Rectus Abdominis Myofascial Flap for Vaginal Reconstruction After Pelvic Exenteration

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Background: Several techniques for vaginal reconstruction after pelvic exenteration such as myocutaneous and myoperitoneal flaps are available. However, the use of a myofascial flap has not been previously described. Thus, the objective of this article is to present our experience of vaginal reconstruction with rectus abdominis myofascial (RAMF) flap.

Methods: Between May 2008 and March 2017, 16 patients underwent anterior, posterior, or total pelvic exenteration with RAMF flap vaginal reconstruction. Patient records were systematically reviewed; demographic, clinic and pathologic, operative details, flap-related and non–flap-related complications, and risk factors for wound healing are reported. Quality of life and sexual function were also investigated.

Results: Eleven (68.8%) of 16 patients died during the follow-up (29.1 ± 25 months), whereas 5 (31.3%) are still alive. Early complications were reported in 7 patients (43.8%), with 2 (12.5%) flap-related and 5 (31.3%) non–flap-related complications. Similarly, late complications were reported in 5 patients (31.3%), with 2 (12.5%) flap-related and 3 (18.8%) non–flap-related complications. Quality of life measured by SF-36 (Survey Short Form 36) significantly improved at 12-month follow-up in comparison with baseline (physical component summary 31.5 ± 4.8 vs 26.8 ± 2.9; $P = 0.027$; mental component summary 29.5 ± 6.0 vs 25.9 ± 2.0; $P = 0.042$).

Conclusions: This study demonstrates for the first time that RAMF flap vaginal reconstruction after pelvic exenteration is an efficacious and safe technique. Furthermore, it is associated with a significant improvement of quality of life and sexual function in those women who had sexual intercourse before surgery.

Key Words: empty pelvic syndrome, pelvic exenteration, rectus abdominis flap, sexual function, vaginal reconstruction, vaginoplasty

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Localized pelvic recurrence from various gynecologic malignancies, including cervical, vaginal, and endometrial cancers, or from locally advanced/recurrent rectal tumors may require radical surgical resection such as pelvic exenteration. Growing evidence suggests that pelvic exenteration might improve oncological outcomes (disease-free and overall survival) in patients with these pelvic diseases.[1–5] On the other hand, severe morbidity and a nonnegligible risk of mortality are related to pelvic exenteration.[6] Although patient selection, enhanced perioperative care, and technical and technological improvements have significantly reduced morbidity and mortality rate over the last years, they still remain very high (ranging between 40% and 70% and between 0% and 10%, respectively) also in recent years.[1–10] In addition, it is well established that postoperative sequelae cause a detrimental impact on patients' quality of life (QoL).[7]

Empty pelvis syndrome represents one of the main causes of severe postoperative morbidity after pelvic exenteration.[11] This syndrome is caused by the dead space in the pelvis and consists of different symptoms, such as abscess formation, bowel obstruction due to severe adhesions to the denuded pelvic sidewall, continuous discharges, bowel perforation, and fistulas.[12]

Several reconstructive techniques have been proposed to fill the empty space including procedures using the omentum, absorbable meshes, or silicon expanders.[13–15] Furthermore, vertical (VRAM) and transverse (TRAM) rectus abdominis myocutaneous flaps receiving vascular supply from branches of the deep inferior epigastric vessels have been successfully used for vaginal reconstruction after pelvic exenteration, and these techniques are associated with low morbidity and substantial decrease in postoperative complications.[16,17] Previous studies reported the use of both myocutaneous and myoperitoneal flaps[18–26]; however, the inclusion of the anterior rectus abdominis fascia has not been previously described. Thus, we hypothesize that the use of anterior rectus abdominis fascia may translate into remarkable advantages: (1) easier surgical handling and suture, resulting in a lower risk of muscle damage; (2) possibility of fascia mucosal metaplasia without myocutaneous flap–related disadvantages (such as sebum, hair, and subsequent odor); and (3) potential lower rate of postoperative complications.

The aim of this retrospective study was to describe our experience with vaginal reconstruction after pelvic exenteration through a modified rectus abdominis myofascial (RAMF) flap.

MATERIALS AND METHODS

The institutional database was retrospectively reviewed searching records of women who had undergone pelvic exenteration and vaginal reconstruction with flaps at Fondazione Istituto Nazionale dei Tumori of Milan, between May 2008 and March 2017. We selected only patients who received RAMF flap vaginal reconstruction. All patients signed an informed consent to undergo surgery and collect data from for scientific purpose and health research.

Demographic details, data on the indication for pelvic exenteration, and data on previous treatments were retrospectively reviewed. Perioperative characteristics were carefully examined. In particular, age, indication for surgery, type of procedures, operation time, type of defect and its reconstruction, estimated blood loss, hemoglobin level changes, number of intraoperative and postoperative blood transfusions, intraoperative complication rates, days of hospitalization stay, and reoperation rate in 60 days from primary surgery were included. Postoperative complications were arbitrarily distinguished in early (those occurring in a period of time ≤60 days) and late (those occurring in a period of time >60 days) complications. Early and late flap-related complications were divided into (1) flap trophic alteration requiring revision, (2) neovagina stenosis, and (3) complications related to flap donor site.

