CHANGING TRENDS IN SURGERY OF THE COLON

GEORGE CRILE, JR., M.D. and R. B. TURNBULL, M.D.
Department of General Surgery

THE preoperative preparation of the bowel with sulfonamides and antibiotics, the prophylactic use of antibiotics after operation, and modern advances in surgical technic have contributed materially to the safety of operations on the colon. As a result of these advances it is possible today to perform with relative safety operations which prior to 1940 were deemed hazardous; to preserve the rectal sphincter when formerly it was often necessary to sacrifice it, and to perform primary end-to-end anastomoses in situations which at one time appeared to demand obstructive resections or complementary colostomies with their attendant inconvenience and morbidity. The purpose of this study is to evaluate the present status of the various types of operations in colon surgery.

Changes in Preparation of Colon

Prior to 1942 patients to be subjected to resections of the colon were prepared by the use of magnesium sulfate and a low residue diet. Occasionally sulfonamides were given after operation, but these were used therapeutically in the treatment of established complications and not prophylactically.

Since the war (1946) we have prepared the bowel by administration of sulfasuxidine given in doses of 3 Gm. four times daily for 7 days before operation and sometimes supplemented by streptomycin, 1 Gm. given twice daily for the last 2 days. More recently aureomycin has been used in doses of 500 to 750 mg. four times daily for 3 days. The latter is not only the most effective means of reducing the bacterial count in the stool,[1] but is also absorbed and is effective in controlling cellulitis and infection in the tissues around an ulcerating lesion.

Prophylactic Use of Antibiotics

Following operation in cases in which the bowel was opened we have routinely given penicillin in doses of 600,000 to 1,200,000 units daily for the first 2 or 3 days and recently have supplanted this by the use of aureomycin. Aureomycin appears to be more effective than penicillin in controlling infections which arise from the colon.

Gastrointestinal Intubation

Previous to 1942 it was not customary to intubate the gastrointestinal tract before resections of the colon. Since 1945 a Levine tube has been placed in the stomach just prior to operation and gastric suction is maintained for the first

Downloaded from www.ccjm.org on June 12, 2025. For personal use only. All other uses require permission.

24 hours to prevent distention which may result from swallowing air. In patients subjected to resection of the right colon, the intestine may be intubated prior to operation, and the tube left in place for 2 or 3 days or until it is apparent that the anastomosis is functioning. However, in the past year we have used this form of intubation infrequently and find that the Levine tube is sufficient protection.

Ambulation

Before 1945 patients subjected to resections of the colon were confined to bed for a week or 10 days. Since the war patients are urged to walk on the day of operation and to spend as much time out of bed as possible. Even patients with Rankin clamps attached to exteriorized segments of bowel are advised to be up and about.

Anticoagulants are used only rarely, chiefly in exceptionally obese individuals or in those who refuse to move about. Recognized embolism has not occurred in the group of cases to be reported. A factor in the diminished incidence of this complication may have been the strict avoidance of the use of leg veins for administration of fluid or blood, a practice which may contribute to the development of deep phlebitis. Long periods of immobilization on the operating table also may be a factor in the production of thrombosis.

Transfusion

The transfusion of blood was employed in almost all patients subjected to operations on the colon before 1942. Since 1945 we have recognized that there is a small but definite hazard in the administration of blood, and have employed transfusion only when the patient is anemic or when specific indications are present.

Changes in Technic of Abdominoperineal Resection

We have not modified the technic of combined abdominoperineal resection as developed by Miles[2] and T. E. Jones except that, since 1946, we have closed many of the posterior wounds tightly. A small catheter is left in place and is aspirated twice daily and 200,000 units of penicillin injected in the cavity following which it is clamped off. After 4 days it is withdrawn. Following this usually there is no further drainage from the wound.

Posterior wounds were packed open and were allowed to close by secondary intention prior to 1946. These wounds rarely healed within 3 months, and often 6 months or more elapsed before closure was complete. Occasionally the posterior wounds became infected and the postoperative reaction including fever and distention tended to be more pronounced because of the infection and the foreign body reaction to the large pack in contact with the pelvic peritoneum. Ambulation was impeded, and urinary complications appeared to be more common. When the wounds are closed primarily there is little or no infection, no contraindication to early ambulation, and the patients void earlier and

Downloaded from www.ccjm.org on June 12, 2025. For personal use only. All other uses require permission.

seem to empty their bladders more completely, possibly because they are ambulatory from the first.[3] We believe that primary closure reduces inflammatory reaction in the posterior wound and hence minimizes the tendency to pelvic phlebitis and pulmonary embolism.

Resections of Left Colon

Obstructive resection was utilized as the standard procedure for resection of lesions of the left colon previous to 1942. The Rankin clamp was left in place for from 5 to 6 days and a colostomy was established by its removal. About the sixth postoperative day a spur clamp was applied. The patient usually left the hospital between the twelfth and fourteenth days and was subjected to the inconvenience of a colostomy for 2 months at home. He then returned for closure of the colostomy which required usually another week of hospitalization.

