

*Observations on the Treatment of Fracture of the Thigh Bone.—*  
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**T**HE best mode of treating a fracture of the thigh, appears to have been a subject of much inquiry, and one which is still more unsettled among the first surgeons in Europe and in this country, than that of the treatment of any other fractured bone. For, aside from minor particulars, in which almost every surgeon will have something peculiar, there are two grand, approved plans, with their modifications,\* for the treatment of this injury; and these differing essentially, both in mode and principle, though the object to be effected is unquestionably the same.

These cases of fracture, though simple in their nature, are of such rare occurrence, that in this country, few surgeons have an opportunity of practically satisfying themselves with respect to the efficacy or advantage of any particular mode of treatment. All plans have been acknowledged to fall short in some degree of effecting the objects for which they were intended. Mr. Pott's method, though recommended in most modern, practical works, written in our own language, and practised, as I believe by most English surgeons, is still allowed to be defective, even by those who advocate its principles and urge its use. This method has been generally adopted in this country, and we often witness its evil consequences. That of Desault, is now practised by many of our best surgeons, some of whom have witnessed its important effects in the hospitals in France, where it is still the prevailing plan in use. This, however, does not ensure that perfect success which is desired.

When the thigh bone is broken obliquely above its middle, the difficulty of reducing the fracture is allowed to be greater in proportion to its proximity to the superior extremity of the bone; and greatest, when it takes place in its neck. Relying, therefore, in such cases, on the experience of our ablest guides, we have little reason to hope that it will be in our power to keep the fractured ends of the bone in place till a perfect union be effected. For we are told, that after all our efforts for the benefit of our patients, we must in most cases expect a deficiency in the length of the limb.

I shall not expect to shew, in a perfectly satisfactory manner, that this is a consequence which may *always* be prevented; but

\* Those of Pott, and Desault, varied by Bell, Physick and some others.

believing that it may more generally be avoided, I shall endeavour to explain why we so often fail in producing the desired effects by Desault's plan of treatment, which I think is the only one calculated to ensure success. I shall also suggest such alterations in the construction and application of his apparatus for extending the limb, as I think will be found of importance in rendering it more effectual, and at the same time more convenient for the surgeon, and comfortable for the patient.

What then are the primary and important objects to be effected in the treatment of this injury? Are they not to place the limb in a natural position, bring the fractured ends of the bone into their proper situation, and to secure them so that they will remain in this state until they become perfectly united? The first of these objects we may obtain, whether the limb be placed in a straight or crooked position; but the others are not so perfectly within our reach.

It is well known, that Mr. Pott's method, or the crooked plan of treatment, is that in which we are directed to place the limb on its outer side, in a state of semi-flexion, both with respect to the hip and knee joints; and to keep the patient partly on his back, inclining to the fractured side.—Or, according to Mr. Bell's improvement of this plan, to place the patient on his back, with the limb laid over a machine which is so contrived as to have two inclined planes of board meeting in a line under the ham; these to be elevated at pleasure, by means of their connection with another plane board which lies on the mattress or bed. These two inclined planes are of such length as to allow the foot to hang unsupported at the lower end of one of them, while the pelvis is in a degree pending on that of the other. To this instrument are added the necessary cushions, splints, bandages, &c., in the same manner as when it is not used.

The theory in support of this plan is, that by the flexion of the limb the muscles are so much relaxed, that the parts of the fractured bone being replaced, no continued extending force is necessary to keep them in a proper situation, there being no active power of the muscles to overcome; or, that if the limb be placed on the above mentioned instrument, all necessary extension will thereby be made.

The ill success which often attends this practice sufficiently shews that the theory is in some way erroneous. The common fault, a deficiency in the length of the limb, must be the consequence of some common but powerful cause; for it happens alike under the eye of the veteran and the inexperienced surgeon. I shall not therefore be thought presumptuous in stating what appears to me to be the probable cause of failure in this mode

of treatment, and in endeavouring to expose any error which may appear to exist in the theory on which this practice is founded.

