Review Article

Treatment of Rectovaginal Fistula

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Abstract
Rectovaginal fistula (RVF) is a challenging complication with unsatisfactory success and a significant burden for the patients. With insufficient clinical data due to the rare entity, the present state of treatments for RVFs was reviewed especially form the point of factors to determine management, classifications, principle of treatment, conservative and surgical treatments with outcomes. Size, fistula localization and etiology, type of fistula; "simple" or "complex," status of anal sphincter complex and surrounding tissue, presence or absence of inflammation, presence of diverting stoma, previous attempted repair and radiation therapy, patient's condition with co-morbidities, and surgeon's experience are important factors to determine the management of RVF. The inflammation should initially subside in cases with infection. Starting with conservative surgical options and interposing healthy tissue for complex or recurrent fistulas, invasive procedures will be performed if conservative treatment failed. Conservative treatment may be effective in RVFs with minimal symptoms and should be done for small RVFs for a 36 months usual period. Anal sphincter damage might need a repair of sphincter muscles along with RVF repair. Diverting stoma can initially be constructed in patients with severe symptoms and larger RVFs to relief the patient's pain. Simple fistula is usually indicated for local repair. Local repairs to transperineal and transabdominal approaches can be used for complex RVFs. Interposition of healthy, well-vascularized tissue can be required for more complex fistulas and abdominal procedures for high RVFs.

Keywords
rectovaginal fistula, treatment, rectovaginal repair, conservative treatment, surgery

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Introduction

Rectovaginal fistula (RVF) is defined as an epithelium-lined abnormal communication between the rectum and vagina[1,2]. RVF generally presents with passage of air and stool from the vagina resulting to the patient's psychological burden secondary to recurrent urinary tract and vaginal infections[1]. The low success rate with a wide range of success and remained common recurrence makes RVF treatment a surgical challenge[1-8]. Furthermore, in patients with previous attempt at repair, low success rate is reported after further surgery[3-8]. RVF optimal treatment options inconclusively determined due to the limited case number and lack of enough evidence, comparison, and randomized studies[9]. Hence, the present state of treatments for RVFs was reviewed especially from the point of factors to determine management, classifications, principle of treatment, and conservative and invasive treatments with outcomes.

Factors to Determine Management

The size, fistula localization and etiology, fistula type: "simple" or "complex," anal sphincter complex and the surrounding tissue status, presence or absence of inflammation,

Table 1.   Classification of Rectovaginal Fistula.

1. Size [12]
    - Small: <0.5 cm
    - Middle: 0.5–2.5 cm
    - Large: >2.5 cm
2. Location
    1) According to surgical approach [1,12]
        - High: transabdominal approach is required
        - Middle: in between high and low
        - Low: correction by anal, perineal, and vaginal approach
    2) According to anatomical location
        From vaginal side [2,20]
        - High: the fistula is in the area of the posterior vaginal fornix
        - Middle: from the level of cervix to just superior to fourchette
        - Low: vaginal opening near the posterior fourchette
        From anorectal side [21]
        - High: rectal origins proximal to the anorectal sphincter complex
        - Low: originate distally from the anal sphincter complex
        From anorectal and vaginal side [8,11,22,23]
        - High: a tract connecting the upper vagina with the rectum
        - Middle: a tract that lies in between these levels
        - Low: a tract between the distal anal canal and the inside of the posterior fourchette

[Reference]

presence of diverting stoma, previous attempted repair and radiation therapy, patient's condition with co-morbidities, and surgeon's experience are important factors to determine the management of RVF[1,2,10,11]. These factors have to be clearly investigated before choosing treatment options. The anal sphincter damage might need a sphincter muscles repair aside from RVF repair; draining the inflammation before RVF repair is required in case of inflammation.

Classification

RVF is generally classified according to the size, localization, etiology and type of fistula; "simple" or "complex"[1,2,10,11]. These basic classifications help in selecting conservative treatment or optimal surgical procedure for the patient with RVF.

Size

The diameter of the fistula is classified as small (<0.5 cm), medium (0.5-2.5 cm), and large (>2.5 cm) (Table 1)[12,13]. Small RVF can be a candidate in initial conservative treatment[2]. Reports on local RVFs repairs include small fistulas or with unknown size[7,14-19].

Localization

The localization of RVF is mostly classified via anatomical location or surgical approach (Table 1). Based on surgical approach, low fistulas are those reconstructed via anal, perineal, or vaginal access, while high fistulas require an ab-

dominal approach[1,12]. In anatomical location, when the site of RVF is determined from the vaginal side, low RVF classifies as a fistula with vaginal opening near the posterior fourchette, high RVF in the area of the posterior vaginal fornix, and middle RVF from the level of cervix to just superior fourchette (Table 1)[2,20]; when the site of RVF is determined from the anorectal side, low RVF originates distally from the anal sphincter complex, and high RVF with rectal origins proximal to the anorectal sphincter complex[21]. According to classification with anatomical location from the anorectal and vaginal side, "low" RVF may be classified as a fistula with a tract between the distal anal canal (at or below the dentate line) and inside of the posterior fourchette; "high" RVF with a tract connecting the upper vagina (at the level of the cervix) and the rectum; and "middle" RVF with a tract that lies in between these levels[8,11,22,23]. In this classification, the terminologies "anovaginal fistula" and "low-rectovaginal fistula" may be interchangeably used[11]. Clarifying the role of anal sphincter complex can be necessary in classifying the site of RVF because repairing sphincter defect influences outcomes in RVF repair[4]. Transabdominal repair is often used for anatomically classified high RVFs.

Etiology

There are various causes for RVFs (Table 2), including obstetric trauma (85%) and pelvic surgery (5%-7%)[1,10]. Inflammatory bowel disease, especially Crohn's disease, malignancy, and radiation are also predominating causes of

Table 2. Etiology of Rectovaginal Fistula.

・Trauma:

  1) Obstetric (Delivery injury)

  2) After surgery: post-LAR, post-pouch surgery, post-pelvic organ prolapse surgery (TVM etc.), post-hemorrhoid surgery (PPH), post-local excision, etc.

  3) Intercourse injury, foreign body, etc.

・Inflammatory bowel disease: Crohn's disease, etc.

・Pelvic irradiation

・Neoplastic: Rectal, gynecological, hematologic

・Infection: Anal gland, Bartholin gland abscess

・Congenital

・Miscellaneous

LAR: low anterior resection, TVM: tension-free vaginal mesh, PPH: procedure for prolapse and hemorrhoids

Table 3. Type of Fistula "Simple" or "Complex".

Factors	Simple*	Complex*
Size	smaller	larger
Localization	low	high
Etiology	obstetric trauma or cryptoglandular infection	inflammatory bowel diseases, radiation, or invasive cancer
Others		failed attempted repair

*"Simple" RVF includes all factors, and "Complex" RVF either of the factors.

