whose care this man was admitted, now desired, that he should be subjected to the plan of treatment which I have recommended, and politely requested me to superintend the management of it.

The patient was placed upon the fracture-

bed on the eighteenth day after the accident, where he remained for eight weeks, at the expiration of which, the limb was examined, and it was considered that union had taken place; but, whether the union was by bone or ligament, it was not easy to decide. The foot was in its proper position, and the limb nearly as long as the other—the degree of retraction which existed being *less than a quarter of an inch*, which was discovered by measuring the limb with the graduated tape as before. The apparent length of the two limbs was the same. He left the hospital in about three weeks after he was removed from the fracture-bed, with power sufficient to walk without any artificial aid, but not without a slight limp. Since he left the hospital, he has been employed in a situation where he was sometimes required to lift, and occasionally to carry four hundred pounds weight at a time, which he has done without producing any injurious consequence. He is now able to walk without the least claudication; and with a freedom of motion, nearly, if not quite equal, to that which he enjoyed before the accident.

This case is important upon several considerations. It shows that a fracture of the neck of the thigh-bone might exist, without being accompa-

Remarks.

nied with eversion or retraction of the limb—it tends to illustrate the doctrine which has been inculcated in a former part of this volume; *viz.* that fractures of the neck of the thigh-bone occur without a sufficient degree of laceration of the investing coverings to allow the fractured ends to overlap; and, that such fractures might become converted into nearly the same state as those which, from the first, are attended with the most prominent signs of fracture of this part.

Situation of the fracture.

It might be a question with some surgeons, whether the fracture in this case was within or external to the capsule—a question which I feel myself unable to decide. It has been noticed, that the man was only thirty years of age. This would lead to the presumption that the fracture was external to the capsule; but, on the other hand, the great retraction of the limb, the absence of ecchymosis, the absence of swelling, except what was confined to the joint, and its immediate vicinity, and the absence of crepitus, would induce one to incline to the opinion that the fracture was within the joint. Let the situation of the fracture, however, be what it may, it seems to me that the result is particularly deserving of attention. It is a demonstration, that we are now in possession of a plan of

treatment, by the judicious management of which, fractures of the neck of the thigh-bone, of a description which allows of retraction to the extent of an inch and a half, might have the fractured parts supported and maintained in such a position, as, sometimes at least, to admit of union, which, if not bony, answers all the purposes of bone—one whose completion is followed by a restoration of the natural strength, freedom of motion, and configuration to a degree which renders the limb nearly, or quite as useful as before the injury was sustained.

Mary Richards, æt. 72, was admitted into St. Thomas's Hospital under Mr. Travers, with a fracture of the neck of the left thigh-bone, occasioned by a fall upon the trochanter, in consequence of a slip in walking. The foot was everted and the limb retracted three-fourths of an inch; which was ascertained, by employing the graduated measure, as in the former cases. She felt pain at the upper and inner part of the thigh and behind the trochanter; and the joint was very tender, so much so, that she could not bear it to be pressed upon. Crepitus could not be felt. She had slight swelling of the upper part of the thigh, and slight apparently superficial ecchymosis in the nates of the injured

Case with laceration.

side. She had not borne upon the limb since the accident, which happened on the day of her admission into the hospital.

On the fourth, day I assisted in placing her upon the fracture-bed, and afterwards superintended the treatment, which was continued for eight weeks. At the end of this time, the limb was examined, and it was found that firm union had taken place without any discoverable shortening of the limb, or other deformity.

This woman being very feeble and much subject to rheumatism, from which she suffered considerably on the other side, while under treatment, and more or less during her convalescence on both, recovered the use of her limb but slowly.

Six months have elapsed since the accident occurred, and the injured limb still maintains its natural position, and is of the same length as the opposite. She feels no inconvenience in the limb, and she walks in the room with so much equality of power on both sides, that it would be very difficult to say which limb had been injured.

Case with laceration.

Hannah Johnson, æt. 67, was admitted un-

der my care at the Dispensary, having a fracture of the cervix femoris, which had been treated, for five weeks, as a contusion of the hip. Upon enquiry, I found that, five weeks before her application to the Dispensary, she fell off a step, and pitched with great violence upon the left side. She was taken up, unable to bear upon the limb—suffering considerable pain at the upper and inner part of the thigh. She was placed, by a medical man, in the horizontal position, which she maintained for a fortnight; and she then, notwithstanding the continuance of the pain, began to sit up daily, by which the pain was considerably increased. When I first saw her, there was a great deal of tumefaction in the whole limb, and the pain in the groin was but little diminished. I was informed there never had been any ecchymosis, and that the swelling, which came on shortly after the accident at the upper part of the limb, was not great. Upon carrying my measure from the superior anterior spinous process of the ilium to the base of the patella, I discovered that the degree of retraction was upwards of three quarters of an inch.* The foot

* In this, as well as in many other cases, I saw the great importance of adopting this mode of measuring the limb; for

was everted, and there was great pain experienced when pressure was made on the hip-joint. The limb could be readily brought to its proper length, and moved in any direction; but when extension was discontinued, it assumed its former relative position. Crepitus was felt with difficulty.

I recommended this patient to go into St. Thomas's Hospital, where she would have the benefit of one of my fracture-beds. She was admitted under Mr. Travers, who examined the limb—felt the crepitus, and concurred with me as to the nature of the injury.

The accident happened on the 28th of February, and she was placed on the fracture-bed on the 5th of April, where she continued for ten weeks, at the expiration of which, the fracture appeared to be united with the limb, in its natural position; and, upon measuring it as before, scarcely any difference in the length of the two limbs was perceptible.

She is now able to walk without any assist-

the woman having a tilt of the pelvis, arising from curvature of the spine, the *apparent* length of the two limbs might have led to a very erroneous conclusion.

ance—not, however, yet without limping. She feels no inconvenience in the joint, when she bears upon the limb in walking, or lies upon the injured side. The length and position of the limb continue the same as when she left the Hospital.

When we review the history of these two old women's cases, we see sufficient to account for their comparatively tardy recovery. The first and second case that I have related, occurred in men who were in good health at the time of the accident, and whose constitutions were strong and vigorous; we might, therefore, have expected in them a rapid restoration of the powers of the limb, after the union was accomplished. The third was in a woman who, before the injury, was old, thin, and in delicate health; and who, after its occurrence, was much afflicted with chronic rheumatism, which greatly increased the debility of her frame. In the fourth case, the slow recovery seems to be fairly attributable to the woman's timidity and to the state of the muscles of the limb; which had become hard, in consequence of the swelling which had taken place from hanging the limb down and moving it about before she

Remarks

was put upon the fracture-bed, and which abated but little during her confinement. The swelling has gradually subsided since she was taken off the fracture-bed, but the rigidity of the muscles is not yet entirely gone.

I cannot say decidedly, whether the fractures in these two females were within, or external to the hip-joint; or whether they were partly within and partly external. The age of the women, and the symptoms which accompanied their injury, would lead me to infer, that the fracture was, in both cases, altogether within the capsule, or very nearly so. This point, however, cannot now be determined; and, therefore, it must suffice, for the present, to say, that the uniting medium is, in both cases, strong, and capable of supporting the weight of the body without yielding; a circumstance from which we might presume, that the fractured ends are joined by the interposition of callus. The four cases are interesting, and seem to me sufficient to shew, that fractures of the neck of the thigh-bone should never be abandoned, before a proper attempt has been made to produce consolidation of the fractured parts.

I have been favoured with the history of the following case, as far as it goes, by Dr. Clark. It occurred in a lady with whom he is closely allied.

My dear Sir,

I have much pleasure in answering your enquiries respecting the case of fracture of the neck of thigh-bone now under your plan of treatment.

Case under treatment, in a letter from Dr. Clark, with remarks.

A thin, delicate lady, 70 years of age, became giddy while standing at the window, and fell on the floor. After the fall, she suffered considerable pain in the groin, and behind the trochanter major, and was unable to bear on the limb. The pain in the groin was greatly increased by rotating and moving the limb; but, as there was no crepitus perceptible, and as the limb was neither shortened nor everted, the medical gentlemen in attendance believed that the bone was not broken. She was placed in bed in the horizontal position, and leeches and fomentations were applied, with some relief. She was confined to bed for about a fortnight; and then began to sit up daily, more or less, according to her sufferings. The pain continued, and was

at times very severe, until you saw her, which was nine weeks after the occurrence of the accident.

The limb was at this time found everted, and also retracted to the extent of an inch, measuring from the anterior superior spinous process of the ilium to the base of the patella. The crepitus of fracture was evident, although not easily discovered. These symptoms and others, joined with the history of the case, led to the conviction, that the neck of the thigh-bone was broken; and it was, consequently, agreed in consultation, that your plan of treatment should be tried, as that most likely to benefit the patient.

All the circumstances of the case, from the time that your plan was commenced, are known to you; but you must permit me to state, that I cannot imagine any mode more effectually calculated to keep the limb steadily extended to its natural length, and to maintain the fractured parts in proper apposition, than that which you have adopted. The old lady has now been placed on your fracture-bed nearly six weeks, during which I have been in the daily habit of observing its effects, both on the

fractured limb, and on the patient generally. The limb has remained steadily fixed in the position in which you first placed it, with very little pain or uneasiness to the patient at any period; and, for some time past, she has expressed herself perfectly easy in every respect. It is, also, particularly gratifying to me to observe, that while your ingenious and very simple apparatus appears to maintain the fractured parts in proper apposition and at rest, it is admirably calculated to prevent the injurious effects of partial pressure; and to render the different inconveniences and discomforts, which usually attend long confinement to bed in one posture, as little irksome as possible.

After having had an opportunity of observing various methods of treating fractures of the neck of the thigh-bone, in this country and on the Continent, I have no hesitation in giving yours the preference over every other plan which I have witnessed.

Your patient to-day is perfectly easy and well, and I think there is every prospect of her continuing so, as long as you shall find it necessary to keep her in her present position.

I am, dear Sir,

Very faithfully yours,

JAMES CLARK.

George-street, Sept. 6th, 1828.

Remarks.

I have no doubt that this lady's case was, in the first instance, fracture of the cervix, without laceration; but, as no care was taken to prevent motion and displacement, the close coverings became divided, either by absorption or laceration, or both. The history and symptoms of the case led to the opinion, that the fracture was probably within the capsule. The lady was placed on the fracture-bed in the presence of Dr. Clark, Mr. Travers, and Mr. Earle, who, as well as myself, had previously examined the limb, and had come to the conclusion, that the neck of the bone was broken.

I was favoured with the following case of fracture of the neck of the thigh-bone by Mr. Haines, of Godalming, Surrey. Mr. Travers, who saw the gentleman, is of opinion, that the fracture was external to the capsule, an opinion which appears to me fully justified by the history of the case.

My dear Sir,

In the evening of February 28th, 1828, I was requested to attend Mr. B. æt. 54, whose horse reared and fell back upon Mr. B.'s right hip. I arrived about half an hour after the accident, and found the right limb shortened and immensely swollen, and the knee and foot everted. On the following morning, Mr. Travers visited this gentleman, felt the crepitus without difficulty; and, having perfectly satisfied himself that the injury was a fracture of the cervix femoris, recommended the application of leeches and evaporating lotions, and, also, the employment of your fracture-bed.

Case, with remarks, by Mr. Haines.

Mr. B. was placed on the fracture-bed on the sixth day, where he lay ten weeks perfectly quiet. In the twelfth week he was able to get down stairs without assistance; and, in the sixteenth, did duty at his own church, after walking near one-third of a mile up hill.

I have this day seen him, and I am happy to say, that he is now capable of walking for two hours in complete ease. He expresses a lively recollection of the perfect comfort felt during his long confinement on the fracture-bed.

After he was placed upon it, so easy was his state, that all medical treatment was abandoned.

Your's, truly,

GEORGE C. HAINES.

Godalming, Sept. 5, 1828.

My observations upon recent fractures of the neck of the thigh-bone, and the experience with which I have been favoured, incline me to draw the following conclusions.

Inferences
drawn from the
preceding ob-
servations and
cases.

1st. That fractures of the cervix femoris within the capsule, unattended with laceration of the close coverings, will unite by the intervention of callus, if apposition, pressure, and rest, be maintained; but, perhaps, the process of union will not generally be so rapidly completed as when the fracture is in the middle of the bone.

2d. That fractures of the cervix femoris within the capsule, attended with a division of the investing membranes, might, under proper treatment, probably arrive, in many instances, in the course of a short time after the accident, at a state nearly as favourable for the accomplishment of osseous union, as those in which these

coverings remain nearly or quite entire; but it is likely that the union will be more or less rapid, according to the degree of injury sustained by the periosteum and reflected membrane.

3d. That we cannot insure accurate co-aptation of the fractured surfaces; and, consequently, if it should be found that union by bone can generally be effected within the capsule, we might expect the consolidation to be now and then followed by considerable inconvenience in the joint, for some time after its completion; but this will only occur when the irregularity is in the anterior part of the cervix, where the tendon of the psoas magnus and iliacus internus would press the front of the capsule against the projecting edges of the bone.

4th. That though I have never yet failed to benefit the patient in any case of recent fracture of the neck of the thigh-bone, and to restore the functions of the limb, as in the cases I have related, whatever might turn out to be the bond of union; yet I think, in the present state of our knowledge upon this subject, it behoves us to give a guarded prognosis. I see, however, no sufficient reason to induce me to believe, that

fractures of the neck of the thigh-bone, within the capsule, might not generally be united by bone; and if osseous union be produced, it appears to me, that it ought to take place without any retraction or eversion of the limb which would be deserving of notice, whether the cervix be broken within or external to the capsule; except, perhaps, in those very rare cases where the fracture is comminuted, and, at the same time, complete.

5th. That the practice I have recommended might be resorted to with perfect safety—that it is not likely that ankylosis of the joint, or a superabundance of callus, will occur where union takes place by bone, so as to impede, in any considerable degree, the act of progression—that there is no danger whatever of sloughing of the soft parts, or other injury, from partial pressure, where the treatment I have advised is properly conducted; and that this treatment might be followed, not only with safety, but with a degree of ease and comfort to the patient, which, as far as I know, cannot be obtained by any other means hitherto introduced.

SEC. 2.—*Treatment of Fractures of the
Trochanter Major.*

It is advisable, in the management of fractures of the trochanter major above the neck, to keep the pelvis and the limb at rest in the same relative position. I do not know any means, commonly resorted to, by which this can be accomplished. It cannot be done by the common short splints, because they do not effect the pelvis in any way, nor have they any influence upon the upper portion of the bone. It cannot be done by the double-inclined plane, because the pelvis must always be moved when the patient uses the bed-pan—it cannot be done by Desault's or Boyer's splints, because they, also, allow the pelvis to move independently of the limb.

Inadequacy
of the usual
means.

The principal part of the treatment of fractures of the trochanter above the cervix, as well as of all other fractures, is mechanical. When the patient is in good health, no constitutional treatment is necessary, except with a view to act upon the bowels as occasion may require. Topical applications should be employed, in

The treatment
principally me-
chanical.

order to reduce the active inflammation which comes on after the accident; but these will rarely be required after the first three or four days.

Treatment
when above
the cervix.

In the mechanical management of these cases, according to the plan which I recommend, the patient should be placed on the fracture-bed, prepared in the same manner as for fractures of the neck of the bone, but with the planes fixed so as to form more obtuse angles. The patient is thus secured in the most comfortable posture, and the pelvis and the limb are kept in a state of quietude. Care should be taken to support the limb in a proper position; which is with the ball of the great toe and the patella in a line with the superior anterior spinous process of the ilium. In these fractures, there can be no shortening of the limb, unless the fracture of the trochanter, of which I am now speaking, is accompanied with fracture of the cervix; therefore, where the fracture is entirely above the cervix, there will be no occasion for extension. The trochanter should be supported by means of a pad placed between the mattress and the limb, and the action of the glutei muscles resisted by a bandage, applied so as to keep the fractured surfaces in close apposition, and a splint should be placed along the outer side of

the limb, in order to maintain the trochanter and the shaft of the bone in their natural relative position. This splint should be secured in the same manner as when the fracture is in the cervix.

When the fracture is at the lower part of the trochanter major below the cervix, retraction of the limb might take place; and when this happens, it should be extended and kept of its proper length by the operation of the fracture-bed. In other respects, the treatment of fractures in this situation does not differ from that which has been advised for fractures of the trochanter above the neck.

Below the
cervix.

If the fracture of the trochanter be complicated with fracture of the cervix, retraction of the limb generally takes place; and the treatment required will be, for the most part, the same as that which is proper for fractures of the trochanter below the neck, when the broken portions overlap; but, in these cases, the surgeon should take care not to make much pressure on the outer side of the limb by the splint, as he might, by so doing, force the fractured parts into unnatural positions, and thus produce deformity.

When attended
with fracture
of the cervix.

Objections to
the usual
means.

The objections which have been urged against the use of the common contrivances in the treatment of fractures of the neck of the femur, also, militate against them, when they are had recourse to, in the management of fractures of the trochanter below the neck, or in fracture of the trochanter complicated with fracture of the cervix; and, therefore, in my opinion, they ought never to be employed, in such cases.

SEC. 3.—*Treatment of Fractures of the Femur just below the Trochanter Minor.*

The common
opinion res-
pecting these
fractures.

This situation has been regarded as one of the worst in which a fracture of the thigh can occur; not that there is any thing, in reality, peculiar in the fracture itself, regarded merely as a fracture, but surgeons, having found the common means inadequate to prevent deformity, have conceived, it would seem, something very formidable in the fracture itself; and have been prone to refer the cause of deformity, which so often follows these accidents, to the nature of the injury, rather than to any fault in the means which they have employed for its cure.

Displacement
of the fractured
ends.

When a loose fracture occurs in this part of

the femur, the upper portion is commonly bent upon the pelvis, so as to form an angle with the lower portion, projecting forward at the seat of fracture. The upper portion being forced into the bent position, principally by the action of the iliacus internus and psoas magnus, pricks and lacerates the extensor muscles of the leg, while the ragged end of the lower portion is forced against the flexors. The transverse displacement having been effected, the fractured extremities of the bone goad the flexor and extensor muscles of the leg; which are thus excited to act most powerfully upon the lower portion of the bone, so as to draw it up beneath the upper portion, and produce a degree of shortening of the limb, varying from one inch to seven, or eight, (*see Plate V. Fig. 1.*) Displacement first occurs in the transverse direction of the bone, and then in the longitudinal. These two varieties of displacement follow one another in all cases; and commonly produce that compound variety which I call transverse, longitudinal, and angular, when the fracture is transverse, or runs through the bone downward and forward, downward and inward, or downward and outward, and is attended with much laceration of the soft parts. But it should be remarked, that when the fracture takes a direc-

tion downward and backward, which, however, very rarely happens, the principal displacement which occurs is in the direction of the long axis of the bone, (*see Plate V. Fig. 2.*) In these cases, the upper portion lies behind the lower; and hence those muscles which have the greatest influence in producing transverse displacement when the bone is broken in any other direction, have the effect of drawing the fractured surfaces together, provided that the natural length of the limb be preserved; and, consequently, we find, that fractures which divide the bone downward and backward are, from this circumstance alone, the most favourable to treat.

The cause of the difficulty experienced in treating these fractures.

It has been supposed, that the main difficulty which surgeons have to contend with, is the contraction of the flexor muscles of the thigh, which they have not been able to control; but the command of these muscles is only one indication out of seven that I shall mention.

Indications.

In these cases, there are seven indications to fulfil—1st. The pelvis should be fixed for the upper portion here, as in fractures of the cervix, or of the trochanter major, follows the motions of the pelvis; therefore, unless this part be fixed, we have no certain means of fixing the upper

portion of the bone in the position in which we ought to place it. 2d. The thigh should be raised so as to form an angle with the pelvis; so that the lower portion of the fractured bone shall be brought into a natural line with the pelvic portion. 3d. Extension must be kept up, so that the fractured ends may be prevented from overlapping. 4th. Inversion and eversion of the foot must be prevented. 5th. The fractured surfaces should be placed in close apposition. 6th. The fractured ends should be prevented from moving upon each other. 7th. The fractured ends should be supported, so as to guard against any displacement which might otherwise arise from the accidental action of the muscles of the limb.

The question now for consideration is—how far the mechanical contrivances usually had recourse to in the management of these accidents answer the indications that have been pointed out?

Do the usual plans of treatment answer these indications?

I have seen the short thigh-splints employed with a view to secure the broken ends of the bone, when the fracture is in this situation, the limb being, at the same time, raised, by placing a pillow under the knee. It must be

Short thigh-splints.

evident, however, to the thinking surgeon, that these splints can have no power whatever in steadying the pelvis ; it must be also clear, that their operation is not calculated to keep up extension. The pillow placed under the knee, is not of a nature to keep the lower part of the thigh at a proper and unvarying angle with the upper ; these splints do not prevent inversion or eversion of the foot ; they have but little influence in preventing the displacement of the fractured ends, which may arise from the accidental contraction of the muscles inserted into the bone.

Inference.

What, then, does the surgeon gain by the adoption of this plan ? It seems to me, he may almost as well leave the case to Nature, as attempt to secure the fractured ends by splints, so little calculated to produce the desired effect. I have seen the limb become shortened *nearly eight inches* under their use, in a case of fracture a little below the trochanter minor ; and otherwise terribly deformed. The degree of success which the surgeon gains, he must refer to his own skill and ingenuity, in contriving other means to assist in keeping the parts in any thing like tolerable apposition.

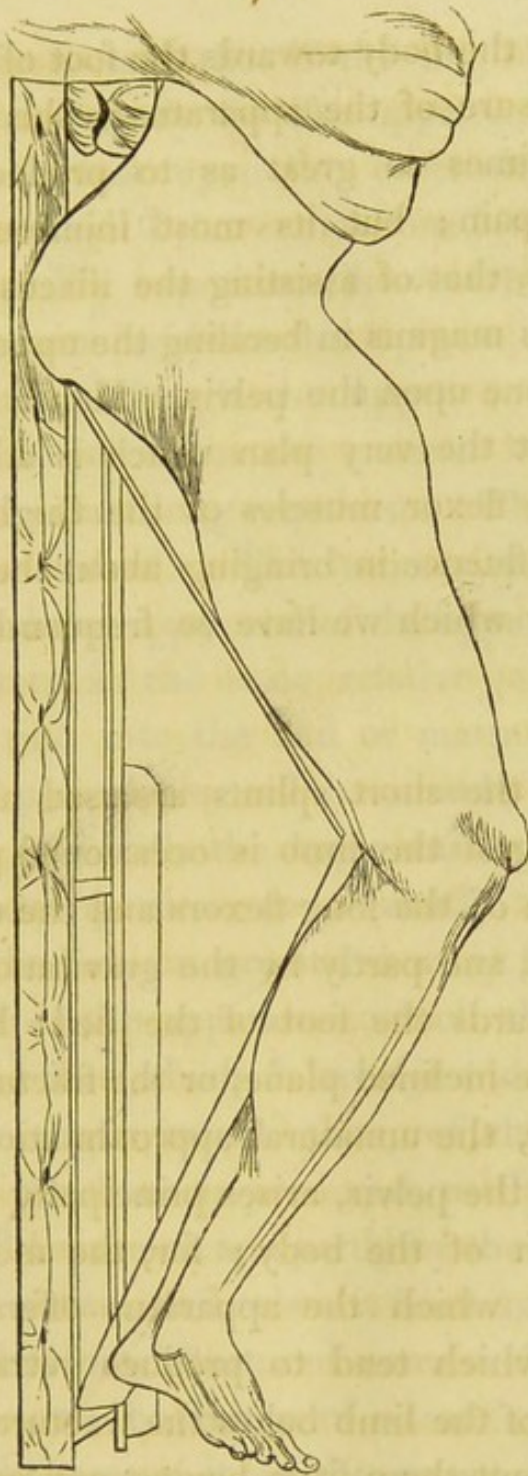
The double-inclined plane, and the common fracture-box, are much resorted to in the treatment of these cases. When either of these contrivances is used, the patient is placed on his back upon a mattress; his shoulders are raised by means of pillows, and the injured limb is laid over the planes of the apparatus, elevated, so that the lower portion of the broken bone may be brought up in such a manner as to form a natural line with the pelvic portion.

The double-inclined plane or fracture-box.

