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Immediate Reconstruction of the Perineal Wound With Gracilis Muscle Flaps Following Abdominoperineal Resection and Intraoperative Radiation Therapy for Recurrent Carcinoma of the Rectum

David Shibata, MD, William Hyland, MD, Paul Busse, MD, PhD, H. Katherine Kim, MD, Steven M. Sentovich, MD, Glenn Steele, Jr., MD, PhD, and Ronald Bleday, MD

Background: Morbidity associated with a nonhealing perineal wound is the most common complication following proctectomy, particularly in the setting of recurrent carcinoma of the rectum and radiation therapy. Immediate reconstruction using the gracilis myocutaneous and muscle flaps significantly reduces the incidence of major infection associated with perineal wound closure. The purpose of this study was to assess the value of immediate reconstruction of the perineal wound using a gracilis flap in patients undergoing abdominoperineal resection and intraoperative radiation therapy.

Methods: This study retrospectively reviewed our experience with immediate pelvic reconstruction using gracilis muscle flaps for patients undergoing rectal extirpation and irradiation for recurrent carcinoma of the rectum. From 1990 to 1995, 16 patients underwent abdominoperineal resection (APR) or pelvic exenteration accompanied by immediate wound closure with unilateral or bilateral gracilis muscle flaps. Morbidity and mortality outcomes were compared to those of 24 patients from our institution who, between 1988 and 1992, underwent proctectomy and irradiation for recurrent rectal carcinoma with primary closure of the perineal wound.

Results: Major complications (i.e., major infection requiring hospitalization and/or operation) occurred in 2 (12%) of the patients with gracilis flaps versus 11 (46%) of the patients with primary closure ($P = .028$ by χ^2 analysis for flap vs. primary closure). Minor complications (i.e., persistent sinus and subcutaneous abscess) occurred in 4 (25%) of the patients with gracilis flaps versus 5 (21%) of those with primary closure.

Conclusion: Immediate perineal reconstruction using the gracilis myocutaneous flap following proctectomy and irradiation for recurrent rectal carcinoma significantly reduces the incidence of major infection associated with perineal wound closure.

Key Words: Gracilis muscle flaps—Carcinoma of the rectum—Reconstruction of perineal wound.

Definitive management of the perineal wound following excision of the rectum continues to be a controversial issue. Morbidity associated with the nonhealing perineal wound remains the most common complication following proctectomy.[1,2] We have found this to be especially true in the setting of primary or recurrent rectal carcinoma in patients who have received external beam radiation and intraoperative radiation therapy (IORT).[3] Others have found similar problems with wound morbidity following IORT.[4] A wide variety of options for management of the perineal wound has been described. One of the commonly accepted techniques is primary closure and drainage of the wound, with or without reapproximation of the pelvic peritoneum.[1] Several authors have studied the packing of the presacral space after suturing of the pelvic peritoneum.[5,6] Unfortunately, these tradi-

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From the Departments of Surgery (DS, WH, SMS, RB) and Joint Center for Radiation Therapy (PB, HKK), Beth Israel Deaconess Medical Center, Harvard Medical School, Boston, Massachusetts; and the Department of Biological Sciences (GS), University of Chicago, Chicago, Illinois.

Address correspondence to: Ronald Bleday, MD, Chief, Division of Colorectal Surgery, Beth Israel Deaconess Medical Center, 110 Francis Street, Suite 3A, Boston, MA 02215.

tional methods generally are associated with a relatively high level of morbidity. Successful use of various myocutaneous flaps in the management of the perineal wound has been reported in the literature.[7,8] The rectus abdominis flap often has been favorably described[9,10]; however, significant morbidity rates are associated with use of the rectus abdominis flap for perineal wound reconstruction, and we often have encountered difficulty in the formation of primary or secondary colostomy sites following pelvic reconstruction using the rectus muscle. Several studies have reported an excellent experience using the gracilis myocutaneous flap first described by Bartholdson and Hulten,[3,11–14] although most of these results have been in the setting of inflammatory bowel disease, delayed reconstruction, or both. In this study, we retrospectively review our experience with immediate pelvic reconstruction using gracilis myocutaneous flaps for patients undergoing rectal extirpation and intraoperative radiation therapy for recurrent carcinoma of the rectum.

