III.

To a tube of peptone water add 3 to 10 drops of polyvalent *B. coli*, *B. pseudo-coli*, *B. coli tropicalis*, *B. neapolitanus* serum, or 3 to 5 drops of each of the respective mono-serums. Inoculate with *B. coli*, *B. pseudo-coli*, *B. coli tropicalis*, *B. neapolitanus*, and shake well. Incubate at 37° C., and examine after twelve hours; the medium will be clear. Repeat the experiment, inoculating the medium with the same bacteria plus *V. cholerae*, and examine after twelve hours' incubation at 37° C.; the medium will show diffuse cloudiness, often more marked towards the surface (and at times a pellicle), due to the growth of the cholera vibrio, which has not been influenced by the serums added. Care of course should be taken to use serums containing no cholera coagglutinin, or only in minute amount.

Action of Non-specific Agglutinins.

I.

Add to a peptone water tube 3 to 5 drops of a very powerful agglutinating paratyphoid B serum, rich in specific and non-specific agglutinins. Inoculate the tube with *B. typhosus*, *B. paratyphosus A*, *B. paratyphosus B*, *B. aertrycke*, *B. enteritidis* (Gaertner), and examine after twelve hours; there will be no homogeneous growth, and no diffuse turbidity. The growth is at the bottom, and at times under the form of flocculi in the medium, which will quickly go to the bottom on centrifuging.

If, instead of a very powerful agglutinating paratyphoid B serum, one of low titre is used, containing only a very small amount of coagglutinins, the medium will show a diffuse turbidity, due to the growth of the *B. typhosus*, *B. paratyphosus A*, *B. enteritidis*, while bottom growth and flocculi will be present, composed of agglutinated paratyphoid B bacilli, and also *aertrycke* bacillus, because generally any paratyphoid B serum contains nearly as much agglutinin for *B. aertrycke* as for *B. paratyphosus*. These two bacteria can be differentiated only by my absorption method, as demonstrated by Boycott, Bainbridge, O'Brien, and others.

II.

Add to a tube of peptone water 3 to 5 drops of a very powerful agglutinating paratyphoid B serum containing coagglutinins for the typhoid-paratyphoid group of micro-organisms.

Inoculate with *B. typhosus*, *B. paratyphosus A*, *B. paratyphosus B*, *B. aertrycke*, *V. cholerae*. Inoculate at 37° C., and examine after twelve hours. There will be diffuse turbidity, due to the growth of the *V. cholerae*, and flocculi and bottom growth due to the typhoid, paratyphoid, and *aertrycke* germs; the flocculi may easily be got rid of by a short centrifugation which will have no effect whatever on the non-agglutinated cholera vibrios. After a few hours longer there may be a distinct pellicle composed of vibrios. Of course, in carrying out this experiment, care should be taken to use a paratyphoid B serum which contains no coagglutinin for *V. cholerae*, or only in very small amount.

From the above experiments, and similar ones, a general method can be devised to facilitate the isolation of the cholera vibrio, the typhoid bacillus, and other germs. The method consists simply in adding to the medium in which the material is going to be sown, serums influencing—that is, agglutinating, and delaying the growth of—the germs we do not intend to isolate, while they do not hinder appreciably the growth of the particular germ, or group of germs, we want to grow.

Cholera.

For the isolation of the cholera and paracholera vibrios from stools the following technique may be followed:

Inoculate peptone water tubes with the faecal matter in the usual way, but before or immediately after making the inoculation add to each tube:

- 3 to 5 drops polyvalent lactose fermenters faecal bacteria serum (*B. coli*, *B. pseudo-coli*, *B. coli tropicalis*, etc.), or the respective mono-serums may be used.
- 3 to 5 drops polyvalent non-lactose fermenter faecal bacteria serum (*B. proteus* group, etc.).
- 3 to 5 drops paratyphoid B serum.

