REPAIR OF FEMUR FRACTURE

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This invention relates to medical apparatus, has particular reference to the field of fracture surgery, and pertains especially to the repair of breaks occurring in the upper extremity of the femur, or thigh bone, of the human skeleton. For its general object the invention aims to provide means expressly designed for use in those fairly common fracture cases in which the break lies between the head of the thigh bone and the shaft of the latter, and comprehends the provision of a perfected permanent splint, and associated equipment for applying the splint, to effectuate a firm grip securely holding the facing surface of the bone section which lies at one side of the break against transverse slippage in relation to the facing surface of the bone section which lies at the other side of the break.

Other and more particular objects of the invention will, with the foregoing, appear and be understood in the course of the following description and claims, the invention consisting in the novel construction and in the adaptation and combination of parts hereinafter described and claimed.

In the accompanying drawings:

Figure 1 is a view partly in longitudinal vertical section and partly in elevation illustrating a splint constructed in accordance with the preferred embodiment of the present invention and portrayed in operative position upon a broken thigh bone, the bone being shown fragmentarily.

Fig. 2 is a plan view of the splint.

Fig. 3 is a fragmentary transverse sectional view on broken line 3—3 of Fig. 1.

Fig. 4 is a view partly in longitudinal vertical section and partly in elevation to illustrate the jig which I provide for guiding a drill in preparing the bone section for application of the splint, and showing said jig in the performance of its intended end of guiding the drill into a thigh bone, the latter being represented fragmentarily.

Fig. 5 is a fragmentary side elevational view with parts in section to illustrate one means of pressing the splint into operating position upon a prepared thigh bone; and

Fig. 6 is a somewhat similar view incorporating a fragmentary showing of the thigh bone and showing a somewhat modified tool for use in forcing the splint home.

Before proceeding with a detailed description of the present invention, clarity in an understanding thereof will perhaps be advanced by first referring to the structural nature of the bone, and namely the femur or thigh bone, on which my splint is expressly intended to be used. The present invention is concerned only with the upper extremity and which consists of a rounded head, denoted a, which articulates with the cavity in the hip bone and which is joined to the shaft b by a constricted neck c, with an eminence known as the trochanter d surrounding the shaft and jutting outwardly therefrom. The splint of the present invention is preferably produced from stainless steel although any other material of suitable strength, and having the necessary characteristic of being free of any toxic effect when placed under the flesh, would suffice for the purpose. This splint provides a comparatively narrow plate designated by the numeral 10 and, considered in transverse section, such plate is made slightly concave upon the underside to conform more or less to the circumferential curvature of the shaft b and, considered, in side elevation, is substantially straight for the major part of its length with the upper terminus curved outwardly, giving to the plate a shape conforming more or less closely to the profile configuration of that part of a thigh bone's outer face which includes the lower portion of the greater trochanter d and extends for a substantial distance along the shaft proper. Piercing the curved upper end and spaced one from the other on the longitudinal median line of the plate there are provided a pair of spikes 11 and 12 which are directed angularly upwardly along parallel axes. The spikes are made an integral part of the plate and when the latter is placed to lie snugly against the outer face of a thigh bone, the angularity of these spikes is desirably such as to approximately parallel the axis of the neck c, and the length is such as to have the spikes substantially traverse the cancellated structure of the neck and bring the lips into the head proper without, however, piercing the coating of compact tissue which lies at the surface. Between and parallel with the axial lines of these spikes the curved end of the plate is pierced by a counter-sunk hole 13. In its other or lower end the plate is drilled to provide two quite widely spaced and tapered holes 14 and 15 of fairly large diameter and which likewise are placed on the longitudinal median line, and between these tapered holes there is provided a third and threaded hole 16. The purpose of the several holes will become apparent in the course of describing the application of the plate.

Associated with the plate and arranged and adapted to be used for drilling into the bone to prepare the latter for reception of the spikes 11 and 12 there is provided a jig, and this jig pre-
sents a head 17 pierced with a center hole 18 and having, both fore and aft thereof, a guide hole 20 paralleling the center hole. The guide holes are arranged to receive a bit 22 therethrough of a diameter substantially the same as the spikes, and with the center hole 18 are spaced apart in substantial correspondence with the spacing which obtains between the spikes and the center hole 13 of the plate. Extending angularly outward from the base thereof, the first, near the tip of the spike, is provided a stabilizing arm 23, and working through a threaded opening in the end of this arm is an adjusting screw 24.

