

TREATMENT OF OLD UNUNITED FRACTURE OF THE NECK OF THE FEMUR BY TRANSPLANTATION OF THE HEAD OF THE FEMUR TO THE TROCHANTER.

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No attempt is made in this communication to review the literature on this subject, or to discuss the various methods of treating this condition, for it has been thoroughly done many times. It will deal only with the old fractures of the neck of the femur, at a period from some months to several years after the injury, when there has already been absorption of practically the entire neck, and when the partly atrophied head consists only of the articular portion, not projecting beyond the acetabulum, and must be regarded somewhat in the light of a sequestrum. It can derive a certain amount of nourishment from the joint fluids in which it is bathed, and also some from the non-vascular fibrous attachment, when such exists, but this union to the head fragment is often found, on operation, to be slight, and hardly enough to be the channel of much nourishment, and the actual bleeding of the bone when it is cut seems to be always questionable. It surely is very different from the dead sequestrum, but it is also very different from the bleeding cut surface of normal bone. This nutritive defect of the head is one of the most important factors to be reckoned with in the attempts to procure firm union between two fragments so long separated, for we must bring about conditions sufficiently favorable for the fragment to become thoroughly living again. The principle in the treatment of this condition in the fresh cases, when nutrition is good, and in the long-standing, when nutrition is necessarily poor, must be radically different. The retention by nail has practically been discarded, as well as the use of graft for retention, as the atrophied head is too soft to withstand any force put upon it, for the purpose of retention or fixation. The use of the graft as a carrier or trelis for osteoblastic stimulus, unless a firm apposition is obtained, is nearly as futile, for the graft, once detached from its bed, becomes dead bone, one end of which is fastened into live bone and the other into a fragment of questionable viability. It is reasonable to expect that the first end should live, but it is expecting a good deal that this insert, which itself must be re-nourished from its attachment into the femoral shaft, can carry its regenerative power across the bridge between the two and into the old head, at least partly dead, and restore it to normal activity. On attempting to freshen the surfaces of the two fragments, it is necessary to hollow the femoral surface of the head, for there

is usually not enough of the head to make a flat fresh surface without encroaching on the cartilage edge of the articular surface; nor is there enough left of the neck to fashion a convex surface which will protrude into the newly made concavity of the head; therefore, any attempt to appose these two freshened surfaces results in approximately placing a cupped or mushroom-shaped head on a flat surface of the shaft, with only the edges of the head, at the best, in contact. If the leg is abducted, the upward riding trochanter pulls the neck surface away from the head, and prevents the firm contact which is necessary for a strong bony union. If, on the other hand, the leg is placed in the position of extension, then the small graft or peg, driven into the head, too soft to be relied upon to withstand any degree of force, must be relied upon to withstand the strong upward thrust of the thigh muscles. The fact is, by these usual methods, a firm bony union in these old cases of fracture of the neck of the femur, ununited after a long time, is not at all common. It has been found difficult to look up the results of operation on the old fracture cases. The pretty constant failure to obtain a firm bony union has not been an encouragement to go through the experience of the long convalescence added to the operation. Twenty-four cases have been studied, among which are some for which I have to thank the general surgical services of the Massachusetts General Hospital for the privilege of using. Of these (24), one has a useful leg. This report is by letter; it is (4?) years since the operation. It has not been possible to get an x-ray, but the patient writes that his leg is strong and useful, and that he has no pain. The operation was freshening the surfaces, no peg or graft was used. The man was younger than the average in these cases, being in the thirties, therefore at a time when the bone repair is more active. This is the only case of this series in which a satisfactory result was obtained. Results such as these, combined with the fact that these patients are permanently out of commission for any activity, is sufficient reason for advocating active surgical measures, even if they are radical.

The method here considered treats the femoral head as if it were a real sequestrum. We know that an entirely dead bone becomes vitalized if grafted on to living cancellar bone, and this seemed to be a solution to the problem here. The details were as to where to place the old head, and how. The thrust of weight-bearing from the shaft to the head should be as direct as possible, and yet have enough obliquity to adapt itself to the weight-bearing plane of the acetabulum. To accomplish this, the head is placed on the inner side of the top of the sawed-off trochanter, and in this way the thrust is passed directly from the shaft to the head, so that there is little or no distraction strain in weight-bearing, and the head has its most favor-

able position for a restored function, to gain which some compromise must be made.

Independent of the ordinary surgical conditions which must always be considered in any major operation, there is one contraindication. Sometimes, after joint injury, particularly in the older people, there is found a distinct osteoarthritic change, with thinning of cartilage, as well as the tendency to overgrowths. Under these conditions, a favorable functional result could not be expected, and this operation must not be advised.

