


Martius Flap Technique for Repairing Rectovaginal Fistulas: A Comprehensive Review with Emphasis on Gynecological Etiologies

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Background: Rectovaginal fistulas (RVFs) present a significant surgical challenge, particularly those resulting from gynecologic procedures, which are often complex and associated with higher recurrence rates. The Martius Flap technique, which involves the use of a vascularized adipose tissue graft, is an established method for enhancing fistula repair, especially in cases involving large, recurrent, or radiation-induced fistulas.

Materials and Methods: We conducted a prospective evaluation of 46 female patients with RVFs treated using the Martius Flap technique between December 2008 and December 2019. The study focused on patients with RVFs caused predominantly by gynecologic procedures, including surgeries for benign and malignant conditions, as well as those with a history of radiation therapy.

Results: The average age of the patients was 38.7 years (range 18–75 years). Of the 46 RVFs treated, 65.2% were due to gynecologic surgery, 26.1% were associated with iatrogenic injury or radiation therapy, and 8.7% were post-coital. Successful fistula closure was achieved in 95.6% of cases, with a recurrence rate of 4.4%. The Martius Flap demonstrated high efficacy, particularly in large and complex fistulas, with most patients reporting significant satisfaction and improved continence post-operatively.

Conclusion: The Martius Flap technique is a highly effective option for the surgical management of RVFs, particularly those secondary to gynecologic procedures. The technique's ability to introduce well-vascularized tissue into the repair site significantly reduces recurrence rates and enhances healing, making it a preferred method for treating complex and recurrent RVFs.

Keywords: Martius flap, rectovaginal fistula, RVF, transperineal approach, surgical repair, complications

Introduction

Rectovaginal fistulas (RVFs) are relatively rare, yet they pose significant challenges primarily due to their debilitating symptoms they cause, complex etiology, and their management challenges. Surgeons face difficulties in their management, particularly when they result from gynecologic procedures. Unlike RVFs arising from obstetric trauma, which are often managed with tissue dissection and direct suturing. RVFs caused by gynecologic interventions, such as surgeries for benign or malignant conditions, radiotherapy, and other pelvic procedures, often present with more complex anatomy and require advanced surgical techniques for effective repair.

These abnormal connections between the rectum and vagina can result in severe physical and psychological distress for affected women, including fecal incontinence, chronic infections, and social embarrassment.

The primary causes of RVFs include obstetric trauma, particularly after difficult vaginal deliveries, gynecologic surgeries, radiation therapy, and inflammatory bowel diseases such as Crohn's disease. Among these, RVFs caused by gynecologic procedures, including surgeries for benign or malignant conditions, are particularly complex and associated with higher recurrence rates. Given the challenging nature of RVFs, especially those resulting from gynecologic procedures, where the integrity of the pelvic floor and surrounding tissues is often compromised. Therefore, a tailored approach to gynecologic-related RVFs management is critical.

The Martius Flap technique, which involves the use of a well-vascularized adipose tissue graft from the labia majora, has appeared as a valuable possibility in the surgical repair of these fistulas. It significantly enhances healing, particularly in cases where the local tissue is fragile and fibrous due to prior surgeries or radiation therapy.

Given these considerations, our study aims to evaluate the effectiveness of the Martius Flap technique in the management of RVFs, with a particular focus on those caused by gynecologic procedures. We hypothesize that the Martius Flap will show high efficacy in achieving fistula closure and minimizing recurrence, thereby improving patient outcomes in this challenging patient population.

Materials and Methods

Study Design

This study was a prospective cohort analysis conducted between December 2008 and December 2019. The study aimed to evaluate the effectiveness of the Martius Flap technique in the repair of rectovaginal fistulas (RVFs), particularly those caused by gynecologic procedures.

Patient Selection

Forty-six female patients who underwent the Martius flap procedure based on the following inclusion and exclusion criteria:

Inclusion Criteria

Female patients aged 18–75 years, diagnosed with rectovaginal fistula confirmed by clinical examination and imaging, RVFs secondary to gynecologic procedures (eg, surgeries for benign or malignant conditions, radiation therapy). Patients with recurrent or complex RVFs that failed earlier surgical interventions, and patients who provided informed consent to take part in the study.

Exclusion Criteria

Patients with low and simple or small RVFs (<1 cm) that could repair with direct suturing, RVFs associated with active Crohn's disease or other inflammatory bowel conditions where primary surgical repair not needed, and patients who were medically unfit for surgery due to severe comorbidities.

Surgical Procedures of Martius Flap Technique

The Martius Flap procedure involved the harvest of a vascularized adipose tissue flap from the labia majora. The flap then transported to the site of the RVF and interposed between the rectal and vaginal closures to reinforce the repair. This technique was effective in cases where the local tissue not normal due to prior surgeries or radiation therapy.

Outcome Measures

The primary outcome measure was the success of fistula closure, defined as the absence of fistula-related symptoms and the confirmation of closure by clinical examination and imaging at follow-up. Secondary outcome measures included recurrence rates, patient-reported satisfaction, continence, and postoperative complications.

Data Collection

Data collected prospectively for all patients, including demographic information, fistula characteristics (size, location, and etiology), details of the surgical procedure, and postoperative outcomes. Follow-up data collection at regular intervals (1 month, 6 months, 1 year, and annually thereafter) to assess long-term outcomes.

Results

Among forty-six patients, the age range was 18–75 years (mean 38.7). RVF was due to gynecologic surgery for benign disease was (30/46; 65.2%), iatrogenic /radiotherapy erosion (12/ 46; 26.1%), post coitus RVF (4/46; 8.7%) and malignancy (4/46; 8.7%) (Figure 1).

The distribution of rectovaginal fistulas (RVFs) in this study (Table 1) reveals significant patterns in both size and anatomical location within the vagina. The majority of the cases were located in the middle vagina, accounting for 50% of all cases (23 out of 46). This predominance is noteworthy because the middle vaginal location is often associated with more complex fistulas that may require advanced surgical techniques such as the Martius flap combined with sphincteroplasty or levatorplasty.

