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Modified Vertical Rectus Abdominis Myocutaneous Flap Vaginal Reconstruction: An analysis of surgical outcomes

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Abstract

Objective—To examine the early and late flap related morbidity and associated risk factors in patients with modified vertical rectus abdominis myocutaneous (VRAM) flap neovaginal reconstruction at the time of pelvic exenteration for gynecologic malignancy.

Methods—From January 1993 to January 2011, all patients were identified who underwent anterior, posterior, or total pelvic exenteration with VRAM flap neovaginal reconstruction. Patient records were systematically reviewed and demographic, clinicopathologic, operative details, flap related complications, and risk factors for wound healing were recorded and statistical analysis performed.

Results—46 patients were identified who underwent exenteration with VRAM flap vaginal reconstruction. A risk factor for poor healing including obesity, diabetes, smoking, prior radiation, previous abdominal surgery, or poor nutritional status was present in 38 (82.6%) patients, and 24 (52.2%) had two or more risk factors. Flap complications occurred in 9 (19.6%) patients, one with complete flap necrosis that required re-operation, two with superficial flap necrosis, and three with superficial flap separation. Three patients (6.5%) suffered from vaginal stenosis, one of which was complete. Anterior abdominal wound separation occurred in 22 (47.8%) patients and pelvic abscess occurred in 14 (30.4%) patients. No individual risk factor was significantly associated with VRAM flap related morbidity; however obesity, prior radiation, and prior abdominal incision were present in nearly all the patients with flap complications.

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Conclusions—This series confirms that modified VRAM flaps can be used successfully at the time of exenteration, even in an increasingly high risk patient population with an acceptable risk for flap complications.

Introduction

Since the initial description of pelvic exenteration in 1946 as a palliative procedure, it has evolved into an operation with curative potential for women with advanced and recurrent gynecologic cancers confined to the central pelvis [1]. Though cure rates and long-term survival have improved dramatically, post-surgical morbidity and quality of life remain significant issues [2-4]. As part of the operation, patients who undergo pelvic floor and vaginal reconstruction tend to report less psychosocial dissatisfaction, improved body image and sexual function, and have better primary healing with fewer post-operative complications [5-7].

Several approaches to vaginal reconstruction have been utilized including split thickness skin grafts, gracilis myocutaneous thigh flaps, and rectus abdominis myocutaneous (RAM) flaps either vertically (VRAM) or transversely (TRAM) oriented. Historically, gracilis thigh flaps were commonly used in gynecologic oncology but have since been shown to have high rates of necrosis, poor healing, and a high incidence of vaginal prolapsed [8]. Rectus abdominis flaps have the advantage of utilizing the primary incision, require only one donor site, and have a vascular pedicle with a large arc of rotation that is highly reliable [6]. The concern that RAM flap donor sites are more difficult to close was addressed by the modification to the VRAM flap described by Sood *et al.* using a smaller skin paddle in a conical shape [9]. The modified RAM flap provides a cosmetically superior result leaving a single midline scar, and the vertically oriented RAM flap does not interfere with concomitant colostomy or urinary conduit placement. The objective of this study was to analyze the early and late flap related morbidity and associated risk factors in the largest series of patients with modified vertical rectus abdominis myocutaneous (VRAM) flap vaginal reconstruction at the time of pelvic exenteration for gynecologic malignancy.

Methods

After Institutional Review Board approval, the medical records from all patients who underwent pelvic exenteration for gynecologic malignancies at The University of Texas M.D. Anderson Cancer Center from January 1993 through January of 2011 were reviewed. One hundred and sixty-one patients were identified who had an anterior, posterior, or total pelvic exenteration, forty-six of whom had a VRAM vaginal reconstruction at the time of surgery and were included in this analysis. All radical pelvic procedures were performed by faculty members of the Department of Gynecologic Oncology, with the assistance of fellows and residents. The surgical technique for the creation of a modified VRAM flap neovagina has been described previously by our group [9].