This position of the limb and of the body is recommended with a very good intention, viz. to relax the psoas magnus and iliacus internus, which are the principal muscles that bend the pelvic portion of the bone, upon the pelvis. But those who follow this mode of treatment must overlook other important indications—they cannot have noticed that the inclined position of the body indirectly increases the degree of deformity which supervenes, when either of these apparatuses is employed. This, however, I think will immediately appear: the tendency of the body to slide towards the foot of the bed will, of course, be greater when it is placed upon a plane inclining in that direction, than it would if it were lying upon a horizontal plane. What, then, must be the consequence

Intention.

of placing the trunk in this position? We have almost daily demonstration, that the body, gravitating towards the foot of the bed, forces before it the pelvic portion of the fractured femur, while the apparatus, and all that part of the limb below the fracture, continue as they were first placed, or nearly so. The apparatus does not slide towards the foot of the bed in the same proportion as the body; and, consequently, that part of the limb which is situated below the fracture will remain comparatively quiet, being little influenced by the gravitation of the body, or by the various movements which take place in that part of the fractured bone which is attached to the pelvis. Now it must be obvious, if the body slide towards the foot of the bed, and the apparatus remain nearly at rest, that the upper and back part of the thigh will be forced against the upper end of the apparatus; pressure will be in this way occasioned at this part of the thigh; which will be increased, in some measure, by the sinking of the nates into the bed. This observation will be illustrated by referring to the diagram, (*Fig f*) where a portion of the frame of the double-inclined plane, and of the side of the mattress, are supposed to have been removed, in order to shew the sink-

*Fig. f*

ing of the nates more effectually, and also the pressure of the apparatus against the back of the thigh, in consequence of this, and the gravi-

tation of the body towards the foot of the bed. The pressure of the apparatus in this situation is sometimes so great as to produce considerable pain; but its most injurious consequence is, that of assisting the iliacus internus and psoas magnus in bending the upper portion of the bone upon the pelvis. Hence it will be seen, that the very plan which is adopted to relax the flexor muscles of the thigh, has no trifling influence in bringing about the horrible deformity which we have so frequently to witness.

Manner in
which retrac-
tion takes place.

When the short splints are used alone, the shortening of the limb is occasioned partly by the action of the long flexors and the extensors of the leg, and partly by the gravitation of the body towards the foot of the bed; but when the double-inclined plane, or the fracture-box is employed, the unnatural approximation of the knee and the pelvis, arises principally from the gravitation of the body; for, the mechanical resistance which the apparatus offers to the muscles which tend to produce retraction of that part of the limb below the fracture is such, as to prevent them from having any considerable effect.

It might be said, that if the thigh-plane be elongated sufficiently for the upper end of the apparatus to bear upon the tuberosity of the ischium, the evil I have mentioned would be prevented. My experience, however, does not enable me to coincide in this opinion. I have observed that, though the upper end of the apparatus be placed in the manner here supposed, it does not long remain so. The reason of this is evident. The tuberosity of the ischium and the upper end of the apparatus are not preserved in the same relative position—the nates sink into the bed or mattress upon which the patient lies, as I have said; but this is not the case with the apparatus or, at least, in the same proportion; consequently, the tuberosity of the ischium gravitates away from the upper end of the apparatus, which thus produces the effect which I have just described. Transverse displacement, then, of the upper portion of the bone is produced, partly by the action of the muscles, and partly by the pressure of the apparatus; and, when it has taken place, the limb becomes shortened more or less; on some occasions, the degree of retraction is very great. I have seen it to the extent of *seven inches* in a case of fracture of the upper third of the femur, where the fracture-box was em-

Elongation of
the thigh-
plane.

ployed; and that, too, under the superintendence of one of the most able surgeons in this town.

Inference.

The fracture-box answers two of the indications which I have pointed out—it supports the limb in the bent position, and prevents inversion or eversion of the foot, but it does not fix the pelvis; it does not maintain a proper degree of extension; it does not steady the upper portion of the bone; it does not keep the fractured surfaces in close apposition; nor does it prevent them from becoming displaced.

Observations.

From what has been said, it might be perceived that, neither the double-inclined plane, nor the fracture-box, is calculated to enable the surgeon to bring these accidents to favourable terminations; and, consequently, we must expect to have deformity of the limb when either of them is employed, if the fracture be attended with a sufficient degree of laceration of the surrounding parts, to allow the broken extremities to become displaced.

**Desault's and
Boyer's plans.**

Another plan of treating fractures at this part of the femur, consists in placing the limb in the straight position, and keeping up extension by the use of Desault's splint, or that contrived by

Boyer. When Boyer's splint is employed, the extension is regulated by the screw, which is placed at the lower end, in the same manner as when the fracture is in the neck of the bone. The extending power of this splint is very great; and, if we had nothing to do but keep up extension, I cannot conceive any thing better calculated to answer this purpose. But the propriety of maintaining the limb of its natural length is only one indication out of seven that I have mentioned; and this can, unfortunately, only be fulfilled, with this contrivance, when the limb is placed in the straight position—a position which is not likely to be followed by favourable results. In the treatment of these cases, the thigh should be bent upon the pelvis, in order to relax the *psoas magnus* and *iliacus internus*, and to bring the lower fragment in a natural line with the upper. This cannot be done with Boyer's apparatus; for this apparatus requires the limb to be placed on a horizontal plane, or nearly so. If it were placed so that the limb may lie on a plane inclining towards the body, the strap which crosses the upper part of the thigh obliquely, would operate so as to assist the muscles in bending the upper portion of the bone upon the pelvis—an effect which is not so likely to happen when the limb is placed in the

straight position. It might be argued, that we might depress the upper portion of the bone, so as to bring it to a natural line with the lower, by the application of a splint to the front of the limb; and thus, not only overcome the flexor muscles of the thigh, when the limb is in the horizontal posture, but also the effect produced by the strap, affixed to the upper end of the apparatus, when the thigh is bent upon the pelvis. This cannot be denied; but, what is to be apprehended from this mode of procedure? I scarcely need observe, that ulceration of the soft parts which cover the broken end of the upper portion of the bone, would be likely to occur; consequently, according to my judgement, this method of meeting the evil, arising from the action of the muscles simply, or from the combined influence of the muscles and the apparatus, ought not to be advised.

Inference.

This apparatus has the effect of keeping the foot in a proper position, and it might also keep up extension, but rarely with impunity; for the pressure of the strap fastened to the upper end of the apparatus, forces the pelvic portion of the bone outward, and thus occasions deformity; even when the fracture is not accompanied with any considerable laceration of the parts which

surround the bone in the situation of the injury. There are five indications which, it appears to me, this apparatus does not fulfil, and therefore I think I shall not be going too far when I state that, in my opinion, it is not a contrivance upon which, in the management of these cases, the profession can depend; its construction is such as to render it inefficient in the hands of the best surgeons.

If I am right in my conclusions, it will be no longer a matter of surprize that we see so many instances of deformity after fractures of this part of the femur. The causes of the deformity are evident; and, in my opinion, if they be not surmounted, in all ordinary cases, whether the fracture be transverse or oblique, the surgeon is to blame.

I shall now proceed to describe a plan of treatment for fractures of the femur just below the trochanter minor, by which all those evils which I have mentioned might be avoided; and by which these fractures might be united with as much facility as fractures at any other part of the upper or lower extremity; and without the occurrence of shortening or deformity of any kind.

Remarks.

Fractures in this situation admit of being treated without deformity.

The author's
mode of treat-
ing these cases.

The fracture-bed which I have recommended to be used in the treatment of fractures of the neck of the thigh-bone, and in the treatment of fractures of the trochanter, will also be found the best for those which occur just below the trochanter minor. When it is employed for these accidents, however, it is proper to fix the planes at more acute angles, in order to relax the iliacus internus and psoas magnus in a greater degree than is required for fractures of the cervix. The surgeon, having placed the patient upon the bed, should apply a roller neatly upon the foot and leg; and then extend the thigh and secure the foot in the same manner as for fractures of the cervix. While the surgeon is doing this, an assistant should prevent the pelvis from being drawn up upon the middle, or thigh-plane, from the angle which is destined to receive it. The assistant continuing to fix the pelvis, the surgeon should place a pad between the back of the thigh and the mattress, wide enough for the thigh to rest upon, and then apply three splints to the thigh; one on the inner side of sufficient length to reach from the pelvis to the lower part of the inner condyle of the femur, another to reach from the superior anterior spinous process of the ilium to the base of the patella, and the

third from the upper part of the trochanter major to the lower part of the outer condyle. These splints, which ought to be well made, should be neatly padded and confined to the thigh by three circular straps, passed round the limb, under the pad upon which it lies, and over the splints, so as to confine them to the limb. The pelvis should now be secured by buckling the pelvis-strap; which should pass over the upper ends of the outer and front splints, but not so as to make the latter press uncomfortably upon the superior anterior spinous process of the ilium. If the fracture be very oblique, care should be taken to pad the splints, so that they might press the fractured surfaces together.

When a fracture in this situation is thus secured, and the treatment properly managed, the seven indications I have mentioned are completely fulfilled, and the surgeon might feel himself morally certain, that union will take place without any shortening of the limb, or any perceptible deformity; unless there be great comminution of bone, as generally happens when the fracture is occasioned by a musket-ball, or when exfoliation occurs; in such cases, a guarded prognosis should be given; but he

Indications answered.

should recollect, that *neither the obliquity of a fracture at this part, nor the action of the muscles of the injured limb*, will any longer be considered an excuse for ignorance or inattention.

Time required
for consolida-
tion.

Fractures of the upper third of the thigh-bone, external to the capsule, require the patient to be confined from a month to six weeks; in order that the bone might become firmly consolidated, and capable of bearing the weight of the body without yielding. If the patient is allowed to bear upon the limb before the callus has become strong, he is in danger of producing shortening of the limb, or a bend in the bone in the situation of the fracture, which cannot afterwards be remedied.*

* I will here relate a case which tends to illustrate this observation; and, also, to shew the advantage derivable from the use of the fracture-bed, before consolidation is completed, in cases of fracture of the thigh, where deformity has taken place under any of the ordinary modes of treatment.

Case.

John Gardener, æt. 28, was admitted into St. Thomas's Hospital, on the 23d of June, 1828, under Mr. Green, with an oblique fracture of the femur, situated at the lower part of the middle third. The fracture extended through the bone downward and outward, and was occasioned, on the 24th of May, by a cask of beef, which fell upon the thigh. He had

I might here observe, that the treatment which I have advised for fractures of the thigh, a little below the trochanter minor, is the best that I am acquainted with; but, before the introduction of my fracture-bed, I was in the habit of using, in these accidents, the apparatus which I employ in the management of simple and compound fractures of the leg, &c. I think, however, that this apparatus cannot hold the upper portion of the bone sufficiently, in all cases, to render it secure from a degree of motion, which might be injurious, when the

The plan recommended considered to be the best, though not indispensable.

short splints applied, and the limb placed in the straight position, with the feet tied together.

At the time of his admission into the Hospital, the lower portion of the bone was *retracted to the extent of two inches and a half*. There was a great deal of swelling of the limb, and strong adhesions had taken place. *Twenty-seven days after the accident*, he was placed upon the fracture-bed, and the limb extended to its natural length; which was done with facility, over the planes of the fracture-bed, though it could be elongated very little by the hands. Before he was placed upon the fracture bed, Mr. Bean, a very intelligent and attentive dresser, who had the management of the case, endeavoured, in my presence, to diminish the degree of retraction by manual force; but he found himself incapable of doing so more than about half an inch. As the man lay upon the fracture-bed, splints were applied to the thigh, to steady the fractured ends, and to press them together. This treatment

patient raises the lower part of the body to answer the calls of nature; and, as there is no advantage gained by it which is not equally well, and even better, obtained, in such cases, by the use of the fracture-bed, I am induced to recommend the employment of the latter, as that upon which the surgeon can best depend; though, as might be seen by the following cases, the apparatus is much superior in its effects, even when the fracture is at this part of the bone, to any of the ordinary means; and might, therefore, be applied when the bed cannot be procured.

was continued for *twenty-five days*, at the expiration of which, the limb was examined, and it was found that the bone was united, with the *limb of its natural length and the foot in its proper position*.

This man felt his limb so strong that he began to bear upon it in a few days after he was removed from the fracture-bed; and the consequence is, that the limb has become shortened rather more than a quarter of an inch. In cases of oblique fracture, I do not think it prudent to allow a patient to bear upon the limb for ten days or a fortnight after the union appears to be quite firm.

I use the fracture-bed, also, in the management of all compound fractures of the thigh, fractures of the pelvis, certain mal-positions of the pelvis, and in cases of diseased hip-joint—but more of these hereafter.

A man, aged 51, fell over a tub and broke Case.
 his thigh-bone obliquely, from one inch and a half to two inches below the trochanter minor. He was admitted into Guy's Hospital, under the care of Mr. Foster. The limb was first placed in the straight position, and confined by means of a long splint; it was afterwards put upon the double-inclined plane, the shoulders being raised at the same time, so as to relax the psoas magnus and iliacus internus: but he suffered greatly from these modes of treatment, and, as they failed to keep the bones in any thing like tolerable apposition, they were discontinued.

On the tenth day, as the limb lay upon the double-inclined plane, the fractured ends overlapped, so as to make the *fractured limb nearly three inches shorter* than the sound one; and there was, also, an angle formed at the seat of fracture, which might be represented by the elbow, when the arm is half bent.

I now assisted Mr. Foster's dresser, Mr. Mash, who is now a well-informed and zealous practitioner, in applying my apparatus, which was worn for a month. At the end of this time, the limb was examined, and the bone was found firmly

united. The limb which had been fractured was now *of the same length as the other, and there was not the least apparent deformity in any way.*

His bed was made two days after the apparatus was applied, and this was repeated at the end of a fortnight. The limb could be rolled upon the pelvis without giving him pain; and, apparently, without disturbing the fracture. He could draw himself up in bed, without experiencing any sensation of motion or of displacement in the injured part.

This poor fellow often expressed himself most strongly in favour of the comparative ease and comfort of the treatment which was last adopted. He rapidly recovered the perfect use of his limb.

The following case I was favoured with by Mr. Joy, and I prefer relating it here to any more of my own, in consequence of its having occurred in the practice of a surgeon, with whom I have not the pleasure to be acquainted, except by name.

Northwald, 18th Aug. 1828.

Dear Sir,

I send you the particulars of a case of fracture of the upper third of the thigh-bone, which occurred in an old lady, in her 74th year.

A communication from Mr. Joy, with a case.

In the evening of Sunday, 6th of April, of the present year, I was summoned to attend upon an old lady, who had met with a serious injury, in consequence of being pushed down by some boys. On my arrival, she complained of great pain in the left thigh and hip; and, upon turning the bed-clothes off the affected side, an immense tumour presented itself at the upper part of the thigh, which I found to be the result of a transverse fracture of the femur, immediately below the trochanter minor: *The limb was shortened an inch and a half, and the foot was turned inward.*

Having placed the limb in as easy a position as circumstances would admit, and ordered a spirit lotion to be applied frequently over the fracture, I left for the night.

Upon visiting my patient the next morning,

I had the honor to meet Sir Richard Sutton, (a gentleman whose name is proverbial in the cause of humanity) who very politely offered me the use of the apparatus which you employed in his own case of non-union. This I found to be that which you, in your Syllabus, recommend to be adopted, in cases of simple fracture of the middle and lower thirds of the thigh-bone, &c. It, however, appeared to me to be constructed in such a manner, as to admit of being used with more advantage in cases like the present, than any of the common contrivances. I, therefore, determined upon giving it a trial. The patient was placed on a mattress; and, when the apparatus was properly adjusted, she expressed herself as being, comparatively speaking, in Heaven. Nothing worthy of remark occurred during her six weeks' confinement, at the end of which the apparatus was removed; and it was now particularly gratifying to observe, that the means employed had produced a most perfect limb, *having neither deformity nor shortening*; nor did moving it in any direction cause the least uneasiness. Thus far, and *as far as your apparatus was concerned*, were our wishes accomplished, and the patient truly grateful for the benefit she had received.

The following evening I was sent for in great haste, as the old lady was supposed to be dying. I found her insensible, bedewed with a cold sweat, and with a pulse imperceptible. I succeeded in getting her to swallow some brandy and water, which was repeated at intervals, until re-action took place; and I resorted to such other measures as the circumstances of the case seemed to indicate, and she was better on the second day; but, after this, she rapidly sunk, and died on the fourth day.

Having obtained permission of the family to examine the limb, I cut down to the seat of fracture, which I found had passed through the bone, about a third of an inch below the trochanter minor; but the fractured ends were now *evenly and firmly united*. In dividing the soft parts, I observed an abscess, situated between the pectinalis and obturator externus muscles, which contained about an ounce of unhealthy pus, but which had *no communication with the fracture*. The irritation occasioned by this abscess was very likely to be the cause of death, in a person so far advanced in years.

Dear Sir,

Yours respectfully,

W. JOY.

These cases are sufficient to shew that this apparatus, though inferior to the fracture-bed, in the management of fractures of this part of the bone, is more beneficial than any of the common contrivances. The only objection I have to its being used, in the treatment of simple fractures of the femur, just below the trochanter minor, arises, as I have said, from the fear that it might not, in all cases, secure the upper portion of the bone from a degree of motion, which might retard the uniting process. It should not be used in compound fractures of the thigh; these can only be safely treated by the employment of the fracture-bed.

PART II.

FRACTURES OF LONG STANDING.

CHAP. I.

THE CAUSES AND NATURE OF FRACTURES OF LONG STANDING.

By the term non-union or dis-union, surgeons signify a fracture which has remained dis-united a longer time than fractures in a similar situation, and at the same period of life, usually take in becoming united. In a more confined sense, however, these terms signify fractures which cannot be made to unite by the usual modes of treating recent fractures.

Usual signification of the term non-union or dis-union.

These terms do not express the state of the fractures which they are used to designate. They express, merely, that the bones are not united without any reference to the time which

Observations upon these terms.

the fracture has existed ; they are, therefore, equally applicable to fractures in a recent state and to those of long standing. It does not appear that we have any word which conveys to the mind, correctly, that particular condition of a fracture which surgeons have attempted to express by the compound appellation, non-union or dis-union. It seems to me, that what we wish to convey, cannot be properly designated by any term which has not, at the same time, reference to the fracture and the length of time that it has existed. I shall not attempt to supply this deficiency ; and, therefore, when I make use of either of these terms, I shall employ it in its most general acceptation, to signify a fracture which, from some cause or other, has continued dis-united beyond the usual period.

Bones endowed
with reparative
powers.

Experience has taught us, that the bones, as well as the softer textures, are endowed with vital powers, by the operation of which injuries inflicted upon them are repaired. If any breach of continuity is accidentally made in the osseous structure, that breach is soon closed ; and the bone becomes again converted into one solid mass. But, it should be remembered, that the bones, like the skin, nerves, blood-vessels, &c. require a period peculiar to themselves for the

reparation of injuries. This period varies in different animals, and at different periods of life. The restorative process is, also, retarded or facilitated, according to the particular state of the constitution of the individual, the vital condition of the parts, the treatment adopted, &c. Thus we see that the process of union in bone is influenced by all those causes which effect the healing of the soft parts. In man, if the constitution and the bone are healthy, and proper assistance be given by art, the process of re-union almost always goes on progressively to its completion; but, if this process has been disturbed by any cause, it often becomes slow and tedious; and, in some cases, no osseous union has ever been produced.

Fractures of long standing are met with at all periods of life, and are by no means uncommon.

When non-union occurs.

The causes of non-union might be said to be either constitutional, constitutional and local, or purely local.

Causes of non-union.

Among the first we may consider fevers, scurvy, &c.; also, some organic diseases, as phthisis, dysentery, &c. which occasion great

Constitutional.

disturbance in the system ; likewise, constitutional debility, which might be hereditary, as scrophula, &c. or acquired, as that enfeebled state, which is often produced by habitual debauchery, old age, &c.

Constitutional
and local.

In the second class of causes we must rank pregnancy. In pregnancy there is frequently much disturbance of the whole system ; and, though this might not amount to disease, it might be sufficient to influence the union of a fracture. Add to this the restless feeling of some women in a state of pregnancy, which, under the use of means so little calculated to secure a fractured bone, as those usually employed, must frequently be productive of motion of the broken ends of the bone ; which, as I shall presently attempt to show, contributes, in no inconsiderable degree, to the formation of preternatural joints. Thus we see, that constitutional and local causes might operate in retarding, and might even prevent, the process of union from being accomplished during the latter months of pregnancy ; though there be no disorder in the system, further than this state commonly gives rise to. According to my experience, however, fractures of long standing do not occur more frequently in pregnant women

than in others. I have seen fifty-six cases of non-union, but have not yet met with more than two which happened during the process of gestation. I should, therefore, be disposed to attribute non-union, in persons so circumstanced, more to the inadequacy of the usual modes of treatment, than to the peculiar disturbance of the system which is observed in pregnancy.

The causes of non-union which might be considered purely local are also various. Local causes.

Disease in the bone sometimes prevents a fracture from uniting. A short time since, I saw a man who had necrosis in the humerus, in which there was a fracture. No union took place, and the man's arm was amputated. I, also, saw a young girl who had a fracture in the humerus, occasioned by an abscess in the bone. In this case, I am informed, no union took place. Disease in the bone.

Want of apposition, from the interposition of a foreign body, as a portion of the clothes, a bullet, a piece of dead bone, &c. between the fractured surfaces, is a cause of non-union. A portion of muscle, which, though not deprived of vitality, might keep the fractured ends from Want of apposition.

coming into contact, and thus, prevent the union from taking place by the intervention of callus.

Diminished action.

Diminished action in the fractured part, from too long a continuance in the use of sedative or cooling lotions, is a frequent cause of tardy union. Such lotions should never be applied longer than is required to subdue the active inflammation. If they are continued longer than is sufficient for this purpose, they invariably retard the union, and sometimes prevent it altogether.

Want of rest.

But, by far the most frequent cause of non-union that I have noticed, is want of rest, in consequence of the inadequacy of the plans of treatment which have been employed. I consider this to have been the primary cause in almost all the cases I have examined.

Insufficiency of the usual modes of treating recent fractures.

I shall not now enter into an explanation of the imperfections of the common contrivances, nor of the particular causes which give rise to the various evils which take place under their employment. This I have already partly done in scattered papers; and shall, perhaps, hereafter, do so in a more enlarged and collected form. Suffice it, for the present, to say, that I believe that, in consequence of the demonstrable im-

perfections with which they abound, loss of limbs and lives are very numerous. I should say that the cause of death, in nine cases out of ten, resulting after compound fractures and compound dislocations might be fairly attributed to the inadequacy of the mechanical treatment. To the same cause we must ascribe, also, the frequent occurrence of deformity after fractures, whether simple or compound. Except, in those attended with great comminution of bone or exfoliation, a degree of deformity which is deserving of notice ought not to occur. Surgeons must no longer attribute the production of deformity to the involuntary action of the muscles. This cloak for ignorance is now grown thin, and will not skreen its wearers. The muscles act, indeed, involuntarily, so as to displace the broken bones under the usual treatment—but why? Because the injured limb is not properly supported—because the fractured ends of the bone are suffered to prick and lacerate their substance. When the broken portions of a bone are kept in proper apposition and at rest, the muscles are not irritated by them; nor is their tonic contraction any thing more than what is readily overcome and resisted, whatever might be the situation of the fracture. To this I know scarcely an exception. Some

narrow minded men in the profession, who are wedded to old plans and practices, or jealous of the introduction of new, will conceive it their interest to oppose this doctrine; while such men live, the weakest measures will not want advocates. With persons of this description it will be in vain to argue. I expect to be opposed here; but, though I am open to honorable discussion, I rest secure from the shafts of petty bickerers. I feel myself standing upon the rock of truth, supported by extensive experience; and I, therefore, fearlessly inform the skeptical, that great deformity, except in the instances I have mentioned, is the result of bad treatment; and, whether the fracture be in any of the long bones of the upper or lower extremity, might be easily prevented where osseous union can be brought about; and the patient's mind and body are in a state to second the views of the surgeon.

An imaginary
cause of non-
union.

To return—It is considered that some peculiar state of the constitution is a frequent cause of non-union in persons apparently healthy—that there exists some latent disease or disorder which evades our senses, but whose operation is sufficiently powerful to prevent the union of bone by the interposition of osseous matter. I

am inclined to believe, however, that such a state of the system but seldom, if ever exists. This is one way of solving the question—a way, indeed, to which we are all too prone to resort, when we meet with a difficulty that does not admit of being readily explained.

