

Surgical Management of Rectal Prolapse

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Background: The problem of complete rectal prolapse is formidable, with no clear predominant treatment of choice. Surgical management is aimed at restoring physiology by correcting the prolapse and improving continence and constipation with acceptable mortality and recurrence rates. Abdominal procedures are ideal for young fit patients, whereas perineal procedures are reserved for older frail patients with significant comorbidity. Laparoscopic procedures with their advantages of early recovery, less pain, and possibly lower morbidity are recently added options. Regardless of the therapy chosen, matching the surgical selection to the patient is essential.

Objective: To review the present status of the surgical treatment of rectal prolapse.

Data Sources: Literature review using MEDLINE. All articles reporting on rectopexy were included.

Study Selection: Articles reporting on prospective and retrospective comparisons were included. Case reports were excluded, as were studies comparing data with historical controls.

Data Extraction: The results were tabulated to show outcomes of different studies and were compared. Studies that did not report some of the outcomes were noted as "not stated."

Data Synthesis: Abdominal operations offer not only lower recurrence but also greater chance for functional improvements. Suture and mesh rectopexy produce equivalent results. However, the polyvinyl alcohol (Ivalon) sponge rectopexy is associated with an increased risk of infectious complications and has largely been abandoned. The advantage of adding a resection to the rectopexy seems to be related to less constipation. Laparoscopic rectopexy has similar results to open rectopexy but has all of the advantages related to laparoscopy. Perineal procedures are better suited to frail elderly patients with extensive comorbidity.

Conclusions: Abdominal procedures are generally better for young fit patients; the results of all abdominal procedures are comparable. Suture and mesh rectopexy are still popular with many surgeons—the choice depends on the surgeon's experience and preference. Similarly, the procedure may be done through a laparoscope or by laparotomy. Perineal procedures are preferable for patients who are not fit for abdominal procedures, such as elderly frail patients with significant comorbidities. The decision between perineal rectosigmoidectomy and Delorme procedures will depend on the surgeon's preference, although the perineal rectosigmoidectomy has better outcomes.

Arch Surg. 2005;140:63-73

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RECTAL PROLAPSE, OR PROCI-DENTIA, is defined as a protrusion of the rectum beyond the anus.¹ Complete or full-thickness rectal prolapse is the protrusion of all of the rectal wall through the anal canal; if the rectal wall has prolapsed but does not protrude through the anus, it is called an occult (internal) rectal prolapse or a rectal intussusception.^{2,3} Full-thickness rectal prolapse should be distinguished from mucosal prolapse in which there is protrusion of only the rectal or anal mucosa.¹⁻³

Prerequisites for the development of rectal prolapse are (1) the presence of an abnormally deep pouch of Douglas,³⁻⁶ (2) the lax and atonic condition of the muscles of the pelvic floor and anal canal,^{4,5} (3) weakness of both internal and external sphincters, often with evidence of pudendal nerve neuropathy,^{5,6} and (4) the lack of normal fixation of the rectum, with a mobile mesorectum and lax lateral ligaments.⁵⁻⁷ With this abnormality, the small intestine, which lies against the anterior wall of the rectum, may force the rectum out through the anal canal.⁴

Rectal prolapse occurs at the extremes of age.^{1,8} In the pediatric population, the condition is usually diagnosed by the age of 3 years, with an equal sex distribution. In the adult population, the peak incidence is after the fifth decade and women are more commonly affected, representing 80% to 90% of patients with rectal prolapse.^{1,8} Patients with complete rectal prolapse have markedly impaired rectal adaptation to distention, which may contribute to anal incontinence, and consequently more than half of the patients with rectal prolapse have coexisting inconti-

Table 1. Results of Suture Rectopexy for Rectal Prolapse

Source	N	Design	Mortality, %	Continence, %	Constipation, %	Recurrence, No. (%)	Follow-up, mo
Open							
Carter, ²¹ 1983	32	NS	0	NS	NS	1 (3)	144
Novell et al, ²² 1994	32	Prospective	0	15 (+)	31 (-)	1 (3)	47
Graf et al, ²³ 1996	53	Retrospective	0	36 (+) 12 (-)	30 (+) 27 (-)	5 (9)	97
Khanna et al, ²⁴ 1996	65	Prospective	0	75 (+)	83 (+)	0	65
Briel et al, ¹¹ 1997	24	NS	0	67 (+)	NS	0	67
Laparoscopic							
Kellokumpu et al, ²⁵ 2000	17	Prospective	0	82 (+)	70 (+)	2 (7)	24
Heah et al, ²⁶ 2000	25	Prospective	0	50 (+)	14 (+)	NS	26
Kessler et al, ²⁷ 1999	32	Prospective	0	NS	NS	2 (6)	48
Bruch et al, ²⁸ 1999	32	Prospective	0	64 (+)	76 (+)	0	30
Benoist et al, ²⁹ 2001	18	Retrospective	0	77 (+)	11 (-)	NS	NS

Abbreviations: NS, not stated; (+), improvement; (-), worsening.

nence.⁹⁻¹³ Constipation is associated with prolapse in 15% to 65% of patients.^{1,12,14-17} Straining may force the anterior wall of the upper rectum into the anal canal, perhaps causing a solitary rectal ulcer due to mucosal trauma.^{1,18}

The aim of treatment is to control the prolapse, restore continence, and prevent constipation or impaired evacuation.^{5,7} This goal can be achieved by (1) resection or plication of the redundant bowel and/or (2) fixation of the rectum to the sacrum.^{5,7} A strong and functional pelvic floor may be restored by plicating the puborectalis anterior to the rectum.⁵ The rationale for rectal fixation is to keep the rectum attached in the desired elevated position until it becomes fixed by scar tissue. In incontinent patients, the patulous sphincter ani begins to regain its tone approximately 1 month after the procedure, and full continence is generally restored within 2 to 3 months.¹⁹ Numerous procedures have been described for the treatment of rectal prolapse and are generally categorized into perineal or abdominal approaches.

ABDOMINAL PROCEDURES

Many abdominal techniques have been described, differing only in the extent of rectal mobilization, the methods used for rectal fixation, and the inclusion or exclusion of resection.⁵

Suture Rectopexy

This operation, first described by Cutait in 1959,²⁰ involves a thorough mobilization and upward fixation of the rectum. The mobilization and subsequent healing by fibrosis tends to keep the rectum fixed in an elevated position as adhesions form, attaching the rectum to the presacral fascia.¹ **Table 1** lists series with more than 10 patients undergoing suture rectopexy. There was no reported mortality, and recurrence rates ranged from 0% to 27%.^{11,21-24} With the exception of one series with a recurrence rate of 27%,²³ the majority of reports claimed rates ranging from 0% to 3%, with most of the reports showing an improvement in fecal continence. The influence on constipation was variable, with different studies showing improvement, deterioration, or no effect on constipation. Briel et al¹¹ in a review of suture rectopexy in 24 patients with rectal prolapse and incontinence noted a bet-

ter overall clinical outcome in males. They postulated that the low success rate in female patients might be explained by the presence of an occult sphincter defect. This assumption was underlined by a history of obstetric tear or episiotomy in female patients with persistent anal incontinence after rectopexy. These patients should be considered as candidates for endoanal ultrasound and subsequent sphincter repair.

Prosthetic or Mesh Rectopexy

Insertion of a foreign material during rectopexy is commonly performed with the assumption that this material evokes more fibrous tissue formation than ordinary suture rectopexy.⁵ Materials used include fascia lata; non-absorbable synthetic meshes such as nylon, polypropylene (Prolene [Ethicon Inc, Somerville, NJ], Marlex [CR Bard, Murray Hill, NJ]), polyvinyl alcohol (Ivalon; Dow Corning, Midland, Mich), and polytetrafluoroethylene (Teflon; CR Bard); and absorbable meshes such as polyglactin (Vicryl; Ethicon Inc) and polyglycolic acid (Dexon; Davis Geck, Danbury, Conn). There are 2 types of mesh rectopexy: posterior mesh rectopexy and anterior sling rectopexy (Ripstein procedure).

