

O'Connor working at Alexandria (about 12 per cent.). But, on the other hand, it may be mentioned that amongst E.L.C. men and Turkish prisoners of war, coming from Mesopotamia, and examined while in the quarantine camps near Suez, I found nearly 12 per cent. to be infected with *E. histolytica*. Conversely, out of over fifty prisoners from the Hedjaz (Arabia) I did not find a single carrier.

In the summer of 1917 I was transferred to Kantara, and dealt there entirely with cases of dysentery, etc., occurring amongst troops east of the canal, in the northern coastal district alluded to. And I soon found, as expected, that there was a distinctly higher incidence of amoebic infections amongst the British troops than I had met with in the southern canal area. For the corresponding season (April–October),* the percentage of amoebic dysenterics—that is, with active *histolytica*—was 7 per cent. of the total dysenterics, as against 2½ per cent.; and the percentage of *histolytica* findings (all forms) in the total stools examined (over 2,000) was 5.2 per cent., compared with slightly under 2 per cent. On the other hand, the percentage of definite bacillary dysenterics to the total stools was much less than at Suez—namely, 37 per cent., compared with 75 per cent.—the fly campaign being probably more vigorous and effective.

Thinking it would prove instructive to compare the variations in the amoebic findings with the variations in the relative humidity, I requested the Physical Department of the Public Health Bureau, Cairo, to let me have, if possible, tables showing the relative humidity at Port Said (the nearest station available in the northern district) for the corresponding season in the two years 1916 and 1917 respectively. This information was very courteously

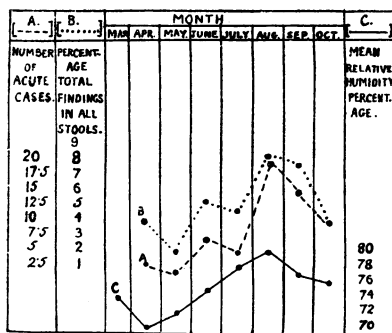


Chart showing comparison between amoebic (*E. histolytica*) findings and relative humidity; season 1917.

infections, in monthly periods, during the season 1917, and an interesting general correlation between the curves is shown. Curve A, indicated by a broken line, gives the actual number of amoebic dysenterics (with active *histolytica*); Curve B (a dotted line) shows the percentage of the total findings of *histolytica* (active forms or cysts) to the number of stools examined; while Curve C (continuous line) indicates the relative humidity. (The amoebic curves begin in April, as that was the first complete month the laboratory was open.)

Two or three points brought out by these curves may be noted: (1) Following upon the low relative humidity for April—a dry month, probably on account of Khamseen winds—there is a distinct drop in the amoebic infections for May, the fall being more pronounced in the curve representing the total percentage of findings. (2) On the other hand, the month with the highest relative humidity (August) is also that in which both the amoebic curves reach their highest level, and the rise has been greatest in the acute cases. The reason for this slight divergence is probably that the degree of infection in the first instance is less in the early months, and so a longer time is required for it to gain a hold and become readily apparent. (3) There is a slight drop in the amoebic curves for July which has no counterpart in the relative humidity curve.

Now, an important fact is that while, after August, the amoebic curves steadily fell along with the relative

humidity curve, the bacillary dysenterics rose to their maximum for the season in October, both as regards actual number (264, compared with a monthly average of 123) and in the percentage of total stools—this being over 56 per cent., as against an average of 37 per cent. And it was especially noticed that flies were most numerous during September and the beginning of October.

It is clear, I think, that for amoebic dysentery (and equally for other protozoan infections) to be prevalent in a particular area, the first necessity is plenty of moisture and a high degree of humidity. There can be little doubt that water is the principal vehicle of transmission, infection resulting by such means as drinking contaminated water, eating uncooked moist food (fruit, "greens") which has been fouled. In districts where amoebic dysentery is known to be common, the elimination of "carriers" amongst men who are cooks, or in any way concerned with the preparation or distribution of food and drink, should be aimed at in order to reduce the liability to infection of troops. There is little indication that flies themselves play actually any important part in the spread of amoebic or other intestinal protozoan infections, but considerable evidence that they are a main factor in the spread of the bacillary type of dysentery.

It would be very useful to have data corresponding to those which I have given above from workers in the military laboratories in Mesopotamia. Owing to the intense relative humidity of this country during certain seasons one would expect to find a still higher percentage of amoebic infections amongst the British troops there than has been met with in any part of Egypt.

REFERENCE.