How do we judge of the vigour of a constitution? I should say by the general appearance of the patient; by his own account of his general health; and by the power which the constitution evinces of resisting the influence of disease or accident. If a patient looks well; is able to bear much exertion without fatigue; if he rises refreshed, has a good pulse, enjoys his food, and tells us that he hardly ever experienced disease, with the exception of a slight cold occasionally, or now and then a little feeling of dyspepsia: if, in his account of himself, he assures us that, whenever he has met with a slight accident, such as a flesh-wound or bruise, he never had any trouble to restore the injured part; that he has always found flesh-wounds heal speedily; that, after the fracture, for which he may be consulting his surgeon, he suffered but little pain; that he had but little tumefaction, or, if he had, either or both of these from the severity of the injury, when the bones were

Signs of a healthy constitution.

placed in their proper situation they very soon subsided—should we, I say, after a detail of such facts, well authenticated, pronounce that the want of union in his bone arose from weakness in the constitution—some hidden disease lurking there or in the part? Surely it would not be philosophical to do so; yet it is in such persons that cases of non-union most frequently occur. One can, therefore, scarcely help perceiving the inconsistency of this opinion.

Non-union occurs most frequently in very healthy persons.

I have examined fifty-six cases of non-union, exclusively of those which I have witnessed in the neck of the thigh-bone, olecranon, and patella. The constitutions of three of the persons in whom these cases occurred were decidedly bad; another had been much reduced by cholera during the recent state of the fracture. The remaining fifty-two, apparently, possessed constitutions and enjoyed health equal to the most vigorous and healthy individuals that come under our observation. I cannot bring myself to believe that there was, in any of these fifty-two persons, some peculiar weakness, or that they had any hidden disease in their systems which prevented their bones from uniting. In these cases, with the exception of two which occurred during pregnancy, where constitutional

causes might, under any treatment, have operated in a measure so as to retard the union, I think the cause was purely local; and, for the most part, if the treatment had been such as to secure the fractured parts in proper apposition, and in a state of quietude, the fractures would have united at an early period.

Here a question might be started. Accord- Question.
 ing to the view which you take of this subject, persons who possess the strongest constitutions are the most subject to fractures of long standing; and that the principal cause of their occurring in such persons, is the frequent disturbance of the fractured ends, in consequence of the insufficient support afforded to them by the contrivances now commonly recommended?—Granted. How comes it, then, that the bones of all the lower animals, whose restorative powers are universally allowed to be greater than those of civilized man, should be found with their bones generally united after fracture; and that, too, sometimes with the fractured surfaces separated considerably asunder?

I should say thus:—When any of the lower Answer.
 animals, in a wild state, have their limbs broken, there is great inflammation set up in the part,

from the friction of the broken extremities upon one another ; and, mark—not only upon one another, but, also, upon the surrounding parts, pricking and lacerating muscles, tendons, nerves, arteries, or any thing else that may happen to be within their reach. This pricking and tearing is, not once only, but whenever the animal moves, till the contiguous textures become dense, in consequence of the large quantity of adhesive matter thrown out to defend them. The inflammation is thus kept up for a long but indefinite period. This continued excitement occasions a large quantity of callus to be thrown out. The broken ends of the bone continue to ride in this as long as it remains soft, and, as it hardens, they become fixed in that situation where they may be accidentally placed. Sometimes, this is at a considerable distance from one another. When the callus is ossified, all that part of it is absorbed, which is more than sufficient to give the bone a proper degree of strength, in order to support the body, or to bear any of the natural actions of the muscles ; and if the ends of the bone happen to be separated much, they then appear to have been united by a bar of bony matter shooting from one to the other, (*see Plate VI. Fig. 1.*) But, in fact, this bar of bone is nothing more than

what remains of the callus which was thrown out in the first instance, as I have said, in a very large quantity.

In order to discover the comparative reparative powers of man and the lower animals, and to see how far they resemble each other in this respect, it is necessary to place the parts, as nearly as possible, in similar states; always bearing in mind, that in man there is much greater excitability than in the lower animals. When a man breaks his limb, the restorative process is assisted by art, with a view to prevent the limb from becoming deformed, and, at the same time, to preserve the patient from the pain which the broken ends of the bone would occasion by pricking and tearing the soft parts; but no such care is taken of the lower animals in a state of nature. If a man breaks his leg, surgery dictates that he should have splints applied to prevent the bones from moving; but, I have already stated, that those commonly resorted to have not this effect in many instances. The displacement, however, and consequent injury which takes place, are much less than they would be were no splints employed; and, in some fractures, no injury of consequence is produced in the surrounding parts from the broken

Comparative
power of man
and the lower
animals—how
discovered.

ends of the bone ; but there are very few in which the fractured ends do not move more or less.

The probable effect of partly restraining the motions of fractured bones in the latter.

Now, if a fracture, in any of the lower animals, were supported so as to prevent the broken extremities from tearing the surrounding parts, in the manner I have described, but, at the same time, not so as to prevent them from rubbing upon each other, I suspect there would be very little inflammation set up ; perhaps, in many cases, not sufficient to give rise to osseous union ; and there would, consequently, be merely an effusion of ligamentous matter, which might ultimately form a preternatural joint.

In order, therefore, to see whether similar states would be followed by similar results in man and the lower animals, it is necessary to prevent, in the latter, the great irritation which is commonly kept up by the broken ends of the bones. This might be done by confining the limb in such a way as would allow of but little motion in the fracture, when the animal moves the limb. Slight motion, however, should be allowed at the same time that the soft parts are guarded from the injury which the fractured ends of the bone would inflict upon them, were they not at all supported.

Such are the notions which I have been led to entertain upon the causes which give rise to fractures of long standing.

When fractures in this state are examined, the ends of the bone are sometimes found connected together by a structure resembling ligament; sometimes by a ligamento-cartilaginous structure; occasionally the fractured ends are enlarged from a deposition of bone around their edges, and are connected together by a preternatural capsule, (*see Plate VI. Fig. 2,*) containing a fluid which much resembles synovia. This fluid lubricates the opposing surfaces, so that they move freely upon each other. In such cases, the functions of a joint are performed between the fractured ends of the bone; and the patient experiences no inconvenience, except from the loss of power in the limb.

State of fractures of long standing.

CHAP. II.

TREATMENT OF FRACTURES OF LONG STANDING.

SEC. 1.—*The usual Modes of Treatment, with Cases and Observations.*

HAD surgeons in general attended sufficiently to the causes which prevent fractured bones from uniting, while the fracture is in what might be called its recent state, we might have expected that these cases would be now far less frequent than they are. A great deal has been said as to the treatment of fractures of long standing; but, as far as I know, we have hitherto been furnished with but little as to the mode of preventing their occurrence. The principal differences which obtain in these cases have been described, but no corresponding attempt has been made to suit the treatment to the particular condition of the injured parts. What has been said upon non-union seems to be a chaos of facts; and, hence, we find, that the plans of treatment that have been recommended are still

generally resorted to in the most indiscriminate manner, according to the particular fancy of the surgeon.

The modes of treatment that have been employed in these important cases are many. These differ from one another in some particulars, but they have all been, for the most part, very unsuccessful; so much so, indeed, that I think I shall be far within the mark when I say, that not one in twenty in which they are tried is followed by a favourable result.

Rarely successful.

The object, in almost all the plans that have been advised, has been to re-produce inflammation in the seat of injury; either of the adhesive or suppurative kind. In doing this, surgeons endeavour to place the fracture in a state somewhat similar to that which existed immediately subsequent to the accident. In this respect they have had science to guide them; for, in all cases of fracture where the process of union goes on uninterruptedly, one of the first changes which takes place after the accident is an inflammation of the soft parts adjacent to the broken extremities of the bone. When, therefore, the action in the part is not sufficiently high, it has been found that, by increasing the

The object proposed.

inflammation or re-producing it, if it should have altogether subsided, osseous union of the broken extremities has been sometimes accomplished.

Blisters.

Blisters applied over the fracture have been occasionally found useful in accelerating the process of union, when it has been proceeding slowly. This mode seems to produce its beneficial effects by exciting the action of the parts immediately contiguous to the fractured ends; therefore we cannot expect it to be serviceable when the bone is surrounded by a considerable quantity of muscle, as the humerus or femur. When the fracture is in the tibia, the inflammatory action might be communicated from the skin to the periosteum, and thus facilitate the cure; but even here it frequently fails to be of any service.

Friction.

Another plan is, to rub the ends of the bone forcibly together. The friction has been produced either by grasping the two ends of the bone, and rubbing them upon one another; or by making the patient bear upon the injured limb, in the act of walking, after it has been firmly enveloped in splints. This plan has also been now and then followed by union of the bone.

I recollect, at an early part of my student-ship, at the Borough Hospitals, I saw a man at Guy's, who had a fracture of the tibia, which was tardy in uniting. He had a leather case, similar to that invented by Dr. Inglis, of the Royal Infirmary, Edinburgh, confined round the limb, from the ankle to the knee; and was directed to walk about with it, buckled as tight as he could bear it. The fracture, in this instance, united in the course of a few weeks.

Case.

A bruise or laceration of the part contiguous to the fracture will sometimes have the same effect.

The effect of a bruise, &c.

A gentleman had a fracture in the thigh, in which no union could be produced. Several months after the accident he was thrown out of his gig, and the wheel passed over the limb at the fractured part. He was confined after the second accident, which was followed by high inflammation; and now the fractured bone united.

Case.

These cases show the advantage which may be gained by exciting inflammatory action in the part when the fracture has existed a considerable period; but this alone rarely succeeds in bringing about consolidation of the bone.

These modes commonly of little use.

Case.

Some time ago, I saw a lady who had a fracture of the tibia at the small of the leg. This lady had had blisters tried for a long time, and had been bearing upon the limb, in the act of walking, for a twelvemonth when I saw her, with the leg tightly bound up; but neither of these plans proved beneficial.

Remarks.

I have seen many instances where these means have been tried without effect. They produce, however, adhesive inflammation, often followed by the deposition of a large quantity of coagulable lymph, which is sometimes mistaken for callus.

Rasping the
ends of the
bone.

When the fractured ends of the bone are cut down upon and denuded by rasping off the adventitious coverings, inflammation of the suppurative kind is commonly occasioned. Sometimes, however, the irritation produced by this operation is followed by gangrene, so extensive as to destroy the patient in a very few days after it is performed.

Removing
them.

Another operation, performed with a view to cure fractures of long standing, is the complete removal of the fractured ends of the bone by the saw, after they have been thoroughly ex-

posed and separated from the surrounding soft parts. This is a very severe operation, and by no means unattended with danger.

Mr. C. White, of Manchester, who, I believe, was the proposer of this operation, succeeded in producing union in the large bone of the leg after performing it. The union was effected in twelve weeks. He succeeded, also, in bringing about consolidation of the bone in a boy, whose arm had remained disunited for six months, by the same plan.

Results favourable.

Dr. Inglis, of Edinburgh, produced osseous union, in the tibia, after nine months had elapsed from the period of the accident, having taken away a portion of the upper part of the bone, by means of a trephine and saw. The bone, in this case, united in about ten weeks.

Result favourable.

But the cases of failure after this operation are very numerous.

Remark.

Mr. G. Rowlands, senior surgeon to the Chester Infirmary, performed this operation (in 1806) in a case of fractured thigh. The fracture was situated in the middle of the thigh,

Case.

and was produced by a blow. Upwards of five months after the accident, when Mr. R. performed the operation, the injured limb was about four inches shorter than the other, and was perfectly useless. Mr. R. made two incisions, one between the vastus externus and the rectus, and the other across the vastus externus, of sufficient length to expose the ends of the bone, which he found separated considerably from each other, by the interposition of muscular fibre. After much difficulty, he succeeded in sawing off the ends of the bone with a common amputating saw; and the patient ultimately, though not till the expiration of many months, recovered sufficiently to be able to walk with a stick and a high-heeled shoe.

Observations.

Mr. R. concludes his observations upon this operation, in the following terms. "Though I have several times performed all the principal operations that occur in surgery, and very often many of them, I confess, this far surpassed any thing I had ever undertaken or witnessed; and I am doubtful as to the propriety of recommending it to be done by others."*

* Medico-Chirurgical Transactions.

Speaking of sawing off the ends of the bone in cases of non-union, M. Boyer observes, that it is an operation painful, bloody, and of uncertain success.

Boyer's opinion of this operation.

Dr. Physic, an eminent surgeon of Philadelphia, mentions that, when a student, he saw this operation performed in the arm; but he states that no benefit was derived from it; and some months afterwards, the arm was amputated. This case, says the Doctor, made a strong impression upon my mind, and rendered me unwilling to perform a similar operation.

Dr. Physic's opinion.

I have seen this operation performed twice; and I can bear testimony, with these gentlemen, as to its great severity. Both the cases to which I allude were in the humerus.

The author's opinion.

The general rule in performing this operation, is to make an incision down upon the ends of the bone, in that situation where they lie nearest the surface; and in such a manner as to avoid wounding important parts. The place chosen in the cases to which I allude, was on the outer side of the arm, between the triceps and biceps. The broken ends of the bone having been exposed, the limb was bent, so as to

The difficulty and pain experienced in two cases, with remarks.

make them project towards the wound. The soft parts were then dissected back from the ends of the bone. This part of the operation was very painful, and was accomplished with great difficulty, in consequence of the convulsive action of the muscles, which was very powerful, and disturbed the ends of the bone at every stroke of the operator's knife. The next step was scarcely less difficult or less severe—that of sawing off the ends of the bone. The muscles continued to act convulsively, the nerves were stretched, and the cries of the patients were exceedingly distressing. Now, what was the result of all this difficulty—of all this pain—what is the common result? To say the best of it, a long confinement in bed, with a large suppurating wound, frequently accompanied with exfoliation of the sawn extremities of the bone. After submitting to this operation—to this pain—to this confinement—after endangering his life, it is more than probable that the patient will be burthened with a limb more useless than before.

First case—
result bad.

The subject of one of the operations to which I have alluded, was a man possessing a strong constitution. After many months' confinement in bed, during which portions of bone came

away, he was allowed to get up. I saw this man about eighteen months after the operation; the wound had then healed, but the arm was much worse than before it was performed.

In the second case, the fracture was oblique, and about half an inch of each of the fractured ends was taken away, in order to obtain as large a surface as possible for the adaptation of the denuded ends. After many months of suffering from exfoliation and abscesses, this man left his bed, with the limb much worse than before. Before the operation, he was able to write, to tie his shoes, and to perform various little offices with the hand; but so great was the injury done to the nerves, that the hand and arm are now perfectly useless.

Second case—
result bad.

This operation is sometimes fatal.

I have to mention a mode of treatment more recently recommended—I mean the introduction of a seton between the ends of the bone. This, I believe, was first employed by Dr. Physic, of Philadelphia. The object of the seton is the same as that proposed by rasping the fractured ends, sawing them off, and rubbing them with caustic; *viz.* to produce an inflammation in the part of the suppurative kind.

Seton.

Case.

Dr. Physic has given in the New York Medical Repository for 1804, a detailed account of a fracture of the humerus, which had existed twenty months, for the cure of which, he introduced a seton, and ultimately succeeded in obtaining consolidation of the bone.

The operation was performed on the 18th of December, 1802, twenty months after the accident happened. The patient was a seaman, twenty-eight years of age, and the fracture was situated about two inches above the elbow, and was occasioned by a heavy sea as it broke over the ship. No swelling of consequence supervened, nor did he suffer "any pain." Nineteen weeks after the accident, he felt he had gained some strength in the arm, and conceiving it united, he went on board ship again, in the capacity of steward. He was here under the necessity of using his arm; and he found, that it got gradually looser and looser, till a complete preternatural joint was formed. The seton which Dr. Physic introduced, was kept in till the 4th of May, 1803, not quite *five months*. The arm was at this time so strong, that he was able to move the limb in various directions. The seton was now removed. On the 28th of May, being a period of upwards of five months from the

time the operation was performed, the consolidation of the bone was considered perfect, and the man was discharged from the hospital.

Dr. Physic states, in his account of this case, that the inflammation produced by the seton was not more than is usual when the seton is placed in the soft parts for any other purpose.

Mr. Brodie mentions a case which occurred in St. George's Hospital, for the cure of which a seton was successfully employed.

A boy, between twelve and thirteen years of age, had both his thighs fractured by the wheel of a waggon as it passed over them. The left thigh was fractured in two places; and, in this, union took place at the end of the usual period. The right femur was fractured through the middle in one place. This limb was supported by splints in the usual way, but the fractured ends did not unite. Case.

The accident happened on the 30th of December, 1812; and, on the 14th of June, 1813, upwards of five months after the accident, Mr. B. introduced a seton between the ends of the bone. The needle met with so little resist-

ance in its passage through the limb, that Mr. B. was led to conclude, there was no union, even by soft substance, but that there was a complete preternatural joint.

No considerable inflammation immediately followed the introduction of the seton. The boy was kept in bed ten days, when a splint was applied on each side of the limb, and he began to walk with the assistance of crutches. At the end of a month from the time of the operation, a good deal of soft union had taken place. On the 2d of August, the union was considered more complete, and he was desired to leave off the splints. On the 10th of August, he was able to walk with one crutch, and to press with considerable weight on the foot of that side. On the 30th of August, an attack of erysipelas took place, which began at the wound made by the seton, and extended over a great part of the limb. The seton was withdrawn, and he was now again confined to his bed. The erysipelas subsided, but left him much debilitated; so that he made no more attempts to walk while he remained in the hospital. On the 20th of September, being upwards of three months after the introduction of the seton, he returned into the country for the recovery of his health.

The broken ends of the bone were now so far united, that only slight motion could be perceived in the situation of the fracture, as if, says Mr. B. the uniting substance was not completely ossified.

This boy's limb afterwards united firmly. No motion could be discovered in the fracture twelve months after the introduction of the seton.*

Here it will be observed, that upwards of five months had elapsed before the operation was performed. The boy remained in the hospital upwards of three months, after the introduction of the seton, from the 14th of June to the 20th of September. He suffered greatly from the introduction of the seton and the movements of the limb; and when he was discharged, motion could be felt, in the fractured part. Remarks.

A case was communicated to the Medico-Chirurgical Society by Mr. Brodie, which occurred in the practice of Mr. Josias Stansfield, in the Leeds Infirmary, where the result was favourable. The fracture, in this case, was in the humerus, and had existed upwards of six Case.

* Medico-Chirurgical Transactions, vol. v.

months. Union was accomplished in two months, during which the man, who was 48 years of age, wore the seton. The attack of fever, which came on in consequence of the seton, was severe, and the pain experienced very great.

Case.

Mr. Brodie mentioned to me another case which occurred in his own practice, where the seton produced a cure. The fracture was in the clavicle.

Case.

Mr. Wardrop relates a case of fracture of the thigh, about four inches below the trochanter major, for the cure of which he employed a seton. The fracture was transverse, and had existed twenty months. The gentleman was confined upwards of three months after the accident, and then suffered to move about with the assistance of crutches.

Considerable hæmorrhage followed the introduction of the seton, which Mr. W. had some difficulty in stopping. In eight days after the operation, suppuration was completely established, and the swelling around the wound began to subside; and, at the same time, the accompanying febrile symptoms which had been pretty severe, became more moderate.

On the evening of the tenth day after the operation, the gentleman had a feeling of distention round the wound; and, on examining the limb some hours afterwards, a considerable quantity of blood was found to have escaped, both from the upper and lower openings. When the dressings were removed, the hæmorrhage appeared to have ceased; but there was a great deal of tumefaction of the soft parts, contiguous to the upper wound, which created much uneasiness.

The bleeding did not return, but the patient's mind continued in a state of great alarm, and he suffered much from the distention, occasioned by the extravasated blood and the pain in the wound. The discharge, too, became profuse. A considerable degree of erysipelatous inflammation attacked the skin of the upper and posterior parts of the limb, and he had a great deal of symptomatic fever, with a weak, irritable, and very frequent pulse.

The seton was withdrawn on the 21st day, the constitutional irritation being extremely severe.*

* Medico-Chirurgical Transactions, vol. v.

Remarks.

All the benefit which this gentleman derived from this operation, the effects of which, it appears, nearly cost him his life, after about *nine months* confinement in bed, was the power of moving the limb, somewhat backward and forward, and from side to side, which he was not previously able to do.

Case.

In the case of non-union in the humerus, mentioned by Mr. Earle, the seton was introduced about nine months after the accident. It produced great irritation and constitutional disturbance. Mr. Earle states, that though great care was taken to keep the bones together, no good resulted from the use of the seton, and at the end of the seventh week it was withdrawn.

Results in three cases.

I have seen three cases of non-union treated with setons—one in the femur, and two in the humerus. The constitutional disturbance produced by the seton in the thigh was extremely severe; but the irritative fever, occasioned by it in the other two instances, was not great. Not the least benefit was obtained from its employment in either case.

Remarks.

Such have been the general results, following

the introduction of the seton in this country. Though I have heard of many cases of non-union, treated by the employment of setons, I am not aware that there are more than three treated in this country, where its operation appears to have brought about consolidation of the bone. The introduction of the seton is, however, an operation much more easily performed, and much less painful to the patient, than that of cutting down upon the ends of the bone, turning them out, and removing them, or the adventitious deposit by which they may happen to be covered; yet its after consequences are sometimes much more severe than those which follow excision of the fractured ends or rubbing them with caustic. In one of Mr. Earle's cases both these operations were performed. Finding the seton unavailing, Mr. E. cut down upon the fractured ends of the bone, and removed the soft parts which held them together, and afterwards rubbed them with caustic till they became black, but no permanent good was obtained.

SEC. 2.—*The Plans of Treatment which the Author has found most successful, with Cases and Observations.*

Having made up my mind upon the treatment of recent fractures, I began to turn my attention to the consideration of those of long standing, which resist the usual means of cure. I had arrived at modes of treatment by which these cases might usually be prevented; my next business was, to find out some way of curing such as may be already in existence; and such as might occur in situations where proper surgical assistance could not be procured during the recent state of the fracture.

Contrivances usually employed not to be depended upon.

I have stated that the contrivances commonly used to preserve apposition and rest are not to be depended upon; that they are scarcely safely used in the most simple kinds of simple fractures; and that, when the fracture is attended with laceration of the surrounding parts, they are any thing but adequate. The knowledge of these facts furnished me with a clue to the most common cause of non-union; and, also, with the most common cause of failure after the

operations which have been performed with a view to bring about a new action in the fracture. It is well known, that the same mechanical means are commonly used after the inflammation is re-established, as far as the state of the parts will allow, as are employed immediately subsequent to the injury; but, in some cases, they are much less efficient, as after the operation of cutting off the ends of the bone, &c. than they are in the first instance; for they cannot, with propriety, subsequent to these operations, be applied so tightly upon the limb as in a recent simple fracture. These means, as I have stated, allow the fractured ends to move frequently, which often prevents the union from taking place, when the fracture is recent; and, after the inflammation in the fracture is re-created, by cutting off the ends of the bone, by rubbing them with caustic, or by any other means, the same cause will operate; and this is the grand secret why the usual plans of treating fractures of long standing are so seldom found successful.

In the treatment of fractures in this state, our business is to re-produce an inflammatory action in the situation of the fracture; and we

Increased action necessary to the formation of callus.

do so upon a principle which I have elsewhere mentioned, and which seems to me as well founded as any one in surgery—that an action higher than the natural standard is necessary to the formation of callus. If this be allowed, it will be granted, that if a fracture does not unite from a want of apposition and rest during the continuance of the action, which is set up immediately after the injury, that it will not unite at all till an action similar in kind, though it may differ in degree, is again set up in the fracture, either by Nature herself, or by the assistance of art.

Some of the means used do not produce it.

Some of the methods which have been resorted to, to produce this new inflammatory action, are not, in many instances, calculated to effect it; such as the application of a blister to the surface of the thigh, or the employment of a stimulating liniment gently rubbed upon the limb, when the fracture happens to be in the femur.

Others produce too much.

Some of them, on the contrary, excite an action much higher than is necessary for the formation of callus, as causticating the ends of the bone, or cutting them off. Both of these operations are usually followed by high inflam-

matory action; which is succeeded by a long suppurative process, and, generally, exfoliation of bone. During this process, bony granulations are formed, which occasionally coalesce and close up the breach of continuity. But the bony granulations are not formed during the high inflammatory action—they are produced, during the slow suppurative process, in the same manner as in compound fractures. The same might be observed of recent simple fractures—the osseous matter is not commonly deposited during the high action which comes on immediately subsequent to the injury. This assists in forming a bed for the new bone, which is deposited at a period when the high action has, in a great measure, subsided.