RVFs. The respective reported cause of RVF incidence depends on the institute or hospital; however, obstetric injury was the most predominant in many reports[7,8,13,16,17,22]. Among these causes, radiation-induced and Crohn's-related and malignancy associated RVFs are more problematic, resulting in poorer success in treatments[1,8,21].

Type of fistula, "Simple" or "complex"

This classification can be used in selecting surgical repair or approach for RVF[10,11]; however, the definition varies depending on literature[3,6,10,11,23-26]. Lowry et al. defined simple RVFs as <2.5 cm in diameter, low or mid-vaginal septum in location, and infectious or traumatic in origin[3]; El-Gazzaz et al. defined simple RVFs to have a low, small diameter (<2 cm) communication between the anal canal and vagina and typically result from obstetrical injury or infection[23]. "Complex" RVFs involve a higher tract between the rectum and vagina, are of larger diameter, or result from radiation, cancer, or complications of pelvic surgical procedures[6,11,24-26]. Other literatures define the difference of these RVF on whether it will be amenable to a local repair vs. a more complicated underlying pathogenesis that will require resection, interposition grafts, and/or diversion[10]. Concretely, a "simple" RVF can be defined as a fistula with size approximately <2.5 cm, more distally located along rectovaginal septum, and generally occurred a result of obstetric trauma or a cryptoglandular infection. Meanwhile, "complex" fistulas typically result from inflammatory bowel diseases, radiation, invasive cancer origin, and fistulas with failed attempted repair, which are more proximally located on the rectovaginal septum (Table 3)[10]. While "simple" RVF will be amenable to a local repair, "complex" RVF will require resection, interposition graft, and/or diversion[10]. The success rate of "complex" RVFs is poorer than that of "simple" RVFs even in previous cases with fail attempted repair[19].

Principle of Treatment

After determining the factors for treatment, the initial management of RVFs is non-operative, conservative treatment[3,11,27]. The inflammation should subside in cases with infection[11]. Inducing remission prior to RVF repair[10,28-32] is essential in patients with Crohn's disease. Starting with conservative surgical options and interposing healthy tissue for complex or recurrent fistulas will be performed if conservative treatment failed[10]. Diverting stoma can initially be constructed in patients with severe symptoms and larger RVFs to relief the patient's pain[6,13,33,34].

Conservative Treatment (Table 4)

Conservative treatment may include baths, wound care, debridement—as needed, antibiotics—in cases of infection, and stool-balking fiber supplements for a 3-6 months usual period[11,27,35]. Among patients with RVFs originating

Table 4. Summary of Outcomes of Conservative/Endoluminal Treatments for RVFs.

Methods	Reference	n	Etiology	Success rate	Follow-up
Conservative					
	[11,36-38]	14.1%–18% of all RVFs		52%–66% of various conservative cases	
	[2,47]	24.6% (14/57) of all RVFs	post-LAR	71% (10/14) of various conservative cases	
Infliximab	[50]	29	Crohn	60.7% (17/28)	10 weeks
				44.8% (13/29)	14 weeks
Infliximab	[51]	14	Crohn	14%	4–6 weeks
Self-expandable metallic stents	[53]	10	post-LAR	80% (8/10)	24 months
Endoluminal clipping	[55]	16	various	43.7% (7/16)	8 months
Fibrin glue	[60]	39	various	31% (12/39)	-

LAR: low anterior resection, Crohn: Crohn's disease, [Reference]

from various etiology, mainly from obstetric trauma, 14.1%-18% of patients have been initially managed conservatively; otherwise, surgical treatments were performed[36,37]. The healing rate of conservative treatment ranged 52%-66%[11,36-38]. Conservative therapy should be used for small RVFs[36,37]. Oakley reported that almost half (45%) of treated RVFs were expectantly small (<0.5 cm)[36]. Successful therapy by hyperbaric oxygen is documented only in two patients with obstetric-related RVF[39].

RVFs after low-anterior resection (LAR)

RVF after LAR is usually refractory to conservative treatment[2,26,40,41]. Conservative treatment might only be effective in RVFs with minimal symptoms (*e.g.,* only passage of flatus but not feces per vagina) and no pelvic radiation[2]. RVFs after LAR are usually managed by bowel rest and total parenteral nutrition up to 2 months before the RVFs spontaneously heals to <1 cm[2,42,43]. However, these healed cases were reported only as case reports[42,43]. The documented case reports in using vaginal or oral estriol tablet in addition to conservative therapy resulted in the closure of RVFs[44-46]. Summarizing the successful case reports after LAR, vaginal estriol tablet was given in eight patients without surgical intervention, and six of eight RVFs healed within 35 days. Meanwhile, oral estriol tablet was given in two patients without surgery, and RVFs healed within 26 days[45]. Oral or vaginal estriol table was given in four patients with surgical intervention (three diverting stomas), and RVFs healed in 16-120 days post-management[45]. A survey of active members of the American Society of Colon Rectal Surgeons (ASCRS) in the 1990s identified that 14 of 57 RVFs after LAR (24.6%) were managed conservatively, and 71% (10/14 cases) healed conservatively[2,47].

RVFs induced by Crohn's disease

Treatment options in patients with Crohn's disease induced RVFs range from observation to medical therapeutics to the need for surgical intervention[48]. Current medications targeting Crohn's disease include antibiotics, corticosteroid, immunomodulators, and biologics. Metronidazole has been reported to successfully treat RVF[32,48,49]. Sands et al.[50] reported in the ACCENT II study that after infusions of infliximab at weeks 0, 2, and 6, 60.7% (17 of 28) and 44.8% (13 of 29) of RVFs were closed at weeks 10 and 14. Concurrently, Parsi et al.[51] documented the rate of complete response to infliximab was significantly lower among 14 patients with RVF (14%) compared to those with perineal fistula (78%) at 4-6 weeks follow-up. Association of Coloproctology of Great Britain and Ireland consensus exercise advocates the use of anti-tumor necrosis factor α (TNFα) therapy[29]. Recent review shows the overall response rates of RVF to medical therapy were 38.3% complete response (fistula closure) and 22.3% partial response, and the response rates to anti-TNFα therapy were 41.0% complete response and 21.8% partial response, respectively[30].

Nine patients with one or more unsuccessful medical and/or surgical treatments for Crohn's disease induced RVFs received hyperbaric oxygen therapy; however, clinical closure occurred in none of the patients at 3-month follow-up[52].

Endoluminal Procedures, Fibrin Glue, Plug and Others (Table 4)

Self-expandable metallic stents have been used for RVFs after colorectal resection for cancer[53,54]. The RVF healed in 8 of 10 patients (80%); however, some of the patients experienced stent dislodgement or severe tenesmus requiring stent removal[2,53].