Patient records were systematically reviewed; demographic, clinicopathologic, and perioperative details along with postoperative complications were entered into a secure database. Demographic information included age at diagnosis and at exenteration, ethnicity,

smoking status and body mass index (BMI). Clinicopathologic characteristics included primary diagnosis, histology, stage, prior treatment, and medical co-morbidities. The type of exenteration, reconstructive procedures, length of procedure, and estimated blood loss were recorded. Post-operative complications were separated into those occurring within 60 days (short term) and those occurring greater than 60 days (long term) after surgery. Histology was based on internal pathologic review, and stage was based on International Federation of Obstetrics and Gynecology staging system at the time of their diagnosis. Patients were considered overweight with a body mass index (BMI) greater or equal to 25 kg/m². Obesity and morbid obesity were defined by a BMI greater or equal to 30 kg/m² and 40 kg/m² respectively. Complications associated with the VRAM reconstruction were divided into (1) complete flap necrosis requiring revision, (2) superficial flap necrosis which required intermittent debridement of the wound, (3) superficial flap separation which was defined as separation from the adjacent tissue with no associated necrosis therefore debridement was not required, and (4) stenosis of the reconstructed vagina.

The collected data were analyzed using frequency distribution tests. The relationships between dichotomous variables of interest were assessed using the χ^2 test or Fisher's exact test for nominal and categorical variables. Continuous variables were assessed using the Mann-Whitney *U* test. Two sided *p*-values were reported and a *p*-value of 0.05 was considered statistically significant. Stata V11 (College Station, TX) was used to perform all statistical analyses.

Results

Demographic and clinical characteristics of all patients are shown in Table 1. The mean age at diagnosis was 48.0 years and the mean age at exenteration was 53.0 years. Primary malignancies were cervical (41.3%), vulvar (19.6%), vaginal (30.4%), and uterine (8.7%). The majority of histological subtypes were squamous cell carcinomas (52.2%) and adenocarcinomas (26.1%). Thirty-two patients had radiation therapy as part of their primary treatment including 18 who received concurrent chemotherapy. Eight patients had surgery alone as primary therapy; 5 of whom had treatment with radiation or chemoradiation for their first recurrence, followed by exenteration for their second recurrence. Only 3 patients did not receive radiation prior to exenteration; 2 with recurrent vulvar melanoma and one with recurrent leiomyosarcoma as their indication for exenteration. Four patients underwent exenteration as primary therapy for vaginal cancer; two with vaginal melanoma and two with a remote history of pelvic radiation for other indications.

The majority of patients had risk factors for poor wound healing, which are outlined in Table 2. Twenty-one patients were current (21.7%) or past (23.9%) smokers. Twenty-two patients (47.8%) were obese or morbidly obese, and 5 (10.9%) had diabetes mellitus. Previous abdominal scars were present in 27 patients (58.7%); 10 (21.7%) of whom had prior transverse incisions and 5 (10.9%) who had more than one previous abdominal incision. None of the patients had a previous Maylard incision with disruption of the inferior epigastric pedicle. A majority of patients had 2 or more risk factors for healing; 18 patients (39.1%) had 2 risk factors and 6 patients (13%) had three or more risk factors. Eight patients had none of the listed risk factors for poor wound healing.

Anterior exenteration was performed in 7 patients, posterior exenteration in 4 patients, and the remaining 35 patients underwent total pelvic exenteration. Surgical details are listed in Table 3. Urinary diversion was performed in 42 patients, 11 (26.2%) of which were continent urinary diversions. All of the urinary stomas were brought to the skin on the same side as the donor flap. All of the anterior abdominal wounds were closed primarily. The median length of surgery was 9.8 hours (range 6.1-15.4 hours). The median intra-operative estimated blood loss was 1700mL (range 280-5000 mL), and 43 patients (93%) required blood transfusion. Length of hospital stay ranged from 7 to 53 days, with a median stay of 14 days. There were no deaths within 60 days of surgery.