If the bones, by their frequent motion and displacement, keep up, for a long time, an action much beyond that which is natural, there will be in simple fractures, in consequence of the long continuance of this inflammation, a greater effusion of coagulable lymph, and also of bony matter; and, in compound fractures, there will be a larger supply of bony granulations.

Effusion of lymph modified by the quantity of inflammation.

If a man dislocates his ankle, a laceration of

Example.

ligament and other structures must take place prior to the dislocation. This laceration will be followed by active inflammation, under which the different tissues will produce a secretion, modified, in some measure, by the degree of inflammation; but, it is probable that, in all of them, the action would run sufficiently high to occasion an effusion of coagulable lymph. But this effusion will, as I have said, differ in proportion, according to the degree of active inflammation. In all cases the action will probably be sufficiently high to occasion the effusion of this part of the blood, as the simple consequence of the injury; but, if we were to make the patient walk upon the limb, while the active inflammation exists, we should apply a mechanical irritant to a part already too much irritated; and, thus, increase the inflammation, and, consequently, the effusion of coagulable lymph; supposing the inflammation should not run so high as to destroy the vitality of the irritated textures: so, if in fractures the action is high, and kept up considerably above the natural standard by frequent irritation, the effusion of coagulable lymph, all around the fracture, will be very great, and so will be the ultimate effusion of callus—sometimes so great as to unite the fractured ends of the bone at a con-

Effusion of lymph and callus very great if inflammation be long continued.

siderable distance asunder, as is seen in *Plate VI. Fig. 1.* This takes place only under long continued inflammation. This kind of union we see principally in the bones of the lower animals, when no attempt is made to keep the fractured ends in apposition and at rest. The great irritation which is kept up, by the ends of the bone, pricking and tearing the surrounding textures, is sufficient to account for the continuance of the inflammation, and the consequent great effusion which we observe.

If the fractured limbs of men were allowed to tumble about in the same way as those of the lower animals, from the moment the injury is sustained, the inflammation set up would probably go on to the destruction of life, man being less able to bear the effects of violence than the lower animals; but, in proportion to the powers of his constitution, he approaches to them in this particular. If the powers of his constitution be great, he has, like the lower animals, commonly less organic sensibility; and, like them, he is better able to resist and repair the effects of injury, inflicted upon the soft parts by the broken ends of the bone, or any other cause.

The constitution of man less capable of bearing irritation than the lower animals.

Inflammation
in strong per-
sons soon sub-
sides.

Hence we should infer, what we actually find, that if we have a fracture in the person of a strong man, and if we treat this fracture so as to prevent the ends of the bone from irritating the surrounding parts, the inflammation, arising from the accident, would soon subside. If the high action produced by the fracture, and the force which occasioned it, be immediately got rid of, and motion, such as would be sufficient to disturb the quietude of the fractured ends of the bone without irritating the contiguous parts, frequently take place, there would, in such persons, be great danger of tardy union. The coagulable lymph, which is thrown out under the first excitement, becomes sometimes formed, as I have said, into a sort of ligament, which supports and covers the ends of the bone; so far as to prevent any material inconvenience from being felt in the soft parts. The excitability being, with difficulty, roused in such persons, Nature does not seem to trouble herself any further, and the fractured ends, thus connected, often form a preternatural joint, occasionally with a cavity, into which is poured a fluid, having the resemblance of synovia; which lubricates the parts, and facilitates their motion. In such persons, therefore, we should be less careful in reducing the inflammation

than in others; and, in some instances, it might be even advisable to adopt means to support an action higher than natural, for a time, in order to facilitate the formation of callus.

In other persons, in whom inflammation is easily excited, and easily kept up, re-union takes place more readily. In these, there is more inflammation and more tenderness, which continue longer; and, consequently, there is a greater effusion of coagulable lymph, and also of callus, than in those whose restorative powers are very great. *In the first class of persons, we must take care that the increased action does not subside too rapidly; in the second, we should be on our guard that it does not rise too high;* for, as I have said, the quantity of callus effused seems to keep pace with the inflammation, and the time it continues, provided the action is not too violent.

In others, it is kept up longer under the same causes.

When a recent simple fracture goes on favourably, we observe that there is commonly more pain felt in the seat of injury, in adults, between the tenth and the sixteenth day, than during the previous four or five days. This pain the patient frequently compares to rheu-

Increase of pain in the seat of fracture.

matism, with an occasional start of the limb; and now and then, especially during sleep, a momentary lancinating pain in the fracture. All these symptoms indicate, that there is increased action going on in the surrounding parts, and that this action, from some cause or other, is higher now than it had been for some days previous. This action, however, does not require the interference of the surgeon. It indicates merely a salutary increase in the calibres and powers of the arteries, to enable them to perform an extraordinary labour. At this period, the callus is forming; and the action of the arteries gradually subsides as the callus gets firm; but the tenderness round the fracture is sometimes felt, when the part is pressed, for two or three months after the bone is united. The tenderness, however, seldom continues so long, unless a large quantity of callus is effused.

The action, when the callus is forming, above the natural action.

Here we see that the action, which is observed when the callus is forming, is above the natural action; but that it is by no means an action which requires to be subdued by the assistance of art. *Hence I inferred, that if an action, somewhat above the natural standard, could be produced in the ends of the bone, and the periosteum which covers them, in frac-*

tures of long standing, and, at the same time, all the causes of non-union be either removed or prevented, union by bone would be often easily effected—probably with almost as much facility, in the majority of cases, as when the fracture is recent.

I had already possessed myself of means by which I could prevent, what, I believe was the principal cause of non-union in almost all the cases I have seen; *viz.* motion of the fractured ends. I therefore conceived, that I had only to excite the action of the parts, and perhaps to produce absorption of some adventitious deposit, in order to unite many of those which had been of long continuance. But, how were these desirable objects to be accomplished? It occurred to me, that they could not be so well effected by any other plan as by the influence of local pressure. Strong pressure produces inflammation; and, at the same time, absorption of the parts which are pressed upon. Pressure I could readily produce and keep up, for an indefinite period; and, at the same time, maintain the parts in a state of quietude, by the contrivances already in my possession. I now wanted facts only to prove or disprove the validity of my reasoning.

New action excited by pressure.

I shall now proceed to mention the different means which I have resorted to, in order to bring about consolidation of the fractured ends in fractures of long standing, and the results to which I have arrived.

Influence of local Pressure and Rest in the Treatment of Fractures of long standing in the Humerus.

Treatment.

In cases of non-union in the humerus, where the bone is healthy, and the fractured ends are not prevented from uniting by the intervention of any foreign body, I employ the apparatus which I invented for simple fractures of this bone. I apply this apparatus in the manner which I have directed in my Syllabus for recent simple fractures of the upper arm, taking care, at the same time, to maintain the fractured surfaces in tight apposition.

Oblique.

When the bone is broken obliquely, this is done principally by padding the apparatus, as in recent fractures, according to the direction of the fracture, so that the fractured surfaces might be forced strongly together. In these cases the pressure operates principally in the transverse direction.

When the bone is broken transversely, the Transverse.
fractured surfaces are forced together and maintained in close apposition, for the most part, by the operation of a short sling, or some other contrivance, which is made to act in a line with the long diameter of the bone.

As John F. Esq. M.P. was returning from Case.
Winchester, in a very dark night, about the 20th of July, 1822, the horses got off the road, and precipitated the carriage into a gravel pit, nearly ten feet deep. He felt the left arm, just above the elbow, very much stunned by the fall; and, upon endeavouring to rub the part with the other hand, he discovered that the bone was broken. He immediately sent back to Winchester for his professional attendant. He was bled; and, in about three hours from the time of the accident, the fracture was reduced and put up in splints in the usual way. The splints were re-adjusted on the third day, and afterwards every seven or eight days, till it was thought they might be safely removed; which was at the expiration of about six weeks. The limb at this time appeared perfectly straight. The arm felt weak, and he could not raise it from the side without great effort; but it was believed that the bone was united. After the splints

were removed, he carried his arm in a cradle for a considerable period. In the month of November, he was thrown from his horse, but was not aware that the arm received the slightest injury from the fall. Some time after this, it began to feel much weaker than before, so that he was obliged to desist from attempting to carve or raise the arm from the side. After two or three days, he again recovered the use of the limb, in a slight degree, as before ; but it had been for some time becoming gradually deformed, and, he observed that, in proportion as he attempted to use it, the deformity increased, and also the weakness, accompanied by a sensation of tightness over the fracture. In April, 1823, Mr. Segar, of Cheltenham, saw it, and expressed his belief that the bone was not united. This opinion was afterwards confirmed by Sir A. Cooper, Mr. Brodie, and myself.

On the 6th of June, 1823, in consequence of the recommendation of Sir Astley Cooper, I was requested to see this gentleman, in company with Mr. Brodie ; and, upon examining the limb, I discovered a fracture extending obliquely downward and inward, a little below the middle of the bone. The limb could be readily bent at the fractured part, and was much

deformed and shortened from the riding of the fragments. On the 7th of June, nearly *eleven months* after the accident, I applied the apparatus for the treatment of fractures of the humerus. By means of this, my first object was to remove the deformity as much as possible. This I fortunately succeeded in accomplishing in a few days, so far that the broken extremities overlapped only in a very slight degree, and they were now brought into tolerable apposition.

I conceived it probable that, in this case, there was a considerable quantity of ligamentous matter thrown out between the fractured ends; and that, after the lapse of so long a period, a more than ordinary degree of pressure might be required to produce its absorption. In order to save time, therefore, I immediately contrived an additional apparatus, furnished with a screw, by means of which I was enabled to produce any degree of pressure I thought requisite, in the longitudinal direction of the bone, and to regulate it with the greatest facility. The additional apparatus was first employed on the 17th of June, and strong pressure was kept up in the lateral as well as in the longitudinal direction. The pressure which I had previously

employed produced some pain in the fracture, which now became severe, and continued so for a few days, and then gradually subsided.

July 26th, the apparatus was removed, and the limb was examined by Mr. Brodie, and myself; and, now, only a very slight degree of motion could be discovered in the fracture. The apparatus was re-applied; and, as the limb was so far recovered, we thought that Mr. F. might return to the country with impunity for the remainder of the period, during which it was advisable that he should wear it. At the expiration of about three weeks more, it appeared that the apparatus might be, with propriety discontinued. Having received instructions how to proceed, he left town with the intention to return at the end of this time; but, in consequence of some business which detained him, he did not come back till the 24th of August; when the limb was again examined, and the bone was found united.

When this gentleman had recovered the use of the limb, I requested him to allow me to ascertain the degree of shortening which remained; and, upon measuring from the point of the acromion over the outer condyle of the

humerus to the edge of the ulna, I found that it was only a third of an inch shorter than the other.

Mr. F. possesses an excellent constitution, and enjoys good health, which was not impaired during the existence of the fracture.

John Nickling, aged twenty-seven, was admitted into Guy's Hospital, under Sir A. Cooper, July 17th, 1821. He had a transverse fracture of the right arm across the middle, occasioned by a blow from a heavy body. Liq. plumbi subac. dil. was applied for a week. The limb was then put up in the usual way with splints, extending from the elbow to the shoulder. He had no pain of consequence after the first week. The splints were removed at the end of six weeks from the time of the accident, and it was discovered that the bone was not united. All tenderness in the fracture had subsided, and the broken ends of the bone could be moved in all directions, without producing pain. Case

The fractured bone was now inclosed in a *leather case*, and the limb was placed in a tin trough, bent to a right angle, and made long enough to extend from the shoulder to the

wrist; and he was ordered to support his arm with a sling. The straps which secured the leather case were occasionally buckled tighter, as the muscles of the limb wasted, in order to keep up strong pressure upon the fractured bone. This plan was continued till the 11th of May, 1822, nearly ten months, but without success. He still felt the yielding and motion in the fracture, which were evident when the limb was examined.

I was now present when Sir Astley Cooper examined the fracture, and told the man that the only chance left, was for him to submit to an operation. I requested Sir Astley to allow me to try the effect of the apparatus, which I have described for fractures of the humerus, before he proceeded to operate, to which he politely consented. The apparatus was applied and the man was directed to carry the arm in a short sling. The broken ends of the bone were pressed strongly together for *six weeks*; and at the expiration of this time, the apparatus was taken off, and the bone was found firmly united and as straight as the other.

During the time he wore the apparatus, he had occasionally pains in the fracture, which

he compared to those of rheumatism. These were at first rather severe, and the part felt sore ; but both the pains and the soreness gradually subsided.

This case occurred in a strong man, whose health had always been good.

March 11th, 1813.—James Game, a shoe-^{Case.} maker, aged twenty-eight, was admitted into St. Thomas's Hospital, under Mr. Travers, having an old fracture of the humerus, just below the head. The accident was occasioned by a sudden jerk of the arm, in consequence of the thread giving way, as he was in the act of pulling it, when mending a boot. At first, he had common splints applied in the usual way ; but it is evident that they had little power over the fracture, as he had always found the broken ends of the bone grate, whenever he moved the body or the limb.

In this case the fracture had existed thirteen weeks. Mr. Travers politely called my attention to it, and allowed me to try to bring about a union by the same means which I had already found eminently successful. I examined the limb. The man could not move the arm from

the side. The fractured part was sore ; and crepitus was easily produced by rotating the lower part of the bone, while the head was fixed upon the scapula, by means of the fingers. The apparatus for fractures of the humerus was now applied, in the same manner as in the last case, and was worn for *thirty-two days*, and was then discontinued, as the bone had united.

The pressure kept up soon produced pain in the fracture, which was at first rather severe ; but it subsided in the course of a few days.

This patient had not the appearance of a strong man ; but he states, that his health had always been good ; having never experienced any illness, except such slight occasional attacks as the strongest men are subject to.

Case.

John Ellis, æt. 22, a sailor, whose health had always been good, was admitted into St. Thomas's Hospital, on the 17th of July, 1827, under the care of Mr. Green, for the cure of a compound fracture of the right humerus. The fracture was occasioned by a severe blow from the handle of a crane, which struck him on the inner side of the arm, where the bone was exposed, and projected through the soft parts.

He was brought to the Hospital immediately after the accident, where he was placed in bed, and had the limb laid upon a pillow; splints, extending from the shoulder to the elbow, having been previously applied, with a view to support the fractured parts.

Very little constitutional disturbance followed the accident. Suppuration was soon established, and he was allowed to sit up, and hang the limb by the side, about the tenth day. The wound healed in about seven weeks. After this, two small abscesses formed in succession near the elbow, which required daily attention for some time.

Sixteen weeks after the accident, it was found that the fractured ends had not united; though the original wound, and those occasioned by the abscesses, had been healed for a considerable period. The tenderness in the seat of fracture had so far subsided, that he could swing the arm freely, without producing pain. The fractured part did not feel sore when handled; but there was slight tenderness experienced when the broken ends of the bone were strongly forced together.

The angular arm-splint was now applied, in such a manner as to meet the circumstances of the case. This soon produced pain in the fracture; but, in consequence of the tender state of the skin about the elbow, where the abscesses took place, it became slightly excoriated; which rendered it advisable to remove the instrument for a few days.

Nineteen weeks after the accident, the skin being sufficiently hardened, the apparatus was re-applied. The limb had now again lost all tenderness, and the fracture was quite loose. Three or four days after the re-application of the apparatus, pain again came on in the fracture; and was accompanied with an aching, and occasionally a shooting sensation, which, at times, was rather severe, but never continued long. The pain and tenderness gradually subsided, and the limb became quite easy in about a fortnight.

The apparatus was removed on the twenty-eighth day after its second application, and the bone was found united. In the course of a few days, he was desired to exercise the arm, in order to remove the stiffness which had taken place in the elbow-joint, which was produced

by the abscesses and confinement; but it was feared that, in doing this, he injured the callus; for, in about ten days after the removal of the apparatus, he complained of pain in the limb at the seat of fracture, where, upon examination, slight motion was discovered. The apparatus was now again applied, and worn for thirty-one days, when its further use was discontinued, as consolidation of the bone had taken place.

The soft ankylosis of the elbow-joint was now removed, by the use of my screw apparatus, and friction—a plan of treatment which should always be resorted to in such cases, as there is danger of fracturing the callus, by the employment of irregular force.

This man is now following his usual avocations, with the limb as strong as it was before the accident.

Mr. Castledine, a strong, healthy butcher, Case.
 æt. 53, had a transverse fracture, situated in the middle third of the humerus, which was produced by a fall from a cart. He wore the split-deal splints, for about two months, and after this, my stiff elbow apparatus (not the angular

apparatus for fractures of the humerus, as I presume was intended) very badly applied.

About four months after the accident, he placed himself under my care, in consequence of the recommendation of Mr. Green. At this time, there was no pain produced by moving the fractured extremities upon one another; but he felt slight tenderness when the part was firmly pressed with the fingers. The state of the fracture did not allow of extensive, though very evident motion. The limb was perfectly useless. I applied the angular apparatus, as for non-union of the humerus of this description. Two days after the application of the apparatus, he experienced pain in the fracture, of the rheumatic kind, which was rather severe. On the seventh day after the application of the apparatus, the pain and tenderness had begun to subside, and had left him altogether at the end of a fortnight. The bone was found firmly united at the end of *three weeks*, when the use of the apparatus was discontinued, and he soon recovered the natural powers of the limb.

Case.

John Wright, æt. 29, a strong healthy man,

came into St. Thomas's Hospital, under Mr. Green, for the cure of an ununited fracture of the humerus. The fracture had existed nearly four months; it was transverse, and not very loose. The common splints had been employed in another hospital, but without any benefit. On his admission into St. Thomas's Hospital, my apparatus was applied. He complained of pain in the fracture, of the rheumatic kind, for the first five days. This gradually subsided, and soon left him altogether. He wore the apparatus five weeks, when it was discontinued, as consolidation of the bone had taken place.

There is a case detailed in the Medical and Physical Journal for July, 1827, in which Mr. Brodie succeeded in bringing about consolidation of the bone by the influence of pressure and rest. The man was twenty-four years of age, and fractured his leg and arm at the same time. The fracture of the leg united, but no union could be produced in the arm. An attempt had been made to unite the bone by the use of a seton, which, however, only produced some thickening round the fracture. When the man entered St. George's Hospital, about four months after the seton was introduced, the fractured ends appeared to be united

Case, by Mr.
Brodie.

by ligament, which allowed of considerable motion. At the time the treatment by pressure and rest was adopted, the fracture had existed upwards of twelve months. By this plan osseous union was effected in three months, and the man's arm is now as strong and useful as the other.

Influence of local Pressure and Rest in the Treatment of Fractures of long standing in the Fore-arm.

Treatment.

In the treatment of non-union in the ulna and radius, exclusively of the olecranon and of the coronoid process, I have not hitherto found it necessary to employ any other means than the convex splints, which I invented for fractures of these bones; though I am disposed to think that, in some cases, additional means might be required.

Case.

A gentleman, recommended to me by Mr. Green, fell, upwards of seven months before I saw him, with such violence as to produce a compound fracture of both bones of the forearm. The wounds were small, and healed by the first intention. He wore the common split-deal splints for a considerable time, and after-

wards a leather case, buckled round the arm; but no union took place from the employment of these means.

When he came to consult me, the two bones were nearly approximated; and an obtuse angle had formed, projecting backward considerably, at the seat of fracture. The limb was very weak, so that he was unable to do any thing with it; and very perceptible motion could be felt in both bones.

I now applied my convex splints, in such a manner as to remove the deformity as much as possible; and, at the same time, to keep the fractured surfaces closely applied to each other. The splints were taken off at the end of *the seventh week*; and, on examining the limb, I found, that it had assumed nearly its natural appearance, but there was still an unnatural approximation of the ulna and radius.

The radius was firmly united, but I had some doubt, whether the union of the ulna was quite so firmly joined as would justify me in removing all mechanical support, though he was now able to use his arm freely; I therefore directed him to wear a guard for a short time, to protect

the bones from injury ; and not to endanger the union which had taken place, by any violent exertion.

Case.

A female, æt. 74, applied to me for the cure of a disunited fracture of the radius, of about eight months' standing. She broke both bones of the fore-arm by a fall down stairs. The injury was treated by short splints, in the usual way. The splints were worn for one month. When I saw her the ulna was united, and the fractured ends of the radius were pressed in close against the ulna, and were overlapping, but had not united to the ulna nor to one another. The arm was very weak, and continued getting more so daily.

When she came under my care I placed the arm in splints, in such a manner as to press the fractured ends together, and keep them at rest. The splints produced some pain and tenderness in the seat of fracture, which did not subside till about three weeks after their application.

This fracture united in seven weeks.

The Influence of local Pressure and Rest in the Treatment of Fractures of long standing in the Femur.

The treatment of fractures of long standing Treatment.
in the thigh-bone must be modified according to the situation of the fracture.

If the fracture happens to be in the upper- In the upper third.
third of the bone, the treatment I resort to is very similar to that which I have recommended in this work for recent fractures of this part.

Should it be in the cervix, the only differ- In the cervix.
ence I have made consists in drawing the pelvis-strap closer; so that the fractured surfaces may be pressed more strongly together than is requisite in the management of recent fractures in this situation.

John Lucette, æt. 44, a labourer employed Case.
in one of His Majesty's victualling yards, was admitted into St. Thomas's Hospital, having an old fracture of the neck of the thigh-bone, which had not been discovered before his admission.

He stated that he fell from a height of about

four feet, and pitched upon the ground, so as to receive the principal force of the fall upon the left trochanter major. When he was lifted up, he was able to bear upon the limb, but not without considerable pain. He walked a few steps with assistance, but the pain occasioned by the effort obliged him to desist from proceeding further.

Upon examining the limb, after his admission into the hospital, it was observed that the *foot was not everted*, but *maintained its natural position*. The limb was retracted upwards of an inch, but could be readily brought down to its proper length by gentle extension. As soon as the extending force was discontinued, the limb became again retracted to its former situation. He had pain at the upper and inner part of the thigh, and the joint was tender when pressed upon. He had, also, some pain behind the trochanter major. He could bend the limb, and rotate it inward or outward; but not without increasing the pain. Crepitus was felt by Mr. Green, several other gentlemen, and myself, but not always readily.

He was placed upon my fracture-bed, on the 18th of January, in the manner I have directed

for fractures of the cervix of this description, and the management of the case, by the kindness of Mr. Green, was confided to me.

Three or four days after he was placed upon the bed, he had an increased degree of pain in the groin, accompanied with an occasional start ; which was sometimes sufficient to wake him. When he had been upon the fracture-bed about a month, a circumstance happened to him, in consequence of the ignorance of the nurse, which could scarcely have failed to disturb the fractured parts. He was again laid properly upon the fracture-bed, and continued upon it altogether eight weeks. At the end of this time, all pain and tenderness had subsided, and the limb was only *one-fourth of an inch* shorter than the other. He was now removed to a common bed ; and, in the course of a few days, was allowed to bear upon the limb. As soon as he began to move the limb freely, the pain in the groin returned ; but this was experienced especially when the flexors of the thigh were exerted. It was difficult to say what was the cause of this pain, as the length of the limb continued the same as it was when he was taken off the fracture-bed. He was kept in the hospital several weeks ; and, during this time, was

cupped twice or thrice, in the vicinity of the joint, with some relief. He improved very slowly in his walk while he was in the hospital; and as the limb did not become retracted, and as nothing satisfactory could be elicited as to the cause of the pain in the groin, he was discharged.

This man went from the hospital into the country, and I had not an opportunity of seeing him again till within these few days. He now walks with a crutch and stick; the limb has become retracted half an inch; he has still pain in the groin when he bears upon the limb, and the crepitus of fracture can again be felt.

Remarks.

