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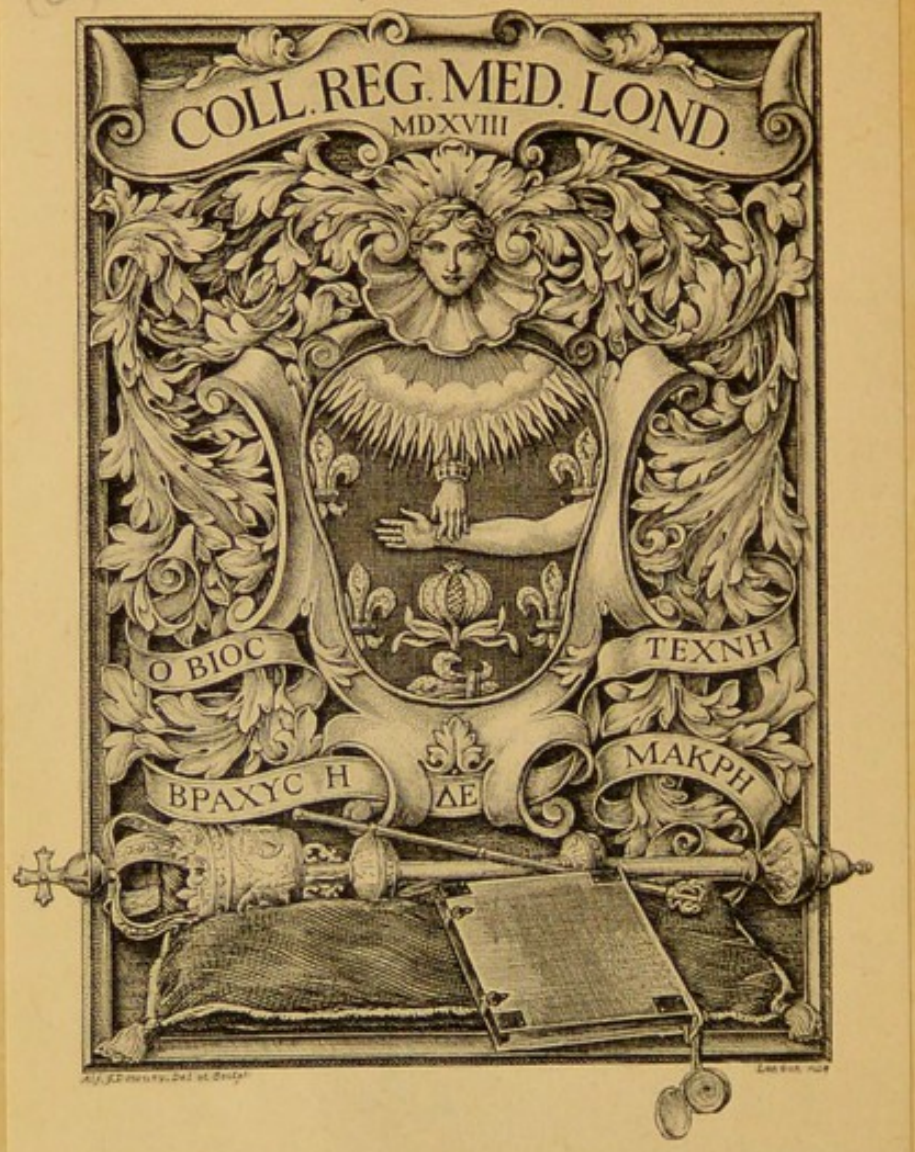


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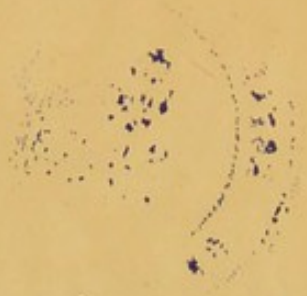

ON

ANKYLOSIS, OR STIFF-JOINT.

By the same Author.

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ON

ANKYLOSIS

OR

STIFF-JOINT:

A PRACTICAL TREATISE ON THE CONTRACTIONS AND DEFORMITIES RESULTING FROM DISEASES OF JOINTS.

BY

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PREFACE.

The Author has few reasons to assign for the publication of the following pages. The treatment of ankylosis, or stiff-joint, by the Stromeyerian method, —subcutaneous division of tendons and subsequent gradual straightening,—may appear to many readers to want the charm of novelty. But, although the method in question has now been frequently practised in this country, and occasionally a successful case has been announced in the medical periodicals, no complete exposition of the forms of ankylosis in which it is especially useful, or the details necessary for enabling the competent practitioner successfully to apply it, has been hitherto published. The pathology of ankylosis in reference to the complications affecting the curability, the production of semiluxation previously to occurrence of ankylosis, and the mode in which muscular contraction arises, will be found to have engaged the Author's attention as a preliminary to the practical portion of the Treatise. The Author believes that some advantage will accrue from his labours to those surgeons who, from having witnessed the success of subcutaneous tenotomy* in the cure of club-foot, may already be prepossessed in favour of its application to this frequent class of

* From *τένων, tendon,* and *τέμνειν, to cut.*

deformity. He ventures likewise to hope that, if any members of the profession incredulous of the value of the method in the cure of ankylosis exist, they will, from a rational consideration of the pathology of this class of deformities, and of the number, severity, and success, of the cases related in the following pages, be induced to test in practice the efficiency of the method rather than abide by preconceived opinions. The Author cannot conceal the difficulties to be encountered in the treatment of long-standing cases of ankylosis, as well as other deformities; great as they may be, they will be found not insurmountable by the exercise of discretion, skill, and perseverance. Recent experience affords the satisfactory assurance that few irremediable cases of ankylosis present themselves.

The value of the cure of ankylosis cannot be too highly appreciated; and that of tenotomy as a means of cure is proportionably augmented by the circumstance that severe ankylosis of the larger joints is irremediable by mechanical processes. The most frequent seat of ankylosis is the knee; it is even probable that the instances of angular ankylosis in this situation are as numerous as in all the rest of the articulations of the frame taken collectively. The consideration of the vast importance of the knee-joint in the act of walking suffices to account for the great amount of suffering and lameness experienced when it is ankylosed. The use of an artificial leg, or of a crutch, is often necessary for locomotion. In this respect individuals labouring under angular knee-ankylosis are more crippled than the subjects of club-foot; consequently until a very recent period

many sufferers submitted to amputation as a means of relief.

In the body of this treatise reference is not made to the violent methods of removing ankylosis advocated by Professor Dieffenbach of Berlin, and M. Louvrier of Paris. That of M. Louvrier consists in placing the ankylosed limb, carefully padded, in a mechanical apparatus possessing the powerful properties of the screw — by the sudden and violent action of which, a limb, that may have been many years rigidly ankylosed, is in the course of a few seconds straightened, apparently regardless of rupture of tendons, nerves, and blood-vessels.

In Dieffenbach's plan of treating knee-ankylosis, the patient lying on his stomach, and the knee projecting beyond the edge of the table, the resisting tendons are divided subcutaneously; the operator then bends the knee so powerfully as to bring the heel in contact with the nates. He then moves the limb in the opposite direction, and extends it more and more forcibly, occasionally reverting to flexion, and continues this motion of the limb up and down until it is straight. Dieffenbach states* that he has often found the united force of three or four men necessary, particularly in adult cases, "*to break a knee straight.*"

In condemnation of proceedings so dangerous, the animadversions formerly published by the Author,† on a similar practice of Sartorius in relation to club-

* Ueber die Durchschneidung der Muskeln und Sehnen. Berlin, 1841.

† Treatise on Club-Foot and Analogous Distortions, by the Author. Introduction, p. xlix.

foot, may be consulted. The methods of Louvrier and Dieffenbach are equally inapplicable. Some strictures thereon, contained in a recent review* of Dieffenbach's treatise, are entitled to serious perusal by those who may contemplate resorting to this summary mode of proceeding.

Rupture of popliteal artery, laceration of the sacro-sciatic nerve and other textures, with the attendant deplorable consequences, occurred in several instances on the application of the sudden forcible straightening by Dieffenbach and Louvrier. These results sufficiently attest the danger of the great degree of violence to which they resorted. Dieffenbach was impelled to adopt this violent plan through experience of failure of the Stromeyerian method.

The following pages demonstrate the possibility

* "Louvrier's violence snaps tendons, tears old adhesions, fasciæ, and ligaments, violently stretches when it fails to lacerate nerves or rupture blood-vessels; yet were some or all of these results to take place, provided the skin is not torn and an external wound produced, the patient has a better chance of recovery than when Dieffenbach, in deference to the tendons, divides them with the knife, leaving one or more punctures. We should sooner anticipate laceration of the skin when a puncture, however small, is made, as that may serve as a point from whence a rent may commence, or inflammation, suppuration, and gangrene, take their origin. No increased danger can result from Louvrier undertaking to rupture tendons as well as other tissues. The rupture of the tendo achillis is comparatively a trifling accident; and if the rupture of the ham-strings was the limit of Louvrier's violence, we should not so much condemn him; but the danger in reality arises from the injury inflicted on the large nerves and vessels of the popliteal region; and if the *sudden forcible straightening* of the limb be accomplished, this injury must be equally great whether resistance of the tendons has been previously removed by division or not."—*British and Foreign Medical Review*, January 1842, p. 16.

of straightening every case of *incomplete* angular knee-ankylosis, even after twenty-six years' duration of deformity; it is therefore probable that Dieffenbach's former want of success was attributable to insufficient attention to the mechanical treatment after the section of tendons. A comparison of the length of time during which mechanical treatment was required, even in Dieffenbach's successful cases of the application of *the violent sudden method,* with the period of time occupied in the treatment by *the method of gradual extension,* shews that Dieffenbach's plan has not the merit of effecting rapid restoration.

Although in Dieffenbach's successful cases the limbs were by violence suddenly straightened after subcutaneous division of tendons, the resulting inflammation (in some proceeding to suppuration and sloughing of integuments) and constitutional disturbance prevented the proper and continued application of apparatus for the maintenance of the parts in the straight position. This part of the treatment, important to the success of even the violent method, having necessarily been neglected, a strong tendency to recurrence of ankylosis was evinced, requiring, after all, the application of the gradual method of extension. In this manner the entire treatment occupied as long a period as usually suffices to effect restoration by the Stromeyerian plan.

Some apology may appear necessary for having enlarged to a small volume the following remarks on the pathology and treatment of a class of affections hitherto considered within the limits of a chapter or an article in a cyclopædia.

A few years since, the treatment of ankylosis was

limited to frictions, manipulations, and mechanical extension, and chiefly confined to mechanists or empirical practitioners, and was rarely successful. The application of tenotomy has introduced this neglected field of exertion to the notice of the qualified medical practitioner, and sanguine anticipations of additional progress in the art of orthopædy* may confidently be entertained. So long as ankylosis was incurable, except in slight cases, a few pages sufficed to contain every thing that could be written on the subject; but its augmented importance at the present time furnishes a claim on the reader's indulgence for the length to which these observations have extended.

From the absence of novelty in the treatment of stiff-joint by the older means, the publication of cases restored without operation is unnecessary. Those which are here presented are extracted from the Author's case-book, without reference to the degree of success (see p. 123) that resulted from the operation.

The Author's acknowledgments are due to those professional friends who have kindly furnished him with instructive cases, and to his colleague at the Orthopædic Institution, Mr. Tamplin, for the able assistance received from him in the operations and subsequent treatment of the cases here detailed that were admitted into that institution.

* From ὀρθός, *straight*, and παῖς, *child*, a young person; the art of straightening children. The term is extended to the art of curing distortions in general. Andry (1743) defines it, the art of correcting and preventing deformities in children.

CONTENTS.

CASES: WITH REMARKS.

ON ANKYLOSIS IN GENERAL.

Its Nature. — By ankylosis,* or stiff-joint, should be understood an unnatural rigidity of a joint, arising from causes operating in a *direct* manner on the structures immediately concerned in the articulation, and by which its natural movements are rendered impossible. The term includes also the idea of distortion and deformity, as, in the majority of the cases of ankylosis, the part is fixed in a position different from that assumed in the quiescent state of the limb, and accompanied with a change of form detracting from its symmetry. It is sometimes used synonymously with contracture; but I shall treat of it separately, and shew in what respect ankylosis and contracture differ.

Ankylosis is divided into true and false, or complete and partial. When described as true or complete, a perfect ossific union of the articular surfaces of the bones, and consequent incapability of restoration to function, is supposed to have taken place. By false or partial ankylosis, on the contrary, is understood such a degree of impediment to the motions of the joint as materially interferes with its function, but without any union, or with merely membranous adhesion, of the articular surfaces. True ankylosis may be practically defined, as that state in which an incapability of movement between the articular surfaces exists; and false ankylosis, that in which

* Ankylosis, or anchylosis, ἡ ἀγκύλωσις (ἀγκύλη, a bending, flexure, more properly the bend of the elbow, the ham, a contracted joint, "contractos articulos ἀγκύλας Græci nominant," *Cels.* v. 28), stiffness, rigidity, and adhesion of a joint, distortion.

limited mobility remains. This definition is anatomically correct; but if the apparent existence or non-existence of mobility were exclusively relied upon in diagnosis during life, serious errors would often be committed.

Each of these divisions of ankylosis, according to chirurgical phraseology, may be angular or straight,* (*orthocolon*, τὸ ὀρθόκωλον; ὀρθός, *straight*; κῶλον, *a limb*,) by which is meant that the joint may be ankylosed either in the bent or extended position of the part.

Ankylosis may be *simple* or *compound*. In simple ankylosis, the rigid, more or less completely immovable articulation, has permanently assumed a position common in the natural temporary movements of the part. The ankylosis is compound when it is combined with a partial or complete luxation, that is, an unnatural displacement of the articular surfaces has also taken place. It will be hereafter shewn that this is, in some respects, an unfavourable complication.

Causes of Ankylosis.—Inflammation is the cause of each variety and grade of ankylosis. Whether we regard it in its mildest form, producing effusion of lymph into the cellular tissue around an articulation, or survey the chronic ravages of the scrofulous variety, or the fearful disorganisation of its acuter forms, we perceive the same chain of phenomena; of which one or more links, according to the intensity and severity of the disease, may be absent; but the result, a greater or less degree of immobility or stiffness, is invariably present.

In addition to the direct effects of inflammation in the production of ankylosis, a variety of other circumstances facilitate its progress and augment its severity. Among these are, the long-continued rest of the limb in one position, and the shortening of the muscular structures on the relaxed side of the member. Surgeons usually suggest, that during

* The convenience, if not the necessity, of describing the ankylosis of a limb in the extended position as a *straight* ankylosis, may be conceded; but it is somewhat tautological to speak of an *angular* ankylosis.

the continuance of disease in an articulation, it should be placed in that position which, in the event of ankylosis, would render it the most convenient and useful to the individual,—the extended or slightly flexed position being recommended for the knee, the flexed for the elbow; but the rarity of *straight* ankylosis of the knee, and comparative frequency of this condition of the elbow, shew that in many cases the practitioner or patient is compelled to disregard the future, and content himself with the cure of the disease in that position which affords the greatest temporary ease. In the knee, the flexed or semi-flexed position is that commonly assumed by the patient; and the constancy with which it is maintained during the continuance of disease, is, even in slight inflammation, a powerful cause of the stiffening of the articulation in that form, through the consolidation of the plastic lymph effused into the inflamed tissues. The shortening of the muscular structures on the relaxed side of the articulation is, in the first instance, equally the result of the continued repose of the limb in the flexed position. The continued approximation of the origins and insertions of the flexor muscles induces a gradual shortening of their fibres, in consequence of the unceasing action of their inherent contractility, or *vis insita;* their antagonists, the extensors, are proportionately elongated, and after a short period their fibres become weakened. Thus, the equilibrium between these opposing sets of muscles being interrupted, the increase of the deformity becomes easy, provided other circumstances do not oppose its progress.

It is not my intention, in these remarks on ankylosis, to examine narrowly the opinions of other authors, but rather to state the results of my own observation and experience. Whilst considering the mode in which contraction of the muscular structures ensues in these cases, I may, however, allude to the prevalent notion, that the inflammation in the articulation excites the irritability of the flexor muscles in particular, as in the knee, for instance, and that thus irritated, a preternatural activity of their fibres results.

The explanation I have previously given, of the influence of continuance in a certain position, appears to me sufficient to explain the phenomenon; and it may be remarked, that no reason is apparent, no physiological or pathological law is proved to exist, which will explain why the extensor muscles should not, through the local disease, be equally irritated to preternatural activity with the flexors. In many articulations, the greater mass and power of the flexor muscles (as the gastrocnemii; see "Treatise on Club-foot, &c." note, p. 40,) favours the supposition that they primarily overpower the extensors, independently of the influence of previous repose in a flexed position; but it can scarcely be conceded, that in the knee the proper flexor muscles of the joint, the biceps and semi-tendinosus and semi-membranosus muscles, are so much more powerful than the extensors, as to suffice for the explanation of the preponderance.* The bent position being assumed, the great length of the fibres of the flexor muscles of the knee, and the freedom of their course, from origin to insertion, enables them to shorten themselves to a greater extent than is possible in the extensors (the rectus femoris excepted), owing to the difference in their anatomical arrangement.

An explanation of the reasons of the instinctive preference given to the bent position of the knee in the majority of cases is not difficult. In this position the larger proportion of the muscles of the extremity is relaxed; for, although some of the extensor fibres may be rendered tense, yet, as the thigh is flexed, the longest portion, that capable of the greatest amount of relaxation, or tension, the rectus femoris, is placed in repose, through its attachments to the ilium. Another

* It is undeniable, that, after a certain period, in the majority of cases of chronic disease of the knee-joint, a greater irritability of the flexor muscles appears to exist. It is not observed in the *earliest* stages of the affection; but when, for some time, the flexed position of the limb has been either instinctively maintained by the patient, or intentionally induced by the surgeon, the slightest attempt to retain the limb in a more extended position excites these muscles, and augments the patient's sufferings.

circumstance also exists, which tends to explain the greater ease experienced in the semi-flexed position of the knee during inflammation, — I allude to the greater amplitude during flexion than extension of the synovial sac, and the diminished pressure of its fluid contents on the inflamed tissues. The severity of suffering in inflammation of an articulation is acknowledged to arise from the inextensibility of the fibrous structures composing it: they cannot so readily swell as the more elastic cutaneous and cellular tissues of the frame; the turgid capillaries compress the accompanying nervous fibrils, the sensibility of which may, moreover, be augmented by the inflammatory process; every part of an articulation rapidly and acutely inflamed is exposed to pressure from the increase of the secretions into the synovial sac; and hence the sufferer promptly avails himself of the smallest relief obtainable from suitable position.

The examination of the course of the simplest case of inflammation of the knee, which tends to ankylosis, will render more clear the manner in which immobility and contraction take place. I will suppose a slight inflammation of the knee from mechanical injury: the characteristic heat, pain, and tumefaction, if not the redness, successively present themselves; these are combated by antiphlogistic measures, the knee assuming and retaining the bent position. At the expiration of days, weeks, or even months, according to the healthiness of the constitution, and propriety of the treatment to which the practitioner may have resorted, the inflammatory symptoms subside without suppuration or disorganisation; but the previous constitutional disturbance, the debility necessarily succeeding to the use of antiphlogistic treatment, and the experience the patient acquired during the inflammation of the exquisite pain and tenderness in the articulation, leave a moral as well as physical morbid sensibility in the patient which strongly oppose any attempt to straighten the limb. The inflammation may have subsided without producing disorganisation, but the interstitial infil-

tration of lymph has yet to be absorbed, some thickening of the tissues exists, the ligaments have not re-acquired their extensibility, the muscles have adapted themselves to the shortened state of the condition of repose of the limb; and whenever the practitioner attempts to straighten the limb, or the patient summons resolution spontaneously to effect the same, the painful tenderness of the joint which is immediately experienced, or the sensation of stiffness behind and around the articulation, together with the feeling of its powerless condition, too often occasion procrastination of this important part of the cure—the restoration of the natural form and movements of the limb. If the judicious management of the practitioner be seconded by proper perseverance on the part of the patient, the case proceeds favourably, motion is gradually perceived, the extent of which is daily augmented by passive and active exercises, the tenderness experienced on first attempting to move the articular surfaces subsides, and the patient completely recovers. But let us reverse the case, and suppose the fear of reproducing inflammation by passive movements of the limb, the want of the necessary resolution to persevere in the use of troublesome restorative measures—frictions and manipulations; or that the inflammation of the joint having been very acute or of long duration, and the patient's health, or even his life, having been endangered by constitutional disturbance, the friends and the patient feel too happy in having escaped imminent peril, and abandon the limb for a time as a thing of inferior importance,—what are the further changes which ensue? These are usually more serious if the subject be young, and the growth of the frame be still in progress. I have already stated that the advance of deformity proceeds rapidly on the destruction of the equilibrium in different classes of muscles; and the tendency to retraction in their fibres may not be arrested until the member becomes contracted to the full extent of the movements natural to the part, and sometimes the contraction proceeds to a greater extent.

Certain circumstances may check the progress of contraction. If, for example, an individual with angular ankylosis of the knee take exercise, with the assistance of crutches, or wear an artificial support beneath the tuberosity of the tibia, the weight of the suspended limb may advantageously operate in preventing further contraction, although it rarely contributes to remove that pre-existing; on the contrary, it sometimes happens that the stimulus thus given to the hamstring muscles encourages resistance to their elongation, and occasions increased contraction in their fibres, and corresponding approximation of the heel to the nates. It is scarcely necessary to mention that the curative efforts, if not adequate to the total removal of contraction, may prevent its increase. The exercise of volition in the weakened extensors, and their restoration to activity, constitute the most effectual counterpoise to the contractility of the flexors.

In infancy and childhood the increase of contraction is accelerated by the operation of causes which do not affect the adult.

The continuance of the muscular contraction, as one of the causes of ankylosis, depends, in the first instance, as already stated, on the continued operation of the organic contractility of the muscular fibre, by which the extremities of the muscles become approximated; but after the lapse of some time, the shortening from this cause attains the maximum, and is followed by a change in the structure of the muscular fibre, which I have named structural shortening. Observation shews that this change is more rapidly effected in infancy and childhood than after adult age, apparently through the operation of the physiological laws regulating the growth and regeneration of the constituent parts of the frame. Various periods have been assigned during which the animal machine undergoes a total change of its component parts; some physiologists assert, that within seven years each integrant particle is removed, and its place supplied by another: but whether the process be slow or fast, it is probable

that the rapidity of any change in the proportionate length or bulk of an organ rendered unserviceable by accident or disease, will depend upon the shortness of the interval during which the deposition and renewal of parts take place. If this position be correct, we should suppose that in infancy and youth, setting aside the extensibility of the tissues in early life, which materially assists the treatment of partial ankylosis, a shorter time would suffice to engender structural and inextensible shortening of a muscle in youth than in the adult, as the processes of decomposition, renewal, and growth, occur in more prompt succession in childhood than in manhood. This supposition, as far as my experience has extended, is confirmed by observation.

The rationale of the occurrence of structural shortening of muscles is very simple. When, from any cause, they are thrown into a state of constant contraction, either passive (from repose of a limb in one position), or active (from spasm), they are not solely diminished in bulk, as commonly stated, from want of use, but the muscular fibres become permanently shortened and inelastic; and provided a period sufficient for the complete renewal of their integrant parts has elapsed, they are necessarily re-deposited positively shorter, to accommodate them to the altered relation of the surrounding parts.

Another striking circumstance which, during childhood, accelerates the progress of this disproportion between the contracted muscles and adjacent parts, arises from the relation that is known to exist between the growth and development of different parts, and their maintenance in a state of activity by a proper and constant exercise of their several functions. Whilst the muscles on one side of a limb remain contracted, and undergo interstitial shortening, in the manner I have described, the bones, gradually advancing towards their full development, are elongated, the disproportion between them and the contracted muscles is augmented, and the deformity of the limb necessarily aggravated.

When inflammation of articulations is followed by suppu-

ration exterior to the synovial membrane, the granulations by which the cavity of the abscess is obliterated constitute afterwards tough bands, approaching in density to fibrous tissue. These gradually contract in a manner similar to the contraction that takes place in cutaneous cicatrices, and constitute an additional obstacle to the restoration of the motions of the joint. The amount of resistance these bands may offer will greatly depend on their direction. Should the suppuration have been accompanied with loss of substance, sloughing of the cellular tissue, fascia, or tendons, the tendency to contraction and ankylosis will be proportionably stronger. But if the intensity of the inflammation have been spent upon the synovial membrane and the ligaments immediately around it, and either cellular adhesions within the joint, or thickening and induration of the ligaments, have resulted, combined with adventitious bands in the track of abscesses, the probability of ankylosis is still greater. This is further increased if the suppuration within the articulation have communicated with the exterior. The case may be complicated with absorption of cartilage, adhesion by granulation between the denuded articular surfaces, fibro-cartilaginous transformation of these adhesions, or osseous deposit, constituting true ankylosis. Such are the modes in which ankylosis is produced by common inflammation. I have now briefly to consider the influence of scrofulous and rheumatic inflammation.

The strumous forms of disease usually differ in the slowness of their course from common inflammation,—the contraction is very gradual; but as the disease affects young subjects, the muscular retraction becomes ultimately, from the causes I have mentioned, as inextensible as in ankylosis from ordinary inflammation. The limb is rarely so acutely flexed, but contraction occurs in the larger proportion of cases. Although suppuration sometimes extends outwardly, accompanied with caries of the bones, it is usually circumscribed, and does not induce the formation of the extensive bands of dense adventitious tissue succeeding to the suppuration of acute inflamma-

tion. The disorganisation of the ligamentous structures being the common result of this disease, the ankylosis is rarely simple. Partial luxation of the articular surfaces often occurs, constituting compound ankylosis. Thus, in the knee-joint, the head of the tibia is drawn outwards and backwards, being applied to the posterior part of both condyles, or it may gradually abandon the internal condyle, and articulate almost exclusively with the posterior part of the external condyle; and sometimes the luxation is so complete, that it articulates only with its external and posterior surface. The tibia undergoes, at the same time, rotation outwards (see Ankylosis of the Knee). *Arthritic* inflammation, under which head I include rheumatism and gout, more frequently induces complete immobility of the joint than any other disease. Greater induration and rigidity of the articular tissues appear to follow this than other inflammations, and considerable proneness to calcareous or ossific deposit around and between the articulating surfaces exists. Ankylosis may occur as an immediate result of acute arthritis, or be a sequel of the chronic form of the disease, years elapsing before the calcareous deposit acquires a sufficient amount to render the joint quite immovable. It is worthy of recollection, that the simple induration of the tissues from rheumatism may suffice to produce complete immobility, without the existence of any ossific union, and occasion an erroneous belief in the presence of true ankylosis.

The ginglymoid articulations, and those by plane surfaces, are more susceptible of ankylosis, whether true or false, than the ball-and-socket joints. The adhesion of the articular surfaces of the ginglymus is probably facilitated by their being naturally more largely in apposition, and by the smaller amount of mobility proper to this form of articulation. Thus ankylosis occurs more frequently in the knee, elbow, and wrist, than in the hip or shoulder. The comparatively greater frequency of ankylosis in the knee, elbow, and wrist, may likewise depend, in some degree, on the greater liability of these joints to disease; and possibly that disease of the

hip often destroys the patient before time is afforded for the production of ankylosis.

Several joints having been simultaneously or successively diseased, the individual may present ankylosis in several parts of the body. This is frequently observed in rheumatic and scrofulous subjects. Extraordinary cases of universal ankylosis, the entire skeleton constituting one bone, have been occasionally witnessed.

The following table contains an enumeration of the causes of the various forms of ankylosis *of the knee*, in the order of their severity. It may be incomplete: it includes, however, the causes of every variety that has fallen under my observation, and will serve to illustrate the causes of ankylosis in other articulations.*

* I have rejected the simple *state of rest* or *disuse* of an articulation as a cause of true ankylosis; for, in the absence of conclusive evidence, we cannot conceive the production of such disorganisation of the synovial membrane and cartilages as is implied by the occurrence of ossific union between the articular surfaces, without that previous alteration in the functions of the capillaries which is designated inflammation. Cloquet (*Dictionnaire de Médecine et Chirurgie*—article, *Ankylose*) mentions the occurrence of ossific union between the articular surfaces of the joints of persons whose limbs had been condemned to constant repose by paralysis. This celebrated anatomist does not state whether he had the opportunity of examining the subjects during life-time, so as to be able distinctly to certify that the cause was paralysis, or whether *les pièces anatomiques* came under his observation only after death: the latter is the more probable conjecture. In our vernacular, persons are often stated to have "lost the use of their limbs;" and the physician cannot from this information determine whether the disease be paralysis or rheumatism. The wasted, powerless muscles of the lower extremities of an individual, with every articulation contracted, and one or more perhaps ankylosed, from rheumatism, present considerable resemblance to those affected with paralysis. In *complete* paralysis of long standing, the utter abolition of voluntary power, and the annihilation of the organic contractility of the muscles which subsequently ensues, occasion the well-known laxity of the paralytic articulation, the articular surfaces being held together as it were by the flaccid skin and ligaments only. This does not constitute a state of things favourable to a complete state of rest of the articulation. Every movement of the patient's frame effected by external aid *jolts* the articulations, and would interfere with the ossifying process, if it were disposed to occur.

The only cases in which I can conceive the occurrence of true ankylosis from paralysis possible, are those in which the paralysis of one set of muscles is

Ankylosis, false and true, each subdivided into angular and straight.

False Ankylosis.

(*a*) Angular:—

1. From strumous synovitis, from inflammation produced by mechanical injury, and erysipelas succeeded by phlegmon, terminating in *thickening of structures in and about the articulation and muscular contraction.*
2. From abscess exterior to the synovial membrane, followed by *reunion of parts, unnatural adhesions, contraction of muscles.*
3. From rheumatic and gouty inflammation, producing *induration and adhesion of tissues, from effusion of lymph*, with or without *incipient calcareous deposit, muscular contraction.*
4. From strumous *synovitis*, or white swelling, ending in *disorganisation of ligaments, muscular contraction, partial luxation of articular extremities, caries.*
5. Inflammation and suppuration within the synovial membrane communicating with the exterior, *destruction of ligaments, membranous adhesions within and without the articulations, muscular contraction, partial luxation, attrition of cartilage and bones.*

False *compound* ankylosis.

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succeeded by permanent contraction of their antagonists, and immobility of the joint—contracture. But *ankylosis* from this source has never fallen under my observation. (See Morbid Anatomy of Contracture.)

True ankylosis is often observed in the bodies of aged individuals, in the bones of the carpus, tarsus, vertebral column, and elsewhere; and is usually, but improperly, considered to be the direct effect of a state of rest of the articulations. It arises, in my opinion, from the slow operation of chronic rheumatism, favoured by the well-known senile tendency to induration and ossification of tissues.

Strong corroborative evidence that disuse of an articulation is not necessarily followed by ankylosis is afforded by the circumstance, that in the highest grade of congenital club-foot of thirty and forty years' duration, the articular facets of the tarsal bones, some of which, it may be safely affirmed, have been many years in a perfect state of rest from disuse, retain their normal anatomical characters, and by the restoration of the position of the foot are enabled to perform those functions which, owing to the congenital nature of the deformity, had never been exercised.

The effects of friction, abrasion of cartilage and bone, may occasionally be observed in such cases of club-foot; and should *inflammation* of the integuments and fibrous tissues investing the articulation of the os calcis with the os cuboides, or this bone with the fifth metatarsal bone, be excited by undue pressure in walking, and spread to the subjacent articulations, the ordinary effects of inflammation, membranous and osseous adhesion between the articular surfaces—ankylosis, may unquestionably occur.

(*b*) Straight :—

1. From abscess resulting from inflammation, preceded by mechanical violence, or erysipelas, terminating in *adhesions, muscular rigidity.*
2. From strumous disease, suppuration, and necrosis of shaft and condyles of femur, *unnatural adhesions, effusion of ossific matter in the popliteal region, rigidity of anterior muscles of the thigh.*
3. From fracture.

TRUE ANKYLOSIS.

(*a*) Angular :—

1. From chronic strumous disease, inducing ulceration of cartilage and bone, destruction of ligaments, and bony union, luxation.
2. From acute inflammation, traumatic, phlegmonous, erysipelatous, or rheumatic, followed by suppuration within the synovial membrane, either communicating with the exterior or not, *destruction of cartilage, osseous union between the articular surfaces.*
3. From gouty inflammation, *without external suppuration, calcareous deposit uniting articular surfaces.*

May be combined with luxation, and constitute true *compound* ankylosis.

4. From fracture.

(*b*) Straight :—

1. From fracture.
2. From rheumatic inflammation.

MORBID ANATOMY OF ANKYLOSIS.

