

Rectovaginal Fistulas: Current Surgical Management

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ABSTRACT

Rectovaginal fistulas represent an often devastating condition in patients and a challenge for surgeons. Successful management of this condition must take into account a variety of variables including the etiology, size, and location of the fistula. Etiologies include obstetrical trauma, inflammatory bowel disease, malignant processes, and complications of radiation therapy and surgery. Repair options include local repairs, tissue transfer techniques, and abdominal operations.

KEYWORDS: Fistula, rectovaginal, obstetrical trauma, mucosal advancement flap

Objectives: On completion of this article, the reader should be able to summarize the etiology, evaluation, and management of rectovaginal fistulas.

Rectovaginal fistulas represent an often devastating condition in patients and a challenge for surgeons. Successful management of this condition must take into account a variety of variables including the etiology, size, and location of the fistula. In addition, the condition of the involved tissues and overall medical condition of the patient are of considerable importance. These fistulas can develop from a multitude conditions, including obstetrical trauma, inflammatory bowel disease, carcinoma, radiation, diverticulitis, and infectious processes, and as a result of postsurgical procedures.

The most common etiological cause of rectovaginal fistulas is obstetrical trauma. Several factors contribute to this process. A prolonged obstructed labor may produce injuries to multiple organ systems. The best known, and most common, of these injuries is obstetric fistula formation. When obstructed labor is unrelieved, the presenting fetal part is impacted against the soft tissues of the pelvis and a widespread ischemic vascular

injury develops that results in tissue necrosis and subsequent fistula formation. Other predisposing factors include forceps delivery, midline episiotomy, and third- or fourth-degree perineal lacerations.¹⁻⁵ Fortunately, few women suffer from fourth-degree lacerations and even fewer from fistulas. Goldabar et al reported a 1.7% incidence of fourth-degree lacerations and 0.5% rectovaginal fistulas in a series of 24,000 vaginal deliveries.⁶

The second most common cause of rectovaginal fistulas is inflammatory bowel disease, particularly Crohn's disease, which has been reported in up to 10% of patients. Radcliffe et al reported an incidence of 9.8% of rectovaginal fistulas in women with Crohn's disease.⁷ Schwartz et al also reported a 9% incidence of rectovaginal fistulas in patients with Crohn's disease in a population-based study in 2000.⁸

Malignant processes, including cancers of the rectum, cervix, uterus, or vagina, can also contribute to the presences of a rectovaginal fistula. In addition, the

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fistulas can develop as complications of radiation therapy and postsurgical operations including low anterior resection with stapled anastomosis, hysterectomy, rectocele repair, and restorative proctocolectomy with ileal pouch anastomosis.

PRESENTATION AND EVALUATION

Patients with rectovaginal fistulas typically present with complaints of passage of flatus or feces from the vagina. Recurrent urinary tract infections and vaginitis with malodorous vaginal discharge may also be the presenting complaints. Up to 50% of patients who suffer from a rectovaginal fistula secondary to obstetrical trauma experience significant fecal incontinence. This may be difficult to elucidate in the history given that the patient has difficulty distinguishing true fecal incontinence from the occurrence of simultaneous anal and vaginal discharge.

Rectovaginal fistulas most commonly occur in the region of the dentate line and communicate with the posterior vaginal fornix. The fistulas that develop distal to the dentate line are referred to as anovaginal fistulas. In addition, fistulas can be classified as low, middle, or high on the basis of their location. Fistulas that are in close approximation to the posterior vaginal fourchette are termed low. High fistulas are in proximity to the cervix, and those that occur in between the cervix and fourchette are termed middle rectovaginal fistulas.

Evaluation of a patient with a suspected rectovaginal fistula includes a detailed examination of the rectum, vagina, and perineal body. Often the low or anovaginal fistula is identified on digital examination with the presence of a dimple on palpation and confirmed easily on anoscopic and speculum examination. A digital examination should include one finger in the rectum and another in the vagina. This allows examination of the local tissue for pliability. The perineal body is often thin or nearly nonexistent in patients with sphincter injuries secondary to obstetrical trauma. The full examination and documentation of the extent of injury should be noted. Endoanal/rectal ultrasonography to confirm sphincter injury and manometry and pudendal nerve terminal latency studies may provide valuable information before a planned repair. The higher the fistula, the more difficult it may be to diagnose. These often result from a postsurgical procedure such as hysterectomy and low anterior resections with stapled anastomosis.

