

Rectoanal Inhibitory Reflex Following Low Stapled Anterior Resection of the Rectum

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The rectoanal inhibitory reflex plays an important role in the normal mechanisms of anorectal continence. Anterior resection abolishes the reflex, but whether it recovers, particularly after inverted stapled anastomosis, is not clear. Anal manometry was performed on patients undergoing low anterior resection for carcinoma. Maximum anal resting pressure and the rectoanal inhibitory reflex were assessed preoperatively and up to two years postoperatively. The reflex was present in 43 of 46 patients (93 percent) preoperatively, in 8 of 45 patients (18 percent) on the 10th postoperative day, and in 6 of 29 patients (21 percent) between six months and one year following surgery. Twenty patients were studied more than two years postoperatively, and in 17 (85 percent) the reflex was demonstrated. In the majority of low anterior resection patients, the rectoanal inhibitory reflex is abolished by surgery, remains absent throughout the first year, and has recovered by the end of the second postoperative year. This may be important in the recovery of anorectal function in these patients. [Key words: Anal sphincter; Anal continence; Anterior resection]

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Transient relaxation of the internal anal sphincter following rectal distention was first described by Gowers in 1877¹ and subsequently confirmed by Denny-Brown and Robertson in 1935.² Duthie and Bennett³ postulated that acute rectal distention with flatus or feces reflexly inhibits the internal anal sphincter, thus allowing a sample of rectal contents into the upper anal canal. Contact with the sensitive transitional mucosa allows differentiation between flatus and feces. This "sampling reflex" allows effective discrimination, enabling the subject to safely pass flatus.⁴ Loss of this refinement may contribute to imperfections of continence sometimes found following low anterior resection.

The reflex is thought to be mediated primarily through an intramural neuronal plexus, and is thus preserved following spinal cord transection, in cauda equina lesions, or in lesions of the sacral roots, but is absent in Hirschsprung's disease.^{1, 2, 5, 6} It remains intact following full rectal mobilization and after presacral blockade but is abolished by circumferential rectal myotomy or transection of the rectum, as occurs during anterior resection.⁶

Given its role in the discrimination between rectal contents, regeneration of the reflex following anterior resection might be expected to result in improved continence. It is unclear, however, whether the reflex reappears following stapled anastomosis as distinct from handsewn anastomosis of the rectum. The purpose of this study was therefore to document the reflex status of patients undergoing low stapled anterior resection of the rectum preoperatively and for a period of two years following surgery.

PATIENTS AND METHODS

Patients

Forty-six patients undergoing low anterior resection of the rectum were studied perioperatively, 29 were studied between 6 and 12 months postoperatively, and 20 were studied two years postoperatively. The median age of patients was 62 years (range, 34-81 years). All operations were performed for carcinoma and were carried out by the same surgeon (W.O.K.). All anastomoses were within 8 cm of the anal verge, were performed with a 31-mm-diameter EEA® (U.S. Surgical Corporation, Norwalk, CT) stapler inserted transanally, and were easily palpable per the rectum. One patient was excluded from the study 10 days after surgery because of difficulty in establishing with certainty

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that the distending balloon was above the anastomosis.

Methods

Anorectal manometry was performed by the same two persons in all cases using a microtransducer mounted on a catheter of 5-mm external diameter (Gaeltec Ltd., Dingwall, Scotland). The data were digitalized, recorded on computer by means of a polygraph (Synectics Medical, Stockholm, Sweden), and analyzed by means of Polygram software (Gastrosoft Inc., Milwaukee, WI). Manometry was performed with the patient in the left lateral position and with the anal transducer directed toward the right lateral position for all measurements to avoid radial pressure variations.⁷ Maximum anal resting pressure was initially assessed using a 1-cm station pull-through technique. A rigid steel tube (3-mm external diameter) graduated in 1-cm lengths with a balloon attached at its tip was then introduced into the rectum, and the balloon was placed at least 5 cm above the anastomosis.

The position of the balloon above the anastomosis was confirmed before and after manometry. A steady rectal resting pressure was achieved for five minutes, and the rectoanal inhibitory reflex was then tested by inflation of the intrarectal balloon with 50 ml of air while recording anal resting pressure. A reproducible drop of 20 percent in resting pressure, with recovery after deflation of the balloon, was accepted as a positive reflex.

Statistical analysis was performed using the chi-squared test for loss and recovery of the reflex and the *t*-test for evaluation of internal anal sphincter pressure.

