

ABDOMINAL TECHNIQUE—A SYSTEM OF OPERATIVE EXPOSURES

H. B. DEVINE, M.S. (MELB.), F.A.C.S., F.C.S.A., MELBOURNE, AUSTRALIA
 Stewart Lecturer in Surgery, University of Melbourne; Hon. Surgeon to In-patients, St. Vincent's Hospital

ADEQUATE exposure is the great secret of success in the performance of abdominal operations. It should be such that the surgeon is able to dissect or carry out any manipulations in the particular operation field under perfect sight, that he is undisturbed and unhampered by the neighboring viscera, and that the organ or organs on which he is operating are, as far as possible, under normal physiological conditions.

It is, of course, a common and traditional practice during the progress of an operation on an organ, to drag it out of the abdominal cavity; such a procedure does not constitute a truly scientific exposure. The proper way is to isolate, expose, and operate on the organ while it is *in situ*, that is, while it is in the abdominal cavity where it is naturally kept warm and moist. In these circumstances there is no necessity to handle bowel or to drag on mesenteries, both of which are richly supplied with shock-susceptible splanchnic nerves. It is perhaps not sufficiently realized what a big factor unnecessary interference with physiological conditions during an operation is in producing shock and inducing inhibition of the movements of the alimentary canal. This has often been signally apparent to us when operating on the abdomen under local anæsthesia. It has been remarkable to see the distinct change in the patient's general condition if much visceral dragging or handling becomes necessary, although no pain is produced. On the other hand, while manipulations on a poorly anæsthetized abdominal wall give rise to pain they have almost a good effect on the patient's general condition.

Many years ago, having these basic considerations in mind, we evolved a system of abdominal technique, the exordium of which was woven round a rather crude mechanical retractor, designed so that these and other desired principles in abdominal technique might be carried out. It was originally an expedient to render possible certain extremely difficult, practically impossible,

secondary gastric and gall-bladder operations. This clean, definite, standardized method of operating gradually forced itself by its very potentiality and usefulness into our technique in other abdominal fields. We soon found that it made abdominal operating easier and quicker; so that if it did nothing else, it minimized anæsthesia and lessened shock to the patient. Also, it saved strain and conserved the energy of the operator.

The keystone of the technique is a gentle, evenly distributed, unvarying, protecting instrumental retraction and control of the abdominal wound and wall. Principles concerned in this technique and attained by and embodied in the use of this retractor are:

1. Effective wound protection from trauma and infection.
2. Control of the anterior abdominal wall, so that it can be lifted away from the viscera, thus creating a space for (a) operative manipulation; (b) exploration; (c) the easy replacement of intestines; and (d) the toilet of the peritoneum of the anterior abdominal wall.
3. Isolation of the organ to be operated on by complete instrumental exclusion of the intestines from the area of operation.
4. Systematic "guy-rope" anchoring of hollow viscera to the frame, enabling gastric or intestinal suturing to be carried out against constant tension with great precision, exactitude, and neatness.
5. A ratchet "spreader" action enabling the retractor to be used for the surgical approach to the kidney, lung, bladder, etc.

We soon found that an extraordinarily light anæsthesia was possible because the anterior abdominal parietes were not constantly being handled, and because once the retractor and its "mechanical hands" were "set," great relaxation was not a consideration.

Difficulties in suturing the abdominal wound also disappeared, probably because the light but

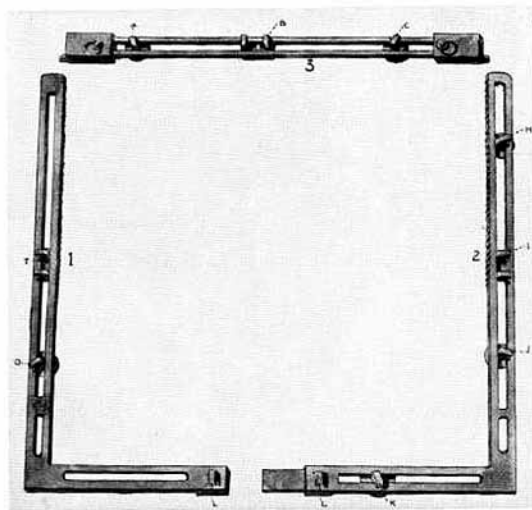


Fig. 1. Four-bladed abdominal retractor. 1 and 2, two slotted L pieces which dovetail into each other; 3, sliding bar which moves on 1 and 2 by ratchet action; I, B, and T, double hooks for retractors; A, C, H, J, K, and O, single hooks for attaching "mechanical hands." All these lock the retractors and "mechanical hands" by a jamming action on the frame because they work on a series of inclined planes.

continuous pressure of the retractor fatigued the abdominal muscles.

The results, both immediate and remote, were exceedingly good, for this method of operating demanded and developed a special type of desirable operative skill, that is, accurate, detailed, dry dissections under good vision with long, very sharp instruments—really an ideal technique.

That this meticulous and precise method was justified was demonstrated by observations in any secondary operations after this technique. These revealed a remarkable absence of adhesions, and some abdomens looked as if they had never been opened before. Since the adoption of this technique, wound infection has been almost unknown to us. Perhaps the most noticeable thing, certainly from the patient's point of view, is the placid postoperative course, the absence of any definite "after-treatment" period. Indeed, the sisters have often volunteered the information that the patients operated on in this way may be distinguished by the remarkably little after-treatment they need. We have often demonstrated that, intelligently used, the retractor never in the least degree traumatizes the wound.

In the light of the foregoing, it is difficult for us to understand why some surgeons still have a prejudice against the use of proper instrumental retraction; why they prefer to draw the viscera

out of the abdominal cavity where they are kept warm and moist; and why they should really make difficulties, as, for instance, by operating in an area which is inadequately lighted, because their own and their assistant's hands are in the light, and because the crowding-in of the intestines and of the wound edges prevents the access of natural light to the part.

THE RETRACTOR

The retractor has been redesigned in the light of ten years' experience, and is here illustrated for the first time, Figure 1. It consists of two slotted L pieces, 1 and 2, which dovetail into each other; a sliding bar, 3, which moves on 1 and 2 by a ratchet action; four retractors (1, 2, 3, and 4, Fig. 2) for claspings the abdominal wound; a system of "mechanical hands" (5, 6, 7, 8, and 9, Figs. 2 and 3 with detachable blades of different shapes and angles, Fig. 4).

The instrument is so designed that there are no screws, yet the retractors and "mechanical hands" by a jamming action remain firmly on the frame in whatever position they are placed. This is accomplished by a system of inclined planes incorporated in the frame and in the single hooks (H, K, U, O, L) and double hooks (B, Q, N, I) in Figure 2 and in the retractor and handles of the "mechanical hands."

