AN ABDUCTION SPLINT FOR THE FEMUR.

BY

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THE war has demonstrated that for the early treatment and transportation of patients with fractures of the femur Thomas's knee-splint is the best general utility splint, and that rigid extension from the ischial tuberosity is practical. There is, however, a class of fractures of the femur—that is,

FIG. 1.

those in the upper third—which presents great difficulty to treatment with Thomas's splint, particularly when accompanied by extensive flesh wounds of the buttocks and hips. These cases require

abduction as well as extension. Their wounds should be available for dressing. They and their splint should be easily transported, and immobilization of the fracture maintained. There is no splint in use at present which performs all of these functions. Thomas's splint does not produce abduction, and the ring interferes with the dressing of high thigh and buttock wounds. Bradford's frame, the Hodgen-Balkan combination, and Sinclair's bed cannot be transported. The Jones abduction frame is cumbersome, expensive, and often very uncomfortable. All of these tie the patient and hold him so that he is unable to move. Sinclair's bed tilts him up the wrong way—head downwards—so that pus tends to track upwards. All of these appliances produce abduction at the hip-joint by swinging the leg away from the mid-line of the body; thus the leg protrudes from the side of a stretcher or bed and is bumped against in transport. There is another way of producing abduction, that is, by tilting the pelvis. The diagrams (Fig. 1) will explain this. By making use of this principle and bearing in mind that most high compound fractures of the femur are accompanied by extensive flesh wounds of the buttocks, thighs, or hips, I have devised a splint,

FIG. 2.

based upon the lines of the Thomas, which has proved useful in my hands.

The Thomas ring is transposed to the uninjured thigh, producing a base for extension against the ischial tuberosity on the sound side of the pelvis (Fig. 2). Coming from this ring is the inner rod of the splint, which has an offset near its origin for the genitals. This rod is continued as in the

ordinary Thomas into the outer rod which fastens to an iliac pad, since the ring is on the opposite thigh. This pad fits just below and parallel to the crest of the ilium on the same side as the fractured femur. The pad is continued into a broad band which passes round behind the pelvis and fits snugly to the hollow of the sacrum. When the pelvis is tilted by counter force on the opposite tuber ischium, this pad impinges, not on the iliac crest, but just below it on the plane of the ilium, which is well protected by the gluteus medius muscle. In front the iliac pad and the ring are connected by an iron rod running transversely across the body (Fig. 3). This is adjustable for width, so that the splint will fit any sized man. The band which passes around the back buckles to this transverse bar in front. The outer rod of the splint is also adjustable, and serves the double purpose of increasing the length of the splint and of varying the abduction angle. The material used is $\frac{3}{8}$ in. iron rod for all parts except the pelvic band, which is a strip of sheet iron 2 in. wide, curved on the flat to fit the back (Fig. 4). The ring is made in varying sizes, from 20 in. to 26 in. A 22 in. ring is the best for universal use. The adjustments are made by means of a coarse screw and nuts. The ring and the iliac pad are well padded. The pelvic band is lightly padded. These parts are covered with leather, and the pelvic band continued into a strap. The buckle is fixed to the transverse bar in front. This splint is applicable to any case in which abduction is required. It produces a maximum true abduction angle of 45 degrees, and can be adjusted to any lesser angle. The absence of a ring round the wounded thigh leaves space for dressings. The hip-joint is fixed. The back, arms, and sound leg are free. This enables the patient to move about in bed, changing the pressure points, and thus preventing bedsores. He can sit up on a back rest. He can raise his buttocks off the bed by making a tripod of his shoulders and the heel of the sound leg, and thus use a bedpan in comfort. One patient has been able to roll over and sleep face downwards. The splint is light and inexpensive compared to other abduction appliances, and is as easily transported as the ordinary Thomas.

FIG. 3.

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Fixed extension can be changed to weight and pulley extension when desired. I have been using a graduated spiral spring extension on the principle of the spring

balance. This reads in pounds. I have seen the ischial tuberosity bear a push of 20 lb. for months without making the skin sore.

Flexion at the hip can be obtained by bending the splint or by elevating the foot as with a Thomas. I have seen no tendency for scoliosis to persist after the splint is removed. Within a day or two the lumbar vertebrae resume their normal position.

Two of the cases which I have treated with this splint follow. The x-ray plates are shown as black and white drawings, since the plates were too thin to make good prints.

CASE I.

