

Outcome after rectum or sigmoid resection: A review for gynecologists

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Abstract. It remains unclear when to perform a discoid or segmental bowel resection for large endometriotic nodules with intestinal invasion. Moreover, endometriosis series are rather small to fully evaluate functional consequences of bowel resection. We therefore reviewed the incidence of leakage and functional problems after anterior and sigmoid resection as reported in the surgical literature albeit for other indications. Endoscopic resection clearly is feasible but requires an experienced surgeon. The incidence of leakage is not different after hand-sewn or stapled anastomosis, but is higher after a low rectum resection than after a sigmoid resection. Similarly, functional bowel problems are higher after a low rectum resection than after sigmoid resection. Low rectum resection in addition can be associated with functional bladder problems and sexual disturbances as anorgasmia. In conclusion, short- and long-term complications are much higher after a low rectum than after a sigmoid resection. This seems to be important in making the decision to perform a discoid or a segmental bowel resection for severe endometriosis.

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Deep endometriosis is a severe condition with an estimated worldwide prevalence of 3% to 10%.¹ Bowel endometriosis is reported to occur between 5.3% and 12% in endometriosis series, with rectum and rectosigmoid endometriosis being responsible for 70% to 93% of all intestinal lesions.^{2,3}

Rectovaginal and sigmoid endometriosis are generally associated with incapacitating pain, and surgery is considered the first treatment of choice. Medical therapy will not

eradicate the disease and cannot be given for a long period of time because of significant side effects.

Several types of surgery are performed for severe endometriosis involving the bowel. Whereas debulking, leaving some endometriosis on the bowel in order to avoid opening the bowel, seems to have lost popularity, it remains unclear whether and when a discoid or segmental bowel resection should be performed. Randomized trials comparing outcome are not and will not be available shortly for the obvious reasons that series are too small and that surgeons who are equally skilled in both procedures are rare. The argument in favor of segmental bowel resection is completeness of endometriosis removal, especially if the area affected is larger than 2 cm.^{4–6} Some authors have found by

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Table 1 Segmental and full-thickness resections for endometriosis

Reference	Total intestinal surgery (No.)	Segmental resection (No.)	Full-thickness resection (No.)	Postoperative leak (No.)	Functional problems (No.)
Jerby et al ⁵	35	7	5	N/A	2
Possover et al ⁶	34	34	—	2	N/A
Redwine and Wright ⁸	28	7	26	N/A	12
Duepree et al ⁹	54*	18	—	1	N/A
Thomassin et al ¹¹	27	27	—	N/A	5
Darai et al ¹²	40	40	—	N/A	11
Fedele et al ¹³	30	30	—	N/A	3
Ford et al ¹⁴	50	10	—	N/A	2
Campagnacci et al ¹⁵	7	—	7	—	1
Jatan et al ¹⁷	81	14	14	1	3

Total intestinal surgery includes superficial bowel surgery. Functional problems include either urinary or intestinal problems.

N/A = data not available.

*The author performed other intestinal surgeries in small bowel.

pathology small endometriotic lesions remaining after discoloid resection.⁷

In the absence of randomized clinical trials, careful reports describing each technique's short- and long-term outcome variables, such as intra and postoperative complications, recurrence rates, and late bowel and bladder dysfunction, are the next best approach.^{5,7-17} For bowel resections performed for deep endometriosis, low leakage rates and organ dysfunction rates were reported, but the numbers remain small (Table 1).

We therefore wanted to review leakage rate and functional problems after rectum or sigmoid resection. Because data of resections for endometriosis only are scanty, we decided to review the data available in the surgical literature. We fully realize that resections were performed mainly for other indications than endometriosis and that extrapolation to endometriosis surgery should thus be done with great care.

Materials and methods

Only English-language papers were searched. Original published studies were identified by searching Medline since 1980. We also searched for references mentioned in the papers when considered necessary. As search keywords, we used: "deep," "rectovaginal," "intestinal," "laparoscopic," and "endometriosis"; "colorectal," "intestinal," "sigmoid," "anterior," and "resection"; "functional outcomes," "urological," "sexual," and "dysfunction," "problems"; "leakage," and "colorectal," "intestinal," and "anastomosis."