Table 4 includes complications associated with vaginal reconstruction. Superficial separation of the anterior abdominal wall wound was the most common complication affecting 22 patients (47.8%), 21 of which occurred within 60 days of surgery. Flap complications occurred in a total of 9 patients (19.6%). Six of these complications were considered short-term and 3 long-term complications. Two patients had superficial flap necrosis that was managed with office debridement. Three patients had a superficial separation of the flap requiring wound care. The one patient, with complete flap necrosis, was noted to have venous congestion of the VRAM flap in the immediate postoperative period. This was initially treated with leech therapy, however the venous congestions continued and there was concern about flap compromise. On postoperative day 10 she was taken back to the operating room for re-evaluation and debridement. Due to the patient's multiple co-morbidities including diabetes, smoking, previous surgery and radiation the decision was made to revise the flap with the use of a gracilis myocutaneous flap.

The 3 patients with long term flap complications suffered stenosis of the vagina with complete closure of the vagina in one patient. Pelvic abscess was diagnosed in 14 (30.4%) patients, the majority in the early post-operative period. Overall, 20 (43.5%) patients required readmission after discharge home, a majority (17, 85.0%) within 60 days of exenteration, for indications unrelated to the vaginal reconstruction. There was no association between the type or number of pre-operative risk factors for wound healing and flap related postoperative complications.

Discussion

Our results confirm that modified VRAM flap neovaginal reconstruction can be used with success at the time of pelvic exenteration for gynecologic malignancy. The incidence of flap necrosis, either complete or partial, compares favorably with previously reported rates of RAM flap necrosis of 9-19% [7] and rates of gracilis flap necrosis of 13-37% [10, 11]. Similarly, vaginal stenosis was less common than previously published ranges of 14-19% [12, 13]. The risk of flap-related complications in this series was particularly low considering the high risk population, with 52.2% of patients having 2 or more risk factors for poor wound healing and all but three patients having received radiation therapy prior to exenteration.

The benefits of primary vaginal reconstruction at the time of pelvic exenteration have been delineated in several publications. In addition to the psychosocial benefits, myocutaneous

grafts improve wound healing by filling pelvic dead space and reducing the incidence of pelvic abscess and intestinal fistulae. In the past, the gracilis myocutaneous flap was used most commonly but carried the disadvantage of additional unsightly scarring on the thighs, increased risk of prolapse, as well as flap necrosis due to vascular compromise [10, 11, 14]. Rectus abdominis myocutaneous flaps have more recently come into favor for vaginal reconstruction as they have low rates of necrosis and vaginal stenosis, do not require the use of vaginal dilators, utilize a single incision, and are facile flaps. The modified VRAM uses a smaller skin paddle alleviating the need for mesh to close the anterior abdominal wall which is required in 20 – 30% of patients described with traditional rectus myocutaneous flaps. In this study, none of the patients required a mesh for closure. To our knowledge this is the largest series in the literature detailing flap-related complications and associated risk factors of modified VRAM vaginal reconstruction at the time of pelvic exenteration in gynecologic oncology [3, 6, 7, 15-18]

Several factors have been shown to increase risk for flap complications including obesity, smoking, prior radiation therapy, poor nutritional status, hypertension, and prior transverse abdominal incisions [17]. Obesity, a known risk for wound complication, affects healing of neovaginal flaps due to the bulk of the skin flap creating compression within the pelvis [16, 19]. Prior abdominal incisions are concerning for flap viability if the inferior epigastric vascular pedicle is compromised, as the derived flap does not have a secondary or collateral blood supply. Prior transverse incision over the flap donation site may compromise the inferior epigastric vascular pedicle leading to partial or complete flap necrosis. Maylard incisions which often transect the distal portion of the deep inferior epigastric artery are considered a contraindication.

In addition, severe aortoiliac atherosclerosis and severe hypertension are considered relative contraindications [15, 16]. Careful patient selection is required for VRAM flap vaginal reconstruction and preoperative screening for claudication symptoms may be prudent. If there is concern about a contraindication to the VRAM flap in a particular patient, referral to a plastic surgeon for alternative approaches, or to evaluate the vascular supply of the potential pedicle graft may be warranted. Primary closure of the perineal defect could also be considered.