¹ BRITISH MEDICAL JOURNAL, 1916, i, p. 714.

THE TRIANGLE SPLINT IN THE TREATMENT OF COMPOUND FRACTURES OF THE HUMERUS.*

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The standard method of treating compound fractures of the humerus by the Thomas's arm splint has undoubtedly many advantages. The fractured arm is fixed in a position of abduction, and, when extension is applied and supports for the limb are adjusted, the fractured ends of the bone can generally be got into good position. Dressings are easily carried out with the least amount of pain and without disturbing the position of the fragments. It has, however, certain disadvantages. The chief of these is that a prolonged stay in bed is necessary, often for many weeks, and the patient is in a more or less helpless condition, even though the wound may be doing well, and the general condition may be perfectly satisfactory. Another drawback is the prolonged fixation of the elbow in the extended position, leading to considerable stiffness in that joint as well as in the fingers and the wrist. Also, unless efforts be made to correct it, there is apt to be an internal rotation of the lower fragment, as shown by the tendency of the hand to assume a position of full pronation. There is also the difficulty of transport with the arm abducted, though this has been largely overcome by the use of the "swivel" modification suggested by Major M. Sinclair, R.A.M.C. The triangle splint described below, which has been used in this hospital for about a year, helps to overcome these disadvantages.

Each splint is made to measurements taken from the man for whom it is intended. This point is of considerable importance, as subsequent comfort depends largely upon the splint accurately fitting the arm and against the chest. An x-ray examination should first be made and the plates inspected to ascertain the site of the fracture and the position of the fragments, for in this way one is able to estimate the extent of abduction necessary.

The measurements are taken from the uninjured arm, the patient lying flat in bed with the arm abducted to the required extent, the elbow being flexed to a right angle and the forearm

* For the amoebic findings of the months April–July inclusive, I have the kind permission of Captain Stuart, officer in charge of the laboratory, to use the laboratory records, as I myself did not take up this work there until August. The findings until then were made by Captain O'Connor and Captain Stuart.

* A paper and demonstration before the Treport Medical and Surgical Society.

held vertically. Any shortening due to loss of bone must be allowed for. The distance between the apex of the axilla and a point 1 in. above the highest part of the iliac crest is then measured and forms the inner side of the triangle. The outer side is the distance between the apex of the axilla and the tip of the olecranon process, while the base of the triangle is the distance between the olecranon and the point already fixed upon just above the iliac crest. The amount of abduction called for will determine the length of the base of the triangle. Any degree of abduction of the shoulder-joint between 30 and 85 degrees can be obtained. The triangle is now made from three pieces of $4\frac{1}{2}$ in. splint boarding, cut to the measurements taken, and firmly fixed together. A support for the forearm is made from

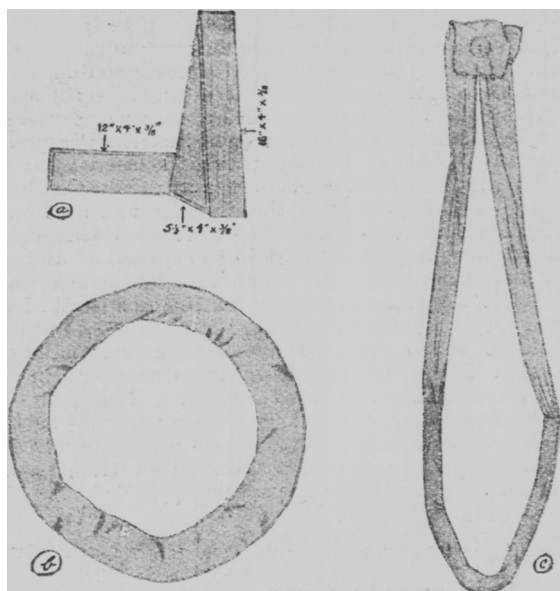


FIG. 1.—Showing the triangle splint (a), the shoulder ring (b), and the perineal band (c).

the same splint boarding of sufficient length to reach from the olecranon to the heads of the metacarpals. This is screwed to the lower end of the outer side of the triangle, so that it projects in a forward direction. The sides of the splint which rest against the chest, arm, and forearm are well padded, including the upper angle, and the whole is covered with jaconet. The splint ready for application is shown in Fig. 1.

