whilst the case looked a malignant one, the opinion expressed was that he had a double infection of tertian ague. This condition seemed to settle after a course of quinine, followed by one of liq. arsenicalis.

Previous History.

The patient had served in India for three years. There he had "an odd day or two" with attacks of malaria, but was never in hospital, and no blood examination was made. From November, 1915, to December, 1916, he was at Salonica. In August, 1916, he had an attack of malaria for which he was detained five days in hospital and then attended for three weeks, taking quinine. He was invalided home after an operation for appendicitis. From the beginning of 1917 he began to notice that heavy work and "jumping about" gave him a feeling of discomfort in his stomach, and after such exercise he vomited on several occasions. He was not short of breath, and thought his discomfort was due to his appendix operation. He arrived in France the day before his admission to hospital. He had been uncomfortable for five days before that, but had suffered no special trauma on land or sea during that time. He marched to his dépôt, took ill with bad abdominal pains during the night, and, when seen by his medical officer, was immediately sent to hospital. The spleen after removal was about eight times the size of the normal organ; it must have been much larger before it ruptured. The patient was transferred to England very well on May 14th, 1917.

THE EARLY TREATMENT OF COMPOUND FRACTURE OF THE FEMUR CAUSED BY GUNSHOT WOUND.*

BY CAPTAIN R. C. DUN, R.A.M.C.(T.F.).

GUNSHOT WOUND, causing compound fracture of the femur, must certainly be looked upon as one of the gravest of war injuries. A more widespread appreciation of sound principles of treatment, and a thorough application of those principles, will, I feel confident, lead to improved functional results.

In no class of case is it more important that the treatment be early and adequate. I emphasize both adjectives.

This note is chiefly based on the practical experience which I have gained in working at casualty clearing stations, and, in the main, deals with the treatment carried out in them. But it has become obvious to me that it is the regimental medical officers and field ambulances in front of the casualty clearing stations who have in their hands the power of giving these cases the best possible start in their race for life. To obtain the best results a definite line of treatment must be adopted as early as possible—that is, by regimental medical officers and field ambulances, and carried on at casualty clearing stations.

What are the factors which we have to fight in these cases of compound fracture of the femur, and how can they best be dealt with before and after reaching a casualty clearing station? Broadly speaking, they are: (1) Shock, (2) haemorrhage, and (3) sepsis.

Shock.

I think we may fairly divide the shock from which these cases suffer into two classes—(a) and (b). The former is due to the gravity of the injury and the pain necessarily caused, especially in the earlier stages of transport, before complete immobilization of the fractured limb is possible; morphine and the best available fixation of the limb is the obvious treatment. Hot drinks, hot-water bottles, and saline injections should be made use of as early as possible. I submit that, up to the time when the patient can be put on a stretcher, a method probably as good as any is to fix the thigh with short local splints and to tie the thighs and legs together.

It is to the second class of shock that I particularly want to draw attention. This is the shock which results from the often unavoidable incomplete fixation of the fractured limb, and frequent handling of the patient in his journey from the field to the ambulance. In my opinion the best and simplest method of completely immobilizing a fractured femur is a properly applied Thomas splint, and this should be put on as early as possible; it would be ideal if it could be done at regimental aid posts or advanced dressing stations. Another ideal would be attained if cases of fractured femur could be transported from advanced dressing stations to casualty clearing stations

* Paper read at a meeting of medical officers of an army in the field.

without removal from the ambulance, so reducing the movement of the patients to a minimum.

I have no hesitation in saying that cases of compound fracture of the femur which have had a Thomas splint applied early, and which are rapidly sent on to the casualty clearing station, arrive there in much better condition than similar cases imperfectly immobilized and subjected to movements during transit.

Haemorrhage.

As regards the treatment of haemorrhage before the case reaches the casualty clearing station, there is strong reason for avoiding the prolonged use of the tourniquet, on account of the increased risk of gas gangrene so entailed by producing anaemia of already devitalized tissues. Large vessels may have to be ligatured, or the patient may be sent down with artery forceps on. The most frequent form of haemorrhage, and one which should always be vigorously dealt with, is slow oozing from the wound. No case should ever be sent down until this has been checked. To do this, wounds often have to be opened up and ligatures or forceps applied to the bleeding points. Failing this, direct pressure with a firm packing of gauze into the *opened up* wound is often sufficient to check general oozing. A cork of gauze is worse than useless.

Sepsis.

