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OPERATIVE TREATMENT OF CANCER OF THE RECTUM.*

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In the communication which it is here my privilege to make before this Association I wish to do no more than mention very briefly the case report and then proceed to discuss at greater length the question of the operative treatment of cancer of the rectum and the bearings which the operation described may have on it.

In the spring of 1903 there was admitted to the Royal Victoria Hospital in my service a man, aged 23, who had for nearly five years been suffering from a tuberculous proctitis. A left iliac artificial anus practically cured the condition, but at the expense of great scar narrowing, so much so as to constitute an obstruction. This condition defeated several attempts at closure of the artificial anus, and ultimately, so to speak, forced on me the idea of a total excision of the bowel from the artificial to the natural anus, though with preservation of the sphincter, together with implantation of the descending colon into the anus, which last was to be accomplished by free cutting of the mesocolon.

The natural objection, *a priori*, was that the blood supply would be too seriously damaged to permit of any such maneuver, yet on looking closer into this question I became convinced that such need not be the case. The anastomoses between the middle and left colic and between the left colic and the sigmoid arteries are so free by way of the communicating loops situated near the mesenteric border of the bowel that, as I believed, one need only take care to spare these loops in the ligation of the mesosigmoid and mesocolon; that is, one need only make sure of ligating the arteries close to their origin from the inferior mesenteric and the blood supply would be assured.

I then looked through the literature and found that Kümmell¹ of Hamburg had performed the operation on two occasions, De Quervain² once and Treves³ once.

Therefore, after doing it on several cadavers, I felt justified in proposing it to the patient, who willingly consented.

Operation.—July 5, 1905, the operation was carried out. I need not describe the procedure at this point; its essential details were as just indicated; they are described in the somewhat fuller article published in the Transactions of the Section on Surgery and Anatomy.

* Read in the Section on Surgery and Anatomy of the American Medical Association, at the Fifty-eighth Annual Session, held at Atlantic City, June, 1907. The article is here abbreviated, especially in its statistical portion. The complete article appears in the Transactions of the Section and in the author's reprints.

1. Arch. f. klin. Chir., lix, p. 555.

2. Rev. Méd. de la Suisse Romande, Dec. 20, 1901.

3. Lancet, Jan. 29, 1898.

Postoperative History.—The patient died of shock twelve hours later. This unfortunate result was not due to the operation as an operation, but rather to avoidable conditions—a weak patient, too painstaking a ligation of the mesorectum, making a long and slow operation; and finally afterward the omission of stimulation, especially intravenous saline, owing to an unfortunate misunderstanding. The postmortem showed no sign of a failure of circulation in the bowel brought down.

This has been my only experience in the performance of this operation and, though unsuccessful, it taught at least the lesson, as shown by the postmortem, that the descending colon with the splenic flexure could be so loosened from its posterior attachments as to be capable of being brought down to the anus without endangering its blood supply. This was a mere confirmation of Kümmell's experience previously related and of De Quervain's.

Lately, however, the idea has been strong in my mind that the principle involved possessed a very definite application to the operative treatment of cancer of the rectum.

The line of thought, elaborated in what follows, was briefly this: The results of the operative treatment of rectal cancer are poor; a wider removal of possibly infected glands than has usually been practiced is necessary. This will necessitate resecting the bowel at least from the level of the promontory. To bring, in spite of this, the proximal end of the bowel down to the anus, in order to escape the *bête noire* of an artificial anus, it will be necessary to mobilize the sigmoid or what is left of it and, on necessity, the descending colon also, by cutting the supporting structures. Can this be done without endangering the blood supply of the bowel brought down?

There is here no time to enter on any discussion as to the comparative value of the various types of operation in common use, nor can I summarize even briefly the published results. These are considered in the unabbreviated article. Speaking generally, I need hardly fear contradiction of the statement that the immediate mortality is high and the ultimate results poor.

In endeavoring to form a judgment on the merits of rival operations in this field there are three chief points to keep in mind: First, the immediate operative mortality; second, the preservation of fecal control; third, most important of all, the permanency of cure. On these points we have now a large body of statistics which are as usual more or less fallacious. In a general way, however, one is justified, I believe, in drawing certain conclusions.