The addition of the last named serum is made with the object of agglutinating and delaying the growth of the bacilli of the paratyphoid B and *aertrycke* type, which, in the tropics at least, are not very rarely found in the intestinal fluid. Care should be taken, of course, to use serums containing no coagglutinin for the cholera vibrio, or only in very small amount. Or serums can be used from which the cholera coagglutinin—which is always in very much smaller amount than the other coagglutinins—has been removed by absorption.

The tubes are placed in the incubator, and the further steps in the investigation are carried out in exactly the same manner as with the ordinary methods.

1. From the very surface of the medium a loopful of liquid is taken, examined microscopically, and the agglu-

tion reaction with cholera serum carried out straightway.

2. A small loopful from the very surface is smeared in the usual way on gelatine plates, bile salt neutral red agar plates, etc., and any suspicious colonies which will grow are further investigated.

The method may be applied to the isolation of the typhoid group of bacilli.

Typhoid.

To facilitate the isolation of bacilli of the typhoid-paratyphoid group the following technique may be used:

1. Inoculate with the faecal matter to be investigated several tubes of taurocholate of soda peptone water, or Browning, Gilmore, and Mackie's telluric acid peptone water might be used.

2. Immediately after, or better immediately before, the inoculation, add 5 drops polyvalent lactose fermenter intestinal bacteria serum, 5 drops polyvalent non-lactose fermenter faecal bacteria serum (*B. proteus* group, etc.), taking care to use serums containing only a very small amount of typhoid coagglutinin; or serums can be used from which the typhoid coagglutinin has been removed by absorption.

3. Incubate for twelve or twenty-four hours, then make plates on MacConkey, Conradi-Drigalsky, or similar media, from the most superficial portion of the liquid medium, and investigate further any suspicious colonies which may develop, testing them with typhoid, paratyphoid A, and paratyphoid B serums, etc. When there are many flocculi of agglutinated bacilli also in the upper portion of the tube, these may be got rid of by a short centrifugation. A short centrifugation with an ordinary electric centrifuge will cause the agglutinated bacilli to fall to the bottom, while it has practically no effect on the non-agglutinated germs in young cultures.

REMARKS.

In theory the method I have described is simple, and it should be possible by means of it to isolate in absolutely pure cultures the germs we want to grow to the exclusion of all those we do not want to isolate. In practice things are not so easy, and several difficulties are encountered: (1) The intestinal bacterial flora found in association with the cholera vibrio varies to a certain extent from country to country, from epidemic to epidemic, and even from individual to individual. Therefore, the serums used may have to be varied, and serums have to be prepared influencing a large number of intestinal bacteria. (2) The preparation of powerful agglutinating serums against certain intestinal germs is far from easy. (3) Occasionally certain intestinal micro-organisms are at first inagglutinable by their homologous serums, becoming agglutinable only after several transplantations on artificial media.

In practice, therefore, we seldom succeed in agglutinating and retarding the growth of all the species of germs we do not want to grow, but merely succeed in agglutinating and retarding the growth of a certain number of them. Even this result is, however, of practical importance, and greatly facilitates the isolation of the germs we want to grow.

ADAPTATION OF THOMAS AND JONES SPLINTS TO OBTAIN FIXATION OF THE ARM IN AN ABDUCTED POSITION WHILE THE PATIENT IS AMBULATORY.

BY

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THE war has demonstrated quite clearly that the ring and wire splints of Hugh Owen Thomas and those which Sir Robert Jones has devised are wellnigh universally adaptable. As surgeons become familiar with their use, and appreciate the soundness of their simple mechanical principles, they are becoming more and more the method of choice, and the results obtained are becoming more perfect.

The principle of extension by traction and counter pressure makes of these splints a unit apparatus which provides easy and comfortable transportation, and allows the detailed treatment in the base and home hospital to be continued with complete satisfaction without change of

the apparatus, which may be and now usually is applied at the casualty clearing station or even at the dressing station. Their comparative cheapness of manufacture, their small bulk, and easy packing, are other advantages possessed to the same degree by no other splints with which we are familiar.