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Follow-up evaluations consisted in pelvic examination and transabdominal ultrasound scan/computed tomography. Follow-up evaluations were scheduled every 4 months for the first 2 years after surgery, every 6 months between 2 and 5 years after surgery, and annually thereafter.

The primary outcome of the study was to evaluate perioperative complications related to RAMF technique. Secondary outcomes were to assess changes in QoL of all patients enrolled in the study and to evaluate modifications of the sexual function of sexually active patients at baseline.

Patients were administered 2 questionnaires at baseline and at 12-month follow-up. The first questionnaire was the Survey Short Form 36 (SF-36) to measure health-related QoL. The survey consists of 36 questions with varying response options. Scores were calculated for the physical and mental component summary scores.[27] Sexually active patients at baseline were administered the second questionnaire, the Italian version of the Female Sexual Function Index. This is a 19-item questionnaire developed as a brief, multidimensional, self-reported instrument for assessing the key dimensions of sexual function in women. It allows obtaining individual domain scores on a 5-point scale (desire, arousal, lubrication, orgasm, satisfaction, and pain) and a total scale score (ranging from 2 to 36).[28,29]

Surgical Technique

All the extirpative surgery was performed by gynecologists or colon-rectal surgeons; reconstructive surgery was performed by plastic surgeons.

The RAMF flap was harvested on 1 side when only the anterior or posterior wall reconstruction was needed. In case of complete vaginal reconstruction, bilateral RAMF flap was used. The right rectus abdominal muscle was mandatorily chosen in unilateral flap because often patients underwent colostomy on the left side.

When complete anterior or posterior wall reconstruction was needed, the flap was dissected from the 10th costal insertion (length 20–30 cm, width 7–10 cm); when partial reconstruction was performed, only the lower part of the muscle was harvested (at least 20 cm in length).

The superior and lateral margins of the rectus muscle were divided just below the costal insertion and the linea alba, depending on the flap length needed. The superior epigastric vessels were identified and ligated. The anterior rectus fascia was preserved on the superior part of the muscle, generally 8 to 10 cm in length (Fig. 1). The rectus abdominal muscle was dissected off the posterior rectus fascia in a retrograde manner, and superior epigastric vessels were ligated (Fig. 2).

The inferior epigastric vessels were identified along the posterolateral surface of the muscle toward its origin on the external iliac vessels,

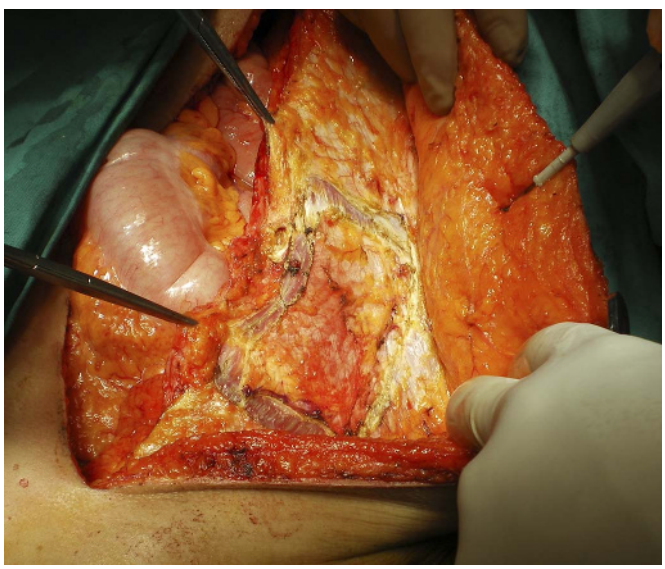

FIGURE 1. The flap is raised first by incising the anterior rectus abdominis muscle fascia, which is preserved on the upper part of the muscle to arrange myofascial flap.

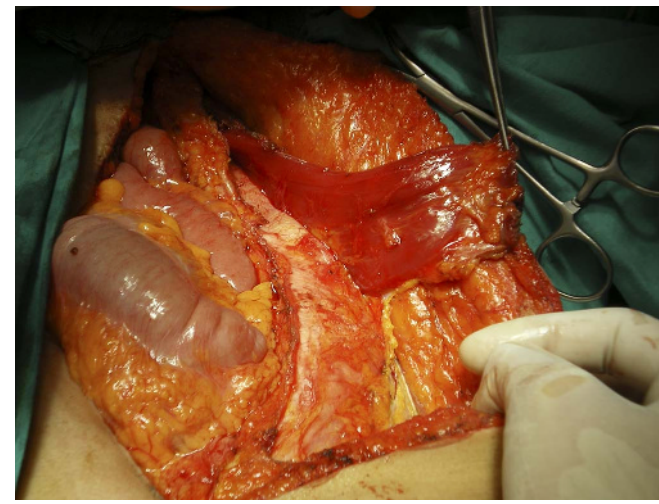

FIGURE 2. Flap elevation: retrograde rectus abdominis muscle dissection off the posterior sheath with superior epigastric vessels ligated.