This is a case of great importance. From its early history, which I have obtained from the gentleman who first saw the man, in company with two other surgeons, I have little doubt that it was, in the first instance, a case of fracture of the cervix femoris, unaccompanied with any considerable laceration of the surrounding parts. In a communication with which this gentleman has favoured me, he says, "I examined the limb half an hour after the accident. There was no mark of injury, neither eversion nor inversion of the foot; neither lengthening

nor shortening of the limb; the trochanter major followed the movements of the limb, and not the least feeling or sound of crepitation was distinguished in the various movements of flexion, extension, and rotation. He complained loudly of pain; but more when the thigh was bent upon the body, or the limb extended, than when it was rotated. There was not the slightest discolouration or swelling; the inner ankles were in exact apposition; the man, while placed at full length on his back, was able, of himself, to draw up the limb, and bend it to a right angle with the body. He even stood upon the affected limb, and swang the other about like a pendulum." The gentleman to whom I am indebted for this account, and who had several times examined the limb, wrote to me, under the idea that there was no fracture. He says, "what more was wanting to come to the conclusion that there was no fracture of the neck of the thigh-bone?" So strongly was he convinced that there was "no fracture," that I doubt, from the tenor of his communications, whether he would have believed that a fracture had been discovered, if bony consolidation had taken place under the treatment that was adopted.

The early symptoms of this man's injury were similar to those which I have observed in others, who had fracture of the neck of the thigh-bone, where no laceration of consequence had occurred; and if he had been placed upon the fracture-bed before the limb became retracted I see no reason why strong union should not have taken place in his bone, as well as in Fitzgerald's, whose case I have related in a former part of this volume; but, laceration of the surrounding parts having been produced, and so long a period suffered to elapse before any curative measures were had recourse to, the injury became one far more difficult to cure; and the man is now a burthen to his country, having been, I understand, made a pensioner for life, with a wife and several small children, without any other dependence for support.

This man's case was the first, which might be considered a case of non-union of the cervix femoris, that I had had to manage; and, consequently, experience had not taught me how long it might be necessary to confine a person so circumstanced, in order that a union might take place, which, if not bony, might be sufficiently strong for the restoration of the natural power and the free motion of the limb. From

the circumstance of the limb remaining of the same length, for several weeks, as when he was removed from the fracture-bed, we might infer that the uniting process had made considerable progress, notwithstanding the parts had been once, during his confinement, in all probability, much disturbed; and, if he had continued upon the bed another month, the union might, perhaps have been completed; or rendered strong enough to bear the weight of the body without yielding.

I have treated another case of non-union of the neck of the thigh-bone, in a female, which had existed about nine months, in the same manner. I think it probable that the fracture was, in this case, external to the orbicular ligament; but, as she had an affection of the chest, which prevented her from lying upon her back so long as I required, that degree of benefit which I hoped to obtain for her was not procured. She is a woman about forty years of age, and still continues to walk with crutches. This woman did not give the plan a fair trial, it would therefore be useless to relate the history of the case.

When the fracture is a little below the tro-

Below the trochanter minor,

—oblique.

chanter minor, and oblique, the splints which are placed upon the thigh must be made to act more powerfully upon the broken ends; so that their fractured surfaces may be pressed together strongly in the transverse direction.

Transverse.

If the fracture be transverse, a power should also be employed in addition to the splints, so as to force the fractured ends together in a line with the long axis of the bone. This might be either a bag of shot, placed upon the knee, or a padded strap; which should be applied so as to exert its influence upon the knee and the pelvis. I am disposed, however, to give the bag of shot the preference, as it may be used with less inconvenience to the patient, in consequence of its pressure being more equal than when a strap is employed.

The subject of the following case was a patient of Mr. Wray's, Salisbury Square.

Case.

Richard Springfield, æt. 39, whose health had always been good, slipped as he was coming down stairs, and falling backward, fractured his *right* thigh, immediately below the trochanter minor. He was carried to St. Bartholomew's Hospital, where he was placed upon one of

Mr. Earle's beds, upon which he continued for a month. After this he was placed upon a common bed, and was removed from the hospital, eleven weeks after the accident, with the limb much deformed, and the fracture still dis-united.

I found the fracture slightly oblique—the foot was everted, and a considerable angle was formed by the two fractured ends, which projected forward and overlapped. He felt slight pain in the injured part, when the limb was roughly handled; and the limb was weak and useless.

Sixteen weeks after the accident, he was placed by Mr. Wray and myself upon one of my mattresses, which was thrown over one of Mr. Earle's fracture beds; which I had had modified, so as to suit the circumstances of the case. This was done in order to save expense; as one of Mr. Earle's fracture beds had been procured before I saw the patient. As he had had a fracture of the opposite limb, which had united with shortening, it was thought advisable not to elongate the thigh, for the cure of which I was consulted. The foot was placed upright, and the whole limb being fixed, the

fractured ends were made to bear strongly upon one another by the operation of a bag of shot placed upon the knee.

Slight pain came on in the fracture on the fifth day after the commencement of this treatment, and slowly increased till the twelfth day, when it was rather severe. It then gradually decreased, and had left him altogether before the twenty-fourth day.

The limb was examined at the end of the fourth week, and the bone was found united; but we considered it advisable to let him remain upon the fracture-bed another fortnight. At the end of the sixth week from the time he was placed upon the fracture-bed, he was removed from it and placed upon a common bed. He was soon after allowed to bear upon the limb, the use of which he gradually recovered. The length of the two thighs were now equal; but as he had had a fracture of the *left* femur, we could not say decidedly whether any retraction had taken place in the right. He had, also, had a fracture of the left leg, which united, with the fractured ends overlapping, so that he now wears a high heeled shoe upon the *left* foot, this limb being shorter than the other.

Oblique fractures of long standing situated in the middle and lower thirds of the thigh, unite under the operation of the apparatus which I invented for recent simple fractures of the middle and lower thirds of the femur, &c.

In the middle
and lower
thirds—oblique

If the fracture happens to be transverse, a strap carried from the pelvis to the knee will be sometimes required in addition; in order to keep up a proper degree of pressure in a line with the bone. The apparatus is applied in the manner which I have directed in my Syllabus for recent simple fractures in the same situations. The straps, however, are kept tighter than is necessary in recent cases.

Transverse.

Nov. 14th, 1825, Sir Richard S——, Bart., was thrown from his horse, which, rolling over the thigh, fractured the bone near the middle. The fracture extended obliquely downward and outward. He was removed to his residence, which was about four miles from the place where the accident occurred; and the limb was laid upon the side, and the fracture treated according to the plan recommended by the late Mr. Pott. The limb was thus confined for six weeks; and, at the end of this time, when it

Case.

was examined, the fractured ends were overlapping, but appeared to be united.

About ten weeks after the first accident, the union gave way, under the action of the muscles; and, on this occasion, the limb was placed in the bent position, half way between the side and heel, and confined by means of splints, extending from the pelvis to the knee, in the usual way. It was kept in this position for nine weeks, but the bone did not unite by the interposition of callus. After this it was attempted, under the direction of Sir Astley Cooper, to excite a new action in the part, by pressing the broken portions together, by means of a strong leather case; according to the plan recommended by Dr. Inglis. During this treatment, the ends of the bone were suffered to rub upon one another; as Sir R. was suffered to exercise himself with the assistance of crutches, though he was not allowed to bear upon the limb. This plan occasioned great pain and tenderness in the fracture, but it had not the effect of producing consolidation of the bone.

Sixty-six weeks after the second accident, Sir R. applied to me, and, upon examining the

limb, I found that the fracture was situated about the middle of the bone, and extended in a direction downward and outward; and that the fractured ends were overlapping rather more than two inches and a half. The surfaces of the bone which were lying the nearest together, were united by a soft substance which did not allow of any great extent of motion. He had lost all pain in the part, and was able to bear, and even walk upon the limb; though the thigh could be easily bent so as to produce an angle at the seat of fracture, projecting in any direction; and Sir R. observed that the fracture was getting looser daily.

At the time this gentleman called upon me, he was under the care of Mr. Brodie, who, however, had seen him only a few times. I had an interview with Mr. Brodie, and we determined to employ the apparatus which I had invented, for the treatment of simple fractures of the middle and lower thirds of the thigh-bone, fractures of the leg, and other purposes.

On the 30th of April, 1827, I applied this apparatus, in the presence of Mr. Brodie, Mr. Copeland, and others.

The apparatus produced a slight pain in the fracture about the third day, which came on occasionally, and was at its height about the sixth day; but, even at this time, the pain was neither severe nor constant.

Sir R. was confined in the horizontal position; but, in the course of a few days after the application of the apparatus, he was allowed to turn his limb from the heel to the side, and *vice versa*, at pleasure. This liberty rendered the confinement less irksome than he would otherwise probably have experienced it.

At the end of the sixth week, Dr. Harrison, Mr. Brodie, Mr. Copeland, and myself, examined the limb as far as we considered it prudent, at this time, and were of opinion that it was going on well; in fact, it was now so far recovered, that we could not discover any motion in the situation of the fracture. The limb was again confined as before; and we determined to let it remain in the apparatus for four weeks longer, in order that the union might become strong. At the expiration of this time, making *ten weeks* from the period it was first applied, the apparatus was removed; and we had the happiness to find that the bone was

united firmly, and the limb upwards of *three-fourths of an inch longer than it was when this treatment was commenced.*

The natural powers of the limb were soon restored, and he is now at liberty to hunt, or use it as he pleases.

The result of this case could not fail to excite great pleasure in the minds of all those to whom Sir Richard is personally known.

It might be asked, why we did not endeavour to extend the limb, so as to make its length equal to that of the other, before we attempted to produce union by the interposition of bone. Mr. Brodie, Mr. Copeland, and myself, had some conversation upon this subject, and came to the conclusion, that it would not be advisable to extend it much; for we considered that, as the ligamentous union was strong, and not loose, we should not be able to bring down the limb to its natural length; and if we failed to do so, it appeared to us that we should lose strength of union, in proportion as we might gain in the length of the limb. We, therefore, determined to apply the apparatus, so as to bring the limb as nearly to its proper form

Remarks.

as circumstances would admit; and, at all events, if possible, to produce consolidation of the fractured ends, without endeavouring to obtain any greater degree of elongation than the then state of the soft union would allow.

Case.

A gentleman in the City, aged 55, whom I attended, with Mr. Dendy, of Stamford Street, in getting from a stage-coach, fell, and broke his thigh at the lower part of the middle third. He was conveyed to an hotel, and treated with the common short splints in the usual way; but no union of the fracture took place while they were employed.

I saw this gentlemen, for the first time, about eleven weeks after the accident, in company with Mr. Dendy. The fracture extended through the bone in a direction downward and inward, and the fractured extremities were connected only by loose adhesions.

The limb was much deformed, there being an angle in the thigh, at the seat of fracture, projecting greatly to the outer side, while the foot was twisted inwards. He was unable to raise the limb—in short, it was perfectly useless.

The apparatus was applied, but not with that nicety which it admits of under ordinary circumstances, as the gentlemen had an ankylosis of the knee-joint, the result of a disease with which he was afflicted at an early part of his life ; and he had, also, a sore in the integuments, on the side of the inner condyle, apparently produced by the pressure of the splints which he had been wearing. In consequence of this sore, the pressure necessary to bring the upper and lower portions of the bone into their natural line could not be so effectually exerted. However, much was done in the accomplishment of this desirable object.

On the removal of the apparatus, two months after it was first applied, I found the bone was united, with the foot in its proper position, and the thigh-bone only slightly curved to the outer side.

This gentleman, possessing an irritable constitution, was very restless during the cure, which probably delayed the accomplishment of the union many days.

Remarks.

It might be observed that, previous to the accident, the injured limb was shorter than the

other, the thigh-bone was curved outward, and the foot everted; so that he walked with the inner side of the foot turned forwards; though he now walks with the foot in its proper position, and the thigh-bone is less deformed than it was previous to the accident.

Case.

March 16th, 1823.—Richard Holdway, aged twenty-nine, was admitted into St. Thomas's Hospital, under Mr. Travers, having a transverse fracture of the thigh, which extended through the bone a little above the condyles. The third day after his admission, he was attacked with cholera morbus, which continued for a week, and reduced him so much, that he was not able to assist himself in the least, when he wanted to be placed upon the bed-pan.

On the 22d, Mr. Travers, with his usual politeness, offered me the superintendence of the treatment of the fracture. The short splints, which had been applied, were now taken off, and there was no swelling nor any appearance of inflammation in the limb. Assisted by his then apprentice, Mr. Macmerdo, I applied my apparatus for fractures, &c. of the lower extremities, in the manner I have directed that it should be used in such cases; and requested

him to have his bed made every two or three days, and to have the limb moved *passively* as often as he wished. This mode of treatment was followed for two months, but without any appearance of union.

May 22.—The apparatus was now applied so as to press the broken extremities of the bone closely together; but the pressure kept up was but slight; and, in order to ascertain whether the motion, which was, from time to time, given to the limb, had any effect in preventing the union, I directed the man to remain quietly in bed in one position, and ordered him not to have his bed made above once in three weeks. This plan was persevered in till the 23d of July, making a period of four months from the time the apparatus was first applied; but neither was there at this time any appearance of ossific inflammation having been set up.

An additional apparatus was now employed, in order to press the broken ends of the bone strongly together. He soon felt pain in the fracture after this, which he compared to the pains of rheumatism. This pain was greater sometimes than others, but was never severe.

On the 28th of August, the fracture was again examined by Mr. Travers and myself, and it was at this time found much firmer. The apparatus, being old, had now got out of order, and, in consequence of some delay, it was not re-applied till the 11th of September; but, in the mean time, great care was taken to keep the limb quiet. October 14th, the apparatus was removed, and the bone was found united.

Remarks.

In this case we see the effect which a debilitating disease has in retarding the union of a fracture; and that when the action, which appears to be necessary to the production of callosus, is once so entirely subdued as in this instance, it does not readily become re-established. Though I had previously treated three cases in the same way with the happiest results, I had some doubt whether, in consequence of inattention, the motion which was, from time to time, given to the limb, during the first two months, was at all influential in preventing the union; but this doubt was removed by the subsequent treatment, in which, notwithstanding the limb was kept quiet in one position for two months, no ossific action was set up till the strong pressure was applied. It appears to me, therefore, that the want of union in this case may be

fairly attributed to the effects of the disordered and debilitated state of the system, from which he recovered but slowly ; and that the action necessary to the production of callus was brought about by keeping the fractured surfaces strongly pressed together, as in the preceding cases. Strong pressure was applied for sixty-nine days, and the man recovered without the least deformity in the limb.

The Influence of local Pressure and Rest in the Management of Fractures of long standing in the Leg.

I employ, in the treatment of these cases, the apparatus which I invented for simple fractures of the leg, &c. This is a simplification of the apparatus which I have recommended for certain fractures of the *thigh and leg*, &c. Treatment.

If the fracture be oblique, the only difference in the application, from the mode in which the apparatus is employed in recent simple fractures, consists in forcing the fractured ends more strongly together in a line with the transverse diameter of the bone, and in keeping the foot-board so that it might not produce shortening of the limb. Oblique.

Transverse.

When the fracture is transverse, the foot-board should be placed upon the leg-piece, (*see the Author's Syllabus*,) so that the distance between it and the knee of the apparatus should be rather less than the distance between the sole of the foot and the ham when the foot is brought to form a right angle with the leg. By this arrangement, it will be seen that, when the limb is placed upon the apparatus, and the foot-board brought up so as to form a right angle with the leg-piece, the back of the thigh, at the ham, will not be quite in contact with the pad covering the thigh-part of the apparatus. The limb being firmly fixed in the apparatus, with the foot and leg placed so as to form a right angle, and the thigh as I have stated, the surgeon has it in his power to force the fractured ends together very strongly, by means of the strap which passes round the thigh over the apparatus, close against the knee; the foot bearing, at the same time, upon the foot-board, so that the lower portion of the fractured bone cannot recede at all from the pressure made upon it by the upper. In these cases the inside of the wooden sole of the shoe should be padded.

I think fractures of long standing in the leg

are more easily united than those which occur in any other situation.

A lady of rank received a blow from the heel of a horse, as she was on horse-back, on the lower part of her stirrup-leg. The force fractured the fibula, about two inches and a half above its lower extremity, and the tibia an inch and half above the point of the inner malleolus. She applied to her surgeon in the country, who placed her in the horizontal position, employed short splints, and did every thing he thought advisable. Eight weeks after the accident, finding she had no power over the limb, she came to town to consult Sir Astley Cooper, and, by his recommendation, requested my attendance. The fibula was, at this time, united close to the side of the tibia, and the leg deformed in consequence; but distinct crepitus and preternatural motion were still observable in the fractured part of the tibia. Case.

The machine was applied; and, in five weeks and three days, the tibia, also, was found firmly united.

During the cure, the lady walked about with the assistance of crutches, carrying the limb in

a sling; received company; or took an airing in her carriage at pleasure.

Case.

As Mr. Wallack, the actor, was travelling from New York to Philadelphia, the coach was upset, and he was thrown from the coach-box into the road. The body of the coach, carrying a heavy load, fell upon his leg, and produced a fracture of both bones, through the upper and middle thirds. The upper fracture was simple, the lower compound. The compound fracture was not attended with much laceration of the integuments. There were two wounds which led to the fractured ends of the tibia, each of which was about half an inch long. Splints were applied to the limb, and he was conveyed to Brunswick, New Jersey, a distance of about fifteen miles, where he was put in bed; and the limb placed upon the outer side. The tension that came on in the limb was great; but the constitutional symptoms, which accompanied it, were not severe.

In a little more than seven weeks after the accident, it was considered that the bones were consolidated; but neither of the wounds was yet healed. In the course of another week, it was discovered that the lower fracture of the

tibia was not united. A scale of bone, about an inch long, and half an inch wide, was now taken away, and he was again confined to bed, with the limb lying, between splints, upon the side.

After the dead bone was extracted, the wounds healed readily, and then various means were resorted to, under the direction of some of the most eminent surgeons in America, with a view to bring about union of the bone. Among these were friction and tight bandaging, accompanied with confinement in the horizontal position. After these means had been tried without benefit, he had splints applied very tightly upon the limb, and he was directed to leave his bed, and move about with the assistance of crutches; but this mode of treatment was equally unsuccessful, and he states that, while he was trying it, he frequently felt the broken ends of the bone grate upon each other.

Finding all the efforts that had been made to produce union of the bone were unattended with any beneficial result, he came to London for further surgical assistance, and I saw him shortly after his arrival, which was upwards of seven months after the accident, in company with Sir Astley Cooper and Mr. Triple.

He could, at this time, suffer the foot to rest upon the floor, so as to support the superincumbent weight of the thigh which was thrown upon it as he sat in a chair; but no additional weight could be borne. The only fracture which remained dis-united, was that which extended through the middle third of the tibia. This was oblique. Motion and crepitus were easily produced in the fracture. The foot was extended, the ankle fixed, and the limb was weak and useless.

I applied my apparatus for fractures, &c. of the lower extremities, in such a manner as to press the fractured surfaces closely together; and directed him to take an airing every day with the assistance of his crutches, or in his gig. Severe rheumatic pain came on in the fracture the following night, but subsided altogether in a few days. This mode of treatment was persevered in for *forty days*; and, at the end of this period, the bone was found united. He states that, from the moment the apparatus was first applied, he never felt the least motion in the situation of the fracture.

Mr. Wallack enjoys good health, and possesses an excellent constitution. He has seldom suf-

fered from illness, and whenever he has received a flesh wound, it has speedily healed.

John Ballard, aged twenty-three, was admitted into St. Thomas's Hospital, under Mr. Green, having an old transverse fracture of the tibia, extending through the middle third of the bone. He had no swelling in the limb, nor pain in the fracture. Motion between the fractured surfaces was easily produced, and was very evident when the limb was examined. Whenever he moved the limb, he felt motion between the fractured surfaces very distinctly ; but it gave him no pain. He could bear the foot to rest upon the floor as he sat, but could not suffer any weight to be placed upon the knee. The limb was weak and useless. Case.

He states, that the accident which occasioned the fracture, happened on the 24th of August, 1822. He was letting down a cask of lead into a cellar; and, as he was standing on the ladder, the cask overpowered him and fell. When the cask had fallen about three feet, the keen edge of the end pitched upon the ladder and upon his leg, snapped the ladder, and, as I am informed by the surgeon who first saw him, produced a simple fracture of both bones

of the leg. He was conveyed in a coach, about a mile, to one of our hospitals, where he was put in bed, and his leg was laid upon the outer side on a pillow. An evaporating lotion was applied to the limb, which soon became very much swelled and very painful. Six days after, the tension was considered to be sufficiently reduced to allow of the application of the common splints. He was kept in bed *three weeks* after the application of the splints, with the limb lying upon the heel. At the end of *this time*, he was suffered to *leave his bed*; as his surgeon conceived, that the *common splints* were sufficient to prevent motion from taking place in the fracture. He moved about with the assistance of crutches, wearing the splints, and carrying the limb in a sling. At the end of the fifth week, it was discovered that the fracture was not united, and that the leg was much deformed. A bandage was now applied tightly round the leg; over this splints of split-deal, so as to incase the leg; and over the splints of split-deal, a pair of common leg splints. He was now confined to bed again for three weeks, with the limb lying upon the side. At the end of the three weeks, he was again allowed to get up and move about as before; with the limb confined by the splints, as last applied. He conti-

nued *this* plan for three weeks, making eleven from the time of the accident. At the expiration of this time, the splints were taken off, and it was found that the tibia was still dis-united. He was confined to bed a third time, and had a stimulating liniment rubbed upon the leg every day, the limb lying upon the side, without splints. This plan was continued till his admission into St. Thomas's Hospital, but without any beneficial effect.

Upwards of fifteen weeks after the accident, and two or three days after he was admitted into St. Thomas's Hospital, Mr. Green politely offered me the superintendency of the treatment. The apparatus was applied so as to press the broken ends of the bone firmly together. He was furnished with a sling, and directed to walk about every day as much as he pleased. At the expiration of *thirty-three days*, during which, he occasionally felt rheumatic pains in the fracture, which, however, were never severe, the apparatus was taken off, and the bone was found united.

He informed me, that he never felt any sensation of motion in the fracture after the apparatus was first adjusted, though he had noticed

that it frequently took place while he was wearing the common splints, notwithstanding they were applied so tight as to give him great pain.

Ballard was a strong man, possessing a vigorous constitution. He may be said to have always enjoyed good health, and he states, that whenever he received a flesh wound, it healed rapidly.*

* This man was admitted into the hospital to which I have alluded, about the same time with another, 55 years of age, who had, also, a fracture of both bones of the leg equally severe. This man was placed under my care, and was up *on the third day* after the accident. He continued to leave his bed daily, and to walk about the ward, with the assistance of crutches, till the 24th day, when the apparatus was taken off, as the bones had united. At the end of the fifth week he was able to walk the ward without crutch or stick. This man's case forms a strong contrast to Ballard's, who was kept in bed till the end of the third week. It shows the rapidity with which union takes place under the use of my apparatus, when a patient is allowed to be up. Ballard's case is a lesson for surgeons who fancy that a patient, with fracture of both bones of the leg, might be permitted to leave his bed with impunity before the fracture is united, when the limb is supported only by the splints which are commonly employed. If Ballard had been treated in the same way as the other man, I have no doubt that the bones would have united by the intervention of callus, within the three weeks, during which he was confined to bed, under the treatment adopted, without its accomplishment.

J. Van W——, Esq. aged twenty-eight, in Case.
endeavouring to quell the Negroes in Demerara,
on the 18th August, 1823, was wounded by
a musket-shot, which passed through the leg,
about six inches below the knee, and produced
a fracture of both bones. He was carried
home, and when the limb was examined, it was
found that the tibia projected about an inch.
The surgeon, not being able to reduce the bone
into its proper situation, sawed off the project-
ing portion. He was then placed in bed, with
the limb lying upon the outer side, and such
means were resorted to as were thought advis-
able to preserve the leg; and he states, he was
attended “with the utmost care.”

High inflammation came on, and was fol-
lowed by profuse suppuration. He remained
in bed, in this position, *three months and nine
days*, without once being permitted to have it
made, for fear of disturbing the fracture. Dur-
ing this time, the discharge continued very
great, and he became much reduced.

In December, he had so far recovered, as to
suffer himself to be wheeled about the room on
a sofa. At the latter part of January, 1824,
he began to use crutches; and in the middle of

February, he went out in a gig. Some bits of bone were taken away during his confinement, and the wounds were healed. After the lapse of seven months, finding the limb entirely useless, he resolved to embark for England.

About thirty-eight weeks after the accident, he arrived in London, and, on the 6th of May, called on me, from the recommendation of Sir Astley Cooper, who had informed him that the bone was not united. I examined the leg, and found a loose fracture of the tibia, extending obliquely downward and backward, accompanied with riding of the fractured ends. The fibula was united, and the part which had been fractured was surrounded with a large quantity of callus. Whenever he moved the leg, he felt motion in the fracture. The limb was very weak. He could suffer it to rest upon the floor, as he sat in a chair, but any additional weight thrown upon the leg gave him pain in the fracture.