If a slight dogmatism might be forgiven for the sake of brevity I would venture to make my own confession of faith with regard to this matter. I would divide rectal cancers into two classes, from the standpoint of operability: 1, Those which are situated in the anus or so close to it that a properly wide removal must needs sacrifice the sphincter; 2, all those above this in which the

sphincter can be saved. It is only of the second class that I wish here to speak. It includes not only the high cancers of the rectum but also those of the middle or ampullary portion.

In the first place the surgical principle, which alone in these days is applicable to the removal of cancer, is that of a block dissection of tumor and glands, including not alone the palpably involved glands but also those which belong to the same lymph territory and are "suspects." With regard to cancer of the rectum, Gérota²¹ has shown that the glands which immediately drain it run up to, and often a little above, the promontory of the sacrum. In operating for cancer of the rectum it is imperative to remove all these glands, and naturally with the glands must go the bowel also, in the mesentery of which they lie. With the access given by the sacral opening which does not extend above the third sacral foramen (Fig. 2) it is difficult, if not impossible, to remove the glands that lie above this point and which may extend as high as, or even above the promontory. Therefore, on this basis the sacral operation is *ab initio* incomplete and consequently unsurgical; and it can hardly be doubted but that this fact is to a certain degree responsible for the frequency of recurrence in rectal cancer.

This is, to my mind, the fundamental objection to the

Fig. 2.—Showing how poor is the access obtained through the sacral opening for the removal of high tumors and of the rectal glands which extend up to the promontory. (Tracing of Fig. 167, vol. 1 of Spalteholz-Barker Anatomy.)

Kraske operation. So true is this that Kraske himself, the father of the operation, at the Twenty-ninth German Surgical Congress, roundly declared himself in favor of the combined abdomino-sacral operation, to the end of a more thorough removal of the disease, for the stated reason that the sacral operation alone was followed too regularly by recurrence. The corollary is that only from the abdomen, or at least with the help of an abdominal incision, can a really thorough eradication of the dependent gland territory be made. In this point the abdomino-perineal operation is right in principle.

In the second place, it being granted that the bowel and the glands must be removed as a routine procedure from the level of the promontory, it becomes evident that the proximal end of the bowel will frequently be too short to pull down to the distal stump or to the anus, or, at least, that if brought down it will be under a tension such as to invite necrosis. Constantly throughout the literature of the sacral operation one meets the mention of this difficulty and the consequent falling back on a

sacral anus, or, if united, the occurrence of necrosis and fistulas. As to the effect of tension, any pull on vessels narrows their caliber, and Rehn has shown that in bringing the upper rectum or sigmoid down under tension there is a very decided pull on the superior hemorrhoidal artery; and if the pull be great the inferior mesenteric itself may become kinked. It is conceivable also that the superior hemorrhoidal is easily compressed against the projection of the promontory if the bowel is brought taut across the latter. In an excision a year and a half ago by the vaginal route the bowel, which I had brought down from about the level of the second sacral to the anus under very slight tension, underwent necrosis for the last inch or more. Other reasons which have issued from certain injection experiments detailed below will be mentioned later.

The sacral operation, moreover, as already said, is apt to damage sphincteric action by cutting its nerve supply. Even Hochenegg and Kraske secured fecal control only in half of their sacral cases in which the continuity of the bowel was restored. For these main reasons I believe that the sacral operation as a type procedure should be abandoned.

The Quénu-Mayo operation effects an ideally wide removal under the best conditions of asepsis, and in that sense is surgically perfect. Nevertheless, it is exposed to two objections, of which the first is its routine establishment of an artificial anus. To sacrifice deliberately in every case all hope of the natural evacuation of the bowels will always seem to most of us a sad confession of failure; nay more, a distinct step backward. One may be ready to admit that a good iliac anus with a sigmoid trap and an intermuscular insertion may be a very comfortable thing, but the patient will rarely take that view of it. To him it is nearly always the worst kind of a *pis aller*. One of Reverdin's²² patients, it is true—a lady in whose case he had been obliged to establish a permanent left iliac artificial anus several years previously—remarked to him one day: "Je ne comprends pas que le bon Dieu ne nous ait pas mis le derrière devant; c'est bien plus commode." An observation of a truly Gallic nature, difficult to turn into proper English. Against this, however, might be set the opinion of a patient of mine, likewise a Frenchwoman, who has had a perfectly functioning artificial anus for two years past, yet maintains that she would much rather be dead and pass no stools than alive and pass them as she does. This more truly represents the general opinion. Indeed, Mayo naively remarks that "for sentimental reasons a large number of patients elect the posterior operation even after careful explanation."