We question, indeed, the wisdom of devising other forms of splints at the present time, since the benefits of unit constitution and universal use are so obvious that it seems

rather that all surgeons should train themselves in their use; nor is that training difficult.

Many orthopaedic surgeons have been accustomed to use plaster-of-Paris, and feel that equally good results may be obtained with these dressings in combination with metal or plaster bridges. It is clearly our duty at the base hospital to abandon these bulky casts, which are time-consuming in application, and demand the acquirement of a certain specialized technique. It is our opinion, after a

FIG. 1.

FIG. 2.

FIG. 3.

FIG. 4.

DESCRIPTION OF FIGURES.

[The diagrams are to scale about one-eighth natural size.—Ed. B.M.J.]

FIG. 1.—Thomas knee and leg splint.

FIG. 2.—Thomas arm splint.

FIG. 3.—Jones humerus extension splint.

FIG. 4.—Jones "cock-up" or "crab" wrist splint.

FIG. 5.—Adaptation of Jones humerus splint (Fig. 3) to retain abduction and some degree of immobilization of the shoulder and upper arm. Splint turned upside down. Axillary rutch fits over iliac crest. Wire designed to extend above shoulder should be padded and obtains its bearing below crest, between the anterior superior spine and the great trochanter. One padded perineal strap and another padded crest strap hold splint fast to pelvis.

FIGS. 6 and 6A.—Adaptation of Jones humerus splint (Fig. 3) and Thomas arm splint (Fig. 2) used in combination. Extension portion of humeral splint bent out to fit over bars of arm splint and retained as they cross by adhesive plaster or metal tape. *Purpose:* To retain arm in abduction with elbow flexed and arm outwardly rotated to any degree, depending upon the bend of the forearm portion of the Jones humeral splint. Patient ambulatory. Extension on humerus in direction of shaft obtained by adhesive plaster or (better) glued strips. More perfect immobilization of humerus is obtained than in Fig. 5.

FIG. 7.—Same combination as in Fig. 6, but well arm passed through ring of Thomas arm splint, whose bars are bent out somewhat to fit over front and back of chest. Counter extension obtained by soft swathe fastened to ring and extending around thorax of injured side. This adaptation leaves axilla and shoulder girdle of injured side free from apparatus.

FIGS. 8 and 8A.—Combination of two Thomas arm splints (Fig. 2). *Purpose:* To retain arm in abduction, immobilize the humerus, and provide for hypertension of wrist while patient is ambulatory. One of the Thomas arm splints is applied in the usual way with extension. The other Thomas arm splint has its ring bent (with two monkey wrenches) downward towards the uprights in order to make it fit more perfectly over the pelvis. The uprights of this splint are bent upward to any desired degree, and the splint acts as a bracket. Where the two splints cross (the pelvic over the arm splint) the arm splint is bent with a slight inward angle, and the pelvic splint is bent with a slight outward angle. Splints are fastened together where they cross by adhesive plaster or metal tape. The hypertension of the wrist is obtained by suspending hand to the projection of the pelvic splint above the arm splint. Perineal and crest straps as in Figs. 5, 6, and 7.

FIGS. 9 and 9A.—Adaptation suggested by Captain F. C. Cutler, M.R.C., U.S.A. Combination of two Thomas arm splints (Fig. 2). *Purpose:* To retain arm in abduction with extension and leave injured shoulder and axilla free from apparatus, while patient is ambulatory. The arm splint is bent downwards an inch or two from its end, while the pelvic splint is bent at the ring, as in Fig. 8, and fastened to pelvis by the same straps. At the point where the pelvic splint meets the arm splint it is bent in a horizontal direction, running parallel to the arm splint and fastened to it by adhesive plaster or metal tape. Extension straps run to end of pelvic splint and counter extension transmitted to pelvis and thoracic bands running from ring on well side to about thorax on injured side.