Of the nine patients with flap complications in our series, all had received prior radiation therapy, and therefore had at least one risk factor for poor wound healing. The most prevalent risk factors among patients with flap complications were obesity, present in 8 of 9 patients, and prior abdominal incision, present in all 9 patients. Twenty-two percent of patients were active smokers. Other relevant complications included superficial wound separation of the donor site and pelvic abscess. While pelvic abscess is common after pelvic exenteration (ranging from 0 - 26%) and may affect wound healing, the rates are inconsistently reported. In our series, pelvic abscess rates exceeded 30% which may be related to our high incidence of obesity (47.8%) compared to other series where only 13.6-25% of patients were obese. Despite all of these high risk factors, the rate of flap complications after modified VRAM was 19.6%.

Pelvic exenteration undoubtedly has a high rate of complications but remains the only curative option for many patients with recurrent or locally advanced central pelvic malignancy. The procedure has been refined and improved dramatically over the years, now employing sophisticated reconstruction. This series confirms that modified VRAM flaps can be used successfully at the time of exenteration, even in an increasingly high risk patient population. Factors such as previous treatment, prior surgical scars, BMI, smoking status, and medical co-morbidities should be taken into consideration when choosing whether to perform vaginal reconstruction and what type of reconstruction to perform.

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Highlights

- The modified vertical rectus abdominis myocutaneous flap (VRAM) is a safe option for vaginal reconstruction at the time of pelvic exenteration.
- Flap related complications after VRAM reconstruction were uncommon even in a high risk population.

Table 1
Patient Demographics and Clinical Characteristics

	N = 46	%
Age at Diagnosis, mean (range)	48.0 years (24.5 – 76.7)	
Age at Exenteration, mean (range)	53.0 years (30.4–77.7)	
BMI, mean (range)	29.3 kg/m ² (16.8– 42.9)	
Primary Cancer Diagnosis		
Cervix	19	41.3
Vulvar	9	19.6
Vaginal	14	30.4
Uterine	4	8.7
Histology		
Squamous	24	52.2
Adenocarcinoma	12	26.1
Melanoma	5	10.9
Clear Cell	1	2.2
Other	2	4.4
Unknown	2	4.4
Primary Treatment		
Surgery [†] alone	8	17.4
Surgery [†] and Radiation	6	13
Radiation alone	8	17.4
Chemoradiation	12	26.1
Surgery [†] and Chemoradiation	6	13
Surgery [†] and Chemotherapy	1	2.2
Exenteration	4	8.7
Unknown	1	2.2

[†] Non-exenteration surgery

Table 2
Risk Factors for Poor Wound Healing

	N = 46	%
Smoking		
Current	10	21.7
Past	11	23.9
Never	25	54.3
BMI		
Normal	12	26.1
Overweight	12	26.1
Obese	20	43.5
Morbidly Obese	2	4.3
Diabetes	5	10.9
Previous Scar		
Vertical	12	26.2
Transverse	10	21.7
Multiple	5	10.9
Unknown	6	13
Pre-op Albumin	3	8.6
HTN	14	30.4

Table 3
Surgical Details

	N = 46	%
Type of Exenteration		
Anterior	7	15.2
Posterior	4	8.7
Total	35	76.1
Urinary Diversion	42	91.3
Continent Conduit	11	26.2
Incontinent Conduit	31	73.8
Median Length of Surgery (range)	9.8 hrs (6.1-15.4)	
Median EBL (range)	1700 mL (280-5000)	
Median Transfused PRBCs (range)	3 units (0-12)	
Median Length of Hospital Stay (range)	14 days (7-53)	

Table 4
Flap Related Post Operative Complications

	<60 Days N (%)	>60 Days N (%)	Total N (%)
Donor Site Wound Separation	21 (45.7)	1 (2.2)	22 (47.8)
Flap Complications	6 (13)	3 (6.5)	9 (19.6)
Complete Flap Necrosis	1 (2.2)	0	1 (2.2)
Superficial Flap Necrosis	2 (4.4)	0	2 (2.2)
Superficial Flap Separation	3 (6.5)	0	3 (6.5)
Vaginal Stenosis	0	3(6.5)	3 (6.5)
Abscess	12 (26.1)	2 (4.4)	14 (30.4)
Readmission	17 (37.0)	3 (6.5)	20 (43.5)