Regarding the size of the fistulas treated, showing the number of cases involving small (<2 cm), medium (2–3 cm), and large (>3 cm) fistulas. A substantial portion of the RVFs were categorized as larger fistulas (>3 cm). Larger fistulas were more frequently observed in the middle and upper vaginal regions, with a significant proportion of these cases being associated with radiotherapy erosion and post-coital injuries. The complexity and larger size of these fistulas in the

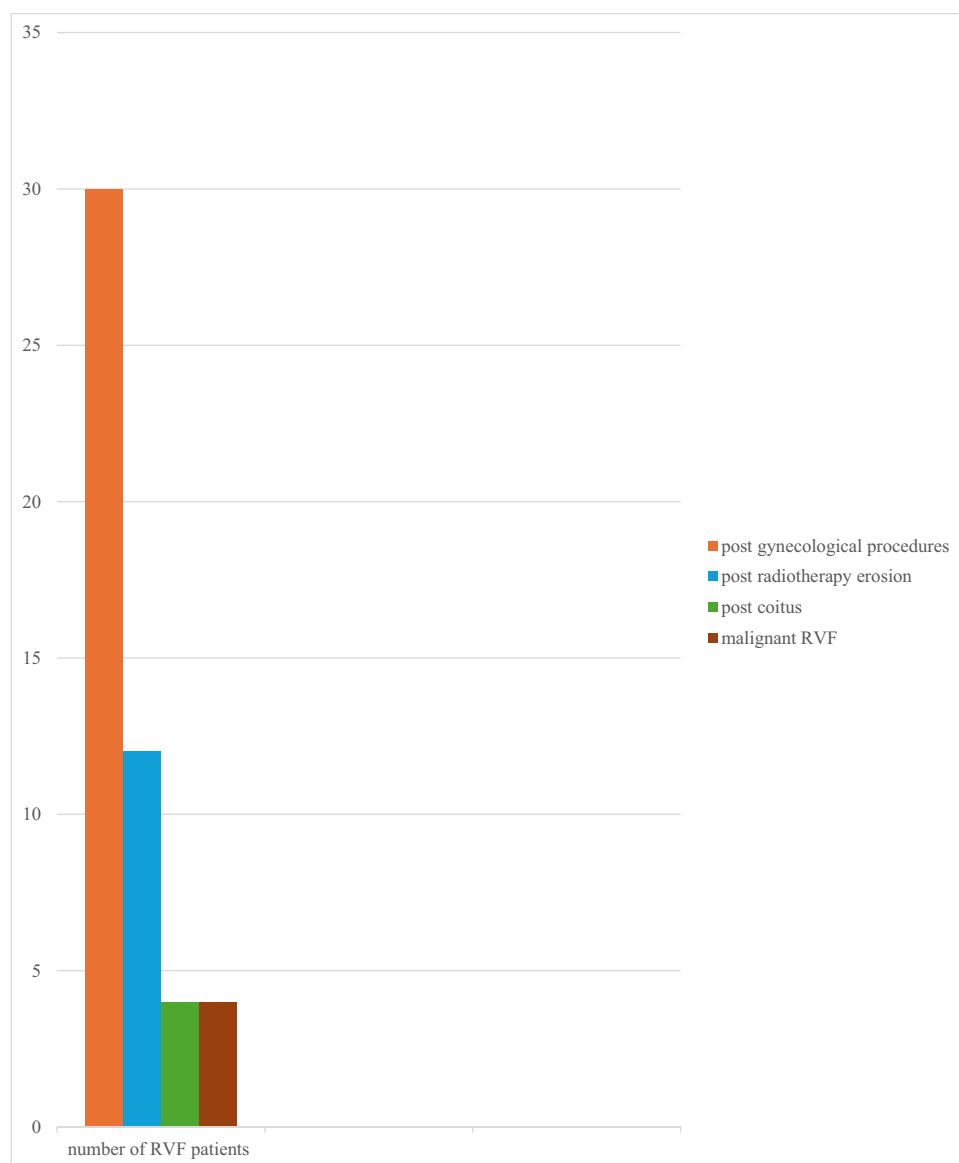


Figure 1 Etiology of RVF in 46 Patients.

Table I Distribution of Gynecologic Procedures by RVF Size and Vaginal Location

Gynecologic Procedure	Vaginal Location	RVF Size (cm)	Number of Cases	Percentage (%)
Hysterectomy	Upper Vagina	< 2 cm	6	13.0%
	Middle Vagina	2–3 cm	8	17.4%
	Lower Vagina	> 3 cm	2	4.3%
Endometriosis Surgery	Upper Vagina	< 2 cm	4	8.7%
	Middle Vagina	2–3 cm	4	8.7%
Fibroid Removal	Upper Vagina	< 2 cm	2	4.3%
	Middle Vagina	2–3 cm	4	8.7%
Pelvic Organ Prolapse Repair	Middle Vagina	< 2 cm	2	4.3%
Radiotherapy Erosion (Post-surgical)	Upper Vagina	> 3 cm	8	17.4%
	Middle Vagina	2–3 cm	4	8.7%
Post-coitus	Middle Vagina	> 3 cm	2	4.3%
	Lower Vagina	> 3 cm	1	2.2%
Malignancy-related Surgery	Middle Vagina	> 3 cm	3	6.5%

middle vagina underscore the necessity for more extensive surgical interventions, which are often required to achieve successful outcomes in these challenging cases.

Overall, this data indicates that 93.5% situated high in vagina (middle and upper) and more complex RVFs, which are often associated with gynecologic surgeries and radiotherapy. The upper vaginal location, which accounted for 43.5% of the cases (20 out of 46), also included a mix of smaller (<2 cm) and larger (>3 cm) fistulas. However, the larger fistulas in this region were predominantly linked to radiotherapy, highlighting the aggressive nature of such injuries and the need for more careful and tailored surgical approaches. This trend emphasizes the importance of specialized surgical techniques in managing these fistulas to ensure optimal healing and reduce the risk of recurrence.