When the "mechanical hands" are inserted, it is particularly necessary to note that they are always at first loosely fixed on the single hook at C (Fig. 5) or a point corresponding to it, that is, with the handle at right angles and near the center of the bar. A firm lateral movement to LI (Fig. 5) will now tighten and jam the "hand" as the side LI-L2 is longer than the side C1-C2.

Except for the frame and "mechanical hands," the retractors used belong as a rule to the armamentarium of any surgeon.

"SETTING" THE OPERATION FIELD

The field of operation should be set deliberately as a stage of the operation. It is better to make a somewhat smaller incision than usual in order to get the spring-like action of the muscle. It is this that really retains the retractor firmly in position and gives the frame its lifting purchase on the abdominal wall; if this lifting purchase is intelligently cultivated and used, it becomes extraordinarily useful in abdominal operating.

If there are no adhesions to the abdominal wall, as a first step the retractor should be introduced and fixed as follows:

Two very thick towels or two specially made sheets of rough glove rubber, 15 inches by 12

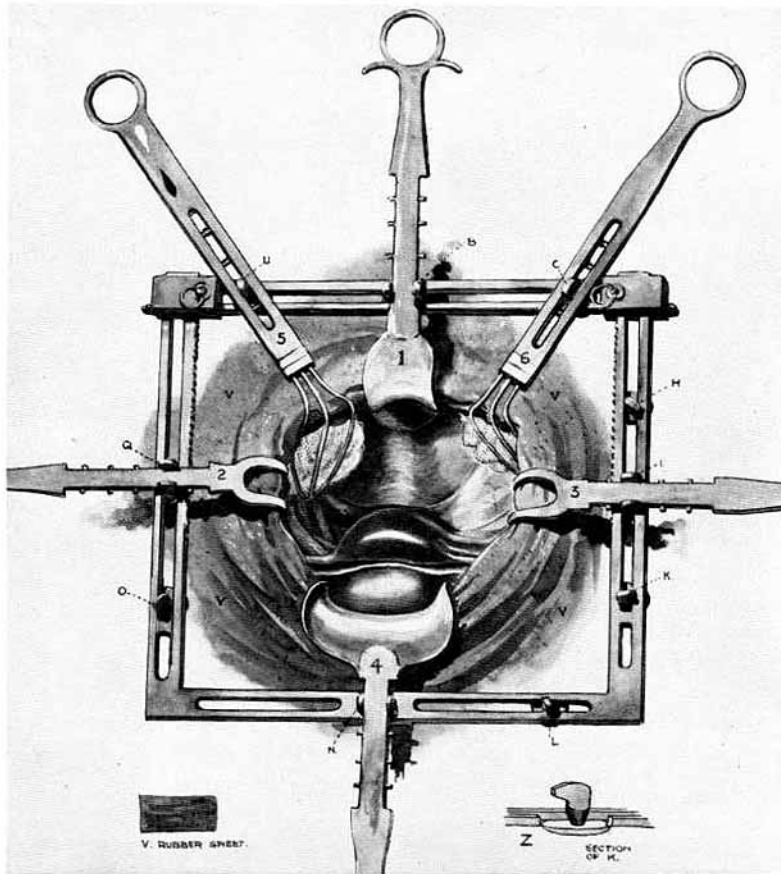


Fig. 2. Retractor set for a pelvic operation. The incision is in the lower part of the abdominal wall. The edges of the wound are covered with rough glove rubber. "Mechanical hands" 5 and 6, with a soft scarf acting as a buffer, keep the intestines well out of the wound and well up into the abdominal cavity. The pelvis is empty except for the rectum, uterus, and its adnexa. Z, Section of a single hook to show how it jams and fixes the "mechanical hands."

inches (Fig. 2) are laid over the wound so that they overlap its edges well. The frame is laid on these and if the wound is in the upper part of the abdominal wall (Fig. 3), the left forefinger is placed on the towels at the lower angle of the incision where they are tucked well under the cut edge of the abdominal wall. Retractor 1 is now substituted for the finger and is held up by the left hand of the assistant so as to elevate the abdominal wall until it is clear of the viscera and thus enable the operator with his left hand at C to tuck the towel at this point well under the peritoneum and, unhampered by intestines, to insert retractor 2 and lock it on the frame. The assistant, using his right hand, pulls the frame

toward him and keeps it on tension at the point C so that omentum or intestines cannot get under retractor 2. He still retains the upward tension on retractor 1. This facilitates the insertion and the locking of retractor 3. Retractor 1 is now locked. The assistant with his hands at E and G now lifts the frame, enabling the towels to be easily turned under the peritoneum in the upper wound angle and permitting the insertion and locking of retractor 4.

The wound now should be open to its fullest extent under slight tension only and the wound edges, including peritoneum, should be neatly covered so that there should be no fear of disarrangement, damage, or infection (Fig. 3).

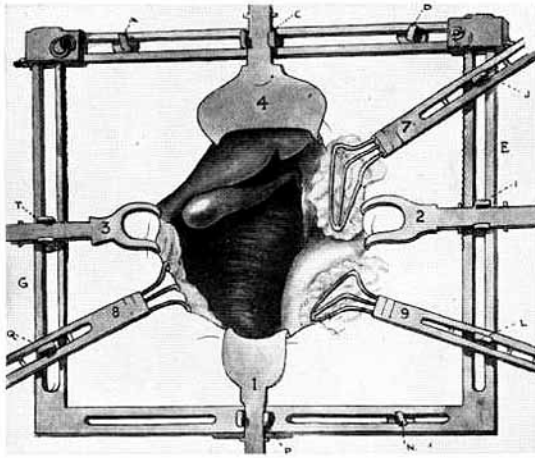


Fig. 3. Retractor "set" for an operation upon the gall bladder. The incision is in the upper part of the abdominal wall. The No. 1 broad Fritz retractor is put in the upper angle of the wound. "Mechanical hand" 9 has the most important function. It draws the duodenum (covered with a scarf) medially and stretches the common duct and draws the gall bladder toward the midline. "Mechanical hand" 8 keeps the hepatic flexure out of the way, and "mechanical hand" 7, a deep one (A, Fig. 4), is used to keep the stomach out of the way.

When the incision is in the lower part of the abdominal wall, retractor 1 is inserted first in the upper angle of the wound and the others in order of their numbers (Fig. 2).