Two different approaches have also been used should the confirmation of a fistula prove to be difficult. One is placing the patient in the lithotomy position with a slight Trendelenburg tilt, placing a proctoscope, and filling the vagina with warm water. Air is then insufflated through the proctoscope and attention is paid to the presence of air bubbles in the vagina, signifying the

presence of a fistula. The other is done by inserting a tampon in the vagina and giving the patient a small methylene blue retention enema. The tampon is removed after 1 hour. The presence of blue color on the tampon also signifies a fistula. Colonoscopy may be performed to evaluate the proximal portion of the colon and rectum prior to repair if Crohn's disease is suspected as the etiology of the fistula. Biopsy of the area should also be performed if carcinoma is suspected or if the fistula is radiation induced, as there may be recurrence of the primary cancer.

The surgical approaches available to surgeons treating patients with rectovaginal fistulas are numerous. The options are determined by the etiology of the fistula, location, size, quality of the surrounding tissue, and previous attempted repairs. Most surgical approaches can be classified as either local or abdominal. Local repairs are most useful for low to middle rectovaginal fistulas and include transanal, vaginal, and perineal approaches. Abdominal operations are most useful for high rectovaginal fistulas and may incorporate laparoscopic approaches. Either approach may require the use of healthy muscle or tissue for transposition.

LOCAL REPAIR

Mucosal Advancement Flap Repair

Two of the more commonly used surgical approaches to simple anorectal or low rectovaginal fistulas are the mucosal advancement flap with and without an overlapping sphincteroplasty. The mucosal advancement flap, first described for dealing with fistula-in-ano disease, is a flap composed of mucosa, submucosa, and a portion of internal sphincter muscle used to cover over the fistula defect. A trapezoid-like flap is mobilized of mucosa, submucosa, and internal sphincter for ~4 cm cephalad. The base of the flap should be at least twice the width of the apex to keep the flap well vascularized and avoid failure of the flap related to ischemia. When the flap is created, the internal sphincter is mobilized and approximated over the fistula opening. The flap is then advanced down the anal canal and sutured with absorbable material. In patients suffering from incontinence, which is usually secondary to obstetrical injury to the sphincter mechanism, a sphincteroplasty can be performed in which the procedure corrects the underlying sphincter defect and interposes bulky muscle in the rectovaginal septum and perineum. These procedures may be performed individually or in combination. Patients undergo a full mechanical bowel preparation the day before surgery. Intravenous antibiotics are administered in the perioperative period. The patient is placed in the prone jackknife position with the buttocks taped apart and the anal canal and fistula tract exposed. The anal canal and vagina are prepared with povidone-iodine

(Betadine) solution and a urinary catheter is placed. The intersphincteric groove is infiltrated with a 1:200,000 solution of saline and epinephrine, which allows additional homeostasis. Patients are usually admitted for a 1- to 2-day hospital stay. The outcomes after this approach have been reported by several authors and vary considerably in success rates.

In a report by Kodner and colleagues⁹ from St. Louis, 107 patients underwent endorectal advancement flap repair for rectovaginal fistulas of a variety of causes: obstetric injury in 48, cryptoglandular abscess-fistula in 31, Crohn's disease in 24, and trauma or postoperative in 4. Persistence or recurrence of the fistula occurred in 17 patients (16%). Nine patients whose initial operation failed underwent a secondary successful operation. Continence status was unchanged in 80% and improved in 18%. The authors' conclusion was that endorectal advancement flap repair successfully treated 93% of the complicated anorectal fistulas, avoiding fecal diversion and improving sphincter function.