Posterior Mesh Rectopexy. After rectal mobilization, a prosthetic material or mesh is inserted between the sacrum and the rectum, sutured into the rectum, and then sutured into the periosteum of the sacral promontory. Although fascia lata was used in the early description of the procedure in general, it is no longer used. **Table 2** lists series in which posterior mesh rectopexy was used with more than 10 patients. Four series used polyvinyl alcohol sponge rectopexy and the rest used other meshes. The sponge rectopexy, first described by Wells in 1959,⁴³ involves insertion of the polyvinyl alcohol sponge prosthesis in front of the sacrum, between the sacrum and the rectum. Mortality rates ranged from 0% to 3%,^{22,30,31} and recurrence rates were reported at 3%.^{16,22,30,31} Improvement in continence occurred in 3% to 40%, but there was a mixed response of constipation to this type of rectopexy.^{10,16,22,29,31,34,38} Although the sponge rectopexy was popular before 1980, it has lost popularity and is confined to studies before 1994. Other nonabsorbable synthetic meshes have replaced the sponge, and more re-

Table 2. Results of Posterior Mesh Rectopexy for Rectal Prolapse

Source	N	Design	Mesh*	Mortality, No. (%)	Continence, %	Constipation, %	Recurrence, No. (%)	Follow-up, mo
Open								
Penfold and Hawley, ³⁰ 1972	101	Retrospective	1	0	22 (+)	NS	3 (3)	48
Morgan et al, ³¹ 1972	150	Retrospective	1	4 (3)	42 (+)	58 (+)	3 (3)	36
Mann and Hoffman, ¹⁶ 1988	59	NS	1	0	25 (+)	39 (-)	NS	NS
Novell et al, ²² 1994	31	Prospective	1	0	3 (+)	48 (-)	2 (3)	47
Scaglia et al, ³² 1994	16	Retrospective	2	0	19 (+)	14 (-)	0	12
Notaras, ³³ 1973	19	NS	6	NS	NS	NS	0	84
Keighley and Shouler, ¹⁵ 1984	100	NS	2	0	64 (+)	NS	0	24
Sayfan et al, ³⁴ 1990	16	Prospective	2	0	75 (+)	NC 75 25 (-)	NS	NS
Luukkonen et al, ³⁵ 1992	15	Prospective	4	0	53 (+)	100	0	NS
Winde et al, ³⁶ 1993	47	Prospective	3 + 4	0	17 (+)	NS	0	51
Galili and Rabau, ³⁷ 1997	37	Prospective	3 + 2	0	(+)	NS	1 (3)	44
Yakut et al, ⁷ 1998	48	Retrospective	2	0	(+)	NC	0	38
Aitola et al, ¹⁰ 1999	96	Retrospective	2	1 (1)	26 (+)	24 (+)	6 (6)	78
Mollen et al, ³⁸ 2000	18	Prospective	5	NS	NS	NC	0	42
Laparoscopic								
Himpens et al, ³⁹ 1999	37	Prospective	3	0	92 (+)	38 (-)	0	26
Darzi et al, ⁴⁰ 1995	29	Prospective	2	0	NS	NS	0	8
Boccasanta et al, ⁴¹ 1999	10	Prospective	2	0	(+)	0	0	30
Zittel et al, ⁴² 2000	29	Prospective	2	0	76 (+)	NC	1 (4)	22
Benoist et al, ²⁹ 2001	14	Retrospective	2	0	10 (+)	21 (-)	NS	NS

Abbreviations: NC, no change; NS, not stated; (+), improvement; (-), worsening.

*1 indicates polyvinyl alcohol sponge (Ivalon); 2, polypropylene (Prolene [Ethicon Inc, Somerville, NJ], Marlex [CR Bard, Murray Hill, NJ]); 3, polyglactin (Vicryl; Ethicon Inc); 4, polyglycolic acid (Dexon; Davis & Geck, Danbury, Conn); 5, polytetrafluoroethylene (Teflon; CR Bard); 6, silk (Mersilene; Ethicon Inc).

cently absorbable meshes have been introduced. A number of authors^{35-37,44} have shown that the use of both absorbable and nonabsorbable meshes achieved similar results. The mortality rate was 0% to 1% and the recurrence rates were 0% to 6% for both absorbable³⁵⁻³⁷ and nonabsorbable^{7,10,13,32,34,37,38} meshes. There was an overall improvement in continence, with conflicting results in terms of constipation (Table 2).

A number of studies have evaluated the efficacy of absorbable mesh in posterior mesh rectopexy. Winde et al³⁶ assessed 47 patients with rectal prolapse in whom they compared 2 types of absorbable meshes (polyglycolic acid and polyglactin) and noted mortality and recurrence rates similar to those with other nonabsorbable meshes. Galili and Rabau³⁷ compared polyglycolic acid and polypropylene in the treatment of rectal prolapse in 37 consecutive patients and produced similar results with both types of meshes. These results have been reproduced by others.^{35,44-46} The mortality and recurrence rates are similar to figures reported after placement of nonabsorbable meshes.

Significant pelvic sepsis is a major contributor to postoperative morbidity, having been reported in 2% to 16% of patients with prosthetic rectopexy.^{4,5,31,36,44,45,47-49} Polyvinyl alcohol sponge placement carries an increased risk of infectious complications.^{47,48} In 1996, Athanasiadis et al⁴⁵ performed posterior mesh rectopexy in 222 patients, with sigmoidectomy in 145. They used polyvinyl alcohol in 87 patients, polyglactin in 109, and polytetrafluoroethylene in 26. The infection rate associated with polytetrafluoroethylene mesh was 0% and that associated with absorbable material without resection was 0%, whereas the presence of resection increased the mortality rate to 1%. In patients with polyvinyl alcohol sponge rectopexy, the infection rate was 3%

without resection and increased to 3.7% in the presence of resection. Insertion of a mesh during rectopexy without resection appears to be reasonable, as it was associated with a 0% or very low mortality.^{36,44,45,50}

Because the main predisposing factor for infection of the implant is an infected pelvic hematoma, drainage of the presacral pelvic region during surgery is recommended.^{22,36,45} The converse argument is that a pelvic drain may serve as a source of infection. If this complication does occur, however, removal of the foreign material is advisable, as sepsis does not resolve until all foreign material is removed.^{36,37,44,47-49} In general, other materials are preferred over the polyvinyl alcohol sponge as this material is highly prone to infection.^{1,5,13} Furthermore, in the presence of an anastomosis in patients having a synchronous resection, the theoretical risk of infection is increased.^{22,45}

Ripstein Procedure (Anterior Sling Rectopexy). This operation was first described by Ripstein in 1952.¹⁹ After complete mobilization of the rectum, an anterior sling of fascia lata or synthetic material is placed in front of the rectum and sutured to the sacral promontory. The rationale is to restore the posterior curve of the rectum to minimize the effect of increased intra-abdominal pressure. The operation provides a firm anterior fascial support in patients with atrophic pelvic structures and restores the normal anatomic position of the rectum. **Table 3** lists series with more than 10 patients undergoing the Ripstein procedure. Mortality rates ranged between 0% and 2.8% and recurrence rates between 0% and 13%, and there was a trend toward improvement in continence and a mixed response to constipation.^{10,17,32,36,45,55-57} Although the Ripstein procedure has been denigrated on the grounds that it causes ob-

Table 3. Results of the Ripstein Procedure for Rectal Prolapse

Source	N	Design	Mortality, No. %	Continence, %	Constipation, %	Recurrence, No. (%)	Follow-up, mo
Launer et al, ⁵¹ 1982	54	Retrospective	0	41 (+) 10 (-)	10 (-)	6 (12)	64
Holmström et al, ⁵² 1986	108	NS	3 (2.8)	37 (+)	17 (-)	4 (4)	83
Roberts et al, ⁵³ 1988	135	Retrospective	1 (0.6)	78 (+)	69 (+)	13 (10)	41
Winde et al, ³⁶ 1993	47	Prospective	0	23 (+)	17 (+)	0	51
Tjandra et al, ¹⁷ 1993	142	Retrospective	1 (0.7)	18 (+)	NC	10 (7)	50
Scaglia et al, ³² 1994	16	Retrospective	0	23 (+)	NC	0	12
Schultz et al, ⁵⁴ 1996	24	Prospective	0	64 (+)	NS	NS	NS
Schultz et al, ⁵⁵ 2000	69	NS	0	20 (+) 10 (-)	37 (+) 8 (-)	1 (2)	82

Abbreviations: NC, no change; NS, not stated; (+), improvement; (-), worsening.