This subject has been so ably treated by numerous pathological writers, that I am relieved from the necessity of minutely describing all the varieties of morbid processes in the articulations which precede ankylosis. However interesting, in a pathological point of view, is the study of many of the phenomena resulting from the ravages of inflammation in articular tissues, I shall, as the object of this treatise is mainly practical, pass over many of those facts and opinions which do not illustrate the diagnosis of stiff joints, and the treatment to be recommended. The morbid anatomy of ankylosis is really that of diseased joints in general; and as an apology for the omission of much that it may be sup-

posed should properly be inserted, I may mention that the morbid anatomy of diseased joints appropriately belongs to the consideration of the nature of those diseases, which is equally beyond the scope of this treatise. With these views, I shall consider so much of the morbid anatomy of ankylosis as may assist in distinguishing the true from false, and investigate the nature of false ankylosis as far as essential to diagnosticate the amount of alteration of the articulation, and deformity which is remediable or irremediable. We have further to learn from it the abnormal conditions of tissue, the removal of which is indispensable for the restoration of the form and functions of the part. The observations on the causes of ankylosis have, in some degree, anticipated the considerations on its morbid anatomy; thus the agency of inflammation has been traced, in its simplest effects producing the slightest false ankylosis, to its most destructive consequences, and bony union of the articular surfaces. The distinction of Synovitis, Synchondritis, Chondritis, articular Osteitis, is of importance to the surgeon in guiding him in the choice of remedies; yet the tendency of each of these inflammations to produce the others in unfavourable constitutions, which are those most affected with these diseases, is so great, and the passage of chronic into acute inflammation so frequent, that instead of considering their individual relation to ankylosis, we have chiefly to survey the general effects of inflammation.

The effects of inflammation upon the tissues in and about an articulation are perfectly similar to those of other structures: whatever difference exists, arises from the circumstance, that certain active agents, numerous muscles, held in antagonism as long as the part remains in health, obtain the mastery over the articulation when diseased, changing the relation of its component parts. We have described as a cause of the simplest form of false ankylosis, inflammation succeeding mechanical injury, terminating in thickening of parts and muscular contraction. Here the inflammatory process has subsided, interstitial deposit of lymph into the

cellular and fibrous tissues having moulded the exterior of the joint into the form it had assumed from the muscular contraction; when abscess exterior to the joint has ensued, adhesions constituting the uniting medium of the parietes of the abscess add to the rigidity which the interstitial deposit of lymph and muscular contraction had already created. These adhesions, which, if exposed to motion, as those connecting the pulmonary and costal pleura are, when the function of the lung remains, would be of cellular nature, soft and yielding, become dense and fibrous when the part is fixed; precisely as in the adhesions of the lung to the ribs, when contraction and immobility of the thorax has taken place, the uniting medium is rendered fibrous, and even fibro-cartilaginous. After a time, when completely organised and adopted as part of the organ, the adhesions arising from abscess in the vicinity of an articulation become as dense and unyielding as the articular ligaments themselves, and, as already observed, impede the movements of the joint more or less according to their situation. The popliteal region, for example, the most frequent seat of suppuration exterior to the knee-joint, is sometimes filled up with a mass of this adventitious tissue, so dense, that when other obstacles have been removed, it may alone occasion immobility of the joint. Sometimes bands, stretching across the ham from one projecting point to another, offer resistance equal to ligament; but more commonly, even when suppuration has not occurred, the fasciæ of the part form a framework on which the adventitious matter is applied, and being at the same time thickened by interstitial deposit, they may oppose an insurmountable resistance to extension. This circumstance induced my friend Professor R. Froriep* to suppose that false ankylosis of the knee was principally dependent on contraction of the fascia lata expanded over the lateral and posterior parts of the joint. On the anatomical examination of cases of this

* Chirurgische Kupfertafeln, no. 346.

nature, he found, that after section of the muscles, the articulation was still maintained rigidly flexed, and extension could only be effected after division of the fascia. He believed the contraction of the muscles to be of secondary importance. An examination of false ankylosis before and after death affords very different results. The tension of muscular fibre ceases quickly after the cessation of life, decomposition speedily renders the previously contracted muscles susceptible of elongation; but the fasciæ and ligamentous structures long resist its influence, and, by continuing tense, may impose the belief that they alone were primarily interested.

When the inflammatory process commences in, or extends into, the interior of an articulation, the usual effects of inflammation arise, increased in destructiveness by the nature of the part, and the extent to which its function is interrupted. The organisation of the synovial membrane, the capsular and other ligaments, is in the first instance affected, their firmness is diminished, they are softened, and yield to the extension produced by the fluid effused into the cavity. The laxity of the connexions by which the articular surfaces are maintained in relation may be so great as to permit free movement of the bones in improper directions; the muscles, therefore, on the flexed side of the articulation, having obtained the preponderance over the extensors in the manner previously described, gradually draw the bones into which they are inserted from their natural position, and produce partial luxation. *Compound* false ankylosis (see p. 1) is daily produced in this manner, without external suppuration. If the inflammation have subsided without this extensive mischief, lymph may have been effused, and constitute loose adhesions between the opposite surfaces of the bones, not calculated materially to impede movement; or the whole articular cavity may be filled with cellulo-fibrous adventitious tissue, rendering the movements obscure and difficult.

In other cases, the deposit of calcareous matter and true

ankylosis takes place in obedience to the pathological law, that the plastic matter effused as the result of inflammation becomes transformed, in the process of organisation, into a tissue similar to that of the organ into which it is effused, or which it abnormally connects. Thus, lymph effused into the interior of an articulation from ordinary inflammation, which has left the cartilages intact, constitutes, on becoming organised, "membranous adhesions," *i. e.* cellular filaments, resembling in structure the synovial fringes naturally existing in the part. But when the cartilages of opposing articular surfaces are destroyed by ulceration, the intervening organisable lymph undergoes a more considerable transformation, and, in obedience to the law above mentioned, receives into its tissue fibrous and calcareous particles, and is converted successively

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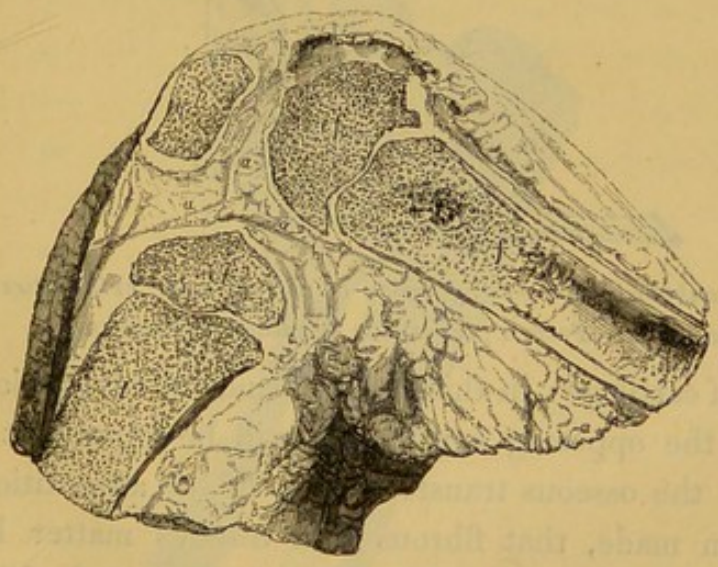
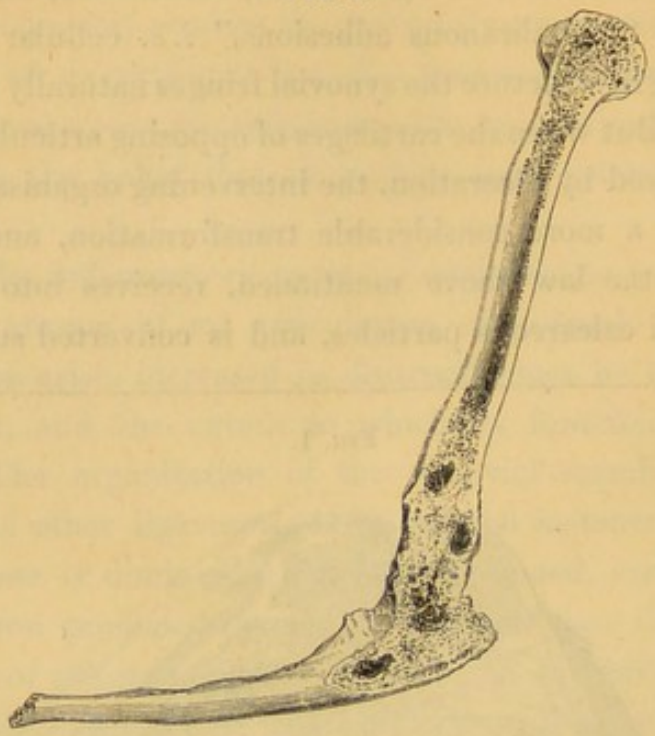
Fig. 1.



Section of incomplete ankylosis of knee-joint, intended to illustrate the observations on adhesions within the articulation from inflammation (see opposite page). *t*, the tibia; *f*, the femur; *e t*, epiphysis of tibia; *e f*, epiphysis of femur; *p*, the patella; *a a a*, cellulo-fibrous adventitious tissue, or adhesions completely filling the articulation.—This drawing is taken from a preparation in London Hospital Museum, marked F. c. 48.

into ligamentous tissue and "new bony matter" (*l'ankylose par intermède*). More frequently, after removal of the cartilages, bony union succeeds with so little appearance of deposit of intermediate new matter, that "fusion" of the articular surfaces is said to have occurred (*l'ankylose par fusion:* see fig. 2). In other instances one articular surface only is de-

Fig. 2.

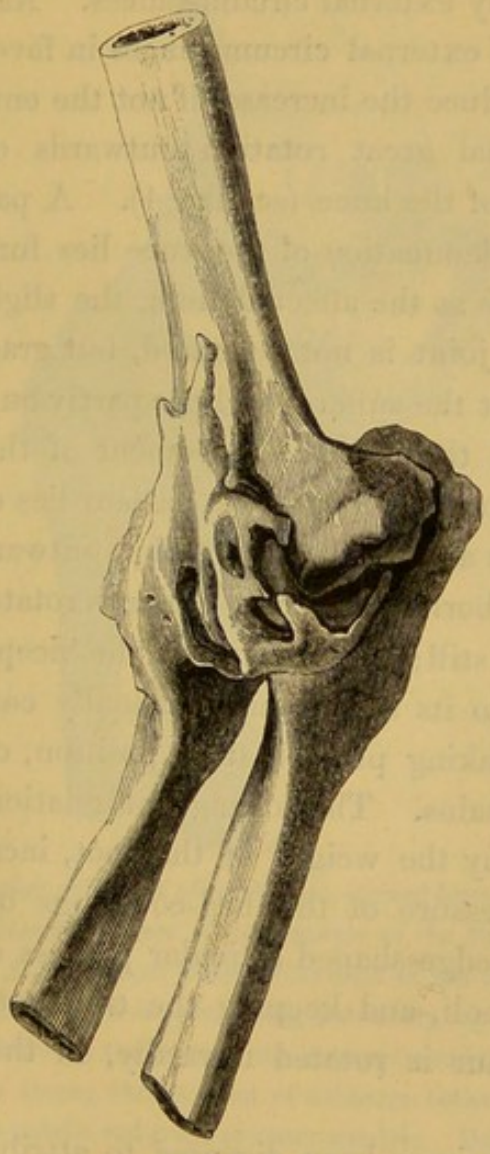


True ankylosis of elbow *by fusion of the articular extremities* of humerus and ulna.—From a preparation in author's possession.

nuded of cartilage: in this case, if bands of adventitious tissue connect the opposing surfaces, it will be found that an effort to effect the osseous transformation of the adventitious tissue has been made, that fibrous and osseous matter has been deposited in that part of it which is connected with the denuded bone, constituting the cartilaginous or osseous vegetations often seen sprouting from diseased bones; but this effort at osseous transformation, meeting with no reciprocal effort from the opposite surface, falls short of producing complete ankylosis.

The adventitious osseous matter is sometimes so abundantly effused on the exterior of the articular surfaces, that a strong lamina of bone, forming a species of splint, connects the bones, and effectually renders them immovable. This kind of complete ankylosis is described by Cruveilhier under the term *l'ankylose par invagination*. The knee and elbow (see fig. 3) frequently illustrate this condition.

FIG. 3.



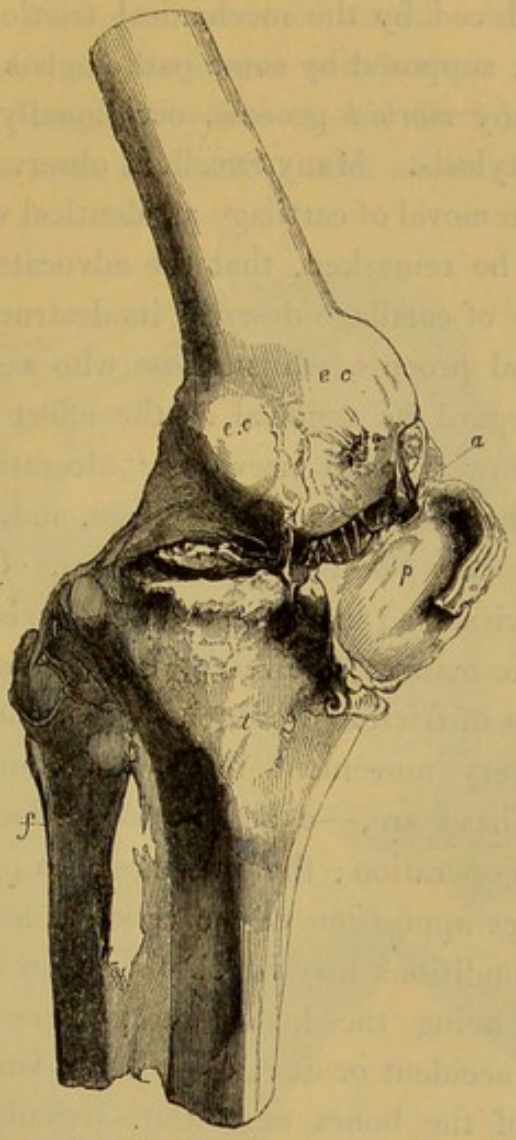
Ankylosis by invagination. Ankylosis of elbow effected by deposit of osseous matter exterior to articulation.—From Cruveilhier's *Anatomie Pathologique*, livraison 9, pl. 4.

Destruction of cartilage, by a process (on the nature of which much discrepancy of opinion exists) similar to ulceration, but differing by an absence of the reproductive process, the attendant on the ulcerative process in other tissues, occasionally co-exists with ankylosis, and more particularly with *compound* ankylosis. The destruction of the ligaments, and the alteration in the form of the articular surfaces, as in the hip, permit the production of partial or complete luxation by the muscles, aided by external circumstances. As an instance of the operation of external circumstances in favouring displacement, I may adduce the increase, if not the entire production, of the occasional great rotation outwards of the tibia in false ankylosis of the knee (see fig. 4). A patient labouring under acute inflammation of the knee lies for days or weeks on the same side as the affected limb, the slightest change of position in the joint is not tolerated, but gradually the body is turned so that the sufferer reclines partly on the back. This is accomplished through the movement of the pelvis on the head of the femur: at length the patient lies entirely supine; but as complete abduction and rotation outwardly of the thigh cannot long be borne, the femur becomes rotated inwardly, the tibia remaining still; the insertion of the biceps flexor cruris is approximated to its origin, and gradually contracts; so that the ankylosis taking place in this position, outward rotation of the tibia remains. This change of relation of the tibia is also favoured by the weight of the foot, increased occasionally by the pressure of the bed-coverings on it, acting by means of the wedge-shaped articular process of the astragalus upon the malleoli, and keeping the tibia rotated outwardly, whilst the femur is rotated inwardly, in the manner above described.

I have sometimes been disposed to attribute the uniform tendency to the existence of this rotation of the tibia outwardly, partly to the action of the biceps being greater than

that of the other flexor muscles of the knee; but it is questionable whether the biceps be more powerful than the inner

Fig. 4.



Incomplete angular ankylosis of right knee, viewed from the *external* aspect: *e c*, *e c*, *external* surface of the condyle of the thigh bone, presenting naturally; *f*, the proper *anterior* surface of the fibula, and *t*, proper *anterior* surface of tibia, presenting outwardly; *p*, the patella situated diagonally between the front of the external condyle and the apophysis tibiæ; *a*, a strong fibrous band of adhesion between upper and outer edge of the patella and front of outer condyle. Beneath this a series of slender cellular adhesions between the patella and under portion of outer condyle is visible. — From preparation F. c. 33 in London Hospital Museum.

ham-string muscles, aided in their action by the sartorius and gracilis.*

Attrition of the cartilages, by which is understood a wearing away, produced by the mechanical friction of the bones on each other, supposed by some pathologists to occur independently of any *morbid* process, occasionally co-exists with incomplete ankylosis. Many excellent observers are disposed to regard this removal of cartilage as identical with ulceration; and it should be remarked, that the advocates of the unorganised nature of cartilage describe its destruction by friction as a mechanical process, whilst those who assert the vitality of cartilage regard its removal as the effect of ulceration.† Friction, with or without previous "ulcerative absorption," is capable of the destruction of cartilage, and, after its entire disappearance, may grind away the bones. Continued pressure, as daily witnessed in the effects of aneurisms and tumors, compels, in like manner, the removal of the hardest tissues.

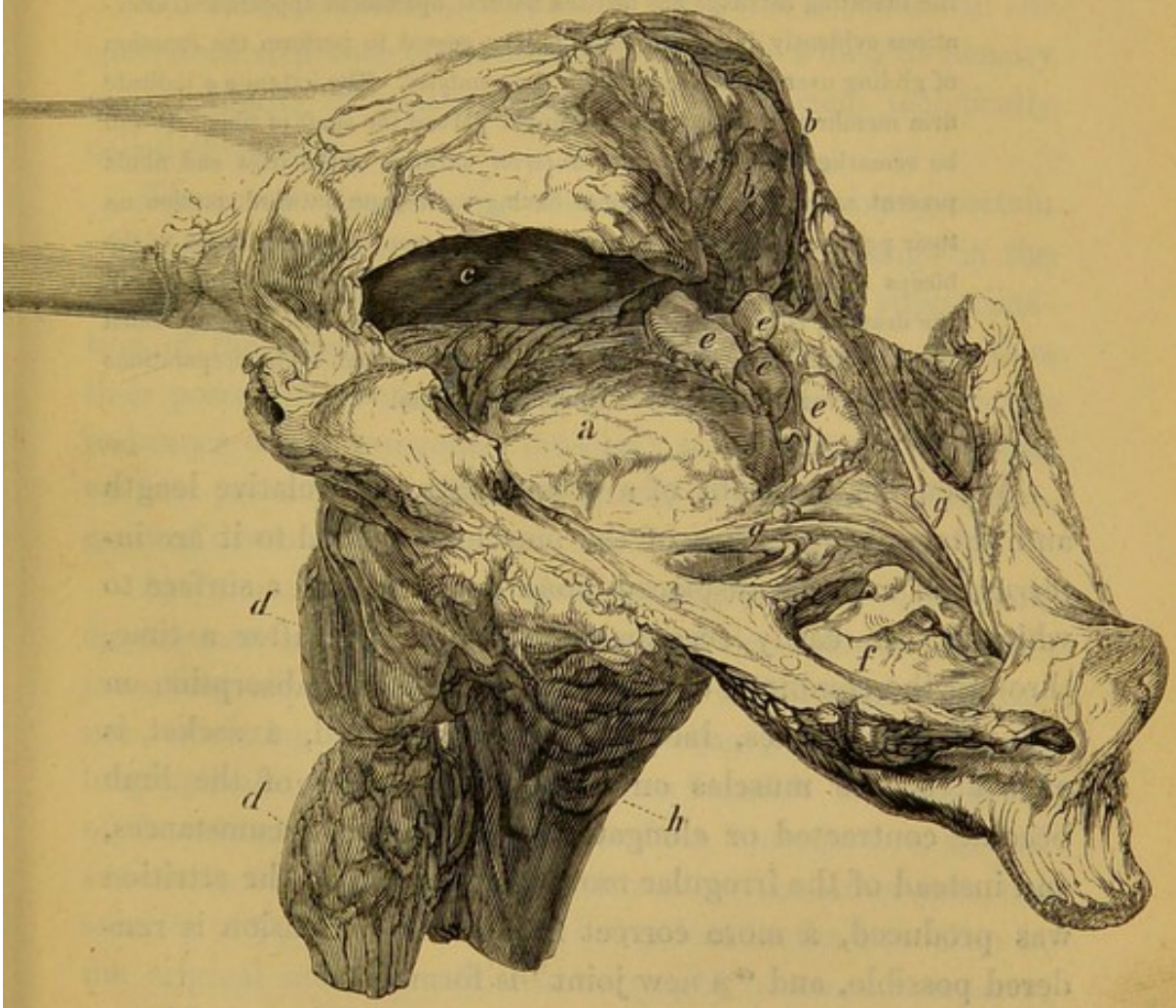
The effects of friction would be experienced in every individual at every movement but for certain counteracting influences. These are,—a healthy condition of the tissues exposed to its operation; the presence of a proper secretion; and the correct apposition of the articular surfaces. One or all of these conditions may be absent in an ankylosed joint. Inflammation being the invariable precursor of ankylosis, whether from accident or disease, it is not surprising that the organisation of the bones and other articular tissues, their capability of resisting external causes, should be diminished;

* Benjamin Bell (*Treatise on Diseases of Bones*, 1828, p. 287 et seq.) very unphilosophically attributes this distortion to the patient twisting his leg round the crutch, a habit frequently acquired by persons thus affected. In opposition to this explanation it is sufficient to state, that this distortion is frequently observed in those who have not quitted their bed since the commencement of disease of the joint.

† The importance of a due consideration of the existence of ulceration or attrition of cartilage will be shewn in the chapter on treatment of ankylosis.

the secretion of the synovial fluid is very commonly altered, if not arrested; and an alteration of the relation of the articulating surfaces we have described as a frequent concomitant of ankylosis. The occurrence of attrition of the cartilages and bones, after long-continued ankylosis in old persons, is not surprising, when we reflect on the diminished vitality of those structures at an advanced period of life (see fig. 5).

FIG. 5.



False angular ankylosis of right knee, *with luxation*, from disease within the articulation, viewed from the external surface of the articulation, exhibiting the peculiar *rotation* described page 20, *erosion of cartilages and bone*, "*formation of new joint*," *membranous adhesions*, *eburnation*, &c. *a*, the upper extremity of tibia, which, instead of presenting two slight concavities for the reception of the two condyles, is

globular, like the head of the humerus, irregular on the surface, in part divested of normal cartilage, and elsewhere of unusual hardness (state of eburnation), and corresponds in size with *c*, a large excavation formed at the expense of the external condyle. The external condyle has entirely disappeared, from the combined operation of friction and absorption; *b*, the internal condyle, not articulating with any part of the tibia; *d d*, the fibula, on which two enlargements or nodes are visible; *e e e e*, pedunculated fibro-cartilaginous growths within the articulation; *f*, the patella, suspended by the thickened and indurated capsular ligament, and by the ligamentum patellæ. The patella is irregular on the surface, and the investing cartilage has lost the natural opalescent appearance, alterations evidently due to the bone having ceased to perform the function of gliding over the space between the condyles. The letters *g g* indicate firm membranous adhesions; *h*, upper part of the shaft of tibia. It will be remarked, that the proper *anterior* surfaces of the tibia and fibula present *externally*, these bones having undergone outward rotation on their perpendicular and transverse axes, the contracted condition of the biceps muscle maintaining the displacement. The subject from which the drawing is taken was an elderly female, who had been thus deformed many years: both knees were very similarly affected.—The preparations are preserved in the London Hospital Museum.

When displacement of a bone exists, the relative length and antagonising power of the muscles attached to it are interrupted, and the displaced bone does not find a surface to which it can easily accommodate itself; but after a time, through the combined operation of friction and absorption on the different tissues, inequalities are removed, a socket is excavated, the muscles on the opposite sides of the limb become contracted or elongated, according to circumstances, and instead of the irregular movements by which the attrition was produced, a more correct flexion and extension is rendered possible, and "a new joint" is formed.

Sometimes the erosion or attrition of cartilage and bone is succeeded by the deposition of a new material resembling cartilage, lubricated by the fluid of the articulation, and serving the purpose of original cartilage.* This investment

* As the head of tibia in fig. 5.

of the denuded osseous surface by a fibro-cartilaginous substance, is, in my opinion, the result of the cessation of the grinding process. It is not a barrier opposed by the *vis medicatrix naturæ* to any further attrition, but the articular surfaces having by this *levelling* process obtained a larger and firmer *point d'appui*, further attrition is prevented, and an attempt to adapt the newly formed cavity to the purposes of movement then takes place.

On other occasions, calcareous matter is deposited in the cancellous structure of the denuded bone, by which its density and capability of resisting abrasion is increased, technically called *eburnation*.

The active agents in displacement and erosion being certain muscles, they cannot indefinitely augment the change in the natural relations of the parts; for the increasing approximation of the origins and insertions of these muscles weakens their power of effecting displacement, whilst it augments the resistance of the antagonist muscles; so that from this cause we may presume an additional barrier is opposed to the progress of destruction.

Attrition of cartilage occurs also independently of previous displacement, as in the articulations of the knee of old subjects long affected with rheumatism, in which marks of friction, consisting of abrasions of the cartilage, or grooves in the longitudinal direction, have often been found.* Displacement of the articular surfaces may hence be a consequence, as well as a cause, of extensive attrition or erosion. In either case, the security of the displaced bone, being less in the new than in the original position, additional strength becomes necessary, and is often afforded by the deposit of calcareous matter around the part against which the displaced bone rests.

The formation of a "new joint" is of frequent occurrence in the articulation of the hip, preparations of the kind being

* See Cruveilhier, *Anatomie Pathologique*, livraisons 3, 9, et 34.

common in pathological museums. Other articulations undergo the same process.

The muscles of an articulation long affected with complete immobility from ankylosis become atrophied, and ultimately undergo a great change in their component parts, constituting the adipose transformation of authors.

SYMPTOMS OF ANKYLOSIS IN GENERAL.

Many of the symptoms by which the existence of ankylosis during lifetime is recognised, may be deduced from the preceding chapters. Of these, the most important is the continued rigidity or immobility of the joint, constituting respectively the characteristic practical difference between true and false ankylosis. The distinction is often very difficult; in either case, the rigidity may be so great that no movement of the articular surfaces may be perceptible when the patient acts on the muscles of the articulation, or when the medical practitioner endeavours by manipulation to effect motion of the joint. It is almost invariably combined with flexion of the limb, and some deformity; except in *straight* ankylosis, in which the natural form is usually unaltered.

The deformity is often the result of displacement of the articular surfaces, but sometimes depends on disproportionate development of the articular extremities, on atrophy of one or more bones, or wasting of the muscles, and is occasionally increased by the indented cicatrices of former abscesses, caries, or necrosis. Contraction of the muscles, tendons, ligaments, and fasciæ, situated on the flexed surface of the limb, exists in every case of stiff joint; but the muscular resistance to restoration is most perceptible in false ankylosis.

As in true ankylosis the origin and insertion of the contracted muscles cannot be separated by the fruitless attempts to move the joint, no tension of their fibres can be mechanically produced; but when false ankylosis exists, although

extension is limited, the joint may remain capable of greater flexion, so that the resistance offered by the muscles is immediately apparent. Even in cases of false ankylosis in which no motion is *visible*, and in which the absence of complete immobility is ascertained only by very slight movements of the articular surfaces being felt on careful examination, an alternate tension and relaxation of the muscles may be produced by forcible attempts made to straighten and bend the limb. Muscular tension is, however, a symptom of ankylosis which may occasion an erroneous diagnosis; as, when absolute immobility of one articulation exists, the patient may be able to act through volition on those muscles which pass over two joints, and occasion their alternate contraction and relaxation. As a means of diagnosis, the practitioner will observe whether the muscular tension be synchronous with his manual attempt to move the joint. The amount of the resistance to restoration afforded by the fasciæ and ligaments cannot always be ascertained; the tension of those situated close to the integuments,—as the fascia lata and external lateral ligament in the knee, or the palmar fascia in ankylosed fingers,—may be distinguished by the touch; but we can only conjecture the degree of rigidity of those immediately connected with many articulations, as the posterior and crucial ligaments of the knee-joint.

The diagnosis of ankylosis from other affections of the joints is not difficult. It is impossible to mistake, as asserted, immobility from acute inflammation of an articulation for stiff-joint; in the absence of constitutional symptoms, the local tumefaction and effusion, with probable increase of temperature, would dissipate every doubt. Ankylosis may have commenced before the subsidence of inflammation; in such case, the aim of the practitioner will be the successful treatment of the inflammation: and beyond the means he may resort to for fixing the limb in a favourable position, or for preventing

displacement of the bones and increased contraction, he will postpone the consideration of ankylosis until the entire cessation of the primary disease.

The distinction of true from false ankylosis is often difficult. The previous history of the case may assist our judgment. Where, for example, absolute immobility has succeeded inflammation produced by mechanical violence, we may conclude that true ankylosis exists. The deformity resulting from *white swelling*, on the contrary, is usually incomplete ankylosis. Tact in the examination of such cases often enables the experienced practitioner to detect mobility where none was believed to exist, and effect the restoration of a limb previously condemned to uselessness, and regarded as an incumbrance. The production of pain, or a sensation of tightness on the flexed side of the limb by manual attempts at straightening, is often an indication of incomplete ankylosis. But a much more delicate test is the production of pain on the opposite side.* It has been stated, that the patient affected with true ankylosis permits examination without apprehension of pain, whereas in false ankylosis, the individual mistrusts the manipulation of the practitioner. This assertion is founded on the circumstance, that pain cannot be produced in one case by forcible attempts at straightening; and that in the other, an instinctive feeling of weakness in the part exists. Great reliance cannot be placed on this mode of diagnosis. Patients labouring under false ankylosis have usually as little

* Opportunities of witnessing exceptions to the infallibility of this test have been afforded me by two instances of ankylosis of knee, in which the patella had become immovably attached to the tibia by exostosis, or by ossification of the ligamentum patellæ In these the attempt to straighten the limb induced pain in front of the knee, either in consequence of the superior edge of the patella being struck against the articular surface of the femur, or through the strain exercised on the adventitious connecting bony matter. In a third case I was unable to distinguish whether the patella was ankylosed to the femur or to the tibia.

apprehension of examination as those affected with true ankylosis, unless they may have already been subjected to painful investigation; and a delicate nervous female would be sensitive to impressions whether affected with complete or incomplete ankylosis.

It is scarcely necessary to mention, that in a supposed ankylosis, the practitioner should be quite certain no tenderness of the articulation from the previous inflammation remains. A completely ankylosed limb also conveys to the hand of the examiner a sensation of union throughout; the tibia and femur in true ankylosis of the knee give the impression of a single bone; and many of the patient's sensations in the limb are referrible to a want of elasticity, which is not absent in false ankylosis even when no motion is *visible*. Thus, in true ankylosis of hip or knee, the patient is more susceptible to shocks consequent on any sudden exertion — the whole frame may be jarred by an unexpected false step. This is in great measure obviated by the flexibility of the ankle, and powerful action of the gastrocnemii; for as in ankylosis of hip or knee the joint is usually flexed, the patient is compelled to apply the toes only to the ground, and the elasticity of the gastrocnemii may, in some degree, compensate for the stiffness of the affected joint.

In true ankylosis of the ankle, the sensibility to shocks reaches its maximum, as no compensating power exists unless the patient walk with the knee slightly bent. This jarring may be painfully felt in the spinal column.

The prognosis of stiff-joint is in the great majority of instances favourable. A somewhat prevalent opinion exists, that true ankylosis is not uncommon, whereas extended observation shews that it is comparatively very rare. This is sometimes a satisfactory preliminary information to possess on the examination of a doubtful case of deformity; for although capable of leading to error, the practitioner may be enabled

to undertake, with more confidence, a case which but for this circumstance would be hopeless. Angular is more amenable to treatment than straight ankylosis, and is fortunately the more common affection. The proportion of individuals who apply for the cure of straight ankylosis does not, according to my experience, exceed one-fiftieth of those affected with the angular form. Thus, during the last seven years, I have witnessed three cases only of straight ankylosis of the knee.*

TREATMENT OF ANKYLOSIS IN GENERAL.

The cure of stiff-joint is accomplished by mechanical and chirurgical means, employed singly or conjointly. A large proportion of cases of false ankylosis, being those in which the rigidity depends on muscular contraction without structural shortening, and with little adhesion of the tissues on the flexed side of the joint, yield to the agency of the first class of remedies. The simplest case of stiff-joint is that which, for a few days or weeks, has been immovable from inflammation of the articulation, without its termination in any disorganising process. Popular practice, based on experience, consists in the energetic employment of frictions and passive movements, by which the stiffness is gradually removed; volition returns, and the part is restored to activity. In a higher degree of rigidity, medical practitioners add the use of steam and vapour baths, oleaginous (relaxing?) embrocations, fomentations, shampooing, and the application of mechanical instruments. It is difficult to state after how long a period of immobility a joint may be restored by mechanical appliances. We are credibly informed, that in India religious

* The statistics of this subject, derived from the relative numbers of individuals affected with either form who apply for relief, may reduce too low the proportionate frequency of straight ankylosis. As locomotion can be effected with straight ankylosis of knee, persons thus affected may rarely seek the means of cure.

devotees, after twenty years' duration of voluntary contortion of the limbs, are restored to symmetry and activity by the energetic manipulations of the native medical practitioners. It appears not improbable, that a greater natural looseness of the articulations in the inhabitants of warm climates, and some influence exercised by an elevated temperature, in relaxing the contracted tissues, may favour this result of oriental skill and perseverance; but the practitioner who would expect similar good fortune in our climate would be disappointed. The difference between the relative facility of elongating the muscles of adults and children has already been alluded to (p. 7). In a favourable case of false ankylosis in an adult, we may succeed in effectually straightening the limb after the lapse of four or five years; but it is rarely possible in a child, unless of very lax fibre, permanently to relieve, by mechanical means, a severe contraction of similar duration. Great muscular shortening in the child is with difficulty overcome; but whatever resistance to straightening depends on cicatrices and adhesions, will be more easily removed in the child than in the adult.

