On the treatment of fractures of the femur by a simple modification of Liston's splint : with observations on re-fracture of the bone in cases of deformity / by Richard G. H. Butcher.

ON

THE TREATMENT

OF

FRACTURES OF THE FEMUR

BY

A SIMPLE MODIFICATION OF LISTON'S SPLINT;

WITH

OBSERVATIONS ON RE-FRACTURE OF THE BONE IN CASES OF DEFORMITY.

BY

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ON THE

TREATMENT OF FRACTURES OF THE FEMUR,

&c. &c.

When writing "On the Treatment of Fractures in the vicinity of the Ankle-Joint," the remarks upon which I published in the February Number of this Journal for 1852, and continued in the May Number of the same year, I quoted from the Cyclopædia of Practical Surgery, edited by Costello, a remarkable passage which instigated me to the task. I find again at page 239 of the work referred to, the following striking observations:—

"In the extensive field of surgery there are not many departments in which our noble art is capable of conferring greater or more frequent benefits on humanity, than in that which relates to fractures. In cases of every day's occurrence, well-directed art will restore its natural strength, and form, and functions, to a fractured bone, which ignorance or unaided nature would have shortened and deformed; with the harmony between the moving powers and the joints so broken, by the change of the relative situations of the muscles and bones, as greatly to impair the usefulness of an entire limb." And "there is no class of cases in surgery which requires more anatomical knowledge, nicer experience, and judgment (medically and surgically), or greater dexterity of manipulation, than that of fractures." If these statements be correct, which few I think will deny, to no special form of fracture are they more applicable than to the varieties involving the thigh bone, about which so much has been written, and in reference to the treatment of which such discrepancy still prevails. If any additional proof were wanting to verify this assertion, it is afforded by the number of splints invented to accomplish a permanent and perfect consolidation of the broken bone. My object in the present paper is to show how efficiently the most unpromising forms of fracture of the thigh bone, *no matter in what*

part of it occurring, can be treated by the simple modification of Liston's splint which I am in the habit of using.

Some of the cases which I adduce are replete with interest, and have been selected from amongst many, to illustrate the mode of treatment advocated, that plan which, if carefully pursued, will restore the member to all its usefulness and perfection in progression. To attract the eye of the practical surgeon, I shall first give a list of the cases treated, in order that their serious character may arrest attention and prove a sufficient guarantee that the test has been sufficiently searching. I shall next narrate the history, treatment, and result of each case, and afterwards make such observations as the localized peculiar symptoms characterizing some of them suggest; and lastly, I will describe the mechanical means employed, the advantages and mode of adjustment.

CASES DETAILED.

I. Fracture of the femur below the lesser trochanter united with shortening and great deformity; re-fractured thirty days after the accident.

II. Fracture of the femur below the lesser trochanter.

III. Fracture of the femur, partly within and partly without the capsule.

IV. Oblique fracture of the femur about its centre.

V. Oblique fracture of the femur through the great trochanter.

VI. Oblique fracture of the femur below its centre.

VII. Fracture of the femur external to the capsule.

VIII. Oblique fracture of the femur close to the knee-joint.

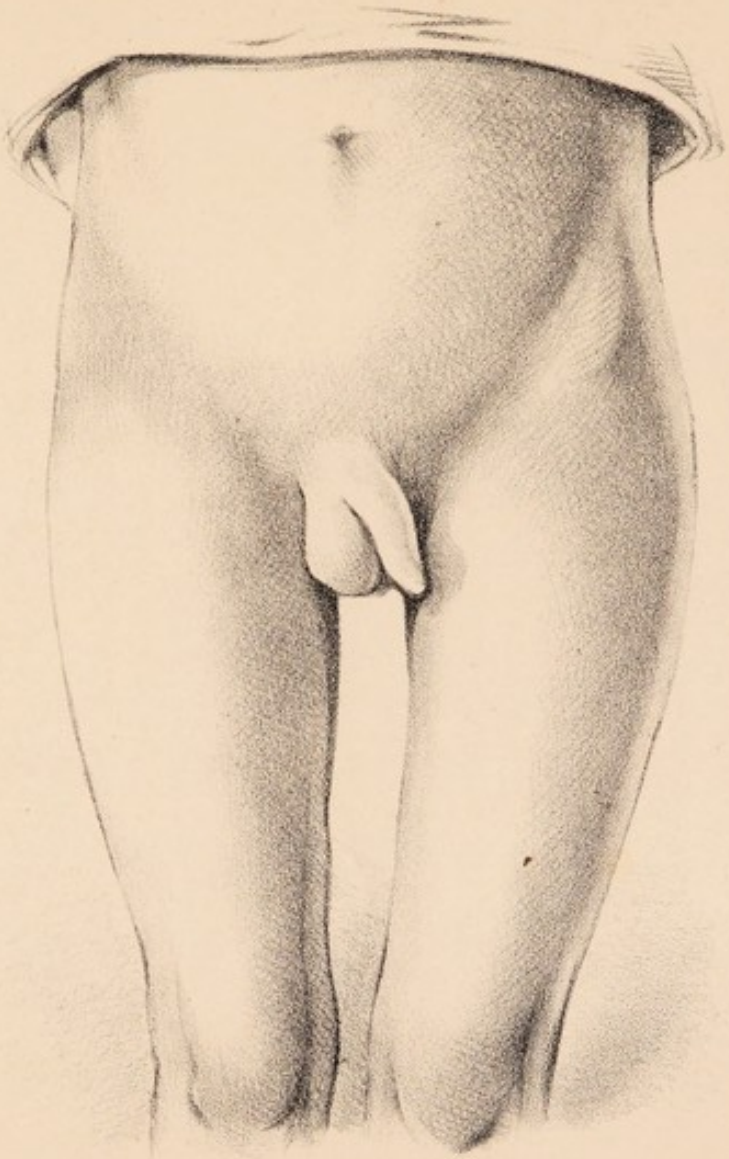
IX. Fracture of the femur through the great trochanter, nearly transverse.

CASE I.—*Fracture of the Femur below the Lesser Trochanter, with shortening and great deformity; Re-fractured thirty days after the accident.*

John Toole, aged 19 years, a healthy-looking young man from the country, was admitted into Mercer's Hospital, October 16, 1849, labouring under great deformity and shortening of the left thigh, the result of fracture. The appearance of the limb on his admission is faithfully preserved by a fine cast in my collection, and from which the accompanying drawing (Plate I. fig. 1) is taken,—the amount of shortening and the characteristic deformity presently to be described are faithfully represented. The history of the case is as follows:—Twenty-six days before presenting himself at the hospital, he was working in a sand-pit, when the bank suddenly fell in upon him, break-

Fig 1

Fig 2.



ing his right fore-arm near the wrist, and his left thigh below the lesser trochanter. He was soon after seen by a medical gentleman, who did all that was requisite; placed the limb in position, and supported it with splints. The patient, candidly enough, admits he never attended to the directions of his medical adviser, but moved the limb about according to his inclination, laying it sometimes on the outside, sometimes supported on pillows forming a double inclined plane, and thus it was subjected to frequent disturbance; nevertheless, union went on rapidly as usual at this period of life,—the more quickly consummating the deformity. By a reference to the engraving it will be seen that the outline of the limb was very remarkable, and formed a considerable arch, embracing in its most prominent part a point a little above the junction of the upper and middle thirds of the thigh, the convexity being directed upwards and backwards; by a careful measurement the thigh bone shows a diminution in its length of somewhat more than five inches as contrasted with the uninjured one. From an attentive consideration of the deformity so strikingly present here, it must be conceded that the lower fragment was drawn upwards, outwards, and backwards, and that the upper also, instead of being inclined forwards and inwards, likewise tended in the same direction, probably owing to the manner in which the force was applied, and the course of the solution of continuity in the bone,—the amount of shortening and the mass of callus thrown out may be fairly ascribed to the obliquity of the fracture. The union between the ends of the broken bone was so firm, that the patient could sustain the entire weight of the body upon the limb; and the connecting medium between the broken bones of the fore-arm was quite solid.

