Anorectal Function after Low Anterior Resection for Carcinoma

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Anorectal function was studied in 13 patients with carcinoma of the rectum 6–12 cm from the anal verge, which was treated by low anterior resection (LAR), and in 13 age- and sex-matched control subjects. Patients were studied before and 3 and 12 months after operation. Anal resting and squeeze pressures were the same in patients and control subjects and were decreased only moderately after surgery, with a slight increase in maximum squeeze pressure 12 months after operation. Three of the patients had an inverse rectoanal reflex before operation, and two had no reflex at all. After operation, only two patients showed a normal rectoanal inhibitory reflex, and none gained a normal reflex within 12 months after surgery. Rectal compliance was significantly reduced before operation, compared to control subjects, and was still significantly lower 3 months after operation. After 12 months, however, rectal compliance had returned to preoperative level in all but two patients with coloanal anastomosis, who still emptied the bowel 4–5 times daily.

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IT IS GENERALLY accepted that carcinoma of the mid and even lower rectum may be treated by low anterior resection (LAR) with colorectal or coloanal anastomosis. This treatment offers the same chance of cure as abdominoperineal resection (APR),[1,2] but in most series a certain number of patients present with unsatisfactory anorectal function after operation, either some degree of incontinence or an uncomfortably high frequency of bowel movements, although these disturbances seem to subside or diminish within the first year.[3,4] Since to our knowledge no systematic study of the changes in anorectal function following LAR has been performed, we have studied anorectal function in a group of patients with cancer in the mid and lower rectum before and 3 and 12 months after LAR.

Patients

Thirteen patients with carcinoma of the rectum 5–15 cm from the anal verge and 13 age- and sex-matched control subjects without anorectal complaints were studied. All patients were continent before operation. There were seven men and six women in each group, median age for both groups being 55 years (range: 46–72). Tumors were located from 6 to 12 cm from the anal verge and included one to three quarters of the circumference in 10 patients and the whole circumference in three. The extent varied from 4 to 10 cm.

The procedure was a standard low anterior resection with mobilization of the rectum to the pelvic floor and ligation of the inferior mesenteric vessels. Mobilization of the splenic flexure was done in eight cases. Anastomosis in 11 patients was done with the EEA stapler (U.S. Surgical Corp.) and two had a perianally handsewn coloanal anastomosis.

The patients were examined before and 3 and 12 months after the operation. On each occasion, the following parameters were studied: maximum resting anal pressure, maximum anal squeeze pressure, rectoanal reflex, and rectal compliance.

Methods

Anal Manometry

Examinations were performed with the patient in the left lateral position; no bowel preparation was used. Pressure in the anal sphincter and rectum was measured with an open-tip, perfused system, consisting of three rigid, low compliance, polyvinyl cathethers with an outer diameter of 2 mm and an inner diameter of 1 mm. Every cathether ends in a steel cap with the same external and internal diameter and three sideholes radiating 120 degrees. Each catheter was perfused with a flow-rate of 0.7 ml/min through a water-filled strain-gauge connected to a four-channel ink recorder. The manometric system had a pressure rise rate ($\Delta p/\Delta t$) of 800 mmHg/sec.

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TABLE 1. *Anal Pressure Profile in Control Subjects and in Patients before and 3 and 12 Months after Operation.*

	Length of Pressure Zone (mm)			Resting Pressure (mmHg)			Squeeze Pressure (mmHg)		
	Median	95% Confidence Limits	Range	Median	95% Confidence Limits	Range	Median	95% Confidence Limits	Range
Control subjects	34.3	(31.0–39.7)	26–41	65.0	(48.0–81.4)	48–81	180.0	(120.0–240.0)	118–268
Patients									
Preop.	33.0	(25.4–38.3)	24–57	59.0	(37.0–76.0)	25–89	163.0	(100.0–210.0)	87–313
3 months postop.	30.7	(24.3–38.0)	23–44	46.0	(28.0–68.0)	17–80	120.0	(94.0–210.0)	76–293
12 months postop.	32.3	(25.0–47.0)	22–51	45.0	(30.0–85.0)	20–104	140.5	(80.0–244.0)	40–260

An anal pressure profile was recorded. A probe consisting of the three catheters was placed in the rectum and withdrawn by constant speed (5 mm/sec), with the pressure being registered as described above. Three profiles were made and the mean zone was calculated. The length of the pressure zone was calculated as the distance from the start of pressure increase until pressure fell below baseline when the probe was withdrawn from the anus. Maximum resting pressure was defined as the highest pressure obtained with the subject relaxed, and maximum squeeze pressure as the highest pressure obtained during voluntary contraction of the anal sphincter.

Following the profile measurement, a soft latex balloon (5 × 3 cm) connected to a stiff polyethylene catheter was inserted in the rectum 10 cm from the anal verge. The probe described earlier was placed so that one catheter was between the balloon and the rectal wall (registration of the rectal pressure), one in the high pressure zone of the anal sphincter, as calculated from the anal profile, and one as low as possible in the pressure zone. The catheters were strapped to each other and to the subject in order to prevent sliding.