Endoluminal clipping of RVFs by using over-the-scope clip proctology system resulted in healing of the fistula in 7 of 16 patients (43.7%) with various etiology at eight months after treatment; however, 11 patients had a temporary diverting stoma at time of the clipping procedure[55]. A technique of combination of endoscopic stent with endovaginal clip-

Table 5. Surgery for RVFs and Main Indications.

Method	Main indication
Stoma	
Fecal diversion alone	small fistula
Stoma with RVF repair	large fistula and burden on the patient
Local repair without tissue interposition	
Advancement flap	low-lying/simple traumatic RVFs
Episioproctotomy	obstetrical or cryptoglandular RVFs with sphincter defect
Transverse transperineally repair	complex, recurrent and larger RVFs
Fistulectomy and closure	small/low-lying RVF, especially obstetric origin
Local repair with tissue interposition	complex, recurrent, or persistent RVFs
Martius flap	low and mid-level fistulas up to approximately 5 cm proximal to the vaginal introitus
Gracilis muscle flap	refractory, recurrent RVFs, especially secondary to Crohn's disease and after pelvic surgery
Levator ani muscles interposition	low and mid-level simple and complex RVFs small to middle size
Abdominal repair	high RVF not amenable to trans-perineal repair
Fistula excision and closure with omentum interposition	tissues surrounding the fistula has minimal fibrosis, good blood supply, no infection, and no evidence of cancer recurrence
Rectal resection	possibility of multiple adhesions and difficult pelvic dissection

ping was also reported[56].

Two of five (40%) RVFs were successfully treated with transanal endoscopic surgery[57]. Recent review of endoscopic repairs of RVF by Zeng et al.[58] includes 71 patients in 11 articles. The causes of RVFs were post-surgery in 51 patients (71.8%), obstetrics in 7 patients (9.8%), and inflammatory bowel disease in 5 patients (7%). Most fistulas are located in low or mid-location. Success rate of endoscopic repairs, including clipping, stenting, and transanal endoscopic microsurgery, ranged 40%-93% at follow-up of >1-year.

Fibrin glue application has been performed for RVFs with various etiology[59,60]; however, durable healing was only achieved in 31% of patients (12/39)[60]. Fistula plug has shown some benefit to the perineal fistulas of cryptoglandular origin; however, the limited data for RVFs has shown only a 20%-50% closure rate[9,10].

Stem cells therapy emerged as a treatment for Crohn's-related RVFs[61,62]. Initial study demonstrated a 60% of success rate at 12 weeks after administration[61]; however, recent review showed a lower healing rate of 27.2% for RVFs compared with 78% and 76.4% for perianal and transsphincteric fistulas, respectively[62].

Surgical Treatment (Table 5, 6)

Numerous surgical techniques have been described for RVFs through various approaches: transanal, transperineal, transvaginal, and abdominal approach. After identifying the factors to determine the management, the first step includes controlling any sepsis by draining abscess and/or seton

placement[28]. ASCRS clinical practice guidelines strongly recommend the use of a drainage seton to facilitate resolution of acute inflammation or infection associated with RVFs as low-quality evidence[11]. Simple fistula is usually indicated for local repair. Local repairs to transperineal and transabdominal approaches can be used for complex RVFs. Interposition of healthy, well-vascularized tissue can be required for more complex fistulas such as those secondary to radiation[28].

The period <9 months between diagnosis and first surgery is reported to be one of independent factors for success[63]. About half of patients with RVFs need multiple surgery[13]. Halverson et al. reported that 79% (27/34) of patients eventually healed after a median of 2 operations[64]. RVFs in Crohn's disease often need surgical intervention, and the response to a combination of medical and surgical treatment was 44.2% though the overall response rates to medical therapy was 38.3%[30].

1. Stoma

Diverting stoma can diminish symptoms of RVF and might help fistula healing. Corte et al. described that temporary transversal stoma significantly increased the success rate of repair[63]. Meanwhile, Lambert et al. found in their retrospective study that stoma did not help to improve the recurrence rate after RVF repair[65]. Due to insufficient proof, the clinical effectiveness of diversion stoma remains controversial[66]. German S3-guideline for rectovaginal fistula commented with strong consensus that the decision regarding stoma creation should primarily base on the extent of the local defect and the resulting burden on the pa-

Table 6. Summary of Outcomes of Surgical Treatments for RVFs.

Method	Reference	n	Etiology	Success rate	Follow-up
Stoma alone	[2,6,40,41,47,54]	-	post surgery	25%–100%	various
Advancement flap	[11,19,63,64,69-71]	-	various	41%–78%	various
	[16,28,32,72]	-	Crohn	33%–83%	various
Episioproctotomy	[8,11,19,22,23,75-79]	-	mainly obstetric & cryptoglandular	78%–100%	various
Advancement flap	[77]	37	obstetric &	62.2% (23/37)	mean 49 months
Episioproctotomy		50	cryptoglandular	78% (39/50)	
Transperineal repair	[10,18]	-	various	64.7%–100%	various
Advancement flap	[69]	37	various	78.4%	3 months to
Transperineal repair		34		64.7%	9.5 years
Fistulectomy*	[36,71,81-83]	-	mainly obstetric	53.1%–100%	various
Martius flap	[9,10,84-87]	-	various	65%–100%	various
Gracilis muscle interposition	[92]	106	various	33%–100%	median 21 months
Anterior levatorplasty**	[13]	16	various	100%	median 84 months
Abdominal approach					
*Fistula excision and closure****	[96]	40	various	90%	median 28 months
Redo coloanal anastomosis	[41]	7	after LSR	85.7%	-
Flap procedures	[71]	38	various	57.9%	median 6 months
Abdominal resections		29		55.2%	
Primary closure with sphincter repair		32		53.1%	
Plug and fibrin glue		22		18.2%	

* Fisturectomy and closure with or without sphincter repair or tissue interposition,

** Transvaginal anterior levatorplasty,

*** Fistula excision and closure with omentum interposition,

LAR: low anterior resection, [Reference]

tient[1].

Stoma for RVFs after surgery

Diverting stoma have been used either as stoma with conservative therapy or with RVF repair. Prophylactic diverting stoma is often constructed in patients with low colorectal anastomosis[2,6,13,40]. In patients without initial diverting stoma for colorectal anastomosis, fecal diversion alone has resulted in the closure of RVF in 25% - 100%[2,6,40,41,47,54]. Barugola et al. reported that half of the RVFs healed within six months after the construction of a diverging stoma; the failed factors after fecal diversion alone were large fistula and the presence of pelvic sepsis[34]. Komori et al. classified RVFs into four types: "Alone type," "Dead space type," "Anastomotic stricture type," and "Dead space and Anastomotic stricture type" according to the diagnostic imaging, and 71.4% (5/7) of patients with "Alone type" RVF healed with only diverting stoma[67].