The second objection to the abdomino-perineal method lies in the fact that, at least in men, its operative mortality is so high, even in expert hands. That of the sacral operation was due rather to infection than to shock; that of the combined method may perhaps be due rather to shock than to infection. And the shock, as I believe, is due not alone to the extra time needed or the extra blood lost, but also, as Crile has shown, to the extra wounding of sensory nerves. The severity of the ordeal is seen in the results reported by Quénu and Mayo. If past masters in the handicraft of surgery like the Mayo brothers, working, moreover, together in this operation for greater speed, lose so many as the result of the operation, how many will the less expert man lose? An exception might perhaps be made of the female cases in which, according to Ito and Kunika, the operative mor-

21. Arch. f. Anat. u. Physiol. (Pflüger), Anat. Abtheilung, 1895.

22. Bull. et Mém. de la Soc. de Chir., Paris, xxiii, p. 409.

tality has been reduced to 9 per cent. In these, however, the first objection remains valid.

Reasoning in this way one comes naturally to an ideal. First, complete block removal of the bowel with its glands, beginning above and starting at least at the level of the promontory (that is, usually through the junction of rectum and sigmoid, according to the older anatomists, or through the middle or the lower third of the pelvic colon, adopting the phraseology of Poirier and the Continental anatomists), but preferably even a little higher, and extending down to well below the growth, the only exceptions being possibly those tumors situated either at or very close to the sphincter. Second, the preservation of sphincteric control where the growth does not invade or abut on that muscle, and the re-establishment of the natural course of fecal evacuation. Third, the lessening of the operative mortality. There are here two problems from the operative standpoint: 1, To remove the bowel high for the sake of thoroughness, and, in spite of that, to bring down the upper segment to the anus for the sake of fecal control; 2, to do this with the least danger of shock, sepsis and other causes of early mortality.

It is with regard to the first of these two problems that I desire to present a certain small amount of practical work.

In a general way the operations reported by Kümmell, de Quervain, Treves and that here recounted demonstrated the possibility of bringing the bowel from just below the splenic flexure or even the transverse colon down to the anus, without tension and without endangering its blood supply. The point, however, is expressly emphasized by Kümmell and de Quervain that the sigmoid and the upper rectum are far less able to be mobilized and brought down than is the bowel above. In the words of Kümmell:²⁴

We were forced to believe (by certain cases of bowel necrosis) that the circulatory conditions in the rectal and sigmoid portions of the bowel when these were freed from their mesenteric attachments, were extremely unfavorable, and that the collateral paths were insufficient to afford the necessary nutrition.

Kümmell's advice in a general way was not to depend on the preservation of blood supply in the sigmoid flexure when it had to be mobilized by cutting its mesentery, but rather to go higher and trust only to the descending or even the transverse colon. And this is exactly what De Quervain²⁴ carried out, obeying this counsel.

Now in the case of rectal or low sigmoid cancer it is evident that, though it is necessary to remove bowel higher than is usually done for the sake of removing possibly infected glands, it will still be desirable to remove no more of it than really is necessary; or, speaking specifically, it will be desirable to save as much of the sigmoid flexure as does not need to be removed on account of there being suspicious glands in its mesentery; and this for the sake of its easier bringing down as well as for the avoidance of unnecessary operative work.

I believe that the injection experiments now to be described demonstrate that while the procedure advised by Kümmell is not only possible but also advisable in certain rare cases of disease extending from the anus up to the descending colon or splenic flexure, it is quite unnecessary to go to such lengths in the case of rectal or sigmoid cancer. We shall revert to this question later.

The bowel being cut through, say, at the level of the promontory, the question, therefore, is, can the sigmoid in all cases be brought down to the lower end or to the anus? Or are we obliged, as Kümmell and De Quervain say, to resect the sigmoid, too, and bring down the descending colon in order to be more sure of the blood supply? In many cases the sigmoid loop is so long that the former can be done with very little trouble. In many others, however, with a sigmoid loop which is short, either congenitally so or as the result of the contracting effect of cancer,²⁵ this will be impossible. These cases in the past have been given a sacral or an iliac anus, or the bowel has been brought down under tension with consequent necrosis.