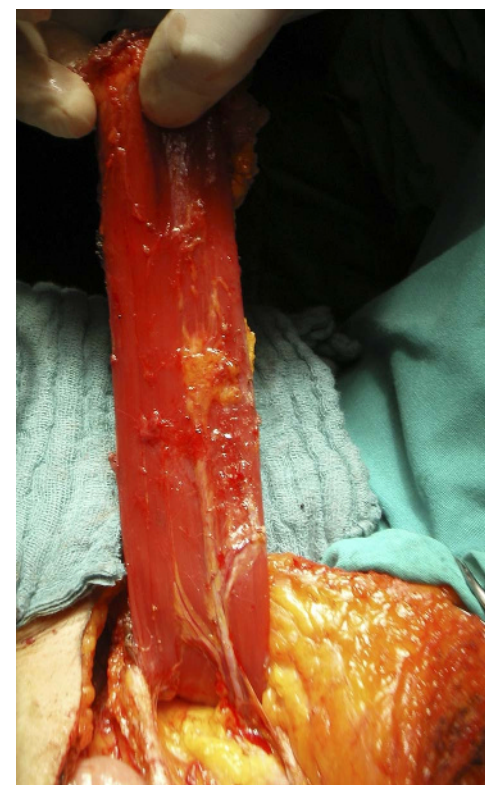

FIGURE 3. Inferior epigastric vessels running along the posterior side of the rectus abdominis muscle.

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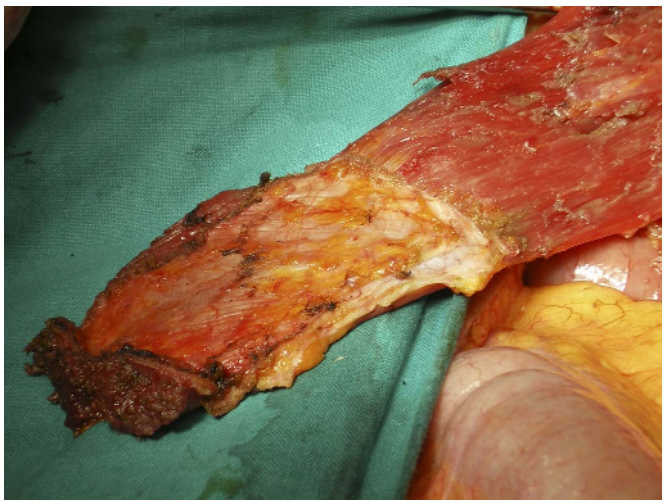

FIGURE 4. The RAMF flap has been dissected with the piece of fascia on top of it and ready to pull through.

and this pedicle was preserved where it crossed the lateral border of the muscle at approximately the level of the arcuate line and freed from possible adhesions (Fig. 3).

The inferior and medial muscle insertions at the pubis level were partially released to allow a better flap rotation without pedicle kinking (Fig. 4). The umbilicus was preserved. The flap was pulled through down to the level of pelvic floor muscles between the bladder and the rectum into the previously prepared vaginal canal, without tension on the vascular pedicle (Figs. 5, 6).

For circumferential vaginal defects, the flap was folded and tubularized along its vertical direction with horizontal mattress absorbable sutures to approximate the superior and inferior margins of fascia and muscle, with the raw side facing out and the fascial side facing in. When the flap was used for partial defect reconstruction (anterior or posterior vaginal wall), the myofascial unit was sutured to the free edges of the remaining vaginal walls. Then the open end of the neovagina was sutured to the mucosa of the vaginal introitus such that

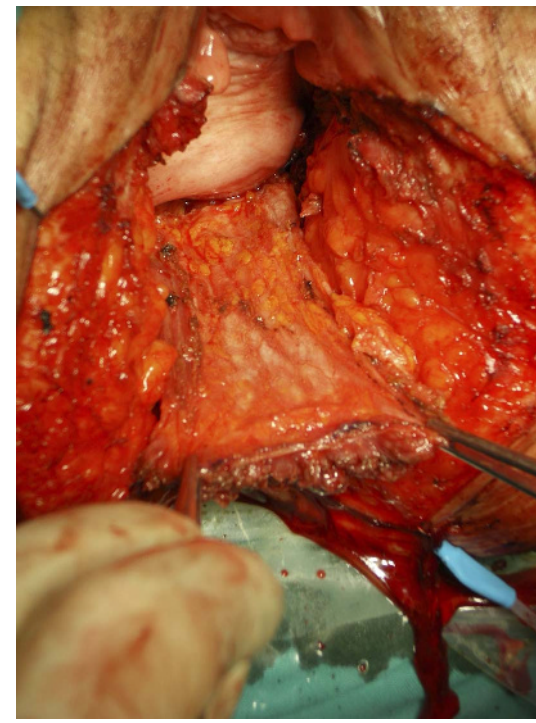

FIGURE 6. Vaginal defect remained after pelvic exenteration. The RAMF flap is bought to the defect with endopelvic course, without tension on the vascular pedicle.

the middle portion of the flap becomes the apex of the vagina, with absorbable sutures. The flap was also secured to the levator plate with loose interrupted absorbable sutures (Fig. 7).