Being made aware of the history of the case, the next point to be taken into consideration was, how far surgical interference was likely to benefit the sufferer's condition. The most prominent features of the case, viz.: the age of the patient, the totally useless condition of the member as an organ of locomotion, the length of time the fragments were permitted to grow togetheir in their distorted relationship, and the solidity of the bond of union established, were all maturely weighed, when it was deemed advisable to re-fracture the bone.

On the morning of the 22nd the patient was brought into the operating theatre, and placed lying upon his back on a table, between the posts used for reducing dislocations; a counter-extending belt was then passed under the perineum on the affected side, and its ends fastened to the chain of one post; while a jack-towel, embracing with the clove-hitch the lower

extremity of the femur, just above the knee, was connected with the pulleys attached to the other. Chloroform was administered in the usual way, sprinkled upon a warm towel, and its effects rapidly produced; extension was then gradually put in force, and the muscles strained to the extreme of tension; the limb at the site of the fracture was forcibly moved up and down, and partly rotated, so as to help to break through the uniting callus; by degrees the connecting bond yielded, and after extension was kept up for twenty minutes, the curve gradually disappeared, and the limb was brought down to its full length; this being accomplished, Boyer's splint was applied, which maintained fully the required extension. The patient was then carried back to the ward, and placed upon a fracture bed covered with a hair mattress. 3, P. M. Not suffering much pain; administered half a grain of morphia. 9, P. M. No pain; to have the morphia repeated.

October 23rd.—The patient slept through the night, and complains of no unpleasant symptoms; ordered four grains of calomel, and afterwards a saline aperient.

24th. Increased the extension by a few turns of the windlass attached to the end of the splint. To have an opiate at night.

26th. Complains of the foot being sorely hurt by the pressure of the shoe and foot-board; this, however, might be obviated, but there is a greater fault in the splint,—it does not steady the upper fragment sufficiently, being too short to confine the trunk. For these reasons I removed Boyer's apparatus and applied Liston's splint, preserving its full length, and with the utmost precautions against pressure from the perineal belt, and at the ankle. When the limb was so adjusted, the patient expressed himself as much relieved.

November 2nd. Not necessary to remove the splint since last report; the limb holds its full length.

9th. Re-adjusted the splint, and placed an additional pad externally between the splint and the place corresponding to the fracture.

15th. Re-applied splint, bandages, &c.; not the least deformity.

30th. Removed splint, bandages, &c.; solid and perfect union is established in the most desirable way; there is no trace whatever of deformity, and the full length of the limb is restored; rolled the limb to support the enfeebled capillaries, in order to remove some little œdema of the leg and foot; there is no further necessity for mechanical support to the thigh; the knee-joint is rather stiffened and limited in its motions, from the long extension exerted upon it.

Dec. 11th. Œdema about leg and foot gone, and knee-joint quite flexible; still confined to bed.

18th. Allowed to get up and walk about with the assistance of crutches.

Jan. 10th. The patient can now walk about without any support, and he has not the slightest halt or trace of the original deformity.

The condition of the limb at this time is accurately portrayed in the engraving (Plate I. fig. 2), taken from a cast which was executed before the young man left the hospital.

I have frequently seen the subject of these remarks since he was dismissed from hospital, and he continues entirely free from any impediment in walking.

Case II.—*Fracture of the Femur below the lesser Trochanter.*

Anne Jackson, aged fifty-six years, admitted into Mercer's Hospital, March 15, 1850. She was thrown down by a car pasing rapidly by, and fell upon her left hip; the surface was uneven, particularly beneath the thigh, and she was conscious of the limb being broken from the moment of the accident. The patient was conveyed to hospital six hours after receiving the injury. The deformity was remarkable: the limb, on measurement, was between an inch and a quarter and an inch and a half shorter than the other; it lay everted, and swelling had set in rapidly both on the anterior and outer aspect of the limb, below the great trochanter. On extension being made, the full length of the limb was readily restored, but on being relaxed the deformity was quickly reproduced. On more close examination, the solution of continuity could be traced just below the lesser trochanter, and to pass from without downwards and inwards, not very obliquely, but sufficiently so to allow the lower fragment to be drawn upwards and outwards, somewhat overlapping the upper, and restraining it back. When by extension the upper and lower fragments were brought into apposition, and rotation of the leg and foot performed, crepitus was distinctly heard; co-existing with the fracture there were considerable contusion and effusion of blood through the soft parts behind the hip-joint. From the time of admission for many hours the patient seemed to suffer very seriously from the shock, and though wine was freely given to her during the six hours before she applied at the hospital, it required great caution and watchfulness to conduct her through this stage of collapse. She was at once placed on a soft bed with the limb steadied by a long splint on the outside, resting evenly supported and elevated towards the heel, on a gently inclined plane of pillows. A mixture containing ammonia, ether, camphor, &c.,

was freely administered every third hour, and warm wine and water were given at short intervals; heated jars were likewise applied to the stomach and sound limb; in a short time she fell into a quiet sleep.

March 17th. Great watchfulness; pulse weak; tongue dry, contracted, and brown; no pain whatever in the limb; ordered to continue the ammonia mixture, &c., and to have six ounces of wine.

18th. Had sleep; pulse better; tongue more expanded and moist; to continue stimulants as on yesterday, and to have aperient medicine, composed of rhubarb pill, blue pill, and carbonate of ammonia.

20th. On this day re-adjusted the mechanical appliances; placed the tail bandage from the toes up to the groin, and the long splint as before on the outer side of the limb and trunk. To continue stimulants and full diet.

21st. The complication of retention of urine, ever since the second day after the injury, was relieved by the catheter at intervals. Had this symptom occurred immediately after the accident, it might probably, and with reason, be referred to some slight concussion of the spine occurring simultaneously with the fracture; but in the present instance, it may be ascribed to the constrained position enjoined on the patient.

22nd. Feels quite comfortable; tongue moist; appetite improved; slept well. The patient has likewise regained the power of emptying the bladder without surgical interference, the incapability having lasted for five days.

25th. Re-applied the splint as before.

29th. Again threatened with sinking and collapse; increased the quantity of stimulants.

31st. Urgent symptoms of depression all gone; pulse again up and steady; tongue moist; every precaution taken to guard against stripping over the sacrum,—perforated air cushions placed beneath the parts exposed to pressure, and the surfaces freely brushed over with a strong solution of the nitrate of silver.

April 3rd. Going on most favourably; now all swelling, the result of the immediate injury about the fracture, is removed, and the upper and lower fragments lie in excellent position.

20th. Re-adjusted splint, bandages, pads, &c., on the 10th, and again on this morning. The case continued to improve; union becoming more and more firm, until finally completed on the 5th of May, when the splints were removed altogether, and on the 10th of the month the patient was dismissed, with the limb preserving its full length, and free from deformity.

Case III.—*Fracture of the Femur partly within and partly without the Capsule.*

Eliza Stafford, aged forty-nine years, admitted into Mercer's Hospital, March 9, 1851. She was walking along the edge of the pathway, and having trod on a piece of orange-peel she slipped off the curb-stone, and pitched forcibly upon the great trochanter of the right thigh. The patient could not move from the ground, and was raised, suffering acute pain at the part referred to, and totally incapable of leaning the slightest weight upon the limb. She was instantly brought to hospital. On removing the clothes, the deformity was characteristic of fracture close to the hip-joint. As she lay upon her back on the bed, the foot and knee were turned out; or, in other words, the right limb was everted; it was also shortened two inches and a quarter. By gentle and continued traction it could be brought down to the same length as the sound one, but on being released, a similar amount of shortening was quickly reproduced; the fulness of the trochanter was comparatively lost; there was prominence on the upper and forepart of the thigh, ascribable to the retraction of muscles; the patient had no power of lifting the extremity *en masse* from the bed; the limb, on being brought down to the full length by extension and then rotated, yielded distinct crepitus close to the trochanter, partly within and partly without the capsule; the line of movement on rotation indicated such a direction. Another point, also, to be taken into consideration was, that the limb, on rotation, moved upon a pivot, the extremity of the trochanter being, as it were, the centre of motion, and not passing through the arc of a circle, as described by it when preserving its integrity with the head of the bone. I at once applied Liston's splint along the outside of the limb with all the exactness which it requires, particularly guarding the groin and ankle from pressure. Ordered a full opiate at night, the bowels having been previously well operated on.

