namely, a tremendous increase of blood viscosity, high venous pressure, slowing of blood flow, and deficient blood aëration?

By the above statement I do not mean to assert that all fatal cases of shock are due to pulmonary fat embolism, but that the physical and chemical properties of lipaemic blood are such that acidosis cannot be avoided, and it is still to be proven whether the terminal mechanism is not the same.

The occurrence of pulmonary fat embolism in the war area is much more frequent than has been suspected, owing, probably, to lack of thorough examination of lung tissue for evidence of fat.

Associated with pulmonary fat embolism disseminated fat is found in the other tissues of the body, included in the capillaries. This undoubtedly accounts for the delirium so frequently associated with this condition.

Examination of Lungs for Pulmonary Fat Embolism.

Use a glazed earthenware plate or platter washed thoroughly with soap and water and rinsed; the knife is cleaned in the same manner.

Wipe the surface of the lung clean with a dry towel. With one long sweep cut into the lung, then, free from contamination with fatty tissue, express some of the blood from the cut surface. Allow this blood to flow slowly in a thin stream over the platter. If there is fat present it will appear as little globules on the surface of the expressed blood. Experience will render the detection of small amounts of fat an easy matter.

Treatment.

1. Prophylactic treatment consists in fixation of fractures with extension where possible; early and efficient surgical interference for fractures; at operation on wounds involving fatty tissue it is imperative to secure careful and complete haemostasis, *particularly the ligation of the non-bleeding proximal ends of veins as well as the bleeding distal ends.*

2. Active treatment is only symptomatic. Small amounts of sodium bicarbonate (2 per cent.) are helpful. The administration should be regulated by the condition of the right heart. Transfusion of blood in small amounts may be useful.

Conclusions.

Pulmonary fat embolism is much more frequent in the war zone than was formerly thought.

A reasonably accurate diagnosis of pulmonary fat embolism can be made.

Cases of pulmonary fat embolism do not respond readily to measures of resuscitation.

The ultimate cause of death in pulmonary fat embolism and in shock may be the same—namely, acidosis.

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THE SURGICAL CURE OF UTERINE PROLAPSE.

BY

HUGH P. COSTOBADIE, F.R.C.S. EDIN.

THE surgery of the present war is occupying the minds of all, and so rapid has been its progress in many respects that our whole attention is required to keep in touch with its various developments. As yet, however, but little of the new work has found an application to general surgery, and it is doubtful whether, excluding orthopaedics, accidental injuries, and possibly the surgery of the chest, any other branch is likely to benefit at all. On the other hand, there are a few surgical conditions, apart from wounds, which have become somewhat more common during this period, and therefore more experience has been gained in them. Of these, hernia, both in the male and female, and prolapse of the uterus are being more frequently encountered. Alternative operations for the former condition are being published and discussed, and the results are being more readily and carefully followed, so that some improvement is likely to accrue in the surgical treatment of this condition. Unfortunately uterine prolapse has not received so much attention.

The following paper has been written to describe what are probably the best operations for the cure of prolapse practised to-day. Though very much pre-war operations, they are not as well known as they deserve to be, nor is

their reputation likely to spread at a time when pressure of work tends to make men adhere to their own methods, unless their attention is especially called to other measures.

That prolapse should increase can be readily understood, and it may chiefly be accounted for by the following factors:

1. Great increase of women workers.
2. Heavier kinds of employment.
3. Less food, especially fats.

4. Increase of wage, which keeps the woman at work even when she is ill and brings her back to work before she is recovered, especially from her confinements.

In other words, it more frequently happens to-day that increased intra-abdominal pressure through heavy work is enabled to take such effect upon generally weakened uterine supports in a woman whose occupation keeps her standing and whose pelvic floor has either been recently injured and has not had time to recover, or has at some previous date become impaired, that prolapse results.

●To treat this, rubber rings can scarcely ever be recommended, and can only occasionally be used, either as a temporary measure, or for a patient upon whom operation is contraindicated. In the woman worker they very soon become irritating because they lack the necessary attention she is unable to give. Operation should therefore be advised in all these cases, whether they are within the child-bearing age or no.