A suction drain was placed beneath the flap. The abdominal wall was then closed: a Prolene mesh (or similar) was used to replace the missing anterior fascia and fixed with single Prolene stitches and a running suture (Fig. 8). A double running Maxon loop 2-0 (Ethicon Inc US LLC) was used to suture the residual anterior fascia with the contralateral anterior rectus abdominal fascia to decrease the risk of

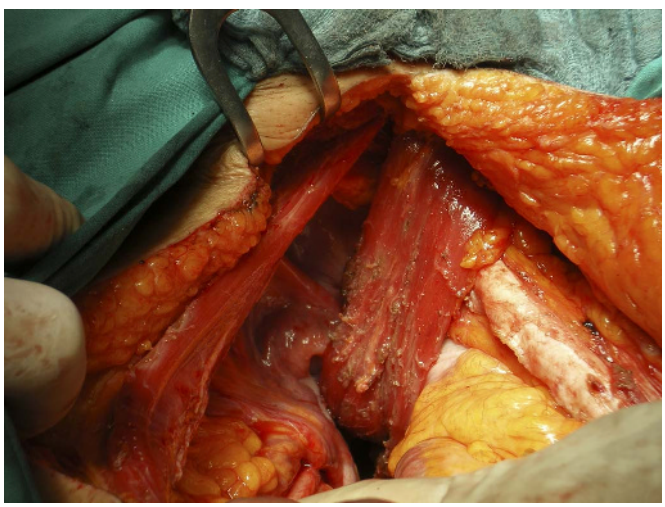

FIGURE 5. Vaginal defect remained after pelvic exenteration. The RAMF flap is bought to the defect with endopelvic course, without tension on the vascular pedicle.

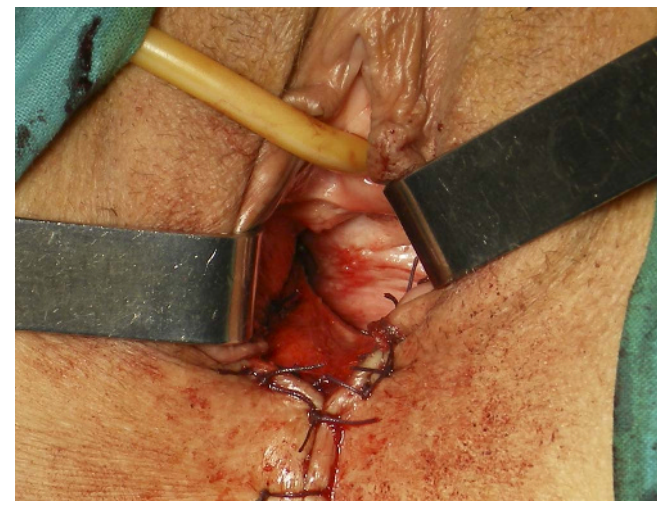

FIGURE 7. Immediate postoperative view of the reconstructed vagina.

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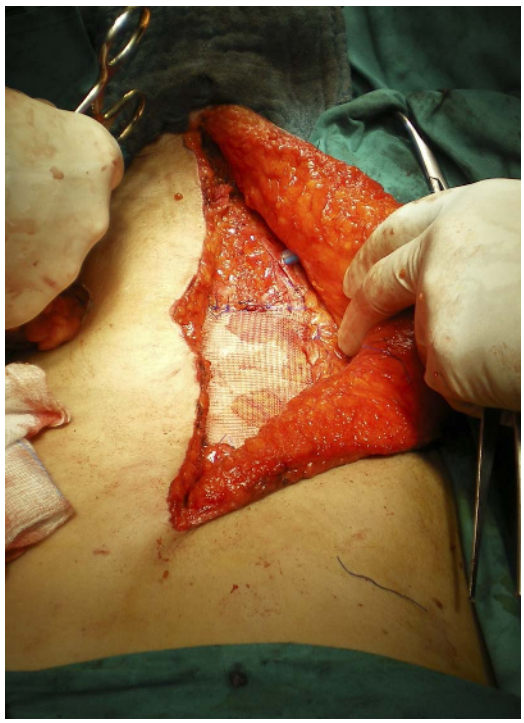

FIGURE 8. The donor site is closed with a nonabsorbable mesh.

postsurgical herniation. A suction drain was arranged over the closed fascia. Subcutaneous tissue was sutured with a double layer of Vicryl 0 and 2-0 single stitches (Ethicon Inc US LLC). The skin was closed with intradermal suture or staplers. A gauze pack was placed into the neovagina. Fluffy gauzes were then packed around the perineum. Postoperatively patients stayed in bed until the second or third day before they were allowed to walk. Digital dilation 7 to 14 days postoperatively was started based on wound healing. To prevent stenosis, vaginal dilators staring at 4 to 6 weeks were begun, and vaginal intercourse was allowed at 6 to 8 weeks.

Statistical Analysis

The normal distribution of continuous variable data was evaluated with the Kolmogorov-Smirnov test. Continuous variables, at baseline and at 12-month follow-up, were analyzed by using the paired *t* test and the Wilcoxon rank sum test accordingly to data distribution.