In contrast, the lower vagina had the fewest cases (6.5%), with a smaller representation of large fistulas. This suggests that fistulas in the lower vagina may often present earlier or may be smaller in size, making them somewhat less complex and more amenable to direct surgical repair without the need for extensive tissue reconstruction.

This differentiation is crucial, as the management strategies varied significantly based on the size of the fistula. Also, it helps to contextualize the figures and provides a clear overview of how the size of the RVF influenced the surgical approach.

In cases where the RVF was larger than 2.5 cm, particularly those exceeding 3 cm, a diverting colostomy was often employed in conjunction with the Martius Flap to reduce the risk of infection and facilitate optimal healing.

Rectovaginal fistulas are situated above the dentate line and are more common (Figure 2). While, ano-vaginal fistulas, located below the dentate line, are less prevalent and often involve sphincter involvement, necessitating medical management if secondary to Crohn's disease. RVFs categorized as either simple or complex, by which surgical approach determined (Figure 3).

The follow-up period varies from one and 10 year in all cases. RVF was successfully closed in 44 patients (95.6%) (Figure 3). Satisfaction and complete Continence was achieved in 44 patients (95.6%) after the first procedure (Figure 4).

Cases of persistent RVF were those received radiotherapy, they subjected to second operation with excision and bull through procedure with good results. Malignant RVF cases were treated by posterior vaginectomy and reconstruction. Postoperative complications were hematoma in 2 patients (4.4%), primary failure in 2 patients (4.4%), and postoperative incontinence in 2 patients (4.4%) (Figure 4).

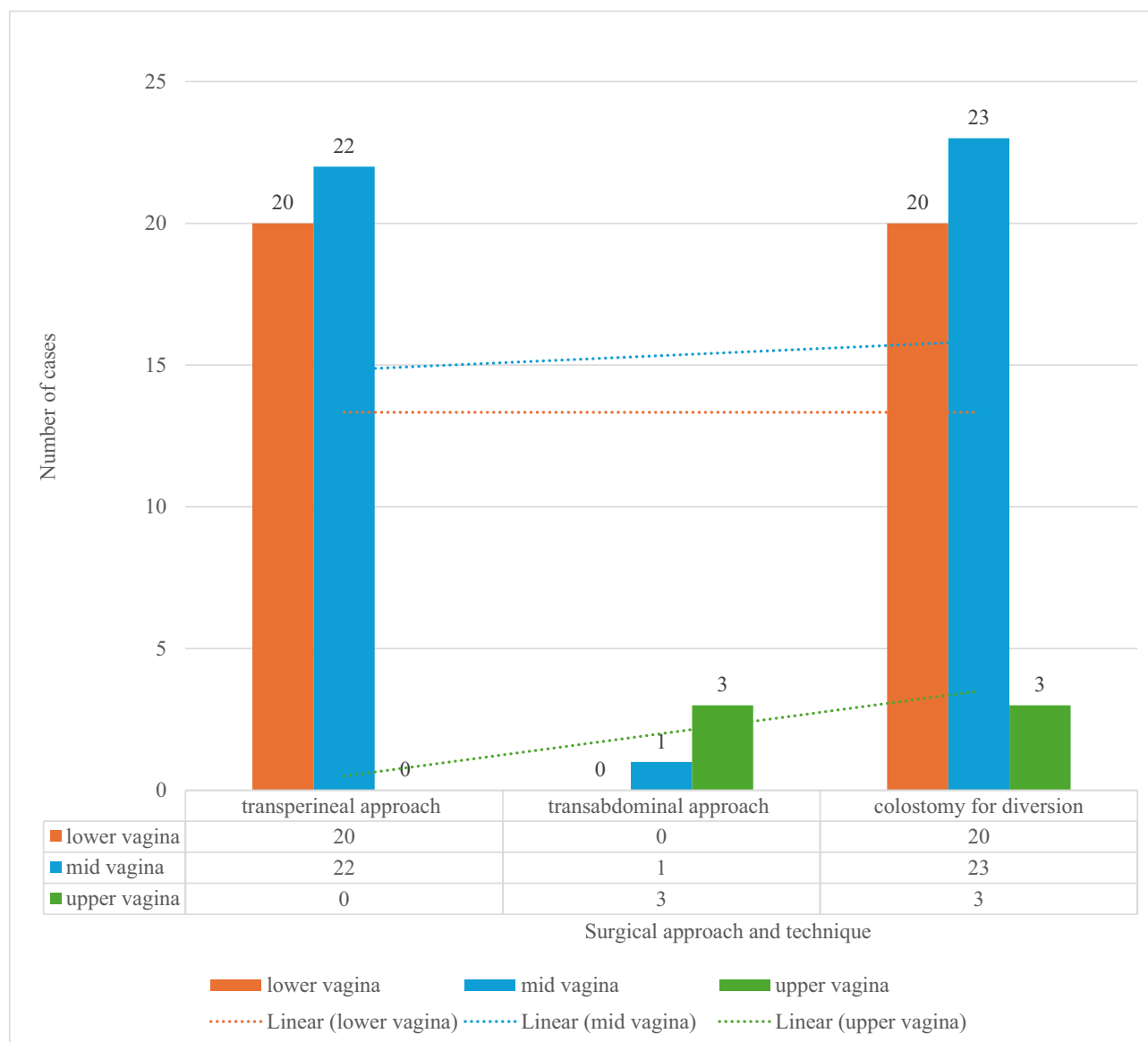


Figure 2 Type of RVF and Surgical Technique.

All patients were continent after the second surgery. Discomfort at the flap harvesting site was of minor importance. Symptoms of RVFs include the passage of feces and flatus through the vagina, vaginitis/cystitis, and possible fecal incontinence.