When there are adhesions to the anterior abdominal wall, as in secondary abdominal operations, a second step will be necessary. Here it is better at the outset to choose or make on each side of the wound a space clear of adhesions. Into these spaces insert retractors 2 and 3 (Fig. 6), lock them on the frame, and with this lift the abdominal wall. The viscera will hang and it is an easy matter to put tension on the now well-lighted adhesions, thus facilitating what is usually a very difficult task—the neat disconnection of adhesions from the anterior abdominal wall, especially those far out from the incision.

When these adhesions have been divided, preferably with a long scissors, and the operation field is "set," then the abdominal wall is lifted away from the intestines by the gentle elevation of the frame. In this way a space is created through which the operator can explore the abdomen. As a matter of fact, much of the abdominal cavity can in this way even be inspected under good vision; certainly it can be explored comfortably because the exploring hand is not hampered and harassed by the intestines and the clinging omentum. It is also wise at this stage to

see to the suturing of any wound made in the peritoneum of the anterior abdominal wall by the severance of adhesions. Lifting the abdominal wall away from the viscera enables this to be done with ease and accuracy, even though the wounds are far out under the wall—an essential precaution to prevent the recurrence of the pernicious parietal peritoneal adhesion.

EXCLUSION OF THE INTESTINES

The next step is to clear away the intestines, stomach, and any other viscera from the operation field and to incarcerate them under the abdominal wall. Here they will be free from injury and will be kept warm. This exclusion of intestines from the operation field by the use of "mechanical hands" is a very special feature in the technique, and is of great value when the organ is deeply situated and access is difficult, as, for instance, in the exposure of a contracted and highly situated gall bladder, or of the pancreas in a fat person, or of a kidney from the abdominal cavity. This maneuver is carried out by means of large soft veils of a single layer of gauze (a yard by a yard-and-a-half) puckered at one end, and "mechanical hands" with blades set at an acute angle. The method varies according to the particular operation field, but follows to a certain extent some general rules.

The veil is laid on the intestines and the frame (not the retractor) is lifted so that the veil tangled up with the intestines is drawn into the abdomen. Add several extra layers of the veil and with the hand draw the intestines far out under the abdominal wall. Substitute a "mechanical hand" for the hand and fix it to the frame. The crumpled-up "veil" acts as a buffer between the "mechanical hand" and the intestines. Do this on the sides of the frame where it is necessary, until the operation field is quite free from the intestines (Fig. 2, 5 and 6; Fig. 3, 7, 8, and 9). As the acute angled blades of the "mechanical hands" are so made that they fit well under the abdominal wall, there should, therefore, be no infringement by these on the operation area.

OPERATIVE EXPOSURES

Gall bladder. The precision, exactitude, and value of this technique is best seen in a difficult cholecystectomy. Indeed, no cholecystectomy can be difficult with it; at least, that has been our experience. There will be no accidents, such as injury to the common duct.

In the planning of the incision, the cystic duct must be regarded as the point of greatest importance—the keystone of the operation and the

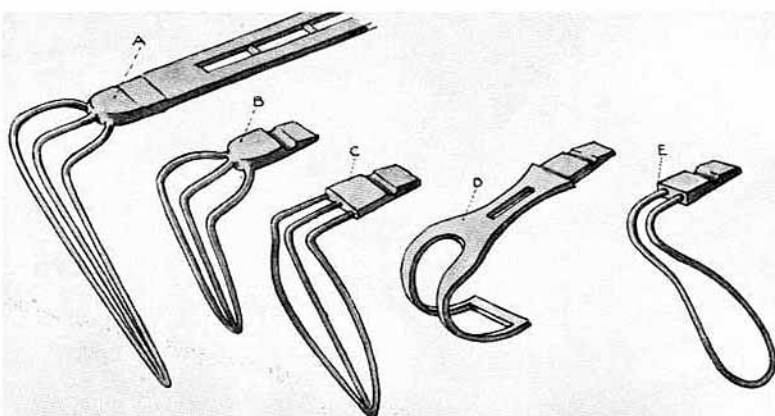


Fig. 4. Detachable blades for "mechanical hands." A, Long deep blade for special purposes; B, narrow shallow blade for difficult appendiceal operations and other purposes; C, blade used for gall bladder, pelvic, and other work; D, small blade for use in small wounds, such as for acute appendicitis, etc.; and E, blade for the urinary bladder.

main objective of the operative exposure. For this reason a paramedian incision must be used and made as high as possible. The retractor is now inserted and the wound set in the usual way. The next object is to stretch the gastrohepatic omentum and thus to unravel and straighten out the biliary vessels and ducts. To do this, three or four folds of a veil are laid loosely on the second part of the duodenum, and by means of a "mechanical hand" the spine and the surrounding intestines are drawn well over to the left under the abdominal wound. With other "mechanical hands" and scarves the stomach (use a deep "hand" for this as in Fig. 4 and Fig. 3, 7) and the colon (Fig. 3, 8) are drawn out of the way.

If the patient is now put in the reverse Trendelenburg position, the operation area will be flooded with light, and dissection of the cystic duct and the gall bladder will be possible under good vision. The exposure¹ is so perfect that it is quite unnecessary to touch or drag on the liver, and this means much less postoperative disturbance and nausea.

Common duct. While a good exposure of the common duct is necessary for the removal of gall stones, especially in fat people, it is of inestimable value in injuries to the common duct, which as a rule are due to some accident during a cholecystectomy and occur near the hepatic ducts—a situation very difficult for operative manipulation. The gall bladder and common duct are dissected free from any adhesions, and the operation wound

is "set" as usual. It is wise in exposing the duct to stretch the duodenum downward, not over the spine, and to push up the liver. To do this it is necessary to use four "mechanical hands." Scarves and "mechanical hands" should, therefore, be used to retract out of the operation area (a) the stomach, (b) the hepatic flexure of the colon, (c) the duodenum and small intestines, (d) the liver edge upward. The important retraction is the lifting of the liver, thus stretching, opening up, and exposing the upper part of the common duct for dissection. So as not to injure the liver, it is necessary to use a small blade, with extra layers of the soft gauze, and light pressure.

The exposure obtained is surprisingly good; the operation area is "set" and does not require the annoying constant readjustment necessary in the usual methods. Certainly patience and deliberation are required, but these are amply repaid by the well lighted operation field and by the precision which is possible in the difficult manipulations of the suturing of the hepatic duct into the duodenum, or the suturing of a wound in the upper part of the common duct. Here, as in all operations on the gall bladder, if a dilated stomach is in the way, it is wise to deflate it with a trocar attached by rubber tubing to a suction pump (Fig. 7).