I may say at once that I believe it will be found possible in practically all cases, whether the sigmoid, that is in particular, the pelvic colon, be short or long, to bring the cut end of the bowel down and pull it through the everted lower segment without tension. Mechanically the task consists simply in cutting the structures that hold the upper end up. These are the peritoneum, the superior hemorrhoidal and the two or three sigmoid arteries, together with the areolar tissue that forms the mesosigmoid and the upper end of the mesorectum, and also the band of the peritoneum and cellular tissue which binds the upper part of the sigmoid, i. e., the iliac colon, close down on the psoas in the basin of the false pelvis. If the cutting of these structures be still insufficient to allow the sigmoid and iliac colon to come down to the anus it would be necessary to free the descending colon. The difficulty in doing this lies in the fact that this part of the bowel possesses a mesocolon only in about 20 per cent. of cases; in all the rest it is bound to the posterior wall of the abdomen rather firmly by the peritoneum which covers only about two-thirds of its circumference. This, of course, is its chief support. If one succeeded in loosening it, one might still be obliged to cut the left colic artery or even the inferior mesenteric itself before being able to get the bowel down to the anus without tension.

It is plain that there may occur the necessity of very extensive cutting of the mesentery with its vessels, involving a large portion of the direct arterial supply to the bowel. What then are the limits to which one could go in this way without running any risk of causing circulatory necrosis?

EXPERIMENTS.

In order to determine this experimentally I ligated in a series of cadavers the arteries in question in various combinations and then drove in an injection from the thoracic aorta. I also operated on two animals.

The protocols run as follows (it should be noted particularly that in all the experiments ligatures were placed and the mesocolon cut as far from the mesenteric border of the bowel as possible):

1. *Body of an Infant.*—Ligatures placed on the superior hemorrhoidal artery and on all the sigmoid arteries at their common root. The injection was then made from the thoracic aorta and the injection material (starch and red lead in water) can be traced as far as the end of the sigmoid loop (Fig. 3).

2. *Body of an Infant.*—Ligation of inferior mesenteric artery near its origin; additional ligatures placed on the left colic and three sigmoid arteries at their origin. Injection. The

25. Schuchardt (*Centralt. f. Chir.*, 1900, No. 28, Beilage) has emphasized the fact that in most cases of tuberculosis and of syphilis of the rectum or sigmoid, and in many cases of cancer of this region, the bowel becomes gradually shortened, and that this shortening may be very great, so much so as to obliterate the sigmoid loop. Witness the case reported at the beginning of this paper.

24. *Arch. f. klin. Chir.*, xliv, 1892.

skigram in Figure 4 shows the result. There was an exceptionally free collateral circulation established in this case—from the middle colic right down to the terminal branches of the superior hemorrhoidal by way of the mesenteric border loops. It is probable, however, that the injection found its way by a short cut, which had escaped ligation, into the superior hemorrhoidal and that the collateral circulation was not by anastomosis with the lowest sigmoid. The mesentery with the blood supply up to the splenic flexure might here have been cut for mobilization without ill effect, if ligatures were placed as in this specimen.

3. *Body of an Adult.*—The superior hemorrhoidal and the sigmoid root were tied. The injection penetrated to the lower end of the sigmoid and very slightly into the rectum.

4. *Body of an Adult.*—Ligatures placed on the left colic, the sigmoid root and the superior hemorrhoidal arteries. Injection from the thoracic aorta; the injection penetrated nearly but not quite to the bottom of the sigmoid loop.

5. *Body of an Adult.*—In the fifth specimen (Figs. 5 and 6) the operation subsequently proposed as the type procedure, was carried out. The bowel was resected from about the middle of the pelvic colon opposite the promontory to within two

mobilized (as usual, there was no mesocolon) by cutting the serosa on its outer side from pelvis up to splenic flexure, and then stripping it bluntly from the posterior wall. In this way it could be brought very easily over to the middle line. The bowel end was thus brought down and pulled through the lower fragment, projecting about two inches outside the anus; and while in this position the body was injected from the thoracic aorta. As the skiagram (Fig. 6) shows, the circulation is fully maintained right to the end. The loosening of the descending colon in particular by blunt stripping of it across to the middle line had not interfered in the least with its blood supply, nor had it cut vessels of any consequence in the retrocolic fatty and areolar tissue, inasmuch as there was no exit of the injection fluid in this region.