May 9th. I applied the apparatus first, in such a manner as to bring the broken ends of the bone as nearly as possible into their proper situation; and having done this, as far as the state of the parts would allow, I regulated it,

as in the other cases, so as to press them closely together, and to prevent any motion from taking place between the fractured surfaces. He was furnished with a sling, and desired to go about with the assistance of crutches, or in any easy spring vehicle, as much as he pleased, taking care not to exert the muscles of the limb.

He soon found considerable pain in the fracture, which subsided in a few days ; and, having never been in London before, he now took every advantage of the liberty I gave him ; but he states that he never felt the least motion in the fracture after the apparatus was applied. At the expiration of *thirty-three days*, I removed the apparatus, and found the bone was firmly united. On the 25th of June, he was able to walk about the house, with the assistance of a cane only, without experiencing the least sensation of weakness or pain in the fracture.

Before he left England, which was in about seven weeks after I first saw him, inflammation was set up in the soft parts, a little distance from the part of the bone that had been fractured, which led me to suspect, that some spi-

culæ of bone were lodged in that situation. This, I was induced to believe, might be the case, though they had not been previously productive of any mischief which led to a suspicion of their existence. He walked about considerably—sometimes the distance of a mile. This, I conceived, might cause them to irritate and produce inflammation; which, it was to be expected, would run on to suppuration, preparatory to their discharge. In a letter, which he favoured me with from France, dated 2d August, he states that these have since come away.

This gentleman's health has always been such as we see in persons who possess strong constitutions; and he is certainly one of the most healthy looking men I ever saw.

Remarks.

As my patients with non-union in the leg were permitted to be about, it may occur to some of my readers, that friction was produced between the broken extremities of the bone, and that ossific inflammation was set up, in the same manner as when a patient, with short splints tightly bound round the leg, is ordered to bear upon the limb; but this was not the case. The ossific inflammation was set up by the pressure, not by the combination of pres-

sure and friction, which happens when the patient bears upon the limb, secured only by short splints in the usual way. The practice of directing patients to walk upon the limb, secured by short splints only, but seldom succeeds; and I suspect that the principal cause of failure is the frequent production of motion in the fracture—an evil which is effectually got over by the use of the apparatus which I have employed, as may be seen by referring to the cases.

Some surgeons may conceive that motion between the divided surfaces does not impede the progress of union; but this opinion, I believe, is fallacious. We must have a certain action in the part, which may be brought about by the immediate effects of the injury, or by pressure; but, in addition to this action, local rest is required, in order to insure a favourable result.

The cases I have related satisfactorily prove, to my mind, that we have no reason to apprehend the occurrence of non-union, from the practice I have recommended in the treatment of recent simple fractures of the leg; and I presume it will scarcely be argued, that an apparatus, which is capable of effecting a cure in

cases of long standing, is, at the same time, likely to occasion such cases, when employed in the treatment of recent simple fractures, provided it be properly applied. If this be granted, and I think it cannot be denied, I must assume, that the mere existence of a fracture in the leg will be seldom sufficient to authorize us to confine a patient to bed, till the consolidation of the bone is effected. He may be permitted to leave his bed a few days after the accident, and will thus be saved from the irksomeness of remaining so long in one position as is necessary for the union of the bones, and from the debilitating effects which long confinement in bed often produces upon the constitution.

General remarks.

In detailing the symptoms which occurred after the application of the apparatus which I employ, I have said that pain was felt in the fracture in the course of a few days, which, in the different cases, differed very much in degree. In some of them it amounted only to a slight aching pain, accompanied with, now and then, a lancinating sensation in the fracture; but the inconvenience felt in all the cases varied, more or less, in the course of the day; and I am not aware that, in any one of them, it was at any period sufficiently severe to effect the pulse—

certainly not so as to produce any noticeable fever.

I have related seventeen cases of non-union, in sixteen of which I have myself succeeded in producing consolidation of the bone; namely,

In the Humerus, 6.	{	1 Fracture had existed (about) ..	11 months,—united in (about)	7 weeks.
		2 Ditto	10 months,—ditto.....	6 weeks.
		3 Ditto	13 weeks,—ditto.....	32 days.
		4 Ditto	19 weeks, { ditto (1 st appl ⁿ) . 28 days. ditto (2 ^d appl ⁿ) . 31 days.	
		5 Ditto	16 weeks,—ditto.....	21 days.
		6 Ditto	16 weeks,—ditto.....	35 days.
In the Fore-arm, 2.	{	1 Fracture had existed	7 months,—united in	7 weeks.
		2 Ditto.... (about)	8 months,—ditto.....	7 weeks.
In the Femur, below the Neck, 4.	{	1 Fracture had existed	16 weeks,—united in	4 weeks.
		2 Ditto	66 weeks,—ditto.....	10 weeks.
		3 Ditto	11 weeks,—ditto.....	2 months.
		4 Ditto.... (about)	19 weeks,—ditto.... (about)	10 weeks.
In the Tibia, 4.	{	1 Fracture had existed	8 weeks,—united in	38 days.
		2 Ditto	7 months,—ditto.....	40 days.
		3 Ditto	15 weeks,—ditto.....	33 days.
		4 Ditto	38 weeks,—ditto.....	33 days.

Why, it might be asked, did the bones in these

sixteen cases not unite while the fractures were in the recent state? I should say, with one exception, because the treatment adopted, and which is commonly recommended, did not prevent the fractured ends from moving upon each other. In some of these cases an increased action had been created in the fracture, and had again subsided before they came under my care—why did the fracture, in these instances, not unite during its continuance? For the reason which I have just mentioned. Why did they all unite with so much facility when the plans of treatment I have advised were resorted to? Because, under their influence, an action above the natural standard was produced in the fractured parts, and during its continuance they were kept at rest.*

* Dr. Willis, the learned Librarian of the Royal College of Surgeons, informed me, that he saw a case of non-union in the humerus, of many months' standing, treated, by the employment of my apparatus, with success. He had lost sight of the patient, and could not give me the particulars.

Besides those I have detailed, I have treated several cases of tardy union, of six and seven weeks standing, by the same means, with success, but the particulars of these are not worth relating here.

Treatment of Fractures of long standing which do not admit of being united under the Influence of Pressure and Rest alone.

When a fractured bone continues disunited, in consequence of disease existing in its structure, the local treatment will depend upon the situation of the fracture and the condition of the limb. In some instances, as where the bone is in a state of necrosis, amputation might be advisable.

Disease in the bone.

When a bone is prevented from uniting by the interposition of a foreign body between the fractured surfaces, it will be proper to remove it by an operation, and afterwards treat the case as a compound fracture; taking care to keep the parts quiet, and in contact, during the granulating process. If the fractured ends should not unite during the healing process, the influence of pressure and rest may be resorted to, in order to complete the cure.

Interposition of a foreign body.

It often happens, after compound fractures, that portions of the fractured ends exfoliate, and, sometimes, the exfoliation takes place in situations where it prevents consolidation of the

Dead bone.

broken ends till the dead bone is removed. This should not be attempted till it is separated by the absorbents from the living parts. The period which Nature takes for this varies exceedingly in different cases. Sometimes it lies loose in the wound in the course of six weeks or two months after the accident; at others, even several years elapse before it is all thrown off. I am not acquainted with any application which materially assists the process of exfoliation, and therefore it appears to me, that the surgeon can do little more, locally, till the dead bone is separated, than keep the parts at rest, and guard the fractured limb from injury; taking care, at the same time, to support the constitution. If the fracture happens to be in the arm or in the leg, the patient need not be confined constantly to bed. During the exfoliating process, when the state of the soft parts will allow, he may leave his bed; but, if they become very much irritated, by hanging the limb down, it will be proper to assume the horizontal posture again for a time. If the fracture happens to be in the femur, the patient must be constantly confined to bed, as the fractured parts cannot, as far as I know, be sufficiently supported to allow the patient to move about with safety. As soon as the dead bone is sepa-

rated, it should be taken away, and the case treated in the same manner as after the removal of any other body, which would have the effect of keeping the fractured surfaces asunder.

Some of these cases are very tedious, and, consequently, require much patience on the part of the sufferer as well as the surgeon.

There is another state of the fractured parts which, as far as my experience goes, are not likely to admit of being united by the influence of local pressure and rest; namely, where the broken extremities are held together by a preternatural capsule, containing a fluid resembling synovia.

Preternatural capsule.

I have failed to produce union in four cases, independent of those which I have stated happened in the neck of the thigh-bone. Two of these, which were in the humerus, were admitted into St. George's Hospital, under the care of Mr. Rose, who favoured me with the management of them, while they were subjected to the influence of my apparatus. In one of these, there appeared to me to be some disease of the bone. In this case, a seton has since been used, but, I understand, without any

Fractures under the influence of local pressure and rest in St. George's Hospital.

benefit. The other occurred in a young man, whose constitution was strong, and the bone apparently free from disease. In this it was doubted whether a portion of muscle did not exist between the broken ends of the bone. I am inclined to think that this was the case, or that there was a preternatural capsule formed.

It was agreed, however, that the most simple treatment, and one which was not likely to be followed by any injurious consequence, was that which I had so often found successful, and that, therefore, this should be first tried. The apparatus was applied about six months after the accident, and worn for about six weeks. The man suffered a good deal of pain in the fracture for several days after its application, but very little benefit was obtained; but it was thought advisable, by Mr. Rose and myself, that he should continue its employment for some time longer. I increased the pressure on this occasion, and the man suffered considerably again, but no bony union took place. He states, that he never felt the least motion in the fracture during the time he wore the apparatus, which was altogether about three months.

Nothing further has yet been done for this

man ; and it therefore remains a question, what condition of the parts existed to prevent the union from taking place.

In these cases the parts could be moved freely upon one another, but pain was experienced when the ends of the bone were pressed together firmly with the hand.

A man was admitted into St. Thomas's Hospital, under Mr. Green, about six months after the accident, having a fracture in the middle-third of the humerus, which was very loose, so much so, that the portions of the bone could be bent upon one another with almost as much facility as the fore-arm upon the humerus. All pain had subsided, and he did not experience pain or tenderness when the injured parts were pressed upon or moved. The apparatus was applied, in order to see what effect it would produce. It occasioned considerable pain in the part in a few hours after it was applied, which was so severe as to interrupt his rest, in a great degree, for several nights, and then gradually subsided. I examined the limb at the expiration of a fortnight, but it did not appear that the least good had been produced. As the parts had not become at all consolidated,

Case in St.
Thomas's Hos-
pital.

notwithstanding the high excitement occasioned, it was the opinion of Mr. Green and myself, that it would be useless to continue this mode of treatment any longer, and as the man declined to have any operation performed, he left the hospital.

Before this man was admitted, we had had the experience of one unsuccessful case, which was the first that I had met with ; the particulars of which I shall now relate, as it seems to me deserving of particular attention.

Case.

Malcolm M'Lean, a strong healthy sailor, aged 36, was admitted into St. Thomas's Hospital, March 11th, 1827, under the care of Mr. Green, having a very loose oblique fracture of the upper part of the middle third of the thigh, which had existed *twenty-four weeks*. The fracture was occasioned by a fall upon deck from a height of about 60 feet. The limb soon became much swollen and very painful. There being no medical man on board, ten days elapsed, after the occurrence of the accident, before any surgical assistance could be procured. At the end of this time, the ship arrived at a port in Montevideo, where he was received into one of the Portuguese hospitals. During the time he was

in that hospital, nothing was employed to support the limb but short splints, extending from the pelvis to the knee. These proved very inadequate to answer the purposes for which they were applied; motion and displacement being produced, almost as readily as if the case had been left to nature. The pain and swelling, however, which came on immediately after the accident, gradually subsided. Ten weeks after the accident, when he removed from the hospital to return to England, the pain had left him, and he had very little tumefaction in the limb; but they were re-produced, in a slighter degree, by his exertion to get to the ship, which he accomplished with the assistance of crutches; the limb being surrounded with short splints as before.

On the 19th of March, twenty-five weeks after the accident occurred, and a week after the man's admission into St. Thomas's Hospital, Mr. Green politely offered me the management of the case. Upon attentively examining the limb, we found the fracture extending obliquely downward and outward, through the upper part of the middle third of the bone. The fractured ends were very loosely connected, so that they could be freely moved in all directions. The upper portion was bent upon the pelvis, and

the lower portion was retracted upwards of two inches and a half along the inner side of the upper. By gentle extension, the limb could be brought to nearly its natural length ; but, the moment the extending force was discontinued, the lower part of the bone was again retracted to the situation which it previously occupied on the inner side of the pelvic portion. Thus, the extent of motion which the fractured ends had upon one another in the longitudinal direction, was about two inches and a half. The fractured part felt somewhat tender when firmly pressed with the fingers ; but scarcely any pain was produced by freely moving the broken extremities upon one another. The lower portion could be carried out of a natural line with the upper, and almost bent upon it without producing any inconvenience calculated to give rise to complaint on the part of the patient.

Treatment by
pressure and
rest.

As I had not had a case of non-union of the thigh so loose, I was unable to say how far the line of treatment which I had found successful in other cases, would prove beneficial in this. I doubted whether a preternatural capsule, containing a fluid resembling synovia, had not formed here ; as I find such capsules form more

speedily when the fractured extremities are loosely held together, than when the connecting medium prevents any great extent of motion ; but, as I had not had any case in which I had not succeeded, I was unable to say, whether the means I adopted to bring about union of the bone by the interposition of callus, would, or would not be sufficient to produce union after the formation of a preternatural capsule. The most prudent mode of proceeding, therefore, appeared to be, to have recourse, in the first instance, to that plan of treatment which, in my hands, had never yet failed. I mentioned my feelings to Mr. Green, and finding that he came to the conclusion to which I had arrived, assisted by his dresser, Mr. Wickham, I applied the apparatus which I invented for simple fractures of the middle and lower thirds of the thigh, &c. in such a manner as to *retain the limb of its proper length, and to press the fractured surfaces strongly together.*

The apparatus had the effect of producing pain in the fracture in a few hours after it was applied. The pain increased and became severe on the third day, accompanied with painful startings of the limb. The pain, however, though severe, was not of a description to produce any marked

effect upon the system. On the fourth day, the pain had much subsided. The straps were now tightened, which increased the pain in the fracture; but it soon became moderate. He wore the apparatus for about ten weeks, suffering more or less pain in the fracture during the whole period, with the exception of two or three days previous to its being removed; but, notwithstanding the existence of the symptoms which precede union; *viz.* pain and tenderness in the fracture, were much more severe than in any former case I had witnessed, the only apparent benefit derived, was a closer confinement of the fractured ends, by the adhesion of the soft parts that had taken place around them, during the continuance of the excitement which the operation of the apparatus had produced.

Introduction of
the seton.

The plan of treatment by pressure and rest having failed to produce union, the consideration now was, what should next be done in order to effect it. Mr. Green concurred with me in the opinion, that the probable cause of failure was the existence of a preternatural capsule, containing a fluid resembling synovia; and that it would be advisable to destroy its integrity by the introduction of a seton, which would, at the same

time, have the effect of exciting a high action between the ends of the bone, and in the neighbouring soft parts. This operation was determined upon as the most simple of those which appeared likely to be advantageous when had recourse to, in conjunction with any means calculated to support the fractured ends in apposition and at rest.

The man was placed upon one of my fracture-beds, and the thigh again extended to its proper length, where it was confined in the bent position. He was brought to the edge of the bed, with the limb kept extended to its natural length, over the middle and lower planes of the bedstead, as before; and, while he lay in this position, Mr. Green introduced a long and somewhat curved seton-needle, armed with silk, through the thigh, directing it between the fractured extremities of the bone. The needle was introduced at the outer and back part of the thigh and brought out anteriorly without difficulty. The needle being removed, the ends of the silk were left hanging, and covered only with a piece of simple dressing. The man was now shifted back to the middle of the bed, without suffering any retraction of the limb to take place; and, when confined in

that situation, by fixing the foot and the pelvis, a splint was applied along the outer side of the limb, and secured in such a manner as to press the fractured surfaces gently together, without pressing at all upon the soft parts surrounding the fracture.

The next day, the limb was rather swollen round the seton, and the pulse was increased in frequency. Suppuration took place in two or three days, and the constitutional disturbance became rather severe. The openings soon discharged a large quantity of pus daily; and this, and the constitutional disturbance kept up by the local irritation produced by the seton, had the effect of reducing his system considerably.

About a fortnight after the introduction of the seton, it was observed that the matter began to burrow beneath the fascia, presenting itself at the upper and inner part of the thigh. This affected his constitution still more; so much, indeed, was the man's health disturbed, that it would not have been safe to allow the seton to remain in any longer; and it was accordingly removed, on the *nineteenth day* after its introduction.

The seton had produced a great deal of thickening of the soft parts surrounding the fracture, such as has been often mistaken for callus; and, when the fractured ends were pressed together strongly, he experienced severe pain in the part. The matter was daily evacuated from the upper part of the thigh, where it lay very deep; and it was found, that the contents of the abscess gradually diminished in quantity, and ultimately disappeared through the openings made by the seton-needle.

After the seton was withdrawn, the constitution soon began to rally under the influence of tonic medicines and a generous diet; so that he was sufficiently recovered, in a few days, to feel himself able to take the common food of the hospital. Great care was taken to keep the fractured surfaces in close apposition and at rest during the suppurative process; but, as it was necessary, for some time, to move the splint daily, in order to evacuate the matter which had burrowed along the outer side of the limb, for about two inches beneath the vastus externus, as well as that which had collected on the inner side, it will be seen that the parts could not be kept in that perfect state of quietude which it was desirable at this time

to maintain. The matter could not be evacuated without producing motion of the fractured extremities of the bone.

At the expiration of about five weeks from the time the seton was introduced, the discharge from the wound had ceased; but there still remained considerable tenderness in the fracture, and thickening of the surrounding parts. Three additional splints were now applied, and the whole secured round the limb as he lay upon the fracture-bed, in the same manner that I have recommended for fractures of the thigh, just below the trochanter minor; care being taken to press the fractured surfaces strongly together, and to maintain them in tight apposition and at rest.

These splints were thus continued upon the limb for a month; and, at the expiration of this period, making nine weeks from the time the seton was introduced, they were removed, and the limb examined, but no osseous union had taken place. The limb was rendered stiffer by the thickening of the soft parts, which was the only difference the seton had produced.

The operation

The man was now removed to a common

bed; and, some time afterwards, it was determined, in consultation, to cut down upon the fractured ends, with a view to ascertain, if possible, the cause which still prevented the process of bony union from being excited; and then to act in that manner, which, upon exposing them, may appear most advisable.

of cutting down
upon the ends
of the bones.

The man was again placed upon the fracture-bed, with the limbs in the bent position; in order to secure to the operator a perfect command over the muscles of the thigh. A semicircular incision was made by Mr. Green, which was commenced about the middle of the rectus, and then carried round through the belly of the vastus externus. The flap was dissected back, and the fractured end of the upper portion of the bone brought into view. Upon clearing away the muscles, it was seen that the two broken extremities of the bone were connected together by a thick dense capsule, resembling the capsule of the hip-joint, the inner surfaces of which were perfectly smooth and shining. The integrity of this capsule was destroyed, by removing a portion of it from the upper fragment; but, in consequence of the difficulty which was experienced in getting at the fractured end of the lower portion, which, as has

been said, lay on the inner side of the upper, *it was left covered with the ligamentous matter.*

In removing about half an inch of the fractured end of the upper fragment, which was done by one of Mr. Hey's saws, in order to give room, it was found that the bone had become soft and spongy at this part, apparently from interstitial absorption. From the manner in which the ends of the bone lay, it was evident that the lower portion could not be cleared of the ligamentous deposit which covered it, without enlarging the wound in the soft parts—a proceeding which, in the opinion of Mr. Green, and some other surgeons, appeared objectionable.

Two or three small vessels were secured, and the cut surfaces were suffered to fall together, where they were lightly confined by a couple of adhesive straps; and a poultice was then applied over the wound. The pelvis was confined by the strap, attached to the upper plane of the fracture-bedstead, upon which he was placed previous to the operation, and the foot was secured to the foot-board. The thigh was left free from splints and bandages, being preserved of its proper length by the unyielding planes of the bedstead.

The man did not suffer much from the operation, except when the finger was passed into the preternatural capsule, between the oblique surfaces of the fractured ends ; which was done in order to ascertain its extent. The capsule possessed a high degree of sensibility, so much so, that when the finger was passed into it, the man could not help crying out. He said, the pain produced by the incision through the integuments and muscles was nothing, compared to that which he experienced when the *inner surface* of the capsule was pressed with the finger. He was a considerable time under the operation, and felt chilly when it was over ; but he soon recovered his natural heat after he was covered with the bed-clothes. He passed a good night, and so free was he from constitutional disturbance, that he was put upon full diet the day after the operation. The limb became moderately swollen at the seat of the operation, and suppuration was established on the third day. The greater part of the cut surfaces adhered, however, so that there was only a small opening, at the upper and outer part of the wound, for the matter to escape. Some of the matter burrowed towards the upper and inner part of the thigh, where an abscess formed, and made its way to the surface, producing

some, but not severe, excitement of the system. The matter was evacuated by two punctures, made within a few days of each other; and his health soon became strong.

On the tenth day, a splint was padded, and applied along the outer side of the limb, so as, if possible, to produce absorption of the ligament which covered the fractured surfaces, by forcing them together; but this was done in such a manner as not to press upon the wound, which could be easily dressed without moving the splint. He experienced a great deal of tenderness in the fracture for the first month after the operation, especially when the slightest motion was given to the limb.

Seven weeks after the operation I removed the splint and examined the limb, but no union of the bone had taken place. The punctures made for the evacuation of the matter of the abscess had now healed, but there still remained a considerable portion of the wound over the fracture to cicatrize.

Thinking it possible that the split cloth, which had been placed round the limb over the splint, had not been sufficiently powerful in its

action to produce absorption of the ligamentous matter which covered the ends of the bone, I applied a splint on the inner side of the limb, long enough to extend from the knee to within a very short distance of the fracture; and having re-applied the outer splint as before, I surrounded the limb with the web of a tourniquet, which passed over the splint just below the fracture. This plan enabled me to force the ends of the bone very strongly together by screwing the tourniquet. The action of the tourniquet did not, however, produce any material excitement in the fracture. There was pain occasionally, but it was only slight and transient.

The action of the tourniquet was kept up, as powerfully as the man could bear it, for a fortnight; making nine weeks from the time of the operation. It was now removed; and, on examining the limb, it was found that no good whatever had resulted from the operation, or the treatment by which it was followed.

The limb was perfectly useless; and, seeing that all our endeavours to bring about union of the bone had failed, the poor fellow was now desirous of losing it, which was accordingly agreed to.

The operation was performed in a very masterly, and somewhat novel manner, by Mr. Green. The bone was taken off immediately above the artificial joint, and about half an inch below the trochanter minor.

Examination of
the bone.

At the time of the operation, which was performed with a view to remove the preternatural capsule, a bit of the fractured end of the upper portion was removed; and it was observed that the bone was soft and spongy, apparently from interstitial absorption. This, however, was not the case higher up. Where the bone was sawed off in amputating, it was found perfectly healthy. Though the integrity of the preternatural joint had been destroyed, it was now again complete. The greater part of it was nearly the thickness of the capsule of the hip-joint, but, at one part, it was thin, like the capsule of the shoulder-joint; the capsule was accidentally torn at this part with the finger, and the inner side was seen smooth, and had very much the appearance of synovial membrane, being moist and shining. The ends of the bone were rounded, and, where they came in contact, they were flattened and covered with a dense fibrous structure, very similar in appearance to the intervertebral substance when divided transversely,

but especially that part of it which is found half-way between the centre and circumference.

The subject of the above case possesses a strong constitution, and has always had good health, in the common acceptation of the term ; his constitution strongly resists local irritation, and when it suffers in consequence of great injury, it soon rallies after the local mischief is subdued.

In this case, we might fairly attribute the want of union, in the recent stage, to the use of means which are inadequate to keep the fractured extremities in apposition and at rest. I regard the loss of this man's limb as a sacrifice to the treatment adopted in the recent state of the fracture—a sacrifice, which I am sorry to say, is often repeated, and will continue to be so, as long as the common means are generally employed.