Where the immobility and contraction is considerable and of long duration, has resisted proper mechanical appliances, and principally or greatly depends on muscular shortening, the propriety of resorting to surgical means should be entertained. These consist in the section of the tendons of the contracted muscles and ligaments, and of those bands of fascia and adventitious tissue which are situated within easy reach of the scalpel, followed by the application of appropriate mechanical apparatus, frictions, and manipulations. In the mode of operation, the Stromeyerian method—namely, that of subcutaneous section—should be followed, and the limb be suffered to remain at rest in the ankylosed position until the small punctures have cicatrised. The limb should then be gradually extended or flexed, as the nature of the ankylosis

may require — the progress of this part of the treatment being slow or rapid, according to the size of the joint affected, and the degree of dependence of the resistance to restoration on the superficial or deeply situated tissues around the articulation.* The length of time requisite to effect a cure varies from one week to six months; and occasionally a much longer period elapses before the articulation entirely resumes its functions.

The treatment by the combined surgical and mechanical method may be divided appropriately into three stages: the surgical operation, the mechanical reduction of the ankylosis, and the period employed in restoring freedom of movement by passive and active exercises, frictions, manipulations, baths, &c. The first and second stages usually engage but little time; the last, which is commonly of longest duration, becomes often very tedious.

The cure of false ankylosis requires, under the most favourable circumstances, the union of skill, great care, patience, and perseverance; and its accomplishment in some instances is so difficult as to discourage both patients and practitioners who are not endowed with the qualities above mentioned so essential to success.

The length of time during which an articulation may have been in part or wholly immovable, remaining, nevertheless, capable of restoration, appears sometimes incredible. I have successfully undertaken the cure of ankylosis of the most important articulation, the knee, which had existed twenty-six years. Restoration after ten and fifteen years' deprivation of the services of an articulation is not uncommon.

True ankylosis, or osseous union of the articular surfaces, having been regarded as a fortunate termination of articular disease, has rarely been the subject of curative attempts.

* See remarks on the "forcible sudden cure of angular ankylosis," in Introduction.

The most notable and most ingenious of these is the relief of true ankylosis of the hip, by Dr. Barton of Philadelphia, by sawing through the neck of the femur, and, after obtaining closure of the external wound, resorting to daily movement of the limb, so as to produce an ununited bone, an artificial joint. This operation, in Dr. Barton's case, succeeded perfectly; in the hands of other practitioners, it has been alternately successful and fatal. It is an operation infinitely preferable, in my opinion, to that proposed for the relief of true ankylosis of the knee, by my friend Prof. Dieffenbach, of Berlin; namely, breaking down the osseous union by chisel and mallet.

I entertain no doubt of the capability, in some instances, of restoring motion in an articulation between the surfaces of which the deposit of osseous particles has already commenced. I have thus successfully treated two cases of ankylosis of the knee—the one resulting from a punctured wound, the other from fracture, extending into the articulation, produced by the fall of a heavy stone on the limb,—accidents both peculiarly apt to produce true ankylosis. In neither case, before subjected to treatment, could the slightest motion between the articular surfaces be detected. The previous history, the local examination, and the phenomena witnessed during the treatment, concurred in indicating the existence of incipient osseous union between the articular extremities (see Cases).

ON ANKYLOSIS OF THE HIP.

Inflammation of the hip-joint, acute and chronic, may be induced by mechanical injury—a blow, or fall, on the part; or it may arise as a sequela of typhus, scarlatina, and variola, or other general disturbance of the health of the individual. Rheumatism is an occasional cause; but more commonly the inflammation partakes of that specific character denominated strumous. By whichever cause the inflammation is produced,

ankylosis is not an unfrequent termination of it; and this may be false or true, angular or straight, simple or combined with change in the relative position of the articular surfaces. I shall commence with the consideration of the most common form:

False ankylosis of the hip without luxation (simple).—The stiffness, or rigidity, may be slight, depending only on some thickening of the capsular ligament, and rigidity of the muscular tissues, from repose of the articulation; lymph may have been effused into the interior, or on the exterior, of the articulation, constituting unnatural adhesions; suppuration may have proceeded externally, the route of the pus being indicated by firm bands and cicatrices more completely obstructing the motion of the member. This is the least severe form of rigidity or ankylosis of the hip, and may result from slight attack of inflammation, as strumous inflammation (ordinary hip-joint disease), from rheumatic affection of the hip-joint, and from mechanical injury. Each of these causes may induce stiffness, immobility, deformity, and lameness, in consequence of the temporary disuse of the joint being attended by structural shortening of the muscles, in the manner described page 8.

Symptoms.—The thigh is rigidly flexed and adducted, and consequently the patient can effect but slight or no voluntary movement of the joint; the trochanter major remains in its natural position; considerable flattening of the nates, from wasting of glutæi; tension of adductor longus, add. brevis, add. magnus, pectineus, rectus femoris, and occasionally of sartorius and gracilis muscles, exist. Little or no motion of the head of the femur in the acetabulum is perceptible on manipulation. With the duration of the ankylosis, the knee becomes more approximated to the abdomen and the opposite member. The patient applies the toes only to the ground, and walks with considerable lameness.

False compound *ankylosis of the hip, or false ankylosis of*

the hip with luxation.—In many cases the ligaments, by means of which the head and neck of the thigh-bone are attached to the acetabulum, become loosened and disorganised; the rim of the acetabulum and part of the head of the femur may be destroyed by ulceration and caries, and the femur being thus left to the unresisted action of the muscles of the hip, becomes luxated, and subsequently rests either on the dorsum ilii, or the ischiadic foramen. In either of these situations, the process denominated the formation of a new joint sometimes ensues; but whether so great natural efforts at reparation take place or not, much rigidity, muscular shortening, and distortion remain.

Symptoms.—Rigid flexion and adduction of thigh, immobility, atrophy and tension of muscles greater than in the simple form of false ankylosis; the trochanter is less prominent, and situated at a greater distance from the anterior superior spine of the ilium than natural; the thigh is shortened by elevation of the femur on the dorsum ilii or on the edge of the sacro-sciatic foramen, and by the caries or absorption of the head of the bone, producing considerable deformity; the leg and foot are rarely so large as the corresponding parts in the sound limb, their development having been impeded by long rest of the limb during the articular disease which produced the ankylosis; the diminution in the length of the member, arising from these various causes, may vary from half an inch to five inches, locomotion being effected with the assistance of a boot, the sole or heel of which is raised to a proportionate thickness; or the flexion of the thigh may be extreme, and, by preventing the application of the foot to the ground, compel the patient to resort to the use of a crutch.

True ankylosis of the hip.—*True* ankylosis of the hip so rarely ensues before the age of twenty-five or thirty, and is consequently so seldom met with in actual practice, that without the existence in pathological museums of preparations

demonstrating the osseous union of the femur and ilium, the practitioner might almost doubt its occurrence. This statement may be opposed to the observation of many of my readers, who, having been accustomed to regard true ankylosis of hip as a comparatively frequent event, have, on the cessation of disease of the hip and production of luxation and deformity of the member, assumed the osseous union of the bones to be one of the necessary consequences of the unnatural state of the parts. During the last seven years of a tolerably large experience, I have been consulted in five cases only in which I was convinced that true ankylosis did exist; whereas I have examined from fifty to seventy cases of false ankylosis during the same period. True ankylosis may be simple, the head of the femur remaining in the acetabulum, which is uncommon; or the true ankylosis may be compound, the head of the bone being luxated, which is the common form. True simple ankylosis may be *angular* or *straight:* that is, the limb be ankylosed either in the flexed or extended position; whereas in true compound ankylosis, or true ankylosis with luxation, the ankylosis is always *angular*, the limb being fixed in the semi-flexed position.

I have witnessed, in the living subject, two instances only of true ankylosis of hip without luxation; these resulted from suppuration in the hip-joint, consequent in one instance on typhus, and in the other on acute rheumatism. The ankylosis was in the extended position of the limb, the head of the femur being immovably fixed in the acetabulum; the thigh slightly rotated outwardly, and the toes everted; movements of the member were effected through the intervention of the pelvis, acting on the opposite femur and the lower lumbar vertebræ. In one instance, *true straight* ankylosis of the corresponding knee, and *false angular* ankylosis of the opposite knee, co-existed (see Cases).

Ankylosis of the hip, by a species of invagination, some-

times occurs, a quantity of osseous matter being deposited in or around the capsular ligament, completely enclosing the head of the femur within the acetabulum as with a shell. A limited amount of mobility of the joint may remain.*

Symptoms of *true* ankylosis of hip *with luxation* are, as regards the position and form of the limb, precisely similar to those of false ankylosis with luxation, the difference being in the absolute immobility of the thigh. The diagnosis is often extremely difficult, as, in false ankylosis, owing to the great degree of muscular tension, and rigidity arising from deposition of lymph or cicatrices, mobility of the femur can, in some cases, be detected only after repeated examination, and often not until the pelvis has been firmly fixed by an able assistant. The alleviation of the inconvenience of ankylosis of hip depends on the existence of mobility, however slight; the importance of a correct diagnosis cannot, therefore, be too highly estimated: in some cases considerable tact and experience in examination are requisite to enable the practitioner to arrive at a correct decision.

In every form of ankylosis of the hip, *contracture* of the corresponding knee and ankle may co-exist; and if the ankylosis be wholly or partially remediable, the contracture of these parts will require separate treatment (see Contracture).

Treatment of ankylosis of hip.—If, in chronic or acute inflammation of the hip, the curative efforts of the practitioner have been so successful that, after a few weeks or months' duration of the disease, resolution has been effected, and slight muscular contraction, with thickening of the articular tissues, alone remain, attention to manipulation, friction and extension of the limb, with cautious exercise, will restore the functions of the member. If the muscular contraction and other resistance cannot be overcome by these means, an apparatus, consisting of a circular bandage fastened to the

* Vide *Museum Anatomicum*, Edw. Sandifort auctore.

pelvis, and sometimes to the shoulders, with a steel spring attached behind to the femur, in order to effect extension of the member, may be worn, and will, in a short time, sufficiently remove the contraction to permit the application of the entire sole to the ground. Should the use of apparatus and friction prove insufficient, the division of the contracted muscles offers the only chance of restoration; but this should not be resorted to until the practitioner is satisfied that no risk of reproducing the disease of the hip exists. Thus, within the first, second, or third year of the cessation of the hip-joint disease, the attempt at restoration by the aid of mechanical apparatus will usually be preferable; and if, in this manner, the member cannot be completely straightened, the aggravation of its position will be prevented. Even in cases of false ankylosis, when osseous union appears imminent, judicious recourse to mechanical means will place the femur in such a position that the deformity will be much diminished, and the member prove much more serviceable than when, from ignorance of the value of attention to this circumstance, the limb is permitted to remain in the completely flexed position in which ankylosis usually exists. The section of tendons is of great value in false ankylosis of hip, even when many years have elapsed since the original disease: thus I have successfully treated adults who had suffered from morbus coxarius in earliest infancy.

The prognosis must, however, be guarded, as, in the investigation of the pathological condition of the hip, owing to its anatomical conformation, greater difficulty in ascertaining the precise amount of change the structures have undergone exists than in ankylosis of many other articulations. Except in children, the flexion of the hip cannot be entirely overcome; but if, in older persons, restoration can be so far effected by the aid of tenotomy, that, instead of walking with a crutch or crutches, and the knee drawn up to the abdomen,

the thigh can be permanently straightened, so that the patient can partially place the foot on the ground,—or if, instead of walking with the knee inverted, and not without the assistance of a boot raised four or five inches, locomotion can be effected with a shoe raised at the heel but little more than an ordinary boot, the patient's gratitude will amply repay the practitioner for the trouble he has experienced in the treatment of a case of no very encouraging nature (see Cases).

ANKYLOSIS OF THE KNEE.

The great frequency of ankylosis of the knee, and the comparative facility with which, owing to the proximity of the articular tissues to the surface, pathological changes may be studied in this joint, induced me, in the remarks on ankylosis in general, pp. 5-13, to refer to this affection for the illustration of ankylosis of other articulations. Many observations which belong properly to this place will, therefore, be found in that section. The causes and varieties of ankylosis of the knee are there enumerated, and its morbid anatomy has been in great measure anticipated. Ankylosis of the knee may be straight or angular, complete or partial.

Straight partial (*false*) *ankylosis of the knee* occurs much less frequently than the angular, and is more often the result of mechanical violence or of acute inflammation, as the rheumatic, than of chronic disease. I have, however, been consulted in one case in which this form of ankylosis was produced by strumous disease of the head and shaft of the femur. The motion of the joint was, in this instance, extremely limited, from the deposition of osseous matter in the popliteal region. A lamina of bone, some inches in length, resembling in form an ivory paper-knife, extended from the upper and posterior part of the tibia towards the junction of the lower and middle third of the femur, somewhat similar to a preparation in the museum of the Royal College of Surgeons, London,

but not ossified with the femur, as in the preparation in question. The patient could execute flexion to the amount of 15°, by acting on the flexor muscles of the knee, considerable resistance to further bending being experienced in the tendon of the quadriceps femoris. Manual efforts to bend the joint caused a yielding to the extent of a very few degrees, the principal impediment being the adventitious osseous deposit in the poplitea.

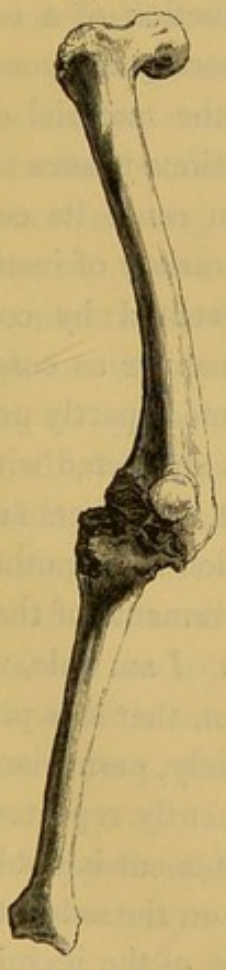
Little or no deformity accompanies partial straight ankylosis of the knee, except that arising from imperfect development or wasting of the muscles of the thigh. These offer occasionally a strong contrast with the powerful mass of the gastrocnemii, the energy and growth of which has been excited by the increased demands on their activity consequent on the stiffness of the knee. The leg commonly presents slight rotation outwardly, the toes being everted. In the act of walking, therefore, the foot more easily avoids inequalities on the surface of the ground.

Straight partial ankylosis is sometimes the result of imperfect cure of angular ankylosis, extension having been accomplished, but the joint remaining incapable of flexion. This may arise either from adhesion of the patella to the condyles of the femur (see Cases), or probably from an alteration in the position of the semilunar cartilages.

Treatment of straight partial ankylosis of the knee.—If slight, mechanical extension, manipulations according to the general principles already enumerated. Subcutaneous section of the tendon of the quadriceps femoris when indicated, or of the adhesions of patella to femur when membranous. I entertain no doubt of the utility and perfect safety of the last operation, under ordinary circumstances, in healthy constitutions; but I have never resorted to it, or recommended its performance, as patients affected with straight partial ankylosis of knee can walk with comparative ease, and it has con-

sequently not appeared advisable to perform any operation that, by the remotest possibility, might produce articular inflammation, and endanger the limb. Although straight stiff knee does not prevent locomotion, it occasions great inconvenience in walking on uneven ground, ascending a hill or staircase. The great flexibility of the ankle to a certain extent relieves the discomfort from this cause; but the limb being, from the inflexibility of its most important joint, rendered relatively too long, it is felt continually *in the way:* patients eagerly embrace the hope of obtaining a slight amount of flexion; and this may, in the majority of instances, be obtained by perseverance in mechanical means, manipulations, and frictions.

FIG. 6.



Complete straight ankylosis of knee, exhibiting ossification of patella to external condyle, and the ordinary displacement of the tibia. Fusion of the femur and tibia.

Complete, true or osseous, STRAIGHT ANKYLOSIS *of the knee* presents the same external characters as *partial straight* ankylosis, excepting that the immobility is now complete, firm osseous union having taken place between the femur and tibia. In this state of the articulation, the case must be considered incurable: it is, however, fortunate that it does not prevent active, although limited, use of the limb.

Cases, however, occur, in which, after inflammation, and the formation of membranous adhesions between the articular

surfaces, and incipient osseous deposits in those adhesions, the attention of the practitioner may be usefully directed to the attainment of a more favourable position of the member, and to the retention of a limited amount of mobility. It should be borne in mind, that a slightly-flexed position of the knee is preferable to an absolutely straight one, and that even mobility to the extent of a few degrees will greatly ameliorate the patient's condition. It does not, at first view, appear probable that any interference on the part of the medical attendant can arrest the deposit of calcareous spiculæ into the abnormal tissues of an articulation, and the production of a complete ankylosis. On the contrary, it is generally supposed that, whenever the organic crystallisation of the material circulating through the newly-organised adventitious tissues has commenced, no means which we possess can cause its cessation. It is, however, well known that, in a variety of instances in inorganic matter, crystallisation is prevented by continued motion of the molecules, in the same manner as coagulation of the human blood within the living frame is partly prevented by the continued motion to which it is subjected within the blood-vessels. Whether the opinion that these facts are applicable to the question under consideration be hypothetical or not, we should imagine that passive movements of the articulation would merely retard the process. I am able, notwithstanding, with some confidence to affirm, that this process of ossification or calcareous deposit may safely, permanently, and advantageously be interrupted, by frequently repeated gentle movements of the articulation. This statement is liable to the objection that, in the experiments made on the subject, it may be doubted whether conclusive evidence of the incipient calcareous deposit existed.* Surgeons entertain well-founded objections to movement of a recently inflamed articulation as a

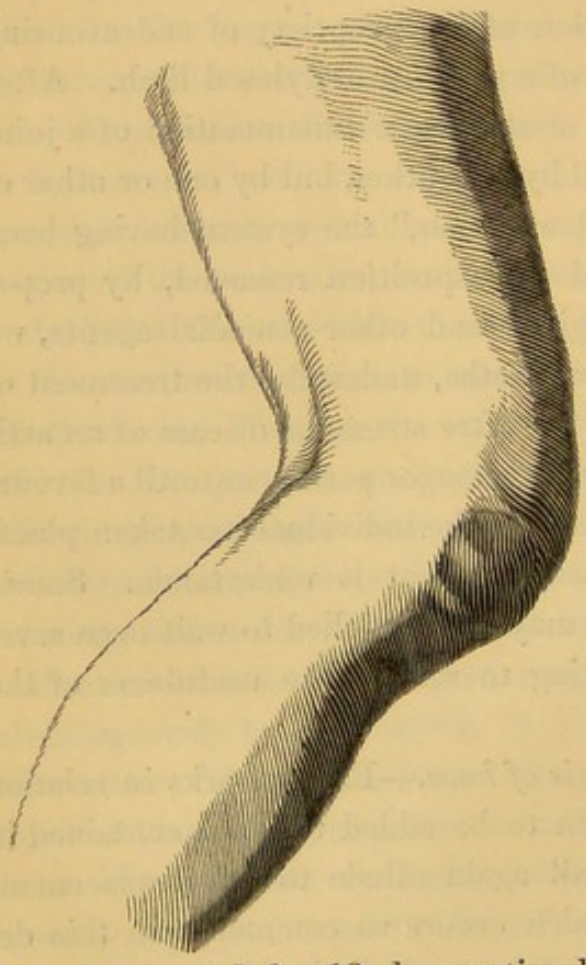
* See remarks on this subject by Dr. Barton in *American Cyclopædia of Medical Science*, article Ankylosis.

means of preventing ankylosis, the danger of reproduction of disease being, in incautious hands, great; but too limited a view of the nature of the previous disease, exaggerated fears of the danger of relapse, often indispose the practitioner to attempt restorative measures. It should be remembered that most local inflammatory affections require for their production and maintenance a morbid condition of the general frame, and that, during the continuance of the local disease, a beneficial change in the general health often ensues; so that those means which, at one stage of the affection, would have been ruinous to the articulation, may, at another, be safely applied. The condition of the general health should constitute an important guide in the determination of the propriety of endeavouring to restore the flexibility of a partially ankylosed limb. After severe traumatic injury, or rheumatic inflammation of a joint which has not terminated by resolution, but by one or other of the "terminations of inflammation," the system having been depleted, or the morbid predisposition removed, by proper regimen, or by antiphlogistic and other remedial agents, we may usually, within a few months, undertake the treatment of the resulting ankylosis; but after strumous disease of an articulation, it is prudent to wait a longer period, or until a favourable change in the diathesis of the individual has taken place, before active orthopædic treatment is undertaken. Sometimes, in such cases, we may be compelled to wait even several years before attempting to restore the usefulness of the member.

False angular ankylosis of knee.—Few remarks in relation to morbid anatomy remain to be added to those contained in pages 13-26; but I shall again allude to the displacement of articular surfaces, which occurs so commonly in this deformity. The symptomatology, and the determination of remediable from irremediable cases of stiff knee-joint, constitute one of the most interesting subjects of orthopædy.

False angular ankylosis of knee presents itself in numerous grades of severity, as described p. 12: the articulation may, from the previous disease, have undergone the smallest appreciable injury in structure and function; or the greatest amount of disorganisation, ulceration, adhesions, cicatrices, and luxation, compatible with remaining motion, may be present. The amount of contraction of the limb may vary from a few degrees, the sole being scarcely raised from the ground; or it may be so considerable that the heel almost touches the nates. In the majority of cases, the knee is flexed less than to a right angle, as at fig. 7; sometimes it does not exceed

Fig. 7.

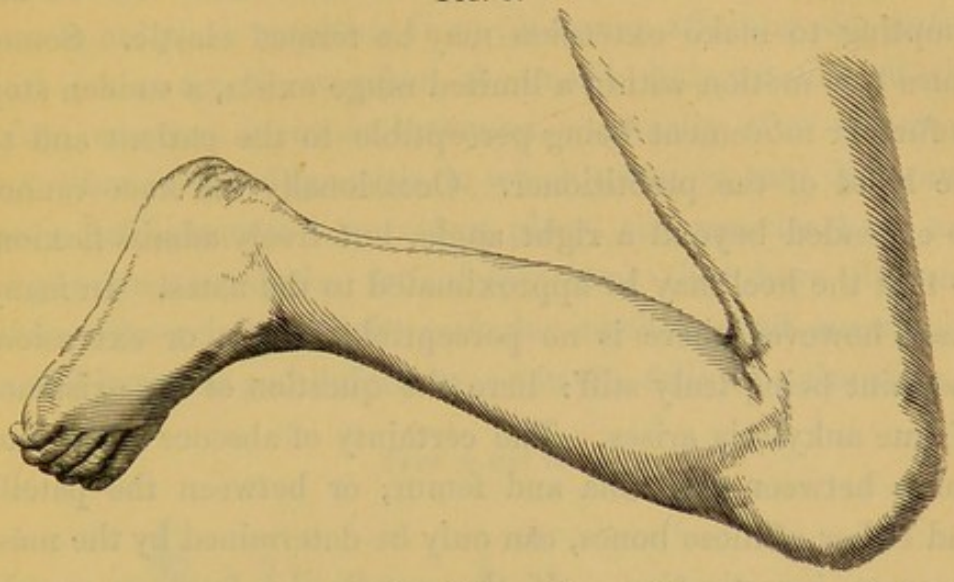


False angular ankylosis of right knee, from acute inflammation occurring as a sequela of puerperal fever. Slight outward rotation of leg exists, and the patella is applied to internal edge of outer condyle (see Cases).

that represented fig. 10, locomotion being frequently in such cases impossible, except with the aid of crutch and stick, or raised shoe; or it may reach the degree shewn fig. 8. The

greatest contraction is usually produced by acute inflammations of the articulation. Artificial supports beneath the knee, or the use of crutches, become then indispensable to locomotion.*

FIG. 8.



Incomplete angular ankylosis of knee, from phlegmonous erysipelas of entire limb (see Cases).

The degree of muscular shortening corresponds with the amount of the contraction. The tendons of the biceps and those of the semimembranosus and semitendinosus muscles are tense when extension is attempted. Sometimes the biceps appears alone contracted; but, in such cases, I have usually found section of the inner hamstrings necessary to complete the restoration. In false angular ankylosis of many years' duration, the lower portion of the vastus externus, and the portion of the fascia lata with which it is connected, are much contracted, and even the sartorius and gracilis tendons.

Emaciation and wasting of the bones, more particularly of the thigh, accompany every case of false knee-ankylosis. Occasionally some contraction of the gastrocnemii, and other *flexors* of the foot, coexists. The degree of motion remaining

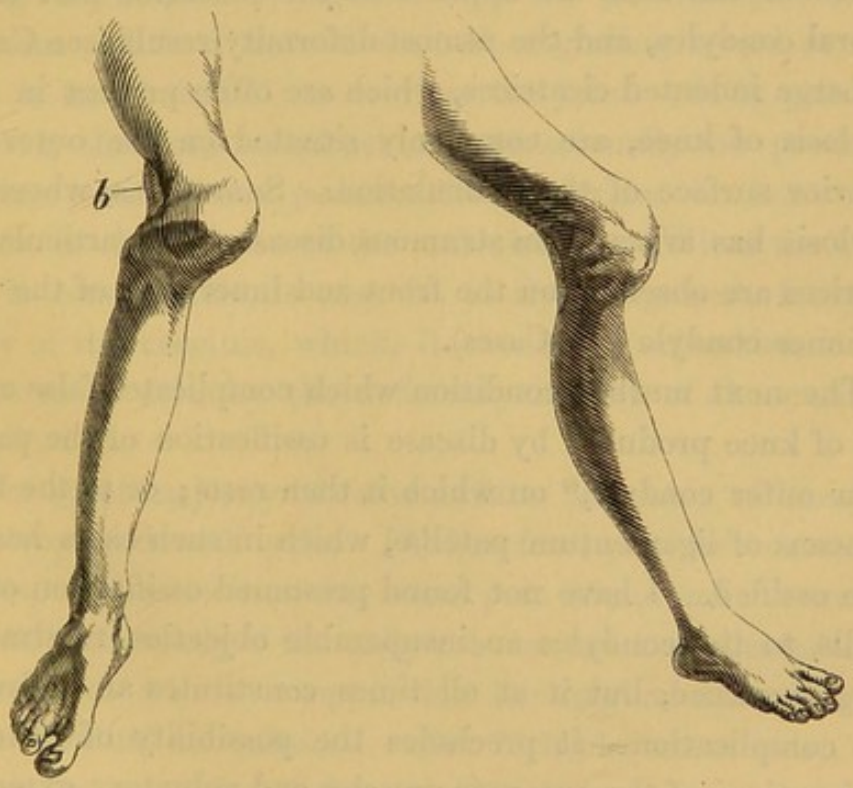
* I have in my possession, as trophies of successful cure of long-standing ankylosis, a cabinet of wooden legs and crutches, which have been thrown aside by different individuals.

in partial knee-ankylosis is variable: in some cases in which the contraction habitually amounts to 70° or 90°, the limb admits of slow extension by pressure, and reduction of the contraction 20° or 30°. The kind of resistance felt on attempting to make extension may be termed elastic. Sometimes free motion within a limited range exists, a sudden stop to further movement being perceptible to the patient and to the hand of the practitioner. Occasionally the knee cannot be extended beyond a right angle, but freely admits flexion, so that the heel may be approximated to the nates. In many cases, however, there is no perceptible flexion or extension, the joint being truly stiff: here the question of the existence of true ankylosis arises. The certainty of absence of osseous union between the tibia and femur, or between the patella and either of those bones, can only be determined by the most accurate investigation. If the patella be free, or merely united by membranous or ligamentous tissues, some slight motion on its perpendicular axis may be discovered; one of its edges, more commonly the inner, may be depressed. A person endowed with an accurate sense of touch may feel a slight movement of the edges of the tibia and femur where they are applied to each other.

In addition to these means, the practitioner will observe whether, on endeavouring to extend the limb, the hamstring muscles be rendered tense. Caution is necessary when resorting to this source of diagnosis, lest the voluntary tension of the muscles by the patient be mistaken for that maintained by the attempt to straighten the limb. The patient's mind should be diverted during the examination; and it should be noted whether the tension and relaxation of the tendons be really produced by the alternate extension and relaxation of the limb effected by the hand of the practitioner. I have already alluded to the production of pain on the contracted and uncontracted sides of the member, and the relative value

of the information derived therefrom (p. 28). The external configuration of the knee in false angular ankylosis varies: the joint may be rigidly flexed, the form not differing from that of the sound knee similarly flexed. This is often the case in ankylosis resulting from phlegmon affecting the entire limb (as at fig. 8), or after rheumatic inflammation of the joint; whereas, in other instances, especially after strumous and other forms of synovitis, in which softening and disorganisation of ligaments have taken place, the muscles have not simply contracted the articulation, but they have likewise altered the relation of the articular surfaces, and occasioned partial luxation and deformity, as in the following drawings.

FIGS. 9 and 10.



Front and lateral views of stiff knee-joint, from chronic (strumous) disease, excited by general debility, consequent on an attack of fever (see Cases).

The displacement (see figs. 4, 5, 9, 10) invariably consists of a dragging backward of the head of the tibia from the

anterior and inferior part of the articulating surface of the condyles of the femur by the continued action of the hamstring muscles, and is increased by the rotation outwardly of the head of the tibia, effected by the more powerful action of the biceps, favoured probably by the peculiar arrangement of the crucial ligaments, and sometimes by a cause mentioned page 20. This outward rotation of the tibia is accompanied with eversion of the leg, both of which are represented figs. 9, 10. The patella and its ligament are abnormally placed on the external condyle. The conjoint phenomenon of displacement, rotation, and eversion of tibia exists in different degrees: it may be slight, as at fig. 7; or almost complete dislocation of the tibia may be present, and even the anterior surface of the tibia be applied to the posterior part of the femoral condyles, and the utmost deformity result (see Cases).

Large indented cicatrices, which are often present in false ankylosis of knee, are commonly situated on the outer and posterior surface of the articulation. Sometimes, where the ankylosis has arisen from strumous disease of the articulation, cicatrices are observed on the front and inner side of the tibia and inner condyle (see Cases).

The next morbid condition which complicates false ankylosis of knee produced by disease is ossification of the patella to the outer condyle,* on which it then rests; or to the tibia, by means of ligamentum patellæ, which in such cases has become ossified. I have not found presumed ossification of the patella to the condyles an insuperable objection to straightening the knee, but it at all times constitutes an unfavourable complication—it precludes the possibility of restoring the functions of the extensor muscles and voluntary extension of the joint by the patient. Ossification of patella to tibia through the intervention of ossific deposit in ligamentum pa-

* I have met with ossification of patella to internal condyle. The cause of the ankylosis was fracture, extending into the joint.

tellæ, or by means of exostosis from tibia, is more unfavourable. The ossification having taken place during the flexed position of the limb, the patella and the uniting osseous matter form a segment of a circle of bone, the upper extremity of which effectually prevents extension of the limb, by pressing against the femur when extension is attempted.

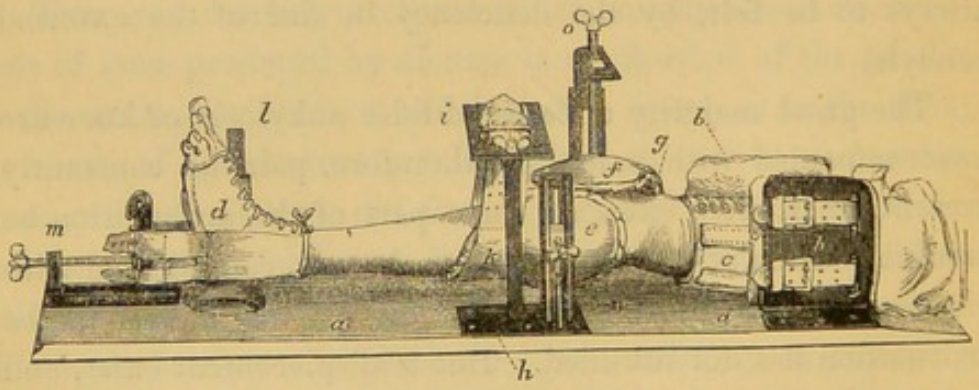
The attrition of cartilage and bone which occurs in false ankylosis of knee is confined to the external condyle, and to the portion of the tibia which rubs against it. I have seen it slight, the cartilage alone having suffered, or one or two lines in thickness of the surface of the condyle itself have been removed; but sometimes nearly the entire external condyle has disappeared, as at fig. 5. Slight attrition may be suspected during lifetime, when, together with the peculiar position of the joint which I have described, a grating sound or crepitus is heard or felt on moving the joint. It is possible, however, that this crepitus may occasionally be produced by fibro-cartilaginous pedunculated growths, or loose substances, in the interior of the articulation. When the attrition is considerable, it may be easily recognised, independently of the crepitus, which, it should be remarked, is not always to be felt, by the deficiency in size of the external condyle.