With this exposure it is also quite easy to dislocate the duodenum, to probe the common duct, and to examine the ampulla of Vater, or to carry out any precise dissections or manipulations necessary in this region.

Stomach. The cesophageal end of the lesser curvature of the stomach is the point of greatest

¹This technique has been given in much greater detail in Surg., Gynec. & Obst., 1927, xlv, 85-89.

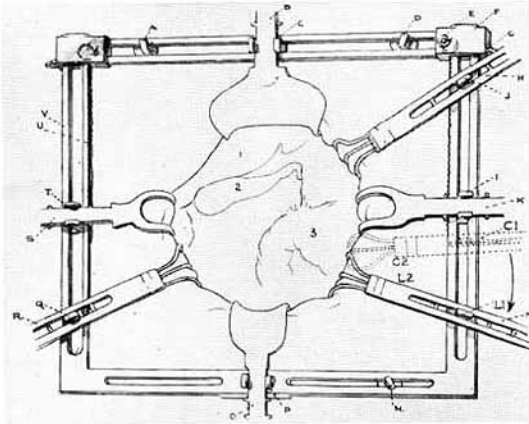


Fig. 5. This is to show how the "mechanical hand" should be inserted and locked. The "hand" is inserted loosely at right angles to bar of frame on to the single hook at *Cr*. A lateral movement in the direction of the arrow to *C2* will now jam the hand without letting the intestine out.

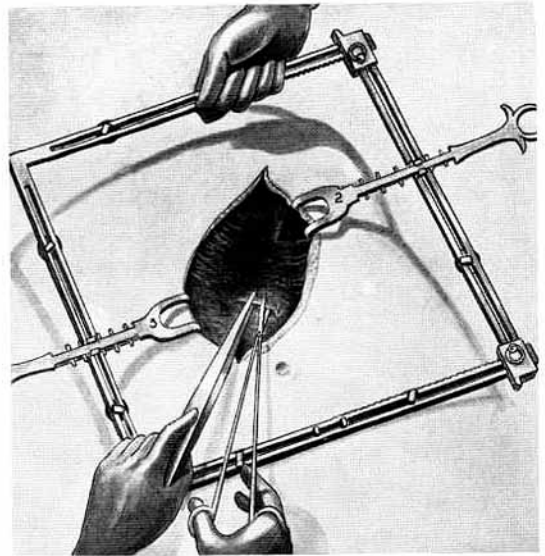


Fig. 6. This shows how, in operations in secondary abdominal cases, a clear space on each side of the incision is made and how into this clear space two retractors are inserted so that the abdominal wall may be lifted to facilitate the disconnection of adhesion from the anterior abdominal wall.

difficulty in gastric operations: it is the most inaccessible; it is important from the point of view of lymphatic infection in carcinoma; it is the starting point for the mobilization of the lesser curvature in contracted and cartilaginous old ulcer. Consequently, we think the main object of any exposure must be this point.

When a left paramedian Bevan's incision has been made,

1. The retractor should be locked in the way described (Fig. 8).

2. The stomach should be deflated by means of a trocar connected to a suction pump (Fig. 7). In the Australasian Medical Congress of 1920, we first drew attention to the great value of this maneuver in difficult operations on gastric conditions.

3. The left lobe of the liver should be covered with some layers of "veil" which should be hooked over to the right with a "mechanical hand" (Fig. 8, 10). This exposes the upper part of the lesser curvature.

4. The patient is put in the reverse Trendelenburg position, so as to throw light into the depths of the wound.

The importance of adequate exposure of this particular region is also stressed, because we think that an operation on a carcinoma of the pyloric end of the stomach should not be started in the usual way, that is, at the pylorus. In our opinion the stomach should be cut across between Payr clamps proximal to the lesion, and the distal segment should be allowed to hang over to the right

so that very accurate dissection of the subpyloric glands and of the adjacent pancreas may be carried out. Bruising of these glands is liable to occur when the dissection is started from the pyloric end.

Very great expertness and speed in bowel suturing can be attained if the frame is used to suspend the bowel segments in proper position by systematic catgut retraction. Advantage should be taken of this in making the gastro-intestinal anastomosis. The segments of stomach and intestine should be fixed together and to the retractor frame by "guy ropes" (Fig. 9, *A* and *B*). This gives a definite tension and a fixed resistance against which suturing may be carried out and this makes for great accuracy and neatness.

Once the retractor is fixed in the wound, very light anæsthesia suffices for an operation on the insensitive stomach.

Posterior wall of the stomach—gastric ulcer penetrating the pancreas. In an operation on the posterior wall of the stomach for a gastric ulcer penetrating the pancreas, the following steps are necessary:

1. The wound is "set" in the way indicated.
2. The stomach is aspirated of air.
3. Large openings are made in the gastro-hepatic and gastrocolic omenta.

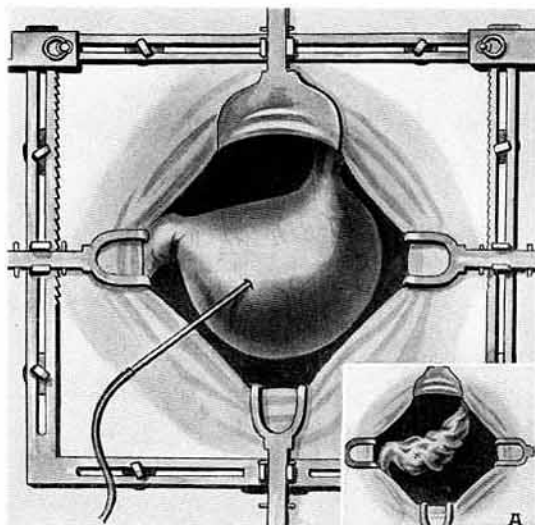


Fig. 7. This shows a stomach which is dilated and filled with air being punctured by a trocar attached to a suction pump. The inset *A* shows the stomach collapsed. In this latter condition it is much easier to operate upon and it allows better operative access to organs in the vicinity.

4. With a "mechanical hand" and scarf the transverse colon is held out of the way.

5. The ulcer is exposed and with an aspirating tube a line of cleavage which will be found between the edge of the ulcer and the pancreas is boldly penetrated. The stomach is dried and with the gloved finger the ulcer is shelled off the pancreas. A scarf is drawn through the openings in the gastrohepatic and gastrocolic omenta and drawing on it the posterior wall of the stomach is rotated so that it assumes an anterior position. It is now possible to suture the ulcer in comfort and with precision.

