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ORIGINAL RESEARCH

Step-by-step combined surgical approach to successfully repair complex and challenging vesico-vaginal fistulas: Insights from a case series

Martina Arcieri[1] | Stefano Restaino[1,2] | Veronica Tius[3] | Andrea Lombisani[4] | Davide Arrigo[5,6] | Lavinia Porto[7] | Giovanni Panico[5] | Daniela Caramazza[4] | Lorenzo Vacca[4] | Giuseppe Campagna[4] | Canio Martinelli[7,8] | Giuseppe Vizzielli[1,3] | Alfredo Ercoli[7]

[1]Clinic of Obstetrics and Gynecology, "Santa Maria della Misericordia" University Hospital, Azienda Sanitaria Universitaria Friuli Centrale, Udine, Italy

[2]PhD School in Biomedical Sciences, Gender Medicine, Child and Women Health, University of Sassari, Sassari, Italy

[3]Medical Area Department (DAME), in Department of Medicine (DMED), University of Udine, Udine, Italy

[4]Precision Gynaecological Surgery Unit, Dipartimento Centro di Eccellenza Donna e Bambino Nascente, Fatebenefratelli Gemelli Isola Tiberina, Rome, Italy

[5]Department of Woman, Child and Public Health, Fondazione Policlinico Universitario Agostino Gemelli IRCCS, Rome, Italy

[6]Istituto di Ginecologia e Ostetricia, Università Cattolica del Sacro Cuore, Rome, Italy

[7]Department of Human Pathology of Adult and Childhood "Gaetano Barresi", Unit of Obstetrics and Gynecology, University of Messina, Messina, Italy

[8]Sbarro Institute for Cancer Research and Molecular Medicine and Center of Biotechnology, College of Science and Technology, Temple University, Philadelphia, Pennsylvania, USA

Correspondence
Canio Martinelli, Department of Human Pathology of Adult and Childhood "Gaetano Barresi", Unit of Obstetrics

Abstract

Introduction: Several surgical approaches are available for the repair of complex vesico-vaginal fistulas; however, robust clinical evidence and standardization of techniques are lacking. Complex vesico-vaginal fistula is defined as either a recurrent fistula following primary surgical repair or a fistula related to prior pelvic surgery and/or radiotherapy. The aim of this study was to describe a step-by-step combined vaginal and laparoscopic technique and to assess its feasibility, safety, and efficacy.

Material and Methods: A retrospective study was performed between 2016 and 2023, involving patients diagnosed with complex vesico-vaginal fistulas. Clinical, perioperative, and postoperative data were collected. The surgical technique was standardized, described, and executed by an experienced surgeon in each case. Postoperative urogynecological follow-up was scheduled at one month, 3 months, 6 months, and one year.

Results: A total of 20 patients were included in the study. Fifteen patients developed vesico-vaginal fistulas after total hysterectomy, four after radical hysterectomy combined with radiotherapy, and one following a cesarean section. Four patients had a prior diagnosis of gynecological cancer, four had received pelvic radiotherapy, and two had undergone previous chemotherapy. Twenty-five percent of the patients exhibited VVF in the trigone area. The median operative time was 317 min (ranging from 250 to 508 min). One minor postoperative complication occurred, and there was no conversion to laparotomy. All repairs were watertight. The median length of hospital stay was 4 days (ranging from 2 to 6 days). No recurrences were observed during the follow-up period, lasting 42 months on average.

Conclusions: This study demonstrated the feasibility and safety of a new surgical approach for repairing complex urogenital fistulas.

Vizzielli Giuseppe and Ercoli Alfredo contributed equally.

and Gynecology, University of Messina, 98124, Messina, Italy.
Email: canio.martinelli@studenti.unime.it

KEYWORDS
laparoscopy, minimally invasive surgery, vaginal surgery, vesico-vaginal fistula

1 | INTRODUCTION

Urogenital fistula is a troublesome condition affecting over 2 million women worldwide.[1] Although it is not life-threatening, it profoundly impacts the quality of life, resulting in various social, economic, emotional, and psychological consequences.

