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# Repair of the Radiation-Induced Vaginal Fistula Utilizing the Martius Technique

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**The radiation-induced vaginal fistula is an extremely difficult rehabilitative challenge to the surgeon. Historically there has been a sense of frustration about prospects for success with these defects and many patients have been managed by either permanent colostomy or permanent urinary diversion. This report reviews a personal experience of 25 radiation-induced vaginal fistulas in 22 patients utilizing the Martius bulbocavernosus-labial fat flap technique. Successful closure was accomplished in 84.2% of the rectovaginal fistulas and 50% of the vesicovaginal fistulas. Only 1 patient required a second surgical effort for successful closure. There was no surgical mortality and no significant surgical morbidity. No patient with a rectovaginal fistula closure required subsequent colostomy for stricture. These results, coupled with the relative simplicity of the procedure, allow us to recommend this technique as first-line therapy for these difficult management problems. The majority of patients will be rewarded with successful rehabilitation.**

The radiation-induced vaginal fistula (rectovaginal, vesicovaginal, vesicourethrovaginal, or combined) poses one of the most vexing complications associated with radiation therapy of gynecologic malignancy. Most vaginal fistulas lend themselves to correction by the application of well-accepted surgical principles. Some fistulas are more complicated and, therefore, difficult to close. Fistulas are "complicated" by virtue of size, location, and associated tissue injury. Size is obvious, for the very large fistula becomes a technical problem by virtue of the necessity of very extensive mobilization of the tissue and concerns for potential lumen compromise. Location is a problem, for a fistula high in the vault may be relatively inaccessible. These 2 factors are combined with a very large defect of anterior wall, with loss of bladder neck, and voiding mechanisms potentially compromised, even if closure is accomplished; or a posterior defect that may involve associated rectal stricture and/or compromised sphincter mechanisms. The third major complicating factor is coincidental tissue injury. This is characteristic of a radiation-induced fistula, which introduces a most unfavorable setting for closure. The defect is often large and the perimeter of these sizable defects consists of tissue often rigid and fibrotic. There is a notable gradient of radiation injury with fibrosis, fixation of tissues, and associated poor vascularity. Closure of these types of defects by the usual techniques carries a high failure rate. Much the same may be said of the patient whose fistula (nonradiation etiology) persists after one or several prior closure attempts. The associated fibrosis and fixation may be severe, although not usually as profound as those seen with full irradiation.

Few surgeons will have more than an anecdotal experience with these defects. It was pointed out by Isaacs [1] that among 2,756 patients treated for cervical cancer by radiation therapy at the Radiumhemmett, Stockholm, only 9 vaginal fistulas were reported; and among 3,158 cases radiated for cervical cancer at the Roswell Park Memorial Institute, only 13 fistulas occurred. Less sophisticated radiation therapy might be anticipated to produce a larger fistula rate; and it has been clearly established that the combination of radiation therapy and hysterectomy increases the fistula rate by 5–10-fold [2–4].

The relative lack of experience of the individual surgeon with these injuries, coupled by the historic poor success of standard conventional closure tech-

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niques, has led to a sense of frustration. Frequently, permanent diversion, either by colostomy or by urinary conduit diversion, has been applied as definitive management of these defects. This sort of frustration was observed in a personal experience in 1966. The patient had an end sigmoid colostomy and mucous fistula as definitive management for a sizable radiation-induced rectovaginal fistula. She had been told that nothing else could be safely done, that she could certainly learn to live with her colostomy, and that she should be grateful that her cancer was cured! She was 30 years old, had been sexually active, and was resigned, although greatly distressed, to live with this fate.

This author's interest in the problem of the radiation-induced vaginal fistula began during fellowship training at the M.D. Anderson Hospital and Tumor Institute 2 decades ago. We did an analysis of that institution's accumulated experience with vesicovaginal fistula [5]. At that time, the largest experience was with either urinary conduit diversion or complete or partial colpocleisis. Urinary diversion was successful both from an immediate and a long-range view; but obviously, it was not without risks. The operation has an acknowledged spectrum of complications, and these are heightened by the fact that this involves surgery in an irradiated field. Particular attention must be made both to selection of the intestinal segment to be used as well as to the health and viability of the ureters. Colpocleisis was associated with a number of problems including incontinence; the need for second operations; reoccurring pyelonephritis, particularly in patients with some degree of obstructive uropathy, and the substantial risk of renal function deterioration; and, of course, loss of coital function. At that time, following our analysis of the clinical material, conduit diversion and colpocleisis were used more selectively, and there began an exploration of other vaginal approaches for fistula closure, particularly with the use of techniques to bring in a fresh blood supply.

Our interest in the problem of radiation-induced vaginal fistula was heightened shortly after joining the faculty at the University of Mississippi Medical Center in 1967. In the Gynecology Clinic were a number of patients with such fistulas. Some had been treated at the parent institution, others had been treated elsewhere in the state. Some had had colostomy or conduit diversion. For some patients (9 of 22), the fistula had existed for a number of years and they were being followed for evaluation of their prior malignancy, and simply suffering, or tolerating, their disability.

The literature contained a number of references to techniques for neovascularization and fistula repair. These included reports of the use of the rectus abdominus muscle [6], the omentum [7], the gracilis muscle [6, 8], the abductor muscle [6], the sartorius muscle [9], and a portion of the gluteus maximus muscle [10]. At that time the most frequently employed of these techniques was the gracilis muscle [6, 8]. It was generally referred to as the Ingleman-Sundberg technique, but there was actually a reference in 1928 to its use by Garlock in New York [11].