Pancreas. In the ordinary way the exposure of the pancreatic region is most difficult, as the pancreas is so deep down in the abdomen. Manipulations are hampered by the crowding in of the stomach, colon, and the small intestines. With ordinary method it is difficult to light the operation area.

1. The retractor is inserted.
2. A six-inch incision is made in the gastrocolic omentum.
3. A crumpled-up veil is placed over the transverse colon and another over the stomach (which has been previously deflated), and perhaps another over the duodenum. With as many "mechanical hands" as necessary these organs are pushed under the abdominal wall out of the operating area.

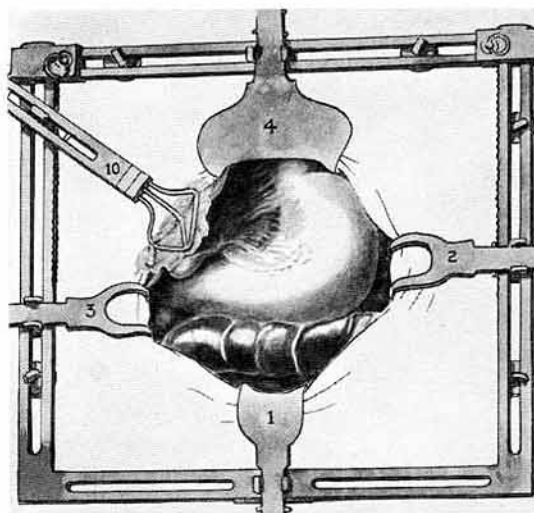


Fig. 8. Exposure of the stomach. Retractor 4 is placed in the upper angle of the wound, and the left lobe of the liver, protected by many layers of gauze, is hooked over out of the way of the lesser curve by "mechanical hand" 10.

4. The area may now be illuminated either by daylight (reverse Trendelenburg position) or by artificial light.

The surgeon will be surprised to find what an enormous difference this exposure makes in operations on the pancreas. Excision of a very large, old, suppurating pancreatic cyst wall in the head of the pancreas and incision of the capsule in acute pancreatitis, have been easily and satisfactorily dealt with by this method.

The kidney from the front. A right upper paramedian incision is made, and the abdominal wound is "set" in the way that has been indicated (Fig. 2). Large folded soft veils are placed over the stomach, ascending colon, and the hepatic flexure. With two "mechanical hands" these structures are drawn toward the midline, and the "hands" are fixed to the median side of the frame. If necessary, a low lying liver may be held out of the way with layers of a scarf and a "mechanical hand" (Fig. 10, 7). The peritoneum is incised lateral to the hepatic flexure and the upper part of the ascending colon. The "mechanical hands" are now unlocked on the medial side of the frame and the colon is stripped from the posterior abdominal wall, the "mechanical hands" reinserted, and this loosened segment of the colon incarcerated still farther into the left part of the abdomen. It may be necessary to use a third small "mechanical hand" on the lower side of the

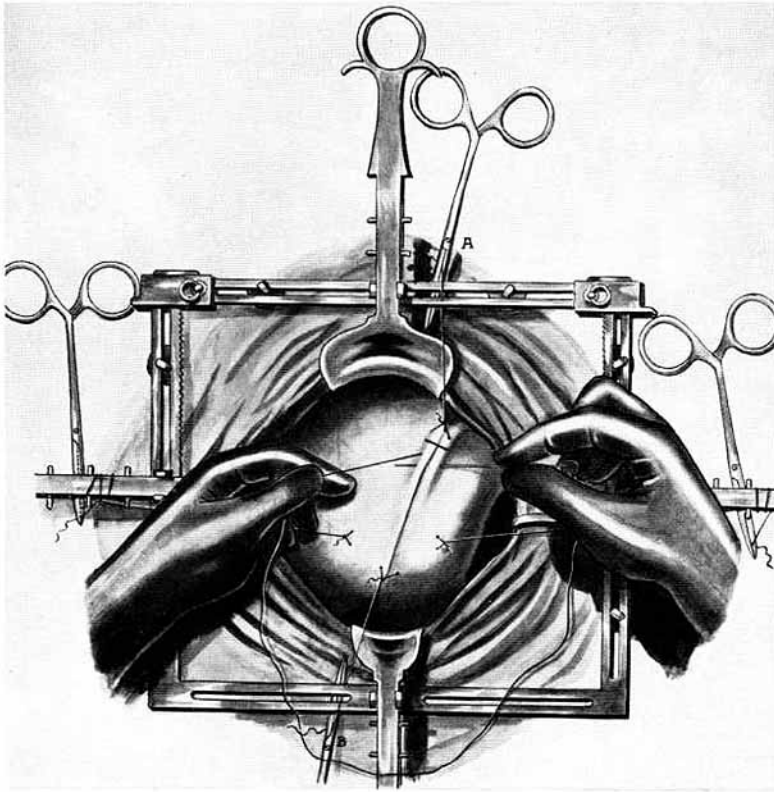


Fig. 9. This gives some idea how segments of stomach and intestine can be fixed to the frame by means of "guy rope" retraction so that exact suturing and accurate adaptation can be obtained and so that suturing can be carried out against constant tension.

frame in order to keep any small intestines out of the operating area. It will now be found that the front of the kidney is well exposed and, if the patient is placed in an exaggerated, reverse Trendelenburg position, the operation area is flooded with light. It is now a very easy matter to isolate the kidney and display its pedicle, which may be delivered more naturally forward than backward. A stab wound in the loin will provide the usual drainage.

This is also the exposure for a chronic subhepatic appendicitis.

Appendiceal region. The average appendectomy gives no trouble, but a good exposure of the appendiceal region is essential and life-saving in what one might call the "mean appendix," that is, the acutely inflamed appendix that from a developmental error is anomalously situated, as, for instance, in the pelvis or in a retrocaecal position; the appendix which is intensely inflamed and

gangrenous and undeliverable; the appendix that is bound down by the fibrosis resulting from inflammation. In all these conditions adequate operative exposure, so as to allow dissection under sight, will avoid intestinal soiling, shock, and bleeding, and make for a neat, expeditious operation.

The following is the method of exposure of a retrocaecally placed acutely inflamed appendix:

The ordinary muscle splitting incision is made, but the incision is continued in the aponeurosis of the internal oblique and transversalis muscles into the sheath of the rectus (after Professor Watson and Davis) (Fig. 11). If the appendix is very inaccessible and more room is required, the incision is connected with a vertical incision *B* in the sheath. The edges of the wound are covered with towelling or rough glove-rubber sheeting (specially made) or with both. With the retractor the abdominal wound is "set," "me-

chanical hands" with small blades being used where necessary (Fig. 4, D).