Technic. The joint is best exposed by the inter-muscular route, between the tensor fasciae femoris and gluteus medius, by an incision from the anterior superior spine to the middle of the trochanter, turning downward, parallel to the line of the femur for a few inches—then starting again at the angle of the oblique and vertical positions of the first, a curved incision is carried backwards and upwards three or four inches. The tensor fasciae femoris and gluteus medius are separated, the muscle attachments on the outside of the trochanter are removed subperiosteally, or with a thin bone attachment, and the top of the trochanter removed so as to save the attachment of the gluteus minimus and pyriformis. These muscles are then all turned backwards and upwards, and the upper and anterior portion of the capsule exposed, to the edge of the acetabulum. The capsule is opened longitudinally to its fibers, on the upper portion of its anterior surface, saving the attachment of the Y ligament, if possible, but which, however, cannot always be done.

The capsule above the opening is then detached from the femur and retracted outward and backward; the trochanter cut off just below the level of the upper edge of the head, the inner portion rounded to correspond to the curve of a $1\frac{1}{2}$ inches to 2 inches radius, saving the anterior and inner cortex. The outer portion is either cut off obliquely, or a wedge taken out, near the outer surface, allowing the outer cortex to be pushed inward. The free surface of the head is thoroughly freshened, covering this area, so as to make a corresponding curve, to the rounded top of the trochanter. In abduction of the leg, the convex surface which has been fashioned on the trochanter, is brought directly into the concaved head, and in this position is firmly held against it. In this way the femoral head with its freshened surface is placed directly on the freshened cancellar surface of the trochanter,—an ideal condition for the vitalizing union of the poorly nourished fragment. The head is not placed directly on the top of the trochanter, for this would not allow the best position in the acetabulum, but on the inner and upper sides, which gives to it a somewhat oblique angle, partly resembling its normal direction, but without the normal neck. The stitches are placed in the capsule, but not tied until the leg is put into position of abduction,

and the head seen to be in the relation to the end of the trochanter which is desired, in order that this contact can be assured, and the position of the leg is then maintained until the plaster is applied. The stitches are then tied, the outer attachment of the capsule which has been freed is secured with the muscle attachment. The attachments of the gluteus medius and minimus, and pyriformis, are either secured to the outer side of the trochanter, or are inserted into the wedge-shaped depression, which has been made, in order to round off its upper and outer end. The wound should be tightly closed in layers, a plaster spica applied, including the foot of the affected, and the other leg, to the knee, and extending well up to the lower thorax on the opposite side from the operated leg. As a rule, the extreme degree of abduction is not required, and less inversion than in the Whitman method with the fresh fractures. This fixation is maintained for eight to ten weeks, fixation with an ambulatory plaster, but without weight-bearing for about two months more, and beginning weight-bearing with active motion at the end of this period. The ideal treatment would seem to be fixation by removable plaster at the end of the first eight or ten weeks, with beginning massage and gentle passive motion; but unless this can be carried out with very intelligent precision, the complete fixation is the safer plan. The bone contact between the two fragments cannot be made over the entire surface of the head, so that considerable bridging in of new bone is necessary, for which sufficient time must be allowed, and a change in the angle of union between the trochanter and head has been observed, after too early motion or strain. The motion must be brought back slowly, for the capsule must be partly newly formed and newly attached, and a considerable amount of flexibility must be developed before all of the potential motion can be expected. There is no diminution in the shortening, or at least not a practical amount, for there is too much adaptive contraction of all structures to allow any decided change in the relative position of the leg to the pelvis. A greater range of motion, however, is possible than might be expected, an entirely practical amount of flexion abduction and rotation results. The amount of this depends somewhat on the oblique position of the head on the trochanter, and on the rounding off of its overlapping portions.

The first case operated on in this series and by this method was in 1911. A man of thirty-five had sustained a fracture of the neck of the femur in a severe railway accident, one and one-half years previously. There was no union, and the man was out of commission. The attempt was made to freshen the surfaces and to bring the surface together in the usual method. The position of the trochanter, with the shape of the surface of the remains of the neck, combined with the irregular shape of the

surface of the head fragment, which had a large spur projecting downwards and backwards, made this impossible, and suggested this transplantation of the head as a compromise. The recovery was uneventful, and the man finally returned to work, and has been working steadily as a railway conductor for several years. Nine cases have been done, but seven only can be used as indicative of results, for two are too recent to be counted. One is just out of first plaster, at the end of ten weeks, and the leg is firm to any up-and-down motion, and the upward thrust has the solid feel, and the x-ray shows the head at an angle on the trochanter. The indications are of a good union, but the case should not be used for definite statistics. The others all have had firm union with strong weight-bearing, limited, but a practical amount of motion, with the same amount of shortening which existed before the operation.