10th. Expresses herself as deriving great comfort from the application of the splint; tendency to spasms, which at first threatened, has ceased ever since the limb was put up.

12th. Free from all uneasiness in the limb; by measurement it remains fully the length of the sound one; deformity in front from the retraction of muscles all gone; brushed over the surface of the back and sacrum exposed to pressure with a strong solution of the nitrate of silver to prevent stripping; tongue inclined to be a little dry and brown; ordered ammonia, wine, and liberal diet.

14th. All threatened constitutional disturbance gone; to continue stimulants.

22nd. Re-applied splint, bandages, &c., twelve days having elapsed since they were put on: the limb preserves its full length.

28th. Re-adjusted splint, &c.

April 10th. On removing the splint to-day, it appears that union is quite firm; there has been no undue pressure exerted over the groin or ankle, and the limb is fully as long as the sound one; put on the splint as before.

24th. Union quite perfect; rolled the limb and supported it on an even pillow in the extended position.

May 5th. Allowed the patient to move about on crutches, and on the 13th she was able to leave the hospital with the assistance of a walking-stick; in a few weeks after, the patient walked unsupported to the hospital without the least halt.

CASE IV.—*Oblique Fracture of the Femur about its Centre.*

Charles Bishop, aged 15 years, admitted into Mercer's Hospital, June 10, 1851. On the day before admission he was wrestling with a school-fellow, who threw him down and fell with considerable violence across him; he was conscious of the right thigh being broken, from the yielding of the limb and the severe pain occasioned at the time; after the fall he lay perfectly unable to move the limb, and had to be raised from the ground and carried home. The patient was brought to hospital on the following morning at visiting hour, when I saw him; the most superficial inspection of the limb at once led to the inference of fracture; the extremity was shortened, the bulk of the thigh increased, and the knee and foot partly rotated outwards; on closer examination the amount of shortening was so great in this young boy, as to awaken curiosity in reference to its real extent: on careful measurement it was found to exceed two inches, being occasioned by the obliquity of the fracture, which occupied the middle third of the thigh bone. On handling the displacement and making extension so as to restore the bone to its full length, there was evidence that the force had been applied to the hip and upper part of the thigh —on its outside marked by severe contusions, while the inner aspect of the knee, which was slightly abraded, rested upon the ground. It was clear the course of the fracture traversed from above and without downwards and inwards; and it was also evident that the lower fragment was drawn upwards and a little outwards, overlapping the upper, and thus restraining it from projecting forwards. I at once proceeded to steady the broken

bone; applying the tail bandage from the toes to the groin, and after this Liston's splint along the outside of the limb. Scarcely had the apparatus been adjusted, when the little fellow said he was free from all pain. In a few hours after the application of the splint, being called suddenly to a case of emergency admitted to hospital, I visited the boy and found him in profound sleep,—a sufficient proof of the relief he obtained.

June 11th. Slept nearly all night; has had no startings or uneasiness in the thigh. I may mention here, that sleep was prevented altogether the first night after the accident, by constant spasms, but which have ceased ever since the limb was placed under control by mechanical means.

16th. Neither bandages nor splint have required removal since first put on, and the broken thigh is fully the length of the sound one.

23rd. Re-applied bandages, splint, &c.; the upper and lower fragments of the broken bone lie in admirable relationship, and in such excellent apposition that the most scrutinizing measurement proves no difference between its length and that of the uninjured one.

28th. Union progressing rapidly.

July 13th. Re-adjusted splint, bandages, &c.

29th. Dismissed from hospital; the length of the limb being fully preserved, and the union perfect.

CASE V.—*Oblique Fracture of the Femur through the great Trochanter.*

Richard Hayden, aged 63 years, admitted into Mercer's Hospital, Nov. 13, 1851. In coming down stairs he slipped the entire flight, and fell upon the right hip. He was assisted up, and could not stand after the fall; he was instantly brought to hospital. On viewing the case it was necessary to diagnose between contusion, dislocation, and fracture; and the latter whether within or without the capsule. The limb lay everted, immovable, its muscles perfectly firm, under control of the will, and as a sequence the power of raising the limb *en masse* from the bed lost; there were also comparative shortening and fulness at the upper part of the thigh. These symptoms awakened suspicion as to the true nature of the lesion; careful measurement of the injured limb, from the spine of the ilium to the upper edge of the patella, and from the former point to the tip of the inner malleolus, as contrasted with similar measurements of the sound extremity, proved an amount of shortening very nearly two inches; on causing gradual and steady extension to be made in the axis of the limb, by an assistant grasping the leg

above the ankle, and rotating inwards and outwards, distinct crepitus was not only communicated to the hand of the surgeon placed over the great trochanter, but was likewise audible to the bystanders; the very line of the fracture could be traced traversing somewhat obliquely through the great trochanter. I at once reduced the fracture, and maintained it so by placing Liston's splint along the outer side of the limb and trunk, retaining it by suitable bandages. Ordered a full opiate immediately after.

17th. On removing the splint to-day for re-adjustment, the assistant unintentionally relaxed the traction at the ankle, and the full amount of shortening was reproduced as on admission; the crepitus was not so distinct, because the products of inflammation had masked it; put on the many-tail bandage and long splint as before.

20th. The patient has suffered no annoyance from spasm,—an exemption to be entirely ascribed to the early coaptation of the parts.

December 1st. Re-applied splint, &c.; threatened with stripping of the sacrum; parts guarded by the application of a strong solution of nitrate of silver, and the use of perforated cushions.

14th. Consolidation of the fractured bone proceeding rapidly; the amount of callus thrown out exceeds that usually secreted when coaptation of the fragments has been so quickly brought about as in the present instance.

30th. Removed splint, bandages, &c.; union quite firm; patient still restricted to bed.

January 6th. There are two points worthy of remark in this case,—first: the rapidity with which the patient gained command over the muscles of the thigh and leg; and secondly, the quickness with which the functions of the knee-joint, flexion, and extension were brought about. In five days after the above date he was dismissed from the hospital, with no impediment in the limb, and its entire length preserved.

CASE VI.—*Oblique Fracture of the Femur below its Centre.*

Thomas Flynn, aged ten years, admitted into Mercer's Hospital, February 26th, 1852. The boy was standing in a car when the horse moved suddenly and rapidly on; the little fellow got frightened and jumped out, and fell forcibly to the ground. On being taken up, it was discovered that his left thigh was broken; he was at once brought to hospital, when I saw him. The outline of the thigh was very considerably altered: it was thicker and much shorter than the right one;

the foot and knee were everted. On manipulation, the femur was readily detected broken a little below its centre; the fracture was very oblique, so much so as to permit shortening to two inches, as indicated by measurement. I drew down the lower fragment, which projected upwards and backwards, bringing it into apposition as nearly as possible with the upper one, which had only deviated a little forwards from the proper axis, owing to the lower fragment taking the position assigned to it; an assistant thus retained them while I applied Liston's splint along the outside of the limb; immediately afterwards the boy expressed himself free from pain.

February 27th. Shortly after the limb was put up on last evening the child fell asleep, and remained so all night. He had no complaint to make this morning either from undue pressure or pain.