In applying my splint, and assuming that the fracture line of the femur under repair is the more or less usual transverse break pictured in the drawing and running between the greater and lesser trochanters, the procedure is to first expose the bone by laying back the flesh and the jgs is then placed in the desired position (see Fig. 4) while adjusting the screw 24 to compensate for individual peculiarities in the bone structure. The surgeon then inserts a fine bit in the center hole 18 and drills into the bone and through the canulated structure until the leading end has worked well into the head a, whereupon the bit is removed and replaced by a straight length 25 of a fairly heavy-gauge wire. With this wire holding the jig against shifting, the surgeon then repeats the drilling operation, using the larger bit 22, and again working through the canulated structure well into the head a. This time on the parallelizing axial lines prescribed by each of the two guide holes 20. The jgs is now removed and the two spike tips of the splint inserted in the drilled holes, and in performing this step the wire may be first removed or it may be temporarily left in the bone and the splint guided into position by feeding the exposed end of the wire through the center opening 13. As the entering spikes encounter resistance, and this will usually occur as the tips near the inner ends of the drilled channels, the surgeon may then either forcefully complete the insertion by heavy thumb pressure or he may employ a tool similar to one or the other of the two tools 26 and 27 which I have illustrated in Figs. 5 and 6, each of which are characterized by their provision of a taper nose, as 28 and 29, which seats in the counter-sunk recess of the center opening 13. In the instance of the preferred tool 27 the surgeon simply presses the nose of the tool against the tapering socket and holds the tool such that the exerted endwise thrust is directed along an axis closely paralleling the axes of the spikes, whereas with the tool 26 provision is made for fixedly locating the center line of the tool's thrust-transmitting stem. In such latter case, the tool presents a threaded shank 30 disposed in following relation to the manner 28, the shank being disposed so as to engage the internal threads of the head of an arm 31 and which is in turn anchored upon the plate 10 by a cap screw 32 working in the threads of the drilled opening 16.

Having now accomplished a seating of the plate against the exposed surface of the bone, the surgeon then anchors the bottom end of the plate by applying screws 33 and 34 through each of the two tappered holes 14 and 15, drawing the plate firmly against the bone. These anchoring screws, which are of a length sufficient to pierce the compact outer tissue and pass through the medullary canal and into the compact tissue at the opposite side of the bone, are by preference applied such that their axial lines lie in diverg-
the bone which includes the upper section of the shaft proper and a portion of the greater trochanter and formed at the plate's lower end with a pair of apertures spaced at intervals of the length, a pair of spikes integrally joined by their root ends to the curved extremity to lie in separated relation on the longitudinal median line of the latter and projecting inwardly from the underside thereof in such angular relation to the general plane of the plate as, upon application of the splint to the bone, to cause the spikes to project through the constricted neck and into the head prominence of the femur along axes parallel one with the other and with the approximate axis of said neck, the outer face of said curved end being also provided with a recess disposed intermediate the axial lines of the spikes and serving as a socket to receive the mating nose of a thrust-applying tool for forcing the spikes into the bone, and headed screws for said apertures of the plate arranged to be inserted therethrough and into the shaft of the femur for drawing the plate firmly against the shaft.

3. A jig for use in preparing a femur bone for application of a splint characterized in its provision of parallel bone-penetrating spikes adapted when the splint is applied to the bone to occupy positions along the approximate axial center of the femur's constricted neck, said jig providing a head drilled along parallel axes to present a median bore and two end bores of somewhat larger diameter than the median bore placed one at one side and the other at the other side of the center bore and spaced apart a distance corresponding to the spacing between the spikes, the end bores serving as bit-receiving guides to hold the drill-bits on parallel axes during the operation of drilling the bone to produce channels for the reception of the spikes and the median bore acting to receive a straight length of bone-embedded wire to localize the jig while said channels are being drilled, said jig also having an arm extension projecting laterally from the head, and an adjusting screw working in said arm and arranged to bear upon the shaft of the femur for stabilizing the head.

4. The splint of claim 2 in which the plate is provided in its lower end with a threaded aperture, and an arm member providing means for stabilizing the thrust-applying tool removably anchored to the splint and arranged to be used with the latter when the splint is being set in position, the anchoring instrumentalities comprising a cap screw working in said threaded aperture.

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The following references are of record in the file of this patent:

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Number Name Date
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