H.'s culture from faeces was then employed and a fairly thick emulsion from an agar slope yielded with the serums the following results:

H.'s Bacillus with Serums.

	1 in 25.	1 in 50.	1 in 125.
D. H.'s serum	+++	-	-
J. A. M.'s serum	++	-	-

The bacilli being recently isolated were much less readily agglutinated than the Oxford emulsion.

For twenty-four hours before his death J. A. M. ceased to have diarrhoea and to vomit, so no material was obtained until the autopsy. On April 22nd *post-mortem* examinations were made; an account of the findings has already been given.

On April 23rd the agglutination of cultures from the spleens of D. H. and J. A. M. was tested with a *paratyphoid* B serum which was supposed to be effective up to a dilution of 1 in 8,000 (R.A.M. College serum).

Paratyphoid B Serum.

	1 in 500.	1 in 1,000.	1 in 2,500.	1 in 5,000.
D. H.'s bacillus from spleen ...	+++	+++	+++	+++
J. A. M.'s bacillus from spleen	+++	+++	+++	+++

Absorption Experiments.

The results of a few out of many tests were as follows:

The *paratyphoid* B serum which agglutinated D. H.'s bacillus up to 1 in 5,000 and the Oxford *B. paratyphoid* B emulsion up to 12,500, was stated on the bottle to agglutinate *B. paratyphoid* B up to 1 in 8,000. It was a year old, and was diluted 1 in 20 in the bottle.

Experiment 1.—Dilutions of 1 in 100 of this serum were made, and were saturated with (1) growth from stock *paratyphoid* B agar culture, and (2) a similar culture of D. H.'s bacillus, and kept for two hours at 37° C.

	1 in 200.	1 in 500.	1 in 1,000.	1 in 2,000.
(1) Serum saturated with <i>paratyphoid</i> B. bacillus:				
D. H.'s bacillus	-	-	-	-
<i>Paratyphoid</i> B	-	-	-	-
(2) Serum saturated with D. H.'s bacillus:				
D. H.'s bacillus	-	-	-	-
<i>Paratyphoid</i> B	+++	+++	+++	-

It would seem that D. H.'s bacillus in two hours can remove four-fifths of the *paratyphoid* B agglutinins, whilst *B. paratyphoid* B under the same conditions removes all the agglutinins.

Experiment 2.—A serum which agglutinated the Oxford emulsion *paratyphoid* B up to 1 in 12,500 and D. H.'s bacillus up to 1 in 5,000 was saturated with (1) *B. coli* and (2) D. H.'s bacillus, exposed to two hours' incubator temperature, and then left in the laboratory overnight at room temperature.

	1 in 250	1 in 500	1 in 1,250	1 in 2,500	1 in 5,000	1 in 12,500
(1) Serum saturated with <i>B. coli</i> .*						
<i>Paratyphoid</i> B Oxford emulsion	+++	+++	+++	+++	+++	+
D. H.'s bacillus	+++	+++	+++	+++	+	-
(2) Serum saturated with D. H.'s bacillus:						
<i>Paratyphoid</i> B Oxford emulsion	+++	+++	+++	+		
D. H.'s bacillus	-	-	-	-		

* Neither *paratyphoid* B Oxford emulsion nor D. H.'s bacillus agglutinated at 1 in 25,000.

The conclusion is that D. H.'s bacillus can absorb at least four-fifths of *paratyphoid* B agglutinins from a *paratyphoid* B serum, whilst *B. coli* has no such effect.

Experiment 3.—The same serum as in Experiment 2 was saturated with J. A. M.'s bacillus (spleen), with *paratyphoid* B.

and with another strain of *B. coli*. Instead of the Oxford emulsion, an emulsion of laboratory strain of *B. paratyphoid* B was employed.

End point for B. paratyphoid B:

Before saturation	1 in 5,000
After saturation with <i>B. paratyphoid</i> B ...	1 in 500
After saturation with J. A. M.'s bacillus ...	1 in 500
After saturation with <i>B. coli</i>	1 in 5,000

End point for J. A. M.'s bacillus:

Before saturation	1 in 5,000
After saturation with <i>B. coli</i>	1 in 5,000
After saturation with J. A. M.'s bacillus ...	1 in 500
After saturation with <i>B. paratyphoid</i> B ...	1 in 500

Experiment 4.—This experiment proved that D. H.'s bacillus was of the *B. aertrycke* group.