28th. Bandages not disturbed; and, though oblique the fracture, the full length of the limb is preserved.

March 1st. Replaced the perineal lac by a fresh one filled with curled hair.

March 8th. Steadily improving since last report. Removed the bandages, splint, &c., now for the first time, a period of twelve days having elapsed since put up; but the perineal lac had been frequently renewed, owing to the child constantly wetting it with urine.

15th. Re-applied splint, &c.

25th. After removing the splint to-day, I carefully contrasted the length of the limb with the sound one—no difference between them; the union is quite firm, and the quantity of provisional callus very small.

29th. Union quite perfect, so dispensed with the splint altogether.

April 2nd. Dismissed from hospital; no shortening whatever.

Case VII.—*Fracture of the Femur external to the Capsule.*

Eliza Lawlor, a cook, aged 50, admitted into Mercer's Hospital, October 8th, 1852. Her statement goes to prove that she fell from a house-ladder, upon which she had been standing, putting some things in a high press; she slipped and pitched upon her right hip, the leg got entangled between the steps, and she fell rather obliquely and with considerable force. After the fall she could not get up from the ground, and when lifted she could not stand upon the limb; she was quickly brought to hospital. On removing the clothes for examination, the rotatory derangement of the limb outwards was

very marked and the shortening very considerable,—on measurement two inches and a quarter. By gentle and gradual extension the limb could be brought down to the length of the sound one, but on traction being discontinued, the entire amount of shortening quickly recurred: the patient possessed no voluntary power over the muscles of the limb, yet I was able to flex and extend it with facility, and to rotate it inwards and outwards with very little force. During the latter movement crepitus was readily elicited, and appreciable almost under the fingers external to the capsule. The prominence of the trochanter was diminished, it was too near the crista of the ilium, and on the limb being rotated, it seemed almost distinctly to move on its own axis instead of describing an arc; besides, the swelling at the upper and forepart of the thigh was remarkable, and over this region, also, the greatest tenderness to the touch prevailed: the shortening in this case was very great, but its excess was the more diagnostic and confirmatory of the extracapsular fracture in contradistinction to that within the capsule; the experience of Boyer, Earle, Stanley, Smith, and others, have now settled this question and set it at rest for ever. Being convinced of the locality of the fracture, and the age of the patient only fifty, I was the more anxious in rendering every assistance to bring about bony union, and at once applied Liston's splint; the greatest comfort was experienced from its support, and all troublesome spasm and pain were relieved.

October 9th. Slept well; the extension is effectually kept up, and the deformity removed; the limb maintains its normal length.

21st. The splint, bandages, &c., were removed to-day for the first time since admission, and more as a precautionary measure to see that all was right than as an act imperatively required.

28th. The patient makes no complaint of undue pressure, though a very considerable amount of extension is required to maintain efficiently accurate coaptation of the broken fragments.

31st. Re-applied splint, bandages, &c., as before.

November 9th. This day removed the splint, and carefully examined the site of fracture: callus is freely thrown out; the full length of the limb is preserved; adjusted the splint as before.

15th. Union progressing favourably.

20th. The case has gone on without a single complication, the mechanical means requiring but seldom to be stirred.

23rd. More than six weeks have passed over since the splint was first put on, and as the repair of the broken bone has been

uninterrupted in its progress, union is firmly established; pressure or motion of the limb in its socket does not produce pain; there is no shortening or deformity of the limb whatever: this has been closely examined into by my colleague, Mr. Tagert. Afforded the limb gentle pressure by a roller from the toes to the groin, and supported it evenly on a soft pillow.

26th. The patient has gained a good deal of motion already in the knee-joint, and is recovering full control over the muscles. Without my permission she made the effort this day to walk on the limb, so as to test its strength, and it fully supported her weight. It is scarcely necessary to add, I cautioned her against a repetition of this rash experiment for some time. As the patient was in comfortable circumstances, she requested permission to be allowed to return home.

There is a good example afforded in this case of what may be accomplished in fracture of the thigh bone close to the capsule, by setting the fracture at once in the straight position, and keeping it steadily and immovably so. I know no treatment which could be so successful in allaying the pain, quieting the spasms, and averting that form of irritative fever so frequently attendant on this injury, and fraught with such peril to the patient.

Case VIII.—*Oblique Fracture of the Femur close to the Knee-joint.*

Mary Murphy, aged fifty-three years, admitted into Mercer's Hospital, September 28th, 1852. A young woman for amusement lifted her from a chair and then tried to run across the room with her; this she was unable to accomplish; she slipped and fell forwards with her burden to the ground; with great force and weight she came upon her knees across the patient's right thigh, instantly breaking it; the fracture was quite audible at the time. The woman was at once removed to hospital, and I saw her immediately after. On examination, the right thigh was considerably shortened; the solution of continuity in the bone was discovered close to the knee-joint, passing from about the junction of the lower and middle thirds of the bone from without downwards and inwards, very obliquely, to just above the expansion of the internal condyle; the obliquity of the fracture permitted an amount of shortening fully two inches, and this created a very striking deformity, more particularly remarkable because in this part of the bone the lesion is usually transverse. I at once applied Liston's splint, modified in the manner hereafter to be noticed, restoring the full length of the limb, relieving the patient from pain, spasm, and apprehension

of agony, from the slightest movement of the trunk. After the application of the splint a full opiate was given.

September 29th. Slept during the entire night free from pain and spasms.

October 6th. Limb lying most comfortably; no necessity for stirring the apparatus.

11th. Necessary to change the perineal belt, from the patient not having observed sufficient cleanliness.

16th. The patient is free from pain, and there is no undue pressure exerted anywhere.

18th. Re-applied splint, bandages, perineal belt, &c. The broken fragments lie closely in contact, and the thigh bone preserves its full length.

27th. Union is progressing most favourably. On contrasting the broken limb with the sound one, there is no appreciable difference as to length between them.

November 3rd. It has not been necessary to re-adjust the splint since the 18th of last month, the perineal belt alone being changed.

12th. Removed the splint altogether, more than six weeks having elapsed since its first application. The union is quite firm; and on the closest investigation and measurement by Mr. Tagert and myself, he pronounced the limb exempt from any shortening whatever, and without the slightest eversion or inversion of the foot; rolled the limb from the toes up to beyond the centre of the thigh, so as to support the enfeebled circulation, and placed a soft cushion beneath its entire extent.

15th. Rolled only the leg, thus leaving the knee-joint free for gentle flexion and extension, and exposed for the application of a simple liniment.

20th. Nearly the entire action of the knee-joint is restored; the patient is able to bend the leg fully to a right angle with the thigh, and is rapidly gaining command over the muscles of the entire limb. Still confined to bed.

25th. Permitted to get up and move about with the assistance of crutches. In a few days she left the hospital with the limb perfect in all its functions.

There is one point of great value to be remembered in this case, namely, by the early coaptation and perfect adjustment of the broken bone, the throwing out of a large mass of callus, was prevented; had this taken place to any extent, it might, from the proximity of the fracture, have afterwards interfered with the functions of the knee-joint. To this practical fact I have already alluded, when writing on fractures in the vicinity of the ankle-joint.