After reading the abstracts, we decided to retrieve the full text of approximately 120 articles, and 50 were found suitable for this review. Case reports were excluded. For leakage rate after colorectal resection, we included articles on both benign and malignant conditions. We focused on the level of resection. It should be noted that low rectum resections, in contrast to sigmoid resections, are almost exclu-

sively performed for malignant conditions and thus are associated with radiotherapy. Moreover, for some authors sigmoid resection can be equivalent to a high anterior resection of others. In order to avoid bias, we provided the data as found in the literature without correction. We also did not differentiate for conversion rates in cases of laparoscopy. Indeed for sigmoid resection, no differences in leak rate would exist¹⁸ between laparoscopic and open surgery; although for low rectum resections, this might not be true given the technical difficulty of surgery. For functional outcomes we included resection for malignant conditions in the absence of data for benign disease only. Functional problems were divided into bowel or urogenital dysfunction. Publications reporting functional bowel problems were heterogeneous and required unification of terminology of clinical outcomes. For urogenital consequences, we restricted the review to surgery that aimed to preserve the autonomic plexus.

Results

Postoperative leakage

The overall incidence of anastomotic leak rate after colorectal resection was reported to be between zero and 10.25%.¹⁹ Leak rates shown in Table 2 ranged from zero to 13.5%. These large differences may be explained at least partially by surgeon experience, as concluded by Chambers et al. Indeed, experienced surgeons had a rate between 3.4% and 6%.¹⁸

The lower the anastomosis, the higher the probability of postoperative leakage. It has been consistently reported that leakage was more common after anterior resections, especially for low resections less than 7 cm from the anal verge.^{18,19} For sigmoid resections, rates varied between zero and 2.9%; while for anterior resections, these values varied between zero and 12.7% (Table 2).^{18,20}

Table 2 Percentage of leakage after sigmoid and rectum resection

Reference	Total No. of surgeries	Type and No. of resections	Type (%) of anastomosis	Overall leakage (%)	Rectum sigmoid leakage (%)	Type of surgery
Fielding et al ²¹	359	AR 151	N/A	2.7	N/A	Laparoscopy
Griffen et al ²²	75	AR 75	Stp (100)	2.7	AR 2.7	Laparotomy
Montesani et al ²³	533	AR 172	Stp (5.2)	4.5	N/A	Laparotomy
Kockerling et al ¹⁹	1143	SR 54	Hsw (94.7)	4.25	AR 12.7	Laparoscopy
		AR 174	Stp (75.2)			
Gooszen et al ²⁴	45	SR 519	Hsw (24.7)	0	N/A	Laparotomy
		SR 45	Stp (11.1)			
Schlachta et al ²⁵	750	SR 126	N/A	2.5	N/A	Laparoscopy
		SR 191				
Degiuli et al ²⁰	108	AR 24	N/A	0	AR 0	Laparoscopy
		SR 19				
Rose et al ²⁶	4834	AR 499	Stp (76.9)	3.1	AR 9.9	Laparoscopy
		SR 2750	Hsw (16.9)			
Schwandner et al ²⁷	396	AR 36	Stp (80.5)	1.6	N/A	Laparoscopy
		SR 279				

Conversion rates for laparoscopic surgery were not considered. From the total of intestinal surgeries, we considered only sigmoid and rectal resections in type of resection.

AR = anterior resection; Hsw = hand-sewn anastomosis; N/A = data not available; SR = sigmoid resection; Stp = stapled anastomosis.

Several trials addressed the differences between stapled anastomosis and hand-sewn anastomosis. Some confusion persists as endoscopic surgery preferentially uses stapled anastomosis. After open surgery, no difference in leak rates was found, as concluded in a Cochrane Review meta-analysis of 9 randomized trials²⁸ that compared the results of 622 stapled versus 611 hand-sewn anastomoses. Also, Kockerling et al reported anastomotic leak rates of 4.7% with stapled anastomoses versus 3.2% in the hand-sewn group, whereas Mileski et al found no difference, with rates of 4.4% and 3.5%, respectively.^{19,29} After stapled anastomosis, we found leak rates between 1.6% and 4.25% versus zero to 6% for those reports with predominantly hand-sewn anastomosis (Table 2).

Variability in leak rates remains important as shown in Table 2, partially because of different definitions used. Indeed, leak definitions ranged from clinical suspicion or radiologic diagnosis to a confirmed leak at reintervention. It is still unclear how to define a clinically relevant leak requiring reintervention. Systematic radiologic controls during the first postoperative days revealed small leaks in up to 30%, most of them resolving spontaneously.¹⁸ As predictors of an anastomotic leak, Mileski et al reported that in patients with a confirmed leak at reoperation, 94% had fever up to 38.3°C or higher, 94% had marked leukocytosis ($>18.2 \times 10^9/L$), and 100% reported pelvic pain. They also found that low albumin and hemoglobin levels were more likely to be associated with postoperative leakage.²⁹ In a large study of 39 leaks by Alves et al, fever above 38°C was found in 19%, diarrhea in 36%, ileus after the fourth day in 49%, persistent abdominal drain in 47%, oliguria in 38%, leukocytosis in 63%, uremia in 39%, and elevated creatinine in 22%. The combination of 2 symptoms had 31% sensi-

tivity and 92% specificity, and 3 symptoms together had a risk of 67%, 21% sensitivity, and 99% specificity.³⁰