A fistula is an abnormal communication between two districts or organs, and urogenital fistulas are characterized by an abnormal connection between the genital and urinary tract; among urogenital fistulas, vesicovaginal fistulas (VVF) represent the most common type. According to Hillary et al. systematic review,[2] the great majority of urogenital fistulas in Low- and Middle-Income Countries are related to obstetrical trauma, whereas in High-Income Countries, they are usually consequent to gynecological damage or interventions, such as pelvic surgeries (in particular, bladder injuries during hysterectomy)[3,4] or pelvic irradiation due to gynecological malignancies. Other potential causes include tissue inflammation (i.e., endometriosis, inflammatory bowel disease, bladder tuberculosis)[5] and the retention of foreign bodies (i.e., pessaries, tampons, or accidentally retained objects).[6]

Urogenital fistulas are typically classified as simple or complex; however, there is no consensus on these definitions. Generally, isolated, non-radiated fistulas measuring less than 0.5 cm are classified as simple. In contrast, complex fistulas constitute a large and heterogeneous group, encompassing various clinical scenarios such as recurrent simple fistulas following surgical repair attempts, fistulas exceeding 2.5 cm in size, and those associated with neoplastic conditions or pelvic radiation.[7] Conservative management is feasible for small (less than 1 cm), uncomplicated VVF and includes prolonged catheterization, the application of fibrin-rich glue or platelet-rich plasma, and cystoscopic electrocoagulation.[7,8] Surgical intervention should be considered in cases of complex fistulas or after the failure of conservative management. In this regard, a definitive gold standard treatment has yet to be established. Numerous surgical approaches are employed worldwide, but the available data are often limited and of low quality, which hampers evidence-based guidance.[9] Surgeon preference and experience significantly influence surgical planning, including the route of repair (open, laparoscopic, or robotic; extravesical, transversal, or transvaginal) and surgical procedures such as trimming, the use of interposition flaps, suture type, and layers of closure.

We aimed to share our experience in the treatment of complex urogenital fistulas carried out by skilled surgeons at referral institutions using a standardized surgical technique that combines transurethral, transabdominal, and vagino-perineal approaches. This study describes our technique and assesses its feasibility, safety, and efficacy in tackling complex VVFs.

Key message

Complex urogenital fistulas remain a major surgical challenge, often recurring after multiple failed repairs and severely impacting patients' quality of life. A standardized combined laparoscopic–vaginal approach proves to be safe, feasible, and achieves long-term fistula closure without recurrences.

2 | MATERIAL AND METHODS

A retrospective study was conducted on patients diagnosed with complex urogenital fistula who underwent surgical repair at the Pelvic Floor Medicine and Reconstructive Surgery Unit of Fondazione Policlinico Universitario A. Gemelli and at the Gynecology and Obstetrics Unit, Department of Human Pathology in Adult and Childhood "G. Barresi" of Messina between January 2016 and December 2023. Among these patients, we selected those who showed at least one of the following characteristics: trigonal fistula, indirect and multiple fistulas, fistula tract involving a third organ, fistula >1 cm in an irradiated pelvis, more than two previous surgical repair attempts, or large (>25 mm) fistulas in patients with a short, fibrotic vagina resulting from previous surgery.

Patients' relevant data were retrieved from the clinical software used in our institutions. The following data were collected: mean age and Body Mass Index of included patients; previous diagnosis of gynecological cancer; previous pelvic radiotherapy; previous chemotherapy; pre-operative bilateral nephrostomies placement. Perioperative data such as median intraoperative blood loss, median operative time (defined as the interval between the skin incision and its suture), median length of hospital stay, and type of additional procedures were also retrieved. Intraoperative and postoperative complications were collected and were defined as adverse events occurring during surgery or within the first four postoperative weeks according to the Clavien-Dindo classification.[10] Data regarding the outcomes of surgery and urogynecological follow-up were recorded during medical interviews according to the follow-up schedule adopted by our institutions after the surgical procedure. It included urogynecological examination after one month, three months, six months, one year after surgery and then remote follow-up by telephone call.