Rectoanal reflex and rectal compliance were studied by inflating the latex balloon with increments of 30 ml of air until the patient complained of discomfort. A rectoanal reflex was defined as an alteration of anal pressure of 20% or more following balloon distension since alterations of less than 20% could not be distinguished from spontaneous pressure variations that occurred in some subjects. Rectal compliance was defined as maximal tolerable volume divided by the increase in rectal pressure during inflation of the balloon.

Statistical methods used were the Wilcoxon test for paired data and the Mann-Whitney test for unpaired data.

Results

There was no significant difference between control subjects and preoperative studies in patients with respect to length of pressure zone, maximum resting pressure, and maximum squeeze pressure (Table 1).

There was a moderate but not significant decrease in maximum resting and squeeze pressure following surgery, with a tendency for maximum squeeze pressure to increase from 3 to 12 months after operation ($p > 0.05$) (Table 2). The length of the pressure zone was unaffected by the operation. Three months after operation all patients were continent and continued to be so.

All control subjects had a rectoanal inhibitory reflex. Seven of the patients also had a normal inhibitory reflex, whereas before operation three patients had an inverse

TABLE 2. *The Rectosphincteric Reflex in Control Subjects and in Patients before and 3 and 12 Months after Operation*

	Anal Sphincter Pressure			
	Decrease	Increase	No Change	Not Examined
Control subjects	13			
Patients				
Preop.	7	3	2	1
3 months postop.	2	6	5	
12 months postop.	2	4	6	1

TABLE 3. *Rectal Compliance in Control Subjects and in Patients before and 3 and 12 Months after Operation**

	Median	95% Confidence Limits	Range
Control subjects	12.0	(8.7–22.8)	8.1–44.0
Patients			
Preop.	9.8	(5.5–13.6)	3.8–30.0
3 months postop.	4.1	(2.1–9.4)	1.2–15.0
12 months postop.	8.3	(6.0–18.8)	5.0–24.0

* Compliance = $\frac{v}{\Delta p}$, where v is the maximal tolerable volume and Δp is the increase in rectal pressure.

reflex with an increase in pressure, and two patients had no rectoanal reflex at all. In one patient the preoperative rectoanal reflex was not studied because of technical problems. The same applies to another patient 12 months after operation. After surgery only two patients had a normal rectoanal inhibitory reflex, and none gained a normal reflex from 3 to 12 months after operation. One patient who had an increase in anal pressure 3 months after operation changed to no reflex at 12 months.

The patients had a significantly lower rectal compliance before operation than did control subjects ($p < 0.05$) (Table 3). Rectal compliance was significantly lower 3 months after than before the operation ($p < 0.05$) and correlated well with an increased frequency of bowel movements observed at this time (median: 4; range: 1–7). Twelve months after surgery compliance had almost returned to preoperative values, and the median number of bowel movements was two (1–5). Only two patients had more than three bowel movements a day (4 and 5, respectively), and these patients also had the lowest registered compliance values at 12 months (5.0 and 6.0).

Discussion

It is well documented that anal resting pressure is one of several factors of importance in continence. In 20 patients who had a sphincter-preserving rectal resection, Williams et al.[5] found a significant reduction in resting anal pressure compared with 20 normal subjects: six of these patients were incontinent for liquid stool. Since the patients, however, were not examined before operation, the degree to which the reduced resting anal pressure was due to surgery is uncertain.

In our study the patients had a moderately lower resting pressure before operation than the control subjects, and the pressure was further reduced after surgery, although not significantly. The postoperative results in the patients were significantly lower than in the control subjects, and it is noteworthy that resting pressure did not increase with the time after surgery. Resting pressure in our study could not be related to continence or frequency of bowel movements. It has been assumed that a normal rectoanal reflex is of importance for continence,[6,7] but, in contrast to the constant finding of a rectoanal inhibitory reflex in the control subjects, we found all variations of rectoanal reflexes in the patients with rectal cancer. In five of the patients, these abnormal reflexes were present before as well as after operation. Only two patients had a normal inhibitory reflex 1 year after LAR, while six patients had no reflex at all. The abnormal preoperative reflex in some of the patients is probably explained by the malignant process itself. The tumor may cause rigidity of the rectal wall so that pressure receptors, probably located in the pelvic floor muscles, are not stimulated, or the tumor may cause destruction of structures in the reflex arch. The outcome of rectoanal reflex examination could not be related to continence. Some authors have found a correlation between rectal compliance and bowel movements.[8,9] This is consistent with findings in our study in which a decrease of rectal compliance in the first postoperative period was related to an increased frequency of bowel movements. After 12 months, compliance was nearly the same as before operation, and by this time most patients had 1–2 movements a day.

In conclusion, LAR does not seem to be followed by reduction in maximum resting or maximum squeeze anal pressure to a degree that affects continence. The rectoanal inhibitory reflex will in a certain number of patients become abnormal, which does not seem to be of any significance for continence. Rectal compliance decreases significantly and is correlated to the frequency of bowel movements but does not affect continence, and in most patients compliance will increase to preoperative levels within a year after surgery.

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