Data are presented as mean ± SD or median and range. Data were analyzed using the SPSS software version 21.0 (SPSS Science, Chicago, Ill). $P < 0.05$ was considered statistically significant.

RESULTS

A total of 16 patients were identified from our institutional database (Table 1). The main characteristics of the study population are described in Table 2. Eleven (68.8%) of 16 patients died during the follow-up, whereas 5 (31.3%) are still alive. The mean time of death was 20 months after surgery (range, 3–45 months). The median follow-up was 24 months (range, 3–99 months). Thirteen of 16 patients had 12-month follow-up. In 9 cases (56.3%), surgery was performed as primary treatment, whereas in 7 cases (43.7%) it was a salvage treatment for tumor recurrence. An RAMF flap procedure was performed in 13 cases (81.2%) using the right rectus abdominal muscle, in 1 case (6.3%) using the left muscle, and in 2 cases (12.5%) using both rectus abdominal muscles. The flap was used to restore different vaginal defects: 11 cases (68.7%) for posterior wall reconstruction, 1 case (6.3%) for anterior wall reconstruction, 2 cases (12.5%) for posterior wall and perineal region reconstruction, and 2 cases (12.5%) of complete vaginal reconstruction. Perioperative aspects of the surgical procedures are summarized in Table 3.

Overall, early complications were reported in 7 patients (43.8%), with 2 (12.5%) flap-related (abdomen wound dehiscence and sovrafascial abdominal fluid abscess) and 5 (31.3%) non–flap-related complications (wide pelvic fluid abscess, pleural effusion associated to atelectasis, bilateral pulmonary disventilation resulting from inflammatory process, bilateral pelvic fluid abscess, ileovaginal fistula, and urinary retention). A detailed description of all surgical-related complications and their management is reported in Tables 4 and 5.

Similarly, late complications were reported in 5 patients (31.3%), with 2 (12.5%) flap-related (abdominal hernia and neovagina inferior third stricture) and 3 (18.8%) non–flap-related complications (sepsis, recurrent intestinal fistula, and urethral stenosis) (Fig. 9).

As far as QoL as measured by SF-36 was concerned, the physical component summary significantly improved at 12-month follow-up in comparison with baseline (31.5 ± 4.8 vs 26.8 ± 2.9; $P = 0.027$). The same significant improvement was observed for the mental component summary (29.5 ± 6.0 at baseline vs 25.9 ± 2.0 at 12-month follow-up; $P = 0.042$).

Six patients (37.5%) were sexually active at baseline and completed the FSFI. At 12-month follow-up, a significant amelioration of the FSFI score (26.9 ± 5.8) was reported compared with baseline (16.8 ± 3.8; $P = 0.028$). Similarly, each individual FSFI domain score was ameliorated at 12-month follow-up ($P < 0.05$, all) with the exception of the lubrication domain (2.6 ± 1.1) that was similar to the one reported at baseline (3.2 ± 0.3; $P = 0.223$). The diagram represents the changes in total FSFI score and in individual FSFI domain scores between baseline and at 12-month follow-up (Fig. 10).

DISCUSSION

Brunschwig[30] first described pelvic exenteration in 1950 in New York as a palliative procedure for recurrent carcinoma of the cervix. Originally, this technique was burdened by such high rates of morbidity and mortality that its practice was mainly confined to a small number of American centers for most of the 20th century. After the World War II era, advances in the medical field, such as improvement of anesthesia, the introduction of blood transfusion, and intensive care medicine, facilitated the evolution and implementation of more radical abdominal and pelvic surgery. Over the last years, pelvic exenteration has continued to evolve into one of the most important treatments for localized pelvic recurrence from various gynecologic malignancies and locally advanced/recurrent rectal cancer.[31] Despite the previously described improvement in modern medicine and a careful selection of patients undergoing pelvic exenteration, morbidity and mortality rates still remain significant (ranging between 40% and 70% and between 0% and 10%, respectively) also in recent studies.[1–10] As previously described, empty pelvis syndrome represents one of the main causes of severe postoperative morbidity after pelvic exenteration with a significant loss of QoL.[11] Given this background, it is clear that reconstructive surgical techniques to restore perineal and/or vaginal defects are crucial not only for reducing the postoperative morbidity but also to support the patient going through a challenging emotional, sexual, and body awareness journey. Several reconstructive techniques have been described to fill the empty space including procedures using the omentum, absorbable meshes, or silicon expanders.[13–15]

Several approaches to vaginal reconstruction have been utilized including split-thickness skin grafts, gracilis myocutaneous flaps, and rectus abdominis myocutaneous flaps (either VRAM or TRAM). Historically, gracilis flaps were commonly used in gynecologic oncology, but their use has been related to high necrosis rates,

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TABLE 1. Patients Characteristics