2. Local repairs

The approaches to local repair include transanal (endorectal), transperineal, and transvaginal techniques with or without tissue interposition.

Local repair without tissue interposition
1) Advancement flap

Advancement flap (AF) may be performed by raising either rectal or vaginal mucosa and using it to cover the fistulous tract[2]. This is performed in conjunction with debridement/excision of the fistula tract and primary closure[10]. Several merits have been listed according to approaches in AF: endorectal or transvaginal. While endorectal AF can be performed from high pressure side with easier mobilization of the mucosa, transvaginal AF might have a merit of providing a better vascularized tissue with easier recovery etc.[10]. AF is usually a procedure of choice for low-lying/simple traumatic RVFs without a history of incontinence[9,10]. AF also has been used for complex RVF including Crohn's disease[11,16,31,32,68]. Mac Rae et al. reported that AF for RVF is generally not recommended for persistent complex fistulas or for simple fistulas with previous failed repair by AF repair[19]. Hannaway et al. stated that endorectal AF in patients with Crohn's disease is contraindicated both in women with extensive ulceration or stricturing of the anal canal and transitional zone and women with anterior sphincter defect[48], although this technique is ideal for patients with minimal disease or nor-

mal anal canal[32,48]. Endorectal AF can be performed in combination with sphincteroplasty in patients with sphincter damage/defect and fecal incontinence. Endorectal AF with or without sphincteroplasty is strongly recommended as the procedure of choice for most patients with RVF by ASCRS clinical practice guidelines[11].

The success rate of endorectal AF for RVFs with various etiology ranges 41%-78%[11,19,63,64,69-71]. Crohn's disease has been implicated as a significant risk factor for failure, associated with inferior outcomes (33% - 83%)[16,28,32,72] and recurrence[73]. The success rate of repeat flaps for failed attempt at fistula repair has been documented in 55%-93%[3,64,74]. Higher success rate has been reported by adding sphincteroplasty on endorectal AF in patients with RVF and incontinence and/or sphincter damage[3,4,17,63,70].

2) Episioproctotomy

Episioproctotomy is one of the transperineal procedures. All tissue above the fistula, including anterior sphincter complex and rectovaginal septum, is cut and then reconstructed in layers with fistulotomy during episioproctotomy. This procedure can be suitable for patients having obstetrical or cryptoglandular RVF with anterior sphincter defect[11]. Success rate ranges 78%-100% with acceptable fecal and sexual function[8,11,19,22,23,75-79]. A slightly or significantly better healing rate has been documented in episioproctotomy than that in the other procedures for RVF secondary to cryptoglandular or obstetrical origin[23,77]. The risk of this procedure is wound healing.

3) Transverse transperineal repair with or without sphincteroplasty

This procedure can be called as transperineal repair or transperineal approach[28,69]. This procedure approaches the fistula tract through the perineum. Transverse incision through the perineal body is initially performed, followed by dissection of rectovaginal septum cephalad to the fistula tract. After excising the fistula tract, multiple closure is accomplished with or without sphincteroplasty or levatorplasty[10,32]. This procedure allows good exposure of the fistula and enables tissue interposition and is indicated for more complex, recurrent, and larger RVF[28]. This procedure is best used in women with pre-existing incontinence, or those a history of failed transanal or transvaginal approach[10,21]. Reports show 64.7%-100% success rate[10,18]. A poorer healing rate is documented in transperineal repair with levator interposition compared with endorectal AF for RVF with mixed etiology (64.7% vs. 78.4%, respectively)[69]. Recent report by Zhou et al. indicates that group undergoing transperineal repair with stapling showed better postoperative Wexner score, less intercourse pain, and lower recurrence rate (6/45 vs. 17/37) than group undergoing transperitoneal direct suturing for low- and mid-level RVF[80].

4) Fistulectomy and closure with or without sphincter repair or tissue interposition

This procedure may be reported as purse-string repair[81], fistulectomy with or without sphincter repair or tissue interposition[36,82] or primary closure with sphincter repair[71]. This can be performed to RVF secondary to Crohn's disease[15] by any approach but vaginal approach is most preferred by gynecologists[81-83]. This procedure includes excision of the fistula tract followed by multiple closure[83]. Sphincter repair may be added in patients with fecal incontinence or sphincter damage[71,82]. This procedure is indicated for small/low-lying RVF, especially obstetric origin[81,82]. Success rate of this procedure ranges 53.1%-100%[36,71,81-83].

Local repairs with tissue interposition

The use of tissue interposition along with local repair improves the healing of RVF repair by inserting well-vascularized tissue into the rectovaginal septum. Tissue interposition enables to separate and protect the vaginal from the rectal suture. Generally, these procedures are most suitable for complex, recurrent, or persistent RVFs.

1) Martius (bulbocavernosus) flap

This procedure can be called as bulbocavernosus muscular fat pad or Martius labial fat pad[2,28]. After separating the rectum and vagina through a perineal dissection, pedicle muscular graft from the labia majora is transposed to the perineal wound between the rectum and vagina[84]. Low- and mid-level fistulas up to approximately 5 cm proximal to the vaginal introitus is indicated for this procedure, according to the reach of the pedicle[10]. Though this procedure has been reported in small retrospective studies with various etiology and limited follow-up[11], success rate is reported to range 65%-100%[9,10,84-87]. This procedure is documented to be superior to rectal AF alone[85]. This procedure merits with lower morbidity among tissue interposition procedures[28]. Disadvantage of this procedure is postoperative dyspareunia and labial wound tissue, which are usually resolved with time and local wound care[10,87].