This experiment in particular, together with the previous ones, seemed to me to prove that the fears of Kümmell and De Quervain as to the insufficiency of the collateral blood supply to the sigmoid when the arteries of the mesosigmoid are tied, were without foundation, although quite justified in the case of the first portion of the rectum, that is, the lowest portion of the pelvic colon. There are but two danger zones that have presented themselves in these experiments: 1, The zone of anastomosis between the lowest sigmoid and the uppermost superior hemorrhoidal branches. Here the anastomosis is poor as compared with that of the blood supply to the bowel above this point, and in the experiments the injection rarely penetrated to any extent into the upper rectum if the superior hemorrhoidal were tied. This artery runs a long course from its origin in the inferior mesenteric over the promontory and down to about the third sacral vertebra before it bifurcates into its terminal lateral branches. In this long course, as I have verified in a series of dissections, it gives off but one or two vessels, and these comparatively small ones, to anastomose with the lowest of the sigmoid branches and form a mesenteric border loop. The poverty of communication is seen in the illustrations (Figs. 3 and 4).

It is altogether likely that the reason for the constant tale of necrosis and fistulas as complications of the Kraske operation lies in the fact that the bowel is very apt to be cut off about this region in the sacral operation, and that in order to bring it down to the lower end its mesentery or the retrorectal tissue, containing its blood supply, is cut too close to the bowel in the effort to free it. This partial interference with blood supply in a region already but poorly nourished, comparatively speaking, together with the slight tension under which in many cases the bowel is pulled down, suffices probably to induce a certain amount of necrosis in the upper fragment in those cases which develop fistulas after circular suture.

One further contributing factor, as I believe, lies in this, that the superior hemorrhoidal in its course over the promontory does not lie close to the bowel but far back in the lumbo-sacral root of the mesentery of the pelvic colon, approaching the rectum at an angle, like the string of a bow, and ultimately becoming closely applied to the rectum only at the third sacral vertebra. Consequently the mesentery of the pelvic colon as it approaches the rectum must be cut very far back from the bowel and very close to the sacrum if the superior hemorrhoidal is to be preserved. Being severed, as it nevertheless frequently must be in the freeing of the bowel, the circulation has to depend on the one or two small anastomotic branches communicating with the lowest sigmoid branches above the point of ligation, and these are apt to be insufficient. Moreover, they, too, may be cut in freeing the bowel because they come off from the

Fig. 3.—Skiagram. Ligature of sigmoid and superior hemorrhoidal arteries near their origin at points marked X, followed by injection from thoracic aorta. The bowel is viewed as from behind. The arterial network stands out in the skiagram because of the red lead in it. Note how amply the sigmoid has been supplied from the left and middle colic arteries by way of the large border loops; also how the supply diminishes steadily in the border region between the lowest sigmoid artery and the superior hemorrhoidal, which corresponds to the first portion of the rectum according to the classic description, that is, from the promontory to the third sacral vertebra. The anastomoses with the superior hemorrhoidal are poor. Although the latter vessel seems to show in the skiagram, as an irregular, patchy line, it was in reality not injected; its appearance is due to a ridge of mesentery inclosing the vessel accidentally smeared with the injection fluid. Outlines of the arteries injected heightened with India ink to guard against their possible disappearance in the process of large reproduction.

inches from the anus, the portion removed measuring 10 inches after preservation in formalin. The proximal end was freed by ligating the superior hemorrhoidal and the sigmoid vessels at their root and dissecting off the iliac colon (fixed portion of the sigmoid) by blunt stripping from its bed in the iliac fossa. In addition (although this was quite unnecessary for the purpose of bringing the bowel down to the anus, abundant slack having already been obtained), the whole descending colon was

main artery low down, not far from the bifurcation. This would make the circulation still more precarious.

The second danger zone is that of the anastomosis between the superior and the middle hemorrhoidal terminals. It is less certain and less important, and I omit further discussion of it here for lack of space.