Patients	Age, y	Preoperative Treatment	Indication for Surgery	Procedure	Vaginal Defect	RAM	Complications	Death	Cause of Death
1	75	RT, CT	Rectal adenocarcinoma	PC + PE	PW	Right	Wide pelvic fluid abscess Pleural effusion associated to atelectasis	No	ADF
2	51	RT, CT	Rectal adenocarcinoma	PC + PE	PW	Right	Abdomen wound dehiscence Abdominal hernia	Yes	DOD
3	60	RT, CT	Rectal adenocarcinoma	PC + PE	PW	Right		Yes	DOD
4	39	RT, CT	Squamous anal cancer	PC + PE	PW	Right	Urethral stenosis	Yes	DOD
5	61	RT, CT	Squamous anal cancer	PC + PE	PW	Right		yes	DOD
6	52	RT, CT	Rectal adenocarcinoma	PC + PE	PW	Right		Yes	DOD
7	58	RT, CT	Rectal adenocarcinoma	PC + PE	PW	Right	Bilateral pulmonary disventilation resulting from inflammatory process	No	ADF
8	34	CT	Botryoid rhabdomyosarcoma	TC	Complete	Bilateral	Urinary retention Neovagina inferior third stricture	no	ADF
9	29	RT	Squamous cervical cancer recurrence	PC	AW	Left		No	ADF
10	56	CT	Vaginal melanoma	PC	PW	Right	Sovrafascial abdominal and bilateral pelvic fluid abscess	No	ADF
11	52	CT	Rectal adenocarcinoma recurrence	TC + AE	Complete	Right		Yes	DOD
12	62	CT	Vaginal melanoma recurrence	PC + PE	PW +PR	Right		Yes	DOD
13	68	RT, CT	Squamous cervical cancer recurrence	PC	PW +PR	Right		yes	DOD
14	66	RT, CT	Squamous vulvar cancer + vaginal melanoma recurrence	PC + PE	PW	Right	Sepsis	Yes	Septic complications
15	56	CT	Uterine leiomyosarcoma recurrence	TC	Complete	Right		Yes	DOD
16	54	RT, CT	Rectal adenocarcinoma recurrence	PC + PE	PW	Right	Recurrent ileovaginal fistula	Yes	DOD

ADF indicates alive disease-free; AE, anterior exenteration; AW, anterior wall; CT, chemotherapy; DOD, dead of disease; PC, partial colpectomy; PE, posterior exenteration; PW, posterior wall; RAM, rectus abdominal muscle; RT, radiotherapy; TC, total colpectomy.

poor healing, and high incidence of vaginal prolapse.[28] Rectus abdominis flaps have the advantage of utilizing the primary incision; they require only 1 donor site and have a vascular pedicle with a large arc of rotation that is highly reliable.[29] The concern that rectus abdominis myocutaneous flap donor sites are more difficult to close was addressed by the modification to the VRAM flap described by Sood et al[25] using a smaller skin paddle in a conical shape. This modified rectus abdominis myocutaneous flap provides a cosmetically superior result, leaving a single midline scar, and the vertically oriented rectus abdominis myocutaneous flap does not interfere with concomitant colostomy or urinary conduit placement.

The rectus abdominis flap procedure after pelvic exenteration has been used in different studies as a myocutaneous flap developed primarily for perineal reconstruction or for neovagina creation.[18–26] While in rectal cancer patients the use of flaps is principally targeted to cover large perineal defects, in patients affected by gynecologic malignancies vaginal reconstruction after pelvic exenteration has been related to a dramatic decrease in postoperative morbidity.

Two main studies compared the morbidity in patients who underwent pelvic exenteration.[17,20] Jurado and colleagues[20] aimed to analyze the benefits and morbidity of primary vaginal reconstruction in pelvic exenteration. Over a 10-year period, 64 patients underwent a pelvic exenteration for gynecologic cancer, except for ovarian and fallopian cancer. Twenty-nine patients underwent pelvic exenteration with vaginal reconstruction, 21 cases with TRAM flap and 8 cases with Singapore fasciocutaneous flap, whereas 35 patients did not undergo vaginal reconstruction. In those with neovagina formation, vaginal stenosis, necrosis, and shortness occurred less frequently for TRAM flap compared with Singapore flap (19.0% vs 28.6%, 14.5% vs 50%, and 0% vs 100%, respectively). In addition, colorectal anastomosis dehiscence leakage appeared more frequently (83.3% vs 28.6%) in the Singapore group.[20] More recently, Cibula et al[17] described their technique and reported their experiences with pelvic floor reconstruction by modified rectus abdominis myoperitoneal (MRAM) flap after extensive pelvic procedures. Sixteen patients in whom pelvic floor reconstruction with MRAM after either infralevator pelvic exenteration and/or extended lateral pelvic sidewall excision were compared with a historical cohort of 24 patients, in whom an exenterative procedure without pelvic floor reconstruction was performed at the same institution. Interestingly, significantly fewer patients of the MRAM group

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TABLE 2. Characteristics of the Study Population (n=16)

Age, median (range), y	56 (29–75)
BMI, mean ± SD, kg/m^2	24.2 ± 4.6
Smokers, n (%)	5 (31.3)
Indication for surgery, n (%)	
Rectal adenocarcinoma	7 (43.8)
Squamous cervical cancer	2 (12.5)
Squamous anal cancer	2 (12.5)
Vaginal melanoma	2 (12.5)
Squamous vulvar cancer + vaginal melanoma	1 (6.2)
Botryoid rhabdomyosarcoma	1 (6.2)
Uterine leiomyosarcoma	1 (6.3)
Previous treatment, n (%)	
RT + CT	10 (62.5)
CT	5 (31.2)
RT	1 (6.3)
Follow-up, median (range), mo	24 (3–99)

BMI indicates body mass index; CT, chemotherapy; RT, radiotherapy.