In this man we see that a preternatural capsule had formed in six months, which is a fact, in corroboration of the opinion which I am disposed to entertain ; *viz.* that, where the fracture is very loose, and the powers of the constitution strong, preternatural capsules form much

sooner, than where the ends of the bone are so connected, as to allow of their having but little motion upon one another.

We have here, also, an example of the inadequacy of the treatment by local pressure and rest, which I have introduced, where the fractured ends of the bone are held together by a preternatural capsule. It is worthy of remark, however, that though this treatment does not appear likely to succeed in such cases, in the case which I have related, and in the other three unsuccessful cases I have mentioned, it produced symptoms far more severe, though similar in kind, to those which preceded the uniting process in all the instances where this plan was resorted to with success.

I have never failed to produce union where the fracture had resisted the usual means of cure in more than four cases ; but I suspect there was in one of these some disease of the bone ; in another, it was thought, that a portion of muscle existed between the ends of the bone ; but, supposing that this should not be the case, which is very doubtful, we might say, that there are only three fair cases of failure under this mode of treatment ; two of which, I am strongly

disposed to believe, were of that description, in which local pressure and rest alone will not, I fear, be found sufficient to bring about the uniting process, even though the bone be perfectly healthy. Hence, it will be perceived, that the plan of treatment *first* adopted in the case above detailed, *commonly* succeeds in producing union, though there is, now and then, an instance in which, when resorted to alone, it will be ineffectual. The converse of this, however, obtains with all the other plans with which I am acquainted. In the other thirty-four cases which I have seen and examined, but in the treatment of which I have taken no part, the modes of treatment adopted were various ; but, as far as I have been able to learn, bony union has been effected in only *one* solitary instance out of the *thirty-four* ; and that after several months of suffering.

In M'Lean's case, it has been observed, that very high inflammatory action, produced by the introduction of a seton, was not sufficient to give rise to the uniting process, notwithstanding the most effectual means were used to keep the fractured extremities in tight apposition, and (as soon as the parts would allow) in a perfect state of quietude.

After this plan had failed, the integrity of the capsule was destroyed by the removal of a portion of it from one of the fractured ends, and though the assistance of apposition, pressure and rest were again secured, osseous union was not produced.

Upon attentively considering the state of the parts in this case, in conjunction with others of a similar kind, I am induced to believe, that in all *very loose* fractures of long standing after trying, for a short time, the plan by pressure and rest without success, it would be better to cut down upon the fractured ends of the bone, and remove with the knife any ligamentous matter with which they may be covered; and then to wash the ends of the bone with some stimulating fluid, calculated to produce active inflammation; or to destroy the connecting medium by the application of caustic. After either of these operations has been performed, we might anticipate, that bony granulations would be thrown out, and, with the assistance of such mechanical support as would maintain the opposing surfaces in apposition and at rest, we might reasonably expect to produce consolidation of the broken ends of the bone, if they should be free from disease.

I am aware, that the removal of the ligamentous deposite by manual operation has, hitherto, been very rarely followed by union of the bone ; but I am inclined to attribute the great want of success which we observe, more to the inadequacy of the mechanical contrivances employed after the operation has been performed, than to any other cause.

Here then we have, in my estimation, an important field of enquiry, which I would throw open to the consideration of the profession at large ; namely, will the removal of the loose capsule connecting the fractured extremities of a bone, in which the solution of continuity has existed many months, be generally successful, when the operation is immediately followed up by the judicious application of apparatus, which it can be proved satisfactorily, is capable of, and is made to support the denuded ends in close apposition and at rest ?

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 success which we observe, more to the inade-
 quacy of the mechanical contrivances employed
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 any other cause. I have seen the operation per-
 formed in the human body, and in some of the
 large animals, and have seen the bones unite
 in some of the instances, and in some of them
 I have seen the bones in a very imperfect union.
 I think that we have in this operation, an im-
 portant field of enquiry, which I would there-
 fore open to the consideration of the profession at
 large; namely, will the removal of the ligament
 capsule connecting the fractured extremities of a
 bone, in which the solution of continuity has
 taken place, be attended with any successful
 result? Many accidents, both generally successful,
 when the operation is immediately followed up
 by the judicious application of apparatus, which
 it can be proved satisfactorily, is capable of,
 and is made to support the denuded ends in
 close apposition and secure from motion, so that
 the nature of the wound and the nature of the
 operation will not be prejudicial to the union
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 of the instances, and in some of them I have
 seen the bones in a very imperfect union.

APPENDIX

TO

THE SECOND EDITION.



THE lady, whose case is mentioned at page 157, Case continued.
continued upon the fracture-bed, with the same ease and comfort which she experienced at the early part of the treatment, till the end of the third month, from the time when she was first placed upon it. It was now deemed expedient, by Mr. Travers and myself, to remove her to a common bed, as there was no reason to suppose that union had not taken place. The limb was now of the same length as the other, and we congratulated ourselves upon the prospect of her complete recovery; but, at the expiration of a fortnight, she met with another accident as she was getting into bed, of which we were but partially informed at the time, but which, it afterwards appeared, produced a degree of mischief in the joint, that led us to suppose, a separation of the callus had taken place, not, however, so far as to lacerate the soft parts by which it was surrounded; at all events, the laceration was not sufficient to allow the limb to become retracted for a considerable

period after the accident occurred. As we were not aware of the extent of the injury sustained, nothing was done with a view to restore the parts to their former condition; and, consequently, she even now occasionally suffers pain in the groin when she bears upon the limb, and is unable to walk without crutches, or some other adventitious support.

It is worthy of remark, that this lady has experienced much better health since she was removed from the fracture-bed, than for many years previous to her being placed upon it.

The following case Mr. Travers has kindly permitted me to publish; and, being complete in its history, it might be inserted here. I think it will be regarded by the candid surgeon as another strong proof in favour of a doctrine which I have endeavoured to support in the first part of this volume; namely, that fractures of the neck of the thigh-bone should never be abandoned till the injured parts have, for a reasonable period, been subjected to the influence of scientific treatment.

Case.

A woman, æt. 45, having a fracture of the neck of the thigh-bone, was brought from the

City to St. Thomas's Hospital, where she was placed under the care of Mr. Travers.

She stated that she tripped as she was walking in the street, and, after staggering for some way, she fell upon the side, so that the trochanter major struck against the curb-stone. She felt great pain in the groin and behind the trochanter immediately after the fall, and was deprived of the power of bearing upon the limb.

Upon examination, a few hours after the occurrence of the injury, the limb was found everted, and also shortened one inch, which was ascertained by measuring both limbs with a graduated tape. She had considerable pain and tenderness in the hip-joint and behind the trochanter; which were increased when the limb was moved, especially when the thigh was bent upon the pelvis, and at the same time rotated inward. When the limb was drawn down to its proper length, and the head of the femur fixed, crepitus was felt; but the crepitus was, according to my experience, that which occurs when the fracture is near the head of the bone. There was no swelling, except what took place in the joint and its immediate vicinity, nor was there any ecchymosis perceptible.

It having been fully determined by Mr. Travers, myself and others, that this was a fracture of the neck of the femur, which, from the degree of retraction that took place, was probably accompanied with considerable laceration of the investing soft parts, Mr. Travers desired that the woman should be subjected to my plan of treatment. She was placed upon one of my fracture-beds on the 11th of August, 1828, the fourth day after the accident, where she remained ten weeks. During this period, the fracture-bed maintained the limb in its proper position and of its natural length.

The limb was now examined, and as it was thought that the bone was united, the patient was removed from the fracture-bed to one of the common beds of the Hospital. She was kept in bed for a few days, and was then allowed to get up, and, shortly after, to use the limb, with the assistance of crutches.

Both limbs are now of equal length, as far as can be ascertained by the most careful measurement, and the foot is in its natural position. She can *walk without limping or other inconvenience; the functions and power of the limb are perfectly restored.*

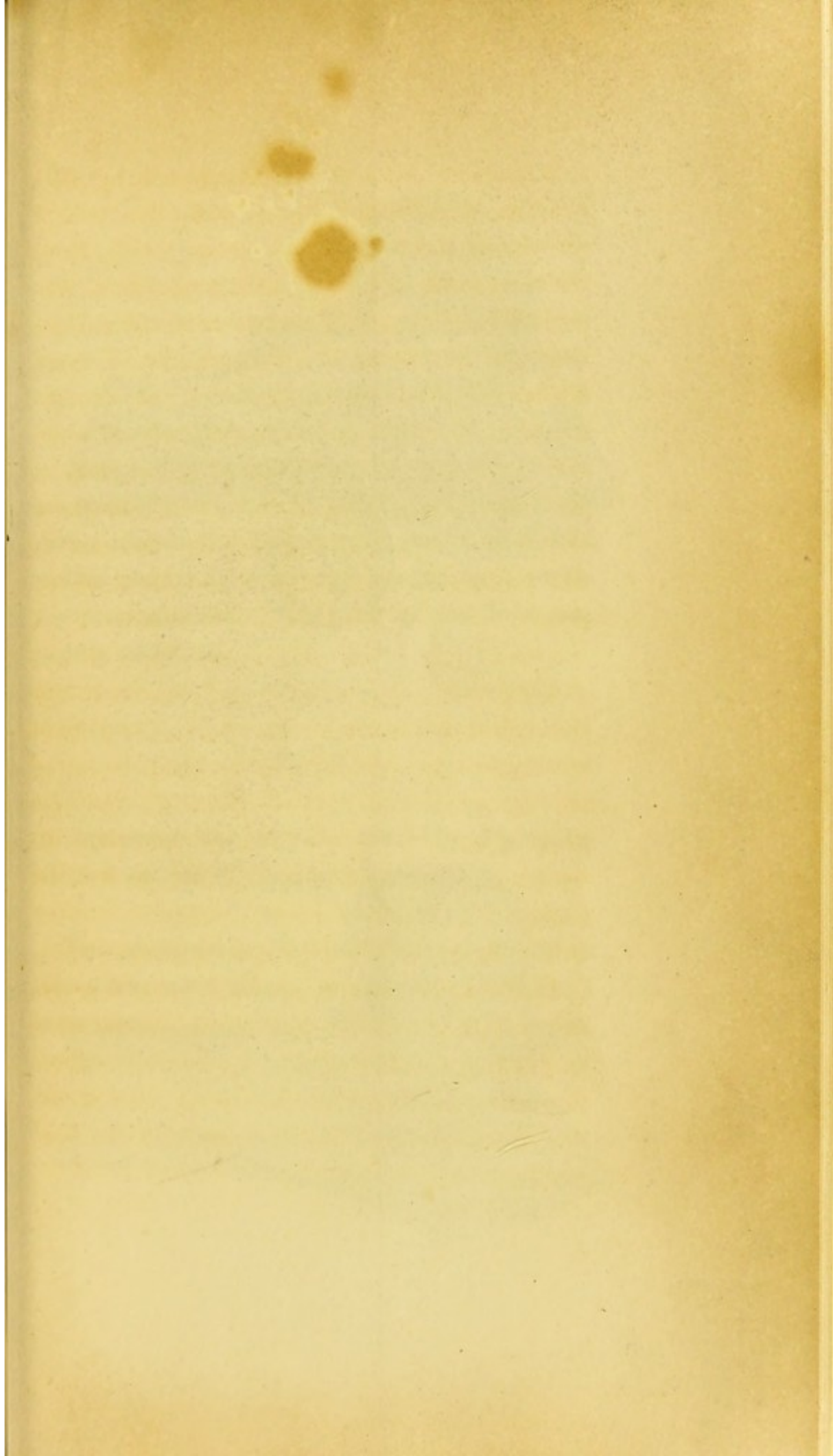


PLATE I.

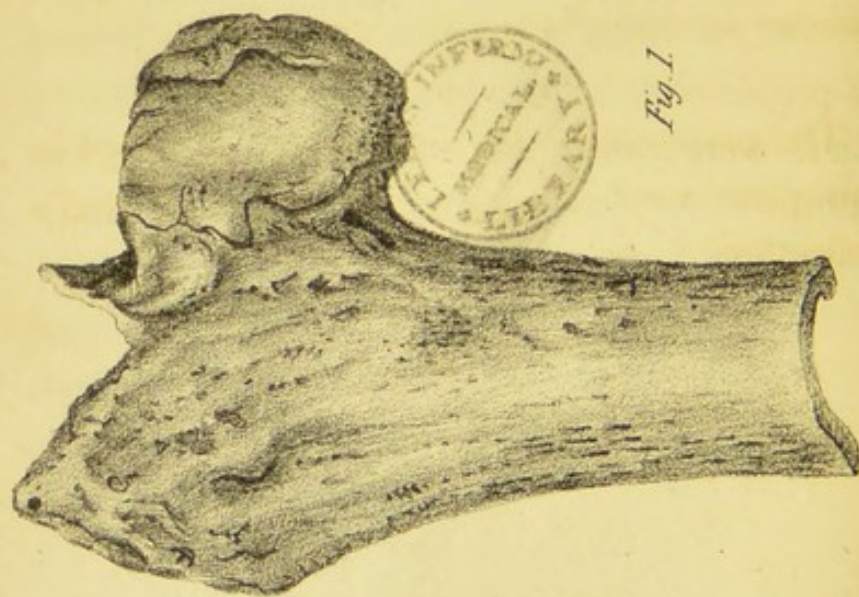


Fig. 1.

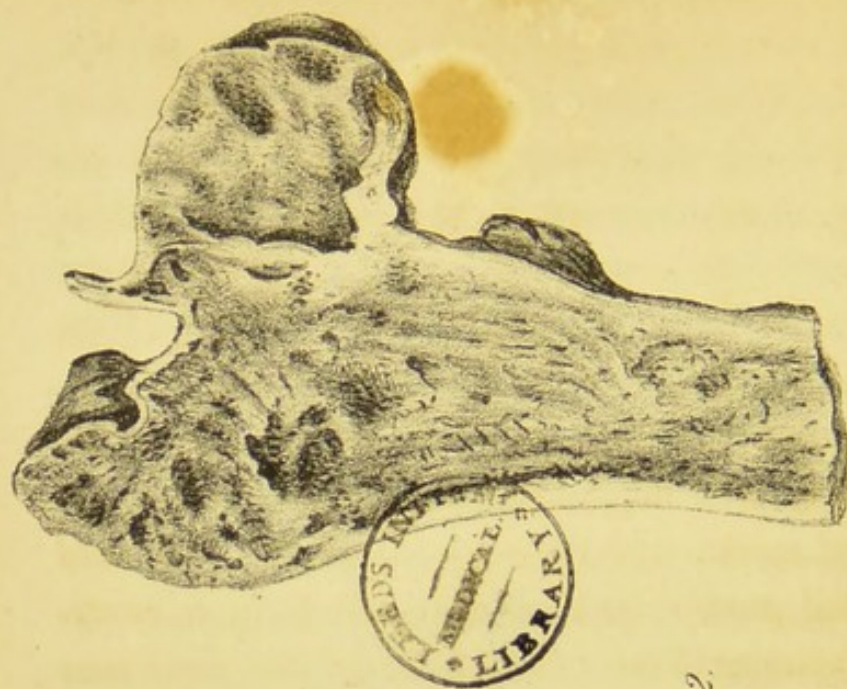


Fig. 2.

PLATE I.

Fig. 1.

Shews the external surface of the upper portion of a thigh-bone, which had been fractured within the capsular ligament, and had united partly by bone and partly by a cartilaginous medium. The neck of the bone was nearly absorbed.

Fig. 2.

Represents the surface made by a perpendicular section of the same bone.

The preparations from which the drawings in this plate were taken, are in Mr. Langstaff's collection.

PLATE I.

Fig. 1.

Shows the external surface of the upper portion of a thigh-bone, which had been fractured within the capsule of the joint, and had united partly by bone and partly by a cartilaginous medium. The neck of the bone was nearly absorbed.

Fig. 2.

Represents the surface made by a perpendicular section of the same bone.

The preparations from which the drawings in this plate were taken, are in Mr. Langstaff's collection.

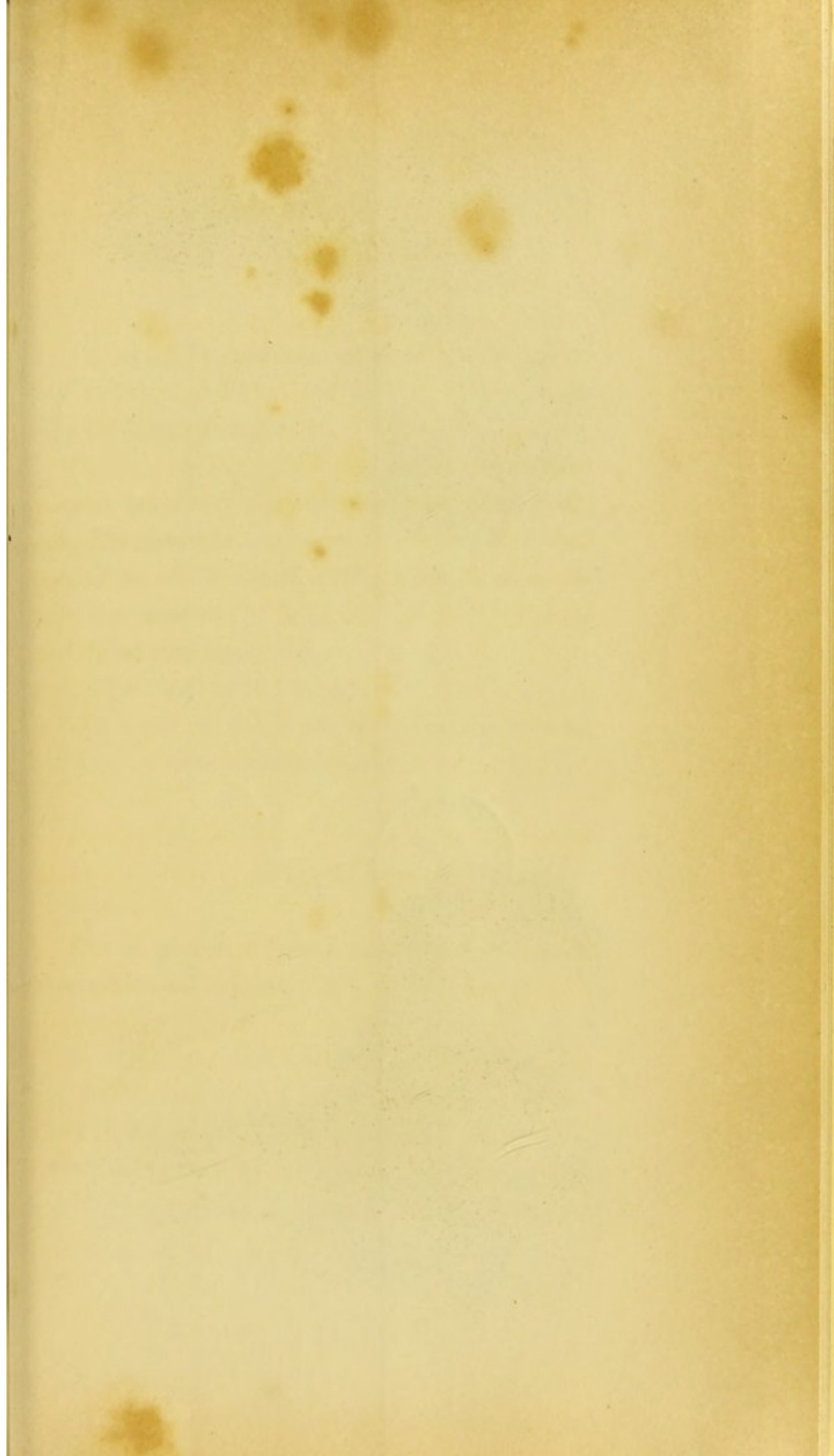


PLATE II.

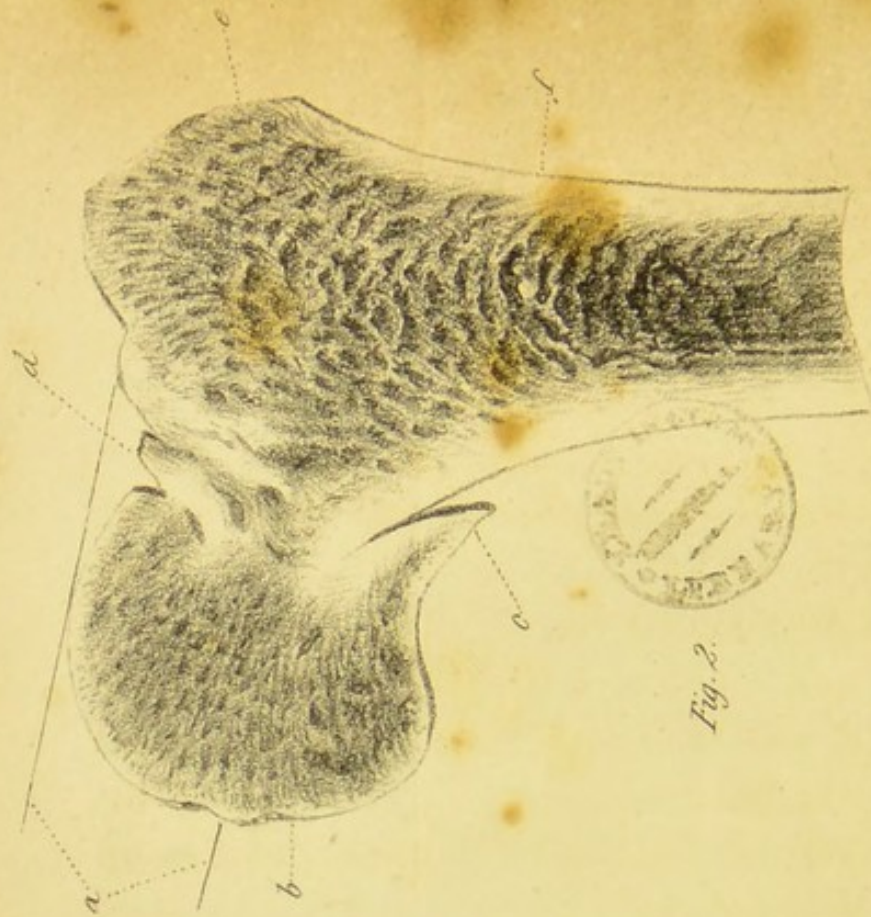
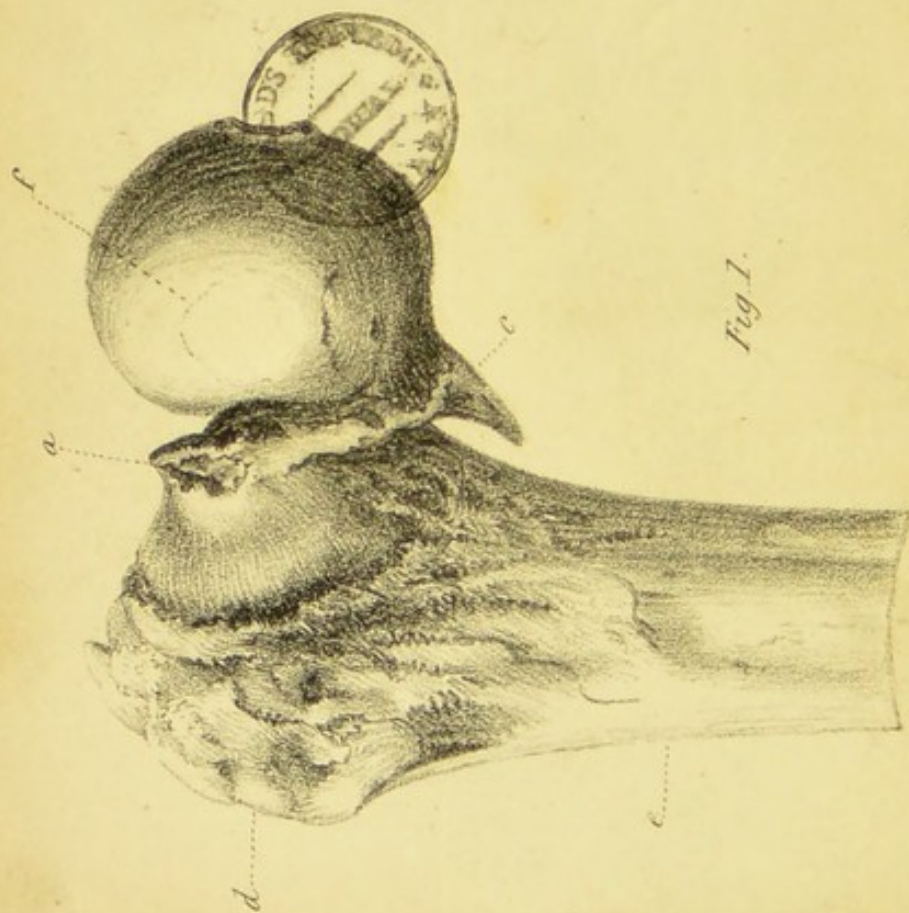


PLATE II.