Table 4. Results of Suture Rectopexy With Resection

Source	N	Design	Mortality, No. (%)	Continence, %	Constipation, %	Recurrence, No. %	Follow-up, mo
Open							
Frykman and Goldberg, ⁶¹ 1969	80	Retrospective	NS	NS	NS	0	NS
Watts et al, ⁶⁵ 1985	138	Retrospective	0	78 (+)	NS	2 (2)	48
Sayfan et al, ³⁴ 1990	13	Prospective	0	66 (+)	80 (+)	NS	NS
Luukkonen et al, ³⁵ 1992	15	Prospective	1 (6.7)	33 (+)	60 (+)	0	NS
Tjandra et al, ¹⁷ 1993	18	Retrospective	0	11 (+)	56 (+)	NS	50
Deen et al, ⁶⁶ 1994	10	Prospective	0	90	NS	0	17
Huber et al, ⁶⁷ 1995	42	Prospective	0	44 (+)	18 (+)	0	54
Yakut et al, ⁷ 1998	19	Retrospective	0	(+)	(+)	0	38
Kim et al, ⁶⁸ 1999	176	Retrospective	NS	55 (+)	43 (+)	9 (5)	98
Laparoscopic							
Stevenson et al, ⁶³ 1998	34	Prospective	0	70 (+)	64 (+)	0	18
Xynos et al, ⁶⁹ 1999	10	Prospective	0	100 (+)	NA	NS	12
Benoist et al, ²⁹ 2001	16	Retrospective	0	100 (+)	0	NS	NS

Abbreviations: NA, not applicable; NS, not stated; (+), improvement.

structed defecation,^{51,58} series looking at constipation after the Ripstein procedure have yielded conflicting results (Table 3). Moreover, to limit the incidence of obstruction, Ripstein himself, with McMahan, modified the procedure to include posterior fixation of the mesh to the sacrum.⁵⁹ In this situation, the lateral mesh is anteriorly sutured to the rectum, with a gap deliberately left between the ends to obviate narrowing. Intraoperative rigid proctoscopy can help determine the snugness of the wrap and caliber of the rectal lumen. Male patients exhibit a higher incidence of recurrent prolapse because of technical difficulties with a narrow pelvis.^{15,53,60}

In 1988, Roberts et al⁵³ reviewed their experience with the Ripstein procedure in 135 patients during a 22-year period at the Lahey Clinic, Burlington, Mass; they noted a 52% complication rate, the most serious complication being presacral hematoma, which occurred in 8% of cases. The overall recurrence rate was 10%. However, the recurrence rate in men was 3 times that in women (24% vs 8%, respectively). They postulated that the reason for a high failure rate in men might be difficulty in mobilizing the rectum in the narrow male pelvis. Technical difficulties at the time of the original operation were implicated in 50% of cases of male patients with recurrence.⁵³

Resection

The concept of rectosigmoid resection is based on the observation that after low anterior resection, a dense area of fibrosis forms between the anastomotic suture line and the sacrum, securing the rectum to the sacrum.⁵ Other advantages include (1) resection of the abundant rectosigmoid, which avoids torsion or volvulus; (2) achieving a straighter course of the left colon and little mobility from the phrenocolic ligament downward, which acts as yet another fixative device^{1,5,61-63}; and (3) relief of constipation in a selected group of patients.⁵ It is well suited to patients with a long redundant sigmoid and a long history of constipation.⁶⁴ However, sigmoid resection alone for rectal prolapse has not been popular and is confined to studies before 1980.

The addition of sigmoid resection to rectopexy (resection rectopexy; Frykman-Goldberg procedure) combines the advantages of mobilization of the rectum, sigmoid resection, and fixation of the rectum. Most of the series describe resection rectopexy in which resection is combined with suture rectopexy. Few studies have addressed a combination of resection and posterior mesh rectopexy. **Table 4** lists series with more than 10 patients undergoing resection rectopexy (suture rectopexy and re-

section). The mortality rates ranged from 0% to 6.7%^{7,17,34,35,37,39,65,67} with an associated recurrence rate of 0% to 5%.^{7,35,37,39,66-68} There was an overall reduction in constipation, which was attributed to resection of the redundant sigmoid colon. Continence was also improved in most patients. Luukkonen et al³⁵ in a comparative study between rectopexy with sigmoidectomy vs rectopexy alone showed that sigmoid resection did not increase morbidity but tended to diminish postoperative constipation, possibly by causing less outlet obstruction.

In a prospective randomized study of rectopexy with and without rectopexy, McKee et al⁷⁰ in 1992 showed that patients with rectal prolapse who underwent abdominal rectopexy alone had a high incidence of constipation. They also showed that patients having rectopexy alone had a higher pressure in the rectum for a given volume of isotonic sodium chloride solution infused. They postulated that this was due to kinking between the redundant sigmoid colon and the rectum at the rectosigmoid junction, and that the addition of sigmoidectomy appeared to alleviate this possibly by removing the redundant loop of colon that may kink and cause delay in passage of intestinal content.

Anterior resection was first described by Muir in 1955,⁷¹ although the first successful operation was performed by Stabins in 1947.⁷² In a retrospective study of 28 patients, Theuerkauf et al⁷³ in 1970 noticed a 4% mortality rate and 4% recurrence rate after anterior resection with improvement of continence in 63% of cases. Schlinkert et al⁷⁴ in 1985 reviewed the Mayo Clinic experience with anterior resection for complete rectal prolapse in 113 patients during a 12-year period. There was a 9% recurrence rate, a 1% mortality rate, and a 50% improvement in continence. Cirocco and Brown¹⁴ performed anterior resection in 41 patients with complete rectal prolapse. All of these authors claimed that the advantages of this operation was that it was familiar and frequently performed, did not require a foreign body or rectal suspension, and had withstood long-term scrutiny in terms of both recurrence and associated complications. As with sigmoid resection, this operation has not gained popularity.

Laparoscopic Rectopexy

Compared with laparotomy, laparoscopic rectopexy has the advantages of reduced pain, shortened hospital stay, early recovery, and early return to work.²⁵ The procedure involves either suture or posterior mesh rectopexy, with or without resection. It has gained popularity as it is relatively simple and easily accomplished and resection with anastomosis is avoided.^{1,26-29,39-41,63,75} The mortality for laparoscopic rectopexy ranged between 0% and 3%, with recurrence rates ranging from 0% to 10% in follow-up of between 8 and 30 months.^{25-29,39-41,63,71,75} These studies have demonstrated that this approach is as effective as the open method in the treatment of rectal prolapse, and the effect on continence and constipation depends on the type of rectopexy performed.

In 1999, Boccasanta et al⁴¹ compared the functional and clinical results of laparoscopic rectopexy with those of the open technique in 2 similar groups of patients with complete rectal prolapse. The laparoscopic approach was asso-

ciated with a reduction in postoperative hospitalization, but there was a nonsignificant prolongation of operative time and the higher cost of surgical materials. The shorter postoperative hospital stay determined an overall reduction in the total cost of laparoscopic rectopexy. In the same year, Xynos et al⁶⁹ compared open and laparoscopic resection rectopexy and concluded that resection rectopexy for rectal prolapse can be performed safely via the laparoscopic approach.

In 2002, Solomon et al⁷⁶ reported on a randomized controlled study of 39 patients undergoing abdominal rectopexy. Nineteen underwent open procedures and 20 had laparoscopic procedures. They concluded that the laparoscopic technique had short-term benefits in terms of return to normal diet and mobility, earlier discharge from the hospital, and less morbidity. These results were paralleled by a reduced neuroendocrine and immunologic stress response. No long-term differences in constipation, recurrent prolapse, or improvement in continence scores between open and laparoscopic approaches were identified. Laparoscopically assisted rectopexy has also been described with good results, equivalent to those of open and laparoscopic rectopexy.^{25,63,75}

Place of Prosthetic Meshes in Rectopexy

The use of prosthetic material in rectopexy has been challenged in recent years. There is evidence that complete encirclement of the rectum (Ripstein procedure) may lead to erosion of the foreign material with subsequent fistula formation and stenosis in approximately 7% of patients.⁵ Furthermore, Kuijpers⁵ reoperated on 4 patients who had had posterior rectopexy with T-shaped polytetrafluoroethylene mesh several years previously. None of the patients had actual prolapse recurrence, but both of the "horizontal" legs of the mesh had retracted to the promontory and were ineffective as a fixation device. Therefore, Kuijpers believed that the purpose of using an implant to evoke an intense fibrous tissue formation is not always achieved by using prosthetic material. In 1972, Penfold and Hawley³⁰ conceded that the polyvinyl alcohol sponge tends to fragment but persists in human tissues for 5 years. Indeed, many authors⁷⁷ now believe that rectal fixation by suture only seems sufficient, with reported recurrence rates of 3% or less.^{1,5,21,55}

Role of Division of Ligaments

The left colon and rectum receive retrograde innervation from neural efferents running through the lateral ligaments; thus, lateral ligament division during rectopexy has been suggested to denervate the rectum, causing postoperative constipation.^{38,50} A number of studies have looked at the effect of the division or preservation of ligaments and are shown in **Table 5** and **Table 6**.