Functional outcomes

The functional results after intestinal resection for benign conditions rarely have been reported. Most studies describe outcomes after resection for malignant disease, which probably is more radical, with more autonomic nerve injury and frequently with neoadjuvant radiotherapy. Autonomic nerve damage is the most likely cause of sexual and urinary dysfunction. Radiation was reported to be associated with an increased incidence of intestinal obstruction, fistula, and urinary tract infection. Also, radiotherapy administered after anterior resection may impair rectal capacity and sphincter function.³¹

Results describing bowel function vary widely. Some authors considered that these problems could result mostly from surgical technique.^{32,33} Others reported that they were infrequent and disappeared gradually, such as Mohr et al who found that most cases of changes in bowel habits resolved within a year of surgery.³⁴ Their findings are in contrast with Lewis, who found in a prospective study that patients who were incontinent 6 months after surgery were unlikely to improve after 1 year.³⁵

As was reported for leak rates, functional outcomes after anterior resection were related to the level of anastomosis.^{35–42} McDonald and Heald described impaired continence in 17% of high anterior resections, in contrast with 25% in low and 52% in ultra-low surgeries. They also found a significant difference in minor fecal leak, with 9% for high resection, 25% for low resection, and 57% for ultra-low resection.³⁶ Because radiotherapy might affect these rates,

Table 3 Functional bowel problems after intestinal resection

Reference	No.	Type of resection	Urgency (%)	Diarrhea (%)	Continence problems (%)	Difficult evacuation (%)
McDonald and Heald ^{36*}	21	uLAR	52†		57†	
	32	LAR	25		25	
	22	HAR	17†		9†	
Frigell et al ^{43*}	11	LAR		91		
	2	HAR		50		
Batignani et al ⁴⁰	20	LAR			80	
	13	HAR			0	
Lewis et al ^{35*‡}	12	LAR	11.7†		23.5†	
	11	AR	0		5.8	
	10	SR	0†		0†	
Graf et al ³³	70	AR			40†	46
	40	CR			13†	25
Ikeuchi et al ^{44*}	34	LAR	2.9		0	67†
	38	AR	0		0	13.2†
Ortiz and Armendariz ^{37*‡}	25	AR	40†		52†	20
	25	Co	12†		8†	4
Sato et al ^{32‡§}	24	LAR		37	4	67†
	22	SR		36	9	32†

Continence problems include soiling, leak, incontinence.

AR = anterior resection; Co = control group (no resection); CR = colon resection; HAR = high anterior resection; LAR = low anterior resection; SR = sigmoid resection; uLAR = ultra-low anterior resection.

*Follow-up 12 months or longer.

†Significantly different results between groups.

‡No radiotherapy used.

§Preservation of autonomic nerves specified.

series without radiotherapy were reviewed separately. In a group of 34 patients, Lewis et al reported 4 (11.7%) cases of urgency and 8 (23.5%) cases of fecal leakage in the low-resection group, versus no symptoms in the higher series.³⁵ Sato et al reported difficulties in emptying in 67% in the low-resection group and only 32% after sigmoid resection (Table 3).³²

Ortiz and Armendariz reported the outcomes of anastomosis between 2 and 11 cm from the anal margin. Of importance, they matched the study population with healthy controls to exclude that functional problems after surgery reflected a normal characteristic of older people. They found significant differences between controls and the study population in all the variables they considered, such as stool frequency, incontinence, urgency, and discrimination of feces. Thus 1 year after surgery, all age groups still had functional problems in comparison with their aged-matched controls.³⁷

Bladder and sexual dysfunction are well-known sequelae of rectal surgery as they usually occur as a result of damage of the autonomic nerves.^{31,45} With the advent of new techniques that aim at preservation of nerve structures, these complications decreased but did not disappear.