TABLE 3. Main Characteristics of Surgical Procedures

Indication for surgery, n (%)	
Primary treatment	9 (56.3)
Recurrence treatment	7 (43.7)
Type of procedures, n (%)	
Partial colpectomy	3 (18.7)
Partial colpectomy along with posterior exenteration	10 (62.5)
Total colpectomy	2 (12.5)
Total colpectomy along with anterior exenteration	1 (6.3)
Operation time, median (range), min	295 (190–420)
Type of defect reconstruction, n (%)	
Posterior wall	10 (62.5)
Anterior wall	1 (6.3)
Posterior wall/perineal region	2 (12.5)
Complete vagina	3 (18.7)
Type of reconstruction, n (%)	
Right rectus abdominal muscle	14 (87.5)
Left rectus abdominal muscle	1 (6.25)
Bilateral rectus abdominal muscle	1 (6.25)
Estimated blood loss, median (range), mL	425 (200–1800)
ΔHb, mean ± SD, g/dL	2.5 ± 1.5
Intraoperative blood transfusions, n (%)	2 (12.5)
Postoperative blood transfusions, n (%)	0 (0)
Intraoperative complication, n (%)	0 (0)
Hospital stay, median (range), d	14 (8–90)
Reoperation in 60 d, n (%)	2 (12.5)

required reoperation within 60 days from the surgery (25% vs 50%), which was due to lower rate of complications potentially related to empty pelvis syndrome (1 vs 7 reoperations; $P = 0.114$). Furthermore, late postoperative complication rate was significantly lower in the MRAM group compared with the historical cohort of patients (any grade: 44% vs 79%; grade ≥3: 6% vs 37%; $P = 0.041$).[17]

In our study, the overall morbidity related to surgery was lower than that in the study by Cibula et al.[17] In particular, the reoperation rate within 60 days from the surgery was very low (12.5%). Furthermore, both early and late complications were reported in 7 patients (43.8%), respectively.

Berger et al[32] described a large group of 46 patients who underwent VRAM flap neovagina reconstruction after pelvic exenteration. In their series, flap complications occurred in 9 patients (19.6%): 1 with complete flap necrosis that required reoperation, 2 with superficial flap necrosis, and 3 with superficial flap separation. Three patients (6.5%) suffered from vaginal stenosis, one of whom was complete. Anterior abdominal wound separation occurred in 22 patients (47.8%), and pelvic abscess occurred in 14 patients (30.4%).

TABLE 4. Early and Late Flap-Related Complications

	Description	Management	n (%)
Early complications			
Flap trophic alteration	—	—	0 (0)
Donor site morbidity	Abdomen wound dehiscence	Conservative	1 (6.3)
		Abscess drainage	1 (6.3)
	Sovrafascial abdominal fluid abscess		
Reconstructed vagina stenosis	—	—	0 (0)
Total			2 (12.5)
Late complications			
Flap trophic alteration	—	—	0 (0)
Donor site morbidity	Abdominal hernia	—	1 (6.3)
Reconstructed vagina stenosis	Neovagina inferior third stricture	Adherence lysis	1 (6.3)
Total			2 (12.5)

In our study, flap-related complications occurred in only 3 patients (18.8%). We did not have partial or total flap necrosis with RAMF flap. We experienced only 1 case of vaginal stenosis (6.3%), 1 case of abdominal wound dehiscence and subsequent hernia (6.3%), and 1 case of sovrafascial abdominal and pelvic abscess (6,3%). In addition, we did not experience any superficial flap separation, and donor site closure was uneventful in almost all patients.

Comparing the results, conventional VRAM flap has a higher percentage of partial or total flap loss and donor site morbidity. Using an RAMF flap, the donor site can be closed more easily, without tension, and the flap without the skin paddle is easier to handle without risk of skin separation.

It could be hypothesized that these findings may be related to the modified reconstructive technique used in our institution. In detail, the main difference with the TRAM/VRAM techniques reported in literature is represented by the inclusion of the rectus abdominis anterior fascia together with the muscle. It takes at least 40 to 60 days for the mucosa to grow over and cover the fascia.