Case IX.—*Fracture of the Femur through the great Trochanter, nearly transverse.*

William Gray, aged forty-three years, admitted into Mercer's Hospital, October 26, 1852. He was found by the police lying drunk in the street, protesting loudly that his thigh was broken; he was instantly brought to hospital. On stripping the patient, it was observed, that his left lower extremity was both shortened and wasted, as contrasted with the right limb, and lay partly everted. On careful manipulation, the limb being drawn down gently and steadily, crepitus was discovered through the great trochanter while the act of rotation was performed; and though this diagnostic feature was distinctly elicited, the limb was not restored to within three-quarters of an inch of the length of the sound one; there was such regularity of its outline, however, I did not hesitate to apply Liston's splint, after the method which I am in the habit of adopting. On the following morning, when the effects of the debauch had passed away, and the patient recovered his senses, I ascertained from him, that he had no remembrance of the occurrence whatever, or the mode in which the accident occurred; at the same time he informed me, that the left limb, ever since he was a boy, was much thinner than the other, and that it was also three-quarters of an inch shorter, the truth of which assertion he proved by having his shoe shown, the heel of which was raised considerably beyond that for the sound foot, so as in some measure to rectify the deformity. This shortening and wasting of the extremity the patient attributed to the effects of a very extensive burn which he experienced over the left loin and upper two-thirds of the corresponding thigh when a boy; the white, silvery cicatrix marking its destruction fully attests its severity. Being anxious again to examine the condition of the fracture, I removed the mechanical support; shortening was produced at once to three-quarters of an inch, the foot being only partially turned outwards; the site of the fracture was confirmed, as in the first instance, traversing the great trochanter; there was great tenderness felt over the part, and the patient was entirely incapable of lifting the limb from the bed; but the most characteristic symptom present in this instance, and one not usually to be met with, was, the upper part of the trochanter did not obey the motions of the limb during rotation; it was clear that great violence had been inflicted to cause this lesion, as the parts around were extremely ecchymosed. With the aid of an assistant, I restored the limb to the same position in which I

had placed it at first, and applied Liston's splint to retain it so. The patient immediately experienced great comfort.

28th. The patient slept steadily through the night, and free from all spasms.

30th. Going on most favourably; free from all pain. As the patient possesses ample means, he requested permission to be removed home, and solicited my attendance. He was removed from the hospital in a cart, and conveyed several miles without the slightest disturbance of the fracture, or displacement of the splint which I had applied three days before.

31st. Visited the patient after his journey; he has not suffered the least irritation from his removal. I did not think it necessary to re-adjust the splint.

November 3rd. Replaced the pelvic band.

24th. This case has gone on from the commencement without any complication. Re-adjusted the splint for the first time since it was put on twenty-nine days ago.

30th. Removed the splint now five weeks after the occurrence of the fracture; and it is remarkable, how far the consolidation of the union between the broken fragments is accomplished; the limb fully preserves the length it was before the accident; and the foot, leg, and lower fragment hold their proper direction without the slightest deformity of any kind. Re-applied the splint as before.

I have no doubt that the limb will be as useful to the patient as it was before he met with the accident. I have stated that the union is already nearly completed, and the man promises to be cured in the ordinary time required for the reparation of a broken thigh.

The most prominent points of interest in Case No. I. are, first, the site of fracture and the nature of the deformity; secondly, the re-fracture of the united bone. In fracture of the femur occurring below the lesser trochanter, it was first strenuously laid down by Sir A. Cooper, that a great prominence in front characterized the accident, occasioned by the upper fragment being lifted forwards and upwards by the action of the psoas and iliacus muscles. He says, "the thigh-bone is sometimes broken just below the trochanter major and minor; it is a difficult accident to manage, and miserable distortion is the consequence if it be ill-treated. The end of the broken bone is drawn forwards and upwards so as to form nearly a right angle with the body, and the cause of this position is evidently the contraction of the iliacus internus and psoas muscles." Ever since this paragraph was written, its substance has been

copied into almost every work on surgery without comment. I do not mean to say, the upper fragment never projects forwards, but I deny altogether the frequency of its occurrence. Sir A. Cooper even gives a plate showing the abnormal projection of the superior fragment, and says, "a better idea of the effect of this accident may be obtained by a view of the plate, in which the bone will be observed to be united not only with extreme shortening, but with a hideous projection forwards." Now in the case of Toole, there was no doubt of the bone being fractured just below the lesser trochanter; from the axis of the fragments, and their point of junction, it was concluded so; and from their re-fracture it was confirmed, because the callus yielded at that part corresponding to the original separation. Yet here, in this instance, though the parts were left uncontrolled, owing to the unsteadiness and irregularity of the patient, there is no projection forward of the upper fragment, but there is "horrid deformity" created by the bones being dragged outwards, and forming an angle salient in that direction. The plate referred to by Sir A. Cooper merely shows the lower fragment drawn up nearly to the root of the great trochanter, and united there; the preparation is said to be in the Museum of St. Thomas' Hospital; but of this specimen there is no accurate information recorded.

In Mr. Hind's book, "On the Causes of Displacement of the Bones of the Extremities in Fracture," the following description is given of this fracture: "The displacement is greater in the upper than in the lower portion of the bone; it will be found projecting almost at a right angle with the pelvis, producing the elevation already described in consequence of the actions of the psoas magnus and iliacus internus." In accordance with these words, we also find a plate in the volume, showing the relative position of the fragments, the upper riding over the lower; but there is no proof given that such a specimen ever existed, from which the drawing might have been taken.

Now in the case of Jackson, No. II., there was clear evidence of fracture below the lesser trochanter, traversing from without, downwards and inwards, with considerable obliquity; so as to allow the fragments to pass each other, the lower being drawn upwards and outwards, contrary to what usually occurs, owing to the action of the adductors preponderating; in this instance, all anterior projection of the upper fragment was prevented by the lower resting upon it; in Case No. IV. we have evidence of an almost exactly similar displacement, and the same force counteracting deformity. I may state here, that

Mr. Tagert, Senior Surgeon to our hospital, whose opinion on all points relating to practical surgery is, from his vast experience, entitled to great weight, mentions, in his Lectures, that he has never seen the deformity even approaching to the extent portrayed by Sir A. Cooper, and in the large majority of cases it is altogether absent in the anterior direction.

Still further in support of my opinion as to the rarity of the projection of the upper fragment, noticed by Cooper in the special fracture under consideration, I lay great stress on the following evidence: specimens that speak out for the truth. In the Museum of the Royal College of Surgeons the following preparations are preserved, and noticed as follows in the catalogue:

E. A. 554.—"Fracture of the left thigh bone in a female below the trochanters. Complete osseous union has been established. The fracture was very oblique, and of such a shape, that the upper end of the shaft lies consolidated in a wide and deep groove, four inches in length, in *front* of the superior fragment, which consisted of the head, neck, and both trochanters. In this case the inferior fragment formed the projection felt at the upper part of the thigh."

E. A. 555.—"Fracture of the right femur in a large man; healed with considerable deformity. The fracture was close beneath the trochanters, very oblique, and overlapping. The upper extremity of the lower fragment stands forwards, and rises as high as the neck of the bone."

E. A. 559.—"Fracture of the left femur in a young man. The fracture extended from within and above obliquely downwards and outwards from below the trochanter; has been completely and smoothly united; the upper extremity of the lower fragment formed the principal projection in the groin, being nearly in front of the upper."

E. A. 580.—"Fracture of the left os femoris of a man, close under the trochanters, firmly united by bone; the lower fragment projects forwards, and makes a tumour in the groin; the upper part of the shaft stands *outwards*."

There is another specimen in the College, where the upper fragment stands outwards. E. A. 582.—"Oblique fracture of the femur below the trochanters. The shaft is elevated and thrown to the inside of the upper piece, which makes a projection towards the outer and anterior part of the thigh; the union is firm and very unseemly."

In the Museum of the Original School of Medicine there is a fine specimen of a very remarkable fracture, occurring below the trochanters, which Mr. Ledwich was kind enough to show

me. In this preparation the superior fragment lies in front of the lower; from the anterior surface of the shaft of the bone a third piece was detached, fully three inches long, which was displaced upwards; it never after regained its normal position, but became united as a wedge between the two fragments, producing prominence of the upper, which must have been remarkable during life. All are bound together by a thick bond of callus posteriorly.