2) Gracilis muscle flap

This procedure is generally much more complex and invasive than that of the Martius flap repair[1]. After harvesting the gracilis muscle from the leg as a proximal pedicle, the gracilis muscle is used as an interposition graft between the rectum and vagina, following direct closure of the corresponding fistula orifices[1,10]. This procedure is usually preceded by a diverting stoma[28,88]. Gracilis muscle flap has been used for refractory, recurrent RVFs, especially secondary to Crohn's disease and post-pelvic surgery[11,73,88-92]. A success rate of 33%-100% has been reported in the review of 17 studies, including 106 patients at a median follow-up of 21 months[92]. Increased postoperative morbidity, including surgical site infection, thigh numbness, hematoma, prolonged decrease in sexual func-
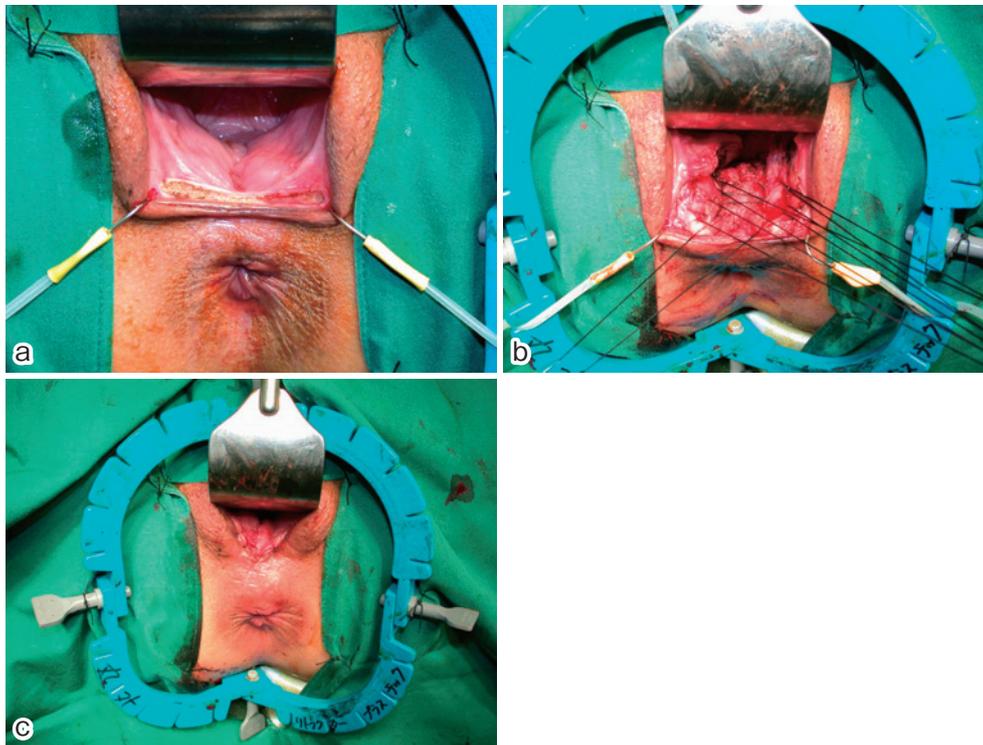
Figure 1. Transvaginal anterior levatorplasty.

a, Transverse incision in the posterior vaginal wall.

b, The puborectalis and pubococcygeal muscles are brought together by interrupted sutures to cover the fistula tract.

c, The posterior vaginal wall is closed without scar in the perineum.

tion, and dyspareunia, are the drawbacks of this procedure[1,9,10,89-91].

3) Levator ani muscles interposition

Two procedures: puborectalis sling interposition and transvaginal anterior levatorplasty have been reported as levator ani muscle interposition procedure[7,13]. The etiology of RVFs is various in these reports. A transverse incision with a vertical incision enclosing the RVF is performed in the posterior vaginal wall followed by dissection of rectovaginal septum up to 3-4 cm above the level of the fistula to expose both limbs of the puborectalis and pubococcygeus muscles (Figure 1a). After excising the fistula tract, anterior rectal wall is transversely closed. The puborectalis and pubococcygeal muscles are then brought together by interrupted sutures to cover the fistula tract (Figure 1b), followed by closure of the vaginal wall in transvaginal anterior levatorplasty (Figure 1c). This procedure was performed for low and middle located RVFs up to 2.5 cm in diameter, including 7/16 previously failed attempt at repair. Healing of RVF was accomplished in all 16 patients (100%) by 18 times of procedures at a median follow-up of 84 months[13]. The advantage of this procedure is no scarring in the perineum and little dyspareunia post-surgery. Oom et al.[7] documented healed RVFs in 16 (62%) of 26 patients by puborectalis sling interposition at a median follow-up of 14 months but healing rate was poorer in patients with previous repairs (31%) than that in patients without previous repair (92%).

3. Abdominal repair

Abdominal repairs are usually performed via a minimally invasive or open approach[2,10]. Abdominal repairs include fistula excision with multi-layered closure of the rectum and the vagina, accompanying with an interposition of well-vascularized omental tissue, resection of the part rectum, including the fistula followed by redo colorectal (or coloanal) anastomosis, and transanal colonic pull-through with delayed coloanal anastomosis after rectal resection[2,41,93-95]. Abdominal repair is indicated for non-amenable high RVF to transperineal repair, especially RVF after LAR[2,10,28,93-95]. Fistula excision with multi-layered closure of the rectum and the vagina can be performed only when the quality of tissues surrounding the fistula has minimal fibrosis, good blood supply, no infection, and no evidence of cancer recurrence. Rectal resection may be needed in cases with the possibility of multiple adhesions and difficult pelvic dissection[2]. ASCRS clinical practice guidelines suggest that RVFs resulting from colorectal anastomotic complications often require a transabdominal approach for

repair and completion proctectomy with or without colonic pull-through or coloanal anastomosis may be required to treat radiation-related or recurrent complex RVF[11]. Success rate of fistula excision with multi-layered closure of the rectum and the vagina accompanying omental interposition is 90%-100% for RVFs with various causes[94,96]. Redo-coloanal anastomosis showed a success rate of 85.7% (6/7) in patients with RVFs after LAR[41]. Maggiori et al. reported a 79% success rate in patients with chronic anastomosis leakage after rectal resection (n = 24), including RVF formation (n = 9) undergoing transanal colonic pull-through with delayed coloanal anastomosis after rectal resection[95].

Conclusion

RVF is a challenging complication with unsatisfactory success and a significant burden for the patients. With insufficient clinical data due to the rare entity, we comprehensively reviewed the factors to determine management, classifications, principle of treatment, and conservative and surgical treatments with outcomes.

Conflicts of Interest
There are no conflicts of interest.

Author Contributions
All authors contributed to the study conception and design. Material preparation, data collection, and analysis were performed by Kotaro Maeda. The first draft of the manuscript was written by Kotaro Maeda and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