The great majority of cases of false ankylosis of knee are unaccompanied with pain. If, therefore, pain be constantly present, or if, after exercise, some part of the articulation be painful, particularly if the ankylosis be not complicated with displacement, we may suspect that the original disease of the articulation has not subsided. But if displacement exist, and pain on the inner side of the articulation be experienced only after unusual exertion, and it subside after moderate rest without application of remedies, we may infer that it is the result of an undue straining of the ligamentous structures of the part, consequent on the weight of the body being ineffi-

ciently borne by the contracted limb, and its having a tendency gradually to produce further displacement.

Treatment of false angular ankylosis of knee (stiff-knee).—When, from the existence of mobility, the absence of disease of the articulation or other insuperable obstacle, the practitioner has determined the remediableness of a case of false ankylosis, he will then decide on the propriety of confiding to mechanical means, or of resorting to surgical operations. The remarks, pp. 30-33, on the treatment of ankylosis, indicate the principles on which the treatment should be conducted; and to complete the details of the mechanical plan, I may enumerate the apparatus I have found serviceable under such circumstances. A common splint bandaged on the contracted side of the articulation during the intervals of the manipulations, frictions, baths, &c.; or if the flexion of the limb prevent the application of a perfectly straight splint, each of a series of tin splints, at different angles, may be successively employed, until the limb is perfectly straightened. A very common and excellent contrivance consists of two wooden or metal splints, adapted to the posterior surface of the thigh and leg, connected behind

FIG. 11.



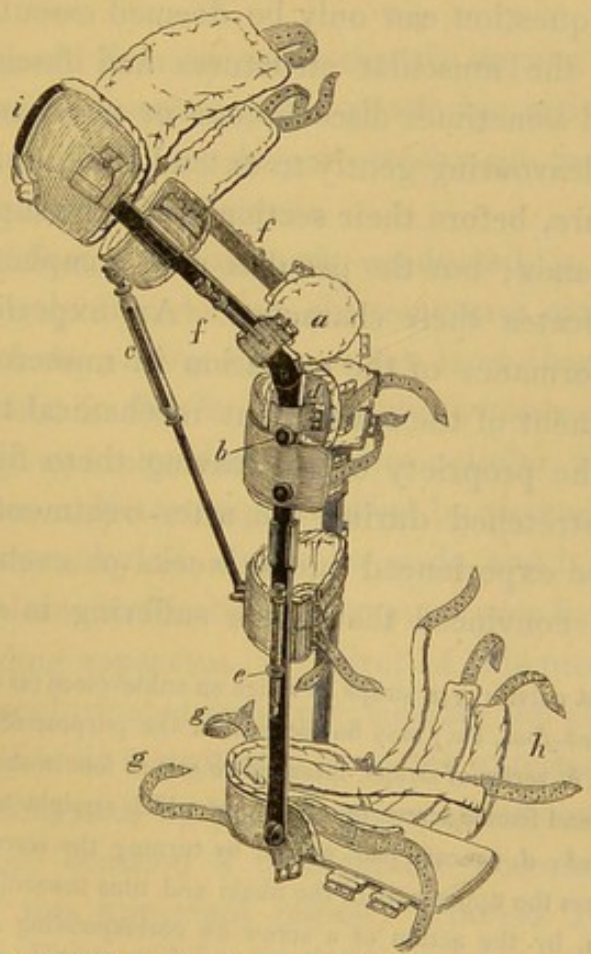
Apparatus for remedying compound false ankylosis of knee. *a a*, mahogany board; *b b*, movable padded metal pieces, and *c*, laced circular bandage, serving to encase and fix the thigh and pelvis; *d*, laced stocking and straps, secured to the screw *m*, constituting the means by which the foot is drawn downwards, and the articular extremities of knee drawn asunder; *f*, concave pad, serving, through the agency of *o*, to press

by an ordinary male and female screw, by means of which the joint may be gradually extended; or the more complex apparatus, figs. 11, 12, may be used.

The structures which, in the chirurgical cure of false

down the knee; *e*, movable pad, attached to a movable screw, adapted so as to press the fibula and tibia inwardly; *g*, similar pad, to press the internal condyle outwardly; *h*, one of a pair of uprights, on which rests transverse piece *i*, serving as a bridge, from which, by means of the strap *k*, the upper portion of the tibia is elevated; *l*, a spring, the action of which inverts the foot, and, combined with *m*, inverts the leg. The application of this instrument confines the patient to bed or couch.

FIG. 12.



Apparatus for effecting extension of the knee. It consists of a firm steel bar, extending, on both sides of the limb, from pelvis to the sole, with joints at knee and ankle, the thigh and leg pieces being capable of elongation by means of the sliding pieces and screws *f f e e*. The part *i* indicates the padded upper extremity of the apparatus, adapted for pressure

angular ankylosis, may require division, are, the tendons of the biceps, semi-membranosus, semi-tendinosus muscles, the lower portion of the fibres of the vastus externus muscle and the fascia above it, some bands of fascia in the popliteal region, and sometimes the more superficial of the nerves which supply the gastrocnemii or traverse its surface. Occasionally section of the sartorius and gracilis tendons will assist the restoration of the limb. The necessity of each or all of these sections will be determined from the existence of such an amount of tension in each of the tissues as will greatly or insuperably oppose mechanical elongation. The section of the nervous filaments in question can only be deemed essential after having divided the muscular structures and fasciæ, when the operator will sometimes discover one or more cords rendered tense on endeavouring gently to extend the limb. If unaware of their nature, before their section he might suppose them to be fibrous bands; but the peculiar pain complained of by the patient indicates their character. An experience founded on the performance of the operation in numerous cases, and the management of the subsequent mechanical treatment, has shewn me the propriety of not leaving these filaments undivided. If stretched during the after-treatment, very severe pains may be experienced during weeks or even months. In short, I am convinced that much suffering is spared by the

against pelvis; *g g*, straps to which an ankle-piece (as at fig. 14, *Treatise on Club-foot, &c.*) may be secured for the purpose of holding down the heel; *h*, series of straps, intended to secure foot in shoe; *c*, an ordinary male and female screw, by turning of which straightening of the knee is effected; *d*, concave pad, which, by turning the screw *b*, may be made to press the upper part of the fibula and tibia inwardly; *a*, similar pad, which, by the action of a screw on corresponding side of apparatus, effects pressure against the internal condyle. When the affected limb is properly secured, the articular extremities of femur and tibia may be separated as described page 55, by gradual operation of the screws *f f e e*. A padded knee-cap, to prevent elevation of the knee, completes the apparatus.

section: the filaments reunite, and recovery from the ankylosis ensues without neuralgia, and without numbness or diminished power in the muscles. The operator will carefully avoid severing one of the main branches of the sacro-sciatic. A certain bold operator is said to have once divided the sacro-sciatic itself, a mistake in extenuation of which nothing can be advanced. The peroneal nerve has been divided by the same puncture as the biceps tendon: paralysis of the muscles of the outer side of the leg and foot, and much loss of sensation, ensued, the recovery from which was only partial when I examined the patient in consultation three years after the operation.

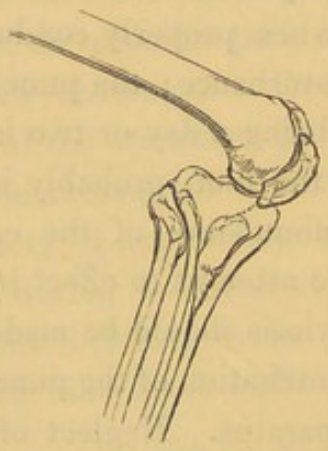
Should an old firm indented cicatrix appear, by its adhesion to the bone beneath, capable of offering resistance to the extension of the limb, its deeper attachment may, if practicable, be *subcutaneously* divided.

The operation, when properly conducted, is followed by no pain or febrile disturbance; the punctures cicatrise on the third or fourth day, being a day or two later than when tenotomy is practised in the foot, probably in consequence of the greater laxity and abundance of the cellular tissue in the popliteal region. No attempt to effect by violence immediate reduction of the ankylosis should be made, and it is important to await complete cicatrisation of the punctures before application of extending apparatus. Neglect of this precaution may separate the agglutinated puncture, lacerate the cellular tissue of the ham before it is protected from the external air by perfect cicatrisation, and, by providing a spot for commencement of suppuration, occasion a considerable abscess among the structures of this important region; whereas I have never witnessed the slightest delay in the cicatrisation, not the most trifling blush of inflammation, or one drop of pus, where rest of the limb has been scrupulously enjoined.

On union of the punctures, the more important portion of

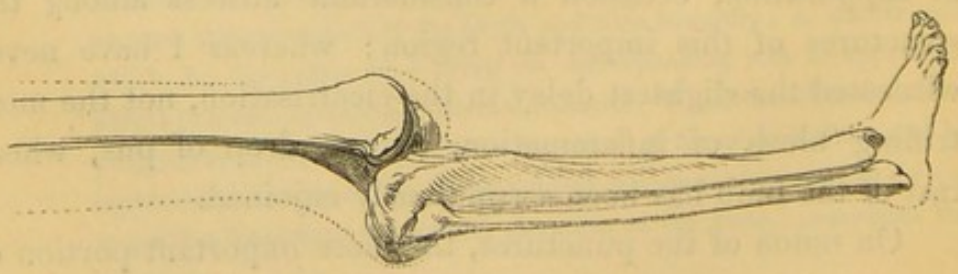
the treatment, the gradual replacement of the ankylosis, may be commenced. In false ankylosis without displacement, the simplest apparatus, as either of those described p. 50, may suffice; but when displacement and rotation of head of tibia, with eversion of the leg, exist, a better adaptation of mechanical powers to the exigencies of the case is required. The objects to be attained are—1. extension of the knee; 2. the carrying forwards, and sometimes inwardly, of the head of the tibia; 3. simultaneous inversion of the leg. I have ascertained from repeated experience, that when attention has been directed to the removal of the abnormal flexion only, an increased displacement of the head of the tibia sometimes resulted. Thus, supposing the relation of the tibia and femur to have been, prior to the operation, as represented in the following diagram,

Fig. 13.



the effect of simply extending the limb will be to change the position of the bones thus,

Fig. 14.



the leg having been extended, but the displacement being undiminished. I have, in a case of this nature, found the luxation of the bones complete, and their extremities as movable as in a recent luxation from injury, the limb presenting to the eye of the almost affrighted attendant an appearance of greater deformity and weakness than before the commencement of his well-intentioned but injudicious management. In a common knee-extending apparatus no contrivance is present to facilitate the gliding of the bones into their proper position; on the contrary, the pressure necessarily exercised on the head of the femur during the extension forcibly urges the bones against each other. The method of obviating this imperfection in extending apparatus consists in availing ourselves of the pelvis as a fixed point, and by making extension from the ankle and foot so draw down the entire limb as will not only *extend* it, but elongate to such an extent the ligaments of the joint and other structures exterior to it, as will enable the tibia to rise into its position.* By this elongation, the painful pressure of the femur and tibia against each other is completely avoided. When the ends of the bones are presumed to be held asunder, pressure on the upper and inner surface of the condyles, and on the lower and outer surface of the tibia and fibula, will essentially promote their reposition. The eversion of the leg and foot is overcome by gradually drawing the malleoli inwardly simultaneously with the more important process of reducing the luxation (see figs. 11, 12).

The figures 15-17 exhibit the relative appearance of a case in which, from the extension having alone been attended to, great prominence of the condyles and eversion of the leg ensued in the manner above described; but by proper

* The utmost caution is requisite during extension, to protect the point of the knee and heel from undue pressure, as excoriations in these situations may entirely frustrate the operation.

FIGS. 15, 16, 17, 18.

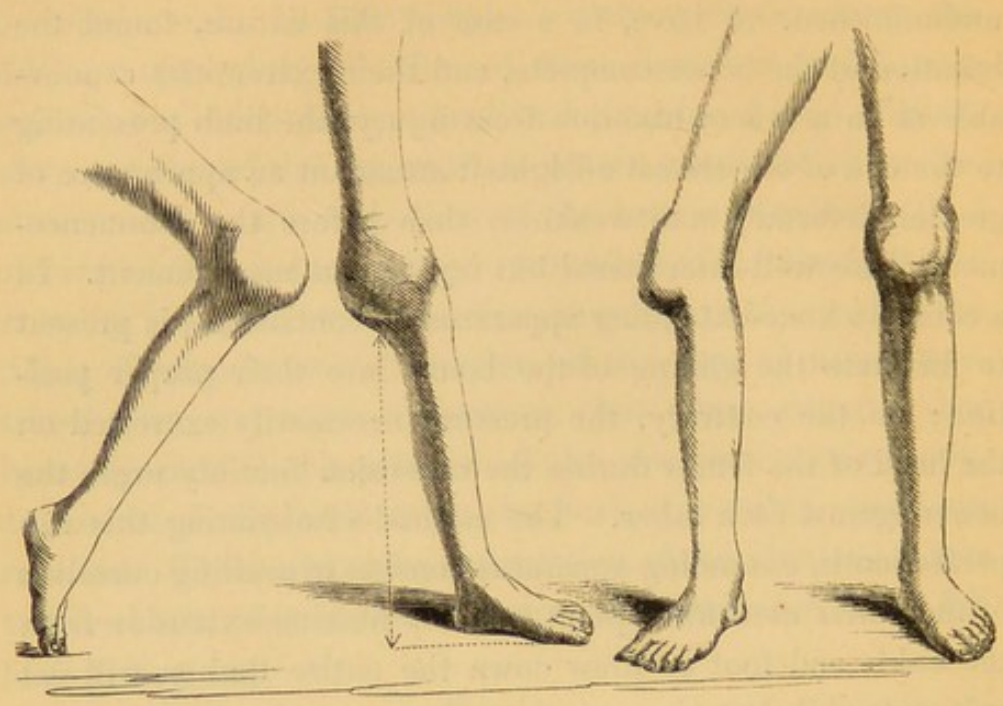


Fig. 15, *False angular ankylosis of left knee, from white swelling*, viewed from inside. Fig. 16, Front view, and fig. 17, external aspect, of the same, after *extension* only had been effected. Fig. 18 represents the appearance of limb after the eversion and outward rotation of leg were removed, and the muscles developed by exercise (see Cases).

subsequent management, the joint was restored to the condition represented fig. 18.

On the completion of the extension, and replacement of the knee, the joint is usually found to be very *stiff* in its new position; the next object of the practitioner will therefore be to endeavour to restore its movements, which is often more difficult than the previous part of the treatment. Passive movements should be diligently practised several times daily, or as often as the tender state of the articulation will permit; frictions, vapour-baths, and the application at intervals of the extending apparatus (fig. 12), its action being reversed, to produce flexion. It occasionally happens that, with the utmost exertion, the knee cannot be bent to the extent of the previous abnormal flexion. In two obsti-

nate cases of this nature, the patients, youths of 17 and 18 respectively, were enabled to bend the knee to the full extent after falling accidentally with the leg beneath the body. Exercise may be permitted as soon as the limb is straightened; but, in the majority of instances, a firm mechanical support, as an ordinary *iron* on the outside of the limb, with a spring to assist the motion of the weak extensor muscles of the knee, will be necessary for weeks or months afterwards, according to the severity of the case. A laced knee-cap may be subsequently substituted for this support.

The average length of time occupied in the straightening and reduction of the displacement of articular surfaces after the operation, in adults, is two months; in children the success is more rapid. The process of restoring mobility, without which the individual continues to walk lamely, is seldom completed, in severe cases, within a period varying from three to six months, at the expiration of which the patient usually walks long distances very comfortably. If the articulation continue unusually tender, or the deformity have existed many years, twelve months may elapse before the patient can be considered fully restored.

Should the case have been unusually complicated, as from adhesion of patella, or the permanently abnormal position of this bone on the upper and outer part of the external condyle prevent action of the extensor muscles, the restoration of the knee may appear very imperfect. If it, however, be straight, the femur be fairly in apposition with the tibia, and the joint admit motion in a range from 20° to 40°, the patient will be able, without artificial aid, to walk long distances with perfect ease, and will express himself very grateful for the change in his condition.

ANKYLOSIS OF THE ANKLE (STIFF ANKLE).

Complete ankylosis.—Notwithstanding that the connexion

of the inferior extremities of the tibia and fibula with the astragalus constituting the ankle is effected by a ginglymoid articulation, true ankylosis of this part is not common. Severe mechanical injury, such as fracture accompanied with dislocation, occasionally induces complete ankylosis; but partial ankylosis, resulting from chronic inflammation of the joint, and caries, is more often observed. The forms in which complete ankylosis of the ankle occur are described by Sandifort (*Museum Anatomicum*); but as the enumeration of the various points by which the astragalus may become united to the tibia and fibula can serve no practical result, I shall refer the reader curious in this matter to that elaborate work.

The *prevention* of osseous ankylosis subsequently to injury of an articulation has been successfully applied by Dr. Barton, of Philadelphia, to the ankle-joint. This gentleman states,* that he had "succeeded in re-establishing a joint at the ankle, which, from compound dislocation and fracture of the ankle-joint, required the ablation of $2\frac{1}{2}$ inches of the inferior extremity of tibia. In this case a quantity of bony matter was secreted, as well from the inferior extremity of the tibia as the fibula, which would have terminated in true ankylosis but for the motion to which I had subjected the part as early as the state of the limb admitted of it, thus applying the same principle of practice to the re-establishing of the motions of a fractured joint which had influenced me in the formation of an artificial joint."† Dr. Barton watched this case two years, during which no ankylosis occurred.‡

* *American Cyclopædia of Medicine*, art. Ankylosis.

† Vide hujus operis p. 42.

‡ It cannot be doubted that many prudent surgeons daily have recourse to the same plan after injury of articulations; but surgical writers have not given to the subject of prevention of ankylosis the prominence it merits.

As locomotion can be effected with the foot completely ankylosed at a right angle, or at a more obtuse angle, with the leg, individuals thus affected do not often present themselves for treatment. It is, therefore, unnecessary for me longer to dwell on this subject, except to venture a hint to surgeons concerning the best position to be given to an ankle in which the process of complete ankylosis is supposed to be imminent. Authors have usually advised that the foot should be flexed to a right angle with the leg; I have, however, observed that less inconvenience is experienced in walking from an ankylosis of the ankle in which the heel is raised half an inch or an inch from the ground. When the ankle is immovable at a right angle, from osseous ankylosis, the entire weight of the body is borne by the heel, and most unpleasant shocks are transmitted in a straight line through the necessarily extended knee to the spinal column and its contents; but when the heel is slightly elevated, a portion of the weight of the frame is received on the anterior extremity of the foot, the shock is diminished by the elasticity of the arch of the foot, and, by the necessarily slightly bent condition of the knee corresponding with the elevation of the heel, the gait is rendered more elastic, and progression effected in greater comfort. A piece of cork nearly equal in thickness to the elevation of the heel may be placed within the shoe: this affords an occasional support to the heel in walking, and prevents the occurrence of tenderness, which is apt to arise from treading on the point of the foot only. In the case of true ankylosis of ankle at right angle, the individual may advantageously wear a shoe with heel sufficiently elevated to produce a small amount of flexion of the knee.

Partial ankylosis of the ankle.— The more frequent form of this affection results from strumous inflammation of the ankle and tarsal bones. I have remarked that in such cases the disease usually commences in the lower extremity of the

fibula and adjacent parts of the astragalus and os calcis, succeeded by suppuration and caries. The ankle-joint is weakened by the degeneration of the osseous structures which should support it in its external aspect, the patient is inclined to tread on the inner edge of the foot, and the peronei muscles being henceforward relaxed, gradually contract and elevate the outer edge of the foot. The progress of the disease is usually slow; several months, or two or three years or more, elapsing before the ulcers completely heal. Cicatrisation is accompanied with the deposit of adventitious tissue beneath the skin in the tract of the previous suppuration: this abnormal tissue constitutes firm bands of adhesions, connecting the eroded or carious extremity of the fibula with the astragalus and os calcis; and by the occurrence of that contraction in its fibres which is peculiar to newly formed tissue, the elevation of the outer edge of the foot is augmented. Increase of deformity rapidly follows the disturbance of the equilibrium of the muscles. The peronei so completely obtain the preponderance, that a considerable eversion of the toe is added to the elevation of the outer margin of the foot, and a Talipes valgus is produced, to which, for the purpose of distinction from true Talipes valgus, I have affixed the term *spurious* (see Cases).

Rheumatic inflammation may induce immobility and a similar contraction, with deformity of the foot amounting to false ankylosis. But if the rheumatism do not especially affect the synovial membrane, but through the continuance of chronic inflammation in the muscles, tendons, ligaments, and fasciæ, on the posterior and internal aspect of the ankle, and particularly in those of the sole, induce so great atony in their fibres as will permit a sinking of the tarsal arch, a spurious Talipes valgus, or flat-foot, results. Eversion of the foot, stiffness of the tibio-tarsal articulation, causing the individual to walk on the inner margin of the foot, accom-

pany the deformity. This constitutes, however, contracture, rather than false ankylosis (see Contracture).

False ankylosis of the ankle may likewise occur in the extended portion of the foot similar to Talipes equinus, as in a case elsewhere related by me.* Elevation of the heel to the extent of five inches existed. This great contraction arose probably from the long-continued entire repose of the limb, rendered necessary by the severity of the scrofulous disease on which the ankylosis depended.

I have witnessed false ankylosis of the ankle in which the foot presented the form of Talipes equino-varus, the heel being elevated to the extent of an inch and the toes inverted. The cause in this instance was strumous inflammation of the ankle, succeeded by suppuration, with caries of the internal malleolus. During the progress of the disease, contraction of the internal ligaments of the ankle and of the posterior tibial and other muscles on the back of the leg ensued, the rationale of which has been already explained.†

The above examples of false ankylosis of the ankle are simple, *i. e.* unaccompanied with luxation of the astragalus. A case of unreduced luxation of the ankle, the astragalus becoming permanently lodged in an abnormal position, would ultimately constitute *compound* ankylosis of the ankle, and might become the subject of orthopædic treatment, as in the case of " old luxation of the foot," related by Professor Dieffenbach.‡ The astragalus had been luxated backwards from accident, the foot being immovably fixed in the position of Talipes equinus. Reduction was accomplished after section of the tendo achillis.

Other contractions and deformities of the ankle from acci-

* See *Treatise on Club-foot and analogous Distortions*, p. 123.

† Idem, p. 131.

‡ *Ueber die Durchschneidung der Sehnen und Muskeln.* Berlin, 1841; p. 302.

dent or disease, resembling ankylosis in some of its features, are not uncommon; but as the injury has been inflicted at a distance from the tibio-tarsal articulation, I shall describe them under the head of "Contracture of the Ankle."

The *symptoms of false ankylosis of the ankle* may be in great measure deduced from the preceding observations. The history of the case, the nature of the stiffness, the dependence of the symptoms on causes directly affecting the structures composing the articulation, will distinguish false ankylosis from other affections accompanied with similar changes in the form and position of the part (contracture, congenital or acquired club-foot). The judgment of the practitioner will at once enable him to distinguish false ankylosis from chronic inflammation.

In each of the forms of false ankylosis of the ankle that I have recognised, the rigidity of the articulation, whether resulting from adhesions within or without the capsular ligament, or from the consecutive muscular contraction, may be so considerable that little or scarcely any mobility of the bones entering into the composition of the articulation may be perceptible; thus, an opinion of the curability of several cases has depended on the detection of slight alternate tension and relaxation in the tendons of the contracted muscles whilst manipulating the limb. Other circumstances, detailed p. 27, may assist the diagnosis of complete from partial ankylosis.

The amount of lameness arising from this affection is often very considerable, and the inconvenience and pain experienced by the individual is usually greater than might be believed to exist by the practitioner whose opinion had been founded on a simple examination of the articulation. The circumstance which, in addition to the pain and discomfort attendant on locomotion with a stiff ankle-joint, occasions a ready application to professional skill for relief is, the constant tendency evinced in the severer forms to increase of lameness

and deformity consequent on the disturbance of the equilibrium of the muscles, and on the weight of the body being transmitted to the astragalus, whilst this bone is not situated horizontally beneath the axis of the limb, so as properly to communicate the weight, by means of the tarsal arch, to the ground. The portion of integument on which the greatest pressure in walking is exercised becomes excoriated or covered with painful corns, and sometimes affected with diffuse inflammation.

Treatment of partial ankylosis of ankle. — The general treatment applicable to the knee may be resorted to, with equal advantage, in slight cases in which the stiffness does not amount to apparent immobility. But if, from the duration of the affection, the intensity of contraction, or if less active means have failed, the case be judged irremediable without section of the more prominently contracted muscles, this operation should be performed; and it is fortunate for patient and operator that the treatment is liable to be attended with fewer inconveniences and interruptions than the similar affection of the knee-joint. Should the partial ankylosis have taken place in the extended position of the foot, subcutaneous section of the tendo achillis will, in most cases, sufficiently relax the articulation to permit its restoration; if the foot be rigidly fixed in the position of Talipes equino-valgus (elevation of the heel with abduction), the peronei may require division; if in that of T. equino-varus (elevation of heel with adduction), the posterior tibial tendon, flexor longus pollicis, and plantar fascia should be included in the operation. In slighter modifications of each of these varieties, the practitioner will be satisfied with severing the tendo achillis, and trust to mechanical extension for the elongation of the remaining contracted muscles and fasciæ. The apparatus adapted for the subsequent gradual replacement of the foot is represented in my *Treatise on Club-foot.*

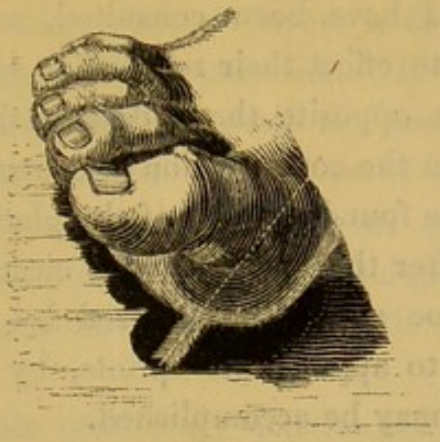
ANKYLOSIS OF THE TARSAL AND METATARSAL BONES.

This form of ankylosis usually takes place in the normal position of the bones, and can scarcely be recognised during lifetime. As the only inconvenience likely to result from it is loss of elasticity in the tarsal arch, it can rarely or never become the subject of orthopædic treatment. Accidental wounds, contusions, and fractures of the instep, accompanied with displacement, may terminate in irremediable ankylosis. Some cases of sinking of the tarsal arch may be accompanied with so great alteration in the position of the tarsus, with immobility of the individual bones, that it is probable that compound ankylosis may ultimately result. These cases are, however, accompanied with derangement of the ankle-joint, and are included in the consideration of false ankylosis of the ankle.

ANKYLOSIS OF THE PHALANGES OF THE TOES.

Rheumatic inflammation of the entire foot is occasionally succeeded by considerable rigidity of the phalangeo-metatarsal articulations, with thickening of the tissues surrounding them, and much deformity — partial ankylosis. The metatarsal articulation of the great toe is more apt to suffer than the remainder, and more particularly from gouty inflammation. Occasionally the affection of these minor articulations co-exists with false ankylosis of the ankle-joint, or it may be accompanied with considerable contraction of the muscular and fibrous tissues of the sole, in which case the retraction of the flexor tendons causes rigid flexion of the whole of the phalanges, except the first phalanx of each toe, which remains extended, in consequence, I believe, of the resistance opposed to the flexion of the whole of the phalanges by the extensor tendons. On examination, the flexor and extensor tendons are found equally contracted; but as the contraction of the extensors is consecutive, the relief of the contraction of the flexors will,

FIG. 19.



Rigidity and contraction of the toes from rheumatism.

unless the case be of long standing, enable the toes to re-assume their proper position.

Considerable inconvenience in walking is experienced from this state of partial ankylosis of the toes,—less, indeed, from the simple alteration of their position than from the pain produced by the weight of the body being continually thrown in an improper manner on the metatarso-phalangeal articulations. In the natural relation of these parts, the inferior round extremity of each metatarsal bone is received into the concave articular surface of the corresponding phalanx, and the metatarsal bone and phalanx receive each its share of the weight imposed on the anterior extremity of the foot in locomotion; but when the first phalanx is extended in the manner above described, as at fig. 19, the inferior part of the articulation and the round head of the metatarsal bone are more exposed to pressure, the ligaments are incessantly stretched and inflamed, causing continued suffering in walking.

Treatment.—Friction and manipulation in slight cases; but as articulations affected with rheumatism usually remain tender for a considerable time after cessation of the inflammatory process, the patient will scarcely desire or permit any attempt to remove the resulting deformity until considerable inconvenience has been experienced. Those cases of false anky-

losis of the toes have therefore commonly existed several years before I have been consulted, so that I have rarely been enabled to effect their restoration without section of the flexor tendons opposite the middle of the first phalanx (see Cases). When the complication of contraction in the sole has existed, I have found division of the plantar fascia essential to the cure. After the operation and cicatrisation of the punctures, each toe should be secured by adhesive plaster, or by bandage, to appropriate splints, by which their perfect straightening may be accomplished.

Ankylosis of the metatarsal articulation of the great toe, and of the articulation of the first phalanx with the second

Figs. 20 and 21.

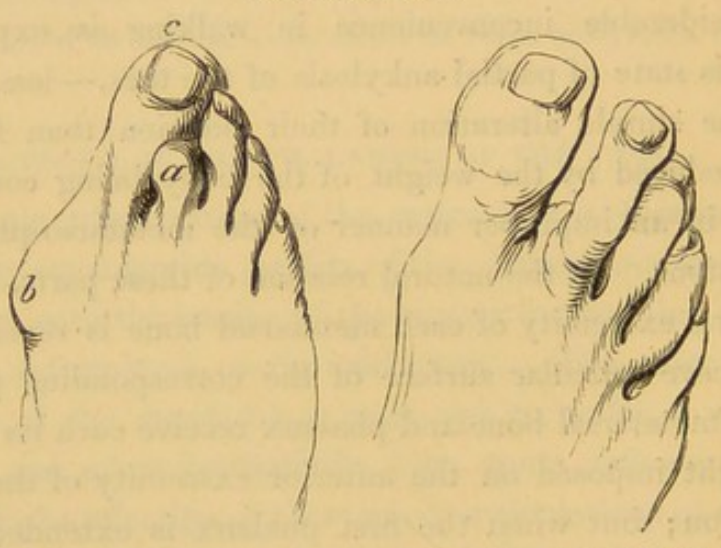


Fig. 20. False ankylosis of second toe, and metatarsal joint of great toe, contrasted with well formed foot, fig. 21.

phalanx of the second toe, are the most frequent instances of ankylosis; yet are they unjustly considered by medical practitioners such ignoble cases of the affection, that their treatment is usually consigned, under the name of bunion and corn, to a class of empirics designating themselves chiropodists and corn-cutters. No long time has elapsed since the entire art of curing contractions and deformities was entrusted to similar hands. I hope it will not be considered that I am

attracting the attention of the medical profession to a subject beneath its consideration when I devote a few lines to the pathology and treatment of this affection. If the endeavour to relieve physical pain and to increase the comfort of suffering individuals be the boasted prerogative of our profession, then may these so truly painful affections as much claim the investigation of the pathologist and therapeutist as some neuralgias or other chronic ailments as little attended with danger to life.

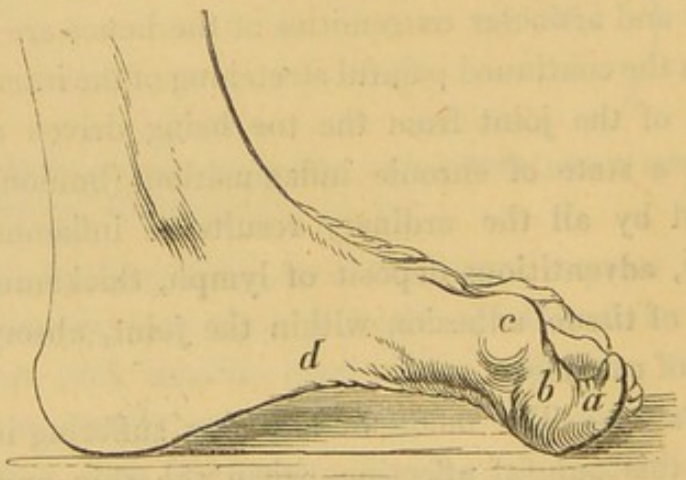
A rigid, immovable condition — partial ankylosis — of the metatarsal joint of the great toe (*b*, fig. 20) is frequently the result of inflammation, induced by the pressure of an improperly fitting boot or shoe against this projecting part of the inner margin of the foot, greatly aggravated by the terminal extremity of the toe (*c*, fig. 20) being pressed outwardly against the other toes through the absence of sufficient room in the shoe for the proper position of the several toes. For a considerable time the friction and pressure limit their mischievous influence to the skin, producing induration and thickening ("a corn," clavus); then the subcutaneous fascial tissue is swollen and inflamed, until at length the pressure to which the capsular ligament and articular extremities of the bones are subjected, as well as the continued painful stretching of the internal lateral ligament of the joint from the toe being driven outwardly, maintain a state of chronic inflammation (bunion), in time succeeded by all the ordinary results of inflammation and ankylosis, adventitious deposit of lymph, thickening and induration of tissue, adhesion within the joint, absorption, and attrition of cartilage.

