Remarks
ON THE MECHANICAL TREATMENT OF COMPOUND AND SUPPURATING FRACTURES OCCURRING AT THE SEAT OF WAR.

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[WITH SPECIAL PLATE.]

I have been asked to offer some suggestions as to a suitable way of treating certain fractures of the upper and lower limbs as they occur at the seat of war. We realize that wounds as met with during the Boer and Russo-Japanese campaigns were very different in character from those occurring on the riddled ground fields of Flanders where suppurating so commonly follows. The point, therefore, is to decide upon the best way of immobilizing compound fractures in the presence of pus.

The method employed must be both efficient and simple; it must allow easy and painless access to the wound, and protect the limb from further injury during transport. From experiences gained by a short visit to the front, and from conversations with many surgeons at home and abroad, I feel strongly that surgeons should abandon all operation on limb fractures for compound cases. They are fraught with danger, and have no place in this campaign.

Plaster-of-Paris, so often used in the treatment of simple fractures, becomes a filthy method where suppurating has occurred. Despite every precaution for the exposure of the wound the plaster may discharges into layering-paper, and becomes horribly offensive, adding to the infection of the wound. I would urge my young colleagues at the front to discard it altogether.

FRACTURES OF THE LOWER LIMB, HIP AND UPPER THIGH.

Fractures through the hip joint and those just below the trochanter are best treated by a modification of the Thomas splint, which I have described as an "abduction frame" (Fig. 1a). Extension is easily maintained and applied, and need not be limited for any purpose. The patient is placed upon this splint, and any displacement should be corrected by immediate extension in the abducted plane. The limb should be rotated inwardly slightly until the foot is at right angles to the table and be fixed in this position on the frame (Fig. 1c). It will be seen from the diagram that both limbs are controlled and that extension is secured by strapping on the injured limb with counter extension by means of a smooth leather gait and strap on the opposite side of the pelvis. This gait strap should not be weakened by the nurse under any pretext, but in order to avoid pressure sores she should be instructed to alter the area of skin over the adductors, which is subjected to pressure, by moving it to and fro. This method of "fixed extension," in abduction secures the lower limb in relation to the pelvis in a manner which can never be satisfactorily achieved by weight and pulley, where reliance is placed on the weight of the body for counter extension. It is by reflex nervous impulsion, induced by changes of tension in the muscle, that muscular spasm is produced. A patient lying in bed with a fractured femur—high up or lower in the shaft—cannot avoid constantly changing the state of tension of the muscles of his thigh if a weight and pulley are attached to his limb. The counterpoise is the weight of the leg, which constrains the patient to shift the position of his shoulders by digging his elbows into the bed. He alters the tension of his muscles, calling forth a reflex spasm. When he falls asleep his muscles relax, when he wakes up, which he is induced to do by a bedpan or moved slightly by the nurse, he has his bed put straight, there is apt to recur this reflex contraction due to sudden change in tension.

The long Delaire splint, which is much in use, is quite unsuitable for fractures of the upper thigh. It does not permit abduction, but maintains the limb in line with the trunk—a position which must result in angular union. Furthermore, as the splint tends to the axilla, any movement of the trunk involves movement of the limb, and attention to the secretions disturbs the fracture. Both the bunion and the ordinary weight and pulley are ill suited for any form of fracture, with suppuration, where good alignment, comfort and ease of transport are desired.

The patient who lies on an "abduction frame" can be lifted and moved without pain, without disturbing the fractures or relaxing the extension, and the traction is changed without interfering with the mechanism of fixation. If the wound is through the buttock and the discharge takes place from there, the splint can be modified as shown in the illustration (Fig. 1c). The abduction frame can be applied in a few minutes.

Upper, Middle and Lower Thigh.

For all other fractures of the thigh, the Thomas knee splint is incomparably the simplest and best (Fig. 2a). I have often fixed a fractured thigh in this splint, and sent the patient home in a cab. By means of its construction, it automatically secures a correct alignment, as any surgeon with a mechanical mind can see if he examines the illustration. I am in the habit of using this splint for the treatment of all fractures of the middle and lower third of the thigh, fractures through the lower extremity of the femur, fractures through the upper and middle portion of the leg.

The application of the Thomas bed splint is quite easy. Strapping of adhesions is applied in the usual way to the sides of the thigh. An initial of the extension strapping is a loop of webbing which is attached a length of strong bandage (Fig. 2b). The ring of the slab is passed over the foot (Fig. 2d) and up to the groin till it is firmly against the tuber ischi. The extensions are then pulled tight, the ends turned round each side bar (Fig. 2e) and tied together with the bottom end of the slab, which should project 6 or 8 in. beyond the foot. Care must be taken to avoid internal or external rotation of the limb, the foot being kept at right angles. Local splints can then be employed, and are made of black tin or sheet iron. They can be moulded only with the hand to fit the limb, and yet, being garter-shaped, they are rigid longitudinally (Fig. 2f). They can be disinfected by fire or water. A couple of transverse bandage slabs suspend the limb from the side barn of the knee slab. A straight slab is placed behind the suspensory bandages of the thigh and knee. On the front of the thigh another similar slab is applied, and the foam is kept right up to the thigh, so that alignment from the hip Joint to the ankle is perfect, being dependent on a straight pull (Fig. 2g). This slab allows the patient to raise his shoulders, or even sit up in bed. His other leg can be moved freely, and the tension on his thigh muscles, and there is no reflex spasm. Even if the muscles try to contract they cannot, for the tension of the slab is firm against the tuber ischi. The muscles therefore do no movement or the slightest motion, are quiescent, and starting pains do not occur. Such is the difference between "fixed" and "intermittent" extension.