To combat sepsis in the early stages, all that can be done is rapid disinfection of the skin for a considerable area around the wound or wounds. For this purpose a 5 per cent. solution of picric acid in methylated spirit is less irritating and more searching than iodine. Except for the necessary treatment of haemorrhage or the removal of visible foreign bodies, the wound should not be interfered with. The insertion of drainage tubes is unnecessary. Dressings should only be changed if soaked with blood.

Treatment at Casualty Clearing Stations.

Arrived at the casualty clearing station, all cases of compound fracture of the femur should be disturbed as little as possible, and sent without delay to the pre-operation ward. No case of this type should be evacuated to the base without first passing through the theatre. Small superficial wounds are deceptive, and invariably cloak much more extensive damage of the deeper tissues. Cases in which haemorrhage is taking place will naturally be given precedence in going to the theatre. Wherever possible inadequately splinted cases should also have next precedence; when this is not practicable the fixation should be improved. The greatest care must be exercised to prevent increase of shock by unnecessary movements; thus no attempt should be made to remove the clothing from the injured limb until the patient is anaesthetized, and he should not be lifted off the stretcher on which he arrives until anaesthesia is complete. The usual methods of treating shock—warmth, morphine, camphor, and salines—will be employed in cases which have to wait their turn for operation.

When the case reaches the operating theatre care must again be taken that no increase of shock occurs from unnecessary or rough handling of the patient. Probably the soundest plan in all cases is to lift the stretcher on to the operating table, and anaesthetize the patient before he is removed from the stretcher. The only circumstance which may justify an exception to this rule is an efficiently applied Thomas splint.

With a view to shortening the time occupied by the operation and to ensure smooth working, all members of the operating team should have been made thoroughly conversant with the details of the technique. Where multiple wounds are present, a second operator should get to work on them at the same time that the femur is being treated. The only reference I will make to the question of the choice of an anaesthetic will be to point out the advantage of spinal anaesthesia in some cases of fractured femur—for example, when associated with a penetrating chest wound.

Shock must be vigorously combated on the operating table. Warm blankets, hot-water bottles, salines, subcutaneously or intravenously, should be used. In all grave cases, the latter is the method of choice, and it should be employed at the start of the operation. As soon as the

patient is anaesthetized he is lifted off the stretcher, splints are removed, and clothing cut away. The limb is then raised from the table by means of a rope and pulley apparatus, attached to a clove hitch round the ankle (see Fig. 1). By this means the limb can be elevated and

FIG. 1.—Fracture of femur. Diagram of rope and pulley apparatus for raising leg from operating table.

extended at the same time. This simple device frees the orderly from the somewhat arduous task of holding up the limb during the whole period of the operation.

The preparation of the skin must be thorough. A wide area round the wound or wounds and the whole circumference of the limb should be treated, as unexpectedly extensive incisions are often necessary.

An important detail is the secure fixing of sterilized towels round the upper part of the limb. Clips should be used which fix the towels to the skin, as they are apt to become displaced during the changes in position of the limb which have to be made in the course of the operation. The leg and foot should be wrapped in a sterilized towel, under cover of which is the suspension sling, or the hands of the orderly supporting or adjusting the leg.

The first step in the actual operation should be excision of the superficial wound, followed by a determination of the main pockets with the finger. The wound should then be opened up in the direction of these pockets, unless this entails the division of important structures. The full extent of the injury to muscles and bone must be seen. The eye must be our guide as well as the finger. It is only when a thorough survey of the injury has been so obtained that the operator is in a position to decide the subsequent course he should adopt in each particular case. The size of superficial wound is no indication of the deeper damage. Most extensive laceration of muscles and severe comminution of bone very frequently underlie apparently trifling skin wounds.

The Question of Amputation.

The full extent of the wound having been appreciated, the question of amputation will arise in a proportion of cases. In some hopelessly mangled limbs the decision is easy. There are again many borderland cases where there is great difficulty in deciding what is the proper course to steer. I think it is a good plan to hold consultation in such cases. Amputation should be performed:

1. Where the main vessels, both artery and vein, are divided, and collateral circulation has not been established; unless, as happens in rare early cases, some form of blood vessel anastomosis can be performed—for example, by intubation with paraffin covered glass tubes, until danger of gas gangrene has passed.

2. Where gas gangrene is definitely established in more than one group of muscles, or where, for anatomical reasons, complete excision of any infected part cannot be carried out.