Since 1947 we have employed resection and end-to-end anastomosis in the management of an increasing number of lesions of the left colon. We believe that a wider segment of bowel and mesentery can be resected by this method and that better protection can be assured against local recurrence of carcinoma in the abdominal wall. Except in palliative resections in patients with distant metastasis we do not believe that carcinoma below the reflection of the peritoneum should be dealt with in this manner but many lesions which lie at or just above the reflection of the peritoneum can be resected and continuity of the bowel re-established without jeopardizing the patients' possibility of cure.[4,5,6,7]

Final evaluation of low sigmoidal anastomosis is contingent upon a longer period of observation than is covered in this series.

Before 1942 we performed open end-to-end anastomosis of the colon with two rows of inverting continuous catgut sutures. This method was not safe because of the high incidence of obstruction and the occasional development of peritonitis due to leaks at the line of anastomosis. At this time, therefore, obstructive resection was a safer procedure.

In the past 2 years, with the development of better means of preparing the bowel we have employed the interrupted suture technic for open anastomosis. An inner row of interrupted chromic 000 catgut sutures through all layers, with knots on the inside, inverts the bowel and is reinforced by an outer row of interrupted silk sutures. There has been only one patient who gave evidence of localized or spreading peritonitis, no abscesses were encountered, and there has been only 1 case in which there was any evidence of obstruction in 90 consecutive resections performed by this technic. The bowels usually move spontaneously on the second or third day, and the usual period of hospitalization after operation is approximately 9 days.

Right Colectomy

In the past few years we have avoided gross contamination of the retroperitoneal space in resections of the right colon and have noticed a striking

Downloaded from www.ccjm.org on June 12, 2025. For personal use only. All other uses require permission.

decrease in morbidity. Since the resistance to infection of the peritoneal cavity is much greater than that of the retroperitoneal tissues, we have protected the vulnerable retroperitoneal area from which the cecum and ascending colon have been removed by closing the peritoneum over it and packing it off before the bowel is transected or the abdominal cavity contaminated. Postoperative obstruction has not occurred in these cases. All ileocolonic anastomoses were of the open type made by the end-to-side, side-to-side, or end-to-end technic.

Subtotal Colectomy

In polyposis of the colon or in severe ulcerative colitis we have been impressed with the relatively high morbidity which attends procedures of more than one stage, in which operations must be performed in the presence of ileostomies or colostomies. It is difficult to prevent contamination from the previously exteriorized ends of bowel, and intestinal obstruction secondary to localized peritonitis has been a common complication. For this reason, and because in acute ulcerative colitis we believed that the patients would benefit if the major portion of the diseased colon could be removed at the same time the ileostomy was established, we have begun to perform end ileostomy with skin graft and removal of the right colon, transverse colon, descending colon and as much as possible of the sigmoid at a single operation through an elliptical transverse incision just below the umbilicus. The stump of the sigmoid is brought out just below the umbilicus in the midline where it can be removed with an ellipse of skin and without contamination at the time of the later abdominoperineal resection. The retroperitoneal space is completely re-peritonealized before the bowel is transected so that the operation of colectomy is, for all practical purposes, an aseptic one. The course of these patients has been remarkably smooth and has justified continuation of the one stage partial colectomy followed by combined abdominoperineal resection as opposed to the former method of performing the operation in 4 stages (ileostomy, right colectomy, left colectomy, and combined abdominoperineal resection).

Protection of the Wound from Contamination

Dr. T. E. Jones always emphasized the importance of protecting the wound from contamination, and invariably protected the entire wound, not just the skin edges, with gauze packs. We have added a layer of rubber between the gauze, and wall off the entire wound completely before incurring any contamination from the bowel. A clean set of gloves and instruments are used for closure, to reduce further the danger of contamination to the abdominal wound.

Results

Two hundred and seventy-four consecutive resections of the colon have been performed by the authors with no deaths in the hospital following operation. (This series was broken when a patient died in August 1950, 5 days after subtotal colectomy. She had been in the terminal stages of acute toxic

Downloaded from www.ccjm.org on June 12, 2025. For personal use only. All other uses require permission.

ulcerative colitis with serum albumin 0.6 mg. per hundred cc., accompanied by massive edema. Death was the result of massive bilateral atelectasis, probably exacerbated by the hypoproteinemia.)

274 CONSECUTIVE RESECTIONS OF THE COLON

Operative Procedure

Combined abdominoperineal resection (Miles)	84
Abdominoperineal pull-through	6
Resection with primary anastomosis	90
Obstructive resection (Rankin)	35
Right colectomy (with primary ileocolonic anastomosis or ileostomy)	38
Left colectomy (second stage colectomy—no anastomosis)	5
Total colectomy (1 stage—rectum remaining)	16
Hospital deaths	0
	274

REASON FOR OPERATION

Cancer	225
Ulcerative colitis	32
Polyposis	9
Diverticulitis	6
Megacolon	2
	274

The average period of postoperative hospitalization for patients with uncomplicated combined abdominoperineal resections was 12 days.[3] For the entire group of 90 patients subjected to resection and end-to-end anastomosis, postoperative hospitalization was only 11 days, while several patients insisted on leaving the hospital as early as the sixth postoperative day.