In examining the arguments of Mr. Pott in support of his plan, we should be led to suppose, that he had no doubt but that by a due degree of flexion, all the muscles, which could operate to displace the fractured portions, and thereby shorten the limb, would be put in a state of perfect relaxation. This, however, can never be the case while the parts to which the opposite extremities of the muscles are attached, are so far distant as they must be in every position in which the limb can be placed when in a sound and natural state : and therefore, although *some* of the muscles may be perfectly relaxed in a case of fracture or dislocation, they cannot *any* of them be in this state, after a sufficient extension has been made in any direction, to bring every part to its proper place of adaptation. If then the muscles do act at all, what must be their tendency ? Certainly to displace the parts and shorten the limb. And this will happen more or less, according to the degree of action produced by the stimulus of pain, the influence of the will, spasmodic contractions, and other incidents to which injuries of this kind are liable.

Further, it is of much consequence to inquire, whether, on the important principle of relaxation of the muscles, so much advantage is gained as has been supposed, by the crooked position of the limb. It is allowed by most surgeons that when the thigh bone is broken in its middle, or below, there is little or no danger of derangement from contraction of the muscles ; and the limb may be placed in a natural position, either straight or crooked, and dressed with the common short splints and bandages.

But when the fracture is much above the middle, and the limb shortened, the effect is very justly attributed to a contraction of those muscles which arise from different parts of the pelvis, and are inserted into the inferior portion of the broken bone, and the superior extremities of the bones of the leg.

Of the muscles most active and efficient in producing this mischief, writers enumerate the semitendinosus and membranousus, biceps flexor, sartorius, gracilis and triceps adductor. And to these might be added the rectus femoris, and in some instances the cruræus. To place the limb in such a position as to give these muscles, or a majority of them, the least power, is an object of the first importance in the treatment of a fractured femur.

What the *proportionate degree* of action is, in any particular muscle or muscles, in the various positions of the parts to which such muscles may be attached, it will be in vain to inquire ; but it is a well known fact, that if we wish to relax a muscle, or place it in a situation to render its action less powerful, and this merely

by altering the position of parts, we must do it by bringing the extreme points, to which such muscle, is attached, nearer to each other.

Let any one duly consider what must be the state of the muscles, when the thigh is in the position directed by Mr. Pott, and I think he will be satisfied, that in ordinary cases no advantage is obtained, and that in the most difficult and doubtful ones, this position is calculated to put on the stretch a majority of the most powerful muscles which can operate to shorten the limb. For if we suppose a patient placed on his mattress, and the limb supported on Mr. Bell's apparatus, we shall find the position such as to bring the origin and insertion of three muscles only, the sartorius, gracilis, and triceps adductor, nearer together than when the limb is extended; and two of these are the most slender of the whole number. The effect which this crooked position has on the remainder of the above mentioned muscles, I contend is not such as has been supposed by Mr. P. and his adherents, to relax them, but one directly the reverse. Of this I think any one may convince himself by a little reflection, and even demonstrate by actual measurement.—If the thigh be kept extended, and the leg bent to such an angle with it as is required in this mode of treatment, the points of attachment of those muscles which arise from the tuberosity of the ischium, will indeed be made to approach each other; but when we bring the thigh to that angle with the trunk which we do in pursuing this plan, we remove the inferior extremity of the femur so far from the tuberosity of the ischium, that, following the course of these muscles, the distance between their origin and insertion is much greater than when the whole limb is extended. Here then we have three muscles in a state of unnecessary extension, which in the aggregate must be more powerful than the three which we have considered as relaxed. To these we must add the tension of the rectus femoris, and in cases where the bone is broken below the origin of the cruræus, the very unfavourable state of this muscle; both these being fixed into the patella; the relative situation of which, when the leg is bent, is materially changed.—But these are not all. The most powerful muscles of the thigh, the glutei, are not to be overlooked; for in cases where the bone is fractured in its neck, cases the most doubtful and troublesome, these muscles offer their resistance to our efforts for reduction, at the very time, and in the very stage of the operation when their power will most effectually prevent our success, viz. when the resistance of all the other muscles is considered to be overcome, yet before the fracture is perfectly reduced, and while the limb is considerably shorter than the sound one.