All patients underwent testing (i.e. blood count, renal and hepatic function) before surgery and underwent pre-operatively an abdominal computed tomography scan with urologic slices and micturition phase, cystoscopy, and pelvic ultrasonography. In case of a VVF involving the trigone area, one month before surgery bilateral

nephrostomies were placed to keep the bladder dry and promote healing at the suture site. All surgical procedures were performed under general anesthesia by one experienced urogynecologist (AE). Antibiotic prophylaxis consisted of 2 grams of cefoxitin administered intravenously prior to the surgical incision.

The primary endpoint was to describe our proposed surgical technique for the repair of complex urogenital fistulas. The secondary endpoints were to evaluate early and late postoperative complications and to investigate the recurrence rate after surgical treatment.

2.1 | Surgical technique

Our combined surgical approach for the repair of complex vesicovaginal fistulas (Figure 1) is described as follows:

Step 1: Surgery started with transurethral cystoscopy to catheterize the fistula(s) tract(s) with a hydrophilic hi-wire guide which was recovered from the vagina and the two ends of each guide were fixed together. At this point, mono- or bilateral ureteral stent(s) were placed if the fistula tract was close to the meatus and/or the intravesical portion of the ureters, in order to avoid any possible ureteral stenosis during the suture of the bladder wall during fistula repair.

Step 2: Then a laparoscopic approach was performed to provide mono or bilateral full mobilization of the ureter(s) up to their entrance into the bladder wall if the ureter was involved, in the case of a trigonal fistula or if the fistula was close (<10 mm) to the ureteral meatus. Thereafter, the vesico-vaginal space was dissected to expose the hydrophilic guide(s) into the fistula tract. If multiple fistula tracts were present in the same area, the interposed tissue bridges were cut to obtain a single fistula. If the dissection allowed mobilization of the vesical portion of the fistula with at least 1 cm of free tissue in all directions, the bladder wall was sutured at this point with two layers of interrupted 3/0 Polyglactin introflecting stitches.

Step 3: Then, we moved to a vaginal approach to complete the fistula tract dissection in its vaginal portion and to remove the fistula tract. In those cases where the bladder wall was not sutured during the laparoscopic time a further dissection around the fistula tract was performed by vaginal route. Once the borders of the fistula tract were exposed for at least 1 cm in all directions, we performed the fistula tract excision and the bladder wall closure with two layers of interrupted 3/0 Polyglactin introflecting stitches.

Step 4: The choice of placing or not placing an interposition flap was based on intraoperative findings. In general, in patients with healthy tissues and minimal correspondence of the vaginal and bladder suture lines a simple peritoneal rotation flap was used, whereas in those patients with large vaginal defects or highly fibrotic vaginal walls, the omental or the Martius flap was preferred. Finally, in those patients with large vaginal defects or poorly vascularized vaginal tissues, a rotation cutaneous vulvar islet graft was created.

2.2 | Postoperative management

All patients underwent continuous bladder drainage via an indwelling transurethral Foley catheter for 30 days postoperatively. Oral antibiotic prophylaxis was administered postoperatively for 7 days given the prolonged bladder catheterization required. Urine cultures were obtained upon occurrence of clinical signs or symptoms suggestive of urinary tract infection. Patients were mobilized on the first postoperative day and discharged after adequate oral intake and bowel function.