During the examination, it is essential to conduct a standard routine history for etiology and examination, to assess the size and location of the fistula, evaluate sphincter status, rectovaginal septum, do rectal/vaginal examination, and if necessary, take a biopsy.

In terms of preparation for RVF repair, complete mechanical bowel preparation is performed. Oral Metronidazole tablets is prescribed the day before the procedure, and second-generation cephalosporin antibiotic is administered half an hour before the induction of anaesthesia. The patient is positioned in lithotomy position, then completing aseptic skin mobbing and drapping (Figure 5).

The surgery starts (Figure 6A) with a horizontal cut (Figure 6B) in the perineal area to separate the posterior vaginal wall from the anterior wall via the rectovaginal septum. Dissection separates the vagina from the rectum beyond the

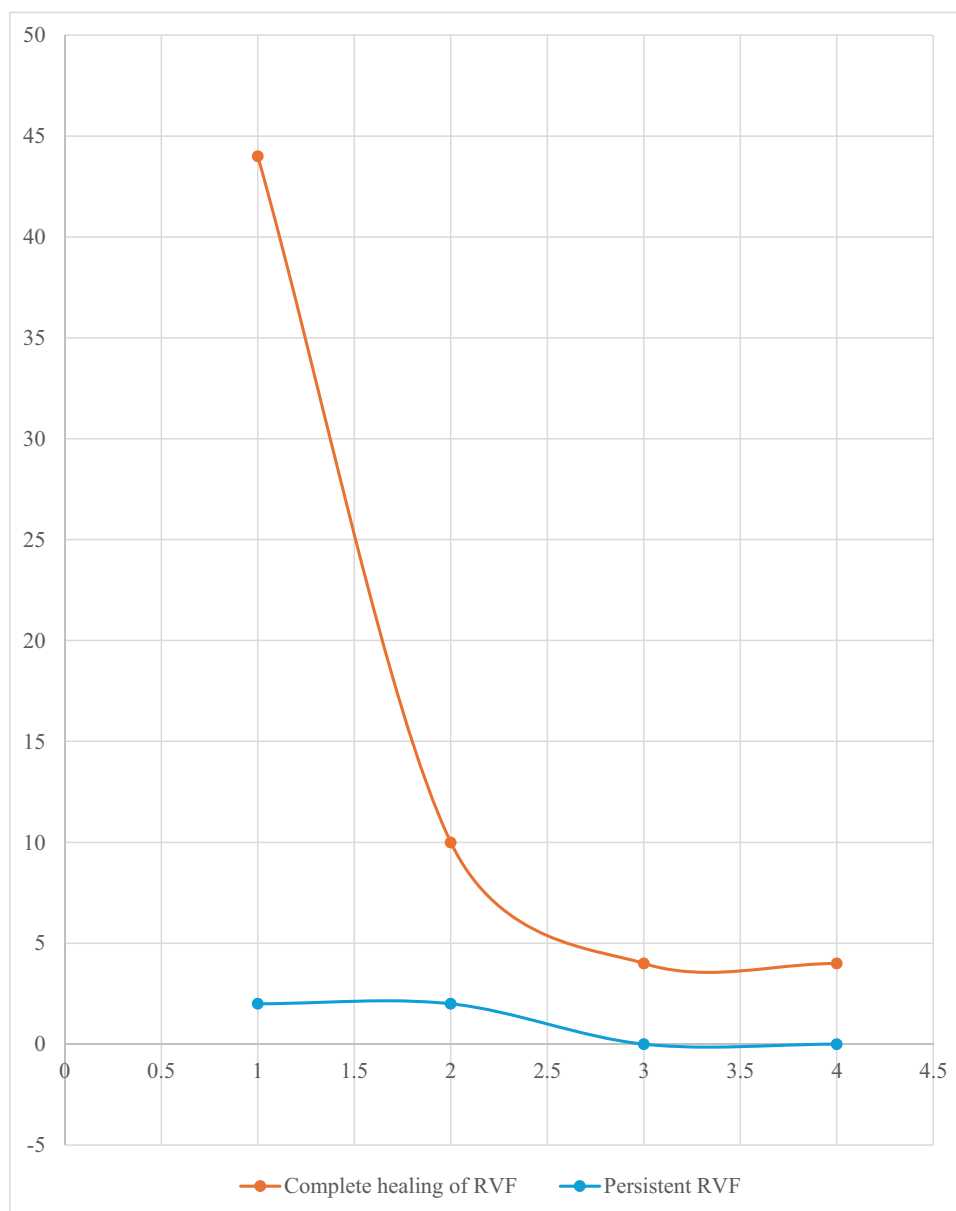


Figure 3 Outcomes.

fistula opening. The mucosal fistulous opening is excised, and the muscle wall of the rectum is approximated, and the posterior vaginal wall is repaired (Figure 6E).

Our modification, in selected cases, includes the vaginal wall is further separated from the rectum, and the rectovaginal fascia is mobilized up to the Douglas pouch (Figure 5D), overlapping the anal sphincter and performing levatorplasty (Figure 6C). Both the posterior vaginal wall and rectal mucosa are closed with interrupted 3/0 Vicryl sutures (Figure 6E).

While, if the anal sphincter is involved, it is repaired with sphincteroplasty using an overlapping suture technique using 0/0 Vicryl sutures (Figure 7).

The Martius fat is harvesting via a second vertical incision over labia majora (Figure 8A), followed by the dissection of latero-dorsally (Figure 8B and C) depending on pedicel (internal pudendal artery) adipose tissue flap (Figure 8D). The flap (Figure 6D) is rotated and placed dorsally to separate the vaginal and rectal sutures. The labial skin is closed with interrupted sutures using 2/0 Vicryl sutures.