MATERIALS AND METHODS

Patients

From 1990 to 1995, 16 patients underwent abdominoperineal resection or pelvic exenteration accompanied by IORT for recurrent carcinoma of the rectum. All patients had received prior external beam radiation either immediately after their primary procedure or before their procedure for recurrence. All operations were performed at the New England Deaconess Hospital, and management of the perineal wound consisted of immediate wound closure with unilateral or bilateral gracilis muscle flaps. Morbidity and mortality outcomes were compared to those of 24 patients from the same institution who, between 1988 and 1992, underwent proctectomy, external beam irradiation, and intraoperative radiation therapy for recurrent rectal carcinoma with primary closure of the perineal wound. Follow-up was accomplished by the retrospective review of office and hospital charts.

End points

Morbidity end points were classified as either major or minor complications. Major complications were defined as major abscesses requiring hospitalization, reoperation, or both. Minor complications in this study consisted of persistent perineal sinus tracts and simple subcutaneous abscesses.

Patient characteristics

The populations were similar with respect to age, use of chemotherapy, serum albumin, serum hematocrit, diabetes, and the presence of residual cancer or metastases (Table 1). Patients who underwent a gracilis muscle flap closure received a significantly higher amount of radiation as compared to patients closed primarily. (Complete radiation data were unavailable for one patient from each of the two study groups). Statistical comparisons were made using a Fisher's exact test or a two-sample Wilcoxon rank sum test. Significance was defined as a P value $< .05$.

Operative technique

The first part of the procedure was an abdominoperineal resection (Figs. 1-3). Because these surgeries were being done on patients who had recurrent rectal cancer, most had urinary stents placed before laparotomy. All patients also were preoperatively marked for a sigmoid colostomy and had metastatic disease ruled out by radiological studies. At laparotomy, extensive exploration was performed to rule out any synchronous recurrent disease, particularly in the liver. In patients with recurrent disease growing anteriorly into the prostate or vagina, appropriate resections were done when necessary. After the specimen was removed, intraoperative radiotherapy was then

TABLE 1. *Patient characteristics*

Variable	Primary closure (n = 24)	Gracilis closure (n = 16)	P value
Age (y)	62.0 ± 10.8	60.8 ± 10.9	NS
Chemotherapy	20/24	12/16	NS*
Serum albumin	3.8 ± 0.4	4.0 ± 0.4	NS†
Serum Hct	35.9 ± 4.5	35.0 ± 4.2	NS†
Diabetes	0/24	1/16	NS*
Residual cancer	10/24	5/16	NS*
Metastases	2/24	0/16	NS*
Mean radiation (rads) exposure	6051 ± 799‡	7180 ± 1597‡	.026†

NS, nonsignificant.
† by two-sample Wilcoxon rank sum test.
* by Fisher's exact test.
‡ radiation data not available from one patient from each group.

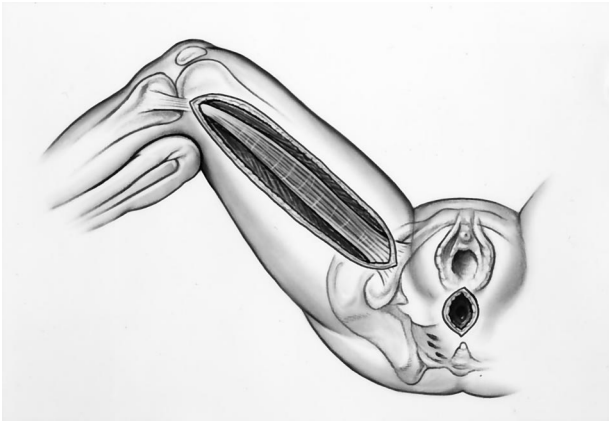

FIG. 1. A longitudinal incision is made through the subcutaneous fat and the gracilis tendon identified by palpation. For the myocutaneous flap, the skin is stabilized on the muscle with tacking sutures to prevent shearing. Minor accessory pedicles from the superficial femoral system are clipped and divided. The major pedicle of the medial circumflex femoral artery is located approximately 10 cm to 14 cm from the pubic tubercle, entering the deep surface of the gracilis along its anterior border. Motor innervation is preserved to prevent a loss in bulk.