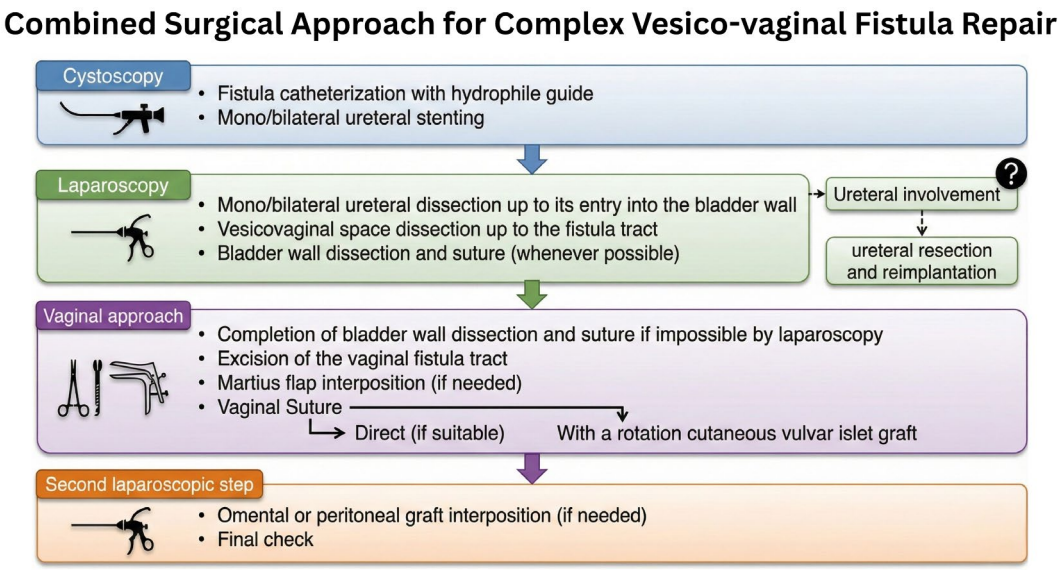

FIGURE 1 Flow-chart of combined surgical approach for the repair of complex vesico-vaginal fistulas.

Adequate oral hydration was encouraged, and activity restrictions—including avoidance of lifting heavy weights, sexual intercourse, and strenuous physical activity—were recommended for at least eight weeks. Nephrostomy tubes were removed 30 days after surgery, whereas ureteral stents were removed after 90 days.

Prior to catheter removal, all patients underwent cystography to confirm watertight closure of the bladder. Follow-up visits were scheduled at 4 weeks, 3 months, and 6 months postoperatively, and then annually, with additional assessments as indicated. At the follow-up visit, any history of urinary incontinence was recorded and a urogynecological examination was performed to confirm its presence.

Recurrence was defined as the presence of a fistula detected on follow-up cystography or as a urinary leak observed during follow-up, confirmed by the presence of a fistula on abdominal computed tomography with urologic imaging during the micturition phase.

2.3 | Statistical analyses

The sample was described in its clinicopathological and demographic characteristics using descriptive statistics techniques. Qualitative variables were summarized as frequencies and percentages. Quantitative variables were presented as means and medians. The Excel Version 16.94 (Microsoft) program was utilized.

3 | RESULTS

We enrolled 20 patients. The mean age and BMI of these patients were 56 years (range: 30–86) and 26 (range: 20–38), respectively. A VVF developed in 15 patients (75%) who had previously undergone total hysterectomy, four women (20%) who had undergone radical hysterectomy and radiotherapy, and one patient (5%) who had previously undergone cesarean section.

Patients' general characteristics are summarized in Table 1. Sixteen women (80%) experienced recurrent fistulas after at least one surgical repair attempt; five cases involved two surgical attempts, while two cases required more than two attempts. The most common first surgical approach was vaginal ($N = 10$, 62.5%), followed by laparoscopic in five cases (31.25%) and open in one case (6.25%). In patients with two or more attempts, the first was performed vaginally, and the subsequent surgeries were done laparoscopically or laparotomically. Four women (20%) had a prior diagnosis of gynecological cancer, specifically: three patients with cervical cancer and one with endometrial cancer. These patients received pelvic radiotherapy, and two patients underwent previous chemotherapy. The characteristics of the fistulas are summarized in Table 2. Among the included patients, 25% had a VVF in the trigone area and underwent preoperative bilateral nephrostomy placement, 15% had multiple fistulas, and 10% had a fistula involving three organs (vagina, bladder, and ureter).