The results shown in Table 5 suggest that the lateral ligaments were usually divided, perhaps because there is a trend toward improved continence. Although fecal incontinence may have been decreased, constipation either worsened or remained the same. Only 4 studies addressed changes in resting and squeeze pressures. Three of these studies showed improvement in both pressures, while only 2 showed improvement in squeeze pressures. Table 6 shows studies of more than 10 patients in whom rectopexy was accompanied by pres-

Table 5. Effect of Division of Ligaments on Outcome of Rectopexy

Source	N	Design	Type	Resting Pressure, %	Squeeze Pressure, %	Continence, %	Constipation, %
Open							
Novell et al, ²² 1994	31	Prospective	Polyvinyl alcohol sponge	NS	NS	13 (+)	48 (-)
	32	Prospective	Suture	NS	NS	15 (+)	31 (-)
Yakut et al, ⁷ 1998	48	Retrospective	Posterior mesh	NS	NS	(+)	NC
Scaglia et al, ³² 1994	16	Retrospective	Posterior mesh	4 (+)	5 (-)	19 (+)	14 (-)
Keighley et al, ¹³ 1983	100	NS	Posterior mesh	9 (+)	9 (+)	64 (+)	NS
Mollen et al, ³⁸ 2000	10	Prospective	Posterior mesh	5 (-)	11 (-)	NS	NC
Cirotto and Brown, ¹⁴ 1993	41	Retrospective	Anterior resection	NS	NS	48 (+)10 (-)	18 (+) 23 (-)
Sayfan et al, ³⁴ 1990	29	Prospective	Posterior mesh	19 (+)	9 (+)	NS	NS
Laparoscopic							
Xynos et al, ⁶⁹ 1999	10	Prospective	Resection + suture	25 (+)	44 (+)	100 (+)	NA
Heah et al, ²⁶ 2000	25	Prospective	Suture	NS	NS	50 (+)	14 (+)
Zittel et al, ⁴² 2000	29	Prospective	Posterior mesh	23 (+)	37 (+)	76 (+)	NC
Benoist et al, ²⁹ 2001	48	Retrospective	Resection + suture	NS	NS	100 (+)	Variable

Abbreviations: NA, not applicable; NC, no change; NS, not stated; (+), improvement; (-), worsening.

Table 6. Effect of Preservation of Ligaments on Outcome of Rectopexy

Source	N	Design	Type	Resting Pressure, %	Squeeze Pressure, %	Continence, %	Constipation, %
Open							
Huber et al, ⁶⁷ 1995	42	Prospective	Resection	9 (+)	12 (+)	44 (+)	18 (+)
Winde et al, ³⁶ 1993	47	Prospective	Ripstein	NS	NS	23 (+)	17 (+)
Holmström et al, ⁵² 1986	108	NS	Ripstein	NS	NS	37 (+)	17 (-)
Schultz et al, ⁵⁵ 2000	112	NS	Ripstein	NS	NS	20 (+)10 (-)	37 (+) 8 (-)
Galili and Rabau, ³⁷ 1997	37	Prospective	Posterior mesh	NS	NS	(+)	NS
Khanna et al, ²⁴ 1996	65	Prospective	Suture	NS	NS	75 (+)	83 (+)
Briel et al, ¹¹ 1997	24	NS	Suture	NS	NS	67 (+)	NS
Watts et al, ⁶⁵ 1985	138	Retrospective	Resection	NS	NS	38 (+)	60 (+)
Luukkainen et al, ³⁵ 1992	30	Prospective	Posterior mesh	NS	NS	46 (+)	89 (+)
Aitola et al, ¹⁰ 1999	96	Retrospective	Posterior mesh	NS	NS	26 (+)	24 (+)
Tjandra et al, ¹⁷ 1993	192	Retrospective	Ripstein	NS	NS	18 (+)	NC
	18	Retrospective	Resection	NS	NS	11 (+)	56 (+)
Mollen et al, ³⁸ 2000	8	Prospective	Posterior mesh	5 (+)	7 (+)	NS	NS
Schultz et al, ³⁴ 1996	42	NS	Ripstein	20 (+)	11 (+)	NS	NS
Scaglia et al, ³² 1994	16	Retrospective	Ripstein	12 (+)	22 (+)	NS	NS
Lechaux et al, ⁷⁸ 2001	35	Prospective	Posterior mesh	NS	NS	72 (+)	5 (-)
Laparoscopic							
Stevenson et al, ⁶³ 1998	34	NS	Resection + suture	NS	NS	70 (+)	64 (+)
Kellokumpu et al, ²⁵ 2000	17	Prospective	Suture	NS	NS	82 (+)	70 (+)
Boccasanta et al, ⁴¹ 1999	10	Prospective	Posterior mesh	15 (+)	10 (+)	(+)	NC
Bruch et al, ²⁸ 1999	32	Prospective	Suture	3 (+)	6 (+)	64 (+)	76 (+)

Abbreviations: NC, no change; NS, not stated; (+), improvement; (-), worsening.

ervation of lateral ligaments; there was an overall improvement in continence. Although results were conflicting, there was a tendency toward reduction of constipation. Again, only 4 studies addressed anorectal physiological changes after rectopexy; there was an overall increase in resting and squeeze pressures. Brazzelli et al⁷⁹ performed a meta-analysis of articles reporting on surgery for rectal prolapse. They concluded that division, rather than preservation, of the lateral ligaments was associated with less recurrent prolapse but more postoperative constipation, although these findings were found in small numbers. The major limitation of this meta-analysis was that only 2 studies (one of which was an abstract) addressing lateral ligament division or preservation were included

in the meta-analysis. In summary, it would appear that preservation of ligaments is associated with an improvement in continence and a reduction of constipation.

PERINEAL PROCEDURES

The advantage of perineal procedures is that they avoid laparotomy, which makes them well suited for high-risk patients. There are 2 widely used perineal procedures: the Delorme procedure and perineal rectosigmoidectomy (Altemeier operation). The Thiersch procedure, which entails encircling and thereby narrowing the anal canal, does not eradicate prolapse but merely prevents its further descent

Table 7. Results of the Delorme Procedure for Rectal Prolapse

Source	N	Design	Mortality, No. (%)	Continence, %	Constipation, %	Recurrence, No. (%)	Follow-up, mo
Pescatori et al, ⁸² 1998	33	Retrospective	0	(+)	44 (+)	6 (18)	39
Lechaux et al, ⁸⁴ 1995	85	Retrospective	1 (1.2)	45 (+)	100 (+)	11 (14)	33
Agachan et al, ⁸⁵ 1997	8	Retrospective	0	(+)	NS	3 (38)	24
Oliver et al, ⁸⁶ 1994	41	Retrospective	1 (2.4)	58 (+)	NS	8 (22)	47
Yakut et al, ⁷ 1998	27	Retrospective	0	NS	NS	4 (4.2)	38
Kling et al, ⁸³ 1996	6	Retrospective	0	67 (+)	100 (+)	1 (17)	11
Watts and Thompson, ⁸⁷ 2000	101	Retrospective	4 (4)	25 (+)	13 (+)	30 (27)	36
Senapati et al, ⁵⁶ 1994	32	NS	0	46 (+)	50 (+)	4 (12.5)	21
Lieberman et al, ⁸⁸ 2000	34	Retrospective	0	32 (+)	88 (+)	0	43
Tobin and Scott, ⁵⁷ 1994	43	Prospective	0	50 (+)	NA	11 (26)	20

Abbreviations: NA, not applicable; NS, not stated; (+), improvement; (-), worsening.