In 1996, Havenga et al studied urinary function in 54 women with a mean age of 56.5 years, who underwent excision with autonomic nerve preservation. They found that 6 months after surgery, 12% still had difficulty in bladder emptying, 31% had urgency, and 30% had urinary

leakage.⁴⁶ Hendren et al studied 45 women who underwent anterior resection and reported urinary problems in 9.1% of them.⁴⁷

Several authors reported sexual disturbances.³¹ The difficulties, however, are the criteria and the objectivity used to measure the problem. Havenga et al found that 15% of women were unable to experience vaginal lubrication and 9% had anorgasmia 6 months after surgery. Pain during intercourse was experienced always by 4% and sometimes by 25% of the study population.⁴⁶ These results were in contrast with the recent report of Hendren et al, who found that 42.9% of patients had an impaired sexual life after surgery, 48.1% had pain during sexual activity, and 17.1% used vaginal cream for lubrication.⁴⁷ It should be stressed that the series comprised women who had radiotherapy, which might affect outcomes.

Discussion

Anastomotic leakage is a feared complication of colorectal surgery and if unrecognized may be associated with a mortality as high as 39%. Also, minor cases may cause late functional problems.¹⁸ Any discussion, however, is hampered by the definition of leak. Clinical suspicion alone will have a low sensitivity and specificity with a high rate of false negatives. As reported by Mileski et al and Alves et al,

relying on a combination of symptoms^{29,30} will not aid in diagnosis. Systematic radiologic controls after resection will reveal a high number of leaks that resolve spontaneously. Thus, a high rate of leaks with scanty symptoms and that resolve spontaneously is probable. Therefore, although the definition of leak tends to vary,¹⁸ it is clear that clinical symptoms alone are inadequate for diagnosis. Diagnosis therefore ranges from liberal use of imaging techniques, such as computed tomography scans or contrast enema, to aggressive laparoscopic second-look whenever a suspicion of leak exists.^{18,30}

Leak incidence and bowel dysfunction are clearly more common after lower resections. It was suggested to be secondary to a low blood supply in the lower part of the rectum, affecting anastomotic healing.¹⁸ In addition, low rectum resections are performed exclusively for malignant conditions and are therefore often associated with radiotherapy. Also, low rectum resection is associated with high pressure at the level of the anastomosis. Functional bowel problems occur less often after sigmoid than after rectum resection. These problems were reported to be related to the length of residual rectum, which is considered of crucial importance for normal function.^{35,36,39,41} Also, surgical technique was found to be important for bowel function, albeit not demonstrated in randomized trials.^{32,33,48,49} The incidence of functional bowel problems remains high, with incidences up to 30%, and it remains unclear whether these are permanent or temporary problems. It should be noted, however, that functional problems following low resections are actually prevented by performing a pouch anastomosis.³⁹

Urogenital dysfunction after bowel resection is generally explained by anatomy, especially the sympathetic and parasympathetic nerve supply. Because the pelvic autonomic nerve plexus is localized in the anterolateral area of the rectum,⁴⁵ the probability of damage is higher in low resections. In addition to transection, injury may be caused by traction during mobilization of the lower rectum.⁵⁰

Sexual problems have been receiving much attention lately, and it is hard to ignore anorgasmia rates of 40%.

Extrapolation of these data to endometriosis surgery should be done prudently. Cancer surgery is more radical; whereas in gynecology, nerve-sparing surgery is more likely to be performed. Functional problems reported after endometriosis surgery involved mainly urinary retention, a consequence of parasympathetic damage that is related more often to the lateral extent of the endometriosis.^{11,12}

Finally, although laparoscopic colorectal resection is considered feasible and safe,^{20,23,25–27} there is agreement that this type of procedure should be performed by only experienced colorectal surgeons. Moreover, the lower the anterior resection, the greater the technical difficulties.^{19,20}

Conclusions

The incidence of leak after bowel resection ranges from a few percent to 10% and is greater with low rectal resec-

tions. For benign conditions, leak rates after sigmoid resections should be around 1%. Clinical diagnosis may be difficult, supporting those who advocate a liberal use of imaging techniques when in doubt or a repeat laparoscopy when a leak is strongly suspected. The incidence of functional bowel problems, as well as urinary and sexual problems, up to 30% and even 40% is high, especially after low rectum resections. It is unclear to what extent these data were inflated by the inclusion of radical cancer surgery, often associated with radiotherapy.

It is also unclear how these data should affect endometriosis surgery. Following are elements to consider. First, endometriosis is not cancer, and the aim of surgery is treatment of pain and infertility. Whether eradication of the disease is important or whether the presence of a few remaining cells is clinically unimportant awaits careful studies of recurrence rates. Second, because late functional problems are much less frequent after a sigmoid than after a rectum resection, and because technically a discoid resection is easier at the level of the rectum, we would suggest an avoidance of resections for lower lesions, if possible. Third, considering the difficulty of discoid resection at the level of the sigmoid, and the much lower incidence of functional problems after sigmoid resection, a more aggressive approach seems reasonable, especially for larger lesions.

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