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References

1. Ommer A, Herold A, Berg E, et al. German S3-guideline: recto vaginal fistula. Ger Med Sci. 2012 Oct; 10: Doc15.
2. Lohsiriwat V, Jitmungngan R. Rectovaginal fistula after low anterior resection: prevention and management. World J Gastrointest Surg. 2021 Aug; 13 (8): 764-71.
3. Lowry AC, Thorson AG, Rothenberger D, et al. Repair of simple rectovaginal fistulas: influence of previous repairs. Dis Colon Rectum. 1988 Sep; 31 (9): 676-8.
4. Tsang CB, Madoff RD, Wong WD, et al. Anal sphincter integrity and function influences outcome in rectovaginal fistula repair. Dis Colon Rectum. 1998; 41 (9): 1141-6.
5. Lolohea S, Lynch AC, Robertson GB, et al. Ileal pouch-anal anastomosis-vaginal fistula: a review. Dis Colon Rectum. 2005 Sep; 48 (9): 1802-10.
6. Kosugi C, Saito N, Kimata Y, et al. Rectovaginal fistulas after rectal cancer surgery: incidence and operative repair by gluteal-fold flap repair. Surgery. 2005 Mar; 137 (3): 329-36.
7. Oom DMJ, Gosselink MP, Van Dijl VRM, et al. Puborectal sling interposition for the treatment of rectovaginal fistulas. Tech Coloproctol. 2006 Jul; 10 (2): 125-30.
8. Tozer PJ, Balmforth D, Kayani B, et al. Surgical manegement of fistula in a tertiary referral center. Many techniques are needed. Colorectal Dis. 2013 Jul; 15 (7): 871-7.
9. Göttgens KW, Smeets RR, Stassen L, et al. The disappointing quality of published studies on operative techniques for rectovaginal fistulas: a blueprint for a prospective multi-institutional study. Dis Colon Rectum. 2014 Jul; 57 (7): 888-98.
10. Kniery KR, Johnson EK, Steele SR. Operative considerations for rectovaginal fistulas. World J Gastrointest Surg. 2015 Aug; 7 (8): 133-7.
11. Gaertner WB, Burgess PL, Davids JS, et al. The American Society of Colon and Rectal Surgeons clinical practice guidelines for the management of anorectal abscess, fistula-in-ano, and rectovaginal fistula. Dis Colon Rectum. 2022 Aug; 65 (8): 964-85.
12. Gordon PH. Principles and Practice of Surgery of the Colon, Rectum, and Anus. 3rd ed. (eds Gordon PH, Nivatvongs S). New York: Informa Health Care USA; 2007. Rectovaginal fistula; p.333-47.
13. Maeda K, Koide Y, Hanai T, et al. The long-term outcome of transvaginal anterior levatorplasty for intractable rectovaginal fistula. Colorectal Dis. 2015 Nov; 17 (11): 1002-6.
14. Watson SJ, Phillips RKS. Non-inflammatory rectovaginal fistula. Br J Surg. 1995 Dec; 82 (12): 1641-3.
15. Bauer JJ, Sher ME, Jaffin BAH, et al. Transvaginal approach for repair of rectovaginal fistulae complicating Crohn's disease. Ann Surg. 1991 Feb; 213 (2): 151-8.
16. Jones IT, Fazio VW, Jagelman DG. The use of transanal rectal advancement flap in the management of fistulas involving the anorectum. Dis Colon Rectum. 1987 Dec; 30 (12): 919-23.
17. Wise WE, Aguilar PS, Padmanabhan A, et al. Surgical treatment of low rectovaginal fistulas. Dis Colon Rectum. 1991 Mar; 34 (3): 271-4.
18. Wiskind AK, Thompson JD. Transverse transperineal repair of rectovaginal fistulas in the lower vagina. Am J Obstet Gynecol. 1992 Sep; 167 (3): 694-9.
19. MacRae HM, McLeod RS, Cohen Z, et al. Treatment of rectovaginal fistula that has failed previous repair attempts. Dis Colon Rectum. 1995 Sep; 38 (9): 921-5.
20. Aronson MP, Lee RA. TeLinde's Operative Gynecology. 9th ed. (eds Rock JA, Jones HW). Philadelphia, PA: W W Lippincot; 2003. Fecal incontinence and rectovaginal fistulas; pp.1121-60.
21. Champagne BJ, McGee MF. Rectovaginal fistula. Surg Clin North Am. 2010 Feb; 90 (1): 69-82.
22. Mazier WP, Senagore AJ, Schiesel EC. Operative procedure of anovaginal and rectovaginal fistulas. Dis Colon Rectum. 1995 Jan; 38 (1): 4-6.
23. El-Gazzaz G, Hull TL, Mignanelli E, et al. Obstetric and cryptoglandular rectovaginal fistulas: long term surgical outcome; quality of life; and sexual function. J Gastrointest Surg. 2010 Nov; 14 (11): 1758-63.
24. Radcliffe AG, Ritchie JK, Hawley PR, et al. Anovaginal and rectovaginal fistulas in Crohn's disease. Dis Colon Rectum. 1988 Feb; 31 (2): 94-9.
25. Hamilton S, Spencer C, Evans A. Vagino-rectal fistula caused by Bartholin's abscess. J Obstet Gynaecol. 2007 Apr; 27 (3): 325-6.
26. Matthiessen P, Hansson L, Sjödahl R, et al. Anastomotic-vaginal

fistula (AVF) after anterior resection of the rectum for cancer-occurrence and risk factors. Colorectal Dis. 2010 Apr; 12 (4): 351-7.

27. Klein JW. Common anal problems. Med Clin North Am. 2014 May; 98 (3): 609-23.

28. Akiba RT, Rodorigues RG, da Silvia G. Management of complex perineal fistula disease. Clin Colon Rect Surg. 2016 Jun; 29 (2): 92-100.

29. Lee MJ, Heywood N, Sagar PM, et al. Association of Coloproctology of Great Britain and Ireland consensus exercise on surgical management of fistulating perianal Crohn's disease. Colorectal Dis. 2017 May; 19 (5): 418-29.

30. Kaimakliotis P, Simillis C, Harbord M, et al. A systemic review assessing medical treatment for rectovaginal and enterovesical fistulae in Crohn's disease. J Clin Gastroenterol. 2016 Oct; 50 (9): 714-21.

31. Zhu YF, Tao GQ, Zhou N, et al. Current treatment of rectovaginal fistula in Crohn's disease. World J Gastroenterol. 2011 Feb; 17 (8): 963-7.

32. Valente MA, Hull TL. Contemporary surgical management of rectovaginal fistula in Crohn's disease. World J Gastrointest Pathophysiol. 2014 Nov; 5 (4): 487-95.

33. Ryoo SB, Oh HK, Ha HK, et al. Outcomes of surgical treatments for rectovaginal fistula and prognostic factors for successful closure: a single-center tertiary hospital experiences. Ann Surg Treat Res. 2019 Sep; 97 (3): 149-56.

34. Barugola G, Bertocchi E, Leonardi A, et al. Post surgical rectovaginal fistula: who really benefits from stoma diversion? Update Surg. 2021 Feb; 73 (1): 165-71.

35. Dawes AJ, Jensen CC. Rectovaginal fistulas secondary to obstetrical injury. Clin Colon Rect Surg. 2021 Jan; 34 (1): 28-39.

36. Oakley SH, Brown HW, Yurteri-Kaplan L, et al. Practice patterns regarding management of rectovaginal fistulae: a multicenter review from the fellows' pelvic research network. Female Pelvic Med Reconstr Surg. 2015 May; 21 (3): 123-8.

37. Lo TS, Huang YH, Dass AK, et al. Rectovaginal fistula: twenty years of rectovaginal repair. J Obstet Gynaecol Res. 2016 Oct; 42 (10): 1361-8.