Table 8. Results of Perineal Rectosigmoidectomy for Rectal Prolapse

Source	N	Design	Levatorplasty	Mortality, No. (%)	Continence, %	Constipation, %	Recurrence, No. (%)	Follow-up, mo
Takesue et al, ⁶⁰ 1999	10	NS	Yes (7/10)*	0	(+)	NS	0	42
Ramanujam et al, ⁹² 1994	72	NS	No	0	67 (+)	NS	4 (6)	120
Deen et al, ⁶⁶ 1994	10	Prospective	No	0	80	NS	1 (10)	18
Watts et al, ⁶⁵ 1985	33	Retrospective	No	0	6 (+) 22 (-)	NS	0	23
Williams et al, ⁹³ 1992	56	Retrospective	No	0	46 (+) 0 (-)	NS	6 (6)	12
Johansen et al, ⁹⁴ 1993	20	NS	No	1 (5)	21 (+)	NS	0	26
Agachan et al, ⁸⁵ 1997	32	Retrospective	No	0	(+)	NC	4 (13)	30
Altmeier et al, ⁹¹ 1971	106	Retrospective	No	0	NS	NS	3 (3)	228
Kim et al, ⁶⁸ 1999	183	Retrospective	No	NS	53 (+)	61 (+)	29 (16)	47
Williams et al, ⁹³ 1992	11	Retrospective	Yes	NS	91 (+)	NS	0	12
Agachan et al, ⁸⁵ 1997	21	Retrospective	Yes	0	(+)	NC	1 (5)	30
Prasad et al, ⁹⁵ 1986	25	NS	Yes	0	88 (+)	NS	0	NS

Abbreviations: NS, not stated; (+), improvement.

*Levatorplasty performed in 7 incontinent patients.

by providing mechanical support, and hence it is associated with a high recurrence rate (33%-44%).^{1,5,8,40,80} Given the safety of modern anesthetic techniques, there is no role for its use.⁵

Delorme Operation

This procedure was described by Delorme in 1900⁸¹ and involves dilation of the anus, separation of the mucosa from the sphincter and the muscularis propria, and the division of the mucosa together with the plication of the muscularis propria. It has an additional advantage of excision of a concomitant rectal ulcer if present.⁸² The Delorme procedure represents a surgical alternative for patients with prolapse who may be unable to tolerate a more extensive operation, such as the elderly, frail patients, and those who are medically unfit for major surgery.^{56,82,83}

Table 7 lists patients undergoing the Delorme operation, with reported mortality rates of 0% to 4% and recurrence rates of 4% to 38%.^{56,57,82,84,86-88} Oliver et al⁸⁶ successfully performed the Delorme procedure in 41 patients with a mean age of 82 years who were deemed unfit for major surgery because of age or comorbidity. They pointed out that important pitfalls in performing the pro-

cedure were weak or absent sphincter tone, perineal descent, and previous sphincter injury. There was a general improvement in continence.

Pescatori et al⁸² combined the Delorme procedure with sphincteroplasty in 33 patients, with good results achieved in 79% of patients. Continence improved in 70%, and in 44% constipation was cured. They concluded that the Delorme procedure combined with sphincteroplasty seemed indicated when both clinical and physiological findings showed a concomitant severe pelvic floor dysfunction. However, many other series without sphincteroplasty have shown improvement in continence.⁸⁴⁻⁸⁷

Factors associated with failure for the Delorme procedure include proximal procidentia with retrosacral separation on defecography, fecal incontinence, chronic diarrhea, and major perineal descent (>9 cm on straining). In the absence of these factors, the Delorme procedure provided a satisfactory and durable outcome.⁸⁹

Perineal Rectosigmoidectomy

This procedure was first advocated by Miles⁹⁰ in 1933 and subsequently by Altmeier et al in 1971.⁹¹ It involves a full-thickness excision of the rectum and, if possible, a

portion of the sigmoid colon. It has gained general acceptance for use in elderly patients in North America.⁶⁰

Table 8 summarizes the data on patients who underwent perineal rectosigmoidectomy. The reported overall mortality rates ranged from 0% to 5% and recurrence rates from 0% to 16%.^{68,69,85,87,92,93,95}

The postoperative course after perineal rectosigmoidectomy is generally uneventful, patients have minimal pain, oral intake can generally be commenced within 24 to 48 hours after surgery, and bowel function returns within a few days of surgery.⁶⁰ The potential complications include anastomotic bleeding and pelvic sepsis and, although leakage is uncommon, tension and poor blood supply can cause anastomotic dehiscence.⁶⁰ Extreme care must be taken not to pull the bowel too tightly while avoiding ligation of the mesentery too far proximally. Since recurrence probably reflects inadequate resection, care must be taken to mobilize the entire redundant rectum and to perform the anastomosis within the pelvis.⁶⁰ Perineal rectosigmoidectomy is well suited for male patients; patients with incarcerated, strangulated, or even gangrenous prolapsed rectal segment; and patients who have had recurrence after another transperineal repair.^{60,92,95}

Perineal rectosigmoidectomy has yielded poor functional results with respect to incontinence, urgency, and soiling, as well as high recurrence rates because of the loss of reservoir capacity due to a rather narrow colon above the anal anastomosis, together with some reduction in anal sphincter function.^{20,66,96} Yoshioka et al⁹⁶ described pouch perineal rectosigmoidectomy as a means of overcoming this problem and suggested that this procedure reduced recurrent prolapse probably because rectopexy sutures were used to fix the transected colon against the presacral fascia. However, a prospective randomized trial at the institution of 2 of the 3 of us (M.K.B. and S.D.W.) had to be discontinued because of the large number of patients randomized to pouch anal anastomosis in whom a viable pouch could not be made to reach the anus.

Reduction in resting anal pressure and compromised compliance make conventional perineal rectosigmoidectomy an unphysiologic procedure that results in increased soiling and frequency of defecation.⁶⁶ Some authors^{15,60,85,92,95} have therefore suggested the addition of levatorplasty to perineal rectosigmoidectomy. The advantage of posterior levatorplasty is that it recreates the anorectal angle, which seems to improve anal continence.⁹² This concomitant levatorplasty achieves not only a more significant improvement in continence but also a lower short-term recurrence rate than either the Delorme procedure or perineal rectosigmoidectomy alone.⁸⁵ When comparing the various perineal options (perineal rectosigmoidectomy, perineal rectosigmoidectomy with levatorplasty, and Delorme procedure), the perineal rectosigmoidectomy with levatorplasty has the largest recurrence-free interval, the lowest recurrence rate, and the most salutary effects on constipation and incontinence. Perineal rectosigmoidectomy is therefore next best and the Delorme procedure is the worst of the 3 perineal options.

There is general agreement that perineal rectosigmoidectomy is often the best operation for extremely elderly patients or individuals with profound comorbidity, in whom an abdominal procedure might be contraindicated.

⁹³⁻⁹⁵ It is also suitable for the elderly or high-risk patients with incontinence because a concomitant levatorplasty can be performed.^{15,60,94}

COMPARISON OF DIFFERENT PROCEDURES AND APPROACHES

Scaglia et al³² compared 16 patients who underwent posterior mesh rectopexy with 12 who had Ripstein rectopexy. Neither procedure improved symptoms of constipation or evacuation problems. The criticism of that study is the very small numbers of patients. Novell et al²² compared the polyvinyl alcohol sponge technique in 31 patients with the sutured rectopexy in 32 patients. There was marginal improvement in continence and reduction of constipation with the suture technique. Those authors concluded that because of the small but definite risk of infection associated with the sponge procedure, it should be abandoned. In a prospective randomized study, Luukkonen et al³⁵ in 1992 compared abdominal rectopexy with sigmoidectomy in 15 patients vs posterior mesh rectopexy without resection in 15 patients. Sigmoid resection in conjunction with rectopexy did not seem to increase operative morbidity but tended to diminish postoperative constipation. Sayfan et al³⁴ prospectively compared 11 patients who underwent sutured rectopexy and resection with 12 patients who had posterior polypropylene mesh rectopexy and concluded that resection rectopexy was comparable with posterior mesh rectopexy.

In 2001, Benoist et al²⁹ published their results of laparoscopic rectopexy in 48 patients. They evaluated laparoscopic rectopexy using mesh, suture, and resection and concluded that laparoscopic rectopexy was safe and effective. They also found that there was no difference among the 3 groups in terms of continence; mesh rectopexy conferred no advantage over suture rectopexy.

In 1999, Kim et al⁶⁸ reviewed their experience with the treatment of 372 patients with complete rectal prolapse during a 19-year period. They looked at choice of operation, recurrence rates, and functional results and showed that abdominal rectopexy with bowel resection was associated with low recurrence rates. Perineal rectosigmoidectomy provided lower morbidity and shorter hospitalization, but recurrence rates were much higher. They pointed out that perineal rectosigmoidectomy has appeal as a less intensive procedure for elderly patients or patients in the high-risk category. They conceded that patients who underwent perineal rectosigmoidectomy were more likely to have associated medical problems.