A sample of *B. aertrycke* serum was obtained from Captain Perry and was found to cause standard agglutination of D. H.'s bacillus, and of the Oxford *B. paratyphoid* B emulsion in 1 in 25,000 dilution, and of the laboratory *paratyphoid* B culture in 1 in 12,500 dilution.

When the serum was diluted to 1 in 200 and equal volumes of it saturated with the growth from three agar slopes of D. H.'s bacillus and three agar slopes of *B. paratyphoid* B, the agglutination results after two hours at 37° C. and twenty hours at 22° C. were as follows:

	1 in 500.	1 in 1,000.	1 in 1,250.	1 in 2,500.	1 in 5,000.	1 in 6,250.
(1) Serum saturated with D. H.'s bacillus						
D. H.'s bacillus	trace	-	-	-	-	-
<i>B. paratyphoid</i> B emulsion...	-	-	-	-	-	-
Oxford emulsion of <i>B. paratyphoid</i> B	-	-	-	-	-	-
(2) Serum saturated with <i>B. paratyphoid</i> B:						
<i>B. paratyphoid</i> B	trace	-	-	-	-	-
Oxford emulsion of <i>B. paratyphoid</i> B	trace	-	-	-	-	-
D. H.'s bacillus	+++	+++	+++	+++	+++	+++

There was standard agglutination of D. H.'s bacillus with a 1 in 12,500 dilution of the serum saturated with *B. paratyphoid* B.

The conclusion to be drawn from this experiment is that from a specific *B. aertrycke* serum (type B, Lister Institute) D. H.'s bacillus can remove all the agglutinins, whilst *B. paratyphoid* B leaves unabsorbed those for D. H.'s bacillus, and that in consequence D. H.'s bacillus is not identical with *B. paratyphoid* B but is of the *B. aertrycke* group.

VENTRAL HERNIA:

A DEVICE TO STRENGTHEN THE ABDOMINAL WALL.

BY

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LEEDS.

REPAIR of the majority of cases of large ventral hernia can be adequately effected by one of the established methods or by a judicious combination of several, but occasionally one is encountered so extreme in degree, so crippling in its results, that life becomes a burden to its unfortunate owner, and the surgeon views with dismay the huge tract of thinned abdominal wall, beneath which movements of intestine are disconcertingly evident.

These extreme cases are usually the sequel of sepsis. In Stanton's report¹ on 500 laparotomies, of which 24 developed ventral hernias, it is stated that 21 out of the 24 were due to sepsis. Such was the sequence of events in the case to be described. Hysterectomy for impacted fibroid tumour of the uterus was performed in February, 1913, by the abdominal route. This was followed by sepsis of the wound and the discharge of urine through a fistulous opening, which finally closed; the weak scar allowed the formation later of a huge ventral hernia in the middle line, reaching from above the umbilicus to the pubes.

Locomotion grew more and more restricted, so that finally the patient could only walk some fifty yards without assistance. Various types of abdominal belt were tried without avail; operation was discouraged for a long time, but she still urged that an attempt should be made.

A device was employed at the operation which may well serve as an adjunct to the ingenious and effective technique of Haines.² I cannot find in the literature a reference to this method, and as any plan which will strengthen the abdominal wall in these extreme cases may prove helpful, it seems worth while recording it.

The patient, Mrs. W., was a multipara, aged 58 years. Operation was preceded by three weeks' rest in bed, restricted diet, purging, and abdominal kneading. The abdomen showed the usual deep hollowing of the upper half, and the recti were obviously displaced to the extreme outer edges of the hernia.

On July 26th, 1918, a transverse incision, curving downwards, was made, midway between the umbilicus and pubes, from the outer border of one rectus to that of its widely separated fellow. A crescentic piece of skin was excised and the flaps carefully dissected up and down. Here a feature that is usual in cases following sepsis was recognized—that is, considerable thickening of the rectus sheath, so that the muscle was "hide-bound," as it were.

In the Trendelenburg position the intestines, covered by the translucent transversalis fascia and peritoneum, still bulged forward, and the recti remained immovable.

FIG. 1.—1, Skin. 2, Subcutaneous tissue. 3, Rectus in sheath. 4, Transversalis fascia. 5, Peritoneum.

FIG. 2.

FIG. 3.

FIG. 4.

FIG. 5.