Driver S. Bullet wound, September 30th, 1917. Entrance wound in left groin; exit left great trochanter. Operation same day: Wounds excised and cleaned; bipp. Comminuted fracture of femur—upper fragment in abduction. Abduction splint applied. October 20th: Comfortable; no fever; wounds clean. Body covered with boils due to pediculi. Boil over sacrum ruptured. October 25th: Boil over sacrum healed; no bed sore.

November 16th: X ray showed spiral fracture through lesser trochanter with a split running into great trochanter and moderate comminution. Upper and lower fragments in good alignment. Abduction at hip of 35 degrees. Some callus near lesser trochanter.

November 17th: Wounds healed. Bony union—all movements at hip and knee good. December 15th: Up and walking in calliper splint. Both legs are the same length.

CASE II.

Pte. J. Bullet wound, October 22nd, 1917. Fracture of left femur at lesser trochanter. Operation: Foreign body removed; wound cleaned; Thomas splint.

November 10th: X ray showed spiral fracture beginning just above the lesser trochanter and following the spiral line,

FIG. 5.—Tracings of x-ray plates of Pte. J. A, Fracture while on Thomas splint. Upper fragment in abduction. Angulation at fracture and consequent shortening. B, Fracture while on abduction splint. Fragments in line with slight over-correction and 1 cm. over-extension.

leaving the lesser trochanter intact on the upper fragment. Considerable comminution and loss of some cortex. Upper fragment is turned out in abduction and is flexed at the hip. Lower fragment in poor line. There is marked angulation at the point of fracture. Plate shows some hazy callus, probably not bony.

Operation, November 16th: Fragments forced into position; callus broken up. Nails driven into condyles for extension. Abduction splint applied. On November 18th x ray showed marked improvement. There was slight over-correction (Fig. 5). Abduction angle lessened from 45 to 35 degrees. Alignment perfect.

December 12th: Condylar nails loose; removed. Adhesive leg extension. December 25th: Union firm.

Measurements:

	Left.	Right.
Great trochanter to adductor tubercle	41 cm.	40 cm.
Anterior iliac spine to adductor tubercle	45 cm.	44 cm.
Anterior iliac spine to internal malleolus	85.5 cm.	85 cm.

The fractured femur is 1 cm. longer than the sound one.

A METHOD OF CITRATED BLOOD TRANSFUSION.

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TRANSFUSION with citrated blood has had a fairly wide use in civil practice during the past few years. Reports have varied concerning the satisfaction this method has given. Some workers report excellent results. Others have experienced certain drawbacks, especially the occurrence of reactions after transfusion. Although the method of citrate transfusion is very simple, definite precautions must be observed or the blood will undergo changes, while outside the body, that may render it toxic. The very fact of the apparent simplicity of transfusion with citrated blood has undoubtedly led in many instances to a lack of appreciation of the care necessary in carrying out the technique, with consequent undesirable after-effects; blood is a very delicate tissue, and must be handled accordingly. The chief consideration is to get the blood quickly and cleanly into the citrate solution so that coagulation changes, which always begin the moment the blood leaves its containing vessel, may be stopped as soon as possible. The passage leading from the vein to the citrate must be of large diameter, as short as convenience will permit, and absolutely clean. The blood must be well mixed with the citrate at once. With unsuitable apparatus, clotting will probably occur in the tube system, which, although it may not entirely occlude the lumen, will slow the flow to such an extent that the blood undergoes considerable change before reaching the citrate. This is the kind of blood which tends to produce reactions when transfused. With properly constructed apparatus and careful technique, reactions ought to be of infrequent occurrence.

APPARATUS.

The apparatus shown in the diagram has been found satisfactory. It is simple in use and can easily be made out of material at hand.

Transfusion apparatus.

A. Transfusion Bottle.

A wide-mouthed well-cleaned drug bottle with a capacity of 900 to 1,000 c.cm. will serve as the transfusion bottle. It should be short and wide, rather than long and narrow, since this shape diminishes the length of intake tube necessary. Three marks are made on the bottle with a file, one at the 660 c.cm., one at the 760 c.cm., and the other at the 860 c.cm. levels, indicating 500, 600, and 700 c.cm. of blood respectively. It is well to use a glass pencil as well to make the marks more distinct. 160 c.cm. of a 3.8 per cent. solution of sodium citrate (isotonic), made up with freshly distilled water and filtered, is placed in the bottle, which is stoppered with a cotton plug wrapped