Treatment.—The mode of relieving suffering in the first stage of this painful affection, when the skin and subcutaneous tissues are alone affected, is only indirectly connected with the subject of false ankylosis; I may, however, be excused the allusion to it in this place. The indications are

three:—1. to relieve the inflammation by leeches, cataplasms, fomentations, or cooling lotions; 2. to remove the painful stretching of the internal lateral ligament of the articulation by gradually pressing the great toe into its natural position, *i. e.* into a straight line with the inner margin of the foot, which may be effected either by the introduction of a soft pad between the great toe and the adjacent toe, or by means of a thin strip of whalebone bandaged as a splint along the inner margin of the foot; 3. to endeavour to prevent the recurrence of the mischief by recommending the sufferer to wear a boot or shoe of appropriate construction.

Another form of partial ankylosis of the great toe is that in which flexion of the first phalanx exists (*b*, fig. 22), the terminal phalanx (*a*, fig. 22) being extended, or turned upwards. In this case both articulations will be found more or less immovable and exceedingly painful, especially when the individual takes exercise. This condition is equally the result of badly made shoes, and probably from such as are much too short. It appears evident from an inspection of

FIG. 22.



Rigidity and contraction of both articulations of great toe. c, Inflamed and enlarged metatarsal articulation (bunion). A painful corn existed beneath great toe, where articulation of first and second phalanges improperly touched the ground. (See Cases.)

the accompanying figure that the natural expansion of the inner margin of the foot, which takes place when the weight of the body is thrown on it in walking, being restrained by the short shoe, a double flexure occurs in the toe to accommodate it to the small space allotted to it. In the cases that have fallen under my observation the general form of the tarsus had undergone much alteration, the convexity was less than natural (this had probably preceded the deformity of the toe); but the principal change observed was an elevation of the inner margin of the foot (*d*, fig. 22), apparently produced by the instinctive habit of treading on the outer edge in order to avoid pressure on the painful great toe.

Treatment.—The indications are the same as in the preceding deformity, with the addition, in many cases, of section of the contracted flexor of the great toe, and sometimes of the terminal fibres of the abductor pollicis.

Incomplete ankylosis of the second toe is a very common affection, and consists (see *a*, fig. 20) in constant extension of the first phalanx, fixed flexion of the second and third phalanges, with rigidity of the articulation of the first with the second phalanx. It appears to be the result of the whole of the toes being inconveniently crowded in a narrow pointed shoe; although I have so often been consulted by several members of the same family similarly affected, that I have sometimes felt inclined to attribute the affection to hereditary proneness to contraction of some of the muscular fibres of the sole, and consequent abnormal flexion of the toe. At the same time, so many individuals have assured me that they had never perceived the contraction until wearing a particularly tight pair of shoes, that I am convinced it has in them arisen from this cause. Another hereditary tendency possibly capable of inducing this affection is that of proneness to flat-foot, with which this affection of the toe is, indeed, often

combined.* As flat-foot is preceded by sinking of the tarsal arch, the tissues of the sole are stretched, and it is not impossible that the tension of the short flexor muscle of the toes may be relieved by flexion of this, the longest of the four smaller toes. Another circumstance which in flat-foot possibly favours the production of this state of the second toe is, that owing to the yielding of the tarsal arch the natural tripod of the foot is destroyed, the bony fabric is no longer applied to the ground at three points only, viz. at the os calcis and the first and fifth metatarso-phalangeal articulations, but the intermediate metatarso-phalangeal articulations sink and directly receive a portion of the pressure; hence a corn is formed beneath the metatarso-phalangeal joint of the second toe, succeeded by inflammation of the tendon passing under it, and contraction.

This false ankylosis of the second toe is usually accompanied by another exceedingly painful corn on the summit of the ankylosed joint, in contact with the shoe, and a third at the tip of the toe, where this part is applied to the ground. The suffering experienced from these various sources must needs be considerable, when we reflect on the frequency with which amputation of the toe has been submitted to for its relief. The inflammation of the integument investing the ankylosed joint is often augmented to so great an extent, that a slough ensues, by which the corn and deeper tissues are thrown off, exposing the immediate covering of the joint. This process is usually attended with entire relief for many years, or so long as the individual has the prudence to wear properly constructed shoes.

Treatment.—When this affection has not existed many years, especially in children, it may be removed by sedulously bandaging the toe, night and day, to a strip of whalebone or

* See Description of "Flat-foot."

a wooden splint. The sensation of resistance within the articulation is so great, that fears may reasonably be entertained that even after removal of any existing contraction in the flexor tendon, the joint may have undergone so much injury from pressure and undue friction, that its restoration will be impossible. This apprehension deterred me, some years since, from section of the flexor tendon, anxiously awaiting the opportunity of anatomically examining such an articulation. I was enabled to do so through the kindness of the late Sir Astley Cooper, who, according to his custom of neglecting no apparently trifling matter that might prove practically useful, after amputation of a toe thus affected, dissected it with the utmost minuteness, and favoured me with an inspection of it. The absence of any alteration of the articulation capable of impeding its restoration has led me to recommend operation of many similar cases, with invariable success. The flexor tendons should be severed by puncture opposite the middle of the first phalanx. If the section be completely accomplished, the toe will readily admit of immediate straightening, and should be loosely secured on a small wooden splint, and maintained in a state of extension for many weeks afterwards, to prevent relapse. Twenty-four hours' suspension from exercise is the only inconvenience attending the relief of this troublesome complaint. (See Cases).

ANKYLOSIS OF THE LOWER JAW.

Rigidity of the articulation of the inferior maxilla, amounting to false ankylosis, induced by inflammation, sometimes requires the employment of mechanical means of enlarging the aperture of the mouth. Wedges of wood, or a small instrument acting by means of a screw, applied between the opposing rows of teeth, are usually employed for this purpose. The wedge is the only available means, when the teeth are

closely approximated; but as soon as sufficient separation is effected to admit the screw-instrument, this may be substituted. But the necessary pressure on those teeth to which the instrument is directly applied is commonly productive of so much inconvenience and pain, that, in rigid cases, patients rarely exhibit sufficient perseverance to obtain more than a slightly increased separation of the jaws. The closure of the mouth is occasionally so complete, that the removal of one or more of the teeth may be indispensable for administration of food, and the insertion of the mechanical contrivance.

When rigidity of the jaw depends on chronic inflammation of the articulation, and complete or incomplete ankylosis be apprehended, the practitioner may consider himself fortunate if, by continued insertion of a wedge between the teeth, he can succeed in causing the jaw to become fixed with a small space between the grinding surfaces.

Partial ankylosis of the maxilla may be accompanied with muscular contraction, and, consequently, division of the contracted muscular fibres be required; but I am acquainted with no case (of rigidity of the jaw consequent on disease of the joint—partial ankylosis) in which the operation has been necessary, although it may be inferred, from the analogy of other articulations, that such cases may occasionally arise. But the operation has been successfully performed for the relief of rigidity of the jaw arising from causes not *directly* influencing the articulation, as contracture from sloughs of the mucous membrane of the mouth, and other tissues of the cheek (see Contracture of the Lower Jaw).

ANKYLOSIS OF THE VERTEBRÆ.

Incomplete and complete ankylosis, arising from different forms of inflammation, may occur in any portion of the vertebral column. The parts most liable to be thus affected are,

the more movable pieces of the column, namely, the cervical and dorsal vertebræ, which are likewise those most exposed to accidental injuries, such as strains, blows, or falls. Ankylosis of the articulating processes of the vertebræ corresponds in general with ankylosis in other situations, being the result of chronic or acute inflammation of the articular tissues (*scrofulous, syphilitic, rheumatic*); but the anatomical peculiarity of this portion of the osseous system occasions characteristic features in its pathology; thus, the intervertebral substance, which often resists the ravages of disease long after the bodies of the vertebræ have been affected, when ultimately involved, undergoes disorganisation, loses its semi-pulpy, semi-laminated structure, becomes absorbed, its place being supplied by ordinary plastic matters, into which calcareous substance is at length deposited, and true ankylosis of the bodies of the vertebræ ensues. Distortion usually accompanies the ankylosis, the spine being bent either to one side or forwards. The bodies of the vertebræ are often compressed and absorbed on the side towards which the spine inclines. Caries is a frequent concomitant.

Structural shortening of the muscular, tendinous, and fascial textures situated on one side of the spine, with elongation and debility of those on the opposite side, necessarily accompanies ankylosis, and constitutes an important obstacle to the straightening of the column even in those cases in which restoration is practicable. The attempt to effect straightening of the spine when complete or osseous ankylosis has taken place is unjustifiable, because impossible: the pretended curative treatment of decided cases of this nature has constituted, notwithstanding, one of the numerous impositions practised by a host of charlatans, on the credulity of a large class of sufferers. Persons thus affected, after eight years' constant confinement to the recumbent position and incessant application of mechanical contrivances, permission

to assume the erect posture having been denied for a single hour during that long period, have at length found themselves as deformed as before, duped of their time and pecuniary resources, and martyrs to dyspepsia and other corporeal ailments.*

The consideration of ankylosis of vertebræ in its practical application is so intimately connected with the subject of spinal curvature in general, that I shall defer, until I treat of that affection, some observations that might be inserted here. One form of disease and ankylosis of the cervical vertebræ, however, exists, to which, as it is liable to be classed with and treated as a species of *wry-neck*, I may here allude. It is a scrofulous inflammation of the vertebræ, appearing to commence in the articulations of one side of the neck, accompanied with tumefaction of the cervical glands of the corresponding side. The disease induces inclination of the head to the affected side, immobility of the cervical portion of the column, structural shortening of the sterno-mastoideus, trapezius, and deeper-seated muscles of this region, and a perfect imitation of the ordinary *wry-neck* from contracture (see chapter on Wry-neck). Incomplete or complete ankylosis of the articulations of the vertebræ and caries of their bodies may ensue. It is distinguished from true *wry-neck* by the commencement of the disease in the spine, the local tumefaction and pain, the distortion being consecutive, the acute suffering experienced in the diseased part by sudden manual or instrumental attempts to rectify the position of the head; sometimes by the co-existence of strumous disease in other parts of the frame; and, when complete ankylosis takes place, by the deformity attaining its maximum and remaining stationary. My attention had not been attracted to this affection of the vertebral column until within the last four years, during

* I shall endeavour at a future period to shew in what cases of spinal distortion remedial treatment is admissible.

which period I have witnessed three cases similar in every respect. In all, the inclination of the spinal column was to the right side, the chin being approximated to the left shoulder. The treatment of such cases consists in the occasional application of leeches to the painful part, counter-irritation by cantharides, inunction of ung. pot. iodidi, or, still better, the frequent pencilling of the part with the tinct. iodinæ. The internal use of iodine is equally serviceable, whether the suspected cause be scrofula, syphilis, or rheumatism,—mild administration of hydrargyrum, with tonics, as quinine, iron, and the mineral acids.

It is also proper to endeavour to afford mechanical support to the head, and thus obviate increase of deformity. This part of the treatment is difficult where the head becomes so rotated on its axis as to simulate wry-neck; but when the head is simply inclined forwardly, its support may be easily accomplished. For the apparatus best adapted to these purposes, see *Wry-neck*. Should the disease of the vertebræ subside without complete ankylosis, and the distortion mainly depend on muscular contraction, the assistance of tenotomy may be available in the restoration of the position of the head.

ANKYLOSIS OF THE SHOULDER.

Complete Ankylosis.—I have in consultation met with no cases of complete ankylosis of the shoulder, except those arising from complicated mechanical injury to the articulation, usually consisting of fractures of the acromion, head of humerus or scapula, and invariably irremediable.

Incomplete Ankylosis.—A stiff immovable shoulder, from rheumatic inflammation of the capsular tissues and articular surfaces, affords a not uncommon example of incomplete ankylosis. The obstacles to the recovery of the articulation thus affected are—1st, the tender state of the articulation

remaining after cessation of the acute stage of the rheumatic inflammation, probably from persistance of chronic inflammation; 2d, alteration of the quality of the synovial secretion, with thickening of the capsular structures, and perhaps occasionally membranous adhesions, the whole of the symptoms being aggravated by the long-continued cessation of the use of the part, and consecutive muscular contraction. The symmetry of the part is destroyed, principally from wasting of the deltoid. I have successfully treated such instances of imminent complete ankylosis, even where other articulations were previously affected with true ankylosis, 1st, by administration of iodide of potassium or quinine, and sometimes colchicum and alkaline remedies, according to the condition of stomach and kidney, and of the general health; 2d, by counter-irritation, frictions, manipulations, and passive movements of the joint.

A species of *compound* incomplete ankylosis, the consideration of which properly belongs to this place, is the long unreduced dislocation of the shoulder from accident. These cases, formerly considered irremediable, at present strongly illustrate the advantages resulting from division of tendons, as a preliminary to mechanical efforts to reduce the displaced bone. Professor Dieffenbach* relates two instances: the one in which reduction, after two years' luxation, was readily accomplished, with perfect recovery of the functions of the joint, through section of the tendons of pectoralis major, latissimus dorsi, teres major and teres minor muscles; in the other, luxation having existed "many years," the same tendons, as well as the articular capsule, were divided, with only indifferent success, probably, as Dieffenbach suggests, "in consequence of the glenoid cavity having become partially filled, and rendered convex instead of concave."

* "Ueber die Durchschneidung der Muskeln und Sehnen," Berlin, 1841, p. 298.

ANKYLOSIS OF THE ELBOW.

Stiff elbow-joint occurs more commonly than any similar affection in other parts of the upper extremity. In addition to ankylosis from traumatic causes, the mobility of the elbow is often annihilated by rheumatism, abscesses consequent on fevers, and even more frequently by strumous disease of the articular extremities. The large extent of apposition of the humerus, ulna, and radius, and the complex articulations these bones constitute, in addition to the greater frequency of disease in this situation, explain the fact of its great liability to ankylosis.

When *complete* (figs. 2 and 3), no hope can be entertained of restoration; and the patient is fortunate if the arm have become fixed in a bent position, enabling the hand to be carried to the head.

Incomplete ankylosis is more common. When it results from traumatic or rheumatic inflammation, the immobility may be considerable, and nevertheless depend on thickening of the ligaments and tissues exterior to the joint, and slight, if any, adhesions within, and consequently, entire mobility be regained by judicious use of the means hitherto enumerated.

An apparent enlargement of one or both condyles of humerus occasionally indicates the strumous character of the previous disease. Should this have been succeeded by caries of one or more of the articular extremities, the mobility may be free within a given range, probably to the extent of a third, or half, of the natural movement; but a sudden check to farther flexion or extension, according to the direction of the resistance, will be experienced on examination. The performance of perfect extension is more often interfered with than flexion. In these cases restoration can only be effected by persevering gradual application of mechanical power and

the auxiliary remedies. Various instruments, the majority consisting of different applications of the common male and female screw to the front of the articulation, have been recommended for this purpose. Although the screw-principle is unquestionably the most powerful, I have so frequently been disappointed in its application to the elbow, owing to its comparative clumsiness, and the greater inconvenience and pain resulting from it, that I have adopted the principle of extension by means of elastic steel-springs to cases of this nature, for the reasons stated in description of the apparatus for club-foot.* In slight cases, a common straight splint, bound with moderate tightness, will suffice.

Tenotomy may be advantageously resorted to in cases that have long existed. In determining the propriety of operation, the absence of osseous or calcareous deposit and vegetations, that may probably interfere with the straightening of the limb, should be satisfactorily ascertained. It may sometimes happen that, after operation, partial extension of the elbow may be speedily effected, but further progress be interrupted by this unfavourable condition of the articulation. Long-continued action of the elastic spring apparatus, by which a not intolerable gradual pressure may be constantly maintained on the obstructing tissues, so as to excite their interstitial absorption, can alone be effectual in restoring the proper extent of movement of the articulation. The parts occasionally requiring division in incomplete ankylosis of elbow are, the tendon of the biceps, and sometimes the mass of muscular fibres arising from the external condyle of the humerus. (See Cases.)

Ankylosis of the elbow is often compound (as at fig. 3), several examples of which are described in Sandifort and Cruveilhier; but as this condition renders the case irremediable, I do not consider that a description of the various degrees of

* See "Treatise on Club-foot."

displacements that may occur would confer any practical value on these pages.

ANKYLOSIS OF THE WRIST AND FINGERS.

The articulation of the wrist is peculiarly obnoxious to ankylosis, and particularly to the complete form of the affection. The exposed situation of this part of the extremity, and consequent liability to accidental injury,—the frequency with which inflammation extends from the hand to the arm, involving this joint in its course,—the exposure of the part to impressions of cold, and its great susceptibility to this agent through the small amount of *warm* (highly vascular) animal textures surrounding it,—the preponderance of fibrous tissues entering into its composition,—all contribute to render it the frequent seat of rheumatism and *arthritic* deposit.

True ankylosis of wrist has, in every instance that has fallen under my observation, occurred in the straight or nearly straight position of the member, the side of the hand corresponding to the fifth metacarpal bone, being also, in some cases, slightly approximated to the ulna. The ankylosis is sometimes compound, the carpal bones being, through the softening of the synovial membrane, drawn by action of the flexor muscles behind the extremities of the ulna and radius. In this case the flexor tendons are slightly contracted.

False ankylosis of wrist presents similar characters of position and form, the extent of mobility being different in individual cases. Often the amount of induration beneath the integuments and fasciæ of the part is so considerable as to occasion doubts of the existence of complete osseous adhesion of the bones. Occasionally, when voluntary movements by the muscles of the joint are entirely suspended, passive movements of the part, as of other articulations similarly affected, are accompanied with a distinct crepitating sensation, perceptible to the ear and touch. A roughness of the articulating

surfaces, depending either on diminution or cessation of the secretion of the synovial membrane, on ulceration, on attrition of cartilages, and probably most frequently, in gouty cases, on the crystallisation of the urates of soda or ammonia and phosphate of lime (tophaceous matter) secreted within and around the articulation. This crepitation is a sure indication of imminent complete ankylosis. The articulations of the fingers are equally liable to ankylosis from the causes here mentioned, and the deformity produced in them by gout is very considerable. Occasionally the cretaceous matter is so abundant, that the superincumbent skin yields to the pressure exercised from within outwardly, is slowly removed by absorption, rarely with ulceration. By these means the cretaceous matter is thrown out, constituting "chalk stones." The interior of the articulation may then communicate with the external atmosphere; but in consequence of the changes previously effected in the synovial membrane, the usual destructive results of exposure of the interior of an articulation do not occur.

Treatment.—If the ankylosis have arisen from accident or phlegmonous inflammation, or if the cause have been struma, the case being complicated by the cicatrices of fistulæ in different situations among the carpal bones, and complete immobility exist, it may be considered incurable. But in several cases of incipient calcareous adhesion of the articular surfaces from "rheumatic gout," or where sufficient tophaceous matter has been secreted around the articulation, so as firmly to encase it, all appearance of inflammation having subsided, I have been enabled, even where complete immobility existed, to restore the functions of the part. Frictions, manipulations, baths, the internal administration of iodide of potassium, and attention to the functions of the liver and kidneys, have been the remedies employed. These cases have proved to me the possibility of absorption of the urates, another proof of which Cruveilhier has deduced from the fre-

quent subsidence and recurrence of grating sounds in the joints of rheumatic or, more properly perhaps, gouty individuals.

Ordinary stiff wrist-joint from common inflammation, whether preceded by accident or not, usually yields to the general remedies applicable to all cases of false ankylosis. Sometimes the flexor tendons remain tense and contracted, and insuperably oppose every attempt at mechanical extension. Tenotomy should, in such cases, be resorted to, and the resistance offered by the palmaris longus, the flexor carpi radialis, the tendons of the flexor sublimis, and even the flexor carpi ulnaris, be thus removed. The section of as many of these tendons as may be necessary should not be effected by a common puncture; each should be divided at a different distance from the articulation, or on successive occasions, so as to obviate the chance of their becoming agglutinated in a common subcutaneous cicatrix, and consequent impairment of function. (See Cases.)

The apparatus I have usually employed to effect straightening of the wrist, in angular ankylosis, consists of a series of metallic splints, adapted to the size and form of the hand and arm, and bent at different degrees opposite the wrist. By commencing with the application of one bent to nearly the same extent as the affected joint, the pressure is readily borne; according to the rapidity of amendment a splint less bent may be substituted. Incomplete ankylosis of the fingers generally yields to mechanical means, unless the flexor tendons have sloughed or become adherent to their sheaths from the previous inflammation. Occasionally I have found tenotomy requisite.

A finger is more unserviceable and deformed when fixed in a straight position; this is usually preceded by destruction of the flexor tendon: the extensor then draws the finger unnaturally backward. Division of the extensor would be

inoperative, when the three phalanges are united into one bone. It is probable that the finger ankylosed in this manner might be transformed into a useful member by dividing one or more of the phalanges, and causing re-union to take place in a curved position.

CASES.

CASE I.

FALSE ANKYLOSIS OF RIGHT HIP, WITH CONTRACTURE OF KNEE AND ANKLE.

Section of T. Achillis, adductor longus, brevis, and gracilis.

March 1, 1841. J. J., æt. 16, a stout robust lad; eyes, hair, and complexion, dark; admitted into Orthopædic Institution with distortion of the right lower extremity, with the origin of which he is but imperfectly acquainted. He believes the "lameness commenced in the knee;" and the marks of former blisters on the external part of that joint appear to corroborate the patient's statement. Another account assigns a congenital origin to the deformity. At present the foot is affected with Talipes equinus, the heel being elevated two inches; the knee is slightly contracted, and the thigh is rotated inwardly and slightly flexed, the knee resting against the opposite member. Tension of the gastrocnemii, ham-string, and adductor muscles of the thigh; and the main dependence of the distortion on contraction of these structures is very evident. No ankylosis of either articulation exists, although motion at the hip is very obscure, abduction and rotation outward quite impossible. The position of the limb suggests the idea of the patient having been affected with hip-joint disease at an early period of life, and that the contraction has resulted from that disease.

March 1. Section of T. Achillis; and on following day flexion of foot commenced, as for club-foot.

March 8. Section of adduct. longus, adduct. brevis, and gracilis. The application of foot-board with joint at knee, and common male and female screw behind, ordered, for extension of knee. Frictions and manipulations thrice daily to the hip.

April 1. Foot and knee reported quite straight, and the thigh capable of abduction from median line to the extent of twelve inches.

Little progress has been made in the voluntary rotation outwardly, although when patient is recumbent, and the pelvis fixed by an assistant, the limb can be rotated outwards, and the trochanter compelled to describe the normal rotatory movement. Ordered to take free exercise.

April 29. Patient walks in comfort about the wards during a large part of the day; he stands flatly; the knee is straight, capable of flexion and extension; he can also voluntarily flex, extend, and partially rotate the thigh. When requested to stand erect, nothing abnormal is perceptible. Even in walking, when the will is powerfully directed towards rotating the thigh outwardly, the toe is directed forwards, and the gait by no means unsightly. He expresses himself grateful for the increased comfort in locomotion, and promises continued attention to the improvement of his gait.

CASE II.

FALSE ANKYLOSIS OF HIP, FROM HIP-JOINT DISEASE.

Section of adductor longus femoris.

May 20, 1841. E. E., æt. 23, dark complexion, dressmaker, admitted into Orthopædic Institution, labouring under deformity of left hip, of nine and a half years' duration, originating from "abscess, produced by a fall." Suppuration had continued eighteen months. The case is described in Case-book of the Institution as "Contraction of the adductors and flexors of hip-joint; heel elevated from ground six inches." The femur partially luxated. Ordered

Frictions and manipulations directed to the production of increased extension, and separation of thigh from opposite limb.

July 2. The head of femur more movable on ilium, but no diminution of deformity. General health excellent. Any constitutional predisposition that may originally have induced hip-joint disease appears to have ceased. Is very anxious to be enabled to place the foot more evenly on the ground, and dispense with assistance of stick.

Section of adductor longus femoris, by subcutaneous operation.

July 6. Puncture cicatrised. Reports that separation of the knees to the extent of five inches more than before operation can be effected.

Frictions and manipulations to be sedulously persevered with.

A fortnight after above report, it was ascertained that the knee had descended so much, as to enable her to walk with a boot furnished with a cork sole two inches lower than before operation.

Aug. 2. The amount of benefit the section was expected to confer having been derived, patient was discharged; she was then able to walk without stick, wearing an elevated heel only, the lameness being considerably diminished.

CASE III.

INCOMPLETE ANKYLOSIS OF HIP, FROM MORBUS COXARIUS.

Section of rectus femoris, pectineus, adductor longus, and part of adductor magnus.

March 1840. A. B., æt. 9½, a boy of sanguineous temperament, reported to have had contraction of the right hip since he was three years old, "produced by a fall." The part presents the ordinary appearance of false ankylosis. The knee is much drawn up towards abdomen, and the thigh is rotated inwardly. He has never used the limb in walking since accident, but has supported himself with a crutch. Original disease has entirely subsided. Ordered

Manipulations and frictions, as in Case 2.

These were continued during five weeks, without any great increase in the power of depressing the thigh; but as I had little confidence in the perseverance of his parents, and the flexor and adductor muscles appeared very tense, I determined to sever the more prominent, viz. the tendons of rectus femoris, origin of pectineus, adductor longus, and part of adductor magnus: this was accordingly effected by puncture; and on third day afterwards, I was gratified, on removal of the dressing, to find that the punctures were cicatrised, and that the thigh could be depressed about four inches. The heel then remained at a distance of two inches from the ground. He was, on cessation of tenderness in neighbourhood of punctures, permitted to walk with sole sufficiently raised. Frictions and manipulations to be continued.

Two months after operation he had abandoned the crutch, and walked comparatively well; the greater portion of remaining lameness depended on shortening of the limb, and some unnatural flexion, for which the hollowness of the loins compensated.

CASE IV.

FALSE ANKYLOSIS OF HIP.

Relieved by section of rectus femoris, tensor vaginæ femoris, adductor long., adduct. brevis.

May 1841. W. W., æt. 16, applied at Orthopædic Institution for relief of deformity of left hip, which had arisen ten years previously, from exposure to cold and subsequent fever. The limb (see fig. 23) is acutely flexed. Patient walks with assistance of crutches, the

Fig. 23.

False angular ankylosis of hip.

foot of affected limb being drawn up beneath the nates, twenty inches from the ground. The thigh is rigidly fixed in the abnormal position, the head of the femur resting on edge of sacro-sciatic foramen. The immobility is so great, that suspicion of true ankylosis exists; limb in other respects well formed. The patient was recommended manual endeavours to depress the limb. During many months he attended occasionally at the Institution, when at length, Jan. 6, 1842, no amendment being perceptible, he was admitted an in-patient. The muscles surrounding the articulation were very tense; but as I was doubtful of the existence of mobility, I entertained serious intentions, should tenotony fail, of resorting to Dr. Barton's operation (p. 33), for which the case appeared particularly favourable.

Jan. 8, 1842. Section of muscles above enumerated. Three days afterwards, apparatus described page 38 was applied. In two months' time sufficient extension had been effected to enable him to walk with the assistance of a shoe raised four inches.

March 16. Discharged as out-patient. Apparatus, combined with manipulations, to be continued.

The entries in journal of Institution for months of July to October 1842, state he is "slowly improving," "much improved," "still mending." At the last date, the sole of his boot had been lowered to two inches; greater depression of limb was permitted when the lumbar vertebræ were inclined forwards, causing a considerable hollow in the lumbar region. He could walk without assistance of stick, his gait being that of an individual labouring under ordinary slight contraction from hip-joint disease. He has not applied since November. I have heard he has been apprenticed, so that it is to be apprehended no greater amendment will be obtained.

CASE V.

FALSE ANKYLOSIS OF BOTH HIPS, FROM SUPPURATION INDUCED BY METASTASIS DURING SCARLATINA.

I was consulted by Mr. Norwood of Hertford in the case of a young gentleman, æt. 4½, who, on recovery from scarlet fever, had become affected with lameness and deformity of both lower extremities.

The child had been examined by several medical and surgical authorities, and various opinions of its nature had been entertained. The

Fig. 24.

False ankylosis of both hips.

detailed history of the case, with which I was favoured by my friend Mr. Norwood, was to the effect, that the fever and debility were prolonged for weeks after disappearance of the eruption. During the fever, the child was observed tenaciously to hold the knees towards the abdomen. Some weeks elapsed, when an abscess formed in the left hip, and pointed on the outside of the upper third of the thigh. Many months afterwards, on approaching restoration of general health, the peculiar lameness and deformity under consideration was first observed. It was then attributed to debility; but notwithstanding that, in other respects, the child's strength increased, he did not improve in walking. By some, the weakness of the lower extremities was attributed to paralysis, consequent on the fever; by others, a contraction of the muscles of the calf was suspected. The circumstance of the lameness appearing equal in both limbs detracted attention from the abscess in upper part of the left hip as a cause of the impossibility of walking. The condition at my first examination was as follows: In walking, the child applied the ball only of each foot to the ground, both heels being elevated one and a half to two inches; the knees flexed to angle of about forty degrees, and touching each other; the thighs flexed on the pelvis; the abdomen very prominent; lumbar region hollow; the head and shoulders thrown back, in order to balance the trunk; the arms, for the same purpose, being held stiffly at a short

distance from the sides. His gait is consequently very constrained and insecure; he often falls, especially when treading on an uneven surface. He cannot play with other children: his stature is short, compared with his younger brother. A closer examination of the limbs demonstrates the absence of structural shortening of muscles of calf or flexors of the knee, by which, if present, the elevation of the heels and bending of the knees could have been explained; no contracture of either of the ankles or knees therefore exists. The hip-joints are rigid, the thighs being fixed at nearly a right angle with the pelvis, and both are adducted so that one knee cannot be separated a hand's breadth from the other. Motion in either hip-joint can be with difficulty distinguished; the flexor and adductor muscles are very tense, and resist extension and outward rotation of thighs. When in the recumbent position, great hollowness in lumbar region exists; but on elevation of both knees, the spinous processes of the lumbar vertebræ touch the couch. It is therefore apparent that immobility of both hip-joints exists; and as these were the only articulations directly involved, I concluded, with the assistance of Mr. Norwood's history of the case, that the state of the hip-joints was that of false ankylosis. No displacement of the head of either femur was present.

It was not difficult to connect this state of the parts with the abscess that had formed in the left hip, but it was difficult to form an opinion whether the inflammatory effusion and suppuration had, in that hip, taken place exterior to the capsular ligament or within it; and, although *external* suppuration had ensued in one hip, whether disease of both articulations had not existed, *internal* suppuration only having been present in right hip. The opinion I entertained was, that, as a consequence of the prostration of strength at the period of decline of the eruption of scarlet fever, metastatic asthenic inflammation had attacked the hip-joints, accompanied by effusion of ill-conditioned plastic matters; that in the left hip, imperfect transformation of effused matters into pus and external suppuration took place; and that in right hip the effused matters were reabsorbed, adhesions in both cases, in the tract of the effused matters, having increased the immobility of the joints, primarily induced by long-continued rest of the muscles in the flexed and adducted position of the limbs. I was in doubt whether the disease had not been within the synovial membrane. Mr. Norwood had also been unable to determine this

point from observation of the earlier symptoms. As displacement commonly succeeds suppuration within the synovial membrane, it might have been inferred, from the absence of displacement of the head of either femur, that the suppuration had been exterior to the articulation—among the muscles only; but, as exceptions in this respect do occur, farther evidence became necessary to complete the diagnosis. It appeared to me doubtful, also, whether so great an amount of rigidity could have resulted from simple adhesions among the muscles.

Such being the view I was induced to take, after full consideration of the case, I recommended the endeavour to elongate the flexor and adductor muscles, and any adhesions existing in or about the joint, by manipulations and instruments. Gradual extension of the thigh was attempted, by placing the patient in recumbent position on table, and fixing the pelvis with one hand on the edge of the table, the knee being depressed with the other. An apparatus was contrived for gradually effecting separation of the knees; it consisted of male and female screw placed between the knees, acting on each through the intervention of appropriate pads. I had occasional opportunities of examining the child during the ensuing months; the only progress observable consisted in increased separation of the thighs to the extent of three inches. After further delay, no improvement of gait being perceptible, I proposed, as an adjuvant to the mechanical treatment, section of the tense muscles around the articulation, which were accessible. I divided, accordingly, the origins of pectineus, adductor brevis, add. long., add. magnus, and rectus femoris, on both sides. Manipulations were recommenced three days afterwards on reunion of the punctures. This was succeeded, in a few days, by separation of thighs to nine inches, and within a month to twelve inches, and ultimately to sixteen inches. So much was gained with respect to extension of limb, that in the recumbent position the knees could be depressed to the couch, the hollow in the loins being nearly obliterated. But although this great change in extent of mobility of the hip-joints existed, the whole of the deformity returned on the patient's attempting to walk. A mechanical contrivance, consisting of steel supports, extending from the ankles to the waist, with springs to maintain extension of the hips and knees, was recommended. In this he could stand erect, the heels touching the ground, and the anterior protrusion of the

lumbar vertebræ being obliterated; but as its use was very irksome, and attended with excoriations, it was soon abandoned. The manipulations were continued until, on one occasion, the child having complained of unusual pain, I ascertained, on examining the limbs, that distinct grating sensations and sounds were perceptible on motion of right hip. The uncertainty in diagnosis, previously alluded to, was removed by this distinct evidence of an altered condition of the synovial membrane, or articular cartilages. The fear of reproducing inflammation of the joint urged me to recommend discontinuance of active manipulations; and as, owing to separation of thighs, he was now enabled to ride comfortably, exercise on a pony in open air was permitted. The lapse of a few weeks shewed that no disease of the hip had been excited; but as the child's health had in some degree suffered from the treatment, and the suspicion of original disease within the articulation was confirmed by the discovery made during the manipulations, and the parents were anxious to incur no risk of increasing the child's affliction, I reluctantly determined to discontinue the application of restorative measures.