In our opinion, this modification may guarantee a better protection of the muscle underneath because the anterior fascia is a tough and resistant tissue. In addition, its tough texture allows a safer flap manipulation, decreasing the possibility of intraoperative muscle damage and thus minimizing the risk of affecting the blood supply. In fact, the preservation of blood supply represents the core part of the operation; it is crucial for appropriate tissue healing and reducing the consequent risk of flap-related complications. This is also important, considering that

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TABLE 5. Short- and Long-term Non–Flap-Related Complications

	Description	Management	n (%)
Early complications			
Septic complication	Wide Pelvic fluid abscess, pleural effusion associated to atelectasis	Systemic antibiotic	1 (6.3)
		Systemic antibiotic	1 (6.3)
	Bilateral pulmonary disventilation resulting from inflammatory process	Abscess drainage	1 (6.3)
	Bilateral pelvic fluid abscess		
Oncological recurrence	—	—	0 (0)
Other	Ileovaginal fistula	Debridement and surgical closure	1 (6.3)
	Urinary retention	Stent	1 (6.3)
Total			5 (31.3)
Late complications			
Septic complication	Sepsis	Systemic antibiotic	1 (6.3)
Other	Recurrent intestinal fistula	Colostomy	1 (6.3)
	Urethral stenosis	Stent replacement	1 (6.3)
Total			3 (18.8)

often patients received preoperative radiotherapy that can lead to an increased number of intraoperative and postoperative complications. The absence of skin can also avoid many of the drawbacks of myocutaneous flaps such as sebum, hair growth, and subsequent odor.

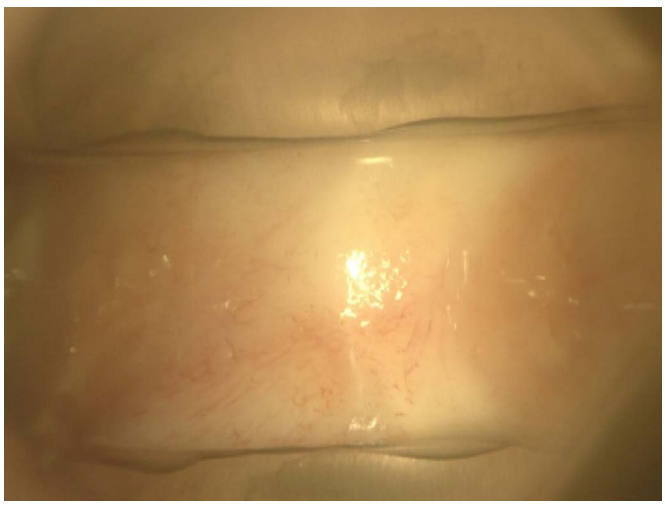

FIGURE 9. Endoscopic postoperative view of the reconstructed vagina at 6-month follow-up: fascia mucosal metaplasia occurred.

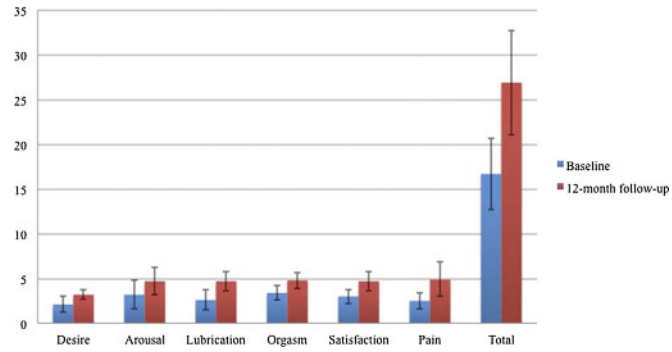

FIGURE 10. Changes in total FSFI score and in individual FSFI domain scores between baseline and at 12-month follow-up.

The RAMF flap is our first choice for vaginal reconstruction for different reasons. First, avoiding including the skin paddle, the donor site can be closed more easily, without tension. Second, the flap is easier to handle without the bulk of skin paddle, especially in obese patients in whom myocutaneous flaps are too bulky to pull through the perineal defect, and the consistent fatty layer could affect the superficial vascularization. Moreover, the fascia over the muscle, because of its tough texture, allows safer flap manipulation, decreasing the risk of intraoperative muscle damage. Third, the possibility of fascia mucosal metaplasia, which occurs within 40 to 60 days, is of great advantage for the quality of vaginal epithelium reconstruction and to avoid skin-related sequelae.

This study presents some limitations that should be underlined. First, the main limitation of the current work is represented by the inherent biases of the retrospective, single-center study design. Second, a limited number of patients were included in this study. Third, the current research lacks a control arm that prevents to state that RAMF flap technique is truly associated with lower complication rates than the traditional operation without reconstructive procedure.

Although current literature supports the use of reconstructive surgery after pelvic exenteration in order to reduce the complication rate, it should be considered that available evidence is scanty and based on retrospective studies. Thus, future well-designed studies, ideally randomized controlled trials, should be planned to allow drawing definitive conclusions on this issue. In addition, because of the rarity of this procedure, multicenter trials should be designed among tertiary care institutions for pelvic exenteration to obtain larger population of patients and similar quality of both exenterative and reconstructive parts of the whole surgical procedure.

In conclusion, the current study aimed to describe our institutional experience with surgery for vaginal reconstruction after pelvic exenteration using RAMF flaps. The first finding of this study is that RAMF flap is a feasible and safe technique with no intraoperative complications and low perioperative morbidity. The second finding is represented by the overall low rate of early and late complications, particularly of those related to the flap. Third, this study shows for the first time that the reconstructive RAMF flap technique is associated with a significant improvement of both QoL of the patients and of sexual function in those women who were sexually active before the operation.

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