Yakut et al⁷ evaluated their results in 94 patients in 1998. They looked at the results of the Delorme procedure and of abdominal resection with or without rectopexy. They noted that the most important complications were sexual problems in male patients who underwent posterior rectopexy procedures. They concluded that the Delorme procedure, posterior rectopexy, and resection procedures were effective surgical operations for the treatment of rectal prolapse but that extensive pelvic dissection during the posterior rectopexy might create serious sexual dysfunction in male patients.

Deen et al⁶⁶ compared suture and resection rectopexy with perineal rectosigmoidectomy. They noted that

abdominal resection rectopexy with pelvic floor repair gave better functional and physiological results than did perineal rectosigmoidectomy by preserving both the internal sphincter and the rectal reservoir. There was a significantly higher maximum rectal resting pressure in patients with resection rectopexy.

In 1997, Agachan et al⁸⁵ compared the Delorme procedure, the perineal rectosigmoidectomy, and perineal rectosigmoidectomy with levatorplasty. The recurrence rate was highest with the Delorme procedure; postoperative continence was improved in all 3 procedures. The postoperative incontinence score was lowest in patients with perineal rectosigmoidectomy with levatorplasty. The median hospital stay was similar for all groups. Recurrence rates were 38% for the Delorme procedure, 13% for perineal rectosigmoidectomy, and 5% for perineal rectosigmoidectomy with levatorplasty. Postoperative anorectal function and anorectal physiological characteristics were similar for all groups. The authors concluded that perineal rectosigmoidectomy with levatorplasty was a safe procedure, resulting in significantly better short-term functional outcome than either perineal rectosigmoidectomy alone or the Delorme procedure. Concomitant levatorplasty achieves not only a more significant improvement in continence but a lower short-term recurrence rate than the other 2 procedures. It would appear that the functional results of the perineal procedures compare favorably with those of abdominal procedures in terms of restoration of continence, with less frequent severe morbidity.^{57,66,72,83,84} However, high recurrence rates after both primary and repeat operations should be explained to patients when their surgical management is planned.^{7,58,66,82,84,87} Extensive diverticular disease may prohibit effective and complete proximal mucosectomy in the Delorme procedure. Inadequate resection may predispose to early recurrence of the prolapse.⁸⁶

Since perineal rectosigmoidectomy is difficult to perform in patients with a small prolapse and in those whose prolapse is not full thickness in its entire circumference, Takesue et al⁶⁰ suggested that if the prolapsing rectal segment is shorter than 3 to 4 cm, a modification of the Delorme procedure is a better approach than perineal rectosigmoidectomy. We agree with this assessment.

CHOICE OF OPERATION

It seems reasonable that patients who are fit for surgery without comorbidity should be offered abdominal rectopexy, as it is now associated with very low mortality rates. The abdominal operation with the lowest recurrence rate should be offered to the medically fit patient. Even though abdominal operations have a higher morbidity, the fit patient is presumably capable of withstanding complications and should be given the best chance to cure the prolapse. This review has established that abdominal operations not only offer lower recurrence but also a greater chance for functional improvements. Suture rectopexy is capable of giving good results, and the addition of the posterior mesh does not offer additional advantage; rather, it has the disadvantage of introducing a foreign body. There seems therefore little to choose between suture rectopexy and posterior mesh rectopexy. The polyvinyl alcohol sponge rectopexy is asso-

ciated with an increased risk of infectious complications and has largely been abandoned. Posterior mesh rectopexy with other types of meshes has reasonable complication rates and recurrence rates. The advantage of adding a resection to the rectopexy seems to be a reduction in constipation. This procedure therefore seems suited to patients with a redundant sigmoid colon and a history of constipation. The Ripstein procedure has been associated with problems of constipation that either persist or postoperatively worsen.

Having chosen an abdominal resection rectopexy as the best option for the fit patient, the next decision is how to address the lateral ligaments. Preservation of the ligaments seems to have the advantage over their division in terms of continence and constipation. There are far fewer studies addressing the influence on resting and squeeze pressures after both approaches, but there seems to be benefit to preservation of ligaments. Further studies are required to assess the efficacy of division and preservation of lateral ligaments in these operations. However, for now the choice of division and preservation of ligaments depends on the surgeon's experience and preference.

Laparoscopic surgery has the advantages of less pain, shorter hospital stay, early recovery, and early return to work as compared with laparotomy. Apart from these advantages, the results are similar to those with the open procedures irrespective of the method used (suture, resection, or posterior mesh). Therefore, where expertise is available, this approach may be preferred.

Perineal procedures are often useful for frail patients with extensive comorbidity and individuals who are not fit for major abdominal surgery. Mortality rates are acceptable considering the type of patient in whom the procedure is done. The higher recurrence rates mandate that patients be forewarned that there may be need for a second operation. Whether to do the Delorme procedure or the perineal rectosigmoidectomy will depend on the preference and experience of the surgeon and, to a lesser extent, on where the physician is practicing. However, the Delorme procedure is associated with even higher recurrence rates than is perineal rectosigmoidectomy. In addition to reducing the potential risk of injury to the pelvic nerves, a perineal approach may be preferable in young male patients.

Favorable outcome could be achieved after perineal procedures by applying stringent patient-selection criteria. Perineal procedures represent a surgical alternative for patients with total prolapse who may be unable to tolerate a more extensive operation such as the elderly, frail patients, and those who are medically unfit for major surgery such as abdominal rectopexy. The Delorme procedure may be useful if there is insufficient length of prolapse to perform a perineal rectosigmoidectomy.^{56,82,83}

For all perineal procedures, the high recurrence rates for primary and repeat operations should be explained to patients when their treatment is planned. Perineal rectosigmoidectomy is well suited for patients with incarcerated, strangulated, and gangrenous rectal prolapse, whereas abdominal rectopexy cannot be used for these situations, even in fit patients.

In recent years, there has been a trend toward offering perineal rectosigmoidectomy to healthier patients.⁶⁴ Although perineal rectosigmoidectomy can be per-

formed with minimal hospitalization and disruption in the patient's life, the recurrence rate is in the range of 16%.⁶⁴ For younger female patients the benefits of perineal rectosigmoidectomy being a lesser procedure must be weighed against a higher recurrence rate.⁶⁸ Among factors to consider in the selection of a treatment option are the age and health of the patient, functional results, and the benefits vs the advantages and disadvantages of the surgical technique.⁶⁸

CONCLUSIONS

The problem of complete rectal prolapse is formidable, with no clear predominant treatment of choice. Abdominal procedures are ideal for young fit patients, whereas perineal procedures are reserved for older frail patients with significant comorbidities. Results after all abdominal procedures are comparable. Suture rectopexy seems adequate in curing rectal prolapse. The superiority of mesh rectopexy has not been demonstrated, and meshes add a foreign body and increase the risk of infection. Suture and mesh rectopexy are still popular with many surgeons, and the choice depends on the surgeon's experience and preference. Whereas sigmoid resection alone and anterior resection are obsolete, laparoscopic rectopexy has results equivalent to or better than those of open rectopexy. Laparoscopic suture rectopexy is preferable because it is simple and easy to perform. Perineal procedures are useful for patients who are not fit for abdominal procedures. Perineal rectosigmoidectomy seems better than the Delorme procedure and, if possible, levatorplasty should be added.

Accepted for Publication: November 25, 2003.