A longitudinal incision through the anterior layer of each rectus was made close to and parallel with the outer border (A A', Fig. 2), the flaps dissected off the muscle and turned inwards (B B', Fig. 3). The muscles were freed also on their posterior aspect nearly up to their outer margin, and by pulling firmly on the flaps these could now be made to overlap, and the recti could be drawn inwards almost to the middle line.

Protrusion of the bowel proving rebellious to pressure, the peritoneum was opened, the intestines pushed upwards and kept back by a flat swab; by pulling on the stout fascial flaps the peritoneal edges were reunited with fine catgut. In more favourable cases this step may prove unnecessary. This detail does not affect the principle involved in the operation.

On one side (at c) it was necessary to peel outwards the diaphanous layer of combined transversalis fascia and peritoneum from the posterior layer of the rectus sheath, and in the angle the free edge of the flap B' was fixed by a series of interrupted stitches of No. 2 catgut. The opposite flap was similarly treated, the two forming a firm bed, on which a McGavin filigree was placed, for it was found that the edges of the recti could not be brought into contact without tension. It is possible that implantation of the filigree was superfluous, but it was felt to be the more prudent course. The rest of the operation was completed on familiar lines.

An important rule, sometimes disregarded and not sufficiently emphasized in the textbooks, is the preservation of the anatomical integrity of the parts adjoining the

linea semilunaris. If the rectus be completely dislocated and displaced inwards, a gap of merely fibrous tissue is left between its outer edge and the strong line of junction of the transversalis with the oblique muscles. By using the method advocated in this paper, the muscle planes in their normal relations are drawn as near to the middle line as is practicable, and any gap that remains is in the middle line, where it can be the more easily bridged by a filigree or controlled by a belt.

Advantages gained by this simple device are:

1. The hide-bound muscles are freed from the strangling effect of contracting scar tissue.
2. The denuded anterior aspect of the rectus comes to lie covered by subcutaneous fat, which tends to prevent reformation of excessive scar tissue.
3. Release of the muscles from dense scar tissue allows of improved blood supply and development.
4. The stout flaps raised from the anterior surface of the muscles give purchase whereby the recti can be drawn inwards.
5. There is no interference with the nerve supply entering the outer border of the muscles.
6. The overlapped flaps form a firm bed on which a filigree may be planted if deemed necessary.

The patient made an uneventful recovery, and now walks well.

The drawings, based on the excellent figures given by Haines, are diagrammatic; sutures are omitted for the sake of simplicity.

REFERENCES.

- ¹New York State Med. Journal, 1916, xvi, p. 511. ²New York Med. Journal, January 10th, 1917.

BOOT HEELS AS A CAUSE OF FLAT-FOOT, SOLDIER'S HEART, MYALGIA, ETC.

BY

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In a normal barefooted man the balance of the body is so perfect that practically no effort is required to keep erect. The weight rests on the heels and outer sides of the feet, not on the arch or inner sides of the feet.

If the heels are raised from the ground by boot heels even a quarter of an inch thicker than the soles the outer side of the foot is removed from the ground and the weight falls on the arch. The centre of gravity is also thrown forwards, and in a man of 5 ft. 7 in. the head is thrown nine inches off the vertical by a heel three-quarters of an inch high. To remedy this, and to prevent falling forwards, the back muscles and the extensors of thigh and foot come into action. The peroneus longus and brevis, while extending the foot, also evert it, and the tibialis anticus which supports the arch and inverts the foot gets elongated and ceases to act. Thus, when an ordinary boot is used, even with a low heel, three influences tend to flatten the arch, namely:

1. The weight of the body, resting on the arch, instead of on the heel and the outer side of the foot.
2. The peroneus longus and brevis pulling the arch down.
3. The tibialis anticus is out of action, and no longer supports the arch.

A strongly formed foot is able to resist these influences, so that when the boot is removed the arch appears perfect, but if skiagraphed with the boot on, and off, flattening and lowering of the arch are evident. Unfortunately, when a foot is examined by a medical man he does not see what goes on inside the boot, and when weight is put on a bare foot the arch is not flattened as with the boot on. Even when a foot is able to preserve its arch, the elasticity of the arch is lost while the boot is worn, as the peroneus longus and brevis anchor the foot in the everted position, and the tibialis anticus is idle. The muscles concerned in preserving the erect position are in continuous contraction, and get spastic, or "muscle bound," and the calf and back muscles are consequently most affected in "myalgia." With average heels (three-quarters of an inch thicker than the soles) the calf muscles contract three-quarters of an inch, even when standing, leaving