Fixation and suspension of the uterus for prolapse is still practised by many surgeons, but the results with patients on whom I performed this operation some time ago have not been altogether satisfactory, nor have the results been much better in those few cases I have seen where suspension was performed for the same purpose by other surgeons. In combination with some form of colporrhaphy the results are better. Hysterectomy need not be considered, though even recently I heard of hysterectomy alone being performed for prolapse, with, of course, a subsequent complete eversion of the vaginal canal.

Of the vaginal operations still performed for the definite cure of prolapse, the transposition operation largely used in America, and extensive anterior and posterior colporrhaphies, as practised in Manchester and elsewhere, are the only methods by which a cure can be almost definitely promised. The American "transposition" operation consists of freeing the uterus and bladder, and using the former and the cervix, or a necessary portion of them, after the remainders have been excised, to give a firm support to the bladder. A posterior colporrhaphy or perineorrhaphy is then performed. The published results of this operation are good, but it has several obvious drawbacks which I think are not possessed by the method of anterior and posterior colporrhaphy which I am about to describe. I first saw these colporrhaphies performed by Professor Donald and Dr. Fothergill of Manchester, and have since carried them out according to their technique with uniformly good results. The operation in the case of complete prolapse, with the almost always present elongation of the cervix, consists of amputation of the cervix by a circular method, or by means of anterior and posterior flaps, followed by a large anterior and posterior colporrhaphy. Dr. Fothergill carries out the amputation and anterior colporrhaphy by means of one incision. Dr. Donald amputates the cervix by means of anterior and posterior flaps, and then follows the anterior colporrhaphy, a separate step entirely. Either operation may be performed according to the requirements of each individual case. Usually I prefer to amputate by means of flaps when the patient is of child-bearing age, but after that time I use the circular method, where, should stenosis of the canal follow, it would not be of so much importance. I perform this operation as follows, which is, I believe, as nearly as possible the method employed by the Manchester surgeons.

The patient having been prepared, is placed in the lithotomy position; the vagina is freely flushed out with a solution of lysol, followed by perchloride. It is then carefully dried out with swabs and washed with spirit and the surrounding surfaces painted with iodine. The anterior lip of the cervix is grasped with vulsellum forceps and a sound is passed to give an accurate measure of the amount of cervical elongation. The cervix is then dilated sufficiently to admit the flushing curette, and the interior of the uterus is carefully curetted. The posterior lip is now grasped with a second pair of vulsella and drawn down as far as possible, evert the vaginal canal almost completely.

(In the following description the words "above" and "below" refer to the position of the parts as they now are.)

A pair of small Spencer Wells forceps is now used to pick up the mucous membrane, just below the urethral orifice exactly in the middle line, and being held by an assistant, serves to mark the apex of the incision which is about to be made, as well as to put the anterior vaginal wall more on the stretch. Two other pairs of forceps are used to mark two points opposite

FIG. 1.

to one another on the lateral aspects of the cervix, well below the point at which it is decided to amputate (Fig. 1). The whole anterior vaginal wall is now made tense by means of gentle traction on these forceps and the vulsellum, and from a point immediately below the first pair of forceps to a point immediately in front of and below the forceps on the left of the cervix an incision is made curving somewhat outwards. This incision is then carried circularly around the back of the cervix to a point just below and in front of the forceps on the right of the cervix; from thence to the starting point at the first pair of forceps (Fig. 1). Care must be taken to cut through the mucosa along the whole length of this line, as the incision is apt to become lost where the folds of the mucosa prevent the knife from reaching the underfolds. The denudation should commence at the apex of the triangular area thus mapped out, and is greatly assisted by catching the free edge of the mucosa with artery forceps at short intervals and stretching it over the finger-tips of the left hand. It is carried out by frequent snipping of the underlying connective tissue with the rounded points of a pair of angled or curved scissors. If the proper plane is struck, gauze dissection can sometimes be used and time saved, but rough handling is to be avoided, as the upper two-thirds of the dissection is over the bladder, the lower fold of which is usually apparent through the mucosa. When the surface has been denuded as far as the level of the two lateral Spencer Wells forceps, deep snips are made with the scissors straight down upon the firm cervix, these deep cuts being carried round the back of the cervix, following the line of the original incision. The firm cervix having been reached throughout its entire circumference, the loose tissues are easily separated from it by means of a swab and pushed upwards until the selected point is reached for its division. The knife is then taken and the cervix cut through half its extent, when, to retain it, its anterior edge is caught with a pair of stout Kocher's forceps applied in the middle line, the amputation completed (Fig. 2), and the posterior edge caught in the same way.