In using this splint a little attention is necessary to prevent soreness of the perineum. The ring of the slab, being covered with smooth lash leather, can easily be kept clean, so can the skin. The nurse should also several times a day press down the skin of the buttock and over a fresh part of the skin under the splint. To change the point of pressure over the perineum the slab can be elevated or abducted. The dressings can be applied without any intervening with the work of the slab. When the fracture has occurred through the knee or upper tibia the slab is applied in the same way.

It has often been a matter of astonishment to me that such simple and effective a splint has not been universally employed. It can be applied in a few minutes, usually without anaesthetic, and the limb is always sure of good length and good alignment. The fractured limb can be moved in any direction without disturbing the fracture. The transport is easy and safe. I have never yet had to plate on wire a femur in a recent case, and this I ascribe to using the Thomas splint.

Leg.

Fractures of the lower portion of the tibia or fibula, and fractures through the ankle joint, I treat in a skeleton [2820]
splits, such as I have illustrated (Fig. 3 a). It allows of easy access to the wound, and can without difficulty be modified to suit a special case. Fortunately, in gunshot wounds, the spiral fracture is rare, and, generally speaking, even when the bone remains unbroken. Then, fractures of the leg does not present so much difficulty as that of the thigh. For transport, however, and for general comfort, the splint should immobilize the knee (Fig. 3 b).

Fractures of the Upper Limb.

Fractures through the shoulder-join and through the surgical neck of the humerus require no, splints. The elbow should be slung in a right angle and fixed by a broad bandage to the side. The dressing would probably replace the usual pad in the axilla, which should never be bulky. Shoulder shields are unnecessary and cumbersome. The patient, where practicable, should be treated in the upright position, and should have his head and shoulders well propped at night.

Where ankylosis is to be expected after a bad smash and suppuration of the shoulder, and opportunity is afforded for continuous treatment, the arm should be kept abducted slightly forward, and slightly rotated inwards (Fig. 4). This assumes a much extended range of movement, and is therefore more useful, since range of movement being brought about by the action of the scapula. This position need not be adopted if the patient has to be transported, as it can be established after the arrival home. Fractures through the elbow or immediately above the condyles are best treated without splints. If possible, the arm should be supported well above a right angle. Suppurating cases will not admit of this very acute flexion which we insist upon in the case of children. If, for a rare reason, a splint has to be applied, the internal wooden angular splint must be avoided, because it is always clumsy and often causes deformity, and a splint as illustrated (Fig. 5 a and b) used.

Fractures of the middle and lower middle portions of the shaft of the humerus, whose dressings have to be frequently changed, require very gentle handling, and I illustrate two splints which may be found very useful. One is a modified Thomas's splint used to maintain extension in the abducted position, the patient being recumbent (Fig. 6 a and b). The other is a modified Thomas's extension splint (Fig. 7 a, b, and c), to be used when the patient can walk about or sit up in bed. Either splint permits of easy dressing, and maintains adequate fixation. As to the local destruction of bone by modern shrapnel, and even by rifle bullet, great care must be taken to prevent over-extension, otherwise non-union will ensue.

FOREARM.

The chief disability to be incurred in fractures of the shafts of the bones of the forearm is inability to supinate the forearm completely. The trouble usually arises where both bones are broken, but it may occur when the radius alone is involved. We must remember that the whole length of the posterior border of the ulna is substantiates and is practically straight. On this straight ulna the curved radius rotates like the handle of a bucket. We must therefore attend to two points. First, we must keep the ulna straight; second, we must not interfere with the natural curve of the radius. That is to say, there must be no lateral pressure of bandage or splint on the ulna above the shaft of the radius. In dealing, therefore, with these fractures, whether one or both bones be broken, the position of supination should invariably be maintained (Fig. 8). This is even more important in septic cases. The worst complication is ulna fracture. Neglect of this important point will often result in a locking of the bones in pronation. We must remember that in nearly all neglected fractures of the forearm, supination and not pronation is defective.

WRIST AND HAND.

I have seen several cases of gunshot wounds through the wrist, and they have been mostly treated with the hand in one position—that is, midway between palmar and dorsiflexion. This is fatal to a useful joint. In order that the fingers may maintain their grasping power, all injuries of the wrist-joint should be treated in the dorsiflexed position, as shown in the illustration (Fig. 9 a, b, and c). Fractures of the hand may be immobilized as shown (Fig. 10 a, b, and c).