Remarks on preceding five Cases of false ankylosis of hip.—Case I. illustrates the extent to which contraction of knee may be relieved by section of gastrocnemii. In Case II. the increased abduction of the affected femur was, for obvious reasons, not the smallest of the advantages derived from the treatment.—The observations page 38 will have prepared the reader for the relation of a series of cases not very brilliantly illustrating the advantages of tenotomy. The results in Cases I. II. III. IV. quite equalled my expectations, and the anticipations of the patients. I was disappointed in Case V. only; but I still entertain the opinion, that cautious perseverance in frictions and manipulations, and the assistance of mechanical supports in the manner described, would ultimately enable this patient to walk tolerably well. I have at present under treatment a similar series of cases, more recently operated, the whole of which will, I believe, receive considerable benefit; the deformity, and the fatigue of taking exercise, being diminished, and the gait rendered less unsightly.

CASE VI.

TRUR ANKYLOSIS OF THE KNEE, PRODUCED BY A PUNCTURED WOUND OF THE ARTICULATION.

Division of the biceps femoris, semi-membranosus and semi-tendinosus muscles, fascia, &c.

August 9, 1841. T. N., æt. 17, admitted into Orthopædic Institution. Reports, that nearly three years since, he accidentally punctured the knee-joint by driving a nail into it. Intense inflammation succeeded the injury: the tumefaction was excessive, and the constitutional disturbance violent, requiring blood-letting, the application of a large number of leeches (the integuments appear covered with the cicatrices of their bites), and other remedies. The patient's statement is corroborated by that of his father, an intelligent man; who also mentions, that the surgeon, who so successfully combated the inflammation, gave the opinion that the articulation had been opened. No suppuration took place. The limb appears to have been necessarily laid on the outside, semi-flexed, during the protracted illness of the patient; in this position it became contracted. The son and parent are positive that the contraction has neither augmented nor decreased since the inflammation subsided, and they have never been able to perceive motion in the joint. The surgeons who have since examined it have pronounced the knee to be completely ankylosed. He is compelled to use a crutch.

The knee is flexed nearly to a right angle; the tibia is slightly rotated outwardly, but no deformity of the joint exists. A total absence of motion, and an apparently fixed state of the patella, indicate the probability of union between the articular surfaces having taken place. The attempt to press down the knee produced no tension in the popliteal muscles; no sensation of stretching in the ham, or pain in front of the articulation.

The most careful and often-repeated examination of the patella, assisted by my colleague Mr. Tamplin, did not afford satisfactory information with reference to its mobility. Although we believed its edges could be alternately depressed, so much doubt existed, that, in recommending the operation to the patient's father, he was informed of the probability of failure; but being assured that, if unsuccessful, the young man would not be in a worse condition than

before, the proposition was cheerfully acquiesced in, as the sole chance of relief from so severe an affliction.

The tendons of the biceps femoris, semi-membranosus, and semi-tendinosus muscles, with numerous fibres of the vastus externus, and several bands of thickened fascia, as well on the posterior aspect of the limb, as those portions attached to both tuberosities of the tibia, were divided subcutaneously. On complete section of the whole of these tissues, firm pressure having been continually maintained on the leg, to render them if possible more tense, a loud cracking grating sound was suddenly heard and felt, evidently resulting from the yielding of structures situated within the joint. The limb at the same moment was straightened several degrees. No attempt was made to straighten it more completely; the punctures in the integuments were dressed in the ordinary manner, and the limb ordered to be kept quiet, in its contracted state.

The limb was free from pain within half an hour after the operation, and the punctures healed without an unfavourable symptom.

On the third day, the apparatus for extension was applied, and with very moderate pressure and little pain the limb was rapidly straightened. Within three weeks it was perfectly extended. At the expiration of the fourth week, no sign of inflammation having occurred to render extraordinary precaution necessary, he was permitted to use the limb. Passive motion, frictions, and manipulations, were recommended. Considerable pain was experienced during the attempt to bend it; but did not interfere with his taking exercise, the limb being supported with a firm steel stem on the outside, to prevent too great strain on the articulation so recently restored to function.

Sept. 17. He was discharged, to attend as out-patient.

The subsequent reports of this case confirm the favourable account already given; the lad walks perfectly well; within three months after the operation he was enabled to bend the knee, and complained of no pain after exercise. Although accustomed to those agreeable feelings which are usually experienced by the medical practitioner on the realisation of his hopes of successful treatment, and relief of patients from suffering, I cannot describe the gratification and surprise afforded me by the prompt recovery of this case, which I had considered one of peculiar difficulty and uncertainty.

CASE VII.

TRUE ANKYLOSIS OF KNEE IN EXTENDED POSITION.

W. K., æt. 35, mason, applied, 30th Aug. 1841, at Orthopædic Institution as out-patient, with stiff-knee, produced by violent inflammation, consequent on the knee having, thirteen months previously, been violently jammed between two blocks of stone. He was confined to bed seven months, during which repeated application of leeches, and general depletion, were required to reduce tumefaction and febrile disturbance. The report states: "the limb presents no trace of inflammation; the knee is perfectly extended and immovable; no appearance of displacement of articular structure, or alteration of form of parts." The femur and tibia were completely fixed, and the patella quite immovable in front of femur. Of the existence of true ankylosis, or calcareous adhesion between some of the articular tissues, at the period of his application, I entertained not the slightest doubt, having, on the most careful and repeated investigation, failed to detect any of the signs which usually, even in difficult cases, assist the diagnosis; when at length, on making a sudden and forcible effort as if to bend the knee, a sudden snap and loud cracking were heard and felt, indicating the rupture of calcareous adhesions. The patella was immediately ascertained to have become movable, and the knee admitted a few degrees of flexion. In consequence of the pain now experienced, and for the purpose of watching the limb, and to relieve any inflammation that might result from the effect of the violent bending, the patient was admitted as an in-patient. Spirit-lotion was applied, and the limb placed on a slightly bent splint. No appreciable inflammation resulted; the joint was painful. Manipulations were ordered for the purpose of retaining the degree of motion already obtained. The limb was, for one or two days at a time, placed alternately on a straight and flexed splint. At the expiration of two months he was discharged, the knee being bent to an angle sufficient to enable him to ascend a staircase without difficulty. The joint was still tender after motion. He has since presented himself for examination: he walked very well; the knee was less flexed and more stiff than when he quitted the Institution; he admitted he had neglected the rubbing and bending the joint previously recommended; but was well satisfied with the benefit he had derived.

Remarks on Cases of true ankylosis.—The remediableness of true ankylosis will probably be found to depend in most instances on the extent of osseous adhesion, or of calcareous deposit, among the articular structures; and I apprehend I may venture from Case VI. to affirm the possibility of curing true ankylosis depending on osseous adhesion of a portion only of the articular surfaces. I have related Case VII. not as an instance of *cure* of true ankylosis, but in order to illustrate the remarks pages 42 and 58. Although the knee of this patient was not so greatly benefited as Case VI., the patient derived great advantage from the incomplete flexion and mobility which resulted from the treatment adopted.

CASE VIII.

FALSE ANKYLOSIS OF KNEE.

Section of hamstrings, fascia lata, and part of vastus externus.

Mrs. L., æt. 50, formerly domestic servant, dark complexion, eyes, and hair, admitted as in-patient into Orthopædic Institution, Dec. 2, 1840, with contracted right knee of sixteen years' duration, produced by rheumatism. Cicatrices of former abscesses exist. The limb is immovably fixed at a right angle, and is applied to the ground through considerable leaning of pelvis to affected side, and by the intervention of a cork boot seven inches high. Slight rotation of tibia outwardly, but no displacement of articular surfaces.

Dec. 4. Section of tendons of biceps, semi-membranosus and semi-tendinosus muscles, and dense bands of fascia lata on outside of articulation. No perceptible amelioration of position immediately succeeded the operation. Extension commenced three days afterwards by apparatus fig. 12. This was gradually continued during six weeks, the knee being much straightened, when, unfortunately, the heel having been subjected to an improper pressure, an eschar was discovered opposite the posterior extremity of the os calcis. Fruitless endeavours to obtain cicatrisation of the resulting wound, during continued application of apparatus, were made. Ultimately the apparatus was removed, and was speedily followed by

return of contraction. More than five months having elapsed since performance of operation, its repetition (May 28) was rendered indispensable for again straightening the limb. A large portion of the fibres of vastus externus muscle was on this occasion included in the section. The knee yielded to pressure as slowly as after first operation; but ultimately, at expiration of eight months from admission, she was discharged, the knee being within 10° of straight line, with scarcely any motion in the joint, but walking very comfortably with a boot the heel of which was raised one inch. She was enabled to return to her former occupation, and has since frequently visited the institution, to shew that no relapse has occurred, and to express her thanks for the amendment in her condition.

CASE IX.

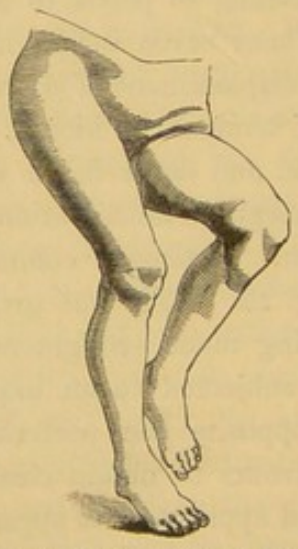
FALSE ANGULAR ANKYLOSIS OF LEFT KNEE FROM RHEUMATISM.

Treated by section of hamstrings and fascia lata.

STRAIGHT OSSEOUS ANKYLOSIS OF RIGHT HIP AND KNEE OF SAME INDIVIDUAL.

Feb. 21, 1842. S. S., æt. 16, dark complexion, eyes, and hair, admitted into the Orthopædic Institution with angular contraction of left knee, the heel approaching the nates (see fig. 25). Motion of

Fig. 25.



Incomplete angular knee-ankylosis from rheumatism.

articular surfaces very indistinct. Slight outward rotation of tibia, but no displacement. The opposite knee and hip are affected with complete ankylosis, the entire member being fixed in a line with the perpendicular axis of the trunk. One elbow is also affected with irremediable ankylosis, and cicatrices of suppurated glands are visible in the neck. The whole of these serious disorganisations resulted from an attack of rheumatic fever five years previously. She is a helpless cripple, incapable of supporting herself even with crutches, in consequence of the affection of both limbs and general debility.

As the right limb is rigid in a straight line, it appears probable that sufficient improvement in position of left knee to enable her to apply the foot to the ground will greatly ameliorate her condition, inasmuch as she may then balance herself, and, as the left hip is unaffected, be enabled to walk.

I had admitted the patient with this consideration, and had determined on section of hamstrings and bands of fascia which resisted extension. This was accordingly effected: very slow progress was made with the extension, partly in consequence of the unfavourable condition of the general health, and partly in consequence of the rigidity of the intra- and extra-articular tissues. Ultimately the limb was so much straightened, that she was enabled to apply the toes to the ground; and with the help of a heel two inches high, she gradually acquired power to walk, assisted with a stick. The amount of benefit which I anticipated having been obtained, she was (July) discharged, and ordered to attend occasionally as outpatient. The reports in journal of Institution, August and September, state she is gradually mending. At the last visit she walked without assistance of a cane, and with comparatively little lameness.

These Cases (VIII. and IX.) are examples of incomplete knee-ankylosis, from rheumatic inflammation of the intra- and extra-articular tissues, the rigidity having amounted to almost complete immobility. Little absolute disorganisation is apparent in such instances, and less change of form than in the cases of false ankylosis to be hereafter detailed; but the frequently intractable nature of rheumatic false ankylosis is attributable to the articular tissues,—synovial membrane, ligaments, tendons, and fasciæ,—being often soldered, as it were, into a

mass by the exudation of plastic matters of a less extensible character than that effused in common inflammation. Such cases require a cautious prognosis. Cases VIII. and IX. were materially benefited by the treatment adopted, and may encourage the practitioner to avail himself of tenotomy under similar circumstances; but the value of tenotomy in the treatment of angular knee-ankylosis would be much underrated if these were considered an average sample of the benefit the operation is capable of conferring.

CASE X.

FALSE ANKYLOSIS OF THE KNEE FROM INFLAMMATION OF SYNOVIAL MEMBRANE AND CARTILAGES.

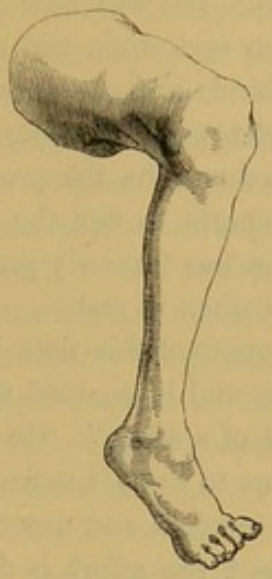
Cured by subcutaneous section of the flexor muscles of the joint.

Mr. * * * æt. 20, was affected in his sixth year with disease of the right knee-joint, the origin and precise nature of which could not then be satisfactorily ascertained. Various surgeons were consulted. Some pronounced the disease to be white-swelling; others, that it was disease of the bones and cartilages. The ordinary modes of treatment were pursued; but during the active stages of the disease, which continued three years, the limb became contracted to nearly a right angle, compelling him to resort to the use of crutches. Sea-bathing, warm and vapour baths, shampooing, forcible mechanical extension under the direction of mechanists, each of whom undertook to straighten the limb in a few weeks, were successively tried in vain. A period of eight years has since elapsed, during which he has been unable to walk without assistance of a crutch and stick, and a boot the heel of which was elevated several inches by means of cork.

At present (see fig. 26) the knee is contracted to about a right angle, and is incapable of movement of either flexion or extension. The patella appears fixed, but its internal and external margins can be alternately depressed, causing a slight undulating movement, which indicates the absence of adhesion or ankylosis of this bone. The internal condyle is prominent; the tibia slightly rotated outwardly; and the toes disproportionally everted, apparently from the

predominant contraction of the biceps femoris muscle. Slight contraction of gastrocnemii co-exists.

Fig. 26.



Incomplete angular knee-ankylosis, from articular disease.

Feb. 3, 1841. The subcutaneous section of the hamstring muscles, and of numerous strong bands of fascia on the posterior and external surfaces of the articulation, was this day accomplished. Considerable straightening followed each successive division of tissue, from the effects of the pressure necessarily maintained on the limb during the operation, in order to render the parts tense. The punctures cicatrised within forty-eight hours, and extension was resorted to without delay.

At the expiration of three weeks the limb was straight within ten or fifteen degrees; five weeks more elapsed before the remaining contraction was overcome. The limb was at this period sufficiently restored for ordinary walking on the entire sole and heel, the knee remaining extended; but as considerable prominence of the femur and eversion of the foot remained, it was resolved to endeavour, by means of the apparatus represented fig. 11, to effect a more complete restoration of the articulation of the knee, as well as remedy the contraction of the gastrocnemii. The influence of this mode of treatment was speedily perceptible; within three weeks, extension was not only perfect, but all eversion of the limb and contracture of the foot had disappeared. The prominence of the femur, and the rotation of the tibia, were much diminished.

Although at first his health and spirits appeared to suffer from confinement, it was subsequently remarked with satisfaction, that the great improvement in the limb had been effected without impairment of the general health. He was now permitted to take gentle exercise, aided by a crutch and stick, the limb being supported by an elastic splint placed behind; and recommended to employ frictions and manipulations directed towards bending the joint.

During the ensuing two months the progress was uninterrupted, although slow. The attempts to flex the limb were as painful as the resistance to extension was formerly great; the joint was, however, free from uneasiness when at rest.

July 23, 1841. The report of this date is, that "he has latterly made great improvement, and is enabled to take short walks from home with the assistance of a stick." He can flex the limb about forty degrees, but the effort to bend it more occasions pain, referred to the patella and to the internal and anterior part of the articulation, but ceases the instant the effort is desisted from. Believing that the pain resulted from a tendency to a return of the eversion of the foot, in consequence of no proper mechanical support having been worn during the act of walking,—a precautionary measure usually of much importance,—I directed him to wear a steel support on the outside of the limb, which permitted motion of the joint, but was furnished with a spring to assist the action of the weakened extensors of the leg, and prevent recurrence of contraction.

Dec. 1841. Pain has entirely subsided; he walks daily several miles in perfect comfort and freedom from lameness. The knee continues quite straight, and is sufficiently flexible for every ordinary use.

I have since frequently examined this patient: the *cure* is perfect.

CASE XI.

FALSE ANKYLOSIS OF THE KNEE, FROM INFLAMMATION AND SUPPURATION AFTER PUERPERAL FEVER.

Relieved by section of the hamstring muscles.

Mrs. * * * æt. 32, states that in May 1831, on the second day after confinement, she was seized with puerperal fever, which was treated

by blood-letting to the amount of ℥lxx., and mercurial ptyalism. A week later, severe constitutional disturbance again set in, indicated by violent pain in the back, rigors, and inflammation of the right knee, which ultimately proceeded to suppuration. At the expiration of ten weeks, two large collections of pus were evacuated. The openings closed two months afterwards, but the patient was unable to commence exercise by means of crutches until nine months from the period of parturition. During the succeeding four years, in consequence of continued pain and tenderness in the joint, the patient was obliged to avail herself of the assistance of two crutches; at length a stick was substituted, and latterly she has walked without support. Five or six years since, the patient perceived motion in the joint. Forcible extension by means of various mechanical contrivances, directed by two highly reputed mechanists, frictions, vapour-baths, and manipulations, have been persevered in, without benefit.

April 23, 1840. The knee is contracted to the extent represented fig. 7, the patient being unable to walk on the heel, although the shoe is at that part raised with cork two and a half inches. The point of the foot is alone applied to the ground. The tibia appears to be slightly rotated outwards, and the toes everted. Patient can walk one mile without much inconvenience, but not without considerable lameness: violent perspirations, the sensation of excessive weakness and pain in the limb, with great fatigue, render a longer walk impossible. The pain presents the following peculiarity: although endurable so long as the joint is kept in motion, it becomes quite intolerable when, after a few minutes' or a longer rest, the patient attempts further locomotion.

The limb is flexed at nearly a right angle (see fig. 7), but is incapable of farther straightening: the resistance to which appears most powerful, evidently depending in part on contraction of the hamstring muscles, but greatly on unnatural adhesions of the fascia and other fibrous tissues around and within the joint. The patella inclines unequally towards the external condyle, and appears fixed in that position. Several surgeons, who have been consulted concerning the possibility of straightening the limb, have declared the patella immovable; but after repeated examination, I was satisfied that although not actually moveable *e loco*, it was not ankylosed, but permitted a movement of rotation on its perpendicular axis, when its external and internal

margins were alternately depressed. The tendons of the flexor muscles, and several superficial bands of fascia, were divided by subcutaneous section; and, on the second day afterwards, extension was commenced, by means of the apparatus represented fig. 12, and the complete straightening of the knee effected within the ensuing six weeks. The earlier portion of this extension was unaccompanied with great inconvenience; but towards its conclusion much resistance was encountered, and the pain became proportionally increased. My patient was rewarded for the firmness and perseverance she had displayed, by finding she could now freely place her heel and entire sole on the ground. Notwithstanding the knee was perfectly straight, the existence of considerable elasticity in the undivided tissues on the posterior aspect of the limb indicated a corresponding proneness to recurrence of contraction. She was advised to continue the use of the apparatus at night, and during the greater part of the day; to take occasional gentle exercise, the knee being supported by a light modification of the apparatus; to employ frictions, manipulations; and to endeavour to obtain flexion of the joint, by gradually reversing the screw of the apparatus. At the end of the ninth week, as she undertook rigorously to follow out the above recommendations, she obtained permission to return home, which urgent domestic considerations rendered necessary.

During the ensuing winter I received occasional communications from my patient, which were by no means so satisfactory as I had anticipated: she complained of inability to walk far, owing to a pain of the same nature, and in the same situation, as that experienced prior to the operation. In the spring I successfully urged the propriety of her re-visiting London, when I found that, owing to a variety of domestic interruptions, she had for several months neglected to preserve the limb extended; so that slight re-contraction had taken place, the heel requiring the interposition of a piece of cork, three quarters of an inch thick, to enable her to tread firmly. Her gait was greatly improved, scarcely a trace of lameness being perceptible when on level ground. She stated she had occasionally walked two or three miles; but that she still suffered greatly on attempting to walk after having rested a short time. She referred the pain to a spot on the inner and anterior part of the joint, not exceeding one and a half inch in diameter. This part was also somewhat swollen, and tender on pressure. Reflecting on the cir-

cumstance that the knee was invariably free from pain when she assumed the recumbent posture and at night-time; that no general disturbance of the health existed; that the foot and leg were still slightly everted, in which position the weight of the body, when erect, is not transmitted directly through the leg to the earth, but occasions a considerable strain on the ligaments of the knee, at the precise part painfully affected in this patient;—I was disposed to conclude I might advantageously overcome, by mechanical means, the eversion of the leg, and greatly conduce to her comfort and recovery. But, on the contrary, from the knowledge that pain is not experienced in this situation by the great majority of patients affected with distortion of the knee similar to that under which this lady laboured, and that tumefaction and tenderness existed, I determined to treat the case as chronic inflammation of the internal articular cartilage, and adjacent synovial and capsular membranes; for which rest and gentle support to the sides of the articulation were prescribed, and the application of an unguent, composed of ung. hydrarg. camphor. and ceratum saponis, with pil. hydrargyri protochloridi comp. internally. She was advised to persist in these means for several weeks, and permitted again to return home. She has since frequently informed me of her progress. The last report, March 1843, states that pain has long subsided: she can at present walk free from lameness. The completeness of her recovery has greatly surprised her acquaintances, who had been for so considerable a period witnesses of the pain and suffering experienced on locomotion.

Remarks on Cases X. and XI.—These cases appeared to me to have originated from disease within the articulation, which had affected the synovial membrane and cartilages; but of a different character from the following cases, being unconnected with struma. Case XI. illustrates the necessity of the caution in diagnosis contained p. 49. Knee-ankylosis produced by the common form of strumous disease, popularly denominated white-swelling, may be distinguished by the peculiarity in the form of the ankylosed limb. See figs. 27 and 28.

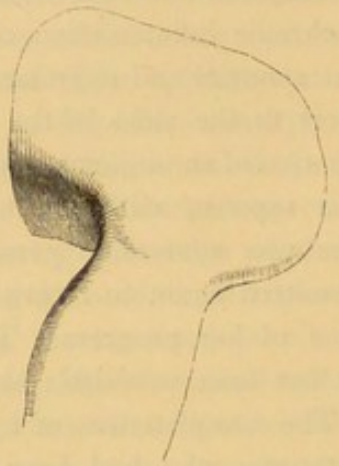
CASE XII.

FALSE ANKYLOSIS OF KNEE AND CONTRACTED FOOT, FROM SCROFULOUS DISEASE.

Division of the tendons of the biceps flexor cruris, semi-memb. and semi-tendinosus muscles, and tendo achillis.

E. C., a delicate girl, æt. 7, patient in the Orthopædic Institution, is reported to have been affected in her third year with white-swelling of the right knee, through which the joint became gradually distorted (see fig. 27). Suppuration did not take place; but it is

Fig. 27.



Angular incomplete knee-ankylosis from white-swelling. The disorganisation of the ligamentous structures of the joint, and consequent displacement of the articular extremities by action of the flexor muscles, attain the maximum in ankylosis from this disease. This partial luxation often occurs without external suppuration, as in the present instance. The small size of the leg compared with the large size of the femoral condyles shews the extent to which the growth of the parts below the knee is interrupted by the detention of an undue portion of the circulating fluid in the tissues of the knee during the articular disease, and the proportionate deprivation of nutritive matter sustained by the leg and foot, as well as from the long-continued disuse of the part.

evident from the position of the articular extremities, that considerable disorganisation of the ligamentous structures of the joint ensued. The condyles of the femur, especially the internal, are very prominent; the tibia being partially luxated backwards, and, at the same time, rotated outwardly, its *crest* presents externally instead of

anteriorly, and the *inner surface* directly forwards. The toes are consequently much everted. The patella, which is movable, rests on the external condyle. The knee cannot be extended beyond the right angle, but is capable of farther flexion. The thigh is much smaller than its fellow, and the leg wasted to a greater extent. The shaft of the tibia is more slender, and the foot smaller, than natural. The heel is retracted to the utmost, the position of the ankle resembling Talipes equinus.*

Dec. 1, 1840. Section of the tendons of the hamstring muscles and the tendo achillis. The punctures healed immediately, and the simple extension apparatus described p. 50 applied.

The leg was on the 28th fully extended; little resistance, and consequently little pain, had been endured. Although, however, the limb was fully extended, the partial luxation, rotation of the tibia, and eversion of the foot, were in no degree remedied, as at figs. 16 and 17.

The apparatus represented fig. 11 was now applied; and within four weeks more, the relation of the articular surfaces was restored as at fig. 18. The utmost attention was now directed to the attainment of the power of flexing the joint. This was accomplished in part by reversing the screws of the apparatus employed to effect extension, by frictions and manipulations, the patient being, in the mean while, permitted to take exercise, the limb being supported as in Case XIII.

The report, March 2, was, that the "patient has made considerable progress, walking, with assistance of a stick, a quarter of an hour several times daily, without pain. Some tendency to a relapse of the articular surfaces into the former abnormal relation has been checked by a better arrangement of the 'support.' Flexion to a right angle is now easily effected, but much want of power in straightening the leg exists, although improvement in this respect has ensued; one proof of which is the increased growth of the anterior as well as of the posterior femoral muscles."

May 1841. "The lameness is now inconsiderable, and partly depends on the difference in the length of the extremities, which may be compensated for by wearing a cork sole within the shoe. She is enabled to take exercise during the greater part of the day, and is consequently discharged from longer attendance."

* See definition of Talipes in *Treatise on Club-foot and analogous Distortions.*

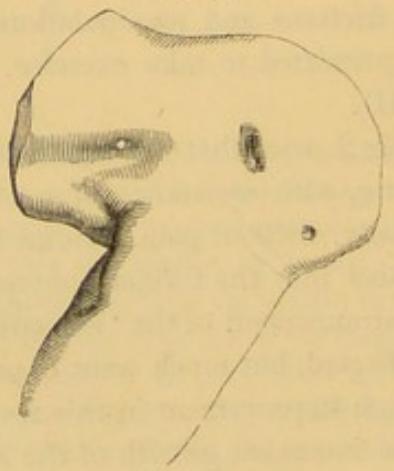
CASE XIII.

INCOMPLETE KNEE-ANKYLOSIS FROM WHITE-SWELLING.

Cured, after the lapse of more than twenty-five years, by section of the hamstring muscles.

Miss W., æt. 31, when two years of age received an injury of the left knee from a fall from the arms of a servant. The affection called "white-swelling" is stated to have ensued, and proceeded slowly to suppuration in several places around the articulation, of which seven indented cicatrices indicate the extent and severity. After several years' continuance of the chronic disease of the joint, the ulcers healed, leaving great contraction; and on the subsidence of tumefaction, considerable alteration in the form of the articulation was observed. The most prominent feature of change was the situation of the patella, completely on the outer side of the external condyle. At the age of seven the patient resorted to the use of a crutch, which was continued for sixteen years. Subsequently she was advised to wear an apparatus resembling an artificial leg, which, by its applica-

Fig. 28.



Incomplete angular knee-ankylosis from white-swelling. The displacement of articular surfaces, eversion of the leg, and atrophy, are similar to Case XII., but occurred in the present instance simultaneously with external suppuration. The flexion of the knee had probably been increased by the employment during many years of the artificial leg. It is worthy of remark, that, notwithstanding the long duration of the deformity, and consequent disuse of the limb, contraction of the posterior muscles of the leg and deformity of the foot had not ensued.

tion immediately beneath the knee, so as to receive the weight of the body from the leg and transmit it to the ground, has enabled her to walk with less apparent lameness than when a crutch was employed.

At present the leg is bent to an acute angle, as at fig. 28; and although capable of farther flexion, cannot be extended beyond the point there represented, the main resistance to extension being offered by the hamstring muscles and fascia, which were divided Oct. 20, 1839. The wounds being healed on the third day, the extension of the knee was then commenced. The action of the apparatus was daily augmented; and I had the satisfaction of observing the gradual increased straightness of the limb.

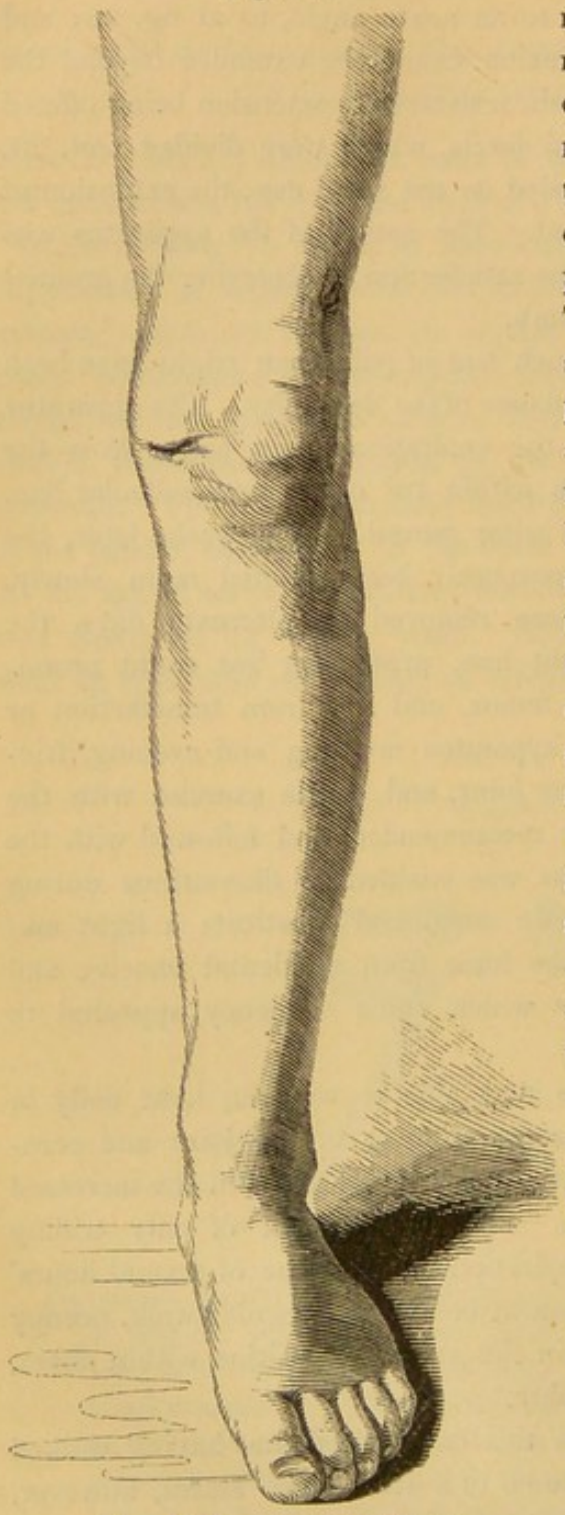
The patient complained much less of pain than might have been expected from the long continuance of the deformity. The apparatus was not removed until after the expiration of six weeks from the operation; the limb was then within 10° of the perpendicular line, and was not very tender on being moved. Four weeks later, the remaining extension having purposely been effected more slowly, and the apparatus having been removed on alternate days, the leg was in a perfectly straight line, presenting but slight prominence of the condyles of the femur, and free from tumefaction or tenderness. Removal of the apparatus morning and evening, frictions and manipulations of the joint, and gentle exercise with the assistance of sticks, were now recommended, and followed with the best effect, as in Feb. 1840 she was enabled to discontinue during the day the apparatus previously used, and substitute a light mechanical support, to guard the knee from accidental shocks, and prevent inward projection, to which some tendency appeared to exist.

April 22, 1840. Patient is now able to walk an hour daily in fine weather; and although some stiffness of the joint and occasional pains cause some anxiety, she is delighted with the increased capability of taking exercise. Formerly a walk of only trifling extent occasioned violent perspiration, and fatigue of several hours' continuance; whereas she can now, besides her regular walk, occupy herself, with the utmost ease, in the standing position within doors, during the greater part of the day.