38. Homsi R, Daikoku NH, Littlejohn J, et al. Episiotomy: risk of dehiscence and rectovaginal fistula. Obstet Gynecol Surv. 1994 Dec; 49 (12): 803-8.

39. Dohgomori H, Arikawa K, Nobori M, et al. Hyperbaric oxygenation for rectovaginal fistula: a report of two cases. J Obstet Gynaecol Res. 1999 Oct; 25 (5): 343-4.

40. Zheng H, Guo T, Wu Y, et al. Rectovaginal fistula after low anterior resection in Chinese patients with colorectal cancer. Oncotarget. 2017 Apr; 8 (42): 73123-32.

41. Woo IT, Park JS, Choi GS, et al. Optimal strategies of rectovaginal fistula after rectal cancer surgery. Ann Surg Treat Res. 2019 Sep; 97 (3): 142-8.

42. Tsutsumi N, Yoshida Y, Maehara Y, et al. Rectovaginal fistula following double-stapling anastomosis in low anterior resection for rectal cancer. Hepatogastroenterology. 2007 Sep; 54 (78): 1682-3.

43. Emoto S, Nozawa H, Yoneyama S, et al. Rectovaginal fistula after low anterior resection for rectal cancer healed by nonoperative treatment. Int J Surg Case Rep. 2017 Oct; 41: 121-3.

44. Sunami T, Tauchi J, Sakashita K, et al. [A case of rectovaginal fistula after low anterior resection successfully treated by administration of estriol]. J Jap Surg Assoc. 2013 Dec; 74 (12): 3416-9.

45. Sasaki T, Furuhata T, Ono T, et al. [A case of intractable rectovaginal fistula after rectal cancer for which estriol tablet was effective]. J Jpn Soc Coloproctol. 2020 Jan; 73 (1): 42-6. Japanese with English abstract.

46. Hiraki M, Tanaka T, Kanai T, et al. The treatment for refractory rectovaginal fistula after low anterior resection with estriol, polyglycolic acid sheets and primary closure: a case report. Int J Surg Case Rep. 2020 Sep; 75: 483-7.

47. Rex JC, Khubchandani IT. Rectovaginal fistula: complication of low anterior resection. Dis Colon Rectum. 1992 Apr; 35 (4): 354-6.

48. Hannaway CD, Hull TL. Current considerations in the management of rectovaginal fistula from Crohn's disease. Colorectal Dis. 2008 Oct; 10 (8): 747-55.

49. Bernstein LH, Frank MS, Brandt LJ, et al. Healing of perineal Crohn's disease with metronidazole. Gastroenterology. 1980 Aug; 79 (2): 357-65.

50. Sands BE, Blank MA, Patel K, et al. Long-term treatment of rectovaginal fistulas in Crohn's disease: response to infliximab in the Accent study. Clin Gastroenterol Hepatol. 2004 Oct; 2 (10): 912-20.

51. Parsi MA, Lashner BA, Achkar JP, et al. Type of fistula determines response to infliximab in patients with fistulous Crohn's disease. Am J Gastroenterol. 2004 Mar; 99 (3): 445-9.

52. Lansdorp CA, Buskens CJ, Gecse KB, et al. Hyperbaric oxygen therapy for the treatment of rectovaginal fistulas in patients with Crohn's disease: results of the HOT-REVA pilot study. BJS Open. 2021 May; 5 (3): zrab042.

53. Lamazza A, Fiori E, Schillaci A, et al. Treatment of rectovaginal fistula after colorectal resection with endoscopic stenting: long-term results. Colorectal Dis. 2015 Apr; 17 (4): 356-60.

54. Lamazza A, Fiori E, Sterpetti AV, et al. Endoscopic placement of self-expandable metallic stents for rectovaginal fistula after colorectal resection: a comparison with proximal diverting ileostomy alone. Surg Endosc. 2016 Feb; 30 (2): 797-801.

55. Tong Y, Trilling B, Sage PY, et al. Short-term outcomes of the over-the-scope clip proctology system for rectovaginal fistula repair: a prospective study. Tech Coloproctol. 2019 Mar; 23 (3): 245-9.

56. Artifon ELA, Silva GLR, Furuya CK, et al. Endoscopic stent combined with endovaginal clipping for resolution of rectovaginal fistula after colorectal anastomotic dehiscence. Gastrointes Endosc. 2014 Nov; S0016-5107: 14902279-2.

57. van Vledder MG, Doornebosch PG, de Graaf EJR. Transanal endoscopic surgery for complications of prior rectal surgery. Surg Endosc. 2016 Dec; 30 (12): 5356-63.

58. Zeng YX, He YH, Jiang Y, et al. Minimally invasive endoscopic repair of rectovaginal fistula. World J Gastrointest Surg. 2022 Sep; 14 (9): 1049-59.

59. Shibata Y, Mizuguchi N, Takeda M, et al. Successful closure of a rectovaginal fistula following low anterior resection by endoscopic fibrin glue application. Colorectal Dis. 1999; 1 (1): 42-4.

60. Loungnarath R, Dietz DW, Mutch MG, et al. Fibrin glue treatment of complex anal fistulas has low success rate. Dis Colon Rectum. 2004 Apr; 47 (4): 432-6.

61. García-Arranz M, Herreros MD, González-Gómez C, et al. Treatment of Crohn's-related rectovaginal fistula with allogeneic expanded-adipose derived stem cells: a phase I-IIa trial. Stem

Cells Transl Med. 2016 Nov; 5 (11): 1441-6.

62. Cao Y, Su Q, Zhang B, et al. Efficacy of stem cells therapy for Crohn's fistula: a meta-analysis and systemic review. Stem Cell Res Ther. 2021 Jan; 12 (1): 32.

63. Corte H, Maggiori L, Treton X, et al. Rectovaginal fistula: what is the optimal surgery?: an analysis of 79 patients undergoing 286 procedures. Ann Surg. 2015 Nov; 262 (5): 855-60.

64. Halverson AL, Hull TL, Fazio VW, et al. Repair of recurrent rectovaginal fistulas. Surgery. 2001 Oct; 130 (4): 753-7.

65. Lambertz A, Lüken B, Ulmer TF, et al. Influence of diversion stoma on surgical outcome and recurrence rates in patients with rectovaginal fistula- a retrospective cohort study. Int J Surg. 2016 Jan; 25: 114-7.

66. Fu W, Yi S, An M, et al. Effect of diverting stoma for rectovaginal fistula a protocol of systemic review and meta-analysis. Medicine. 2020 Dec; 99 (49): e23202.

67. Komori K, Kinoshita T, Oshiro T, et al. Surgical strategy for rectovaginal fistula after colorectal anastomosis at a high-volume cancer center according to image type and colonoscopy findings. Anticancer Res. 2019 Sep; 39 (9): 5097-103.