A retrospective analysis was reported by Ozuner et al¹⁰ of all patients at the Cleveland Clinic undergoing endorectal advancement flaps between 1988 and 1993. They reported 52 patients with rectovaginal fistulas. Median follow-up was 31 months (range, 1 to 79 months). Immediate failure (within 1 week of the repair) was seen in 6% of patients. Statistically ($p < 0.001$) higher recurrence rates were observed in patients who had undergone previous repairs. Etiology of the fistula, use of constipating medications, antibiotic use, and, most important, associated Crohn's disease did not statistically affect recurrence rates. Failure rate was influenced only by the number of previous repairs in this study. A follow-up study reported by Sonoda et al¹¹ in 2002 looked at 34 patients with rectovaginal fistulas from 1994 to 1999 at the same institution. They reported a primary healing rate of 63.6%. The only factor that negatively influenced the healing rate of the flap in patients with rectovaginal fistulas was the diagnoses of Crohn's disease ($p = 0.027$).

A variety of factors contribute to the different success rates with this approach reported in the literature. Lowry et al¹² described their results for 81 mucosal advancement flap repairs in women with simple fistulas at the University of Minnesota. Simple fistulas were defined as those in the middle to lower rectum and less than 2.5 cm in diameter. The mean age of the patients was 34 years (range, 18 to 76 years). The causes were obstetrical injury (74%), perineal infection (10%), operative trauma (7%), and unknown (8%). Overall, the repair was successful in 83% of patients. Success correlated with the number of previous repairs; patients with no previous repair had an 88% success rate; those with one previous repair had an 85% success rate; and those with two previous repairs had a 55% success rate. In 25 patients a concomitant sphincteroplasty was performed.

This study suggests that one should be considerably reluctant to perform a mucosal advancement flap in patients in whom two previous attempts have failed. In addition, it suggests that a higher rate of success may be achieved if one adds a concomitant sphincter repair.

Tsang and colleagues¹³ from the same institution analyzed the outcome of rectovaginal fistula repairs based on preoperative sphincter status. They identified 52 women who underwent 62 repairs of simple obstetrical rectovaginal fistulas. Fourteen patients (27%) had preoperative endoanal ultrasound studies and 25 (48%) had anal manometry studies. Median age was 30.5 years, and median follow-up was 15 (range, 0.5 to 123) months. Twenty-five patients (48%) complained of varying degrees of fecal incontinence before surgery. There were 27 endorectal advancement flaps and 35 sphincteroplasties (28 with and 8 without levatoroplasty). Success rates were 41% with endorectal advancement flaps and 80% with sphincteroplasties (96% success with and 33% without levatoroplasty; $p = 0.0001$). An endorectal advancement flap was successful in 50% of patients with normal sphincter function but in only 33% of patients with abnormal sphincter function. For sphincteroplasties, success rates were 73% versus 84% for normal and abnormal sphincter function, respectively ($p =$ not significant). Results were better after sphincteroplasties versus endorectal advancement flaps in patients with sphincter defects identified by endoanal ultrasonography (88% versus 33%; $p =$ not significant) and by manometry (86% versus 33%; $p =$ not significant). Poor results correlated with prior surgery in patients undergoing endorectal advancement flaps (45% versus 25%; $p =$ not significant) but not sphincteroplasties (80% versus 75%; $p =$ not significant).

Khanduja et al¹⁴ reported the effectiveness of combining an advancement flap with sphincteroplasty in patients symptomatic with rectovaginal fistula and anal sphincter disruption. The mean age of the patients was 30 years and the mean duration of symptoms was 54.8 weeks (range, 7 weeks to 6 years). In addition to mucosal advancement flap repair, 13 patients underwent two-layer repair of anal sphincters (with reapproximation of the puborectalis in 8 of the patients); 6 patients underwent one-layer overlap repair of anal sphincters (with reapproximation of the puborectalis in 2 of the patients); and 1 patient underwent reapproximation of internal anal sphincter alone. Postoperatively, vaginal discharge of stool and flatus was eliminated entirely in all 20 patients. Perfect anal continence of stool and flatus was restored in 14 patients (70%). Incontinence was improved but not eliminated in six patients (four incontinent to liquid stool and two to flatus), and two patients required perineal pads. Subjectively, 19 patients (95%) reported the result as excellent or good and there were no complications.