FIG. 10.—Adaptation of Thomas knee and leg splint (Fig. 1) for shoulder and humerus. *Purpose:* For quick application in injuries of shoulder and upper arm. Ring of leg splint passed over well arm. Bars bent out to fit front and back of thorax. Ring retained in position by soft swathes passed through it and about thorax of injured side. Shoulder straps to hold bars in place. Leaves shoulder free on injured side. Extension in usual way to end of splint, and counter extension by means of thoracic swathe. The patient may be ambulatory to some extent, but on account of its weight the splint is more useful for bed treatment. Patient, however, may sit up easily for dressings.

FIGS. 11 and 11A.—Combination of Thomas arm splint (Fig. 2) and Jones "cock-up" crab splint (Fig. 4). Splint may be described as a "yoke" splint. *Purpose:* To obtain fixation of shoulder girdle and humerus, leaving back of thorax free, and in case of pelvic or upper thigh wounds avoiding necessity of a pelvic support while the patient is ambulatory. The weight of the arm is borne by the root of the neck like a water-carrier's yoke. The forearm is supported with the elbow flexed on a Jones "cock up" crab splint (Fig. 4), the iron bar bent flat and then twisted about an angular bend near the end of the anterior thoracic bar of the Thomas arm. The single rivet in the Jones "cock-up" crab splint hand bar allows the splint to extend forward at any angle from the arm splint, and thus any degree of flexion of the elbow maintained. Extension on the humerus in the usual way to the end of the Thomas arm splint against a counter pull on the thoracic swathes extending from the ring on the well shoulder about the thorax on the injured side.

FIG. 12.—Simple method of maintaining tight extension straps with Thomas leg or arm splints, devised by Lieutenant F. R. Ober, M.R.C., U.S.A. A four or five inch wire board nail is inserted between the extension bands above knot, and twisted like the tightening stick in a "buck saw" or a Spanish windlass. The head of the nail is caught under or over one of the bars of the Thomas splint. Any degree of steady traction may thus be obtained. [There is an error in the drawing: the number of twists above and below the nail should of course be the same.]

FIG. 5.

FIG. 6.

FIG. 6A.

FIG. 7.

FIG. 8.

FIG. 9A.

FIG. 10A.

FIG. 11.

FIG. 12.

FIG. 12A.

FIG. 12A.

war experience in which we employed almost exclusively and with satisfaction plaster-of-Paris dressings, that, except in the occasional case, equally good, perhaps better, results may be obtained by the use of the Thomas and Jones splints.

The suggestions made in this note are in no way modifications of these splints, but only adaptations which may possibly be found to increase their usefulness.

In fractures of the head or neck of the humerus and in injuries to the bones or muscles of the shoulder girdle we have been impressed with the value of fixation with extension in the abducted position. In our experience there are a surprisingly large number of these injuries. Not only may better alignment and more speedy subsidence of the septic process be gained by the abduction, but the

comfort of the patient seems greater in this position. There can be no doubt that future function is favoured also. As Sir Robert Jones has pointed out, even a stiff shoulder with the arm in at least 60 degrees of abduction provides a surprisingly useful limb. As soon as the septic process begins to subside and the temperature is under control, ambulatory treatment increases the resistance of the patient, and greatly simplifies his care.

It is with these ends in view that these adaptations have been planned. Sufficient trial has been given in the wards and in transport to England to seem to prove their practicability. Many other adaptations may easily be made, indeed have been made. These figures with their legends are merely suggestive and demonstrative of certain forms we have found useful.

A SPLINT FOR THE TREATMENT OF GUNSHOT WOUNDS INVOLVING THE SHOULDER-JOINT.

By J. CAMPBELL, CAPTAIN R.A.M.C.(S.R.).