Haemorrhage, the bladder, and Douglas's pouch require special mention. Bleeding is not brisk until the cervix is reached, when branches of the uterine and vaginal arteries are wounded. The amputation should therefore be carried out fairly quickly, the larger vessels temporarily controlled with pressure forceps, and permanently by suture-ligatures of gut as soon as the amputation is completed. The bladder, which can usually be easily located before the operation is commenced, is not readily wounded during the denudation if reasonable care be taken, and, even if very low, is pushed up out of the way with the loose tissue by means of a pad of gauze, as described during the freeing of the cervix before its amputation. It is at this stage also that the pouch of Douglas, lying behind, is also pushed upwards out of danger. In most cases, however, it lies much lower than the bladder and is therefore more frequently injured. If this happens, it should be closed at once by means of a purse-string suture, for though the danger of a general peritoneal infection is not very great, a local collection of pus may form.

Suturing is now commenced, and as the success of the operation depends greatly upon them, the sutures are most carefully applied. A medium sized cutting needle, preferably Hagedorn's, is threaded with No. 3 chromicized gut. The needle is easily introduced a little way up the dilated cervical canal and driven through, in the middle line, the posterior wall of the cervix, the latter being steadied by means of the Kocher forceps here applied. These are now removed and the free edge of the mucosa behind is picked up with dissecting forceps, its edge brought over the raw surface of the stump of the cervix till it reaches the edge of the cervical canal. Retained in this

position, the needle is made to penetrate it and the suture is tied and the ends are left long. A large "Auvards" self-retaining speculum is now introduced into the vagina, and sutures are applied in the manner described, first on one side and then on the other of the primary suture, until the circuit of the cervix is completed. During their application the cervix is steadied by pulling upon the long ends of those already in place, though the traction must not be so great as to prevent the easy and accurate covering of the cervical stump.

As the suturing from behind gradually approaches the front it will be found that the uterus tends to retract within the vagina, and the two marking forceps originally applied laterally to the mucosa covering the cervix approach one another in the middle line. The final stitch is best applied as a blanket stitch gathering up the loose lateral parametric tissue, approximating the two edges of the mucosa, and at the same time fixing these upon the last bare part of the cervix. The Kocher's forceps, together with the Spencer Wells, are removed before this stitch is tied. Still using with care the stitches as tractors, the uterus is now lightly packed with gauze, the end being left long enough to remain outside the vagina. This packing serves to keep dilated for the time being the new orifice of the cervical canal. The long ends of all the cervical sutures except the last one (that in the middle line in front), are now cut short and the speculum withdrawn, and the uterus is tucked further into the vaginal canal, where, though still readily accessible, the supporting parametric tissues are allowed to become more relaxed. It is in this position that the remaining sutures must be applied. These are of No. 4 or 5 catgut, used with the same needle as before. It is well to remember that a double turn to the first half of each knot, when tying catgut, saves much time and gives more accuracy to the result. It will now be found that the surface to be covered runs from the tip of the cervix to the first pair of "marking" Spencer Wells. It is oval in shape, and its edges can be readily approximated (Fig. 3). Interrupted sutures are used, commencing from the cervix, and the first three or four are the most important. These should be wide and deep, biting well into and gathering up as much more as possible of the loose parametric tissue lying laterally to the cervix. By this means the cervix will be kept back, and a position of anteversion of the uterus obtained.