In summary, the use of a mucosal advancement flap repair is appropriate for most simple rectovaginal

fistulas. Its success rate depends on the etiology of the fistula, with a better outcome in patients with obstetrical injuries than patients with inflammatory bowel disease. It also depends on previous repairs, with a higher failure rate in patients who have undergone two or more attempts, and it depends on the preoperative assessment of sphincter function, with patients undergoing sphincter repair having a higher success rate with mucosal advancement flaps.

Transanal Sleeve Advancement Flap

The majority of patients with Crohn's disease and a rectovaginal fistula eventually undergo a proctocolectomy. However, a small subset of patients with Crohn's and anal ulcerations with rectovaginal fistulas and a relatively spared diseased rectum may be candidates for a transanal sleeve advancement flap (TSAF) procedure. In this procedure a circumferential dissection of the mucosa and submucosa commences at the level of the dentate line and proceeds in a cephalad direction until the rectum is mobilized. When this occurs, the anal ulceration and rectovaginal fistula are excised and the rectal tube is anastomosed to the anoderm. First reported by Hull and Fazio in 1997¹⁵ and subsequently updated, the Cleveland Clinic experience involved 12 women with severe perianal Crohn's disease and multiple fistula tracts.¹⁶ One year after surgery, the fistula had healed in 8 of 12 patients (with 3 requiring additional surgery before healing). Of patients in whom the procedure failed, three underwent proctectomy for progression of disease and the other two had recurrence of a rectovaginal fistula 6 and 8 months after surgery. Of six variables evaluated (previous procedure, steroid use, steroid dosage, associated Crohn's disease, associated procedures, and diverting stoma), only associated procedures were significantly related to a successful outcome ($p = 0.008$). Some patients with severe perianal Crohn's fistula and a relatively normal rectum can be offered TSAFs, particularly when the only alternative would be a total proctocolectomy and a permanent stoma.

Perineoproctectomy with Layered Closure

When a substantial injury to the perineal body, anal sphincter, or rectovaginal septum exists, a more extensive repair is often required. In this procedure one converts a rectovaginal fistula into a fourth-degree laceration. This takes quite a bit of intestinal fortitude and should be reserved for the very low fistula. In this procedure, the tract is excised or divided and the vagina, sphincter muscles, and rectal mucosa are identified, mobilized, and repaired in several layers. Several have reported excellent results with this approach. Mazier and colleagues¹⁷ from the Ferguson clinic reported on

95 consecutive patients operated for rectovaginal fistulas via septal repair after conversion to a fourth-degree perineal laceration. No covering stomas were used. Fistula etiology included obstetric injury ($n = 77$), perianal cryptoglandular infection ($n = 15$), and other ($n = 3$). Thirty-one patients had previous unsuccessful repairs. Types of repairs were fourth-degree perineal laceration (38), endoanal flap (19), and anoperineorrhaphy (38). Excellent or good functional results occurred in 92 patients (97%). Similar success occurred in patients with previous failed repairs (90% excellent or good). The recurrence rate was 3%.

Fistulotomy

The use of fistulotomy to treat rectovaginal fistulas is associated with a prohibitive rate of fecal incontinence and is mentioned only to discourage its application.

Biological Agents: Fibrin Glue and Surgisis Plug

Although there have been various reports of successful outcomes in treating anorectal fistulas with biological agents such as fibrin glue¹⁸ and Surgisis¹⁹ anal plug, there is a dearth of literature, which is limited to small series reporting results in the treatment of rectovaginal fistulas. In a small series, four of five patients with rectovaginal fistulas treated with fibrin glue were healed.²⁰ In a series report by Loungnarath and colleagues²¹ from Washington University in St. Louis, there was one successful outcome in three patients treated with fibrin glue for rectovaginal fistula.

In our experience these biological agents tend to work when the fistula tract is long, which is usually not the case in rectovaginal fistulas, where the tract is extremely short, and therefore we are not enthusiastic about this approach.

Transvaginal Repair

The transvaginal approach to repairing rectovaginal fistulas is well described with encouraging results. Rahman et al²² described their results in 39 patients undergoing transvaginal repair for low rectovaginal fistulas. They reported a 100% success rate with this approach.

