

THE BONE GRAFT PEG IN THE TREATMENT OF FRACTURES OF NECK OF FEMUR *

AUTHOR'S TECHNIC

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FRACTURE of the neck of the femur is by all means the most disabling of all types of fractures. These fractures were formerly regarded as occurring mainly in old age. Recent personal statistics, as well as those of other surgeons who have large fracture clinics, show a large number of fractures of the femoral neck occurring in individuals below the age of forty-five or fifty. Senile osteoporosis, associated with thinning of the cortex and absorption of many of the lamellæ of the spongia of the neck, is the chief cause of the increased frequency of this fracture in the aged, and, as would be expected, traumata of much less severity cause fracture in the aged more frequently than in younger individuals.

There seems to be no object, so far as treatment or prognosis is concerned, in classifying these fractures further than the single term, "fracture of the neck." The terms intracapsular and extracapsular are inaccurate and misleading. The capsular insertion to the neck of the femur is oblique, thus causing the joint to include more of the neck on its anterior and inferior surfaces than on the posterior and superior. Then, again, most fractures are oblique and diagonal, and are only infrequently strictly transverse. If any classification is used, that of Stimson is by all means the preferable one, *i.e.*, subcapital, or fracture through the neck, and fracture at the base of the neck. A fracture is apt to occur in one of these two places, either at the junction of neck with head, or with the trochanter. The associated outward rotation in epiphyseal separation or fracture occurs as frequently and is often more pronounced than in fractures of the neck, which fact cannot be explained by the more fragile posterior portion of the neck. The predominance of the external rotators, especially the short trochanteric muscles, is believed to be the more tenable explanation. Shortening depends upon the lessening of the angle between the femoral neck and the shaft or a sliding by of the fragments.

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In speaking of the poor results obtained in treatment of fractures of the femoral neck by the conventional methods, an authority states: "At first one can hardly appreciate how startling these results are unless he has carefully studied various series of statistics; and wherever the usually accepted principles of practice are employed, the long side-splints with Buck's extension, there the average results are uniformly unsatisfactory."

Of value in this connection are the conditions existing in 16 cases of fracture of the limb observed by Scudder many years after the accidents. "In only 2 cases, or 12 per cent., could it be said that the leg was functionally useful."

Walker studied the records of 112 cases of fracture of the neck of the femur treated in Bellevue Hospital between 1906 and 1907. Only 15 cases, or 13 per cent., recovered good function.

The British Fracture Committee tabulated 91 cases, in which 87 of the patients were over fifteen years of age. Only 20 of the adults, or 23 per cent., recovered good function.

Unquestionably Whitman's abduction method offers better results than the foregoing. Certain men, however, have not obtained the favorable results secured by Whitman.

Cotton offers the following objections to this treatment: "First, many men are inclined to doubt the locking of the upper fragment at the limit of abduction, believing rather that tension on the abductor muscles gives the limit of abduction; second, there is real danger that in less expert hands the fragments may be forced by one another, not jammed together; third, plaster spicas in stout patients do not hold abduction firmly."

At best, fracture of the neck of the femur is one of the most difficult problems in all surgery. The anatomico-mechanical conditions, the poor blood supply, the sluggish osteogenesis, and the difficulty of fixation are all potent adverse influences to securing satisfactory union and good functional results, and it is believed that if ever radical measures are justifiable they are indicated in the treatment of this desperate condition. Realizing this, certain surgeons have employed the metal spikes to assure better approximation and fixation than could be obtained by non-operative measures. This method has not given uniformly good results because of the failure of sufficient callus formation.

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An illustrative personal case was that of a woman thirty years of age, suffering from a fracture of the neck of the femur ununited after eight weeks. There was no destruction of the fragments from friction, nor was there any systemic disease to inhibit callus formation. It was a favorable case, and a tin-plated square steel spike, three and a half inches long, was driven into good position longitudinally through the centre of both fragments of the neck, which were in excellent apposition. The convalescence was uneventful. The wound healed by primary union, and at no time was there a temperature above half a degree, after the day following the operation. The operation, however, resulted in failure, and non-union occurred. Fig. 8 is a skiagram taken four months after the operation, showing that the spike, owing to its own weight and some destroying influence, had dropped through the lower portion of the capital fragment and no longer engaged it. The metal spike had not only destroyed bone, but it had inhibited callus formation in a region where osteogenesis is at a low grade, to such a degree that it prevented union or, at any rate, was a contributing cause to non-union.