6. *Body of an Infant*.—Ligature of the inferior mesenteric artery, and also of its branch, the left colic, with cutting of the mesentery as far as the division of the left colic, leaving a broad flange of it attached to the bowel. Removal of the sigmoid and rectum, then injection. The injection filled the territory of the left colic very freely down to the cut end of the descending colon.

7. *An Adult Cat*.—Resection of the rectum, descending colon and part of transverse, with invagination of the transverse into the rectal stump. The circulation was maintained.

8. *Dog (terrier)*.—Excision of two and one-half inches of the descending colon with ligature of the inferior mesenteric artery and of the meso-colon up to the colica media. End-to-end suture. Death two days later from bursting of stitches and evisceration. At postmortem circulation to both segments of the bowel well maintained.

Several injections were also made after tying off the inferior mesenteric artery in dogs and cats that came to postmortem. This showed uniformly a very free collateral circulation from the middle colic artery by way of the border loops into the inferior mesenteric district. Morestin²⁶ ligated during life the inferior mesenteric in five dogs, and found that the circulation was constantly re-established without the least difficulty.

There is a reasonable degree of parallelism between these animals and man in respect to the blood supply, but not in respect of the ease with which the transverse or descending colon may be brought down to the anus, because in the cat and dog the descending colon and rectum possess a very free mesocolon, and the sigmoid loop is absent. In any case these extensive resections and ligations did not disturb the blood supply of the bowel brought down.

The experiments as a whole showed that one might cut off the whole arterial supply of the descending colon, sigmoid and rectum, and still find the circulation maintained as far as the lower end of the sigmoid at least, provided only that the vessels were ligated far back from the bowel so as to leave a broad flange of mesocolon containing the important anastomotic loops of the mesenteric border.

In view of these facts it seems justifiable to assert that the cancerous rectum may be removed in its whole extent from the promontory downward, with the whole territory of the anorectal (Gérola) glands; that the upper segment by employing a proper method of mobilization may nevertheless in all cases be brought down to and through the anal segment without tension and without danger to its blood supply; and that by that fact the necessity or the advisability of a permanent artificial anus disappears, save for the cases that come to operation during obstruction and the inoperable ones in which obstruction threatens, and short circuiting is impossible. It is probable that for the first class of rectal cancers, those cases in which the sphincter has to be sacrificed in removal, an iliac anus may be preferable to a perineal one without control.

OPERATION PROPOSED.

On the basis of these facts I would like to summarize the details of the operation which to my mind fulfills best the indications of the proper operation for cancer of the rectum, and which I would venture to propose as the normal procedure. It is with some hesitation that I do so because there is still lacking the application to the human, save in so far as the experience related at the outset of this communication may bear on the matter. Yet I hope that this experience, such as it is, together with the results of the cadaver injections and the general surgical principles involved, may be considered sufficient justification for venturing to bring these views of the question before the profession even in this unfinished stage. The *raison d'être* of the method lies in the proof given here, in so far as it is proof, that the circulation in the sigmoid is well maintained under circumstances of extensive mobilization.

The operation may be thus described: The tumor is supposed to be situated somewhere between the pelvic floor and the promontory, so that the sphincteric ap-

Fig. 4.—Skiagram. Ligature of the inferior mesenteric at its root; also of its branches, the left colic and the four sigmoid arteries near their origin. The subsequent injection coming by way of the superior mesenteric, in particular the middle colic, filled the whole territory—descending colon, sigmoid and rectum—that had presumably been cut off by the ligatures of the arteries mentioned. Note, however, how the supply to the first portion of the rectum, from promontory to third sacral vertebra (the latter marked by the bifurcation of the superior hemorrhoidal) becomes comparatively poor and how little anastomosis there is of the sigmoid with the superior hemorrhoidal. The latter vessel would almost certainly not have been injected here if it had not been for a small collateral running in between the ligatures on the inferior mesenteric and the sigmoids, which escaped ligation; this led almost directly into the superior hemorrhoidal. The outlines of the arteries have been heightened with india ink as far as the mesenteric border for reason given.

paratus, including the levator ani, remains intact after resection of the bowel. As an anesthetic one might use lumbar anesthesia by way of nerve blocking for the avoidance of shock in so far as this depends on the cutting of sensory nerves. To what extent, however, it is permissible to use lumbar anesthesia with the Trendelenburg position long maintained I am unable to say. The latter is important for work in the pelvis. A preliminary colostomy is undesirable, inasmuch as it might

interfere with the free mobilization and descent of the descending colon on necessity. If experience should prove its advisability, it would best be done not as a preliminary but at the close of the operation when all the bowel that was necessary had been brought down.