3. Where either the main artery or vein requires ligature, and there is evidence of even a localized patch of gas gangrene beyond the point of injury to the vessel.

4. Where virulent sepsis is already established in extensive wounds, the patient being in low condition.

In cases where the general condition of the patient is bad, especially as a result of hæmorrhage, one's leaning should be towards amputation.

Involvement of the knee or hip joint does not by any means necessarily call for amputation. The same may be said of extensive laceration of muscles and severe comminution of bone—if the circulation is good, and there is no evidence of gas gangrene in the wound.

When amputation is decided on, the circular or modified circular method—as low down the limb as possible—is the one which should be employed. When sawing the bone, a strong flat metal plate, with a slot in it to admit the femur, is useful in keeping muscles out of the way and in saving time. In order to prevent superficial necrosis of the sawn bone, a layer of deep muscle fibres may be stitched over it. The dressing used is either a "salt pack" or Carrel's method. Such amputation stumps are ideal wounds for the application of a salt pack. A practical point is that room should be left between the skin edges for drainage when the strips of adhesive plaster are being applied.

Conservative Treatment.

I should like again to emphasize that, in addition to the careful removal of foreign bodies, the superficial wound must be completely excised, and all badly lacerated fascia and muscle cut away. With regard to the muscles, contraction alone is not a sufficient guarantee of the necessary degree of vitality—definitely bleeding muscular tissue must be reached before one holds one's hand. Great care must be taken that the vascular supply of muscles previously treated be not cut through during the later stages of the operation. Once embarked on such an operation, there must be no half measures. Most extensive dissections may have to be carried out. There must be no hesitation in cutting wide. The principles which guide us in the operative treatment of malignant disease must be applied. One small piece of devitalized muscle left in the wound may be sufficient to render the whole procedure useless. Bone fragments, unless completely separated, should not be removed.

If a joint has been directly opened by a missile, the damaged portions of the capsule and synovial membrane must be cut away. The joint is then washed out and the opening into it closed with sutures. A drain should always be employed down to, but not into, the capsule.

Perfect hæmostasis is essential. The operative technique is the same whatever form of after-treatment is followed.

After-Treatment.

Practically speaking, there are but two methods of after-treatment: the pack (at present the "salt pack"), and Carrel's method. The difficulty in applying a pack to many of the wounds associated with fracture of the femur is considerable. One should always ask oneself: Can any given wound be completely and accurately packed, and, if this can be done, will the necessary pressure so applied increase the risk of gas gangrene? In any case in which a main vessel has been injured, a salt pack should not be employed, as the requisite pressure may interfere with the establishment of the collateral circulation. If any doubt exists it is wise to use Carrel's method. Where a pack is put in, a drainage tube should be inserted down to, but not between, the bone fragments—the tube coming out through the centre of the pack.

The operation completed, all that remains to be done is to immobilize the limb. Incomplete fixation may lead to failure, in spite of the most careful operative treatment.

Fixation by Thomas's Splint.

A "Thomas splint outfit," properly used, is the simplest and most efficient method of obtaining complete fixation.

The detail of the application is, shortly, as follows (see Fig. 2):

1. The suspensory sling is removed from the ankle and the limb is supported by an orderly.

2. Application of Extension Bandage.—It is not necessary to shave the limb. Paint the entire circumference from the malleoli upwards, sufficiently high to allow the

extension to get a good pull on the lower fragment, with a glue solution, of which the formula is—

Glue	...	...	...	50 per cent.
Water	...	...	...	
Thymol	...	...	...	1 per cent.
Glycerin	...	...	...	
Calc. chloride	...	...	...	2 per cent.

A shaving or small painter's brush is used for applying the glue. During an action a pot of this glue should always be kept ready melted. The glue will become too thick after a time, and a little water should then be added.

Next apply, on either side of the limb, a length of bleached calico bandage, and run a roller bandage round the limb.

3. Application of Splint.

—The ring of the splint is passed over the foot and pushed upwards, until the posterior part of the ring presses firmly against the ischial tuberosity.

4. *Tightening of Extension Bandage* (Figs. 3 and 4).—The surgeon takes an extension bandage in each hand and passes one of them over, the other under, the lateral bars of the Thomas splint. First one bandage and then the other is thereafter passed round the notch in the cross-bar, a complete turn being taken in each case. The turns are taken in opposite directions, and the last overlaps the first. The ends are made secure by tying a half-bow.