To avoid the disadvantages of metal the author began, in 1912, to use a bone graft peg as a substitute for the metal spike. (For report, see author's report in *Murphy's Clinics*, June, 1913.) If these bone pegs are placed in the cervical fragments by the technic described elsewhere, an equally satisfactory amount of internal fixation is furnished at the same time that the disadvantages of a metallic foreign body are avoided, and the advantages of a living bone graft gained.

A strong autogenous bone peg, accurately fitted into a hole drilled longitudinally through the neck of the femur, with the fragments in good position, offers unquestionably the most ideal condition for the rapid and satisfactory union, in good position, of this difficult fracture. In other words, the influences adverse to union, enumerated elsewhere, are better overcome by this procedure than by any other treatment; also every argument for the autogenous inlay graft in ununited and selected fresh fractures of shafts of long bones holds equally in fractures of the neck of the femur.

Soft tissues are removed, if present, from between the ends of fragments; the fragment ends are secured in good apposition; callus formation is stimulated by the presence of the graft at the same time that the graft produces bone growth itself; and an osteogenetic bridge, capable of conducting both blood-vessels and bone-cells from one fragment to the other, is furnished.

Indications for Bone Graft Peg in Fracture of Neck of Femur.— This operation is believed to be indicated in all ununited fractures of the neck of the femur; in most unimpacted fresh fractures in oper-

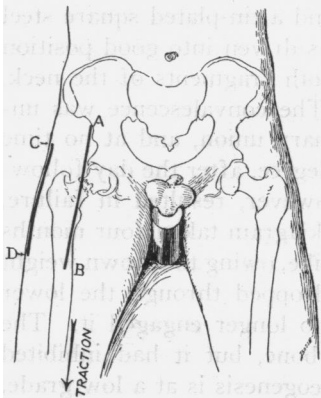


FIG. 1.—Drawing representing patient on Hawley traction table. *A B* and *C D* are skin incisions.

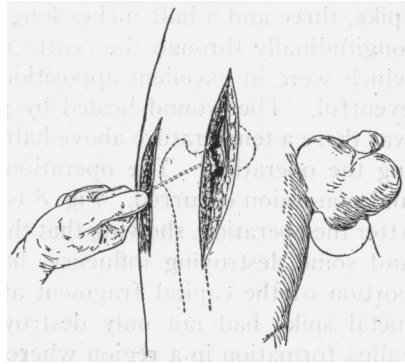


FIG. 2.—Drawing to illustrate author's method of determining with small hand drill the proper situation and direction for the motor drill. This hand drill is withdrawn as the motor drill is inserted (see Fig. 3).

able subjects under fifty years of age; in all old fractures of the neck or at the epiphyseal cartilage where malunion has resulted, with the neck depressed in a coxa vara relationship with the shaft. The bony

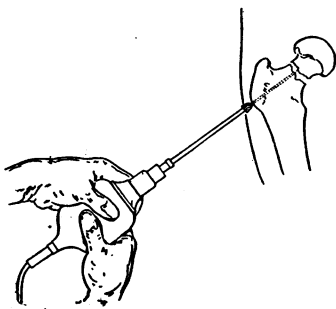


FIG. 3.—Insertion of motor drill.

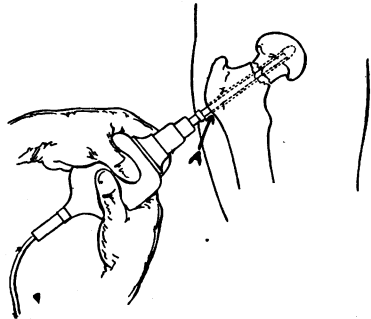


FIG. 4.—When the end of the burr has reached the space between the fragments and is ready to enter the capital fragment, a reading on the graduated shaft of the burr is taken at *A*, one is then able to tell just how far the burr should penetrate this fragment.

deformity is corrected by either a cuneiform or linear osteotomy, and placing the limb in full physiological abduction (Whitman). After the operative correction of these two latter conditions by the usual

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cuneiform osteotomy, Hitzrot states that weight-bearing should be prohibited for at least a year. The employment of the bone graft peg reduces this time by at least six months.

Technic of the Author's Bone Graft Peg Operation for Fracture of the Neck of Femur.—A most careful iodine preparation of a wide field for operation should always be carried out. The pubes should be shaved on the day before the operation and the preparation started.