June 9, 1840. Patient has this day visited me, having walked nearly three miles with assistance of a stick: she states, however, she has lately often accomplished a distance of five or six miles. A

careful examination of the joint gives the following results. Extension is perfect; flexion to a right angle can be effected without difficulty; the patella has moved much more anteriorly, being now placed on the front of the external condyle, on which it rests with sufficient firmness to enable the extensor muscles of the knee to act and partially to extend the leg. The muscles of the thigh are still weakly developed, compared with those of the opposite member; the foot is perfect; and the gastrocnemii have increased to double their size before the operation, although they remain smaller than natural. I have recommended discontinuance of steel supports, but perseverance in frictions, manipulations, and an elastic lace knee-cap, to prevent patella again slipping into the former vicious position. The attendant is instructed, whilst rubbing the limb, especially to endeavour to push the patella towards its natural position in the groove between the condyles.

Fig. 29.



Case XIII. *after restoration.*

July 1841. I have had frequent opportunities of observing the progress of this case; fig. 29 represents the present appearance of the limb. The patient continues to take exercise with the utmost fa-

cility. She walks a long distance without pain, fatigue, or the slightest lameness. The femoral muscles have grown since last report, although they remain smaller than those of the opposite side. The patient justly congratulates herself on the completeness of the restoration.

CASE XIV.

FALSE ANKYLOSIS OF KNEE FROM STRUMOUS INFLAMMATION.

Subcutaneous section of the hamstring tendons, and gradual extension.

J. E., æt. 16, was admitted Dec. 4, 1840, into the Orthopædic Institution, with contraction of the left knee of ten years' standing, occasioned by inflammation, the result of a blow inflicted between the age of two and three years. Two cicatrices on the outer surface of the articulation—one involving the dense band of fascia lata attached to the external tuberosity of the tibia—indicate the former existence of suppuration; and an indented cicatrix on the internal tuberosity of the tibia shews some necrosis to have occurred in this situation. The knee is flexed more than to a right angle; the tibia is rotated outwardly, and the toes everted; the internal condyle of the femur prominent. Little difference exists in the length of the leg, although the muscles are much wasted. The foot is smaller than the opposite one. The flexor tendons and the contracted fascia lata were divided in the usual manner, and gradual extension resorted to on the second day, by means of a simple leg-rest, furnished with a joint corresponding to the position of the knee, and having an ordinary male and female screw behind. No obstacle to the speedy straightening of the limb occurred. He was discharged 11th Feb. 1841, and ordered to exercise the limb. He subsequently attended as out-patient. Frictions, manipulations, and attempts to bend the knee were employed, with gradual amendment of the position of the tibia. The report, March 18, was, "the limb continues perfectly straight; the inner condyle still appears prominent; the rotation of tibia and eversion of the foot have disappeared. He has acquired considerable power in the joint, being enabled, by the action of the muscles, to flex it 45°, and walks daily a mile or more, without pain.

With the assistance of the hand, he can bend it beyond the point to which it was formerly contracted. He mentions having, two months after his discharge, accidentally fallen, and suddenly and violently flexed the knee, attended with severe pain. He has since been surprised to find that flexion has been much more easy.

Nov. 15, 1841. Patient visited the Institution to-day: he walks without lameness, and states he can draw a truck ten and twelve miles, which he is often compelled to do, in order to obtain a precarious livelihood.

CASE XV.

ANGULAR KNEE-ANKYLOSIS FROM STRUMOUS DISEASE.

Section of hamstrings.

G. D., æt. 9, a boy of dark eyes, hair, and complexion, admitted into Orthopædic Institution 18th Nov. 1841, with contracted knee from "white-swelling." The joint cannot be extended beyond a right angle, but free motion between articular extremities exists, so that the heel can be closely approximated to the nates.

Appearance of limb is represented fig. 15.

Nov. 22. Section of hamstrings; from which considerable change of position immediately resulted. Straightening was effected as in last case; and within five weeks patient was discharged, walking perfectly on sole, and with only a slight limp. He has since visited the Institution; the restoration continues perfect.

CASE XVI.

INCOMPLETE KNEE-ANKYLOSIS FROM SCROFULOUS DISEASE.

Section of hamstrings and fascia.

S. B., æt. 18, a young woman of melancholic temperament, admitted into Orthopædic Institution Dec. 16, 1841, with knee contracted about seventy degrees, attributed to inflammation from a fall twelve years previously. Active disease of joint has subsided nine years.

Dec. 20. Section of hamstrings and fascia; and on third day afterwards, application of extension apparatus. The extension was slowly conducted in ordinary manner, and was unattended by pain until 31st, when, on complaint of unusual uneasiness in popliteal region, I was induced to order removal of apparatus, when an erysipelatous inflammation was discovered affecting the neighbourhood of the punctures. For several days the inflammation threatened to spread, but subsided on occurrence of suppuration, and the evacuation of pus by free incision.

On cicatrisation of the wound extension was recommenced, and the knee gradually straightened without difficulty. No unfavourable symptom attended the process; mobility to the extent of 40 degrees was restored; and on April 28, 1842, patient was discharged, walking well.

CASE XVII.

INCOMPLETE ANGULAR KNEE-ANKYLOSIS.

Section of hamstrings.

M. D., æt. 16, a young woman of unhealthy aspect, light eyes, with dark complexion and hair, admitted into Orthopædic Institution, labouring under contracted left-knee, of ten years' duration, produced by a fall, succeeded by inflammation of the joint. The knee presents the ordinary characters of angular knee-ankylosis from strumous disease, and is flexed to the extent that she is unable to walk without assistance of crutches. The operation was performed in the usual manner.

May 2, 1842. Straightening of the limb was rapidly effected by a common knee-extending instrument, but the condyles of the femur were daily observed to become more prominent; and on removal of the apparatus, June 26, it was discovered, that although the tibia and femur were straight, and no abnormal flexion remained, yet the tibia appeared to be luxated behind the femur, as at fig. 14, p. 54. This unnatural condition of the knee was aggravated by great lateral mobility of the bones, the articular extremities being freely movable on each other. Several weeks were occupied in effecting replacement

of the articular surfaces. This was accomplished by careful application of splints to under and outer surfaces of the limb, pressure being made on the internal condyle and external tuberosity of tibia and the fibula, traction from the ankle being simultaneously maintained by a bandage around the malleoli, secured to the lower part of the bedstead. On September 3d, the knee presented a perfectly natural appearance,—extension perfect, mobility to the amount of 25 to 30 degrees. The report of that period states, "the patient has during the last fortnight walked in the wards, the knee being supported by splints to prevent return of displacement." On September 26th she was discharged as out-patient, having been ordered, as a precautionary measure, to wear an iron support on outside of member. She subsequently applied occasionally at the infirmary, walking without pain and lameness.

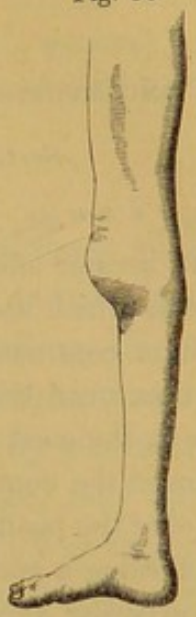
CASE XVIII.

ANGULAR KNEE-ANKYLOSIS OF EIGHTEEN YEARS' DURATION.

Section of hamstrings.

P. P., æt. 30, needlewoman, of melancholic temperament, admitted into Orthopædic Institution with right knee rigidly contracted, from inflammation produced by a fall on the part when twelve years of age. The knee is flexed as at fig. 13, p. 54, patient supporting herself by means of a high boot and a stick. Locomotion is laborious and very fatiguing, as, in order to apply the foot to the ground, she is compelled to incline greatly towards the affected side. Operation performed August 1, 1842. On cicatrisation of the punctures, the limb was placed for a few days in common extension-apparatus; and as soon as the position of the knee was sufficiently amended to permit its adjustment in the apparatus fig. 11, the more perfect replacement of articular extremities was commenced. This was uninterruptedly persevered with; and on Sept. 27, the report was that the knee was nearly straight, and the form in great measure restored. She continued to improve; and on Nov. 10, the limb being perfectly straight (see fig. 30), she was discharged as out-patient. At this period frictions and manipulations, and attempts to bend the knee, were recommended; but owing to the exquisitely tender state of the

Fig. 30.



articulation, little progress was made during the few weeks immediately succeeding her discharge; since which period, although the tenderness has subsided, the articulation has become very stiff in the extended position. She is, notwithstanding, enabled to walk with facility compared with her former condition; and I do not doubt, that after a longer interval sufficient mobility will be acquired, and locomotion be effected without lameness.

Feb. 1843. She expresses herself much benefited by the treatment adopted; walks daily in the open air, and is rapidly acquiring strength. Muscular development may be expected speedily to ensue.

CASE XIX.

ANGULAR KNEE-ANKYLOSIS, FROM SCROFULOUS DISEASE.

Section of flexors of knee.

W. H., æt. 12, a delicate-looking boy, received into Orthopædic Institution, labouring under contracted left knee, of five years' duration, and inveterate angular spinal curvature. The knee is flexed to the extent represented fig. 15, p. 56, the toes scarcely touching the ground, locomotion being effected with assistance of a stick. Limited movement of patella on external condyle. Development of leg and foot greatly inferior to that of the sound limb.

Nov. 28, 1842. Operation performed in usual manner, and extension rapidly effected without pain. On Jan. 30 the leg was reported quite straight; on Feb. 9 he was discharged as out-patient, the limb being supported on wooden splint to prevent relapse. Manipulations directed to obtainment of flexion were recommended; but after a short attendance as out-patient, mobility to amount of 30 degrees having been obtained, the patient's mother informed me, that being enabled to walk free from lameness, unassisted by splint or support of any kind, she was unwilling to subject him to the pain of manipulations, and therefore begged for his discharge as cured.

CASE XX.

INCOMPLETE KNEE-ANKYLOSIS FROM "WHITE-SWELLING."

Section of hamstrings. (*See* figures p. 47.)

MAST. * * * æt. 15, a tall, intelligent youth of sanguineous temperament, became affected with inflammation of right knee after an attack of fever which had left him greatly debilitated. Disease of the articulation continued four years, and was accompanied by gradual contraction, until the knee became flexed to a right angle. Perseverance in the most approved plans of mechanical extension had partly removed the contraction, so that when the patient was placed under my care the position of the limb was that represented figs. 9 and 10, —affording a good exemplification of the manner and extent to which the articular surfaces may become displaced from the disease denominated white-swelling. The knee is very rigidly fixed, admitting neither flexion nor extension; the knee-cap is obscurely movable on its perpendicular axis, and rests on the external condyle. Patient has not applied the limb to the ground since the deformity occurred, but effects locomotion with aid of a crutch and a stick. The muscles of the thigh are small, but the development of the leg and foot is less impaired.

August 1841. Section of hamstrings, and complete reduction of deformity by means of apparatus figs. 11 and 12; so that at expiration of nine weeks the patient could walk evenly on the sole, the knee being supported by an iron on outside. The support was furnished with a hinge at the knee, and a spring adapted to assist the weak extensor muscles in maintaining the straight line of the limb. After his departure for the country I received from Mr. Dodd, of Chichester, who subsequently had charge of the case, frequent reports of his progress, and I have occasionally examined the limb. The straight line of the femur and tibia has been preserved; no return of inward inclination of the condyles of the femur; the mobility of patella has slightly increased, and this bone is placed more nearly in the front of the articulation; mobility between the tibia and femur to the extent of 15 to 20 degrees only has been obtained; the iron support has been superseded by a thin steel busk, sewn on outside of a laced knee-cap, to prevent the possibility of inversion of knee; and my patient walks several miles daily without fatigue, and with few

traces of lameness except in ascending a staircase. He has acquired a great increase of height, is much stouter, and his general health has much improved from the operation and the consequent restoration to activity.

Remarks on Cases XII. to XX.—It is a pleasant duty to offer a few observations on these nine cases of knee-ankylosis, arising from the disease denominated white-swelling. No class of deformity better illustrates the advantage of the Stromeyerian operation; for, although the relief afforded by this method, when properly conducted, in cases of club-foot, may appear more complete, as not only the form but mobility of the ankle and development of the muscles will be more nearly perfect, yet the consideration of the comparatively greater importance and size of the knee-articulation, the circumstance that angular ankylosis of this joint necessarily impairs the functions of the corresponding ankle, together with the greater amount of lameness attendant on contracted knee than club-foot, will suffice to shew that relief of knee-ankylosis by tenotomy is as great an addition to the healing art as that of club-foot. White-swelling, popularly regarded with a degree of horror, is indeed divested of its terrors, when it is considered how rarely in the present day, owing to the improved mode of treating the disease in its earlier stages, amputation of the member is resorted to; and that notwithstanding this disease is peculiarly prone to terminate in deformity, it constitutes the most favourable form for division of tendons, the subsequent mechanical treatment being more easy, and the restoration of the limb more complete, than in ankylosis from rheumatism, or from extensive suppuration from phlegmon. The cases are individually instructive: Case XIII., from the completeness of the restoration, after twenty-five years' duration of deformity; Cases XII., XV., and XIX., from the rapid success of the treatment; Case XIV., from the accidental

manner in which mobility, usually so difficult of obtainment, was effected. In Case XVI. some apprehension of failure might have been entertained, from the occurrence of suppuration in the poplitea. It was fortunate that closure of the abscess speedily ensued, so that straightening of the limb was effected in the ordinary manner. It became important, however, to consider the probable cause, in this instance, of so unusual a circumstance as suppuration. On referring to the successive stages of the treatment, it was remembered that during the operation, owing to some uncertainty whether, by a puncture in the usual situation, the biceps tendon had been severed, a second puncture in the integuments, near to the insertion of the tendon where it was more prominently felt, had been made, and the tendon redivided in that situation. It appeared not impossible that the portion of tendon included between the two sections, through receiving too few vessels from adjacent cellular tissue, may have lost its vitality, and become a necessary cause of disturbance to the neighbourhood, and of suppurative inflammation for effecting its exit from the limb. It was also ascertained, that prior to the application of extension-apparatus, the assistant had not satisfied himself of the cicatrisation of the punctures—a point I have been accustomed to recommend as worthy of great attention. To whichever of these causes the suppuration may have been attributable, the practitioner will profit by the experience afforded by this case, and avoid a second section of a tendon until the part previously severed may be expected to have become sufficiently reunited by vascular medium. An interval of two or three weeks should therefore be permitted to elapse. The case will serve as a caution against application of extension prior to cicatrisation. I have observed that punctures in the popliteal region rarely unite firmly within four or five days, probably on account of the abundance of cellular tissue in this region, and the stretching to which the

skin may have been subjected during the division of the tendons. In most other situations twenty-four or forty-eight hours suffice for cicatrisation.*

In Case XVII., the appearance of the knee, from the luxation of the tibia, was quite alarming, and well illustrates the observations p. 55. It demonstrates the great extent to which ligamentous and other fibrous (non-muscular) tissues may be elongated by gradual pressure. Whilst on the subject of treatment of angular knee-ankylosis, I may allude to the inapplicability of tenotomy as a means of rapidly *straightening the member* prior to the complete subsidence of the primary articular disease. I do not consider the operation applicable for the above-mentioned purpose until at least two or three years have elapsed since subsidence of active disease. In one case, a boy, out-patient of the Orthopædic Institution, I resorted to the operation at an earlier period, and had occasion to regret its performance: the latent strumous disease of the articulation was temporarily excited to renewed activity, and the advantages that might otherwise have been derived from the operation were necessarily abandoned. I shall repeat the section at a later period, and expect still to be enabled to restore the form and functions of the member.

CASE XXI.

FALSE ANKYLOSIS OF THE KNEE, AND CONTRACTURE OF ANKLE FROM PHLEGMONOUS INFLAMMATION.

Cured by section of biceps femoris, semi-membranosus, semi-tendinosus, and achilles tendons.

A. C., æt. 34, was admitted April 22, 1841, into the Orthopædic Institution with contracted right knee and ankle. She states, that three

* Deficient constitutional energy will also in some degree explain the slowness of cicatrisation in strumous knee-ankylosis.

years since, in fifth month of pregnancy she was attacked with erysipelas of the knee, which subsided in a few weeks. A second attack ensued between seventh and eighth month, abortion took place, and subsequently copious suppuration in front of the knee and in the popliteal region. She was confined to bed during a period of eleven months. On partial recovery of the general health the limb was contracted as at present, being so acutely flexed that the heel almost touches the nates, as at fig. 8; the condyles are not more prominent than is natural in the acutely-flexed position of the knee; but the tibia is rotated outwardly, and the toes everted. The foot cannot be completely bent, owing to contraction of the gastrocnemii, and resembles the slighter form of Talipes equinus. General health tolerably good; patient never possessed a strong constitution.

April 26. Division of the outer and inner hamstrings effected this day; and on cicatrisation of the punctures extension commenced as usual. Great pain and disturbance of sleep, and some derangement of the general health, accompanied the process. The occurrence of menorrhagia required the suspension of the extending process. At the expiration of the tenth week the knee was within 25 degrees of the straight line, and the eversion of the foot was removed; but as the resistance to complete extension appeared to have increased, and the elevation of the heel was observed to be greater, I determined on the propriety of immediate division of the tendo achillis, instead of deferring it until complete restoration of the knee, as I had previously intended. I did not consider redivision of the hamstrings necessary; for as the corresponding muscles had retracted to a great extent at the first division, I was convinced that, although the divided extremities were reunited, the resistance to complete straightening of the joint arose from shortening of the ligamentous tissues, on interstitial deposit, the result of the inflammation, and on contraction of the gastrocnemii muscles. The section of the tendo achillis was effected 5th July, and the extension renewed the following day; the farther restoration, nevertheless, took place slowly; considerable œdema of the limb, and derangement of the general health, occurred,—both very unfavourable for the progress of the mechanical treatment, requiring during several weeks the free exhibition of quinine, and a liberal allowance of wine and porter, with full diet. At times the tenderness of the knee appeared so exquisite that I feared the existence of chronic disease in the synovial mem-

brane or cartilages. Ultimately, however, the obstacles to complete straightening were overcome: she commenced exercising the limb, walking on the entire sole; and on October 18th was discharged, and ordered to attend as out-patient.

Feb. 6, 1843. Patient has occasionally visited the Institution since last report. The knee has not relapsed, although little progress has been made in bending it, which she attributes to inattention to manipulations, and the exercises recommended. This is not surprising, as her maternal duties employ a considerable portion of time, and she has been again pregnant and confined since her discharge as out-patient. She walks tolerably well, but somewhat stiffly; experiences some inconvenience from treading unequally on outer margin of the foot. This is attributable to omission of sufficient mechanical treatment of the foot after section of t. achillis, in consequence of the unfavourable state of her health, and the approaching accouchement. To be re-admitted for a few days. Redivision of t. achillis effected by puncture below the seat of former operation.

Feb. 8. Application of "extension-shoe." 27th. Discharged from Institution on 16th inst. Foot is now completely flexed and abducted; patient expresses herself much relieved by last operation. She is walking well, and already enabled to attend to the whole of her domestic duties.

March 13. Walks extremely well, without mechanical apparatus or assistance of stick. Foot movable in every natural direction. Ordered to apply the shoe for an hour occasionally, that she may obviate any tendency to relapse. Discharged from further attendance.

CASE XXII.

FALSE ANKYLOSIS OF THE KNEE, FROM ERYSIPELATOUS INFLAMMATION AND ABSCESSES.

Cured by division of the hamstring muscles and t. achillis.

August 19, 1840. F. H., æt. 41, a tall man, of anxious, care-worn appearance, was affected two years since with erysipelas of the right leg and thigh, followed by enormous suppuration, extending from ankle to the hip-joint. Several openings were at different periods

made on the outside of the ankle, knee, and thigh, and large quantities of pus were thence evacuated. At the end of six months, the latter part of which was spent in one of the metropolitan hospitals, the alarming train of symptoms was finally arrested by the closing of the abscesses. Attempts, by mechanical treatment, were then made, to relieve the contraction which ensued during the cicatrisation of the abscesses, and the long and necessary confinement. When discharged from the hospital, eight months having elapsed since the commencement of his sufferings, the contraction was partly removed, to the extent that in the erect posture he could almost touch the ground with the toe. He persevered in the use of the mechanical apparatus *five* months longer, and succeeded to a considerable extent in straightening the limb; but when the apparatus was removed (to use his own words), "in less than an hour the limb relapsed as bad as before." He states further, that to the present time he has "continued on crutches, in great pain and misery."

At present the knee is bent to an acute angle (see fig. 8, p. 45), and the foot is slightly extended. On endeavouring to straighten the limb with the hand, very powerful resistance is experienced from contraction of the flexor muscles of the thigh. The intimate adhesion of the whole of the tissues surrounding the articulation, and the contracted state of the extensor muscles of the knee, from the fixed position in which they have long remained, equally prevent any farther flexion of the joint. The existence of the slightest motion between the articular surfaces, or of the patella, is with the utmost difficulty distinguishable. The gastrocnemii oppose flexion of the ankle. The calf of the leg is somewhat wasted; but the posterior muscles of the thigh are strongly developed, and their tendons very prominent. The relation of the articular surfaces of the knee does not at first view appear incorrect, but an accurate examination shews that the patella, although movable, is situated on the outer condyle, and that the shaft of the tibia is rotated outwardly on its long axis.

Aug. 25, 1840. Assisted by Dr. Elliott, of Denmark Hill, and Mr. Tamplin, I divided biceps cruris, semi-membranosus and semi-tendinosus muscles, and a large portion of the thickened fascia lata on external surface of the joint. At this operation he (to use his own words) "suffered but little, the pain not exceeding that of bleeding." The wounds were dressed in the usual manner, and the patient desired to keep the limb quiet on the outer side.

On the seventh day after the operation, the wounds having perfectly healed, and all tenderness in the ham from the operation having subsided, the apparatus for effecting extension of the knee (see fig. 12) was applied, and the straightening of the limb gradually effected. He daily complained of pain in the front of the knee for a short time after the extending power of the apparatus was augmented, but was enabled, with the assistance of crutches, to take daily exercise in the open air.

On the nineteenth day he visited me at my house, "felt the weight of the apparatus extremely awkward in walking." This was the principal complaint; the straightening of the limb had already advanced so far as to enable him to touch the ground with the toes. He was recommended to suspend the limb in walking by means of a strap thrown over the shoulders.

Until the twenty-third day the pain had not been severe; but the nights were now attended with so much suffering that some relaxation of the mechanical extension became necessary, and it was determined to increase the tension on alternate days only.

On the thirtieth day he was enabled, when standing upright, to place nearly the entire ball of the great toe on the ground. During the whole of the treatment his appetite and health continued extremely good. He visited me as often as was necessary. He took no other medicine than an occasional opiate to procure rest.

Oct. 2. Considerable pain from the strain on the limb continuing, it is arranged that the screws of the apparatus shall not be tightened oftener than twice a-week.

Oct. 8. The entire heel and sole can now be applied to the ground.

Oct. 15. Since the limb has attained a position which is almost straight, the inconvenience and pain occasioned by wearing the apparatus has increased to the extent that remaining beyond a short time either in the horizontal or upright posture is equally uncomfortable. The apparatus was therefore removed, having remained incessantly applied nearly six weeks. I was much pleased with the condition of the limb: it presented no appearance of unequal pressure or excoriation. The knee was almost perfectly *extended*, although the condyles of the femur projected unnaturally beyond the anterior edge of the tibia. From this period the apparatus was daily removed for one or two hours, and the limb well rubbed with oleaginous liniment, and

manipulations used for the purpose of reproducing motion in the joint, which was now nearly stiff in the extended position.

Oct. 27. The limb has swollen considerably and been more painful since the removal of the apparatus. There is much tenderness in the joint and sensation of weakness when motion is attempted. He stands well on the foot and heel, and believes he could, if permitted, walk without assistance.

Nov. 4. Tumefaction has subsided, and the only uneasiness remaining when the limb is at rest arises from a strong sensation of "red hot pins in all the nerves," requiring him to rise and walk at night to obtain relief.* This uneasy sensation is strongest in the foot and heel, and increased when accidentally touched. Recommended to remove the apparatus and employ frictions twice a-day.

Nov. 11. At his visit of this day he has made the following remark :—"The sensation of hot pins, &c., increases as I feel more and more the use of the muscles." He is now commencing to exercise the limb, walking with assistance of sticks instead of crutches.

* The cause of this sensation is an important subject of inquiry. It obviously depended on injury to the sacro-sciatic nerve, resulting from too rapid straightening of the limb. The fact suggests, therefore, the propriety of conducting extension slowly in cases of extreme contraction. I have been twice consulted in cases that had been operated by practitioners who, either from too great boldness in the performance of the operation, or from imperfect acquaintance with the anatomical relation of the biceps tendon to the surrounding structures, had severed the peroneal nerve. Immediate paralysis of the anterior and external parts of the leg and foot had ensued. I have watched one of these cases nearly three years; sensation and volition have gradually returned, and will probably be completely restored. An event so untoward was calculated to have destroyed the patients' confidence in the value of tenotomy. It may always be avoided by studiously keeping the edge of the tenotome close to the tendon to be severed. In some of my earliest cases of knee ankylosis, of which Case XXII. was an instance, I was induced, owing to the obscurity in the anatomical relation of the parts consequent on numerous cicatrices in the ham, not to resort to the subcutaneous section, but after exposing the tendons and passing a director beneath, divided them under the eye; so that it cannot be premised that in Case XXII. any nerve was severed. Moreover, in Case XXII. the formication did not occur until upwards of nine weeks after the operation, by which time the sacro-sciatic trunk became insupportably stretched. I have had ample experience of the impropriety of dividing tendons by exposure under any circumstances, whereas by subcutaneous puncture in thousands of instances in which I have performed it, or in which it has been effected under my direction, I have never witnessed the slightest subsequent inflammation or constitutional disturbance.

The tenderness of the knee is rapidly diminishing; and although the joint does not yet possess much motion, and the condyles of the femur are still unnaturally prominent, no doubt exists of the ultimate complete restoration of the limb.

It is unnecessary to quote longer reports from my case-book; it will suffice to observe, that until the present period, April 1843, he has continually acquired power in using the limb. The formication has ceased. Some months since, on observing that slight remaining contracture of the ankle caused him to walk on outer margin of the foot, section of t. achillis was resorted to with much advantage. At present he walks without lameness, and pursues his former active avocations.

Remarks on Cases XXI. and XXII.—The rapid straightening of these cases of extreme contraction of knee from recent inflammation, contrasted with the slowness with which restoration is often effected in slight contractions of many years' duration, is consistent with the general idea of the greater difficulty of remedying a long standing than a recent deformity. But since the discovery of subcutaneous tenotomy by Stromeyer, the comparative difficulty of cure does not depend on the intensity of the muscular contraction being augmented by continuance in the vicious position; for when section of tendons is once effected, the contraction of years' duration from that cause is as immediately removed as that which has existed months only. The cases of knee-ankylosis here related demonstrate that the difficulty of restoration is proportionate to the extent to which the solidification of the plastic matters effused into and around an articulation, as a consequence of the inflammation, has proceeded.

The above series constitutes the whole of the cases of incomplete knee-ankylosis I have subjected to tenotomy up to the date of the latest of the operations here detailed.* I

* I may justly exclude from this list of cases of *incomplete* knee-ankylosis a case which, after section of hamstrings, was proved to be *completely* ankylosed. In this instance I formed an erroneous diagnosis, not having at that

have excluded from the table the more easily remediable cases of knee-*contracture* induced by spasm, paralysis, burns, &c., as these do not fall within my definition of ankylosis.* The results of the application of tenotomy to knee-ankylosis will, as shewn by these cases, bear comparison with the results of therapeutics applied to an equal number of any other diseased conditions incidental to the human frame. In no case did the operation aggravate the patient's condition, in no case did it fail to afford relief; in two, which were the least benefited, locomotion was, in the one (Case VIII.), effected with greatly diminished fatigue; in the other (Case IX.), the patient, who had been unable to walk since occurrence of the ankylosis, was rendered able to do so without assistance even of a cane. In the remaining fourteen cases, some acquired a greater degree of mobility and a more perfect joint than others; all were enabled to walk, unaided by crutch or stick, and the younger individuals with scarcely a trace of lameness. Although an observer, critically conversant with the elegance, flexibility, and strength characteristic of the movements of this part of the frame in the normal condition, might not fail to perceive some defect in the attitude or gait of these fourteen former subjects of knee-ankylosis, their condition so nearly approached the normal state, that I shall venture to designate them *cured*.†

period discovered the source of error in diagnosis described page 27. Tenotomy was successful in relieving false ankylosis of the opposite ankle of this patient.

* The only other case of *false ankylosis* excluded is one formerly related in my *Treatise on Club-Foot and analogous Distortions*, 1st edition, 1839.

† The term *cure* is commonly employed by physicians and surgeons in a relative and not in the absolute signification. How rarely the condition of individuals justly said to be *cured* of inflammation or disease of any organ will bear a comparison with that of individuals who have never been the subjects of disease! The cured condition is relative to the previously diseased state; and the value of the medical or surgical treatment is determined, not by comparison of the cured individual with those who have never suffered, but with his previous condition. The *cure*, in the ordinary point of view, is the restoration of the structure and function of an organ to that condition which enables the individual

CASE XXIII.*

FALSE ANKYLOSIS OF THE ANKLE IN THE EXTENDED POSITION.

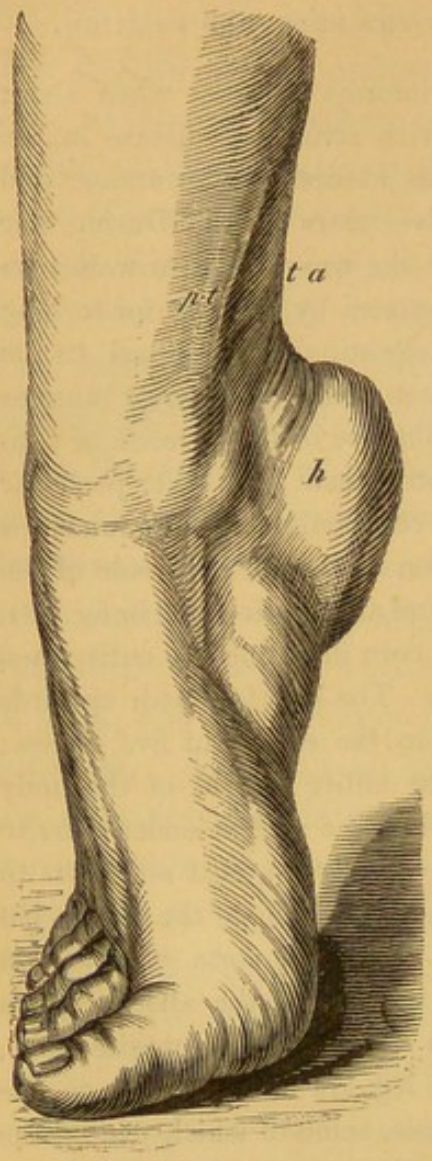
Sept. 4, 1837. Miss ***, aged 27, informs me that when about seven years of age she was attacked with scrofulous disease in the right leg, accompanied with numerous abscesses, ulcerations, and fistulæ, the last of which closed twelve years since. During the continuance of this protracted disease she was unable to walk; on its subsiding, the extended position assumed by the foot for so long a period had produced a permanent elevation of the heel to its greatest extent. This position had arisen from the anterior muscles of the leg being overbalanced, in the absence of the exercise of volition, by the superior power of the gastrocnemii and other posterior muscles, combined with the gradual contraction of the numerous cicatrices. The patient now walks upon that part of the sole of the foot corresponding to the metatarso-digital articulations (as in fig. 31), which is covered with the usual painful corn investing the cutis when subjected to undue friction or pressure. The heel is drawn upwards by the contracted muscles of the calf to the extent of five inches; this distance is retained even when the entire weight of the body is thrown upon the affected limb, or when the patient endeavours to force it down; so rigid, indeed, is the contraction, that no efforts to force up the toes effect the least alteration in form of the foot. No actual deformity of the foot beyond the fixed state of so-called extension exists. The whole of the muscles of the affected thigh and front of the leg are weaker than those of the opposite side; those of the back and outside of the leg are bound down to the bones by ten or twelve indented cicatrices, some of which exceed the length of three inches. She is incapable of exercising voluntary power by the action of the anterior muscles, through their being constantly kept on the stretch; and is also unable to exercise the posterior muscles, some of them in various parts being firmly adherent

to pursue the ordinary avocations of life with ease and comfort, although the restoration may not be so complete that the organ will endure the same wear and tear as an organ never affected.

* Cases XXIII. and XXV. have been already published in my *Treatise on Club-Foot and analogous Distortions* (edit. 1839); but as they are properly cases of false ankylosis, I have republished them here in an abbreviated form.

to the bones, and the remainder being already contracted to their fullest extent. The entire extremity, owing to the fixed straight position of the foot, is rendered longer than that of the opposite side. The tibia and fibula, however, from the long continuance of the scrofulous disease, not having kept pace in growth with those of the opposite limb, are about one inch shorter, and consequently diminish to that extent the excess in length of the affected extremity. This, in addition to the studious efforts of the patient to conceal her deformity, by walking leisurely, and as much as possible upon the toes of the sound leg, renders the lameness less than that which usually results from a deformity so considerable. She cannot stand or walk for any great length of time, particularly if the pavement be sloping or uneven, without much pain and fatigue. She is urgent for the performance of an operation, which has succeeded in the case of an acquaintance, also one of my patients, whose deformity was of twenty-five years' standing. The non-existence of true ankylosis of the joint is evident from the lateral motion given to the astragalus and tarsus by alternately moving the toes inwards and outwards.