To shew that these muscles are in an unfavourable state in this plan of treatment, it need only be remarked, that their situation on the dorsum of the ilium is such, that a line following the direction of their fibres from the point of origin to that of insertion, is longer when the thigh is in a state of flexion, than when it is extended; and that when they contract, they tend to carry the thigh backward and outward.

Another objection to this mode of treatment is, that the crooked position of the limb, and the consequent situation of the patient, render it impossible to compare with any degree of precision, the length of the fractured limb with that of the sound one; and consequently, we are obliged to trust to the uncertain efficacy of this treatment, till it is perhaps too late to repair the injury done by it.

The advantages of the straight method, or that which is now called Desault's plan of treatment, may be briefly pointed out by attending to a few of its most prominent points. In the first place, the position of the patient, and the situation in which the limb is placed, are such as in a much less degree expose him to uneasiness and inconvenience, and particularly to prevent any unfavourable motion of the parts, either from involuntary muscular action, or from any other accidental cause. Next, it will be found, if what I have stated above prove correct, that all the muscles except *three*, are in the most favourable situation, so far as position affects them, for the immediate temporary extension of the limb, as well as for that which should be continued during a great part of the confinement; and two of these three, the *sartorius* and *gracilis*, are of no considerable importance. And lastly, in all cases in which extension becomes necessary, the straight position of the limb only is that which will allow the application of a due degree of power for bringing the parts into their proper place, and retaining them there for the necessary length of time. And every one must allow, that by a proper application of Desault's extending-splint, or the common fracture-box which operates on the same principle, a sufficient extension may be effected, and continued as long as any force is necessary to prevent a shortening of the limb.

To the question which will now naturally arise, why this method is not generally and completely successful? I hope the following observations will prove an answer not wholly unsatisfactory.

When a fracture happens under such circumstances as to allow a considerable contraction in the length of the limb, much force may be required to effect a reduction; and if this be continued in a proper direction, and with due caution, it will never

be too great, while more is required to bring the limb to its due length, and the injured parts to their natural position. But the signs by which we aim to discover when we have done this, are often fallacious.

The circumstances to be noticed during the operation of reduction, and on which we are directed to rely as signs of its being perfectly performed, are, a correspondence in the position and length of the two extremities, an even and natural position of the pelvis, a natural feeling of the parts about the fracture, and a crepitation from the movement of the fractured surfaces of bone on each other: yet I feel assured, that all these points may be carefully attended to, according to rules given in the best practical works, and the surgeon still be deceived with respect to the true state of the fracture.

In the first place, with respect to the length of the limb; though it be brought to compare well with the sound one, and the extremities be found to correspond to the position of the pelvis; yet, before the resistance of the muscles can be sufficiently overcome to allow a perfect reduction, the ligaments of the joints will yield so much as to make a material difference in the length of the two extremities, which is not to be detected till the patient begins to recover in some degree the use of the injured one; and the deficiency in length will then be found to increase till he is able to walk without assistance.

Next, with regard to the position of the pelvis, there are two circumstances connected with it, by which we are liable to be deceived. First, the situation of the patient is such, that a slight obliquity in this part may often pass undetected. Secondly, from the very great difference in the relative situation of the two extremities when a slight obliquity only exists; for, by the application of the physical and mechanical force employed in the operation of reduction, the ischium, on the side with the fracture, is made the centre of motion for the pelvis; and the moving points to which the thigh bones are attached, are distant from this centre in the unequal proportion of three to one; and consequently, though by the depression of the pelvis on one side, we were to bring the fractured limb down but two lines, the sound one, with the other side of the pelvis, would be elevated six; thus allowing the heels and patellæ to be brought to their proper lines of comparison, before the fracture can be perfectly reduced. This state of the parts, with such an extension of the ligaments as would make unitedly a difference of from a half, to a whole inch in the length of the limbs, may, I am confident, exist during the confinement of the patient, undiscovered by frequent and careful examinations.

And, finally, as to the other signs on which we are to place our confidence; the most experienced surgeon cannot, by feeling through the thick muscles of the thigh, determine by this alone when the fractured portions are in place; and a crepitation from the bone is not to be depended on, since it may happen when any two portions of the fractured surfaces are brought in contact.