THE treatment in a base hospital in France of a large number of gunshot wounds involving the shoulder-joint has impressed on me in the first place the great necessity for securing adequate rest and fixation, combined with extension, and in the second place the absence of any useful method for attaining them. Many cases, that came under my care last year after being treated for some time, showed a considerable degree of toxæmia, and not infrequently had the elbow close-in to the side, a bad position for ankylosis owing to the subsequent limitation of movement in the limb. The method of treatment I formerly adopted was merely to bring the arm to the fully abducted position, and secure it there by means of weight extension over a pulley. The abducted limb was slung in place from a Balkan frame placed crossways of the bed, at the level of the shoulders. Care was taken that the patient was never

the uppermost malleable band, is also turned forwards in the same way. To the extremities of these rigid, forwardly curved bands are attached the side pieces of an ordinary Thomas arm splint, in a position of almost complete abduction with very slight forward flexion. The splint is applied in the following way: The patient is placed on his back on the padded frame with the affected shoulder region lying over the gap in the frame, and securely fixed by bending the malleable iron bands to the contour of his body (Fig. 3). He is prevented from slipping up or down on the frame by shoulder and perineal bands fastened as shown. The affected arm is supported by rigid bands of perforated zinc, and fixed extension is applied, not to the forearm, but to the upper arm. In this way the elbow can easily be passively moved and thereby prevented from becoming stiff—a most important consideration in treatment. By passing a bandage, impregnated with French chalk, from side to side between the body and the frame several times a day, any tendency to a sore back is easily overcome.

By the use of this splint I have found that the patient can be easily nursed and the dressings changed without pain or discomfort, and without the general reaction described above. Certainly such cases as I have treated on this frame settled down more rapidly and required less interference than had formerly been the case. Furthermore, patients can be transported in it with ease.

FIG. 1.—Frame, front view.

FIG. 2.—Frame, back view.

FIG. 3.—Frame applied.

moved. The dressings were changed only once in five to ten days after slightly raising the patient's shoulders and pushing the bed from underneath towards the sound side, till the patient was lying on the edge of the bed with the scapular region exposed behind. The dressings could then be done with but little movement; in spite of this, however, there nearly always followed a not inconsiderable rise in temperature and pulse rate, lasting several days.

Accordingly the idea suggested itself that a splint made after the principle of a Jones's abduction frame for the lower limb would prove useful for such cases, and after having used it in several instances I am quite convinced of its efficacy.

The splint consists of an iron frame, as shown (Figs. 1 and 2), covered by a thick, firm pad. The frame and pad are cut away in such a manner as to allow of free access to the greater portion of the scapular region. Three pairs of malleable iron bands, running transversely, embrace the body (a) just above the trochanters, (b) at the level of the lower ribs, and (c) at or just above the level of the nipples. The upper and lower bands are joined together in their respective pairs by straps and buckles. On the side for which the splint is intended the uppermost malleable iron band is replaced by a rounded rod of stouter metal carefully padded—this acts as the point of counter extension. The band of the frame on this same side also is curved round above the shoulder and then turned forwards, and a stout bar, running transversely at the level of

After the period of acute sepsis subsided the cases were put up in plaster with the limb still in the abducted position, but with the elbow flexed, and windows were cut out to allow of access to the wounds. The cases were then sent to England as walking cases.

My thanks are due to Surgeon-General Sir George Makins, K.C.M.G., for the help he kindly gave me in having the splints made at the Base Dépôt Medical Stores, Boulogne.

THE Paris house of Masson announces that it has made arrangements to publish in two annual volumes papers founded on the work done at the Ambulance de l'Océan, La Panne, Belgium. The publication will be directed by Dr. Depage, with the assistance of Drs. A. P. Dustin and G. Debaisieux.

SCHWARZE (*Deut. med. Woch.*, August 2nd, 1917), in some comments on methods of treatment of bacillary dysentery in the field, is rather pessimistic as to the so-called specific treatments, such as antiserum, bismuth, etc. He has had the best results with daily injections of adrenalin up to six doses, combined with two or three injections of atropine. The colic and tenesmus were greatly relieved, and the stypitic action of adrenalin was of value in severe and debilitated cases.