Perioperative data are presented in Table 3. The median operative time was 317 min; 7 patients underwent concomitant intraoperative bilateral ureteral stenting. The median intraoperative estimated blood loss was 30 mL (0–100). No intraoperative complications were recorded, and no conversion to laparotomy occurred. All operations concluded with watertight repairs. The median hospital length of stay was 4 days. Concerning early and late postoperative complications, only one postoperative urinary infection, which was treated with oral antibiotics, was recorded. The median follow-up lasted 42 months (ranging from 12 to 108); two patients died of cancer during this period. No cases of fistula recurrence were documented during follow-up and no patients reported postoperative urinary incontinence.

TABLE 1 Patients' general characteristics.

Gynecological cancer, *N* (%)	4 (20)
Previous chemotherapy, *N* (%)	2 (10)
Irradiated tissues, *N* (%)	4 (20)

TABLE 2 Fistula characteristics.

Indirect fistula, *N* (%)	4 (20)
Multiple fistula, *N* (%)	3 (15)
Trigonal area fistula, *N* (%)	5 (25)
Three organ fistula, *N* (%)	2 (10)
Fistula in patients with short, fibrotic vagina, *N* (%)	4 (20)
Fistula >1 cm in irradiated pelvis, *N* (%)	2 (10)
More than two previous surgical repair attempts, *N* (%)	2 (10)

TABLE 3 Perioperative data.

Intraoperative bilateral ureteral stenting, *N* (%)	7 (35)
Median operative time, minutes (range)	317 (250–508)
Median hospital stay, days (range)	4 (2–6)

4 | DISCUSSION

In our study, we demonstrated the feasibility, safety, and efficacy of our proposed surgical technique for repairing complex urogenital fistulas, which pose a significant challenge in urogynecological surgery. We provided a detailed, step-by-step description of our vaginal-laparoscopic repair technique to ensure reproducibility.

It is important to note that the use of a guidewire allows for a better anatomical view of the fistulous tract throughout the surgical procedure, thereby enabling the surgeon to accurately repair the urogenital fistula.

Numerous surgical techniques have been described for VVF repair. A comprehensive systematic review published in 2024[9] summarized current data regarding the surgical route, use of omental flaps, trimming of fistula edges, and catheterization duration, yet provided

only moderate evidence. Current data did not show a significant difference between repair routes in terms of successful outcomes; however, it is reasonable to prefer the minimally invasive route (laparoscopic or robotic) over laparotomy, as it is associated with better anatomical visualization, less intraoperative and postoperative morbidity, reduced blood loss, and shorter hospitalization. A consensus statement from the European Association of Urology[11] recently confirmed the use of robotic surgery for vesico-vaginal fistula repair and described a step-by-step robotic repair of VVF, providing useful recommendations about the need for cystoscopic visualization of the urogenital fistula, pre-operative placement of ureteral stents, and at least seven days of bladder catheterization. In this context, it is of utmost importance to standardize the surgical technique and clinical management of patients to provide common guidelines for urogenital fistula repair.

The most commonly reported repair technique in the literature is the vaginal approach which reaches an overall success rate of 93.8% according to a previous systematic review.[12] Advantages of the vaginal approach include shorter surgical time, less intraoperative bleeding, faster recovery; moreover, it can be repeated over time if needed, regardless of the timing of recurrence or repeat repair. On the other hand, this technique might not be ideal for complex, high-positioned and recurrent VVF, where fistula suturing is technically challenging. The abdominal approach allows better visualization of anatomical landmarks and better identification of fistula and scar tissue; therefore it facilitates proper preparation of anatomical spaces, optimal exposure to the fistula area, adequate tissue mobilization, layers closure and hemostasis. The success rate of the abdominal approach is greater than the one reported for the vaginal approach, especially when a minimally invasive technique is used.[12,13]

A combined vaginal–minimally invasive approach allows for reaping the benefits of both techniques and it is currently investigated only by a few studies. A combined vaginal-laparoscopic approach for complex VVF treatment was previously explored by Tozzi et al.,[14] reporting effective results in terms of low incidence of intra-operative and post-operative complications and no cases of recurrence after a 3-year follow-up, which is consistent with our findings. Further surgical approaches are under investigation, such as minimally invasive transvaginal single-port[15] and transvesical single-port repairs, which have shown promise as less invasive surgical options, although the data available comes primarily from small studies and single case reports.