Whatever the anesthetic employed, the abdomen is opened through a median incision, and the amount of involvement estimated. If inoperable, the least harm has been done the patient. If operable, the patient is placed in the Trendelenburg posture, the incision enlarged, the sigmoid loop is pulled out of the pelvis, and it is determined at what lowest point it may be cut across. This will depend on the extent of glandular involvement. Even when no glands are palpable the bowel must not be cut through at any level lower than that of the promontory, for the glands in its mesentery are in suspect territory up to that point. But if the glands higher up, in the mesosigmoid or along the iliac or the inferior mesenteric arteries, be involved, and if the

Fig. 5.—Photograph of specimen of which Figure 4 is a skilgram of a portion. Showing bowel cut through in lower third of sigmoid and in right half of transverse colon; also the portion of sigmoid and rectum excised, which measured ten inches after preservation in formalin.

operator consider that this fact is no sufficient bar to an attempt at radical operation, then it will be necessary, probably, to cut through the bowel higher up in the flexure. Just how high will depend on the width of the mesosigmoid, which may safely be left after removing widely the glands mentioned.

One need not fear to remove the bowel high up for the sake of thoroughness; the higher one goes in the sigmoid flexure the more certainly is the blood supply maintained when one comes to cut the mesentery for mobilization; and, on the other hand, one can always get sufficient mobilization, even if one be forced to detach the whole descending colon to do it. Nevertheless it is manifestly better to save as much of the length of bowel as possible.

At the point chosen the bowel is crushed with an angiotribe, doubly ligated in the furrow, cut between, the ends cauterized, and each end inturned with a purse-string suture.

The lower segment is then pulled forward taut toward the pubis, thus putting on the stretch the superior hemorrhoidal artery which runs in the lumbo-sacral root of the mesentery of the pelvic colon. This is doubly tied, as also the vein, and is cut between. The peritoneum is now cut with button-pointed scissors on either side of the rectum down to the peritoneal reflection in the cul-de-sac, and there transversely across. The bowel with the growth can now be peeled off with all the fatty and areolar tissue behind it from the hollow of the sacrum down to near the tip of the coccyx; this, according to Chalot, Kraske, R. F. Weir, J. B. Roberts and others, will cause but slight bleeding, and the necessity for mass ligature may be quite avoided. It was remarkable how in the operation on the cadaver after proceeding as described, the sacral hollow was not invaded by the injection fluid. It seemed as if one might confidently expect in the living but very little arterial bleeding at any rate. Possible venous bleeding might easily be stopped by packing. It has been advised to tie the middle sacral at the promontory. This is easily done, and might be of some advantage, as it sends a few small branches to the rectum as well as supplying in part the retrorectal tissue. Yet in one cadaver, in which I ligated it, the injection fluid penetrated it from below very freely through anastomosis with the lateral sacrals. The advantage therefore is doubtful.

In front the rectum can be peeled off from the basfond of the bladder without great difficulty. By this time one has got close down on the pelvic floor, and, in the case assumed, one is far enough below the growth to cut across the bowel at this point; that is, about two inches above the anus. One is still in many cases above the middle hemorrhoidal vessels, which may very well not need tying. If it be necessary to go a little lower, it is not difficult to isolate, still from the abdomen by blunt dissection, the lateral expansions of the pelvic aponeurosis which enclose the middle hemorrhoidal vessels, and which are so resistant as to be called by Poirier the lateral ligaments of the pelvic rectum. These can then be ligated easily from above. The rectum, with all the contents of the sacral hollow inside the aponeurosis which covers the branches of the iliac vessels and the sacral plexus—neither of which one need see at all in the operation—is now freed.

At this stage of the operation I would prefer to cut the rectum across just above the levator ani muscle and accept the risk of infection. This, with careful packing, with clamping or ligating, and with cauterizing, need not be great.

The lower segment is then to be pulled outside the anus, turned inside out. This is best done by an assistant, the table being lowered to near the horizontal, and the thighs held semi-flexed and abducted. He must stretch the sphincter, then pass three or four pairs of volsellum forceps up and grip the bowel at different points of the circumference, from the mucous surface through all its coats, and so by pulling evert it.