5. *Application of Slings.*—In cases where the wounds are in such a position that it will be necessary to remove the ham splint for dressing purposes, slings formed by bandages or, better still, perforated zinc strips should be applied at this stage.

6. *Application of "Ham" Splint.*—This should be padded to suit each case. Moss pads serve the purpose well. Over these a sheet of jaconet is placed to prevent soiling. The ham splint is now slung to the side bars of the splint by three strips of adhesive plaster—the adhesive side being next the ham splint. This effectively prevents lateral movement of the ham splint.

7. *Application of Anterior Thigh Splint.*—The splint consists of a piece of Gooch's splinting applied to the thigh, canvas side towards the limb. It should extend from near the ring of the Thomas splint to just above the patella. A number of suitable lengths of Gooch's material should be cut beforehand. The whole roll may be sawn through; an orderly can cut off any breadth

required. The thigh splint is fixed by the bandage, which is now applied to the limb from the ankle upwards. This bandage encircles all the splints.

8. *Application of Foot-piece.*—The foot must be supported at a right angle by means of the metal foot-rest, which is supplied with the outfit. A bandage sling passed round the ball of the toes, fixed there by glue on the sole of the foot, and pinned on either side about the knee level to the bandage which surrounds the limb, is perhaps more comfortable to the patient. An oblong piece of splint, rather longer than the breadth of the foot, padded thinly and covered with jaconet, will prevent the bandage pressing

on the sides of the foot. Glue will prevent slipping of both bandage and splint.

9. *The Suspension Stretcher Bar should always be Used.*—To this the Thomas splint is slung by two pieces of bandage, one attached to

FIG. 2.—Fracture of femur. Diagram of application of "Thomas splint outfit" for transport of fracture of femur.

either bar of the splint. If no suspension bar is available, the leg must be slung by some other means.

Similarly, if the patient cannot be evacuated, the injured leg must be slung in the wards. A simple method is the use of two bandages, each passed over a beam of the hut. The two ends of one bandage are then tied to the bars of the splint close to the ring. The ends of the second bandage are secured to the bars at the level of the foot.

Evacuation.

Many cases of compound fracture of the femur may safely be evacuated as soon as they have recovered from the anaesthetic. Before evacuation the extension should always be inspected—the bandages may require tightening or loosening. A pad of wool may be required between the ring and antero-external part of the thigh, so as to prevent the ring from nipping the scrotum or slipping off the tuber ischii.

In cases which have to be kept at a casualty clearing station for more than twenty-four hours, the superficial dressing

should be changed before evacuation, on account of oozing. Here also care must be taken of the skin pressed on by the posterior part of the ring—it should be pulled up to change the point of contact, and carefully dusted. Alteration of the degree of elevation of the splint, or propping up the patient, frequently adds to his comfort.

The abduction frame should be used for fractures of the femur so high up that the upper fragment cannot be

FIGS. 3 and 4.—Fracture of femur. Method of tying the extension bandages so as to prevent slackening of the adjustment and loss of time during adjustment. Pull and hold A taut (Fig. 3). Pull and hold B equally taut, thus fixing A at C. A may now be left loose. Tie loop knot with A on B and draw tight up to C (Fig. 4). In adjusting, hold B taut; undo loop knot; hold A taut and pull to its own side. Pull B taut, and proceed as above, merely substituting B for A.

controlled by the anterior thigh splint. The method of its application is indicated in the official memorandum on "Treatment of injuries in war."

Memoranda:

MEDICAL, SURGICAL, OBSTETRICAL.

CONGENITAL DEFICIENCY OF PHALANGES.

THE accompanying radiograph (taken by E. Terry Coppin) and photograph are those of the left hand of a young woman whom I examined as an entrant to Woolwich Arsenal. She was a dressmaker by trade, anxious to do her share of work in munitions. She was rejected by a labour exchange on account of the deformity of her hand, but was brought to me by her sister, who had been passed as suitable. Although she had apparently only one phalanx to the first finger and to the thumb, she could grasp firmly and had considerable power in the first two fingers and thumb. There were no nails.

No family history and no antenatal history were ascertainable. The girl was passed as medically fit, and she is at present engaged in "ringing fuses" as expertly as any worker in her shop.

London, W.

ELIZABETH SLOAN CHESSEY, M.B.

DERMATITIS FROM EXPLOSIVES.