The patient should be placed upon some traction table (Hawley) which will allow, simultaneously, abduction and traction. The point

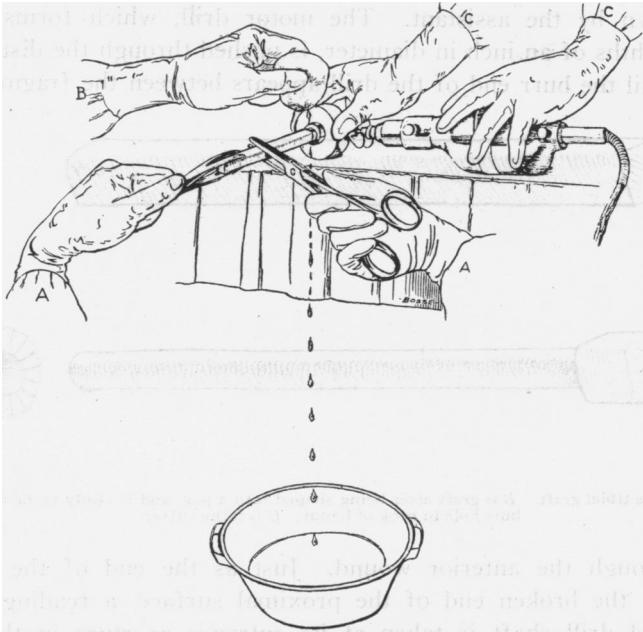


FIG. 5.—Graft from crest of tibia being pushed through the author's dowelling apparatus. *A A* is surgeon; *CC*, assistant; *B*, nurse.

of fracture is reached by an incision starting from a point a finger's breadth inside of the anterior superior spine and curved downward three to five inches along the inner border of the sartorius. The inner border of the muscle is exposed and retracted outward. The tendon of the rectus femoris is also exposed and retracted outward. The iliopsoas muscle is next exposed and retracted inward. The point of fracture is exposed and all soft tissue is cleared from between the fractured ends, which are curetted and freshened.

The limb is now placed in abduction and sufficient traction applied

to bring the fragments into good apposition as determined by both sight and palpation through the anterior wound. An incision two to three inches long is then made over and just below the great trochanter, which is exposed. With a small hand drill, the proper direction for the motor drill is determined by trial, as shown by observation through both wounds. The drill hole should be situated in the centre of the neck of both distal and proximal fragments, and parallel to the neck. The small hand drill may have to be reinserted in order to locate the proper tract for the motor drill. The motor drill should be held ready by the operator for insertion into the tract of the hand drill as it is withdrawn by the assistant. The motor drill, which forms a hole three-eighths of an inch in diameter, is pushed through the distal fragment until the burr end of the drill appears between the fragments, as

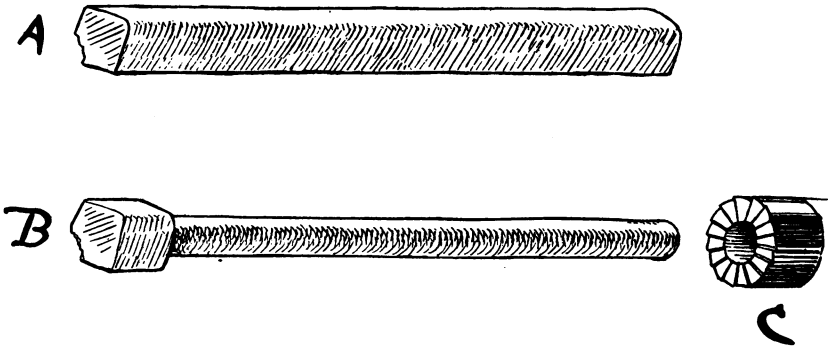


FIG. 6.—A is tibial graft. B is graft after being shaped into a peg, and is ready to be driven into burr hole in neck of femur. C is lathe cutter.

seen through the anterior wound. Just as the end of the drill is engaging the broken end of the proximal surface, a reading on the graduated drill shaft is taken at its entrance aperture in the great trochanter, so that by making additional readings it can be determined just how deep the capital fragment is being penetrated. By studying the skiagram, the length of this fragment can be very accurately determined, and hence the desired depth of the drill-hole obtained. When the fracture has occurred near the head and the proximal fragment is consequently short, the drill-hole should extend close to the articular cartilage of the head.

The drill is disengaged from the motor and left in place, to avoid any possible displacement of the fragments while the tibial graft is being procured.