Amongst all the preparations of fractures, traversing the upper part of the thigh bone, and in which the pathological department of the Museum of the College is very rich, there is not a single specimen where fracture has occurred below the lesser trochanter, which exhibits the superior fragment lying in front of the lower, while, as already observed, there are several to prove the converse of the proposition. Again, there is not a specimen to demonstrate a transverse solution of continuity in the bone below the trochanters—all are alike characterized by their obliquity and extent of fracture. I have stated before that I do not mean to deny the possibility of the upper fragment projecting in the groin; but I cannot bring to my mind or find in my note-books a single well-marked case where the distortion could be attributed to such a cause. Circumstances may conspire to produce it: the direction of the force, most probably when applied from behind; youth—for at this period when the bones yield they break more transversely than in after life;—such a sequence is most likely to disentangle the upper fragment, and leave it free to the action of the psoas and iliacus muscles.

The second position to be considered in the case of Toole is in reference to the re-fracture of the bone. It has been already stated that the limb was useless in progression, being somewhat more than five inches shorter than the sound one. Thirty days had elapsed from the period of the accident, and the union was quite solid, sufficiently so to bear the weight of the body. The breaking of the callus in fractures badly consolidated is a very ancient practice, and highly extolled by many. And it was not until about the beginning of the last century that Petit and Heister so strongly objected to it, and Boyer and Callisen easily succeeded in causing it to be generally proscribed. Richerand, however, amongst the moderns, believed in its utility, but confines its application to cases where the deformity is excessive, and where it is urgently demanded by the patients. In Germany, however, we have very strong evidence in its favour. M. Oesterlen, in his endeavour to demonstrate the advantages of the rupture of the callus, has collected in his book several

instances, not only derived from his own practice, but from that of surgeons in neighbouring Cantons. The rule upon which Dupuytren acted in those cases was consonant with his views respecting the formation of callus; he concluded that, in general, it might be considered practicable to overcome the resistance of the callus within a period not exceeding sixty days from the receipt of the injury; but that exceptional instances prove that this operation has been successful even after the lapse of a much longer interval of time. Dupuytren relates several cases in his "Leçons Orales de Clinique Chirurgicale," where he removed serious deformities by mechanical force,—with splints, compresses, bandages, &c. But the mode by extension, counter-extension, and forcibly moving and rotating the limb,—that practised in most of Dupuytren's cases, and so successfully in mine,—will not always succeed, and then we must proceed to more severe measures.

It is important on this subject to divide the deformities into two classes, according as they are merely a shortening of the limb, or where the bone is consolidated with an angular deformity. Velpeau says, the rupture of the callus in the first case should not be attempted after the third month of the fracture. At a later period we should have to fear the fracture of the bone in a sound portion, as well as in the diseased part, and we may well conceive that there would then result no advantage from it.

When the callus is angular to the degree of interfering to a considerable extent with the functions of the limb, Velpeau approves of its being broken, no matter how ancient the consolidation may be. Numerous apparatus and various processes have been contrived to arrive at this result. M. Oesterlen has given a figure of one of these. It consists of a strong wooden bar, from the extremities of which two metal stems pass down, each of which terminates in a pad concave below, and to which is attached by straps another pad concave on its upper surface. These pads, and along with them the whole instrument, are firmly fastened on the limb, by tightly buckling the straps in such manner that the seat of the fracture occupies the middle point between the two metal stems. From the part of the bar midway between the two stems another metal stem, terminated by a pad, passes down, which, when the instrument is applied as directed, will correspond exactly to the callus. With the middle stem is connected a winch, by which, in the operation, the pad is brought suddenly and forcibly to bear upon the callus, so as to rupture it. M. Oesterlen adduces many cases in proof of the safety with which the fracture may be reproduced by means of his invention, which certainly admits of the

application of a greater force, and one that can be much more nicely regulated than the rude methods of the old surgeons. It is obvious that this method is adapted to those cases chiefly in which the deformity is angular, or rather to cases in which we may anticipate the line which the secondary fracture will assume, and in which the rupture of the callus will enable us to restore the proper form of the limb with little extension.

Velpeau's method is very simple: he says it almost always answers in angular deformity to fix the affected limb on its concave part to a solid plane, while we suddenly press down upon it, with the knee or the two hands placed upon its convex part. Having effected the rupture, we then must extend the part as much as possible, and retain it so until it has acquired its natural strength. Even this will not always answer: and excision of the angular callus is sometimes preferred, as recommended by M. Clemont;—the first time he performed the operation on a young child, and the second time on an adult. In both cases it was a femur, bent into an angle, in consequence of former fractures badly treated. The surgeon laid bare the osseous projection by an incision sufficiently long, removed by two cuts of a saw a wedge from the femur, re-adjusted the limb, re-united the wound, and afterwards applied the ordinary dressings for fracture of the thigh; the two patients recovered perfectly[a]. It must be conceded, however, that to Dr. Barton is due all the credit of this operation: for the *wedge principle* is precisely the same, whether to remedy a permanently angular or flexed position of the limb from an anchylosed joint, or a badly treated fracture.

The foregoing cases afford evidence of oblique fracture occurring almost in every part of the thigh bone; and each alike equally amenable to treatment, on the principle of extension by the long splint, even in the fracture taking place below the lesser trochanter, should there be displacement forwards, which, as I have pointed out, under certain conditions may occur, though rarely; yet it, too, may be made subservient to a similar plan of treatment, as proved from the following interesting case given by the late Dr. Houston:—

"Ellen Kelly, aged 13, was admitted into hospital on the 17th June, 1835, with fracture of the right thigh, close beneath the lesser trochanter. Two days had elapsed before she was brought to hospital, and during this time she had been allowed to lie on the side, with the limb in the flexed position; no other mechanical means had been used to bring the bones into apposition,

[a] Archives Générales de Médecine, 2me Serie, tom. xi. p. 235.

or to preserve them against being moved by the action of the muscles. The girl had, in consequence, suffered much from spasm; the limb was swollen to more than double its natural size; vesications had also formed on several parts of the skin; and there was severe symptomatic fever. The upper fragment projected much forward, and gave to the thigh a curved appearance. The same position as that in which she had lain before admission was persevered in; and under the use of refrigerant applications a considerable reduction of the inflammation was effected by the end of the fifth day from the occurrence of the accident; but, nevertheless, during all this period a night-nurse was obliged to sit by the bedside, with her hand on the broken limb, which otherwise, on every attempt to sleep, awoke the patient with a spasm. On the morning of the sixth day she was turned on the back; the broken limb was pulled to the same length as the sound one; permanent extension was kept up by Desault's splint, applied on the outside; a corresponding long splint was placed along the inside, and a short one was laid on the front, so as to make pressure on the projecting end of the broken bone. Long pads of bran were interposed between these and the limb, and the whole secured together by broad straps and buckles, in such a manner that the limb was subjected on every part to moderate and uniform pressure.

"The business of altering the position of the patient, and of setting the fracture, was productive of much pain; and no doubt, had the operation been practised in the first instance, not only would the amount of suffering caused by it have been comparatively trifling, but most probably the distressing spasms and inflammatory swelling, borne during the first five days, might have been averted; for, from the moment in which the limb was settled, as has been just described, all tendency to deranged action of the muscles ceased, the girl slept soundly, and the tumefaction rapidly subsided. She expressed herself as much more comfortable in her new than in her old position, and got well rapidly, without any farther untoward symptom. She walked out of the hospital on the 20th of August, without any appreciable difference, as to the shape or length, between the unbroken and mended limb."

Dr. Houston goes on to say:—

"The treatment, by permanent extension, of fractures of the femur close to the trochanter, is not, it will be observed, that which is usually practised in such cases, but it was here most completely successful; and I might state other instances in which I have adopted it with equal effect. I might also

mention cases of a similar kind, in which the plan of keeping the limb in a state of complete flexure, all through the period of healing, was followed by an opposite result"[a].