Comment

The late master of colon surgery, Dr. T. E. Jones, had developed the technical aspect of the combined abdominoperineal resection to such perfection that the operation was practically aseptic and required, in his hands, no special preparation of the bowel. In resections of lesions in the left colon or transverse colon he employed the obstructive resection. Hence there was no indication for preparing the bowel with sulfonamides or antibiotics, and the mortality rate of colon surgery was so low that he once performed 161 consecutive combined abdominoperineal resections for carcinoma without a death.

Despite this extraordinary record there are certain disadvantages to this

Downloaded from www.ccjm.org on June 12,.2025. For personal use only. All other uses require permission.

method of management. Pathologic studies indicate that carcinomas located above the reflection of the peritoneum rarely metastasize downward[4,5,7] unless the lymphatics above are blocked completely with tumor, in which event it would be unlikely that a cure could be obtained by any method of treatment.[8] Therefore the combined abdominoperineal resection, which removed a perfectly normal rectum along with a cancer of the sigmoid, may be unnecessary for lesions located above the reflection of the peritoneum.[9]

Since exteriorization and obstructive resection is neither a safe nor mechanically sound method of treating lesions just above the reflection of the peritoneum, resection with anastomoses after thorough preparation of the bowel is displacing the other procedures as the preferred treatment. By employing this method the rectum can be saved without jeopardizing the chances of cure in a high percentage of cases which formerly would have been treated by the combined abdominoperineal operation.

The abdominoperineal resection fulfills all requirements of a good operation for cancer and should be employed in its most radical form in the treatment of all lesions below the reflection of the peritoneum. The pull-through modification of this procedure is applicable to carefully selected lesions at this level, but is hazardous and should be employed with caution by those not trained in its fundamental principles.

We have employed variations of the pull-through type of operation in 5 carefully selected cases with low-lying papillary lesions too extensive to fulgurate but not so invasive as to necessitate sacrifice of the sphincter. In 4 of these excellent functional results were obtained, indicating that this procedure has a definite place in the treatment of selected cases.

We should never jeopardize the patients' chances of cure by employing operations which do not allow the surgeon to excise the primary tumor and its zone of metastasis. The operation should be started with this in mind, and then when the tumor and its zone of metastasis are mobilized, the decision may be made as to whether the operation can be completed by re-establishment of continuity or by abdominoperineal resection.

Summary

1. Preoperative preparation of the bowel with sulfonamides and antibiotics, and the prophylactic use of antibiotics after operation have resulted in decreasing mortality and morbidity following operations on the colon.

2. Open end-to-end anastomosis with interrupted sutures has, to a large extent, replaced the operation of obstructive resection and obviated the need of even a temporary colostomy.

3. Resection with anastomosis has supplanted the combined abdominoperineal resection in the treatment of carcinomas located above the reflection of the peritoneal floor.

4. Primary closure of the posterior wounds in the combined abdominoperineal resection has resulted in a striking decrease in the period of convalescence.

Downloaded from www.ccjm.org on June 12, 2025. For personal use only. All other uses require permission.

5. When it is necessary to establish an end ileostomy and remove the entire colon and rectum for ulcerative colitis or polyposis, the operation appears to be better done in 2 than in 4 stages.

6. Two hundred and seventy-four consecutive resections of the colon and rectum have been performed by the authors without a death.

References

1. Dearing, W. H. and Heilman, F. R.: Effect of aureomycin on bacterial flora of intestinal tract of man; contribution to preoperative preparation. Proc. Staff Meet. Mayo Clin. **25**:81 (Feb. 15) 1950.
2. Miles, W. E.: Cancer of Rectum. London, Harrison and Son, Ltd., 1926.
3. Crile, G., Jr. and Robnett, A. H.: Primary closure of posterior wound after combined abdominoperineal resection of carcinoma of rectum. Cleveland Clin. Quart. **17**:5 (Jan.) 1950.
4. Coller, F. A., Kay, E. B. and MacIntyre, R. S.: Regional lymphatic metastasis of carcinoma of rectum. Surgery **8**:294 (Aug.) 1940.
5. David, V. C. and Gilchrist, R. K.: Abdominoperineal removal of low lying cancer of rectum; five-year cures and local recurrences. Surg., Gynec., and Obst. **89**:31 (July) 1949.
6. Dixon, C. F.: Anterior resection for carcinoma low in sigmoid and rectosigmoid. Surgery **15**:357 (March) 1944.
7. Gilchrist, R. K. and David, V. C.: Lymphatic spread of carcinoma of rectum. Ann. Surg. **108**:621 (Oct.) 1938.
8. Dukes, C. E.: Classification of cancer of rectum. J. Path. and Bact. **35**:323 (May) 1932.
9. Garlock, J. H. and Ginzberg, L.: Appraisal of operation of anterior resection for cancer of rectum and rectosigmoid. Surg., Gynec., and Obst. **90**:525 (May) 1950.

Downloaded from www.ccjm.org on June 12, 2025. For personal use only. All other uses require permission.