The crest of the lower portion of the tibia is laid bare, and an area

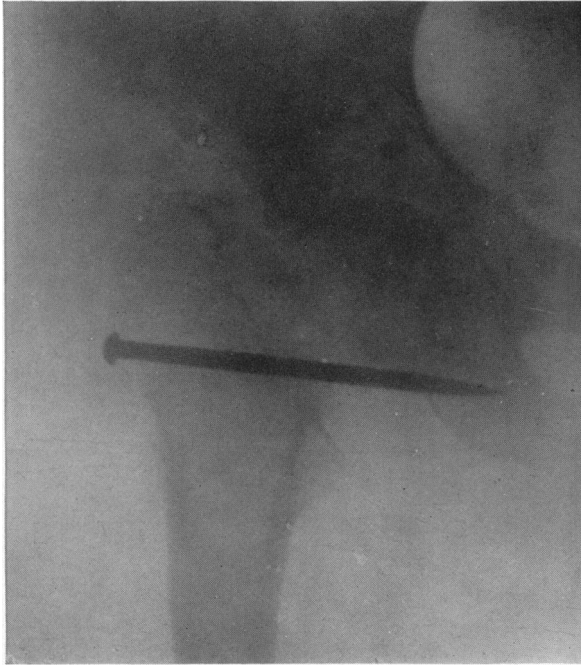


FIG. 8.—This spike was placed in the centre of head at operation. It has destroyed bone and dropped out of the capital fragment entirely, non-union resulting (see text).

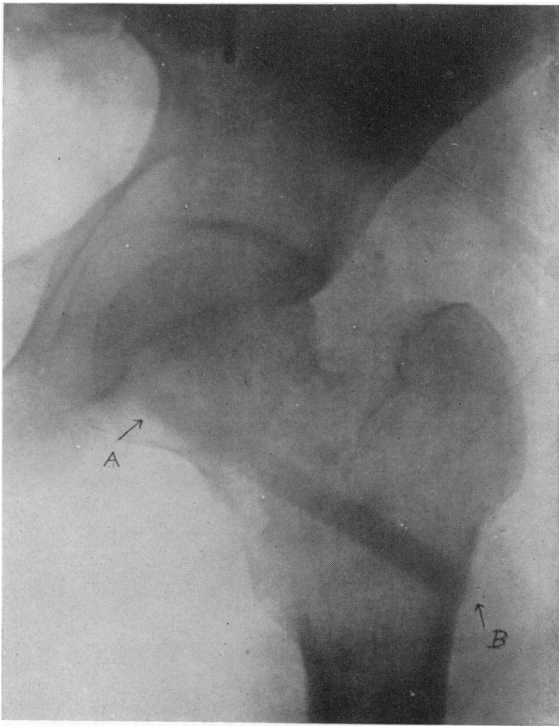


FIG. 9.—A B is bone graft peg three months after insertion. Firm bony union resulted immediately. It has been six months since operation and the union is firm. The graft was placed lower than it was intended, but did not interfere with the result.

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of the desired size and shape is mapped out in the periosteum with a scalpel. The desired length of graft can be determined by the graduated scale on the motor drill. The cross-section of the graft should be just large enough to be shaped into the peg when the dowel shaper is used.

When the graft peg is ready, the drill is withdrawn from the femur and the peg inserted. The fit must be accurate because the dowel cutter is the counterpart of the drill used. This accuracy of fit is very important. Too tight a fit is undesirable because a pressure anæmia of the surrounding cancellous bone would be produced. Too loose a fit, or an irregular, inaccurate fit, would not produce good fixation or favor an immediate bony union of graft to the host fragments.

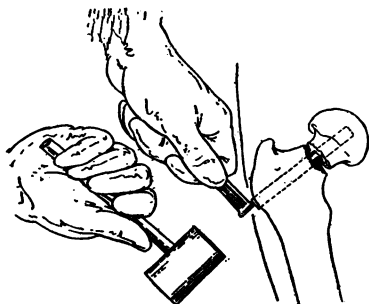


FIG. 7.—Drawing representing graft peg being driven home.

The deep fasciæ are approximated with interrupted sutures of No. 2 chromic catgut; the skin wound is closed with continuous suture of No. 1 chromic catgut.

The limb is put up in abduction (Whitman's position) in a plaster-of-Paris spica extending from the toes to the axilla. Three weeks after the operation, windows are cut in the plaster, and the wounds dressed. The dressing should be replaced with cotton for the purpose of restoring the tension of the plaster splint and retaining the fixation. The long spica should be continued for six weeks and followed by a short one for six weeks longer.