The best criterion of any plan of treatment is the efficiency with which it fulfils the required object. In the nine cases recorded, it will be seen all were cured without the least eversion of the foot,—a distortion so frequently produced by the treatment with the double inclined plane; in all, though oblique fractures, the limb was restored to its full length, and in a short time the motions and functions of the neighbouring joints perfect. I have seen in the hands of others this method equally successful: then great was my surprise to read in a volume, not long since issued from the press, the following observations:—"During the attendance of Mr. Abernethy on St. Bartholomew's Hospital, his custom was to place all patients with fractured thigh upon the side, according to the practice of Mr. Pott, bending the thigh on the pelvis, and the leg on the thigh; and I cannot find the practice of the present day more successful than his"[b].

There is not a book on modern surgery but discards Pott's views and mode of treating fractures of the thigh; because they are incapable of fulfilling the indications of cure, and if persisted in, are almost in every instance followed by pitiful deformity: the method is renounced by every modern surgeon for a better line of practice eminently successful; and why Mr. Skey has not advanced with his contemporaries I cannot pretend to answer.

In Case VIII., where the femur was split very obliquely above the knee-joint, the double inclined plane, as favourably recommended by Sir A. Cooper, was quite useless,—extension, and that with considerable force, was imperatively required to counteract the fragments passing each other, and this was gratefully afforded by the long splint.

The mechanism adopted by Desault and Boyer, for keeping up permanent extension, were appliances most successfully employed by these celebrated surgeons; and although complicated and cumbersome, yet they were useful on a like principle, though not to the same extent as the apparatus now in most general use, as simplified and improved by the late Mr. Liston. Many, indeed, have been the additions made to Desault's splint. Van Houte's alteration of it is for the purpose of keeping up extension in the long axis of the limb, by means of a cross

[a] Houston, in Dublin Journal of Medical Science, First Series, vol. viii., Art. XIX.
[b] Skey's Operative Surgery, p. 168.

board connected at right angles with the splint. Similar to this, except that to the cross board an inner splint is fastened, is Volpe's machine. Also Josse's apparatus, with a peculiarly arranged bed; Meyer's machine; Physick's apparatus, in which the external splint is continued to the arm-pit; that of Houston; also Alban's machine, which consists of a strong splint fixed on the outside of the ailing limb and to the pelvis; the extension is effected by means of a kind of lever contrivance at the lower end of the splint[a].

Of all methods of treatment that by the simple contrivance of Liston, modified, as I shall presently notice, is the most comfortable to the patient,—preventing eversion, shortening, and deformity; and the mechanism is so applied, that the trunk, pelvis, thigh, leg, and foot constitute one rigid body, which may be moved entire, but the component parts of which being immovable, *inter se*, preserve the same mutual relation. I have proved the advantages accruing from the appliance of this splint in every form of fracture to which the thigh bone is liable from without the capsule to the lowest part of its shaft. And, had I wished to transgress the bounds which I have marked out for myself in this paper, I could easily have given cases where it proved of most essential service in steadying the parts in fracture of the cervix femoris occurring in old subjects; as also in soothing and allaying the spasms consequent upon ulceration occurring in the cartilages of the knee and hip joints.

Liston gives the following description of his splint, and directions for its application:—"The apparatus consists of a plain deal board, of a hand's breadth for an adult, and sufficiently strong; narrower and slighter, of course, for young patients. It is made to suit the particular subject of the injury, to extend from opposite the nipple to three, four, or five inches beyond the sole of the foot. It is perforated at the upper end by two large holes, and provided with two deep notches at its other extremity; a sufficient hollow or perforation is made opposite the malleolus. A pad of corresponding length and breadth is attached by a few pieces of tape; a roller is split at the end, and having been tied through the openings in the top part of the splint, is unrolled so far, and fixed for a time to the lower end of the pad. Reduction having been effected by a little gentle and continued extension of the limb, while the pelvis is fixed, the position is preserved by an assistant placing one hand over the dorsum of the foot, and the other upon the knee; a narrow roller is applied from the toes to a little below the

[a] Chelius' Surgery, by South, vol. i. p. 569.

site of the fracture, with a moderate degree of tightness, to prevent infiltration of the limb, in consequence of pressure by the perineal band, which is now placed under the patient: it consists of a large soft handkerchief or shawl, containing the necessary quantity of tow or wadding, and covered with oiled silk. The splint is then laid along the outside of the limb, and the roller already spoken of is passed under the sole of the foot, and turned round the ankle and heel. These parts are previously thickly padded with tow, cotton, wool, or wadding, to prevent the painful effects of pressure, as upon them the resistance to the extension principally falls. The roller is carried repeatedly through the notches in the end of the splint, as it is crossed over the dorsum of the foot, and ultimately turned round the limb to near the groin. The object in pursuing this plan must be apparent: by the attachment of the end of the roller, and its subsequent arrangement, the apparatus is prevented from slipping upwards, and is made, as it were, of a piece with the limb. The ends of the perineal band are passed through the perforations, drawn with moderate tightness, and firmly tied; and a few turns of a broad bandage round the pelvis and chest complete the proceeding"[a].

Numerous disadvantages are laid down by writers, as resulting from the use of Liston's splint. It is stated that permanent eversion is likely to occur; that inversion of the foot, knee, and lower fragment may take place, the result of rotatory displacement; that much of the force necessary for extension is lost, owing to the obliquity of the counter-extending belt; that the ankle and groin are likely to suffer from pressure; that the pressure made across the groin causes great œdema of the whole limb, in consequence of the obstruction which is caused to the circulation in the inguinal veins and absorbents; and lastly, the objection made by Earle, that the limb being bound to a perfectly straight body, placed at the outside of the thigh, and considerable pressure made on the inner side of the knee in fractures of the shaft of the bone, tends to destroy the natural obliquity of that part, and bring it more into a straight line, which he states is not only destructive to the symmetry of the limb, but impedes progression, and renders the erect posture less secure. No doubt some of these untoward results arise from an inefficiency in the splint to accomplish all that is required, while others are created by its not being properly adjusted. To remedy these defects, I offer to the profession a modification of the splint, that which I have been in the habit of using,

[a] Liston's Operative Surgery, p. 88.

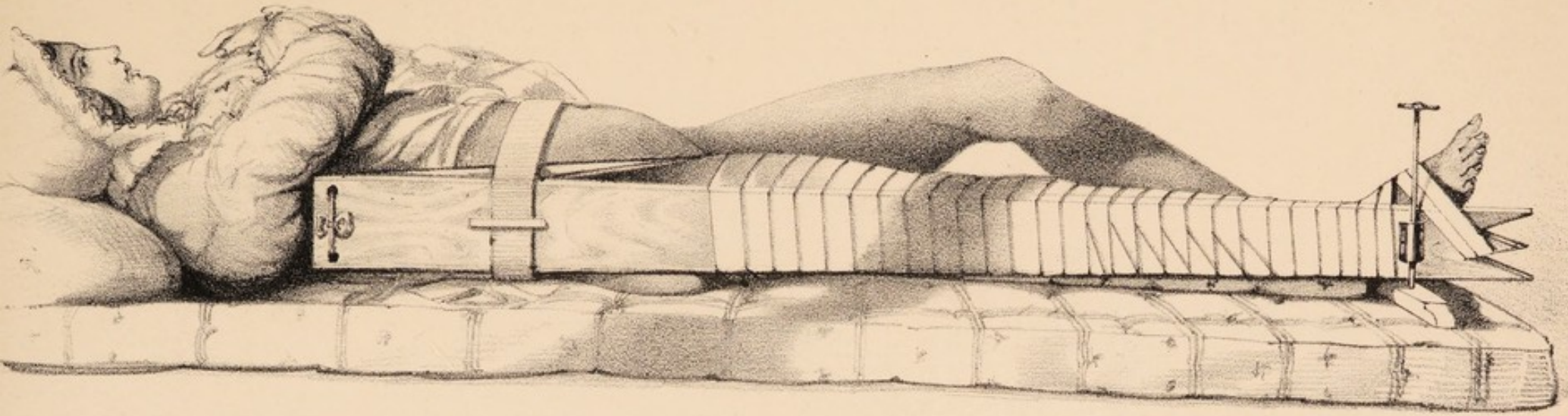
and, as proved by the foregoing cases, with the very best results. I am happy to say it has met with the warm approval of my colleague, Mr. Tagert.