Retention of Loose Pieces of Bone.

I do not intend to deal with the surgical considerations involved in the treatment of the suppressing wound. Many distinguished surgeons are devoting themselves to this problem. It may be well, however, to offer a word of warning against the destruction of loose pieces of bone removed from the wound. If quite loose they can be left out, cleaned, and replaced. Even in the presence of pus they may unite. Superglue or composd fracture unites well if time be given them; a common source of failure is due to the removal of bone.

Preparation of Splints.

The appliances which I have described can be obtained from P. H. Crickley, 21, Great George Square, Liverpool, and for the convenience of surgeons as the front a paper the measurements required when a splint is ordered.

Additional Notes (Fig. 1 a and b).—Give measurements from axilla to external malleolus, and state left or right. For an undercrurf splint—state of wound measured from axilla. 

Hold Knee Splint (Fig. 8 a).—From fork to heel, and circumference of thigh at fork.

Take Foot Splint (Fig. 8 c a).—Length of foot, also heel to knee.

Note: Hand Splint (Fig. 9 c).—From palmar surface of wrist to below metacarpo-phalangeal range, usually 8 in.

Long Hand Splint (Fig. 10 a).—Same as short, but to finger ends.

Extension Splint for Arm (Fig. 6 c).—Circumference of arm at junction of shoulder and from axilla to finger tips.

Augerine Fluid Splint (Fig. 5 a).—To obviate, and occlusion to tip of shoulder.

Materials Extension Axilla (Fig. 7 a).—Wrist to olecranon, occlusion to axilla, and circumference of arm round shoulders.

Frequently the unaffected limb can be measured to ensure correct length, etc.

The Bactericidal Action of Colloids of Silver and Mercury.

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In March of 1911 Crookes introduced two new preparations—colloidal argonum and colloidal hydra-gyna—containing 1 in 2,000 of gold in mercury. Since then, these have been used in a colloidal form. From his bacteriological experiments with these preparations he concludes: "I know of no microbe that is not killed in laboratory experiments in six minutes." The experiments consist in applying a colloidal silver to cutaneous tissue infected with a micro-organism, and making streak cultures from the mixture on agar plates at definite intervals of time. This method and the slight modifications of it adopted in the case of galenous experiments appeared to us to show little more than the antiseptic action of these preparations, since, after subculture on a semisolid medium like agar jelly, the micro-organisms are still in an environment of the antiseptic little removed in strength from that of the original mixture.

We therefore performed the following experiment: A vigorous twenty-four hours' growth of Bacillus coli on agar was suspended with colloidal argentum, and after ten minutes the colloidal silver was poured off, and the growth carefully washed with sterile distilled water to remove any colloidal adhering to the micro-organisms or suspensoids. The colloids then remained on agar in MacConkey's medium and the tubes incubated for twenty-four hours at 37° C. Growth occurred in both media.

Further experiments on the bactericidal and antiseptic actions of these preparations were made in the laboratory of Professor Marshall, and are summarized in the preceding table. The preparations were obtained through a retail pharmacists, and when examined after dilution by the ultramicroscope showed the usual structure of galenous colloids. There was very little clumping of the particles, and no other evidence of coagulation.
Fig. 1a.—Left abduction frames with streaming extensions, wadding, and bandages used in application.

Fig. 1b.—Convenience of abduction frame for transport.

Fig. 1c.—Abduction frame applied.

Fig. 1d.—Modified abduction frame for pelvic wound.
Fig. 1a.—Robert Jones, with strapping extensions, local splints, wadding, and bandages used in application.

Fig. 1b.—Strapping extensions applied to leg, bandage suspension sling to support limb.

Fig. 2a.—Thomas's knee splint, with strapping extensions, local splints, wadding, and bandages used in application.

Fig. 2b.—Knee splint in position, traction applied.

Fig. 2c.—Sheet iron splints molded by hand for various uses.

Fig. 2d.—Sheets iron splints applied.

Fig. 2e.—Thomas's knee splints applied.

Fig. 2f.—Application of local splints.
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Fig. 3a.—Skeleton splint for injuries near the ankle joint.

Fig. 3b.—Skeleton splint applied.

Fig. 4.—Position to be maintained whenankylosis is expected.

Fig. 5a.—Splint immobilizing elbow joint, but allowing access to it.

Fig. 5b.—Elbow splint applied.

Fig. 6a.—Modified Thomas's bone splint to secure extension of arm. Note flattened face of ring.

Fig. 6b.—Extension arm splint applied.
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Fig. 7a.—Modified Thomas's humerus extension splint.

Fig. 7b.—With supporting bands in position.

Fig. 7c.—Applied.

Fig. 8.—Securing supination in fractured forearm.

Fig. 9a.—Dorsiflexed wrist splint to secure good grasp.

Fig. 9b.—Dorsiflexed wrist splint applied.

Fig. 9c.—Dorsiflexed wrist splint applied.

Fig. 10a.—Dorsiflexed wrist splint for wounds of hand.

Fig. 10b.—Applied.

Fig. 10c.—Applied.