The principle aimed at is to fix the injured limb in a position of abduction, with the humerus in a natural position intermediate between internal and external rotation, or with possibly a slight degree of the latter. To ensure this position the forearm must project directly forwards, and not be rotated inwards across the chest. The fixation of the splint is thus of great importance; simply to fix the splint to the chest by strapping and a bandage, and to secure the upper angle by a bandage or sling over the opposite shoulder will not be sufficient. If too loosely secured the apex of the splint will drop away from the axilla, and, as the patient moves about, the upper angle will probably, owing to the weight of the forearm, tilt forwards, and the lower angle backwards. The whole splint will move about on the side of the chest instead of taking a firm support from it, so that the fracture will not be immobilized, and there will be much pain and discomfort, calling for constant alteration and readjustment. The most important points about fixation are to firmly secure the upper and lower angles of the splint, especially the former.

To fix the upper angle a soft ring is made which fits comfortably over the opposite shoulder (Fig. 1, b). The ring is easily made by sewing a piece of four-inch flannel bandage about twenty inches long round a piece of thick rubber tubing one inch in diameter and the same length. The two ends are then sewn together so as to form a ring, which will be about one inch thick and six inches in diameter. If the tube cannot be obtained a satisfactory ring can be made by sewing the bandage round a thick layer of wool, but an india-rubber basis is preferable. The ring must not be too narrow or the pressure will chafe the skin, or too thick, when it will interfere with movements of the sound arm. The ring should fit in front into the concavity of the outer half of the clavicle, and below it should rest against the chest wall just below the axillary folds. For a small man the internal diameter of the ring will be about five inches, while for a bigger man an inch or two more will be required. The ring having been placed in position on the sound shoulder, the upper angle of the splint is fixed by passing a length of strong bandage beneath the axillary angle of the triangle. One end is then threaded through the ring in front

and the other behind, and the ends are then brought back and securely tied, the knot being in all cases beneath the upper angle of the splint. The principle of this method is that the weight of the splint, and so of the injured limb, is supported from the circumference of the opposite shoulder. The upper end having been fixed, the lower angle is secured by a perineal band. This, again, is easily made from a yard of flannel bandage, the middle third or so being sewn round a rubber tube or layer of padding (Fig. 1, c). The central part may with advantage be covered with jaconet. The perineal band is tied above the lower angle of the splint sufficiently tightly to steady the splint, but not so tightly as to draw it down from the axilla.

This splint was first employed for fractures of the surgical neck of humerus. In these fractures the small upper fragment, which cannot be controlled, is generally abducted and externally rotated. The triangle splint in such cases ensures abduction of the lower fragment to the required extent and also prevents internal rotation. If there is comminution and fissures which extend into the head of the humerus, the arm should be abducted as much as possible on account of the probability of ankylosis. In some of these fractures there is little or no displacement, and it has been advised that certain of these may be treated without any splint, the arm being simply bandaged to the side. Though possibly some of these cases may be satisfactorily treated in this way, yet, in view of the tendency to abduction of the upper fragment and the possibility of limitation of movement in the shoulder-joint, the triangle splint offers a convenient method of fixation and treatment. In some cases where the displacement is slight, and where the wound is small and the infection is not serious, the triangle splint may be applied at once, but in those where the displacement is serious, or where there is much comminution, or where there is severe septic infection, it will be best to put up the arm on a Thomas's splint in the abducted position for about three weeks until the wound is healthy and there is some attempt at union. As a late measure the Thomas's splint may then be removed and the triangle splint substituted.

In gunshot fractures of the upper and middle thirds of the shaft the severity of the fracture and the displacement will vary very greatly. Generally speaking, the upper fragment will still be abducted, though in some fractures of the upper third of the shaft the upper fragment may be abducted by the action of the pectoralis major, the lower fragment being abducted by the deltoid. In all these cases an x-ray examination will indicate the amount of abduction which is desirable. The principles which guide the treatment in these cases are similar to those mentioned for the treatment of fractures of the surgical neck—namely, if the wound is not seriously infected and the displacement is slight, the triangle splint may be applied at once. If the wound is very septic, or if there is severe comminution and displacement, a Thomas's splint should be used until there is sufficient improvement to allow a triangle to be substituted for the Thomas's splint. Cases of fracture of the humerus where there has been great loss of bone, or where the wounds are large and septic, or where secondary haemorrhage is likely, are not suitable for treatment on the triangle splint, and this splint should not be used for fractures of the lower part of the shaft, or for fractures involving the elbow-joint.



FIG. 2.—The triangle splint applied to the right arm, showing the position of the forearm while the patient is lying down.