No attempt is made to find the appendix, but by the tracing of the terminal ileum to the cæcum, the ileocæcal junction is located. The base of the appendix nearly always bears a definite relation to this and is isolated and divided by means of a cautery between clamps. The butt is tied and invaginated into the cæcum (Fig. 12, A). A crumpled-up veil is placed over the cæcum, which, with the hand, is now pushed well under the abdominal wall and so out of the operation area. It is fixed there with a "mechanical hand" (Fig. 12, H). Now by the clamping and snipping of what there is of the appendiceal mesentery, G, the appendix itself can gradually be drawn out from under the cæcum without the least tension being put upon it or the slightest force being used. This "lifting" out of the appendix is important, because very often it is the surgeon who, manually enucleating the appendix, ruptures the inflamed, friable appendiceal tip, and distributes infection through the coils of the very susceptible small intestine. When the appendix lies lateral to the cæcum and ascending colon and is very long, extending up toward the liver, it is possible, by means of the lifting action of the retractor, to elevate the abdominal wall away from the intestines and to create a space, previously only potential. Then, when the patient is placed in the reverse Trendelenburg position and the wound becomes sufficiently well lighted, it is possible to dissect out with long instruments one of these long appendices and to clamp its arterial supply.

Acute pelvic appendicitis. In acute pelvic appendicitis the same wound "setting" is used as for the retroperitoneal type of appendix (Fig. 12). The base of the appendix is found in the same way (Fig. 12, A). Now with "veils" and "mechanical hands" the cæcum is pushed up into the abdomen and the small intestines are cleared from the appendix as it descends into the pelvis (Fig. 13, B). If the patient is now placed in the Trendelenburg position, the appendix can be seen the whole way into the pelvis, so that unhampered by intestines and under good vision, the appendiceal mesentery (Fig. 13, C) can be clamped and snipped with long handled instruments and the appendix itself can be lifted out of the pelvis without the slightest injury. In this way the terminal part of an acutely inflamed pelvic appendix, often gangrenous or thin and full of pus, is never ruptured.

It frequently happens that an appendiceal pelvic abscess causes an obstruction of both the small intestine and the sigmoid, "ileus duplisis" (Hand-

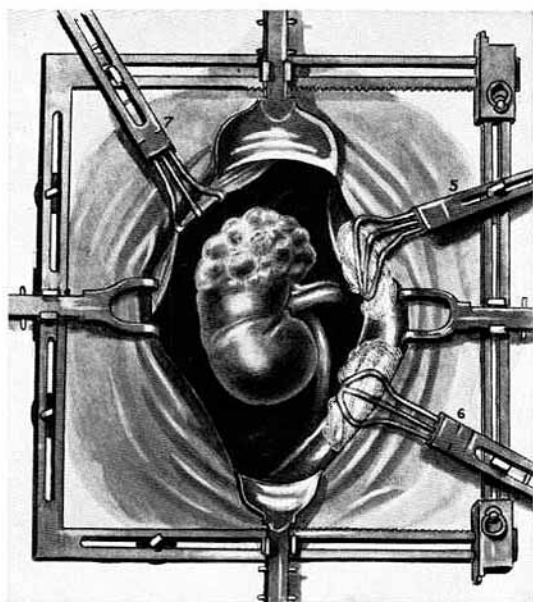


Fig. 10. The exposure of a right kidney by the abdominal route. The ascending colon and hepatic flexure, covered with layers of gauze, are held in the abdominal cavity by "mechanical hands" 5 and 6. The liver, also well protected with many layers of gauze, is held up by the gentle tension of "mechanical hand" 7.

ley). Here the cæcum and the small intestines adjacent to the appendix will be so much dilated that it would be very difficult to give adequate exposure even to a normally situated appendix and certainly next to impossible to remove the deeply situated, acutely inflamed, abscessed, pelvic appendix. In such circumstances the operation can be made almost easy by the insertion of a hypodermic needle of a slightly larger caliber than usual, connected to an air pump, obliquely through the coats of the cæcum (Fig. 14, E) and with this withdrawing intestinal gases. This procedure causes the cæcum and the adjacent foot or so of small intestine to collapse (Fig. 14, D). The aspiration through such a fine needle is slow, but the content is mostly gas, and it is remarkable how this maneuver simplifies what appears to be an almost impossible appendicectomy.

In difficult appendicectomy in acute cases, we deprecate the use of the paramedian incision and we claim for our technique, that is, the modified "split muscle" incision combined with the use of this special retractor and its "hands," the following advantages:

1. The incision is made directly over the base of the appendix—the best point of attack.

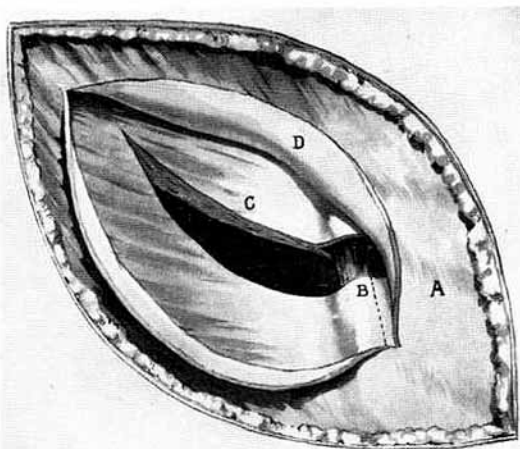


Fig. 11. A modified McBurney incision. *A*, The sheath of rectus; *B*, incision in the conjoint tendon continued into the sheath of the rectus, and, if necessary, vertically down the sheath of the rectus (after Davis and Professor Watson, by courtesy *Journal of the College of Surgeons of Australasia*).

2. The small intestine with its larger and more absorbable lymphatics is not disturbed and soiled, as it must be in the manipulations through, or in suturing of, a midline incision.

3. The pelvis and kidney fossæ—most important regions—are accessible by an aspirating and drainage tube with the least disturbance of small intestines.

4. Valvular drainage may be established and loose suturing may be adopted. This avoids infective necrosis of muscle and subsequent hernia.

The lower end of the ureter. In operations on the lower end of the ureter in the male when the vas deferens must be conserved, a large paramedian incision is not of much advantage. An incision exactly similar to that used for the pelvic appendix may be used, except that it should be made an inch above the inguinal canal. The "mechanical hands" are used in exactly the same way as in the removal of the pelvic appendix, except that they are placed outside the peritoneum and the deep "mechanical hand" (Fig. 4, *A*) is used in the lower angle. This lower angle of the wound should be at a point an inch above the insertion of the rectus muscle into the pubis. At this point the lower end of the ureter is nearest the surface. The "mechanical hands" must therefore be utilized to create the biggest cavity in this region.