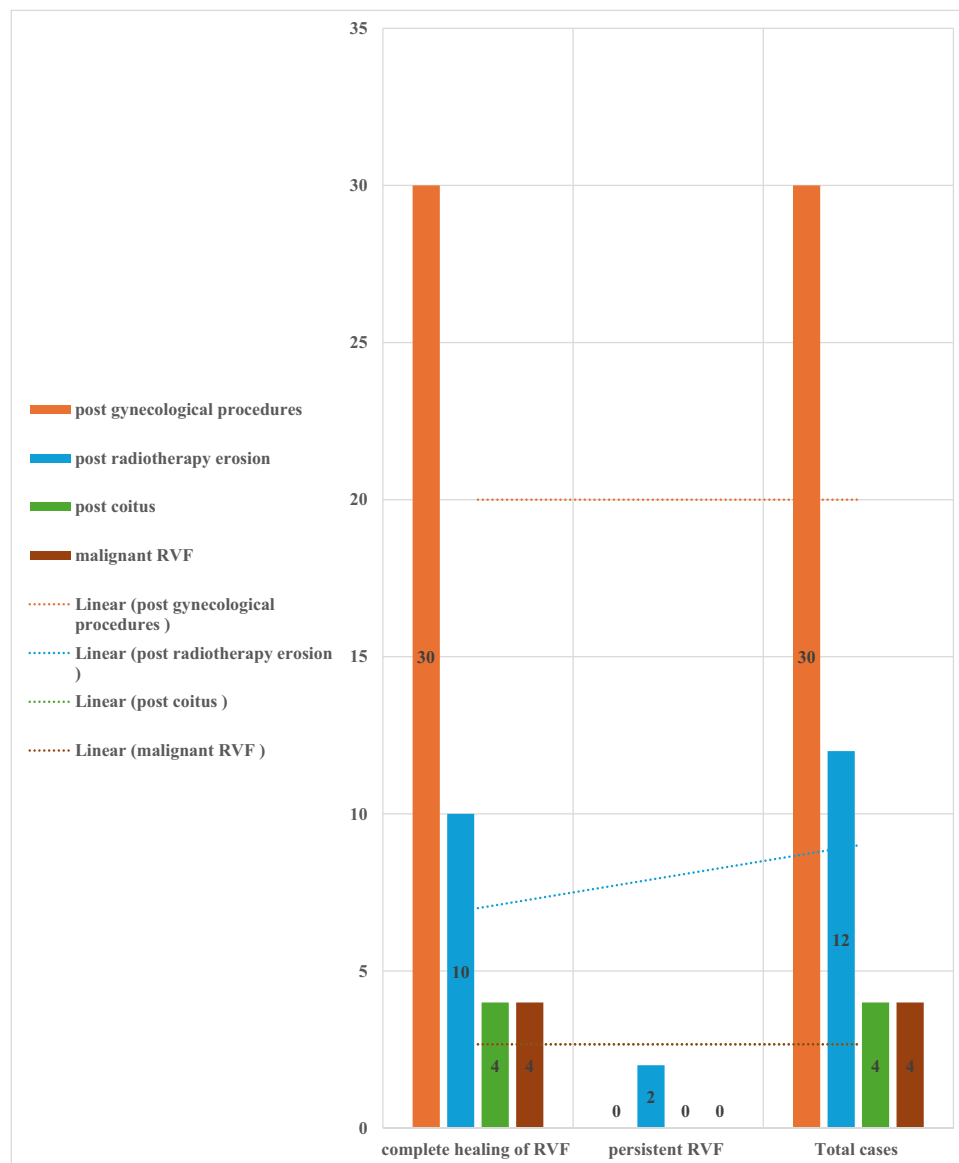


Figure 4 Outcomes of Martius flap technique on 46 RVF Patients.

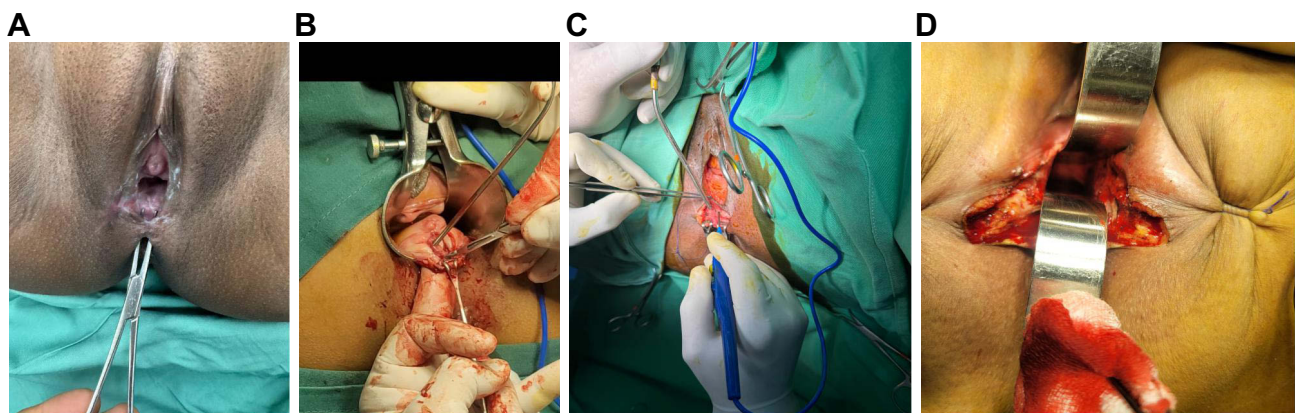


Figure 5 Trans perineal approach in RVF repair, (A) and (B) RVF, (C) Transperineal approach, (D) Douglas pouch.