To sum up: the triangle splint may be used at general hospitals for the permanent treatment of fractures of the surgical neck, upper and middle thirds of the shaft of the humerus where displacement is not serious and wounds are clean or mildly infected. It may also be used with advantage in a later stage of the treatment of many of the more serious cases after these have been treated on a Thomas's splint until the wounds and the fracture have sufficiently improved.

In addition to these fractures of the humerus, the triangle splint has been used (1) for fractures of the scapula extending to the glenoid cavity and opening the shoulder-joint; (2) for wounds of the shoulder-joint, with perforation or growing of the head of the humerus; (3) for severe wounds of the shoulder-joint which have called for excision of the head of the humerus.

The splint is applied in the following way: In some of the simpler cases no anaesthetic is required, but often either the presence of a missile, or the desirability of providing drainage,



FIG. 3.—The triangle splint applied, the patient sitting down.

or the removal of loose fragments, renders an anaesthetic necessary. When a change is being made from a Thomas's splint to a triangle, an anaesthetic is advisable chiefly on account of the pain caused by flexing the elbow, which has been in the extended position for some weeks. After the arm has been abducted the splint is placed in position, the ring is slipped over the sound arm, and the upper angle is fixed in the manner already described. The lower angle of the splint is now secured by the perineal band. The arm is then firmly held just above the condyles of the humerus so as not to disturb the fracture, and the elbow is gradually flexed to just over a right angle.

Passive movements of pronation, supination, flexion, and extension of the wrist and fingers may also be carried out. The patient's fingers are held flexed over the end of the splint, extension is applied from the elbow, and the arm and forearm are fixed to the splint by bands of strapping above the elbow, below the elbow, and above the wrist. It is well to place an extra pad of wool between the internal condyle and the splint, and a broad flannel bandage may be run round the patient's chest and the inner side of the triangle. The dressing is now applied, and additional support is given to the fracture by a piece of Gooch's splinting cut away obliquely in front so as to encircle the arm on its anterior, external, and posterior aspects. There is often some pain in the elbow for a day or two, but the patient soon becomes accustomed to the new position of his arm. If the ring is not too large or too thick it will cause no discomfort, but if the suspending bandage seems tight it may be loosened, or pads of wool be placed beneath it where there is undue pressure. In about two days the man should be able to sit up out of bed, and a day or two after this he will be able to walk about. He should be encouraged to grasp the end of the splint with his fingers, as this steadies the splint and helps to overcome stiffness. The position of the arm with the patient lying in bed, sitting, and standing is shown in Figs. 2, 3, 4. Dressings are easily done without disturbing the fracture by removing the Gooch's splinting (Fig. 6), the patient sitting up either in bed or in a chair.

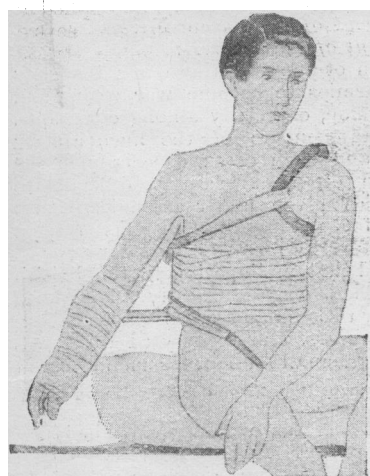


FIG. 5.—Showing the straight triangle splint and its method of fixation. The Gooch's splinting and dressings have been removed.

Some men have much more confidence than others and learn to get about much more quickly, and it is always a good thing for men who are to be put up on the triangle splint to see others already fitted with it getting about and even doing light ward duty. A large proportion of cases of fracture of the humerus from this hospital have in this way been evacuated as sitting cases, while those on triangle splints who have been evacuated as cot cases are not "helpless" unless they have other injuries, but could walk in case of any emergency. Transport is thus simplified. The splint requires very little readjustment, provided that due care has been taken to construct it to measure so that it fits well, but, if called for, it is easily carried out.

X-ray examinations have shown that the fractures are kept in good position—indeed, there is often an improvement upon the position when the limb was in a Thomas's splint.