The ureter is found at the junction of the internal and the external iliac arteries and traced down to the bladder.

The art of the exposure is the creation of a good operating cavity, adequately lighted (a good Trendelenburg position will probably do this) right over the lower uterus, that is, in the lower angle of the wound.

In a female where the round ligament can be sacrificed without any hurt to the patient, a big paramedian incision will give a more comfortable exposure. In the female in order to create an operating cavity, it will be necessary to push the peritoneum toward the middle line with veils and two "mechanical hands."

The pelvis. This technique is really ideal in operations in the pelvis and makes operations on the rectum and sigmoid very much easier. Retractor 4 fits neatly over the os pubis (Fig. 2).

The wound is "set" in the usual way. The upper end of the retractor frame is lifted; the patient is placed in the Trendelenburg position, when it will be found that the intestines fall easily out of the pelvis into the main abdominal cavity. "Mechanical hands" (Fig. 2) are now used to incarcerate them in this situation. The acute angles of the "mechanical hands" prevent them from encroaching on the operation area. If the rectum or sigmoid is the object of the operation, the latter is left lying in the pelvis. If a fibroid is too big to deliver through the retractor, it is delivered first and the retractor is inserted afterward.

Urinary bladder. The ratchet action, "mechanical hands," and four-blade principles of the retractor can be most successfully applied to operations on the urinary bladder, such as those for the prostate, papilloma, or diverticulum.

Prostate. For operations on the prostate the moveable bar *C* is adjusted to a position on the frame about the points *A* and *B*. "Mechanical hands" (Fig. 15) with blades *E* (Fig. 4) are inserted into the opening in the bladder. The bladder wound is now opened with the ratchet which may even tear it a little, until there is a sufficiently large opening through which to work. Into the upper angle of the wound is inserted a "mechanical hand" (Fig. 15, 3) with a very acute angled blade which is made somewhat like a soup spoon. This is used to push the fundus of the bladder up into the abdomen so as to draw up any retroprostatic pouch and flatten the base of the bladder and also to bring it nearer to the surface. It is our experience that in a fat person the weight of the intestines makes the fundus of the bladder bulge downward and renders a satisfactory exposure of the prostate difficult. It may be necessary to use a small blade (Fig. 4, *D*) in the lower angle of the bladder wound in order to give a bet-

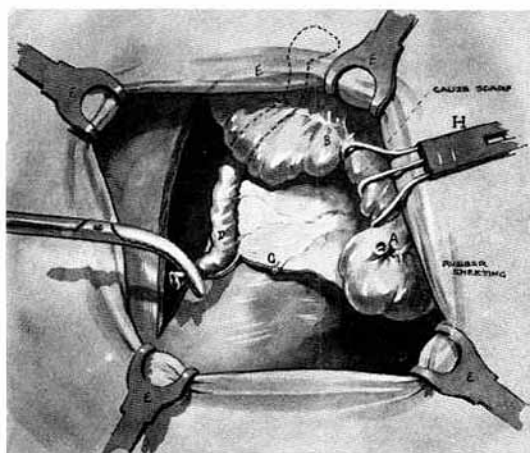


Fig. 12. Exposure for retrocaecal appendix. *A*, base of appendix divided and butt invaginated so that caecum *B*, covered with a scarf, can be pushed into the abdomen with a "mechanical hand;" *C*, arterial twigs being snipped and tied; *D*, appendix (retrocaecal); and *E*, the abdominal wall is lifted up with the retractor so that the terminal part of the appendix (dotted in) may be removed under good vision. (By courtesy *Journal of the College of Surgeons of Australasia*.)

ter view of the anterior margin of the prostatic orifice, and to act as counter-pressure to the "mechanical hand" in the fundus.

A small lamp may be screwed into a socket in the middle of the highly silvered "spoon mechanical hand" (Fig. 15, 3, inset). From the shelter of the fundus, this lamp reflects light directly on the prostate and trigone or wherever necessary.

The patient should be placed in the Trendelenburg position.

Papilloma. In operations on papilloma of the bladder the exposure will need to be wider and to be contrived so as to suit the situation of the lesion. It may be necessary to insert the blades in a radiate fashion. At any rate they should be so adjusted that the papilloma area is free to be dissected.

Malignant tumor. In malignant tumor of the bladder where it may be necessary to resect a large portion of the bladder wall, a low median incision is made between the recti and pyramidales, and the peritoneum is opened. The retractor is inserted in the usual way and with it the abdominal wall is lifted. The intestines are removed from the pelvis and incarcerated in the main abdominal cavity by means of a veil and two "mechanical hands" (Fig. 2, 5 and 6).

The patient is placed in the Trendelenburg position. With a trocar and pump the bladder is aspirated. The bladder is opened and dried out

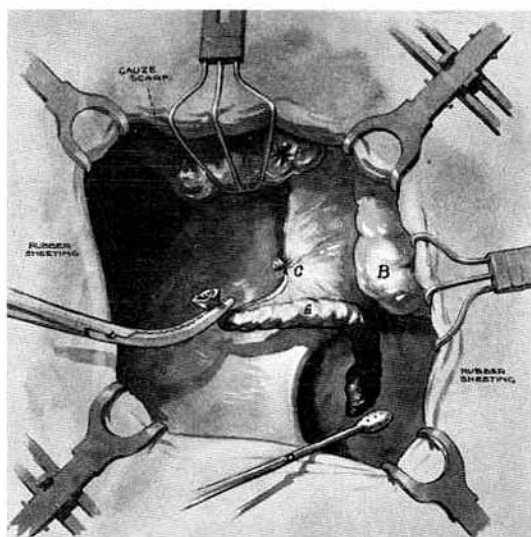


Fig. 13. Exposure for pelvic appendix. Base of appendix divided between clamps and invaginated. *A*, Deilated caecum covered with gauze and held out of operation area with "mechanical hand" (blade flexed at an acute angle); *B*, small intestines covered first with omentum and then with a scarf and excluded from operation area with "mechanical hand;" *C*, arterial twigs in mesentery clamped, cut, and dried so as to make the appendix come up to the operator; *D*, aspirator for perforating the abscess and rapidly and completely removing the pus; and *E*, pelvic appendix. (By courtesy of *Journal of the College of Surgeons of Australasia*.)

carefully with an aspirator tube. The bladder is isolated and the tumor is resected. As the resection of the tumor proceeds, corresponding or particular parts of the bladder wall should be fixed to the frame by catgut "guy ropes" in order to keep the proper relations for reconstitution of the remnants of the bladder. This allows replanning and easy and exact suture of the much mutilated bladder.