When applying each successive suture some traction may be made upon the last to steady and approximate the edges of the incision above, but this must be so conducted that the stitching is carried out actually within the vaginal canal; nor must the cervix or any part of the anterior vaginal wall be again drawn outside. Here again the bladder needs special consideration. When, during the denudation of the anterior vaginal wall, the connective tissue which lies between the bladder and vagina is found much thinned and even entirely absent, a row of buried sutures may be placed in the bladder wall folding it inwards from top to bottom of the surface exposed. A second or third row may follow, until the denser connective tissue lying laterally has been so approximated that it can be picked up and drawn together with each stitch that closes the mucosa. By this means the bladder is raised, the so-called "hernial opening" of the cystocele closed, and the urethra straightened. It is advantageous at times to separate the bladder somewhat from the uterus to perform this step the more effectively.

The last suture having been placed and cut short, a small speculum is passed and the suture line inspected for possible bleeding from needle puncture of small vessels, when the flattening or slight incurving of the anterior vaginal wall, together with a marked increase in its length, will be noted—in other words, a complete disappearance of the cystocele, and a backward pointing cervix.

So much of the foregoing description applies to the alternative method—that is, that of flap amputation of the cervix followed by an extensive anterior colporrhaphy—that it will not be necessary to do more than indicate the steps of the operation.

FIG. 2.

The two cervical lips, after dilatation and curettage have been carried out, are seized and held apart by means of vulsellum forceps, while the cervix is split laterally to a height corresponding to the length of cervix it is thought desirable to remove. The posterior half is now amputated, leaving a flap thin enough and of sufficient extent to be turned forward over the cut end of the cervix, where it is fixed by three or four sutures which are carried first through the cervix, entering it

FIG. 3.

just within the dilated cervical canal, and then through the flap. The ends of these sutures, which are of chromicized gut, are left long and serve to steady the cervix while its anterior portion is removed in the same manner, and the flap fixed. A few more stitches serve to bring the mucosa together over the stump on each side of the cervical canal and to control all the haemorrhage. The uterus is now packed, the end of the gauze being brought out of the vagina and all the stitches, except two or three in the front, are cut short. Having picked up the mucosa in the middle line and just below the urethral orifice with a small pair of Spencer Wells forceps, the anterior vaginal wall is made sufficiently tense by traction upon these and upon the long ends of the sutures. An incision is now begun just below the forceps and carried downwards with an outward curve in the manner already described. The cervix, however, being already amputated, the incision curves sharply forward across the front of the stump, instead of passing behind, and from here, in a curve corresponding to that of the opposite side, is carried back to the starting point. Denudation is commenced either from above or below. It is carried out in the same manner and with the same precautions as before described, as also is the suturing which is begun at the cervix. Care should again be taken to make the first stitches include as much of the lateral parametric tissue as possible, and before they are applied to push the uterus well within the vaginal orifice.

The introduction of a small speculum and inspection of the anterior vaginal wall and cervix will show that a result has been obtained almost identical with that already described.

The posterior vaginal wall has now to be dealt with. The insufficiency of a simple perineorrhaphy led Professor Donald to devise the operation of posterior colpo-perineorrhaphy. By its means the "bagginess" of the upper vagina is greatly diminished by a colporrhaphy which is commenced high up upon the posterior vaginal wall, which is stripped of its mucosa in stages from above downwards. Each stage is closed before the next is commenced, and the triangular denudation with its broad base reaches the muco-cutaneous junction at the perineum.

The final steps are those of a perineorrhaphy. No speculum is used, but a point in the middle line, and fairly high up the posterior vaginal wall, is picked up with a pair of Spencer Wells forceps. Slight traction upon these brings down much redundant mucosa, so that a second pair of forceps may be applied above the first, but still strictly in the median line. These, when gently pulled upon, should bring the mucosa, at the point held by the forceps, as far down as the vaginal outlet but no further. This is the proper point at which to commence the denudation of the posterior wall. Thus fixed and raised, it will be noted that the mucosa falls sharply away from the forceps in two lateral folds, which eventually become lost in the lateral vaginal walls. At the lowest point at which these folds remain prominent they are again picked up with forceps, one on each side (Fig. 4). In this manner an isosceles triangle of mucosa is formed, about an inch and a quarter upon the sides and an inch across the base, which can be kept on the stretch. The incision runs from the apex to the base upon each side, keeping within the marking forceps. Denudation is carried out from above downwards, and when the base of the triangle is reached the lateral tension is relaxed and suturing is commenced from above. Interrupted sutures of catgut are again used as in the anterior suturing, and the last suture here applied will bring together the lateral marking forceps, which

have not been removed and which, held together, now form a traction point for the apex of a second triangle, which is mapped out, denuded, and sutured in the same manner as the former.