Meanwhile the operator proceeds with the mobilization of the upper segment in the manner already described. Ball²⁷ has said that if the sigmoid loop be not longer than six inches, it will be impossible to bring

27. British Med. Jour., March 7, 1903.

it down. This I have demonstrated to be erroneous. The operator may strip the iliac colon from the iliac fossa and may cut one or all of the sigmoid arteries, or even the inferior mesenteric itself; and will thus in all cases, as I believe, be able to bring the upper end to the anus without tension. Under these circumstances the blood supply will be maintained by the superior mesenteric. Having mobilized the bowel sufficiently, it is simply brought down, telescoped through the everted lower fragment, reopened by removing the temporary purse-string suture, the ends sutured and the whole reinvaginated.

I believe that the method by which the upper segment is telescoped through the lower and is held in that position permanently by stay sutures to the anal margin, whether the mucosa of the lower segment be removed or not, is inadvisable, for the reason that the broad flange of fatty mesentery purposely left on the upper segment will always be apt to interfere with proper union and so favor the development of a fecal leak when the bowel retracts somewhat, as it must always do. End-to-end union outside the anus, imitating Maunsell's method; great care not to include in the suture much of the mesentery behind the line of union for fear of interference with the blood supply at the edge; and, finally, absolute lack of tension so that the bowel brought down lies loosely in the sacral hollow and is not pulled across it like the string of a bow—allowing for a subsequent retraction of one to two inches—these ought to be the essentials in guarding against the failures of circulation or of asepsis.

Drainage of the pelvis had best be employed for a few days through an incision between anus and coccyx. In the pelvis the cut edges of the peritoneum may be united to the sides of the bowel brought down in order to prevent hernia of the coils of small bowel under the latter, and to close off the peritoneal cavity. The abdomen is finally closed without drainage.

CONCLUSION.

This purely abdominal operation I would propose as the normal procedure for cancers situated within the limits mentioned, the chief arguments being that by judicious mobilization the upper segment can in all cases be brought down and joined to an intact sphincter. The great advantage would be the avoidance of the distressing artificial anus in all cases save the inoperable and obstructed ones. Further, inasmuch as the sphincter and levator have not been cut through at all, nor the coccyx and sacrum removed, the pelvic floor is intact and one may expect normal sphincteric action in all cases. Such a gain would be enormous. In addition to this, there are the advantages: first, of a thorough removal as a routine procedure, no matter how long or how short the sigmoid bowel, of the entire gland-bearing district, from which we may hope for better permanent results; second, of a greater economy of blood, and less cutting of sensory nerves, than when the sacral or perineal operation is added, and consequently less shock with, presumably, a lower immediate mortality; and third, of a preservation of the pelvic floor and the sacrum, intact, which will add to the comfort of the patient.

THE MAGNESITE SPLINT. A NEW PERMANENT SURGICAL DRESSING.

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Some ten months ago I began a series of experiments with the object of improving our present methods of surgical dressing by obtaining a hard, durable, coaptative dressing which would be easily penetrable by the Roentgen ray. My studies have taken me into the literature of various processes of a purely mechanical nature, and my adaptation of a reaction employed in the arts and but slightly known to general chemists to the usages of surgery has been a difficult matter. My work

Fig. 6.—Skiagram. Bowel viewed from behind. Outlines of arteries heightened with india ink for reason given. Resection of bowel from just above the promontory (about middle of pelvic colon) to within two inches of the anus. Mobilization of sigmoid and whole descending colon, with ligation of the superior hemorrhoidal and the sigmoid vessels (save one which is either sigmoid or a branch of the left colic). Injection from the thoracic aorta after bowel had been brought down and pulled through the anal portion, projecting to the extent of two inches. Note the richness of the anastomosing loops along the mesenteric border and the complete preservation of the blood supply to the very end. Compare this with the poor blood supply to the first portion of the rectum when the superior hemorrhoidal has been cut, as is frequently done in the Kraske operation, in which the attempt is usually made to save this part of the rectum.

has at least given me a wholesome regard for the existing method, for the use of plaster-of-Paris as a permanent surgical dressing has so many points of superiority that it has replaced all others.