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REFERENCES

- Jacobs LK, Lin YJ, Orkin BA. The best operation for rectal prolapse. *Surg Clin North Am*. 1997;77:49-70.
- Felt-Bersma RJ, Cuesta MA. Rectal prolapse, rectal intussusception, rectocele and solitary ulcer syndrome. *Gastroenterol Clin North Am*. 2001;30:199-222.
- Roig JV, Buch E, Alós R, et al. Anorectal function in patients with complete rectal prolapse: differences between continent and incontinent individuals. *Rev Esp Enferm Dig*. 1998;90:794-805.
- Brodén B, Snellman B. Procidentia of the rectum: studies with cineradiography. *Dis Colon Rectum*. 1968;11:330-347.
- Kuijpers HC. Treatment of complete rectal prolapse: to narrow, to wrap, to suspend, to fix, to encircle, to plicate or to resect? *World J Surg*. 1992;16:826-830.
- Nicholls RJ. Rectal prolapse and the solitary ulcer syndrome. *Ann Ital Chir*. 1994;65:157-162.
- Yakut M, Kaymakcioglu N, Simsek A, et al. Surgical treatment of rectal prolapse: a retrospective analysis of 94 cases. *Int Surg*. 1998;83:53-55.
- Wassef R, Rothenberger DA, Goldberg SM. Rectal prolapse. *Curr Probl Surg*. 1986;23:397-451.
- Siproudhis L, Bellissant E, Jugué F, et al. Rectal adaptation to distension in patients with overt rectal prolapse. *Br J Surg*. 1998;85:1527-1532.
- Aitola PT, Hiltunen KM, Matikainen MJ. Functional results of operative treatment of rectal prolapse over an 11-year period: emphasis on transabdominal approach. *Dis Colon Rectum*. 1999;42:655-660.
- Brief JW, Schouten WR, Boerma MO. Long-term results of suture rectopexy in patients with fecal incontinence associated with incomplete rectal prolapse. *Dis Colon Rectum*. 1997;40:1228-1232.
- Hiltunen KM, Matikainen MJ, Auvinen O, Hietanen P. Clinical and manometric evaluation of anal sphincter function in patients with rectal prolapse. *Am J Surg*. 1986;151:489-492.
- Keighley MR, Fielding JWL, Alexander-Williams J. Results of Marlex mesh abdominal rectopexy for rectal prolapse in 100 consecutive patients. *Br J Surg*. 1983;70:229-232.
- Ciocco WC, Brown AC. Anterior resection for the treatment of rectal prolapse: a 20-year experience. *Am Surg*. 1993;59:265-269.
- Keighley MR, Shouler PJ. Abnormalities of colonic function in patients with rectal prolapse and faecal incontinence. *Br J Surg*. 1984;71:892-895.
- Mann CV, Hoffman C. Complete rectal prolapse: the anatomical and functional results of treatment by an extended abdominal rectopexy. *Br J Surg*. 1988;75:34-37.
- Tjandra JJ, Fazio VW, Church JM, et al. Ripstein procedure is an effective treatment for rectal prolapse without constipation. *Dis Colon Rectum*. 1993;36:501-507.
- Womack NR, Williams NS, Holmfeld JHM, et al. Pressure and prolapse—the cause of solitary rectal ulceration. *Gut*. 1987;28:1228-1233.
- Ripstein CB. Treatment of massive rectal prolapse. *Am J Surg*. 1952;83:68-71.
- Cutait D. Sacro-promontory fixation of the rectum for complete rectal prolapse. *Proc R Soc Med*. 1959;52(suppl):105.
- Carter AE. Rectosacral suture fixation for complete prolapse in the elderly, the frail and the demented. *Br J Surg*. 1983;70:522-523.
- Novell JR, Osborne MJ, Winslet MC, Lewis AA. Prospective randomised trial of Ivalon sponge versus sutured rectopexy for full-thickness rectal prolapse. *Br J Surg*. 1994;81:904-906.
- Graf W, Karlhom U, Pahlman L, et al. Functional results after abdominal suture rectopexy for rectal prolapse or intussusception. *Eur J Surg*. 1996;162:905-911.
- Khanna AK, Misra MK, Kumar K. Simplified sutured sacral rectopexy for complete rectal prolapse in adults. *Eur J Surg*. 1996;162:143-146.
- Kellokumpu IH, Virozen J, Scheinin T. Laparoscopic repair of rectal prolapse: a prospective study evaluating surgical outcome and changes in symptoms and bowel function. *Surg Endosc*. 2000;14:634-640.
- Heah SM, Hartley J, Hurley J, et al. Laparoscopic suture rectopexy without resection is effective treatment for full-thickness rectal prolapse. *Dis Colon Rectum*. 2000;43:638-643.
- Kessler H, Jerby BL, Milsom JW. Successful treatment of rectal prolapse by laparoscopic suture rectopexy. *Surg Endosc*. 1999;13:858-861.
- Bruch HP, Herold A, Schiedeck T, Schwandner O. Laparoscopic surgery for rectal prolapse and outlet obstruction. *Dis Colon Rectum*. 1999;42:1189-1194.
- Benoist S, Taffinder N, Gould S, et al. Functional results two years after laparoscopic rectopexy. *Am J Surg*. 2001;182:168-173.
- Penfold JC, Hawley PR. Experiences of Ivalon sponge implant for complete rectal prolapse at St Mark's Hospital. *Br J Surg*. 1972;59:846-848.
- Morgan CN, Porter NH, Klugman DJ. Ivalon sponge in the repair of complete rectal prolapse. *Br J Surg*. 1972;59:841-846.
- Scaglia M, Fasth S, Hallgren T, et al. Abdominal rectopexy for rectal prolapse: influence of surgical technique on functional outcome. *Dis Colon Rectum*. 1994;37:805-813.
- Notaras MJ. The use of Mersilene mesh in rectal prolapse repair. *Proc R Soc Med*. 1973;66:684-686.
- Sayfan J, Pinho M, Alexander-Williams J, Keighley MRB. Sutured posterior abdominal rectopexy with sigmoidectomy compared with Marlex rectopexy rectal prolapse. *Br J Surg*. 1990;77:143-145.
- Luukkainen P, Mikkonen U, Järvinen H. Abdominal rectopexy with sigmoidectomy vs rectopexy alone for rectal prolapse: a prospective, randomized study. *Int J Colorectal Dis*. 1992;7:219-222.
- Winde G, Reers H, Nottberg H, et al. Clinical and functional results of abdominal rectopexy with absorbable mesh-graft for treatment of complete rectal prolapse. *Eur J Surg*. 1993;159:301-305.
- Galili Y, Rabau M. Comparison of polyglycolic acid and polypropylene mesh for rectopexy in the treatment of rectal prolapse. *Eur J Surg*. 1997;163:445-448.
- Mollen RM, Kuijpers HC, van Hoek F. Effects of rectal mobilization and lateral ligaments division on colonic and anorectal function. *Dis Colon Rectum*. 2000;43:1283-1287.
- Himpens J, Cadière GB, Bruyns J, Vertruyen M. Laparoscopic rectopexy according to Wells. *Surg Endosc*. 1999;13:139-141.
- Darzi A, Henry MM, Guillou PJ, et al. Stapled laparoscopic rectopexy for rectal prolapse. *Surg Endosc*. 1995;9:301-303.
- Boccasanta P, Venturi M, Reitano MC, et al. Laparotomy vs laparoscopic rectopexy in complete rectal prolapse. *Dig Surg*. 1999;16:415-419.
- Zittel TT, Manncke K, Haug S, et al. Functional results after laparoscopic rectopexy for rectal prolapse. *J Gastrointest Surg*. 2000;4:632-641.
- Wells C. New operation for rectal prolapse. *Proc R Soc Med*. 1959;52:602-603.
- Arndt M, Pircher W. Absorbable mesh in the treatment of rectal prolapse. *Int J Colorectal Dis*. 1988;3:141-143.