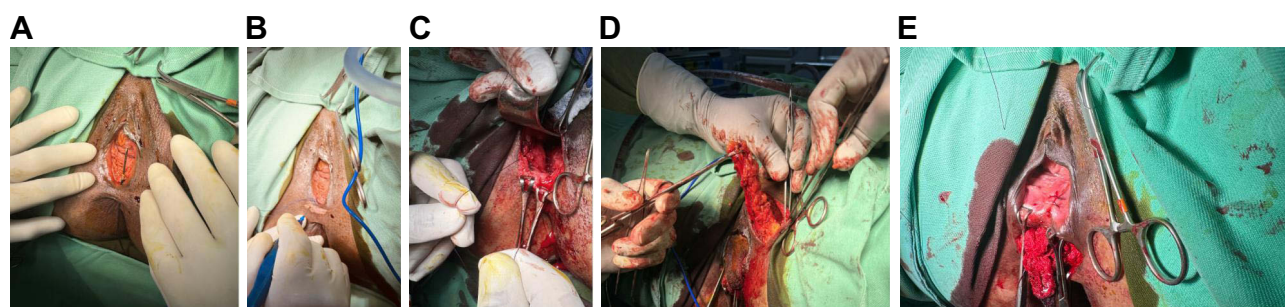


Figure 6 Rectovaginal fistula repair using Martius flap and levatorplasty. (A) RVF. (B) Transperineal incision. (C) Levatorplasty. (D) Martius fat harvest. (E) Posterior wall of vaginal closure.

The harvested flap (Figure 6D) is sutured in an interrupted manner on the external surface of anal sphincter using 3–0 Vicryl sutures without tension (Figure 9).

Hemostasis is controlled, and the wound is closed using single 3–0 Prolene sutures leaving small wound in the middle to avoid postoperative seroma (Figure 10).

Discussion

In 1928, Heinrich Martius first described the Martius flap procedure, which involved the use of the bulbocavernosus/bulbospongiosus muscle for reconstruction.¹ Over time, the Martius flap has undergone revisions and has evolved into a more extensive procedure. It now utilizes a vascularized adipose tissue flap from the labia majora, positioned between the bulbospongiosus and ischiocavernosus muscle, with or without the muscle itself.

The Martius procedure and its modifications have been employed for the extra-peritoneal repair of fistulae in the perineal region, including uro-vaginal and rectovaginal fistulas.^{2,3} Furthermore, it has been utilized to treat stress urinary incontinence by lifting the bladder neck in cases of tethered vagina syndromes, rectal strictures, or vaginal stenosis.⁴

RVFs commonly occur as a result of iatrogenic causes, such as post-perineal sepsis or post-low anterior resection. They may also arise from para-vaginal cyst excision or erosion of the rectovaginal septum due to radiotherapy in rectal cancer cases.³

The consequences of RVF, both psychological and physical, can be debilitating, often leading to complaints of both fecal and flatus incontinence through the vagina. In some cases, additional surgery for incontinence may be necessary to achieve a satisfactory outcome, particularly in patients who have experienced a fourth-degree perineal tear during vaginal delivery.

The management of RVF is based on various factors such as the type, classification, and localization in relation to the rectum and vagina. Moreover, management strategies, vary based on other factors such as, recto-vaginal septum and anal sphincter integrity. This study is aiming to give a complete outline review of the Martius flap method, encompassing its historical context, anatomical details, surgical process, results, and factors influencing success rates. Moreover, the implementation of sigmoid colostomy for fecal diversion and the correction of related rectovaginal septum and sphincter abnormalities will be examined.

The effectiveness of the Martius flap in repairing large rectovaginal fistulas (RVFs) is well-documented, particularly in cases where the fistula size complicates direct closure techniques. Large RVFs, typically defined as those greater than 2 cm in diameter or involving extensive tissue damage, pose significant challenges due to the increased risk of recurrence and the complexity of achieving complete closure. The Martius flap provides an invaluable tool in these situations, as it offers a robust, well-vascularized tissue layer that can be interposed between the rectum and vagina, thereby enhancing the healing environment, and reducing tension on the suture lines.

In our study, the size of the RVFs treated ranged from 1.5 cm to 4.5 cm, with the majority exceeding 2.5 cm. These larger fistulas often resulted from gynecologic procedures such as extensive pelvic surgeries or were associated with



Figure 7 Sphinteroplasty by overlapping technique.

previous radiation therapy. For fistulas larger than 3 cm, the use of the Martius flap was particularly beneficial in preventing breakdown of the repair, as these fistulas typically involve more significant tissue loss and scarring.

The flap's ability to introduce healthy, vascularized tissue into the repair site is critical in these larger defects, where the risk of ischemia and later recurrence is higher and to provides a robust and reliable option for reinforcing the repair of these complex fistulas.

Our results showed a high success rate in fistula closure for these larger defects, with 95.6% of cases achieving complete resolution after the first procedure, underscoring the flap's effectiveness in managing complex and extensive RVFs.

These findings are consistent with other recent studies that have reported similarly high success rates for large RVFs treated with the Martius flap, particularly when used as part of a multi-modal approach to managing these challenging cases.^{5,6} This evidence supports the continued use of the Martius flap as a primary technique for large and complex RVFs, particularly those that have proven refractory to simpler surgical interventions.

This technique is particularly helpful in cases 0077 here the fistula is associated with earlier radiation therapy, as it brings healthy, well-vascularized tissue into the area, promoting better healing in an irradiated field. Additionally, the