The circumstances which I have here mentioned, I would not be understood to consider as connected with difficulties which are not to be overcome; they are, however, such as I have nowhere seen noticed; and to these only can I attribute the very common failure of restoring a limb to its perfect length, after an injury of the kind in question, when treated by a well-informed and experienced surgeon.

A brief description of two cases, which were under my care in the years 1818 and 1819, the circumstances of which gave rise to the above remarks, will serve to illustrate what has been stated. In these cases, however, there was nothing very uncommon; and their termination was as favourable as I had any reason to expect, from all I had seen and read of such as were similar.

**CASE 1st.** A young man, about eighteen years of age, while mounted on an ungovernable horse, was carried with such force against a post, as to fracture the thigh bone. It was broken about four inches below the trochanters; the soft parts much bruised, and the cuticle removed from some small spots. The sharp, fractured end of the inferior portion of the bone was sensibly felt as it passed above the other; the fracture was evidently oblique, and the limb shortened about two inches. It was treated on the plan of extension, with the usual splints and bandages, as directed by Desault. The case did well until the patient was able to walk across the room, supported by one person. The limb, at this time, appeared of equal length with the other, in every position and situation in which I could test it. But, before the patient recovered any farther, an imprudent attempt to help himself beyond his ability, resulted in a second fracture in the same part. I treated him as before, and no bad consequences followed, except that the limb proved to be about one-fourth, or one-third, of an inch too short. Before the second confinement of this patient had terminated, I was called to

**CASE 2d.** A man, about sixty-four years of age, fractured his thigh, by falling ten or twelve feet from a hay-loft upon an oaken floor. The whole force of the fall was received upon the great trochanter, and the bone was broken about this part, either *in* or *near* its neck. This was treated in the same manner as case first, except in the use of bandages and short splints, from which

no advantage was expected. The same care was also taken in this case in the application of the apparatus; the position and comparative length of the limb were inspected, and appeared well until the patient was released from the confinement of his bandages and long splint. In about one week after this, the limb appeared to be rather shorter; and by the time he became able to walk, it was found not to be so long as the other by three-fourths of an inch. This patient possessed that kind of constitution, which, from extreme laxity of fibre, and deficiency of vigour and energy in the extreme vessels, constantly exposed him to echymosis, and even sloughing and ulceration, from very slight bruises or other wounds. The unavoidable pressure, therefore, from the bandages used to keep up extension, produced some ulcerations about the ischium and foot; though they did not appear till several days after the bandages were removed. These sores did not heal kindly by the use of common, local applications alone, but a disposition to cicatrize in a sound manner soon followed the use of bark and wine, though the general health of the patient did not appear to require the use of these remedies.

In the first treatment of *case first*, after every thing was adjusted, I found that the broken limb had the appearance of being a little the longest, though no obliquity in the pelvis, or any deviation from a straight position, was discovered, which would account for it. Believing that the consequences would be harmless, no alteration in the degree of extension was made; the same appearance continued, and the result of this first treatment has been given above. When called the second time in this case, I was equally careful in making the extension; the limbs appeared of equal length; and with this I was satisfied, attributing their difference in the first confinement to some deviation in the position of the parts which was not to be detected. But, when my patient became able to walk the second time, the extremity was found to be too short. In *case second*, the appearances after reduction were equally good as in the other, and the patient more closely attended; yet the difference in the length of the extremities after confinement was much greater, owing, as I now think, in a great degree, to that constitutional laxity of fibre mentioned above.

In treating such cases, then, should we be satisfied with merely bringing the limb to the same length with the sound one? Or should we not make some allowance for those accidents, by which, according to the preceding remarks, we are liable to be deceived? To what degree we should, under various circum-



stances, extend the limb, is a question which, like the last, must be determined by future experience.

With respect to the alterations which I am about to propose in the form and application of the apparatus for making extension, I cannot expect that they will at once obviate all the bad consequences noticed above. They were suggested by circumstances connected with the cases which I have described, since which no similar one has occurred; I submit them, therefore, to the candour of my professional brethren, some of whom, no doubt, may have an opportunity of preceding me in testing their efficacy.