Fig. 31.*



The letters *t a* indicate the tense tendo achillis; *p t*, posterial tibial tendon; *h*, the heel elevated to the utmost.

Sept. 7. Divided the tendo achillis. I punctured the skin on the inner side of the limb, opposite to the part where the tendon was least engaged by the adhesions, and as far from the anterior

* This figure illustrated another case in the same treatise; but as it perfectly resembles the cast of the foot here described, I have availed myself of it on the present occasion.

surface of the tendon as compatible with the safety of the posterior tibial nerve and vessels, one side of the knife being directed towards the latter. The edge was then directed backwards against the tendon, the point being made to describe a quarter or third of a circle, the centre being that part of the skin where the external puncture was made. By this cutting backwards and circular motion of the point of the knife, the tendo achillis, and nearly all the adhesions (which I found to be fibro-cartilaginous) between the edge of the knife and the skin, were divided in the same manner I usually adopt for cutting the former only, without puncturing the skin of the opposite side of the leg. After the withdrawal of the knife, two small portions of fascia, or bands of adhesions, were felt through the integuments unsevered, which were cut by the reintroduction of the bistoury. Cicatrisation immediately followed.

After a few days, extension was commenced, and the apparatus was slowly tightened, but with little amendment in the state of the ankle-joint. The patient complained of restless nights, and took a few doses of tinct. opii. The pain endured from the apparatus was not referred to the situation of the ligamentum deltoideum and fibulare posticum, to the former of which, after the operation for club-foot, patients usually point as the part where they feel the process of extension, but to the back of the fibula, two inches above the malleolus. On the eighth day of the extension I found, to my disappointment, that the foot was nearly in the same position as before the operation, the heel having but slightly descended; it was therefore evident that some unusual impediment existed to the bending of the ankle. At the place where the patient complained of pain and of having felt the process of extension, close to the tendons of the peronei muscles, a cicatrix adherent to the bone was observed somewhat inflamed, appearing as if it had been on the stretch. I now suspected that these tendons might be implicated in the cicatrix, and adherent to the fibula, although before the operation I believed them to be free; I therefore resolved that if, on subsequent examination, this suspicion were confirmed, I would divide them below the cicatrix. The bandages and apparatus were removed, and the spirit-lotion directed to be constantly applied to the ankle, and a dose of laxative medicine to be taken, in order to accelerate the removal of œdema of the parts, which obstructed an accurate examination.

On the eighteenth day after the division of the tendo achillis, all swelling having subsided, I was enabled to satisfy myself of the precise state of the parts. No adhesion of the peronei tendons at the cicatrix was present; for on moving the ankle-joint as far as the deformity would admit, I found that they were rendered, both above and below the cicatrix, alternately tense and lax. The cicatrix was still slightly œdematous and red, accompanied with a sensation of pain on attempting to press the toes upwards, ranging from the cicatrix to the posterior extremity of the os calcis. By careful manipulation I discovered what I believed to be a firm band, passing from the os calcis, or from the inferior portion of the divided tendo achillis, to this cicatrix of the fibula. Pain was felt in the direction of this band on pressure, and also on endeavouring to force the toes upwards.

My friend Mr. Herring of Sun Street, who attended the case with me, coincided in the opinion that this fibrous band constituted the impediment to bending the joint; I therefore determined to divide it between the cicatrix and its connexion with the lower part of the tendon, which was effected after the manner of dividing the tendo achillis, with the exception of the introduction of the knife on the outside of the limb. The wound at the part healed the second day; but a minute puncture, made by the curved point of the knife in the posterior median line, cicatrised a day or two later. Stromeyer's foot-board was then immediately re-applied, and the same degree of extension which had previously produced great pain and uneasiness was now borne with comparative ease. The heel gradually descended, and on October 9th, fourteen days after the second operation, she was able to put the heel and entire sole to the ground, which had not been done for twenty years. A lighter modification of the apparatus was subsequently worn for three weeks, to support the joint when walking, and (although the foot had now acquired to the eye of a cursory observer a perfectly natural form) to endeavour to bend the ankle beyond a right angle with the leg, and thus obtain the full extent of natural motion. This instrument did not occasion the slightest uneasiness; on the contrary, it proved a source of ease; for when the foot was allowed to hang unsupported, she felt, as is usually the case for a short time after the operation, pain from motion of the recently elongated ligaments of the joint.

This inability to retain the foot in a bent position by the action of the anterior muscles of the leg, was caused by their previous elongation during the many years the deformity had existed.

Nov. 5. Apparatus is laid aside, and the patient now walks with a common shoe; the gait resembles that of a person who has recently recovered from a sprained ankle or broken leg, the foot being cautiously placed on the ground, and the toes turned outwards, to avoid motion of the yet tender ligaments of the joint. She only complains of the sensation that her leg is much shorter than it was previously to the operation, or than the other leg is at present. It was stated at the commencement of this report, that the tibia and fibula were nearly an inch shorter than those of the opposite extremity; but her impression is, that when walking, the operated limb is at least three or four inches shorter than the other. This impression arises from a false sensation, depending upon its former greatly elongated state. The spinal column and pelvis, with the vertebral and pelvic muscles, had accommodated themselves to the unnatural length of the deformed limb; and the ankle-joint being now restored to its proper action, and the limb shortened to the extent of the former elevation of the heel (five inches), it is not surprising that the change should appear to the patient so remarkable. It may be observed, notwithstanding that the foot is restored, and that for three weeks she has been walking on the whole of the sole, the shoulder of the affected side continues higher than the other; so slowly is the proper relation of the pelvis and vertebral column restored, after having, during so many years, assumed an unnatural position. This defect will shortly cease, and the only remaining trace of lameness will depend upon the difference between the actual length of the tibiæ.

Nov. 19. The stiffness and awkwardness of the gait have much decreased. A perceptible difference exists in the length of the two extremities, although the exaggerated sensation of shortening has ceased. The shoulder which had previously been elevated has gradually descended, and is somewhat lower than the other. She is able to stand or walk within doors for a considerable part of the day, without experiencing uneasiness, with the exception of a slight pain over the front of the articulation when the whole weight of the body is thrown upon the toes in ascending the stairs. I have this day carefully examined the state of the muscles of the leg: the

situation where the tendon was divided is not indicated by depression or enlargement; she can voluntarily contract the gastrocnemii, and, assisted by the other posterior muscles, elevate the heel; the action of the peronei in drawing the toes outwards is perfect; and she can also, by means of the tibialis anticus and other anterior muscles, bend the ankle-joint perfectly.

Jan. 1, 1838. At the present time she is able to walk or dance as if the limb had never been ankylosed.

May 1843. The cure is permanent; Mr. Herring has repeatedly informed me that the lady does not retain a trace of lameness even after considerable exertion.

Remarks.—The *indications of cure* in this case were, to divide the tendo achillis, and to obtain, by gradual stretching with the appropriate apparatus, the full natural extent of motion of the ankle-joint. A difficulty presented itself, arising from the lowest cicatrix—uniting the skin, bones, and tendo achillis—approaching closely to the insertion of the latter into the os calcis; and also from the distance between the anterior surface of the tendon and the back of the ankle-joint (occupied in a healthy limb by yielding cellular tissue) appearing, from thickening and induration around the tendon, to be filled up by a dense mass of organised lymph, which denoted the former situation of an abscess. It was necessary to avoid injuring the bursa at the insertion of the tendo achillis, and appeared objectionable to traverse the old cicatrices in the course of the operation. But being convinced that the greater portion of the obstacles to bending the joint would be overcome by division of the large and inelastic tendo achillis, with as much of the subjacent indurated cellular tissue as might be reached with safety to the tibial nerve and vessels (unless that left undivided were completely fibro-cartilaginous), I did not hesitate to undertake the treatment of this case on the same principles I have recommended in the treatment of club-foot.

The prompt recovery in this case of the power of volition

in the tibialis anticus is highly instructive in the study of the ætiology of congenital and acquired deformities in general.

In the commencement of my investigations into the causes of these diseases, I supposed that the debility of the anterior muscles of the leg invariably resulted solely from the long-continued over-action of the powerful antagonist muscles, producing mechanical extension, and physically altering the muscular fibres. That the latter takes place to a certain extent is proved by this case, as the patient was for more than a month after the removal of the deformity unable to bend the ankle; but although the anterior tibial muscle had been held mechanically elongated to the utmost extent for nearly twenty years, a few weeks sufficed for the complete recovery of its power, on the restoration of the ankle-joint to its proper motion; whereas, in some distortions of paralytic origin, where the same muscle was primarily involved, and which I have watched for seven years after cure by division of the tendo achillis, I have not perceived that the paralysed muscle recovered its natural power, although this defect may have only caused a trifling impediment in walking.

CASE XXIV.

FALSE ANKYLOSIS OF ANKLE IN EXTENDED POSITION.

I WAS consulted by Mr. Wood, of Rochdale, in the case of a gentleman very similar to the above, in which, after section of the tendo achillis, the heel could not be depressed. I recommended division of the peroneus longus and brevis, and redivision of T. achillis. But even these means were not successful. On subsequent examination a band similar to that described Case XXIII. was discovered, connecting the extremity of the fibula to the posterior and external surface of the os calcis, which was divided. With the additional relaxation of the ankle thus effected, we succeeded, though slowly, in depressing

the heel so that the entire sole was applied to the ground; but flexion of ankle beyond 90° could not be obtained. It then became obvious that the remaining resistance depended on the changes in form of the articular surfaces. I was strengthened in this opinion by the history of the case furnished me by Mr. Wood, and by the evidence of previous disease of the tibia and fibula, the former of these bones being, in its whole length, in a *sequestered* condition. The patient's state being so greatly ameliorated that he could walk with comfort and almost entirely free from lameness, it was undesirable to risk disturbance of the reparatory processes going on in the limb by longer continuance of mechanical extension. I was, notwithstanding, disappointed in having been unable to restore complete flexion.

CASE XXV.

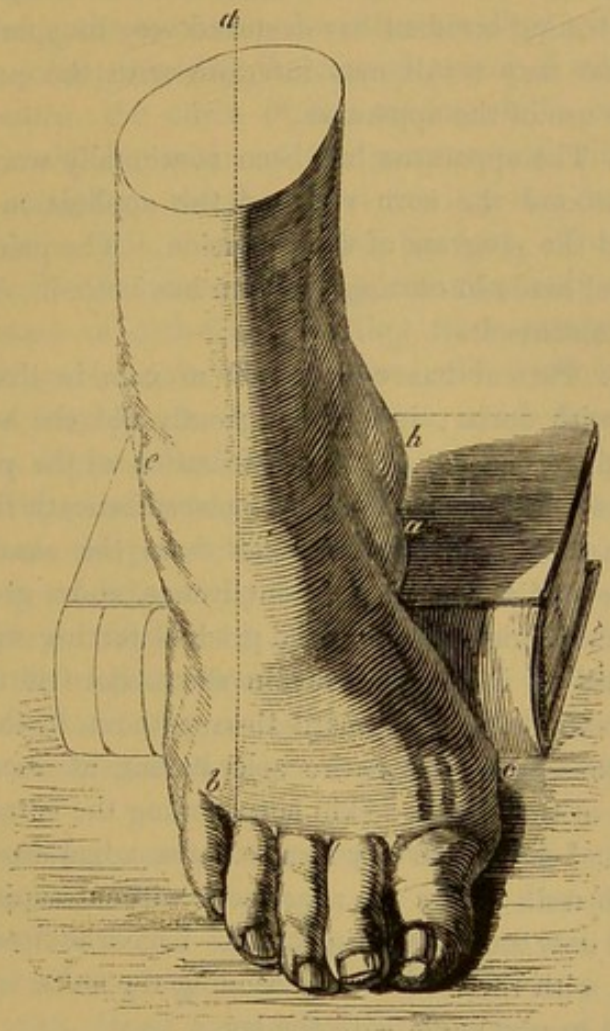
FALSE ANKYLOSIS OF THE ANKLE IN THE EXTENDED POSITION.

July 27, 1837. Miss * * *, ætat. 24, the daughter of a medical friend, informs me that a disease attacked her right leg nearly nine years since, which at first was supposed to arise from rheumatic inflammation. It continued for four years, during which period numerous abscesses were formed in different parts of the back and outer side of the leg, from several of which large pieces of bone were removed. When the wounds had entirely healed, and she had regained strength, she found herself unable to touch the ground with more than the front part of the foot (see fig. 32), the heel having been drawn up to the extent of two inches and a half. The action of walking was consequently very difficult. This has throughout continued, great fatigue and profuse perspiration resulting from trifling exercise. Her medical attendant had placed her under the care of a mechanist of repute, who undertook, by means of appropriate apparatus, to overcome the contraction of the calf, and gradually to force the toes upwards and the heel downwards. This plan had been perseveringly continued to the present time by the almost daily attendance of the mechanist, without the production of further benefit than the prevention of any aggravation of the contraction.

The patient does not touch the ground equally with the ball of the great and little toes, but chiefly treads on the latter, from the

toes having been thrust inwards. The drawing exhibits a degree of external convexity and internal concavity of the tarsus, shortening of the distance from the posterior extremity of the heel to the metatarsal articulation of the great toe, and a projection (see *a*, fig. 32)

Fig. 32.



False ankylosis of ankle (*spurious Talipes equino-varus*), Case XXIV.—The perpendicular line *d b*, passing through the axis of the leg, shews the inward inclination of the anterior part of the foot, the little toe being alone situated on the outside of that line. The patient, therefore, chiefly walked on the ball of the little toe.

occasioned by the outline of the abductor pollicis muscle, all characteristic of the similar grade of club-foot.

Aug. 1. Divided the tendo achillis, assisted by my friend Mr. Kingdon.

7th day after section. Extension has been slowly carried on, without pain or inconvenience to the patient, except from the pressure of the apparatus against one of the corns covering that part of the sole on which she formerly trod. A friend of the patient this morning undertook to remove the projecting part of the corn which occasioned the pain, in doing which he unfortunately wounded the cutis. This trifling accident has occurred very inopportunely, as the tenderness that may result may interfere with the perseverance in the necessary use of the apparatus.

10th day. The apparatus has been continually worn, but the inflammation around the corn required the application of poultices, and prevented the progress of the extension. The pain is subsiding, and the wound made in cutting the corn has healed. The extension can now be continued.

11th day. Patient has complained of pain in that part of the foot covered with corns; indeed, so greatly did she suffer, that, in order to produce a more equable distribution of the pressure of the foot-board over the entire sole, I have placed beneath the foot a temporary air-cushion.* Complete relief from the soreness and pain succeeded the application of this contrivance, and a greater pressure than I considered necessary for the gradual forcing upwards of the toes occasioned no inconvenience; in short, she felt more comfortable when wearing the foot-board than without it, the elastic uniform pressure against the entire sole having at once relieved the burning pain of the inflamed skin surrounding the corns.

16th day. I have this day removed the apparatus, and allowed the patient to walk across the apartment without support, the entire sole and heel now touching the ground. I have advised reapplication of apparatus, with the intention of bending the ankle so that the foot may form the proper angle with the leg.

22d day. Flexion is obtained to the extent requisite to ensure perfect walking hereafter. I have applied a light instrument, which combines the perpendicular elastic springs of the Scarpa shoe with a certainty of bending the joint to the natural extent by means of a screw acting as a lever against the spring (see *Treatise on Club-foot*).

* This was prepared by introducing portions of the intestine of a bullock within each other, tying them firmly at one end, and properly securing them after inflation. I doubled the intestine to prevent its stretching, whereby it might have become too flaccid, or burst from the pressure.

The patient can walk with facility. The only remaining inconvenience arises from tenderness of those ligaments of the joint which have undergone elongation.

It is unnecessary here to offer further detailed reports from my note-book; I may, however, be permitted to give a summary of the subsequent progress.

Six weeks after the operation, the patient walked with a common shoe, the ankle-joint possessing the natural extent of motion; at the end of two months, the union of the tendo achillis could be felt perfect. She could, by means of the gastrocnemii, tib. post., and other muscles, straighten the foot upon the leg, and freely contract the anterior tibial muscle, thereby raising the foot. The peronei had likewise recovered their power, affording a strong contrast with their inactivity in cases of club-foot resulting from paralysis of those muscles. During the succeeding severe cold weather, she occasionally suffered from pain in the ankle-joint, which for a short time caused a certain degree of lameness.

The following extract from a communication, dated March 16, 1838, will indicate the progressive improvement:

"My foot is so delightfully well now, that I am quite anxious to shew it to Sir A. Cooper. I have repeatedly walked five or six miles without the slightest inconvenience; and I cannot conclude this without once more expressing my gratitude to you for having afforded me so much comfort and ease in walking, to which I was so long a stranger."

Sir A. Cooper had occasionally seen this young lady previously to the performance of the operation; on seeing her afterwards, he was much pleased with the alteration of the foot, and the improvement which had taken place in her general health.

Dec. 6th, 1838. Great amendment in the state of the foot and the muscles of the leg has ensued since the above reports. The patient can not only perform the whole of the ordinary movements of the foot, but stand on the affected leg, throwing the entire weight of the body on it; and whilst in that position, can even elevate the heel and rest on the toes only. This suffices to shew the perfect nature of the union of the tendo achillis, and the complete recovery of the function of the muscles of the calf. The improvement in the form of the foot consists of a considerable elongation; the great toe

extends an inch farther forwards, in consequence of the flattening of the tarsal arch.

May 1843. During the last five years I have occasionally examined this patient: the cure continues perfect.

CASE XXVI.

FALSE ANKYLOSIS OF ANKLE, FROM CONTUSION AND FRACTURE.

Section of T. achillis, and of peroneus longus and brevis, flexor longus pollicis, and fascia plantaris.

A LADY, æt. 56, consulted me, Aug. 1840, on account of a contracted ankle, so perfectly similar in external configuration to fig. 32, that it is unnecessary further to describe the appearance of the limb. The history I received was, that she was thrown from her carriage fourteen years previously, and sustained considerable contusion of the ankle-joint. Severe inflammation ensued, the limb remaining tumefied during many weeks. On minute examination of the bones, some irregularity of the surface of the lower portion of fibula was discovered, from which the existence of previous fracture of this bone was inferred. The leg was for a considerable time supported by splints. During this period of inactivity of the muscles, those on the posterior surface of the limb obtained an undue preponderance; so that on attempting to walk, the heel was incapable of application to the ground. Frictions, manipulations, and the use of apparatus calculated to effect depression of the heel, were for three years sedulously persevered with, but in vain: the heel was but little depressed. Gradually the toes became inverted. The position of the foot, and great tension of the T. achillis, indicated the principal dependence of the lameness on contraction of the gastrocnemii; and consequently, with the hope of effecting so much restoration as would enable this lady to tread flatly and firmly, I advised section of T. achillis. I was satisfied that her condition could not be aggravated; and as she was unable to walk without great claudication, or stand many minutes without suffering and fatigue, I was sanguine of affording considerable benefit. The principal cause of suffering resulted

from the circumstance that the entire weight of the body was thrown on the ball of the little toe, invested consequently with an exquisitely tender corn. Carriage exercise was alone available ; hence my patient's anxiety for relief. The subcutaneous section of T. achillis was accordingly performed, followed by gradual depression of the heel by means of apparatus represented in my "Treatise on Club-Foot." Within four weeks, the heel and entire sole were applied to the ground, although the foot was not completely flexed. Moderate exercise and carriage-airing were then permitted. The general health had not suffered from confinement, and daily improvement in walking ensued. At the expiration of seven weeks my patient went into the country. During the succeeding autumn and winter I received frequent satisfactory reports of the progress of the case. In the summer of 1841 I was again consulted, on account of remaining tenderness and pain in front of the ankle. This pain was not constant. Patient's statement was, that she was enabled to stand and walk for a considerable time; but, after resting a short period, the first few steps, on resuming her walk, were accompanied by so sharp a pain in the situation mentioned, that further exercise was sometimes impossible. Usually, however, the pain would gradually decrease on persevering with exercise. Position of foot continues favourable; but slight fulness of synovial membrane exists. Ordered vesicatorium to the instep, and occasional exhibition of gentle aperients, with rest of the limb for a fortnight. At the end of this period, locomotion was effected with so much greater comfort, that permission was again granted for patient's return into the country. In the winter I was informed that, excepting during the prevalence of easterly winds, no pain was experienced; and that patient continued to increase the length of her daily walks.

In the summer of 1842, I was again enabled to examine the condition of the limb. I ascertained that my patient had, during the spring, been confined to her apartment by severe attack of a catarrhal nature, during which the manipulations, baths, and frictions previously recommended, were necessarily omitted. On examination of the foot, I found it still flexible to the extent of a right angle, slight contraction only having recurred, through the temporary cessation of exercise in the spring, and through diminished attention to prevention of re-contraction. The only uneasiness complained of after exercise was tenderness in the situation where anterior tibial tendon

presses over the ankle-joint. Section of peronei tendons was effected subcutaneously one inch and a half above point of malleolus externus, and that of the flexor longus pollicis and plantar fascia in the sole, succeeded by active manipulations of the foot, directed to obtainment of increased flexion.

Success attended this proceeding, the pain on anterior and internal part of ankle was relieved, and three weeks after the section, patient again quitted London.

During the winter 1842-43, I learned that my patient had visited on foot many spots she had been unable to reach since the period of the accident, seventeen years previously; but that she had occasionally experienced the pain already described on rising to take a second walk. The position of the foot was unimpaired, and the consequent firmness and evenness of the gait continued perfect. From the existence of slight rheumatic pains in other parts of the frame, she was convinced that the uneasy sensations were referrible to the same cause.

May 1843. I have recently examined the state of the limb. Position and flexibility improved since last year. No complaint of pain in articulation after exercise. The only inconvenience experienced arises from tenderness of the inferior extremity of the fifth metatarsal bone, which continues somewhat enlarged, owing to its having for many years borne the principal weight of the body. The anterior part of the foot being much expanded in width, as usual when an individual has for many years trodden on the point of the foot only, and having observed that the shoemaker was compelling this lady to wear an improperly narrow shoe on the previously contracted foot, I recommended a shoe, the sole of which should correspond with the unusual width of the front of the foot. This simple advice was perfectly successful in removing the only obstacle to the apparently perfect success of the operation.

CASE XXVII.

FALSE ANKYLOSIS OF ANKLE (TALIPES VALGUS SPURIUS), RESULTING FROM SCROFULOUS DISEASE OF THE ANKLE.

Restored by section of peronei, and extensor communis digitorum longus tendons.

May 1841. R. S., aged 14, was attacked with strumous inflammation of the bones of the ankle and tarsal joint, December 1836. The tumefaction and heat were considerable, requiring frequent applications of leeches and blisters. During the winter of 1837-38 suppuration ensued: in several places the wounds closed and re-opened occasionally during eighteen months, until cicatrisation finally resulted in the spring of 1840, leaving the ankle and tarsus enlarged and distorted as at present.

The position of the foot resembles Talipes valgus:* the inner ankle is very prominent; the outer one is depressed; the arch of the sole is lost; the inside of the heel, and astragalus, with the remainder of the inner margin of the foot, and inside of the great toe, are applied to the ground, the entire external margin being raised from it. The form of the ankle is in other respects very unsightly, being disproportionately large compared with the fore part of the foot. Three indented cicatrices, one on the front of the malleolus internus, the others corresponding with the anterior extremity of the astragalus and the upper surface of the navicular bone, indicate the situation of the former abscesses.

Patient cannot walk a mile, through weakness, fatigue, and straining pain on the outside of the tarsus, in the depression anterior to the external malleolus produced by the recession of the astragalus. One continuous corn extends from the posterior and inner edge of the heel to the inside of the great toe, which, after walking, becomes tender. I divided the peroneus longus, p. brevis, p. tertius, and ext. comm. dig. tendons, and two days afterwards, on the healing of the punctures, applied the apparatus employed for cure of T. valgus.† He was ordered to wear it day and night, exercise and standing on the foot being for the present prohibited. A manifest improvement in the position of the foot was daily perceptible; at

* See *Treatise on Club-foot, &c.* † Ibid.

the expiration of three weeks moderate exercise was permitted. The restoration of the foot was unattended by pain, the only complaint having been inconvenience at night, from wearing an apparatus. Within six weeks the position was perfectly natural, the enlargement of the ankle had disappeared, the natural arch of the sole was restored, he trod equally on the outer edge of the foot, the heel, and ball of the great toe. He was then permitted to discontinue the apparatus during the day, a boot calculated to support the ankle being substituted. From this time he visited the Orthopædic Institution as an out-patient, walking daily three or four miles.

At these occasional visits I perceived no tendency to relapse; he was ordered to discontinue the apparatus at night only, and was discharged from further attendance.

Aug. 28, 1841. I have this day seen this patient; the foot continues perfectly straight; patient walks with ease five or six miles daily, without the slightest uneasiness or fatigue. He has drawn my attention to the circumstance that the joint, instead of being stiff, as before the operation, can be voluntarily bent and extended to the full extent. He also possesses considerable power of inverting and everting the toes. I have permitted him to use a common boot.

May 1843. The restoration of this case has been permanent and complete.

CASE XXVIII.

FALSE ANKYLOSIS OF THE TOES AND CONTRACTURE OF THE ANKLE.

Cured by section of tendons of phalanges and T. achillis.

A. B., æt. 28, applied at the Orthopædic Institution in Oct. 1841, complaining of inability to walk, in consequence of pain experienced in the front parts of both feet, and contraction of the toes (see fig. 19, p. 65) from rheumatism. The account given was, that one year previously he had been confined for some weeks to bed with rheumatic fever, which had "settled" in his feet. On examination, a contracted condition of the whole of the toes was observed, and tumefaction of the ball of each foot. The constant and principal seat of pain was that part of the foot corresponding to the metatarsal articulations of the whole of the toes. The patient was anxious for the perform-

ance of an operation; but as the debilitated condition of general health was accompanied by an evident rheumatic tendency, unfavourable for operation, he was recommended the internal use of quinine, with laxatives occasionally, and application of tinct. iodinii comp. to the affected articulations. This treatment was continued three months, at the expiration of which period his health was greatly mended; the pain in the phalangeal articulations was removed, except on attempting to walk; but the contracted condition of the toes, and the absolute incapability of locomotion, remained. Contracture of ankle, to some extent, was also perceptible: patient could not bend either ankle beyond the right angle, owing to contraction of gastrocnemii, which had resulted from the continued immobility in which the limbs had remained during the illness. It was ascertained that the ankle had never been affected with inflammation. Active manipulations, frictions, and fomentations, were now recommended, with the view of relaxing the toes and ankle-joints, and were employed several months without benefit. Patient was now more anxious for performance of tenotomy, as I had formerly informed him of the probability of ultimately obtaining capability of locomotion by this means. In order to test the amount of dependence of the lameness on the contracted state of the toes, I determined to postpone operation on them until relief had been afforded to the contracted state of the ankle, more particularly as the contraction of gastrocnemii, by preventing perfect bending of the feet, necessarily threw the weight of the body, in walking, disproportionately on the toes. Each T. achillis was therefore divided; and as the contraction of gastrocnemii was not considerable, the subsequent complete bending of the ankle was purposely conducted slowly. At the expiration of six weeks, union of the tendons being firm, and the ankle-joints perfectly flexible, he was so far improved, that the undue weight was no longer thrown upon the toes; and the heels being depressed, he could walk upon them; but in endeavouring to walk properly on the plantar surfaces equally, he was unable, particularly when in the act of springing forward from one foot to the other, to bear pressure on the ball of the foot. It was evident that the hindrance to locomotion arose from the cause described page 65, and that the relief of the contracted state of the toes was essential. The metatarsal articulations were incompletely ankylosed, and painful on attempting to straighten the phalanges. The muscular resistance shewed the

toes could not be extended without tenotomy. The whole of the flexor and extensor tendons of each foot were severed by subcutaneous operation. The punctures united within three days, and straightening of the toes was readily permitted. The eighth day after the operation, the pain formerly experienced had entirely subsided, and patient commenced exercise. The improvement was so rapid, and the relief so complete, that at the expiration of three weeks from last operation he was discharged from further treatment.

CASE XXIX.

CONTRACTED TOE FROM WEARING IMPROPER SHOES, FALSE ANKYLOSIS.

Cured by section of flexor tendon.

February 1840. Miss * * *, æt. 20, complains of inability to walk without pain, in consequence of contracted state of the second toe of the right foot, as at *a*, fig. 20, page 66. The affected articulation is in a state of incomplete ankylosis, in addition to contraction of the flexor tendon; the summit of the joint is enlarged, and almost immovable. The corresponding toe of the left foot is similarly affected, but in a slighter degree; it habitually assumes the contracted position, but may be straightened by slight pressure. The pain experienced in the right arises from the causes described page 69. Section of flexor tendon of the right was effected; the toe admitted of immediate straightening, and was lightly bandaged on a small splint. Exercise was permitted after one day's entire rest. Three days later the bandage was removed, and the puncture observed to be cicatrised, and the toe perfectly straight.

A whalebone splint was recommended to be constantly worn beneath the inferior surface of the phalanx for the space of a few weeks, and the use of a shoe sufficiently large to permit the proper juxtaposition of the toes was urgently enjoined.

May 1843. I have since frequently seen this lady: the relief has been permanent.

Remarks.—I have been consulted by many individuals similarly affected, principally of the fair sex. A person not

conversant with this apparently trifling evil, would not comprehend the anxiety evinced by many individuals to be relieved from the torment it occasions. Individuals of the rougher sex rarely experience so much inconvenience, as they usually wear shoes the soles of which are more proportionate to the width of the foot; whereas many ladies seek relief, the pain and lameness under which they suffer being sufficient to prevent locomotion in comfort; and as the necessity of ladies taking out-door exercise is not often great, they become in time altogether precluded from regular walking, which is so essential to the maintenance of perfect health. I have repeated this operation in numerous instances with invariable relief. As in tenotomy in general, so in this little operation, it is important to effect entire division of the tendon. I have successfully treated three cases in which the operation had been previously performed without benefit. In them, I believe, the tendon had not been entirely severed. Occasionally it happens that tenderness of the part will prevent the individual walking freely for a few days; but usually the cure proceeds as rapidly as I have stated p. 71.

CASE XXX.

INCOMPLETE ANKYLOSIS OF BOTH ARTICULATIONS OF THE GREAT TOE FROM WEARING TOO SHORT A SHOE (*fig.* 22).

JANUARY 1843. * * *, æt. 31, complains of pain and lameness, depending, in his opinion, on deformity of great toe of left foot, which has existed since earliest infancy. The claudication is considerable, and the patient walks so completely on the outer edge of foot, and the boot is so misshapen from improper treading, that a casual observer might suppose him affected with club-foot. On examination it is apparent that the lameness proceeds from incomplete ankylosis of the first phalanx of great toe in the flexed

position, and of the second phalanx in the extended position, as at fig. 22, p. 68. Each of the articulations of the great toe are exquisitely painful and rigid; the entire inner margin of foot is elevated, obviously in order to avoid pressure on the great toe. This elevation of inner margin is, however, no longer voluntary and therefore temporary, but constant, and cannot be removed on raising foot from the ground, or by pressure with the hands. It is apparent that originally long-continued voluntary effort to raise the inner margin has at length induced permanent contraction and rigidity of the anterior and posterior tibial muscles; so that were section of the long flexor muscle of great toe effected, the toe might be straightened, but patient would be unable to tread flatly. This opinion is corroborated by the circumstance that the flexor and extensor tendons of the great toe have already been divided (two years since) by an eminent surgeon without benefit. With these considerations I divided the long flexor and abductor muscles of the great toe, and the tendons of ant. tib. and post. tibial muscles. Straightening of great toe was effected by bandaging to a firm splint; and patient was directed to wear a boot furnished on its exterior with a perpendicular spring, to cause him to tread on inner margin, as in the treatment of T. varus. Within two months patient walked perfectly well, and is now relieved from pain and lameness of upwards of twenty years' duration.

CASE XXXI.

FALSE ANKYLOSIS OF ELBOW FROM FRACTURE.

Section of biceps flexor cubiti.

March 1843. I was consulted by Mr. Neville of Croydon in the case of a boy aged 11, who had two years previously suffered fracture of the humerus, extending probably into the elbow-joint; he had been out-patient of a metropolitan hospital. The limb had been necessarily placed for a considerable period on a flexed splint, and union had ensued. It is doubtful whether passive movements of the articulation were subsequently resorted to with sufficient perseverance, especially as the boy has, during the last

twenty months, resided with his parents. Tension of the biceps tendon was prominently felt on endeavouring forcibly to extend the arm. Supination was imperfect. Mr. Neville entertained the opinion, that as mechanical efforts effected so little change in form of the articulation, tenotomy might be advantageously resorted to. In this opinion I concurred, and admitted the patient into the Orthopædic Institution. Section of the biceps was effected by subcutaneous puncture; and on cicatrisation of the puncture, extension (by bandaging arm on splints) was daily increased; and within three weeks the arm was perfectly straightened. The boy was retained in the institution a few weeks longer, that mobility and flexibility might be obtained. These were accomplished; and although the strength of the limb was not entirely restored, he quitted the institution possessing a much more serviceable member than on his admission.

The Apparatus described in this Treatise were manufactured by Mr. D. Ferguson, *Giltspur Street, Surgical Instrument Maker to the Orthopædic Institution.*

THE END.

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