This is a particularly appealing approach in patients with Crohn's disease in which dissection in the diseased rectum can be avoided. Bauer and colleagues²³ from Mt. Sinai reported their results for 13 patients with Crohn's disease who underwent repair of rectovaginal fistulae by a transvaginal approach. All patients had a diverting intestinal stoma either as part of the initial step in the staged management of intractable perianal disease or concurrent with the repair of the rectovaginal fistula. Each of the patients had low or middle septal fistulas. Fistulas were eradicated in 12 of the 13 women and did

not recur during the follow-up period, which averaged 50 months (range, 9 to 68 months).

TISSUE TRANSFER PROCEDURES

The purpose of tissue transfer procedures in patients with rectovaginal fistulas is to provide healthy tension-free, well-vascularized tissue in the area of the repair. A multitude of tissue transfers are available, such as the gracilis, rectus, gluteus, and bulbocavernosus muscles and omentum.²⁴⁻²⁸

Zmora and colleagues²⁴ reported their experience with gracilis muscle interposition for the treatment of rectovaginal fistulas. They had five patients with a rectovaginal fistula and one patient with a pouch-vaginal fistula who underwent this repair with favorable results. All patients had fecal diversion as a step preliminary to or concurrent with fistula repair. Five of the six repairs healed completely after reversal of the fecal diversion. One patient with severe Crohn's proctitis has a persistent rectovaginal fistula.

The Martius or bulbocavernosus muscle flap repair has been well described in patients with rectovaginal fistulas secondary to radiation injury. In this approach, after the rectal opening of the fistula is closed in several layers, a longitudinal incision is made in the labia majora and dissection of the bulbocavernosus muscle and its adjacent labial fat pad is performed. The muscle and fat pad are transected above the insertion into the perineal body, preserving its blood supply from branches of the pudendal artery intact. The muscle flap is then tunneled underneath the labia minora and sutured over the repaired fistula defect site.

White et al²⁷ performed 14 Martius procedures on 12 patients with radiation-induced rectovaginal fistulas. Eleven patients had successful closure of their fistulas with this procedure, and no operative complications occurred. Aartsen and Sindram²⁸ reported results in 20 patients with a radiation-induced rectovaginal fistula. In this study, 9 procedures were done without and 14 procedures with a Martius flap. After a mean follow-up of around 10 years, the success rate of fistula repair was 5 of 9 (55%) and 13 of 14 (93%).

ABDOMINAL PROCEDURES

High rectovaginal fistulas are usually approached through an abdominal procedure. There are several approaches, and this type of repair depends on the location, etiology, and consistency of affected tissues. If the tissues surrounding the rectum and vagina are minimally affected, dissection of the rectovaginal septum with simple closure of each fistula opening in several layers with interposition of a large pedicle of omentum can be performed. The coloanal sleeve anastomosis procedure, first described by Parks and colleagues,²⁹

involves dissection of the rectum below the fistula site with mobilization of descending and sigmoid colon with a coloanal anastomosis in the setting of a mucosectomy. The need for a mucosectomy is negated with the advent of the double-stapled approach. Nowacki³⁰ reported functionally good results in 18 of 23 patients undergoing the procedure for radiation-induced rectovaginal fistulas. In addition, Cooke and Wellsted³¹ reported a 93% success rate in 55 patients. Another approach to dealing with the radiation-induced rectovaginal fistula is the onlay patch anastomosis reported by Bricker and Johnson.³² First described in five patients, the technique essentially relies on the proximal part of the colon as a vascular pedicle graft, used as a patch to close the rectal defect and to provide circumference to relieve any associated stricture. In supplying the area with a sound, vascular sigmoid pedicle graft, this improves tissue vitality locally; it restores rectal function to a near-normal preradiation level and preserves the previously intact sphincter muscles. Steichen and colleagues³³ reported the repair using stapling devices with good results.