The mapping out of the third and final area will require the placing of the lateral marking forceps on the sides of the vaginal outlet. In estimating the position in which these are to be placed, it is only necessary to remember that the portion of the vaginal outlet in front of the forceps will remain and will correspond to the new vaginal orifice, the size of which can be estimated before the incision is commenced by approximating these two pairs of forceps. An incision is made first on one side, then on the other of this final triangle of mucosa as it is made tense by means of counter-pull upon the forceps at the apex and those last applied at the vaginal orifice. Between these two lateral incisions the area is denuded until the muco-cutaneous junction is reached. Along this line—the base of the large triangle—the separated mucosa is cut free. Within this area much scar tissue is frequently met with, binding the rectum firmly to the posterior vaginal wall, and care should be taken to see that the former is thoroughly freed. Lateral tension is again relaxed and the suturing of the mucosa continued from above downwards. When the proper level is reached the levatores ani are brought together with buried sutures and the suturing of the mucosa afterwards continued to the outlet. Two or three silkworm gut tension sutures are placed deeply through the perineum, which serve also to bring the skin edges together. A further light packing for the vagina is tied to the free end of that which is already within the uterus and the operation is completed.

I have not given a more detailed description of the later stages of the operation because so much has been written upon perineorrhaphy, but I must call attention to one or two points which are sometimes missed in these descriptions. They are: the height at which the denudation should commence, the depth to which it is necessary to carry it out, and the objects to be attained by the suturing.

It has been stated that there is no necessity to carry out denudation beyond the level of the upper border of the levator ani muscle. It should be remembered that the operation is in part a plastic operation upon a tube, and to commence abruptly and yet sufficiently extensively would result in a great bagginess above a narrowed outlet, which would be a hindrance to the future proper drainage of the vagina. The mucosa only need be removed throughout the whole extent of the posterior colpo-perineorrhaphy. There is no necessity whatever to bare the levator ani muscle by removing the sub-mucous fibrous tissue. This, indeed, must be carefully left, as the muscle can be well defined by touch, and the fibrous tissue gives greater support to the sutures drawing the muscle together than will the muscle fibres themselves; and of course, however carefully these muscle fibres be approximated, the union that follows will be a fibrous one.

The two objects of the suturing, over and above the closing of the raw surfaces, are to approximate as accurately and as far forwards as possible the separated and stretched levator ani muscles, and to build up at the same time as large and firm a perineal body as is possible. The former object is greatly aided by making as broad a denudation as will not too greatly constrict the vagina so that a maximum of the muscle can be reached. This also will be aided by placing the sutures for approximating the levatores ani before the mucosa of the posterior vaginal wall (opposite the plane on which the muscles lie) has been brought together. It will be found that if the loose fibrous tissue be gathered up with every stitch used to

FIG. 4.

coapt the edges of the mucosa there will result a great addition to the remnants of the perineal body.

The operation here described may be looked upon as the most extensive ever found necessary, and therefore has only to be modified to suit lesser degrees of prolapse, when amputation of the cervix nearly always ceases to be necessary. The results are almost invariably excellent, even in very stout women, and the operation can be carried out without fear of preventing pregnancy or interfering with delivery. Retroversion, uterine prolapse, cystocele, and rectocele, which are each in turn dealt with during this operation, are corrected and cured.

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A METHOD FOR THE IMMEDIATE TREATMENT OF FRACTURE OF THE FEMUR ON THE BATTLEFIELD AT THE SITE OF THE CASUALTY.