45. Athanasiadis S, Weyand G, Heiligers J, et al. The risk of infection of three synthetic materials used in rectopexy with or without colonic resection for rectal prolapse. *Int J Colorectal Dis.* 1996;11:42-44.
46. Araki Y, Isomoto H, Tsuzi Y, et al. Trans-sacral rectopexy for recurrent complete rectal prolapse. *Surg Today.* 1999;29:970-972.
47. Lake SP, Hancock BD, Lewis AA. Management of pelvic sepsis after Ivalon rectopexy. *Dis Colon Rectum.* 1984;27:589-590.
48. Ross AH, Thomson JPS. Management of infection after prosthetic abdominal rectopexy (Wells' procedure). *Br J Surg.* 1989;76:610-612.
49. Wedell J, Schlageter M, Meier zu Eissen P, et al. Die problematik der pelvinen sepsis nach rectopexie mittels kunststoff und ihre behandlung. *Chirurg.* 1987; 58:423-427.
50. Speakman CT, Madden MV, Nichols RJ, Kamm MA. Lateral ligament division during rectopexy causes constipation but prevents recurrence: results of a prospective randomised study. *Br J Surg.* 1991;78:1431-1433.
51. Launer DP, Fazio VW, Weakley FL, et al. The Ripstein procedure: a 16-year experience. *Dis Colon Rectum.* 1982;25:41-45.
52. Holmström B, Brodén G, Dolk A. Results of the Ripstein operation in the treatment of rectal prolapse and internal rectal procidentia. *Dis Colon Rectum.* 1986; 29:845-848.
53. Roberts PL, Schoetz DJ, Collier JA, et al. Ripstein procedure: Lahey Clinic experience: 1963-1985. *Arch Surg.* 1988;123:554-557.
54. Schultz I, Madoff RD, Dolk A, et al. Continence is improved after the Ripstein rectopexy: different mechanisms in rectal prolapse and rectal intussusception? *Dis Colon Rectum.* 1996;39:300-306.
55. Schultz I, Mellgren A, Dolk A, et al. Long-term results and functional outcome after Ripstein rectopexy. *Dis Colon Rectum.* 2000;43:35-43.
56. Senapati A, Nichols RJ, Thomson JP, Phillips RK. Results of Delorme's procedure for rectal prolapse. *Dis Colon Rectum.* 1994;37:456-460.
57. Tobin SA, Scott IHK. Delorme operation for rectal prolapse. *Br J Surg.* 1994;81: 1681-1684.
58. Madoff RD, Mellgren A. One hundred years of rectal prolapse surgery. *Dis Colon Rectum.* 1999;42:441-450.
59. McMahan JD, Ripstein CB. Rectal prolapse: an update on the rectal sling procedure. *Am Surg.* 1987;53:37-40.
60. Takesue Y, Yokoyama T, Murakami Y, et al. The effectiveness of perineal rectosigmoidectomy for the treatment of rectal prolapse. *Surg Today.* 1999;29: 290-293.
61. Frykman HM, Goldberg SM. The surgical treatment of rectal procidentia. *Surg Gynecol Obstet.* 1969;129:1225-1230.
62. Solla JA, Rotheberger DA, Goldberg SM. Colonic resection in the treatment of complete rectal prolapse. *Neth J Surg.* 1989;41:132-135.
63. Stevenson AR, Stitz RW, Lumley JW. Laparoscopic assisted resection rectopexy for rectal prolapse: early and medium follow-up. *Dis Colon Rectum.* 1998; 41:46-54.
64. Azimuddin K, Khubchandani IT, Rosen L, et al. Rectal prolapse: a search for the best operation. *Am Surg.* 2001;67:622-627.
65. Watts JD, Rotheberger DA, Buls JG, et al. The management of procidentia: 30 years' experience. *Dis Colon Rectum.* 1985;28:96-102.
66. Deen KI, Grant E, Billingham C, Keighley MRB. Abdominal resection rectopexy with pelvic floor repair versus perineal rectosigmoidectomy and pelvic floor repair for full-thickness rectal prolapse. *Br J Surg.* 1994;81:302-304.
67. Huber FT, Stein H, Siewert JR. Functional results after treatment of rectal prolapse with rectopexy and sigmoid resection. *World J Surg.* 1995;19:138-143.
68. Kim D-S, Tsang CB, Wong WD, et al. Complete rectal prolapse: evolution of management and results. *Dis Colon Rectum.* 1999;42:460-469.
69. Xynos E, Chrysos J, Tsiaoussis J, et al. Resection rectopexy for rectal prolapse: the laparoscopic approach. *Surg Endosc.* 1999;13:862-864.
70. McKee RF, Lauder JC, Poon FW, et al. A prospective randomized study of abdominal rectopexy with and without sigmoidectomy in rectal prolapse. *Surg Gynecol Obstet.* 1992;174:145-148.
71. Muir EG. Rectal prolapse. *Proc R Soc Med.* 1955;48:33-44.
72. Stabins SJ. A new surgical procedure for complete rectal prolapse in the mentally ill patient: case report. *Surgery.* 1951;29:105-108.
73. Theuerkauf FJ Jr, Behrs OH, Hill JR. Rectal prolapse: causation and surgical treatment. *Ann Surg.* 1970;171:819-835.
74. Schlinkert RT, Beart RW, Wolff BG, Pemberton JH. Anterior resection for complete rectal prolapse. *Dis Colon Rectum.* 1985;28:409-412.
75. Baker R, Senagore AJ, Luchtefeld MA. Laparoscopic assisted vs open resection: rectopexy offers excellent results. *Dis Colon Rectum.* 1995;38:199-201.
76. Solomon MJ, Young CJ, Eysers AA, Roberts RA. Randomised clinical trial of laparoscopic versus open abdominal rectopexy for rectal prolapse. *Br J Surg.* 2002; 89:35-39.
77. Blatchford GJ, Perry RE, Thorson AG, Christensen MA. Rectal prolapse: rational therapy without foreign material. *Neth J Surg.* 1989;41:126-128.
78. Lechaux JP, Atienza P, Goasguen N, et al. Prosthetic rectopexy to the pelvic floor and sigmoidectomy for rectal prolapse. *Am J Surg.* 2001;182:465-469.
79. Brazzelli M, Bachoo P, Grant A. Surgery for complete rectal prolapse in adults. *Cochrane Database Syst Rev.* 2000;2:CD001758.
80. Dietzen CD, Pemberton JH. Perineal approaches for the treatment of complete rectal prolapse. *Neth J Surg.* 1989;41:140-144.
81. Delorme R. Sur le traitement des prolapsus du rectum totaux pour l'excision de la musculature rectale ou rectocolique. *Bull Mem Soc Chir Paris.* 1900;26:499-518.
82. Pescatori M, Interisano A, Stolfi VM, Zoffoli M. Delorme's operation and sphincteroplasty for rectal prolapse and fecal incontinence. *Int J Colorectal Dis.* 1998; 13:223-227.
83. Kling KM, Rongione AJ, Evans B, McFadden DW. The Delorme procedure: a useful operation for complicated rectal prolapse in the elderly. *Am Surg.* 1996; 62:857-860.
84. Lechaux JP, Lechaux D, Perez M. Results of Delorme's procedure for rectal prolapse: advantages of a modified technique. *Dis Colon Rectum.* 1995;38:301-307.
85. Agachan F, Reissman P, Pfeifer J, et al. Comparison of three perineal procedures for the treatment of rectal prolapse. *South Med J.* 1997;90:925-932.
86. Oliver GC, Vachon D, Eisenstat TE, et al. Delorme's procedure for complete rectal prolapse in severely debilitated patients: an analysis of 41 patients. *Dis Colon Rectum.* 1994;37:461-467.
87. Watts AMI, Thompson MR. Evaluation of Delorme's procedure as a treatment for full-thickness rectal prolapse. *Br J Surg.* 2000;87:218-222.
88. Liberman H, Hughes C, Dipolito A. Evaluation and outcome of the Delorme procedure in the treatment of rectal outlet obstruction. *Dis Colon Rectum.* 2000; 43:188-192.
89. Sielezneff I, Malouf A, Cesari J, Brunet C, Sarles JC, Sastre B. Selection criteria for internal rectal prolapse repair by Delorme's transrectal excision. *Dis Colon Rectum.* 1999;42:367-373.
90. Miles WE. Rectosigmoidectomy as a method of treatment for procidentia recti. *Proc R Soc Med.* 1933;26:1445-1452.
91. Altmeier WA, Culbertson WR, Schwengerdt C, et al. Nineteen years' experience with the one-stage perineal repair of rectal prolapse. *Ann Surg.* 1971;173:993-1006.
92. Ramanujam PS, Vankatesh KS, Fietz MJ. Perineal excision of rectal procidentia in elderly high-risk patients: a ten-year experience. *Dis Colon Rectum.* 1994; 37:1027-1030.
93. Williams JG, Rotheberger DA, Madoff RD, Goldberg SM. Treatment of rectal prolapse in the elderly by perineal rectosigmoidectomy. *Dis Colon Rectum.* 1992; 35:830-834.
94. Johansen OB, Wexner SD, Daniel N, et al. Perineal rectosigmoidectomy in the elderly. *Dis Colon Rectum.* 1993;36:767-772.
95. Prasad ML, Pearl RK, Abcarian H, et al. Perineal proctectomy, posterior rectopexy and postanal levator repair for the treatment of rectal prolapse. *Dis Colon Rectum.* 1986;29:547-552.
96. Yoshioka K, Ogunbiyi OA, Keighley MRB. Pouch perineal rectosigmoidectomy gives better functional results than conventional rectosigmoidectomy in elderly patients with rectal prolapse. *Br J Surg.* 1998;85:1525-1526.