The use of laparoscopic approaches has been reported only by a few as case reports.³⁴⁻³⁶ Schwenk and colleagues³⁴ from Germany reported on a case in which laparoscopic resection of a high rectovaginal fistula with primary intracorporeal anastomosis and an omental flap was performed with a good outcome. Kumaran et al³⁶ reported on a successful repair of a high rectovaginal fistula performed laparoscopically. However, further studies involving larger numbers are needed to state conclusively that laparoscopic approaches are safe and feasible in this group of patients.

REFERENCES

1. Fenner DE, Genberg B, Brahma P, Marek L, DeLancey JO. Fecal and urinary incontinence after vaginal delivery with anal sphincter disruption in an obstetrics unit in the United States. *Am J Obstet Gynecol* 2003;189:1543-1549
2. Signorello LB, Harlow BL, Chokos AK, Repke JT. Midline episiotomy and anal incontinence: retrospective cohort study. *BMJ* 2000;320:86-90
3. Christianson LM, Bovbjerg VE, McDavitt EC, Hullfish KL. Risk factors for perineal injury during delivery. *Am J Obstet Gynecol* 2003;189:255-260
4. Hudelist G, Gelle'n J, Singer C, et al. Factors predicting severe perineal trauma during childbirth: role of forceps delivery routinely combined with mediolateral episiotomy. *Am J Obstet Gynecol* 2005;192:875-881
5. Venkatesh KS, Ramanujam PS, Larson DM, Haywood MA. Anorectal complications of vaginal delivery. *Dis Colon Rectum* 1989;32:1039-1041
6. Goldaber KG, Wendel PJ, McIntire DD, Wendel GD Jr. Post-partum perineal morbidity after fourth degree perineal repair. *Am J Obstet Gynecol* 1993;168:489-493
7. Radcliffe AG, Ritchie JK, Hawley PR, Lennard-Jones JE, Northover JM. Anovaginal and rectovaginal fistulas in Crohn's disease. *Dis Colon Rectum* 1988;31:94-99