BY

F. B. CHAVASSE, CAPTAIN R.A.M.C.,
ATTACHED No. — CASUALTY CLEARING STATION.

Scope and Objects of the Method.

THIS method is not a rival to the far more satisfactory Thomas splint; but the first place at which a Thomas splint is available is not at the site of the casualty, but (with fortune) at the regimental aid post, or, if active operations are in progress, not until the advanced dressing station in most cases.

Up to this point the nature of the ground renders constant jolting and severe undulation of the stretcher inevitable. Often covering many thousand yards, and occupying many hours, this preliminary journey to the aid post or advanced dressing station is by far the roughest portion of the patient's transit to a casualty clearing station. It is also by far the longest in time. The most deadly portion of the journey is, therefore, before a Thomas splint can be applied.

At present this journey is undertaken with the aid of the very ineffectual rifle splint, or more generally with no splint at all.

The following method is designed for use by regimental stretcher-bearers at the place where the casualty occurs.

The Method.

The principle of the method is the application of very powerful extension, followed by fixation in the extended position.

A stretcher and two slings are required. It is the rule for each of the four bearers in a squad of regimental stretcher-bearers to carry a sling. Thus two slings are still available for carrying the stretcher (should this method of carrying be possible or desirable). If there are no slings, puttees can be used. Spare slings should be available at aid posts. The procedure is as follows:

1. Expose and dress the wound.
2. Enlarge the adjustable loop of one sling to its maximum by shifting the grip plate as far as ever it will go. Slip the loop over the foot on the injured side, and pass it up as far as the groin.
3. Tie the ankles and knees firmly together (with narrow fold triangular bandages, or other bandages or makeshifts).
4. Open the stretcher and place on it a small pillow where the knees will be. (A waterproof sheet, doubled from side to side and loosely rolled from end to end makes a suitable pillow.)
5. Place the patient on the stretcher so that his heels project an inch or two beyond the edge of the canvas, or more if he is a tall man. The heel on the injured side should be a little lower than the other if possible.
6. Adjust the loop of the other sling so that it is equal in length to the distance between the poles of the stretcher (1 ft. 7 in.). Slip it over one handle and wind very tightly about the feet, as shown in Figs. 1 and 2. That is to say,

pass it from one handle across the soles of both feet, up across both insteps, behind both ankles, down across both insteps, *then through the loop* (to avoid torsion of the feet), and thence across the soles of both feet to the opposite

FIG. 1.—Securing the feet. Note small loop end passed through large loop, and small loop itself turned inside out, bringing small strap inside the small loop.

FIG. 2.—Securing the feet. Note end of sling passed through large loop before buckling off. Small loop turned inside out, bringing small strap inside the small loop.

pole. Secure by buckling the small strap round the opposite handle, making all as taut as possible. To avoid the small strap tearing away owing to the strain, the small loop to which it is sewn should be turned inside out, thus causing the strap to pass actually through the small loop.

7. Gently raise the stretcher almost into the perpendicular, so that the patient is hanging by his feet. Draw the patient down head first as far as he will come (Fig. 3). (If the patient continues to have pain he may be

FIG. 3.—Obtaining extension.

left for a few minutes until the muscles are tired. He may then be drawn down a little further.) The stretcher may be propped up against something.

8. See that the back part of the loop is well behind the buttock. Adjust the loop so that the grip plate will almost lie on the surface of the stretcher when the strain is taken. (This position of the grip plate tends to correct the flexion abduction and external rotation of the upper fragment.)

9. Put a very heavy strain on the groin sling and secure by buckling the small strap round the pole handle by the head in such a way that it does not rotate and slip (Fig. 4).

FIG. 4.—Note that the dressing on the wound, the bandages round the ankles and round the knees, and the bandage securing the pelvis to the stretcher are omitted for the sake of clearness. Also the rifle, which may be placed (bolt removed) along the outside of the limb to steady it.

While making fast the strong pull must be kept up in order that everything shall be taut after making fast. (There is no possibility of the groin loop constricting the femoral vessels, as in the rifle splint and a badly applied long