68. Andreani SM, Dang HH, Grondona P, et al. Rectovaginal fistula in Crohn's disease. Dis Colon Rectum. 2007 Dec; 50 (12): 2215-22.

69. Athanasiadis S, Oladeinde I, Kuprian A, et al. Endorectal advancement flap-plasty vs. transperineal closure in surgical treatment of rectovaginal fistulas. A prospective long-term study of 88 patients. Chirurg. 1995 May; 66 (5): 493-502.

70. Sonoda T, Hull T, Piedmonte MR, et al. Outcomes of primary repair of anorectal and rectovaginal fistulas using the endorectal advancement flap. Dis Colon Rectum. 2002 Dec; 45 (12): 1622-8.

71. Studniarek A, Abcarian A, Pan J, et al. What is the best method of rectovaginal fistula repair? A 25-year single-center experience. Tech Coloproctol. 2021 Sep; 25 (9): 1037-44.

72. Mizrahi N, Wexner SD, Zmora O, et al. Endorectal advancement flap: are there predictors of failure? Dis Colon Rectum. 2002 Dec; 45 (12): 1616-21.

73. Pinto RA, Peterson TV, Shawki S, et al. Are there predictors of outcome following rectovaginal fistula repair? Dis Colon Rectum. 2010 Sep; 53 (9): 1240-7.

74. Sirany AM, Nygaard RM, Morken JJ. The ligation of the intersphincteric fistula tract procedure for anal fistula: a mixed bag of results. Dis Colon Rectum. 2015 Jun; 58 (6): 604-12.

75. Chew SSB, Rieger NA. Transperineal repair of obstetric-related anovaginal fistula. Aust N Z J Obstet Gynaecol. 2004 Feb; 44 (1): 68-71.

76. Hull TL, Bartus C, Bast J, Floruta C, Lopez R. Multimedia article. Success of episioproctotomy for cloaca and rectovaginal fistula. Dis Colon Rectum. 2007 Jan; 50 (1): 97-101.

77. Hull TL, El-Gazzaz G, Gurland B, et al. Surgeons should not hesitate to perform episioproctotomy for rectovaginal fistula secondary to cryptoglandular or obstetrical origin. Dis Colon Rectum. 2011 Jan; 54 (1): 54-9.

78. Khanduja KS, Padmanabhan A, Kerner BA, et al. Reconstruction of rectovaginal fistula with sphincter disruption by combining rectal mucosal advancement flap and anal sphincteroplasty. Dis Colon Rectum. 1999 Nov; 42 (11): 1432-7.

79. Soriano D, Lemoine A, Laplace C, et al. Results of recto-vaginal fistula repair: retrospective analysis of 48 cases. Eur J Obstet Gynecol Reprod Biol. 2001 May; 96 (1): 75-9.

80. Zhou Q, Liu ZM, Chen HX, et al. Stapled transperineal repair for low- and midlevel rectovaginal fistulas: a 5-year experience and comparison with sutured repair. World J Gastroenterol. 2021 Apr; 27 (14): 1451-64.

81. Rahman MS, Al-Suleiman SA, El-Yahia AR, et al. Surgical treatment of rectovaginal fistula of obstetric origin: a review of 15 years' experience in a teaching hospital. J Obstet Gynaecol 2003 Nov; 23 (6): 607-10.

82. Beksac K, Tanacan A, Ozgul N, et al. Treatment of rectovaginal fistula using sphincteroplasty and fistulectomy. Obstet Gtaenecol Int. 2018 May; 6: 5298214.

83. Knuttinen MG, Yi J, Magtibay P, et al. Colorectal-vaginal fistulas: imaging and novel interventional treatment modalities. J Clin Med. 2018 Apr; 7 (4): 87.

84. Pitel S, Lefevre JH, Parc Y, et al. Martius advancement flap for low rectovaginal fistula: short- and long-term results. Colorectal Dis. 2011 Jun; 13 (6): e112-5.

85. Gosselink MP, Oom DM, Zimmerman DD, et al. Martius flap: an adjunct for repair of complex, low rectovaginal fistula. Am J Surg. 2009 Jun; 197 (6): 833-4.

86. Trompetto M, Realis Luc AR, Novelli E, et al. Use of the Martius advancement flap for low rectovaginal fistulas. Colorectal Dis. 2019 Dec; 21 (12): 1421-8.

87. McNevin MS, Lee PY, Bax TW. Martius flap: an adjunct for repair of complex, low rectovaginal fistula. Am J Surg. 2007 May; 193 (5): 597-9.

88. Gariufalia Z, Gefen R, Emile SH, et al. Gracilis muscle interposition for complex perineal fistulae: a systemic review and meta-analysis of the literature. Colorectal Dis. 2022 Nov; 16427.

89. Hull TL, Sapci I, Lightner AL. Gracilis flap repair for reoperative rectovaginal fistula. Dis Colon Rectum. 2023 Jan; 66 (1): 113-7.

90. Wexner SD, Ruiz DE, Genua J, et al. Gracilis muscle interposition for the treatment of rectourethral, rectovaginal, and pouch-vaginal fistulas: results in 53 patients. Ann Surg. 2008 Jul; 248 (1): 39-43.

91. Korsun S, Liebig-Hoerl G, Fuerst A. Gracilis muscle transposition for treatment of recurrent anovaginal, rectovaginal, rectourethral, and pouch-vaginal fistulas in patients with inflammatory bowel disease. Tech Coloproctol. 2019 Jan; 23 (1): 43-52.

92. Hotouras A, Ribas Y, Zakeri S, et al. Gracilis muscle interposition for rectovaginal and anovaginal fistula repair: a systematic literature review. Colorectal Dis. 2015 Feb; 17 (2): 104-10.

93. Mukwege D, Mukanire N, Himpens J, et al. Minimally invasive treatment of traumatic high rectovaginal fistulas. Surg Endosc. 2016 Jan; 30 (1): 379-87.

94. Schloericke E, Zimmermann M, Benecke C, et al. Surgical management of complicated rectovaginal fistulas and the role of omentoplasty. Tech Coloproctol. 2017 Dec; 21 (12): 945-52.

95. Maggiori L, Blanche J, Harnoy Y, et al. Redo-surgery by transanal colonic pull-through for failed anastomosis associated with chronic pelvic sepsis or rectovaginal fistula. Int J Colorectal Dis. 2015 Apr; 30 (4): 543-8.

96. van der Hagen S, Soeters PB, Baeten CG, et al. Laparoscopic fistula excision and omentoplasty for high rectovaginal fistulas: a prospective study of 40 patients. Int J Colorectal Dis. 2011 Nov; 26 (11): 1463-7.