Limited recommendations are extrapolated from the literature regarding fistula trimming and the use of interposition flaps. Specifically, a previous meta-analysis showed that trimming, which is the removal of poorly vascularized or fibrotic tissue of the fistula tract, did not improve the success rate of fistula closure.[9] However, moderate or severe peri-fistula fibrosis may negatively affect the recurrence rate of VVF,[16] so it could be reasonable to remove fibrotic tissue during surgery. Our findings endorse the systematic execution of this surgical step during vesico-vaginal repair.

No significant differences in success rate were shown using interposition flaps (e.g., Martius flap, gracilis muscle flap, peritoneal flap, and omental flap).[9,12] This is in contrast with a recent systematic review,[17] which demonstrated the efficacy and feasibility of using omental flaps during robotic-assisted reconstructive urological procedures. Our data and experience support the use of interposition flaps in the surgical repair of complex fistulas.

It is important to note that a highly experienced and skilled surgeon is needed for this type of surgical procedure, and technical confidence is crucial for successful surgery.

The main limitations of our study include its retrospective design, the absence of a validated questionnaire to assess quality of life and sexual function, the lack of a control group that could have helped evaluate the potential clinical superiority of the proposed technique, and the limited sample size.

Nevertheless, our study focused exclusively on patients diagnosed with complex vesico-vaginal fistula, providing evidence specifically for the management of those urogenital fistulas whose repair might be more challenging. A substantial amount of data, including peri-, post-, and follow-up findings, was collected to provide strong clinical evidence. Importantly, every surgical procedure was conducted by a highly specialized team surgeon.

Prospective studies and randomized trials, possibly collecting long-term follow-up data, are strongly required to assess the most effective surgical approach for repairing complex urogenital fistulas.

5 | CONCLUSION

Our study demonstrated the feasibility of our combined technique for the repair of complex urogenital fistulas. Standardizing the technique, identifying key surgical points, and providing treatment at reference centers with extensive experience are essential. Our experience suggests a potentially innovative and successful surgical approach for the repair of complex urogenital fistulas, yielding promising objective results and representing a viable treatment option.

AUTHOR CONTRIBUTIONS

Conceptualization and supervision: EA, VG, and AM; data collection: LA, AD, PL, PG, CD, and CG; writing—original draft preparation: AM, RS, TV, and MC; review and editing: AM, RS, TV, MC, VL, VG, and EA; supervision: EA and VG; project administration: EA and VG. All authors have read and agreed to the published version of the manuscript.

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CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest.

DATA AVAILABILITY STATEMENT

Data are available upon reasonable request. All data relevant to the study are included in the article or uploaded as supplementary information.

ETHICS STATEMENT

The study was approved by the institutional review board (N° PROT. APROV. DIPUSVSP-22-02-231) on February 13, 2023. All patients gave written consent to use their data for research purposes and to undergo proposed surgery.

ORCID

Martina Arcieri https://orcid.org/0000-0002-8257-0618
Stefano Restaino https://orcid.org/0000-0002-7848-0329
Veronica Tius https://orcid.org/0009-0008-6178-2233
Davide Arrigo https://orcid.org/0009-0006-1911-1060
Giovanni Panico https://orcid.org/0000-0001-5473-9503
Daniela Caramazza https://orcid.org/0000-0003-0858-025X
Lorenzo Vacca https://orcid.org/0000-0003-3774-0259
Giuseppe Campagna https://orcid.org/0000-0003-2128-077X
Canio Martinelli https://orcid.org/0000-0002-0587-8467
Giuseppe Vizzielli https://orcid.org/0000-0002-2424-2691
Alfredo Ercoli https://orcid.org/0000-0002-5019-5526

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