A useful modification of this splint, the "straight" triangle, is shown in Figs. 5 and 6. This is similar to the splint already described, but the elbow is not flexed, so that the outer side of the triangle extends from the axilla to the heads of the metacarpals. The method of fixation is seen from the figures to be similar to that already described. This splint has been used for wounds of the elbow-joint, for excisions of the elbow-joint where other wounds have interfered with the extension bands for the Thomas's splint, and for a few fractures of the upper part of the shaft of the humerus, where it was thought that

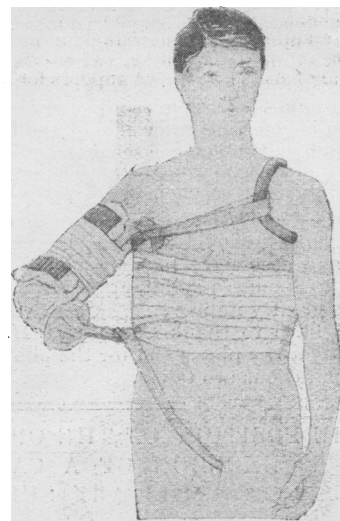


FIG. 4.—Showing the triangle splint and its method of application, the patient standing up.

the weight of the arm would provide some extension when the splint was in a vertical position. The patient can sit up in bed or on a chair, and can also walk about, but not so freely as when the forearm is flexed. The dressing is done with the patient sitting up (Fig. 6), when the weight of the limb will prevent any movement of the fracture. Fig. 5 shows a case of fracture of the upper third of the shaft of the humerus when the patient was able to walk about, two days after the splint was applied. In all cases in which it has been used this splint has proved remarkably comfortable.

The advantages of the triangle splint are: (1) It is simple and easy of construction. Nothing beyond ordinary splint boarding is required, and it can be made in a few minutes by any hospital carpenter. The accessories—the ring and perineal band—can easily be made by the sisters. (2) The elbow is flexed to a right angle, and while the elbow and shoulder are fixed, free movements of the fingers and wrist are possible, and also slight movements of pronation and supination. (3) The patient can get out of bed; he can sit down, walk about, and get out into the fresh air and sun, with benefit to the wound and his general condition. (4) Transport is easy. Most men will travel as sitting cases, and those evacuated as "cot" cases will not be "helpless" unless there is also some other injury.

One disadvantage to this splint is that there must be no wound on the inner aspect of the arm, the axilla, or the side of the chest, which are in contact with some part of it. If the possibility of putting the arm up on a triangle splint later on be borne in mind when making incisions for drainage, or for the removal of bone or metal fragments, the number of cases in which it cannot be employed will

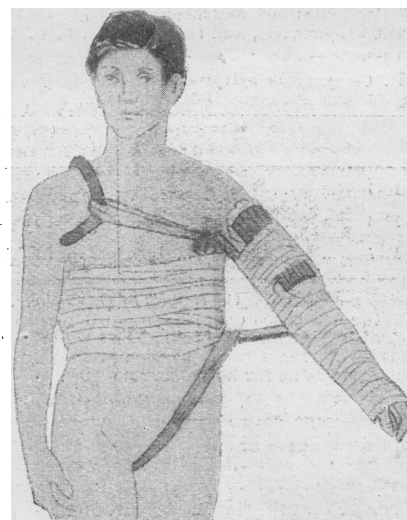


FIG. 6.—The straight triangle splint applied, the patient standing up.

be diminished. Attention, too, may be directed to getting wounds in these situations into a healthy condition and closing them. Interruptions might be made to allow for dressings, but hitherto this has not been tried, as such changes would probably be at the expense of comfort and simplicity. Major M. Sinclair, R.A.M.C., has suggested that in the straight triangle splint the outer side might be made of two straight metal bars like those of the Thomas's arm splint and that the arm might be fixed to it in a similar manner—a plan which seems well worth trying. Another disadvantage is that there is no active extension. It would be possible to arrange for an apparatus for extension beyond the outer side of the triangle, but there is no doubt that in some cases of fracture of the humerus extension can be overdone, and when it is necessary it is best applied with the Thomas's splint. The axilla, too, is not a satisfactory place for counter-extension. It may again be pointed out that severe and very septic cases, and those where secondary haemorrhage is likely, are best treated on a Thomas's splint, at any rate until the local condition has greatly improved.

I have to thank Captain M. H. Watney, R.A.M.C., for many x-ray plates and for the photographs from which the illustrations are taken.

THE POSITION OF THE OPERATION FOR THE EXCISION OF A CARTILAGE IN MILITARY SURGERY.

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THE average stay in hospital following an operation of the excision of a cartilage is in the case of civilians three weeks; in four weeks the patient is again back at work. It has become increasingly evident that the prognosis in the case of soldiers is not nearly so good. At the request of General Sir Robert Jones the statistics of cartilage operations performed at Alder Hey Military Orthopaedic Hospital were investigated.