RESULTS

The reflex status of patients is seen in Table 1. The reflex was present in 93 percent of patients preoperatively but in only 18 percent 10 days post-

operatively ($P < 0.00001$). There was no significant recovery in the reflex six months postoperatively (21 percent positive, $P = 0.75$ when compared with day 10 postoperatively), but two years after surgery the reflex could be demonstrated in 85 percent of cases ($P < 0.00001$).

Figure 1 shows a typical patient record demonstrating the presence of the reflex preoperatively with loss of the reflex immediately postoperatively. There is no evidence of recovery of the reflex at 12 months, but the reflex has recovered two years after surgery.

Mean anal sphincter resting pressure is seen in Table 2. There was a marked drop in maximum resting pressure immediately postoperatively ($P < 0.0001$). No significant recovery was seen at 6 to 12 months or at two years postoperatively.

DISCUSSION

This study confirms previous reports that the rectoanal inhibitory reflex is present in the majority of preoperative patients but is usually lost after low anterior resection. In addition, we have demonstrated for the first time that the reflex may subsequently regenerate after a low stapled colorectal anastomosis. Lane and Parks⁸ have demonstrated that the reflex may regenerate with time in the majority of patients after handsewn colorectal anastomosis, and this has been confirmed by other authors.^{9,10} However, because the reflex is thought to recover by the regeneration of nerve fibers across the anastomosis, it is conceivable that the fate of the reflex might be different after an inverted stapled anastomosis rather than a handsewn anastomosis. The only previous study to examine the reflex after stapled colorectal anastomosis failed to demonstrate recovery.¹¹ In that study, however, the short follow-up period of only 12 months probably explains the failure of the study to demonstrate the recovery of the reflex with time. With the increasing popularity of the stapler in low colorectal anastomosis, it is important to demonstrate, as we have done, that the reflex may indeed recover after stapled anastomosis.

Transection of the rectum during anterior resection would be expected to abolish the reflex by disconnecting the internal anal sphincter from its proximal intramural connections. In this study, 82 percent of patients demonstrated an absence of the reflex on the 10th postoperative day. Although it is commonly assumed that the rectoanal inhibitory

Table 1.
Rectoanal Inhibitory Reflex After Anterior Resection

	Reflex Present	Reflex Absent
Preoperatively (n = 46)	43 (93%)	3 (7%)
10 days postoperatively (n = 45)	8 (18%)	37 (82%)
6 to 12 months postoperatively (n = 29)	6 (21%)	23 (79%)
2 yr postoperatively (n = 20)	17 (85%)	3 (15%)

reflex is abolished in all patients after low anterior resection, this assumption is not supported by available literature. Lane and Parks⁸ reported positive reflexes in three of seven patients at the first postoperative examination, while in Pedersen *et al.*'s¹¹ series 2 of 13 were positive at that time. In each of these cases this examination was performed

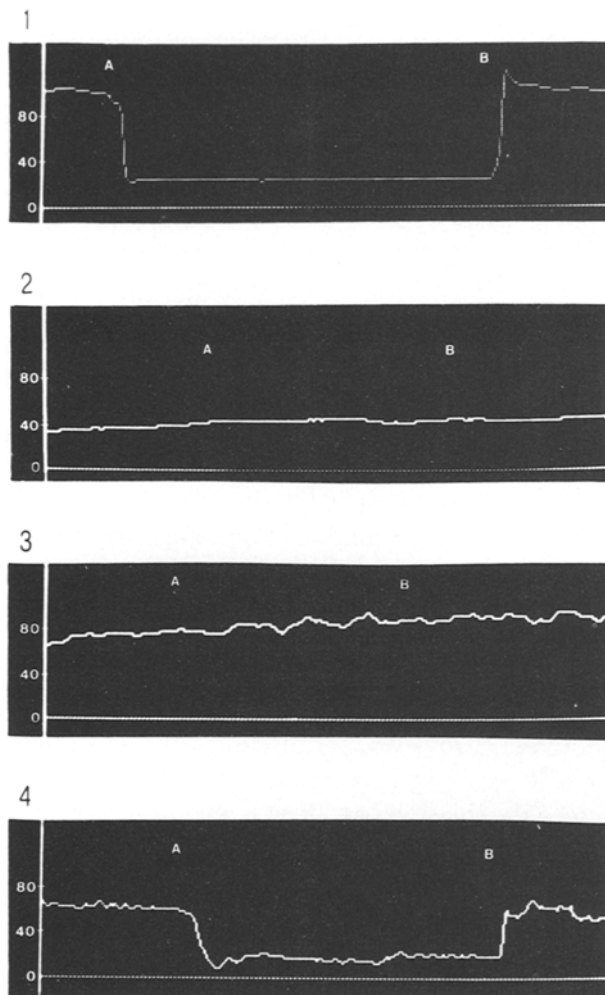


Figure 1. Loss and recovery of the reflex after low anterior resection. This shows the reflex in a typical patient (1) preoperatively, (2) 10 days postoperatively, (3) 12 months postoperatively, and (4) two years postoperatively. In each case "A" denotes the inflation of the balloon, while "B" denotes its deflation. Resting sphincter pressure is shown in mm Hg on the left side of each graph.