In addition to the single extending-splint used by Desault, let another be placed on the inside of the limb, made to reach from the ischium the same distance below the foot as the other. The upper end of this splint should be formed and cushioned like the head of a common crutch. On the ends, below the foot, let there be a cross-piece made to slide by means of two mortises, six or seven inches apart, through which these ends may pass. This cross-piece may be kept at any required distance from the foot, by pins put through the splints, in which a number of holes are to be made for that purpose. The splints may be secured, or kept steady, by straps or tapes passed round the limb, and fastened to both, in the usual way of securing one; and the ends, next to the pelvis should be very firmly connected in this way. The bands from the foot and knee, for extending the limb, may be fastened directly to the cross-piece, or to a wooden screw made to pass transversely through it, by which the extension may be regulated.

The objects of this variation, I think, will be readily seen by those who have had occasion to apply the different machines now in use, or have seen them used by others. The one just described will be light and convenient, while it possesses all the strength required, and be but little more complicated than those of the most simple form. It will allow the limb to be extended in the proper direction, without pressing unnecessarily on any part of it; and may be made at short notice, in many cases, even while the surgeon is preparing other requisite dressings. We may, therefore, instead of an unwieldy framed box, or a board four or five inches wide, extending to the axilla, substitute two spruce laths, half an inch thick and two inches wide, with a small piece of light board for a cross-bar. By these, the limb will not be so much incumbered, and will be more accessible for the application and removal of bandages and other dressings; a circumstance of much importance, both to the surgeon and patient, in cases of compound fracture.

In the application of any apparatus for making an extension, if we would render it most effectual, it is important that the bandages which are to confine the splints, or other machine, to the pelvis, should be so contrived that this part (the pelvis) should be as firmly *fixed* as the nature of the case will admit. Desault was fully aware of this, and has been very particular in his directions for effecting the object; yet this accomplished and very adroit surgeon was often defeated in his endeavours to make his own bandages answer this purpose, as many others must be, who attempt to follow him.

In order to secure the pelvis to the splint in the manner desired, instead of using the bandages of Desault, or the top parts of a pair of buckskin breeches, as recommended by some author, I would recommend that a thick compress or cushion, four or five inches square, should be placed between the trochanter and superior edge of the ilium, to be secured by a broad, soft, but unyielding belt, buckled or laced round the pelvis, and by another narrower strap or band passed under the ischium; this is to be firmly attached by its ends to the belt, just over the lower edge of the cushion. At this part of the belt, also, an inverted sob may be attached to receive the head of the extending splint. These bands may be so applied as not to slip from the pelvis; and by them we may prevent the ilium from moving under the splint, as it always will do when the pelvis is in a manner balanced on the ischium, supported merely by the bandage or napkin which is passed under this part, and otherwise confined only by a common roller round the hips.\*

The effects which followed the pressure of bandages, mentioned in *case second*, are such as are rarely produced, and might, perhaps, always be prevented on the *foot*, by the use of the laced sock, or boot, instead of the handkerchief or napkin, which is too often substituted. We can only obviate the bad effects of pressure on the *ischium*, by care in adjusting the compresses, bandages, and other parts of the apparatus; for a certain degree of pressure is necessary on this part; and if we make any in the axilla, therefore, as is sometimes done, it does not diminish the degree requisite on the ischium, except at the risk of producing that evil which Desault's plan of treatment is calculated to prevent: Because, if the shoulder were not, as it is, a very moveable part, and the axilla were a point on which we might make firm pressure, this would but give us the power of pulling the pelvis into a more oblique position; and if we connect the shoul-

\* For an illustration of the above description of variations in the extending-apparatus, see the plate prefixed to this Number.

der to the pelvis by strong bandages, we do but return the pressure to the very part we meant to relieve, the ischium,

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#### REFERENCES TO THE PLATE.

- Fig. 1.** Represents the whole apparatus, applied to the limb.  
**2.** The inner splint, the head of which is not seen in fig. 1.  
**3.** The cross-piece.  
**4.** A belt, which may be made of leather or strong cloth, and furnished with straps and buckles.  
**5.** The ends of a similar belt, which may be made to lace.  
**6.** A strap, to pass under the ischium and buckle to the belt.  
**7.** The cushion, to be placed on the side of the pelvis, under the head of the outer splint. See fig. 1.  
**8.** Screws for regulating the extension.