I WISH to express my own thanks and those of my brother officers in this ambulance to the authors of the contributions on the above subject. They solve the mystery of a case we had to deal with a few nights ago. A young soldier was brought in with a deep erythematous rash over both buttocks. The portions of skin affected were very tense and painful, and, on the right, vesicles of varied minute sizes had developed. I asked if a German shell had recently burst near him. His history was that eight days previously a shell had burst some yards distant from him while he was sitting over a pole on an open latrine with his gluteal region exposed. Further than a shower of light earth he felt at the time no serious consequences of the explosion. Till the morning of his admission to our ambulance he felt all right. On that morning he felt intense pain in the right hip, and discovered the rash. It seemed to us at the time like a case of shingles, though its bilateral character was unusual. The long interval between the explosion and the appearance of the rash seemed to annul the likelihood of any connexion between the two. The case was sent to a casualty clearing station as one of dermatitis. It is obvious now that powder from the explosive had been conveyed with the shower of earth which he felt on the unprotected parts.

R. B. ROBSON, M.B., Ch.B. Aberd.,
Captain R.A.M.C.(T.C.).

RESUSCITATION OF THE NEW-BORN INFANT BY HEART MASSAGE.

I HAVE had some experience in midwifery, having attended over 2,200 cases in thirty-five years, but I have not before this come across an instance in which I have been able to revive a child when the heart impulse had ceased.

The labour was one in which the head was delayed by a very deep perineum in a primipara. Chloroform was used and delivery completed by forceps, the perineum being torn to the anal margin. No time was lost in extracting the child. The child was more white than blue. Artificial respiration was of no use even after blood had been allowed to flow from the cord.

I had read lately of a successful case of heart massage performed in an operating theatre by incising the epigastrium and massaging through the diaphragm, and as there was not any heart beat at all, I tried massage.

I pressed my right fingers deeply into the left epigastric region, and pushed them right under the ribs, invaginating the belly wall, the left fingers pressed in the chest about the left nipple, and I was able to grasp the heart. I tried to make my two sets of fingers meet by repeated quick thrusts, and after five or six the heart started beating. In about one or two minutes it was fairly established, and then ordinary artificial respiration caused the child to breathe in about five minutes; keeping it up I got a good cry before ten minutes had gone by. The child never had a throw back afterwards, but bruising showed itself where my fingers had pressed in the skin.

As a rule, one finds a heart beat in these cases, and continues artificial respiration as long as a heart flutter can be detected. Hitherto, if that heart flutter has ceased, one has considered that no more can be done. Now I am convinced that heart massage as described will most probably set the heart going again, and then artificial respiration will complete the process.

Whether the cardiac stoppage was due to the chloroform I cannot say. Certainly the mother did not have an overdose, as she was sufficiently round to implore me to save her child if I could.

King's Langley, Herts.

FRED. C. FISHER, F.R.C.S.

Reviews.

CAUSATION.

DR. MERCIER'S book, *Causation, with a Chapter on Belief*,¹ is polemical. Polemics are usual in essays on causation, and normal in chapters on belief. But, in addition, it has the rare merits of wit and lucidity. One gets a first impression of a jolly thing, almost a skit, dashed off in gay high spirits. All sorts of reverend people—Hume, and Mill, and lesser lights—are scalped with zest and enjoyment. But the first impression is wrong. Here is no skit, but an extraordinarily thoughtful and convincing, and withal original, piece of work. The proof lies in the fact that, though we smile as we pass easily from chapter to chapter, yet, afterwards, we find that we have looked, often more deeply, always more clearly, into matters that have been treated with dreadful obscurity for centuries.

It is impossible to review the essay adequately. It consists of a chain of reasoning of which an examination would require as much space as the work itself. It is possible to indicate only its point of view.

What is a cause? What is causation? Every one thinks he knows. In a sense, every one does know. According to Dr. Mercier, "the notion of causation is almost elementary. Cause and effect, like matter and force, are terms which every one understands more or less vaguely, more or less precisely, but that it is difficult to express more simply for want of simpler terms." Here, near the beginning of the essay, is adumbrated a particular point of view which is held consistently to the end—the view-point of science as distinguished from metaphysics.

In front of the reader is a printed page. He may consider it in two fundamentally different ways.

1. He may regard it as a real object in a real universe—

¹ On *Causation, with a Chapter on Belief*. By Charles A. Mercier, M.D., F.R.C.P., F.R.C.S. London: Longmans, Green, and Co. 1916. (Roy. 8vo, pp. 240. 4s. net.)