A. Conditions Present.

The total number of cases admitted with the diagnosis of displaced cartilage to the end of 1917 was 283. The total number of cases operated upon for the excision of a cartilage or a synovial fringe was 112. In many of the remaining 171 cases nothing abnormal could be found, while in others only slight wasting of the quadriceps was observed. In 20 cases definite osteo-arthritis was present, in 7 tuberculous disease, in 4 villous synovitis, and in one sarcoma of the lower end of the femur.

B. Comparison of Cases Admitted during the Corresponding Four Months of 1915, 1916, 1917.

	Admissions.	Operations.
1915	28	17
1916	50	16
1917	52	13

C. Results of Operations.

Of the 112 cases operated upon 8 were discharged as fit for general service immediately; 99 were discharged to a command dépôt as fit for general service within four months; 5 were discharged as fit for home service only.

D. Average Stay in Hospital.

The average stay in hospital before operation was 22 days, and varied from 3 to 50 days. The average stay in hospital after operation was 85 days, and varied from 21 to 135 days.

E. Final Category of Patients Discharged after Operation.

In order that the final category of officers and men discharged as fit for general service in four months should be known, a request was sent to Records for their posting after discharge with the present category. Replies were received in 36 cases.

	Number.	Percentage.
Class A (General Service)	19	53
Class B (Garrison Duty)	8	22
Class C (Home Service)	5	15
Class P (Reserve)	2	5
Unfit for further military service ...	2	5

Five of the Class A men had been killed in action.

F. Final Category of Patients not Operated on.

For comparison a similar proceeding was carried out in cases in which nothing abnormal was found with the knee, and the soldier was discharged to a command dépôt as fit for general service in four months. Replies were received in 27 cases.

	Number.	Percentage.
Class A	9	33
Class B	4	15
Class C	5	19
Class P	6	22
Unfit for further military service ...	3	11

Symptoms of a Displaced Cartilage.

These are briefly as follows:

Stage of Dislocation.—Sudden locking of the joint with marked pain, followed by rapid effusion and tenderness over the cartilage. With proper treatment the effusion disappears and full movement is regained. In some cases complete recovery may follow, but there is a marked tendency for the dislocation to recur. Each recurrence is followed by less pain and a less marked tendency for effusion to arise.

Intervening Stage.—The patient may complain of weakness and instability of the knee, especially marked when walking on rough ground. There is usually tenderness over the edge of the cartilage and wasting of the quadriceps. At the time of dislocation physical signs are well marked. The intervening stage is characterized by the complete absence of such signs in many cases, and is the stage in which the soldier usually reaches the orthopaedic hospital.

The Effects of a Displaced Cartilage on a Soldier.

When a cartilage has once been displaced, a soldier runs the greatest risk of a recurrence in the face of the enemy, since the dislocation may recur during a charge, raid or patrol. Such an accident may be disastrous to him and to his comrades. Apart from this danger constant recurrence as a result of marching over the uneven ground at the front is only to be expected. This may lead to chronic synovitis and even arthritis. Therefore no soldier who has once suffered from a displaced cartilage should be returned to the firing line until this has been removed. There is not the same objection to returning such men to the A.S.C. or the Mechanical Transport.

Internal Derangement of the Knee a Favourite Complaint of Malingerers.

With the prolongation of the war there is a tendency for the soldier in all armies to become war weary and for malingering to develop, especially among conscripts. Simulated internal derangements of the knee are by no means uncommon, and such cases, especially in the intervening stages, are often exceedingly difficult to diagnose. The statistics given under B indicate that there is a tendency for malingering in this respect to increase.

It must not be inferred that malingering in the British army is common. To Alder Hey practically all doubtful cases from the Western Command were sent. These numbered 283 in three years, and in only 51 cases was nothing abnormal found, a small number for such a period.

Pre-operative Treatment.

In certain cases diagnosis was evident, as, for instance, when locking was still present. In the intervening stages no signs apart from tenderness over the cartilage and wasting of the quadriceps were present, and the diagnosis was often difficult. Wasting of the quadriceps occurs in all cases of internal derangement; it may also occur in a normal knee which is kept stiff and not fully used. Consequently, while the absence of wasting indicates that there is nothing abnormal in the joint, its presence, while supporting, does not prove that some derangement exists.

In all doubtful cases the soldier was put through a full gymnastic course each day, following which an examination for limited movement, effusion, etc., was made. Under no consideration was an operation performed until something more than the soldier's statement was present to