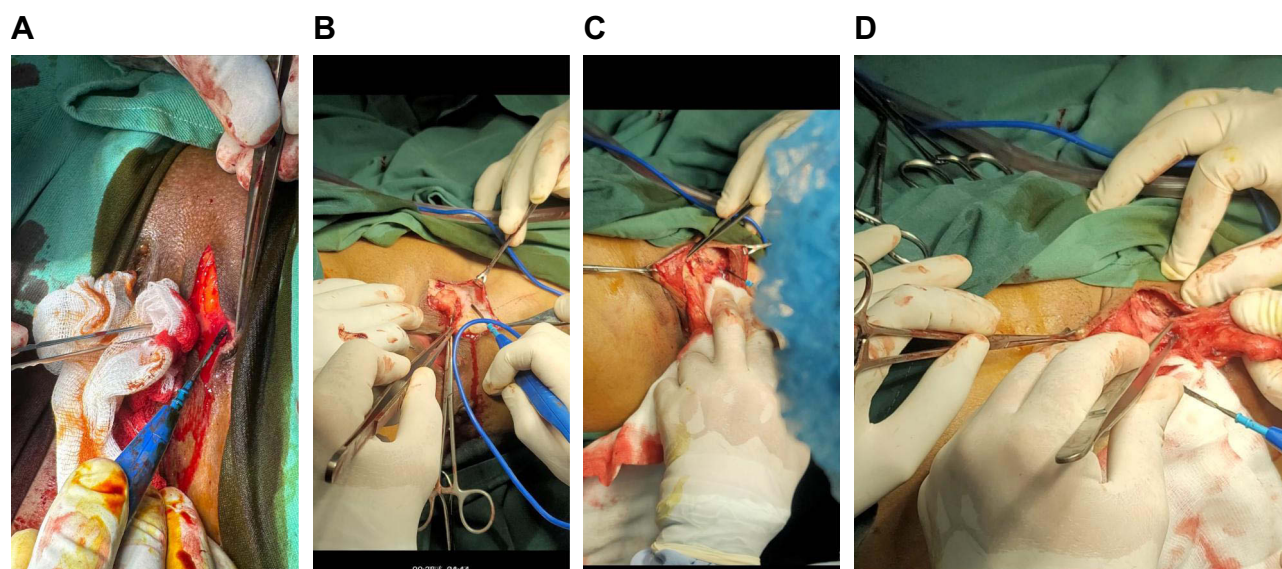


Figure 8 Martius flap technique steps: (A) and (B) skin and subcutaneous tissue dissection, (C) and (D) labia majora fat pad harvesting.

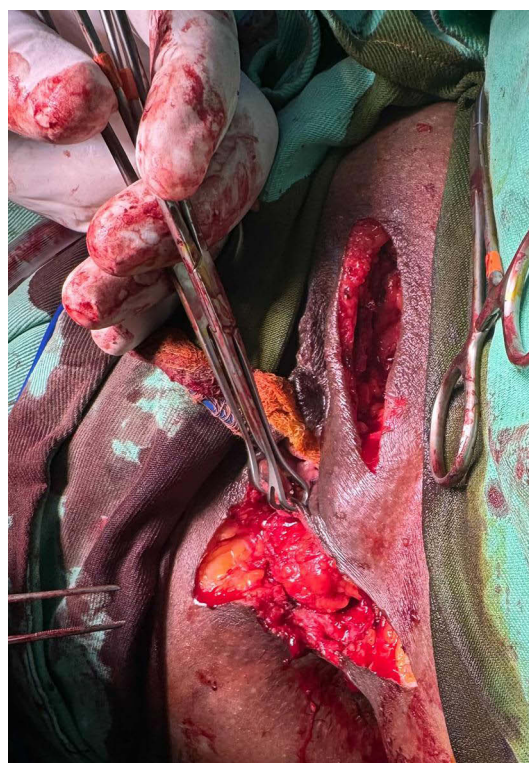


Figure 9 Harvested Martius flap to the external surface of anal sphincter.

Martius flap has been shown to reduce recurrence rates in gynecologic-related RVFs, which tend to have higher complication rates due to the involvement of the pelvic floor musculature and surrounding structures.

Recent studies have highlighted the utility of the Martius flap in this context, showing high success rates and improved patient outcomes, especially in those with recurrent or radiation-induced fistulas.^{5,7}

One of the critical aspects of evaluating the effectiveness of the Martius Flap in the repair of rectovaginal fistulas (RVFs) is comparing its outcomes to other surgical techniques. While our study focused primarily on the outcomes of the



Figure 10 Wound closure.

Martius Flap, it is important to put these results within the broader spectrum of available treatments. Recent literature has provided valuable comparative data that can be used to assess the relative efficacy of the Martius Flap compared to other approaches such as the endorectal advancement flap, transvaginal repair, and the use of bioprosthetic grafts.

A meta-analysis by Brown et al evaluated outcomes across multiple techniques for RVF repair, including the Martius Flap, and found that the Martius Flap had a higher success rate (87%) compared to the endorectal advancement flap (72%) and transvaginal repair (68%).⁸

The study also noted that while the Martius Flap is associated with slightly longer operative times and a more complex postoperative recovery due to the nature of the tissue transfer, it offers superior long-term outcomes, particularly in cases involving recurrent or radiation-induced fistulas. This aligns with the findings in our study, where the Martius Flap achieved a success rate of 95.6% in complex and recurrent cases.

Additionally, a randomized controlled trial by Green et al compared the Martius Flap with the use of a bioprosthetic graft in RVF repairs. The trial demonstrated that while both techniques were effective, the Martius Flap had a significantly lower recurrence rate at one-year post-operation (8% vs 22%) and better patient-reported outcomes in terms of continence and quality of life. This evidence suggests that the vascularized nature of the Martius Flap provides a more durable repair, particularly in anatomically challenging or previously irradiated tissues.⁶

While our study did not include a direct statistical comparison with these alternative techniques, the inclusion of such comparative data from recent literature underscores the Martius Flap's effectiveness, particularly in complex cases. Future research should aim to include a prospective, randomized comparison to further validate these findings and provide more definitive guidance on technique selection in RVF repair.