The proceeding is a radical one, but the operation is one that is easily borne by anyone in reasonably good condition, provided there is no organic disease, and the recumbency in plaster is made more safe by the double spica, as it allows a considerable change in position. The very great deal of disability in those who still have a long working period ahead, and the prominence of the pain element, is indication for a reasonable although radical attempt to obtain a useful leg.

DISCUSSION.

DR. C. L. SCUDDER, Boston: There is only one pleasure that is greater than hearing Dr. Brackett present this subject, and that is to see him operate, which I have had the opportunity of doing several times on cases of this sort. I think his paper is a distinct contribution to the procedures which the surgeon may have in this group of cases, because, as has already been intimated, and as we know from practical experience, these patients are practically helpless, chronic invalids, unable to get about.

Now, fractures of the neck of the femur, in my mind, should be regarded something after this fashion, and they really group themselves into two groups,—without any reference to the old classification which has to do with the capsule and which is of very little importance practically: into the impacted cases and the unimpacted cases. If the impaction is a good impaction, if there is a good position, we are all agreed, I think, that we should let that impaction alone, and that probably union will take place in a large proportion of cases. If the impaction is a poor impaction, that is, the kind of impaction in which there is great eversion or inversion, the question will arise, is the individual old or young? If it is an old person, with poor impaction, it is better to do as we would with a good impaction,—let it alone and treat the case by immobilization. If it is a young, active adult, I believe we are justified in gently breaking up that impaction and either reimpacting it by a blow over the trochanter, or replacing it in position with abduction according to the Whitman method.

With the unimpacted cases I think the situation is quite different. We have here the recent cases in which I believe we should use the Whitman method or the Cotton method. These are the unim-

pacted cases which you see soon after the injury, and we know that if the leg is put in the abducted position and extended, union will take place.

Then there are the old cases of unimpacted fractures which Dr. Brackett has spoken of,—and I believe that Dr. Brackett's operation which he has described, and the results of which we have seen, is a distinct contribution to this group of old unimpacted necks of the femur. We may use, if we please, the method of refracturing the neck, and we may simply lay open the joint, curette the surface and put the parts as nearly in apposition as possible; and hope that union will take place. Then we may do what has been suggested,—refracture these edges and put a graft of bone from the tibia through, and place the parts in as near apposition before putting the graft through as possible; and in a good proportion of these cases union takes place, but I am inclined to think it does not as often as supposed.

In the reported cases of Dr. Albee in New York, we should scan very carefully the kind of cases in which he has performed this operation, because, as I understand it, Dr. Albee is doing this operation in certain recent cases with obviously good results; but in the old ununited cases it is a question whether this grafting operation is one which will meet the conditions satisfactorily in the large percentage of cases.

I believe that one great merit of Dr. Brackett's operation is that it is comparatively simple to do. It makes the weight-bearing come on the normal places. I think this is a distinct advance in the treatment of this particular group of cases.

DR. FREDERIC J. COTTON, Boston: I agree perfectly with what Dr. Scudder has just said, and I think this operation helps us around a corner which we have not known the way about before.

I have done a good many of these operations which were extremely unsatisfactory, but I am not quite as pessimistic as Dr. Brackett is about the results. The fact is, however, we get bony union in only a small proportion of cases, and in the majority of cases we do not even get functional result. Dr. Brackett has shown us the way out of this.

The reason some of these operations have been so unsatisfactory is that we tried to restore the bone to normal length; whereas Dr. Brackett reconstructs a new bone without attempting to restore the length.

DR. JOHN D. ADAMS, Boston: I have one word of commendation I want to add. I surely commend the operation most highly as being a comparatively simple operation, as hip operations go; all of which are difficult.

My experience is based on one case which Dr. Brackett saw in consultation. She has been out of plaster now only about three weeks, and is about on crutches, of course bearing no weight; but apparently the union is firm, and the patient has a little less than one-half inch shortening where there was over an inch. This I considered a rather good result.

SPINA BIFIDA AND ALLIED MALFORMATIONS. BASED ON AN OPERATIVE EXPERIENCE OF 34 CASES.

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I do not come here with indiscriminating enthusiasm and optimism, but rather with the