Fig. 1.

A view of the anterior surface of the upper and external part of the femur, taken from Mr. Chorley's patient.

- a*, A portion of the shortened cervix.
- b*, The head of the bone.
- c*, Part of the shell of the neck, broken off with the head of the bone.
- d*, The trochanter major.
- e*, The shaft of the bone.
- f*, A mark on the head, showing the attachment of an adventitious ligament.

Fig. 2.

A view of the internal surface, made by a penpendicular section of the same bone.

- a*, The upper and lower lines, connected by the dotted lines, point out the situation of the shell of the upper and lower surface of the trochanteral portion of the neck. The lower line points to a portion of the lower surface of the

shell of the neck imbedded in the head of the bone. This part of the cervix probably maintains its natural direction and density.

b, The head of the bone excavated, and receiving a part of the trochanteral portion of the neck.

c, A part of the shell of the neck broken off with the head. This was apparently united, before the accident, with that part which is pointed out by the lower line, *a*, and with it formed the natural oblique line of the lower surface of the neck.

d, The callus, by which consolidation is effected, partly cancellated.

e, The trochanter major.

f, The shaft of the bone.



f



b

c

9.3.

PLATE III.



Fig 1.



Fig 2.

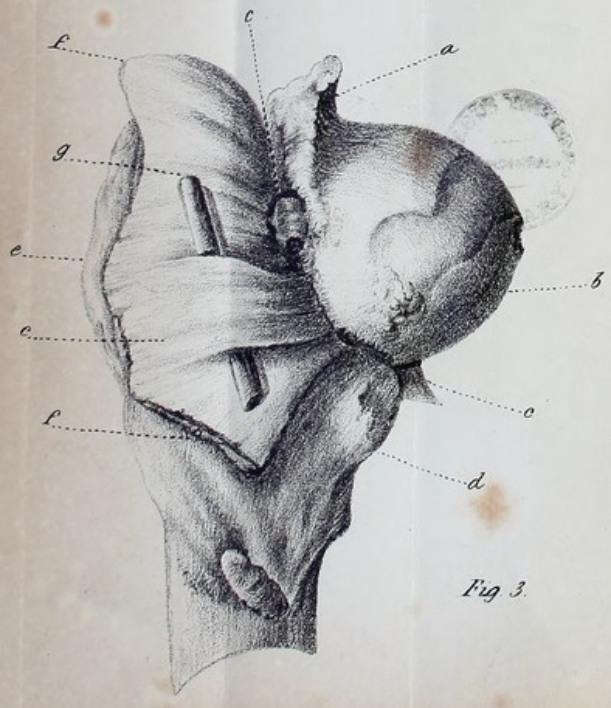


Fig 3.

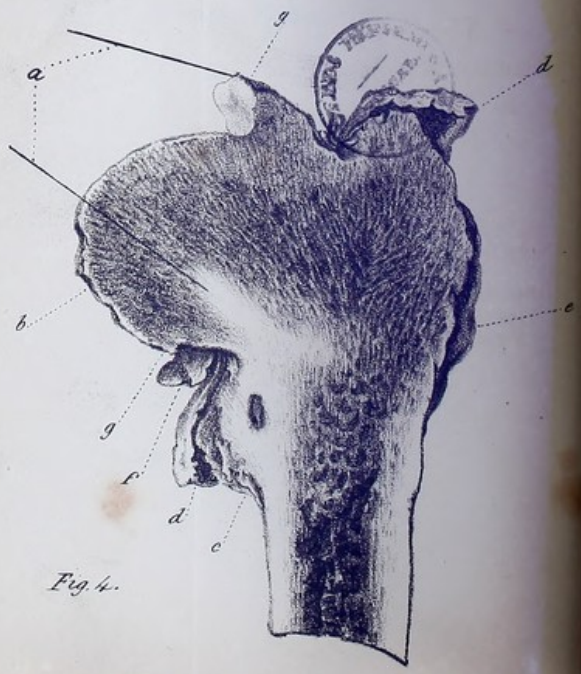


Fig 4.

PLATE III.

Fig 1.

A view of the anterior surface of the upper part of the right femur, taken from the subject of Mr. Field's case. In this figure is seen the natural direction of the neck. A part of the pelvic and trochanteral portions of the neck having been absorbed, the fractured surfaces could not be brought into contact at every part, but as there is a portion of the investing membranes left entire, the proper position of the head could not be mistaken.

a, The head of the bone, with its round ligament attached.

b, The trochanter major.

c, The trochanter minor.

d, The shaft of the bone.

e, e, The capsular ligament; a portion of which is removed, in order to show the anterior part of the neck more effectually.

f, f, The line of fracture.

Fig. 2.

A view of the anterior surface of the upper part of the left femur, taken from the same subject.

- a*, The head of the bone.
- b*, The trochanter major.
- c*, A part of the trochanteral portion of the neck.
- d*, The capsular ligament turned back.
- e*, The shaft of the bone.
- f*, The neck rendered smooth by the action of the tendon of the psoas magnus and iliacus internus.

Fig. 3.

A view of the upper and posterior part of the same bone.

- a*, Part of the shell of the upper surface of the cervix.
- b*, The head of the bone.
- c, c, c*, Strong adventitious ligaments running from the inner surface of the capsule, to the pelvic portion of the bone, into which they are firmly inserted.
- d*, The trochanter minor.

- e*, The trochanter major.
f, f, The capsular ligament cut and turned back over the trochanter major.
g, A bit of bougie separating a portion of adventitious ligament from the capsule of the joint.

Fig. 4.

Represents the internal surface of the same bone, made by a perpendicular section of the wet preparation through the head, neck, large trochanter, and capsular ligament.

a, The shell of the neck at the upper and lower part of the trochanteral portion, pointed out by the uninterrupted lines. These parts appear to be of their usual density, and show the direction and thickness of the cervix.

b, The head of the bone, excavated and receiving, near its centre, the lower part of the shell of the neck. The head is seen depressed towards the trochanter minor *c*, which it nearly touches, and is firmly united to the trochanteral portion of the neck by osseous matter which has become cancellated.

d, d, The capsular ligament opened and turned back over the trochanter major and minor.

e, The trochanter major.

f, Strong ligamentous band running from the neck of the bone, close to its junction with the head, to the capsular ligament, into which it was inserted.

g, g, The apparent line of fracture.

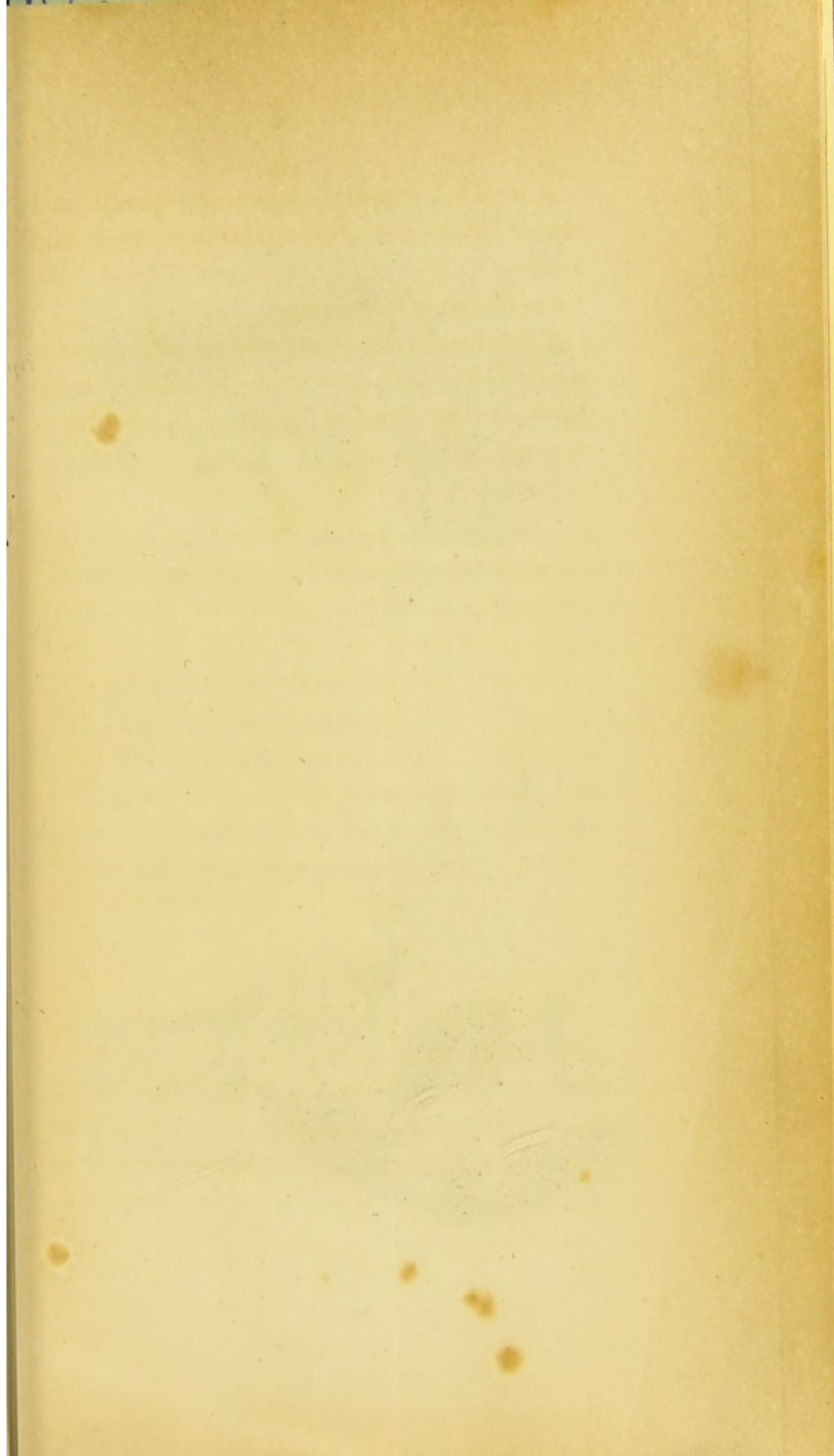


PLATE IV.



Fig. 1

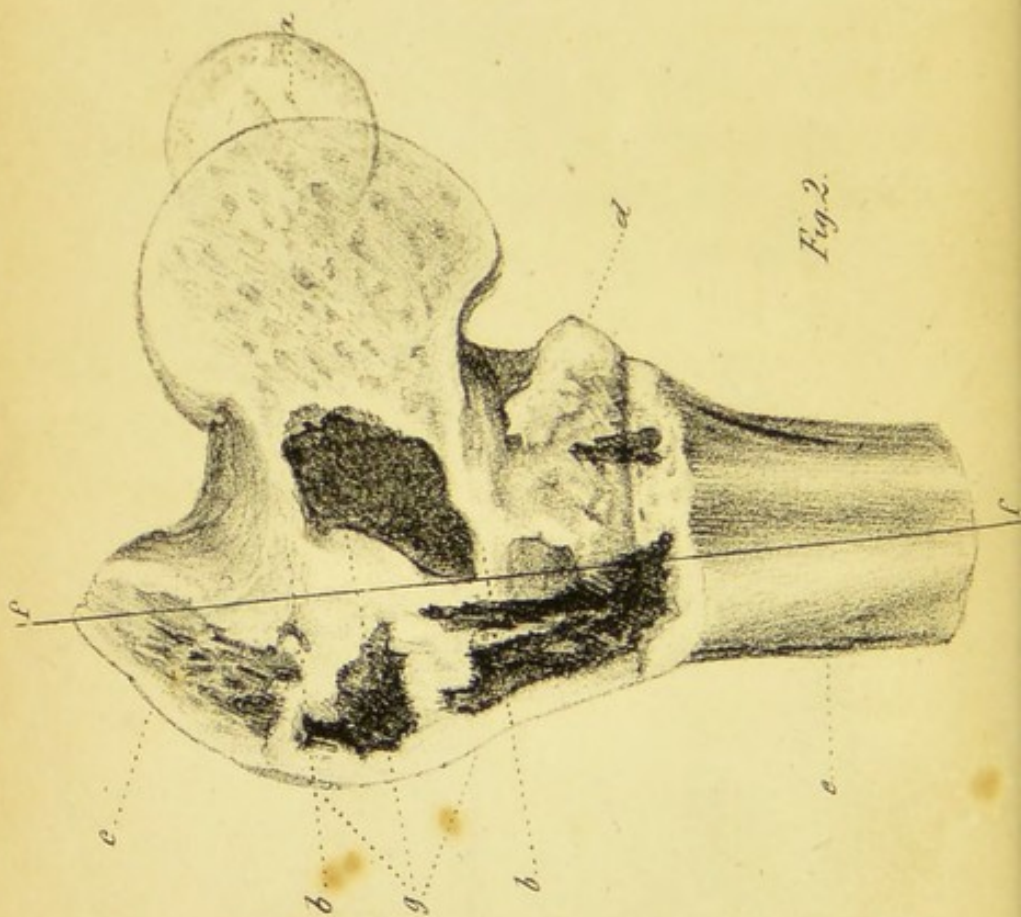


Fig. 2.

PLATE IV.

Fig. 1.

A section of the upper part of a femur in Mr. Langstaff's collection, showing a fracture of the cervix closely united by ligament, and the neck of the bone considerably absorbed.

The patient lived only six months after the accident, and the limb was shortened one inch and a half.

a, a, The line of union.

b, The trochanter minor.

c, The trochanter major.

d, The head of the bone somewhat excavated and receiving the lower part of the shell of the neck into the concavity.

Fig. 2.

A section of the head, neck, and trochanters of a femur, which had been fractured at the base of the neck; showing the neck of the bone driven into the cancellated structure of the trochanter major, where it is firmly united by

bone. This preparation is in Mr. Green's collection who allowed me to take the drawing.

a, The head of the bone.

b, b, The shell of the neck.

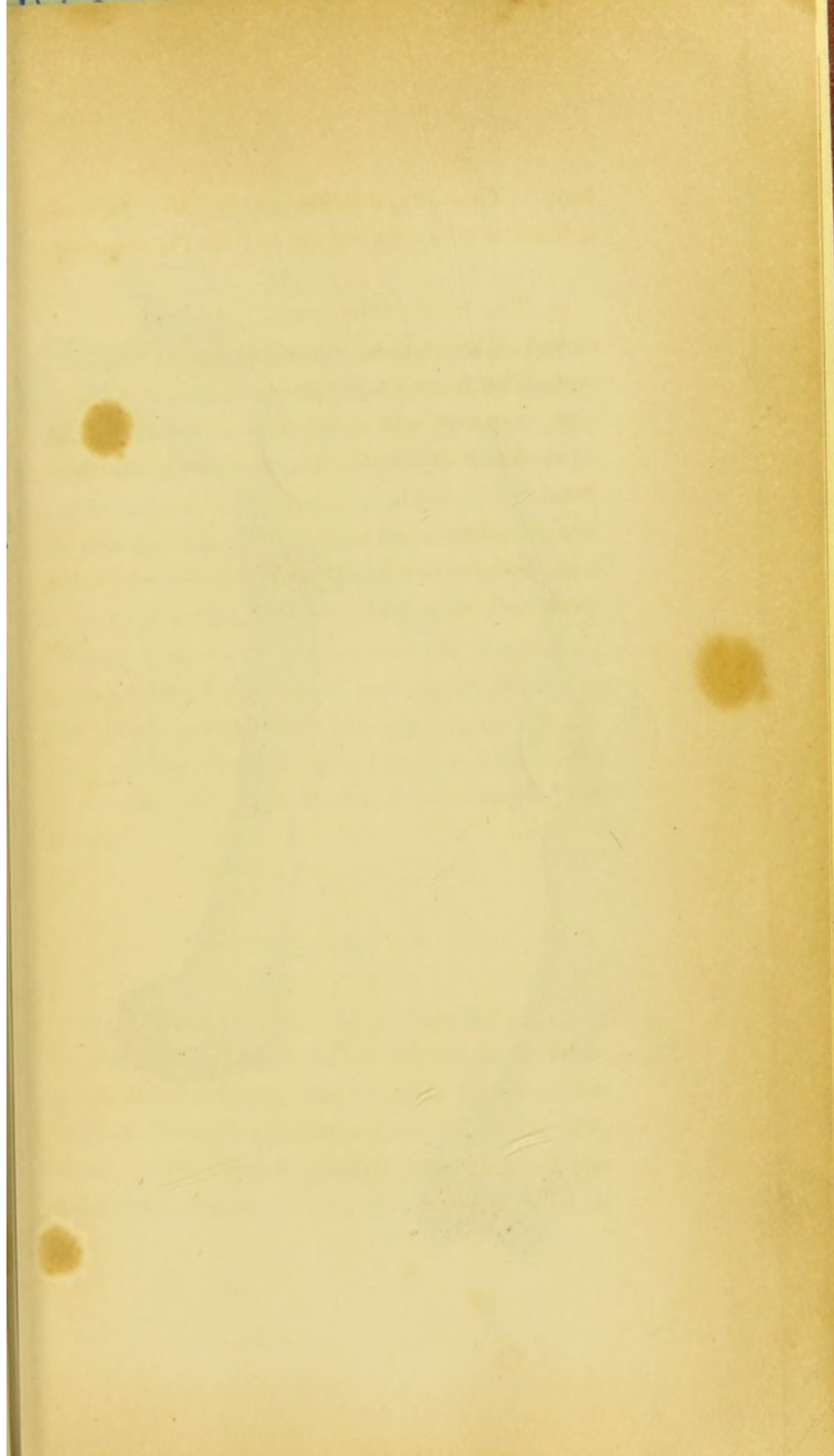
c, The trochanter major.

d, The trochanter minor.

e, An undivided portion of the shaft of the bone.

f, f, The line of union.

g, Holes in the cancellated structure of the neck and trochanter major.



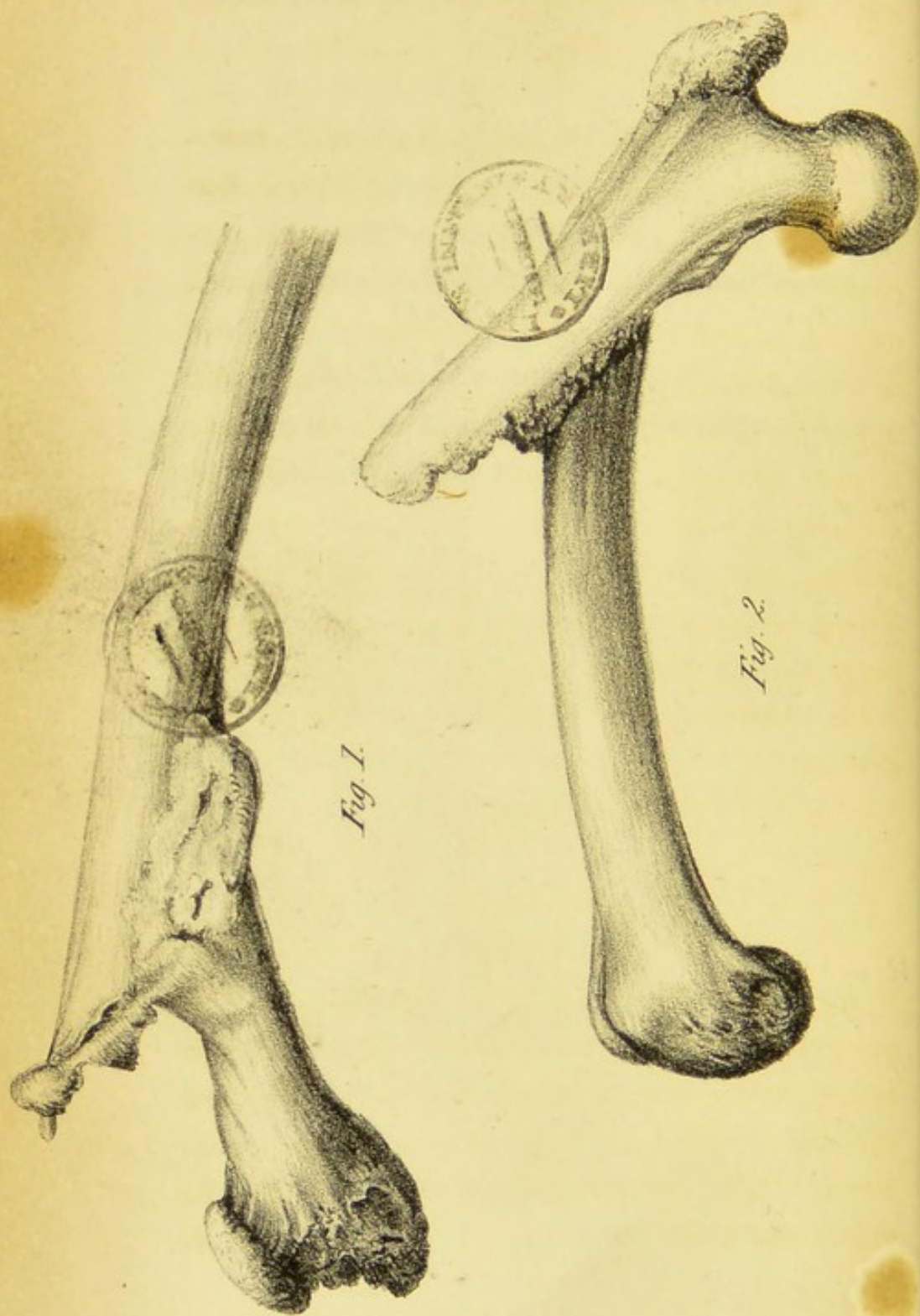


Fig. 1.

Fig. 2.

PLATE V.

Fig. 1.

Shows the kind of deformity which takes place in fractures of the thigh, a little below the trochanter minor, when the fracture extends through the bone obliquely, downward and backward. The lower portion of the bone is retracted along the anterior surface of the upper portion, and firmly united to it by callus; a part of which is seen curiously deposited, forming a hook-like process over the sharp projecting end of the lower portion of the bone. The drawing represents the appearance of the outer side of the bone, the head of which had been absorbed, apparently, from scrophulous disease.

Fig. 2.

Represents the kind of deformity which is observed after fractures of the thigh, a little below the trochanter minor, when the fracture extends through the bone downward and forward. The upper portion is bent upon the pelvis and abducted; and the lower portion is

13
19

retracted beneath it, and to the outer side, where it is firmly united by callus near the trochanter minor.

The preparation from which the figures in this plate were taken, are also in Mr. Green's collection.

PLATE VI.

Fig. 1.

The humerus of a duck united by a cross bar of bone, presented to me by Mr. T. M. Lane, Surgeon to the Eye Infirmary, Madras, E. I. C. S.

Fig. 2.

A clavicle fractured near the sternal end. The fractured ends were connected together by a preternatural capsule, which is laid open, in order to show the broken extremities which are seen lightly shaded in the centre of the cavity.

The preparation from which this was taken belongs to Mr. Green.

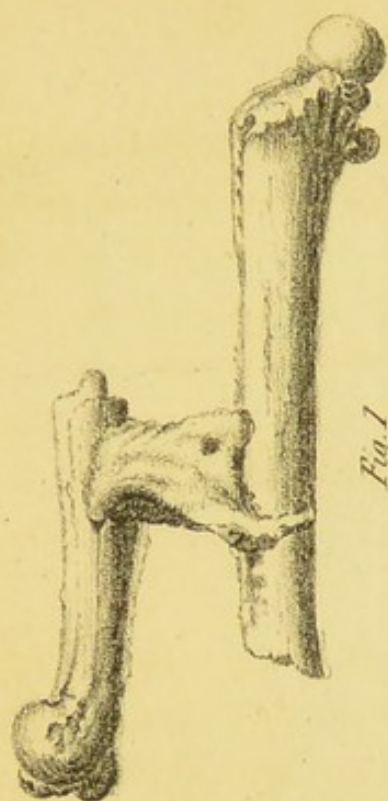


Fig. 1



Fig. 2.