Diverticulum of the bladder. "Guy rope" catgut retraction is particularly valuable in the removal of a very large and adherent diverticulum through the bladder.

The edges of the diverticular opening are freely incised and the neck of the diverticulum separated from the bladder wall. The diverticulum is now freely exposed by the drawing of the bladder wall away from it by a number of "guy-rope" catgut retractions placed symmetrically round the frame. It may even be possible to expose the diverticulum further by the insertion of a couple of narrow deep "mechanical hands." By these means the opening in the base of the bladder is set widely open and brought nearer the surface. This

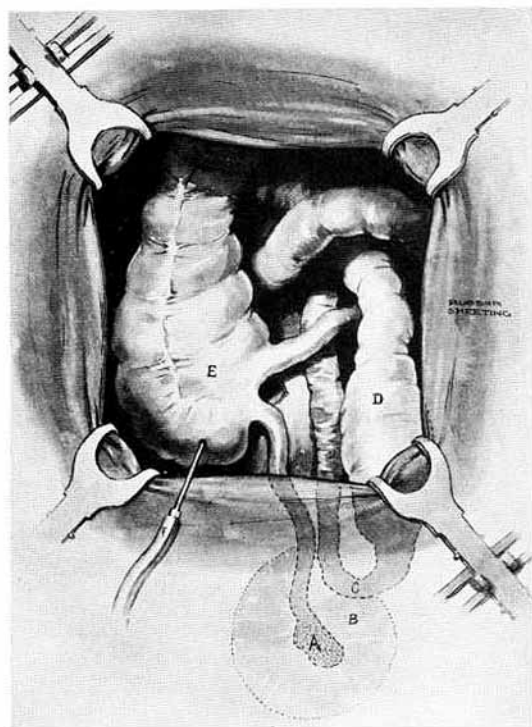


Fig. 14. Exposure of pelvic appendicitis with "ileus duplilis." A, infected appendix (dotted in); B, abscess (shadowed in); C, paralyzed segment of small intestine; D, obstructed small intestine; E, dilated cæcum; and F, hypodermic needles attached to air pump deflating cæcum.

renders it possible, with long scissors and forceps, to dissect out the diverticulum under good vision, so that it keeps on coming up to the operator, as he snips around the walls.

This system of retraction is also most useful in the extraperitoneal removal of a diverticulum.

SUMMARY

We have found that this technique has great potentiality in enabling the surgeon to get out of serious operative difficulties. To every surgeon there must come a time when, unexpectedly, an almost insurmountable operative problem occurs at an operation or the unexpected happens. For instance, a patient has been operated on for gall stones. No disease of the gall bladder has been found, but examination reveals that the kidney has a dilated pelvis. It is a matter of a few minutes to rearrange the retractors, deliver the kidney into the wound, and explore or deal with the kidney condition without making a fresh incision. Or if a gastric lesion is found, the incision can be

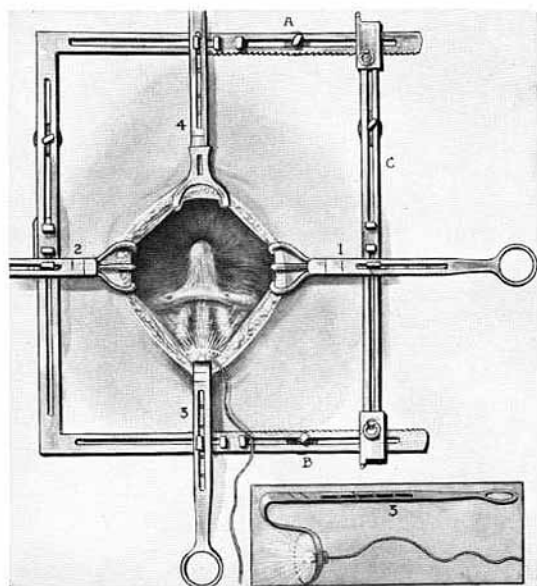


Fig. 15. Retractor set in the bladder for exposure of the prostate. "Mechanical hands" 1 and 2 are used to retract opening in bladder (see Fig. 4, e). Retractor 4 is seen in Figure 4, d, and retractor 3 is a spoon shaped "mechanical hand" with a light in the middle of the highly silvered spoon.

made to expose the whole of the stomach by just rearranging the retractor so that the incision is made wider at the expense of its length. The reverse happens. During an operation for a gastric lesion a pathological condition of the gall bladder is found; the gall bladder can be removed without enlarging the incision.

Let us suppose that in operating from the abdomen a hydatid cyst or an abscess of the upper surface of the liver is found; then, it is possible to elevate the costal arch, to press the liver down, and to create a space that enables the surgeon to attack the upper surface of the liver. It is quite unnecessary to go through the pleura. Once the abscess is opened, counter drainage at its lowest point can be easily established. In a similar way, access can be obtained to the left side of the diaphragm, so that adhesions from a spleen can be severed with a scissors, rather than be torn by the hand.

The patient has disease of the gall bladder but needs the removal of the appendix as well. An incision is made as high as possible in the abdomen, just sufficiently big to enable the gall bladder to be removed. The abdominal wall is elevated, a swab on a holder is pushed against the anterior abdominal wall at McBurney's point from inside

the abdomen. A stab incision is made on to this. With the left hand in the abdomen, the appendix is delivered through this stab incision and removed. One stitch closes it. This means that there is an incision very high up in the abdomen and a tiny incision in the lower part of the abdomen—a much better arrangement from the patient's standpoint so far as the strength of his abdominal wall is concerned, than the necessarily big incision in the middle of the rectus, made to give access to a high gall bladder and a low appendix, at a point where there is the greatest postural tone.

An appendix is being removed: it is found that the patient has a uterine fibroid. It is an easy matter by the incision of the sheath of the rectus and the re-arrangement of the retractor to elon-

gate the incision so that the fibroid tumor can be removed without a fresh incision being made. A hernia is found: it is possible to close the opening from the inside. Indeed, additional uses are constantly being found in which this method of operating is a distinct advantage.

This technique has to be seen in order that its potentiality and its rationality may be appreciated, but even we who have employed it for years, could not adequately tell our readers what it has meant to the great number of patients on whom we have operated; to the surgeons whom we have initiated into its many uses; and to the assistants and nursing sisters. Any surgeon who would assimilate this method, must cultivate it before he can regard it as part and parcel of his general technique.