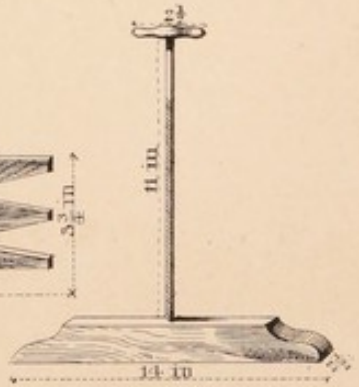
The alteration is very simple, and consists in the addition of a piece of wood placed in a transverse direction beneath the lower end of the splint, and upon which its edge rests. The splint is steadied in this position by means of a long screw conveyed through a socket rivetted vertically on the side of the splint. The upper end of the screw has fitted to it a brass handle placed across, while the lower end terminates in a cylinder which is received into the centre of the piece of wood, and fastened in a hollow beneath by means of a nut and washer. The cylinder, as contrasted with the screw, is somewhat contracted, and presents at its commencement a shoulder which rests upon the steel plate on the upper surface of the transverse piece of wood, while the remainder moves freely in the tube for its reception. From this it must follow that, by a few turns of the screw, the splint may be elevated or depressed at pleasure. Another advantage resulting from this mechanism is, the facility with which the splint can be reversed, the screw changed, and its adaptation to either limb effected.

Plate II. shows the proportions to be observed in the form of the splint. It may be made of seasoned pine; its length, as will be seen presently, must be in accordance with the height of the patient. The length of that represented in the drawing measures four feet four inches; the widest part at its upper end being four inches and a half, which gradually diminish downwards to three inches and three-quarters opposite the ankle. It is eight lines thick, and is deeply notched at the lower end to the depth of four inches; whilst it is pierced at the upper by two circular holes, two inches and a half apart. There is cut in the lower end of the splint, corresponding to the outer ankle, an oval aperture, the centre of which is eight inches and a half from its extremity; and the socket for the screw is placed midway between its circumference and the acute angles formed by the notches. The length of the transverse piece of wood is fourteen inches; its breadth two inches and a half, and its depth two inches. The height of the screw above it measures eleven inches; and the length of the cross handle two inches and a half. A long cushion, somewhat wider than the splint, is applied to its inner surface, and extends from the apertures above to a point opposite the attachment of the screw. This cushion is retained in position by four straps and buckles; it is stuffed with horse-hair, and perforated for the reception of the ankle. The corresponding hole in the splint has tacked into it

Mr Butcher's Modification of Liston's Splint.

Plate 2.





a pad, softly filled with a like material, and covered with chamois leather.

The application of the apparatus, modified as I have described, is almost exactly in accordance with the directions given by Liston,—the screw and transverse piece of wood being detached, the splint is applied nearly in a similar manner; there are, however, some cautions to be observed in its adjustment which he has not adverted to, yet a strict observance of which I consider absolutely essential, that the same satisfactory results may be obtained as followed in the embarrassing cases that I have detailed.

First, as to the preparation of the splint, and the guarding of the ankle from pressure. It has been stated that the splint is perforated, and has, adapted to the aperture, a soft chamois cushion; that a suitable pad extends along its inner surface, with a similar opening for the reception of the outer malleolus; but this not enough; there is also an additional pad, of variable thickness, required to lie between the outer surface of the knee and the padded splint; or, in other words, to fill up the space between them occasioned by the natural obliquity of the thigh bone, this, of course, from the breadth of the pelvis, greater in women than in men. The next point is, that the limb should be drawn down to its full length, the broken bones coapted and retained so by assistants, the ankle, heel, and dorsum of the foot rolled with soft wadding, the depression above the outer malleolus obliterated by additional folds of it, and the entire supported with a roller neatly applied from the toes to above the knee; then the ankle may be lashed to the splint, the surgeon taking good care that the turns of the bandage be even above the ankle, and secure the heel closely to the splint; if this be correctly done, eversion of the foot will be prevented. The ankle being thus fixed, and extension at the same time fully kept up, the perineal band is to be applied; this lac must be made of soft material and well stuffed, at the same time that a strong piece of tape is stitched along its entire extent, from one end to the other, to prevent its yielding; in its application care should be taken that it lies evenly up against the ramus of the ischium and pubis, that when the ends are brought through the holes at the upper part of the splint to be tied, they may be drawn on with an equal force; because otherwise the integuments will be wrinkled, and quickly excite much irritation. Until the lac is tied the required extension should be kept up by an assistant at the ankle, so as to obviate the reprehensible practice of thrusting the splint with the lower part of the limb downwards; for if this manœuvre be employed, the folds of

the bandage connecting the splint to the ankle are more or less altered in their direction: they no longer lie even, their upper edges constrict the part, and the skin is unevenly strained; if so, it soon irritates, inflames, and becomes so exceedingly painful that the patient demands the removal of the dressings altogether. The great advantages obtained from the length of the splint being preserved can be appreciated when the lac is applied; the counter-extension is directed exactly as the extension, in the most favourable line,—the axis of the thigh bone; because, as before noticed, its inclination is slightly inwards; from this direction then it follows, not a particle of force is misdirected or lost. Again, with regard to the holes for the reception of the ends of the counter-extending belt, I have mentioned they should be two inches and a half apart, or, more correctly, close to the edges of the splint; this favours the proper axis of traction, and takes the pressure in some degree from the trunk before and behind. From preserving the full length of the splint greater advantages still flow. In fractures of the thigh bone, approximating the hip-joint, the upper and lower fragments cannot be pressed upon and forced out by the perineal belt, because its action is directed upwards; this occurrence may take place if the splint be short, and applied as is usually represented in books; but if adjusted as originally intended by Liston, and according to the directions I have given, no such untoward result can follow. Besides, the pressure of the perineal bandage occasions no uneasiness when directed upward; while on the contrary, if strained outwards across the groin to reach the splint, undue pressure is made on the tender integuments, veins, and numerous lymphatics of this region, and, above all, against the sharp edge of the adductor muscles. The foregoing objections fully apply to Boyer's splint; the pressure of the counter-extending belt cannot be borne, and it must displace the fragments if the fracture be situated high up. After the requisite extension has been secured, the next step is to turn a roller round the limb and splint, commencing at the ankle and continuing it to about the centre of the thigh: during this proceeding it is necessary that the limb be fairly supported, and not permitted to gravitate backwards. A few turns of a wide bandage are likewise made to encircle the trunk and upper part of the splint, and pinned to the counter-extending belt before and behind it. It only remains now to pass the screw through the socket, and attach to it the transverse piece of wood in the manner already described, and the apparatus is perfected, so as altogether to preclude the possibility of inversion or eversion of the foot and lower fragment. It will be observed, by a re-

ference to the plate, that the splint is raised at its lower end from the mattress, by the depth of the transverse piece of wood, and a thin pad fills the intervening space. By this arrangement the foot is somewhat elevated beyond the rest of the limb, and the returning circulation favoured.

Frequently, when a patient is under treatment for fracture of the thigh by the ordinary method with the long splint, he will complain of pressure at the heel, owing to the limb resting for a length of time on its posterior surface; this unpleasant contingency is entirely obviated by the simple employment of the screw as applied by me; for by a few turns of it any required elevation may be attained, and another annoyance is likewise removed by the transverse handle bearing off the weight of the clothes from the foot. Lastly, from the treatment by continued extension, as I advocate its application, I have never seen troublesome abrasions, relaxation, or weakness of the ligaments of the knee or ankle-joint to result.