FIG. 2. The muscle or musculocutaneous flap is then introduced into the wound cavity, where it is sutured into place with no tension on the vascular pedicle.

done using a Siemen's orthovoltage unit that could be directed into the pelvis through either the perineum or the abdomen. Intraoperative radiation dose was determined according to the presence of microscopic, macroscopic, or disease-free margins.[3] For patients who had a relatively diffuse area to be treated, brachytherapy catheters were placed for postoperative placement of radiation seeds. After the radiation therapy or placement of brachytherapy catheters, the pelvis was irrigated and then the plastic surgical team commenced with the gracilis flap. Occasionally, closure of the abdomen was delayed to facilitate the anchoring of the gracilis into the pelvis from the abdominal approach.

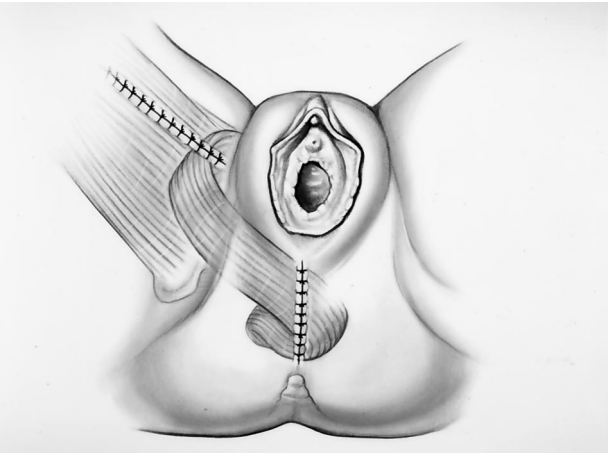

FIG. 3. The donor site in the lower extremity is closed primarily, in layers, over a suction catheter, and the perineal wound also is primarily closed in its entirety.

For patients who did not undergo gracilis flap closure, the perineum was closed in multiple layers, first by approximating any residual levator muscle with interrupted absorbable suture, followed by a subcutaneous layer, and then, finally, closure of the skin with interrupted staples or sutures. Before closure, drains were placed in the pelvis and brought out through separate stab wound incisions on either side of the perineal incision.

The gracilis flap dissection was begun as soon as the ablative surgery was completed and any IORT had been administered. A cutaneous paddle with the muscle was used for six patients for reconstruction of the back wall of the vagina or perineal skin.

The patients were instructed to avoid marked extension or abduction at the hip as well as prolonged sitting for 4 to 6 weeks.

RESULTS

Patients in both populations were followed for a minimum of 6 months following surgery, and most have been followed for many years. In the control group treated by simple primary closure, the wounds of eight patients (33%) healed without incident. Three patients developed minor subcutaneous abscesses managed by office incision and drainage and oral antibiotics. One patient developed a persistent perineal sinus managed by local wound care. One patient had both a persistent sinus and subcutaneous abscess. Eleven patients in the control group (46%) suffered major complications. In each instance, the problem was a major pelvic abscess requiring reoperation, hospitalization, and intravenous antibiotics.

By comparison, only 12% of the patients treated with gracilis flap closure had a major complication; a statistically significant difference ($P = .028$). The perineal wounds of ten patients healed without evidence of postoperative complication (63%). The minor complication rate in the patients treated by flap closure (25%) was comparable to that of the control group ($P > .05$). Of the six patients who had a cutaneous paddle, one patient had partial necrosis of one skin edge. There were no wound complication-related deaths in our series (Table 2).