well before any regeneration of nerve fibers might be expected. These results are consistent with our results, where 18 percent of patients have retained their reflex 10 days postoperatively. There are a number of possible mechanisms whereby the reflex might be preserved after low anterior resection. Inflation of the distending balloon just above an anastomosis, while distending mainly the neorectum, might also stretch the anastomosis and rectal stump just below it, thereby eliciting the reflex. The existence of extrarectal pelvic pressure receptors contributing to the reflex cannot be discounted. Although these are not thought to play a major role in the mechanism of the reflex in health, it is possible that they may provide an alternative pathway in some patients after rectal transection, thus explaining why the reflex is preserved in some cases. In this study, the use of a calibrated rigid balloon carrier allowed accurate placement of the balloon well above the anastomosis in the neorectum. Its position was carefully checked before and after the examination. This excluded any artifacts caused by the displacement of the balloon or microtransducer during the examination.

We have shown no evidence of recovery of the reflex within 12 months of surgery. By the time two years had elapsed, however, 85 percent of patients tested had a positive reflex. Recovery of the reflex occurred even though no significant recovery in anal sphincter resting pressure was seen in these patients. It has been suggested that regeneration of intrinsic intramural neurons across the anastomosis is responsible for recovery of the reflex.^{6, 8, 12} Recent studies of nerve regeneration across small bowel anastomoses in guinea pigs support the latter mechanism,¹³ and the timing of recovery of the reflex in our patients is consistent with this.

Up to 25 percent of patients have difficulties with continence following low anterior resection of the rectum.¹⁴ These include inability to control passage of feces or flatus, difficulty in discriminating between these, and nocturnal soiling. Difficulties with continence after low anterior resection

Table 2.
Anal Pressure Measurements (Mean \pm SEM)

	Preoperatively (n = 46)	10 days Postoperatively (n = 45)	6 to 12 months Postoperatively (n = 29)	2 yr Postoperatively (n = 20)
Maximum resting pressure (mm Hg)	60 \pm 2.7	42 \pm 2.7	42 \pm 3.5	46 \pm 3.8

are multifactorial and are due to loss of rectal capacity with frequency of bowel movement,^{4,15} as well as direct stretch injury to the anal sphincter as a result of a perianal procedure.¹⁶⁻¹⁸ While it may not be the prime cause of incontinence, loss of the rectoanal inhibitory reflex is very likely to contribute to incontinence in these patients. Although there are no direct data concerning the importance of an intact rectoanal inhibitory reflex in the maintenance of normal continence, Miller *et al.*¹⁹ have recently linked the absence of the closely related phenomenon of anorectal sampling with incontinence. Anorectal sampling is a physiologic reflex whereby the anal sphincter relaxes periodically in order to allow rectal contents to come in contact with the sensitive mucosa of the upper anal canal. Miller *et al.*¹⁹ demonstrated spontaneous sampling in 89 percent of normal humans but in only 33 percent of patients with incontinence. Sampling, like the rectoanal inhibitory reflex, may be induced by the introduction of air into the rectum,¹⁹ and they may well represent the same phenomenon. Indeed, an intact rectoanal inhibitory reflex may be necessary for normal sampling. Further studies are required to study anorectal sampling in ambulatory postoperative patients who have lost the rectoanal inhibitory reflex.

Improved continence is seen in patients who have regained the inhibitory reflex after ileoanal anastomosis.¹² We have not examined the relationship between recovery of continence and recovery of the reflex in our patients. However, only 25 percent of our patients exhibit problems with continence after low anterior resection¹⁴ despite the fact that in this study the majority have lost the reflex. This implies that the reflex is not absolutely necessary for full continence in all cases, and continence may be maintained in many patients provided that sphincter tone and neorectal capacity are adequate. The reflex, however, may be very important in those patients with suboptimal sphincter pressures or very diminished rectal capacity. The well-documented improvement in continence that continues for up to two years following anterior resection is likely to be secondary to increased reservoir capacity and improved sphincteric function, but the return within two years of the rectoanal inhibitory reflex as demonstrated in this article may be a further factor contributing to the recovery of full continence in many of these patients.

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