8. Schwartz D, Loftus E, Tremaine W, et al. The natural history of fistulizing Crohn's disease: a population based study. *Gastroenterology* 2000;118:A337
9. Kodner IJ, Mazor A, Shemesh EI, Fry RD, Fleshman JW, Birnbaum EH. Endorectal advancement flap repair of rectovaginal and other complicated anorectal fistulas. *Surgery* 1993;114:682-689
10. Ozuner G, Hull TL, Cartmill J, Fazio VW. Long-term analysis of the use of transanal rectal advancement flaps for complicated anorectal/vaginal fistulas. *Dis Colon Rectum* 1996;39:10-14
11. Sonoda T, Hull T, Piedmonte MR, Fazio VW. Outcomes of primary repair of anorectal and rectovaginal fistulas using the endorectal advancement flap. *Dis Colon Rectum* 2002;45:1622-1628
12. Lowry AC, Thorson AG, Rothenberger DA, Goldberg SM. Repair of simple rectovaginal fistulas. Influence of previous repairs. *Dis Colon Rectum* 1988;31:676-678
13. Tsang CB, Madoff RD, Wong WD, et al. Anal sphincter integrity and function influences outcome in rectovaginal fistula repair. *Dis Colon Rectum* 1998;41:1141-1146
14. Khanduja KS, Padmanabhan A, Kerner BA, Wise WE, Aguilar PS. Reconstruction of rectovaginal fistula with sphincter disruption by combining rectal mucosal advancement flap and anal sphincteroplasty. *Dis Colon Rectum* 1999;42:1432-1437
15. Hull TL, Fazio VW. Surgical approaches to low anovaginal fistula in Crohn's disease. *Am J Surg* 1997;173:95-98
16. Marchesa P, Hull TL, Fazio VW. Advancement sleeve flaps for treatment of severe perianal Crohn's disease. *Br J Surg* 1998;85:1695-1698
17. Mazier WP, Senagore AJ, Schiesel EC. Operative repair of anovaginal and rectovaginal fistulas. *Dis Colon Rectum* 1995;38:4-6
18. Cintron JR, Park JJ, Orsay CP, et al. Repair of fistulas-in-ano using fibrin adhesive: long-term follow-up. *Dis Colon Rectum* 2000;43:944-949 discussion 949-950
19. Champagne BJ, O'Connor LM, Ferguson M, Orangio GR, Schertzer ME, Armstrong DN. Efficacy of anal fistula plug in closure of cryptoglandular fistulas: long-term follow-up. *Dis Colon Rectum* 2006;49:1817-1821
20. Abel ME, Chiu YS, Russell TR, Volpe PA. Autologous fibrin glue in the treatment of rectovaginal and complex fistulas. *Dis Colon Rectum* 1993;36:447-449
21. Loungnarath R, Dietz DW, Mutch MG, Birnbaum EH, Kodner IJ, Fleshman JW. Fibrin glue treatment of complex anal fistulas has low success rate. *Dis Colon Rectum* 2004;47:432-436
22. Rahman MS, Al-Suleiman SA, El-Yahia AR, Rahman J. Surgical treatment of rectovaginal fistula of obstetric origin: a review of 15 years' experience in a teaching hospital. *J Obstet Gynaecol* 2003;23:607-610
23. Bauer JJ, Sher ME, Jaffin H, Present D, Gelerent I. Transvaginal approach for repair of rectovaginal fistulae complicating Crohn's disease. *Ann Surg* 1991;213:151-158
24. Zmora O, Tulchinsky H, Gur E, Goldman G, Klausner JM, Rabau M. Gracilis muscle transposition for fistulas between the rectum and urethra or vagina. *Dis Colon Rectum* 2006;49:1316-1321
25. Tran KT, Kuijpers HC, van Nieuwenhoven EJ, van Goor H, Spauwen PH. Transposition of the rectus abdominis muscle for complicated pouch and rectal fistulas. *Dis Colon Rectum* 1999;42:486-489
26. Horch RE, Gitsch G, Schultze-Seemann W. Bilateral pedicled myocutaneous vertical rectus abdominis muscle flaps to close vesicovaginal and pouch-vaginal fistulas with simultaneous vaginal and perineal reconstruction in irradiated pelvic wounds. *Urology* 2002;60:502-507
27. White AJ, Buchsbaum HJ, Blythe JG, Lifshitz S. Use of the bulbocavernosus muscle (Martius procedure) for repair of radiation-induced rectovaginal fistulas. *Obstet Gynecol* 1982;60:114-118
28. Aartsen EJ, Sindram IS. Repair of the radiation induced rectovaginal fistulas without or with interposition of the bulbocavernosus muscle (Martius procedure). *Eur J Surg Oncol* 1988;14:171-177
29. Parks AG, Allen CL, Frank JD, McPartlin JF. A method of treating post-irradiation rectovaginal fistulas. *Br J Surg* 1978;65:417-421
30. Nowacki MP. Ten years of experience with Parks' coloanal sleeve anastomosis for the treatment of post-irradiation rectovaginal fistula. *Eur J Surg Oncol* 1991;17:563-566
31. Cooke SA, Wellsted MD. The radiation-damaged rectum: resection with coloanal anastomosis using the endoanal technique. *World J Surg* 1986;10:220-227
32. Bricker EM, Johnston WD. Repair of postirradiation rectovaginal fistula and stricture. *Surg Gynecol Obstet* 1979;148:499-506
33. Steichen FM, Barber HK, Loubeau JM, Iraci JC. Bricker-Johnston sigmoid colon graft for repair of postradiation rectovaginal fistula and stricture performed with mechanical sutures. *Dis Colon Rectum* 1992;35:599-603
34. Schwenk W, Bohm B, Grundel K, Muller J. Laparoscopic resection of high rectovaginal fistula with intracorporeal colorectal anastomosis and omentoplasty. *Surg Endosc* 1997;11:147-149
35. Pelosi MA III, Pelosi MA. Transvaginal repair of recurrent rectovaginal fistula with laparoscopic-assisted rectovaginal mobilization. *J Laparoendosc Adv Surg Tech A* 1997;7:379-383
36. Kumaran SS, Palanivelu C, Kavalakat AJ, Parthasarathi R, Neelayathatchi M. Laparoscopic repair of high rectovaginal fistula: is it technically feasible? *BMC Surg* 2005;5:20