While the Martius Flap is a well-established method for RVF repair, various techniques for repair exist, including endorectal advancement flaps, transperineal, transvaginal approaches, and the use of fistula plugs,⁹ are also commonly employed, each with its own set of advantages and limitations. For instance, the endorectal advancement flap is usefully

for low RVFs and those with limited surrounding tissue damage. This technique involves the mobilization of the rectal mucosa and submucosa to cover the fistula opening. Although effective in many cases, its success rate is lower than that of the Martius Flap, particularly in cases involving large or recurrent fistulas, or those with prior radiation therapy.⁸

Another alternative is the gracilis muscle flap, which offers a robust solution for larger or more complex RVFs. This technique involves transposing the gracilis muscle from the inner thigh to the perineal area to cover the fistula. Studies such as those by Johnson et al have shown that while the gracilis muscle flap is effective, it is associated with higher donor site morbidity and a more challenging postoperative recovery compared to the Martius Flap.¹⁰

Additionally, the rectus abdominis muscle flap has been employed in cases where extensive tissue coverage is needed, particularly for large or recurrent fistulas. However, this technique is also associated with significant morbidity due to the invasive nature of the muscle harvest and the potential for abdominal wall complications.¹¹

These comparisons underscore the importance of selecting the right surgical technique based on the individual characteristics of the fistula and the patient's overall health status. While muscle flaps like the gracilis and rectus abdominis provide certain advantages in specific scenarios, the Martius Flap is still a highly effective and less invasive choice for the majority of RVFs, particularly those related to gynecologic procedures.

In literature success rates for primary procedures range from 50–60%, increasing to over 70% after multiple procedures.⁹

Complex RVFs are uncommon, being particularly challenging to manage. In difficult cases, such as those involving inflammatory bowel disease, a history of pelvic radiation, malignant fistulae, or failed multiple other repairs, proctectomy and colonic pull-through may be necessary.¹²

RVFs can vary in terms of etiology, size, and location. The etiology of RVFs can be attributed to obstetric trauma, radiation toxicity, or iatrogenic trauma caused by staplers in rectal surgery, pelvic dissection for neoplasms, or inflammatory bowel disease (Crohn's).¹² While the Martius graft is well-documented for repairing cysto or urethrovaginal fistulas, its adaptation for complex rectovaginal fistulas has also been reported in the colorectal surgery literature, with success rates ranging from 60% to 100%.¹²

The anatomy involved in rectovaginal fistulas could include the rectovaginal septum, anal sphincter complex and perineal body. According to Fry,¹³ rectovaginal fistulas are classified by location and size into simple (low) and complex (high) RVFs. The appropriate repair method depends on the fistula's location.

A perineal approach is suitable for low/perineal fistulas in the middle and lower thirds of the vagina. However, high RVFs in the upper third of the vagina require a transabdominal approach. This approach is mainly indicated for high, complicated fistulas and those caused by radiation, inflammatory bowel disease, and diverticular disease. In these cases, the affected segment must be resected, and the omentum can be used as an interposition buttressing structure. In the modified Martius flap procedure, a pedicle fibro-fatty graft harvested from the labia majora is transplanted through a subcutaneous tunnel. The graft is positioned over the rectal closure, separating the rectal and vaginal walls to fill the dead space and promote granulation tissue formation.

The rate of spontaneous healing for RVFs is generally low, emphasizing the importance of adequate repair. It is worth noting that the success rate of RVF repair decreases with the number of previous operations.¹⁴

The pedicle of Martius flap consists of adipose tissue between the bulbocavernosus and ischiocavernosus muscles. This flap receives its blood supply latero-ventrally and latero-dorsally from branches of the external pudendal artery and internal pudendal artery, respectively. Latero-ventrally vascular depending on flap is used in cases of vesicovaginal and urological fistulas.⁴

While internal pudendal artery is the main source of blood flow for the posterior vascular pedicle used in repairing RVF.⁴ During the dissection and mobilization of the vascular pedicle Martius flap, it is important to handle the flap with care to avoid rotation or twisting and ensure optimal blood supply the success rates of the Martius flap usage in recurrent RVF varied from 33% to 100% in literature.¹⁵ These findings demonstrate a wide range of outcomes, highlighting the importance of individual patient factors and the surgeon's expertise in achieving optimal results.

In cases of recurrent RVF, infectious complications in the perineal region can impair wound healing. To prevent such complications, sigmoid colostomy can be an appropriate method. This involves creating a temporary diversion of stool at

the same time of the RVF repair. This approach helps to minimize the risk of infectious complications and promotes better wound healing outcomes.

Ethical Considerations

The study conducted in accordance with the Declaration of Helsinki and proved by the 21st of September University of Medical & Applied Sciences (21SUMAS), Faculty of Medicine, Sana'a, Yemen. Written informed consent obtained from all patients prior to their participation in the study and are available for review.

Limitations

We acknowledge the absence of a comparison group as a limitation of our study. This aspect has now been explicitly stated in the discussion section of the manuscript. Furthermore, we have expanded the methodology section to provide a more detailed account of the patient selection criteria, data collection methods, and quality assessment tools. These additions aim to enhance the transparency and reproducibility of our study.

Conclusions

The findings from our study underscore the significant utility of the Martius Flap technique in the management of rectovaginal fistulas (RVFs) that arise due to gynecologic procedures. Unlike RVFs resulting from obstetric trauma, which often respond to more straightforward surgical interventions, those associated with gynecologic procedures such as pelvic surgeries, radiation therapy, and other interventions present unique challenges as in cases undergone intersphincteric resection of the rectum.

The Martius Flap, with its ability to introduce well-vascularized, healthy tissue into the repair site, has proven particularly effective in these cases. It not only enhances the healing environment but also has the potential benefit to separate both lines of repair between vagina and rectum, so significantly reduces the risk of recurrence which is notably higher in gynecologic-related fistulas due to the complex involvement of pelvic floor structures. It is essential to note that majority of patients with rectovaginal fistulas often have associated anal sphincter and rectovaginal septum defects, mandating to be addressed during the same procedure. Those patients have reported significant improvements in functional and cosmetic outcomes as before. However, fecal diversion does not prevent recurrence, it reduces perineal sepsis, thereby facilitates the post operative wound care and improves patient satisfaction.

Disclosure

The author reports no conflicts of interest in this work.

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