DISCUSSION

Complications arising from the perineal wound are a common source of morbidity following proctectomy. Most studies reported in the literature have looked at a heterogeneous population consisting of patients undergoing proctectomy for a variety of indications including ulcerative colitis, Crohn's disease, primary cancer, and recurrent cancer.[4,7,8,10,12,14] Huber reviewed a group of patients similar to ours with resection and IORT and experienced a 26% major wound complication rate and a 49% minor wound complication rate.

The gracilis muscle has provided a useful source of well-vascularized tissue for the irradiated, scarred, perineal wound. It is particularly successful when the cavity to be obliterated is relatively narrow and when the tissues are pliable. It is less helpful when the cavity is extremely large, as, for example, when the bowel has been retracted out of the pelvis with a synthetic sling to allow postoperative external beam therapy of the pelvis or when brachytherapy is contemplated contiguous to the flap itself. In the former situation, the muscle itself is not of adequate volume and the addition of a mid- to mid-distal skin paddle can be relatively tenuous. These flaps are very susceptible to vascular spasm, and the cutaneous paddle in particular cannot tolerate the slightest degree of vascular compromise. There are some variations in the major pedicle location that can prevent the introduction of all but a small portion of the distal muscle and tendon, which would prove to be inadequate. In these situations one must either evaluate the opposite gracilis or choose another option, e.g., the inferior gluteal artery-based posterior thigh flap or the inferiorly based rectus abdominis flap. The rectus flap, although it does provide a large bulk of healthy tissue, is not always available, and Loessin[10] reported a relatively high complication rate related to the transpelvic positioning of the rectus abdominis flap. Use of the gracilis avoids these problems. Use of a rectus abdominis flap also limits colostomy placement or resiting in the future should the primary site suffer from a significant complication (e.g., retraction or hernia).

TABLE 2. *Complications*

Technique	Major complication*	Minor complication†
Gracilis flaps	2/16 (12%)	4/16 (25%)
Primary closure	11/24 (46%)	5/24 (21%)

* Major infection requiring hospitalization, operation, or both, $P = .028$ by χ^2 analysis for flap vs. primary closure.

† Small sinus tract or subcutaneous abscess, P = nonsignificant.

Problems might occur with gracilis flaps where brachytherapy catheter insertion with postoperative afterloading is performed. Of our two patients with major complications following gracilis flap placement, one had brachytherapy with postoperative irridium afterloading. The gracilis muscle may have been compromised postoperatively by the radiation afterloading, as opposed to being placed in an operative field after all the radiation treatments have been completed.

Reports of the use of myocutaneous flaps for primary or secondary closure of perineal defects have been promising. Many of these reports refer to secondary reconstruction for nonhealing perineal defects.[10,12,14] Our institution has had extensive experience and success using gracilis myocutaneous flaps for pelvic reconstruction. For perineal wound closure, detractors of the gracilis muscle flap point to several disadvantages, such as inadequate tissue bulk and a limited arc of rotation.[9] However, the gracilis flap is an excellent option. We contend that most major infections involve the lower pole of the pelvic cavity and that entire filling of the pelvic defect is unnecessary. In addition, the use of the gracilis muscle flap as opposed to the rectus flap does not impede the subsequent creation of a colostomy site.

Anthony et al. identified three risk factors associated with delayed or poor perineal wound healing following rectal extirpation: radiation therapy; resection for recurrent cancer; and inflammatory bowel disease.[2] Our study focused specifically on patients undergoing primary reconstruction of the perineal wound with gracilis muscle flaps following abdominoperineal resection (APR) or pelvic exenteration and radiation therapy for recurrent carcinoma of the rectum. This population is susceptible to nonhealing of the perineal wound, and we have noted that nearly half of these patients suffered major wound-related sepsis following primary closure. With the immediate use of gracilis flap closure, we noted a 4-fold reduction in the incidence of major wound infection.

Our findings suggest that immediate pelvic reconstruction using the gracilis flap following proctectomy and irradiation for recurrent rectal carcinoma is an effective technique that significantly reduces the incidence of

major wound infection associated with perineal wound closure.

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