Use of the bulbocavernosus flap or labial fat pad method was introduced by Martius in the late 1920's, with his greatest experience with vesical fistulas. The Martius technique was introduced to the United States in the American translation of *Martius' Operative Gynecology* edited by McCall and Bolten [12]. This appeared to be an eminently reasonable approach. It was relatively simple, offered the most accessible of all sources of new blood supply, and our experience with the procedure has been most gratifying. Almost all but the most massive fistulas can be successfully closed, and an attitude of futility no longer seems reasonable.

## Preoperative Assessment

Many factors deserve consideration when deciding whether or not to attempt definitive fistula management, and in selecting the time and method of management. These include the size and location of fistula, the dose of prior radiation, the presence or absence of persistent radiation slough, the status of the bladder and the upper urinary systems, and the status of the rectosigmoid colon. Additionally, the risks of surgery to the patient (age, obesity, diabetes, heart disease, and other medical factors) all merit careful assessment. Liberal biopsy of the fistula margin, cystoscopy and proctosigmoidoscopy with biopsies if indicated, intravenous pyelography, barium enema, rectally and through the fistula, and occasionally fiberoptic proctosigmoidoscopy all may be helpful. Obstructive uropathy in a patient radiated for cervical cancer must be viewed as evidence of recurrent cancer until this has been excluded. Biopsy and palpation may not always be conclusive. A computed tomographic (CT) body scan with fine-needle biopsy may be helpful. Selective use of bulk retrograde pyelography may also be of value in assessing upper tract obstruction. Occasionally, a short period of observation will help to clarify the situation. Clearly, the presence of recurrent cancer should be known before fistula correction is planned.

Careful adherence to the following 3 steps is important in the preliminary evaluation:

(a) Recurrent or persistent cancer should be excluded. In addition to the factors outlined above, it

is worth mentioning that weight loss is often a misleading complaint. The systemic effect of profound radiation injury is remarkable, and significant weight loss was noted frequently among patients we have managed. (One patient weighed 120 lb when initially treated, dropped to 64 lb at the peak of her injury, and now weighs 137 lb some 20 years after primary treatment.)

(b) One must await resolution of the acute radiation injury. Evaluating the patient's symptoms such as tenesmus, pain, heavy mucous, or frequency, dysuria, hemorrhagic cystitis, and the like is helpful. In addition, the clinical appearance and consistency of the tissues certainly present distinctly different contrasts: the acute necrosis associated with the initial fistulization has a far different appearance from the "burnt out" fistula after a number of months of delay with its rigid, firm perimeter and smooth fibrosis and fixation. In most instances we delay fistula closure for approximately 1 year after fistulization. Our earliest closure was after a delay of 5 months. One must wait until the acute reaction subsides.

(c) We believe all rectal fistulas should have diversion of the fecal stream. The margin for error is probably small and complete defunctionalization with better immediate, as well as long-term, control of chronic infection in the adjacent tissues seems advisable. While a point has been made in the literature for double-barreled colostomy, we have generally employed a simple transverse loop colostomy and, in view of the success, have not altered that approach.

## Closure of the Fistula

We have emphasized that simply bringing in a source of new blood supply does not serve as a substitute for the proper surgical approach to fistula closure. The tissues must be carefully and completely dissected and mobilized. Simply "plugging" the fat pad into a defect will fail.

Certain technical aspects of the fistula closure perhaps bear stronger emphasis. Isaacs [1], in a discussion of our preliminary results, observed, "the reason . . . for success is most likely due to patience and fastidious handling of these delicate tissues at the time of repair . . . this probably has more to do with the results than the added blood supply contributed by the labial fat pad." I believe both are important and would reemphasize standard surgical principles for closure of a fistula or closure of a ruptured viscus. These specifically include a suture line without tension, the absence of infection, and a good blood supply.

Contemporary atlases of surgery from the European community describe circumcising the vaginal side of the fistula a centimeter or so away from the defect, mobilizing this tissue both centrally and laterally, and then turning this "collar" or "button" (attached centrally to the fistula margin) inward and approximating it as the first layer of closure. It would appear that this is a successful technique; our preference has been to excise the irradiated fixed fistula margin and remove this fibrotic fistula tract completely. One reaches fresher, healthier tissues and then wide mobilization is carried out. In view of the gradient of injury to these fixed radiated tissues, the separation of these planes often must be wider and more generous than with the usual fistula in otherwise healthy and more pliable tissues. Special care must be taken at the lateral margins because of the increased potential for troublesome bleeding. In instances in which hysterectomy has been performed, the mobilization of the cephalad portion of the defect often involves careful separation of bladder and rectal walls. We generally close the rectal wall transversely so as to avoid further lumen narrowing. The bladder defects are closed longitudinally with precise attention to location of ureteral orifices. Initial steps in rectovaginal fistula closure are illustrated in Figs. 1–4. The episiotomy is shown schematically only, and is laid open much more widely.

## The Martius Technique

### *Martius' Description of His Procedure*

"If this [routine closure] is not possible, an additional maneuver should be executed. This can be done by utilizing bulbocavernosus fat flap. Eighty-six and three tenths percent of 110 vesicovaginal fistulae in my department (some of them very extensive) have been cured with one or more operations. Follow-up of our material showed that 85% of the patients were cured with this procedure, whereas 88% were cured without it. The first group naturally deals with the most extensive cases, so that it seems certain that the additional procedure is of value. This type of plastic repair was devised by this author in 1928. In this operation a fat muscle flap is formed from one of the labia majora. It is about as thick as a thumb and as long as a finger and is left attached to a pedicle posteriorly. It contains the bulbocavernosus muscle. It is placed around the neck of the bladder and fixed on the other side with sutures. This is a very simple, safe, and rapid procedure if carried out as follows: after the fistula is dissected free and sutured, the right or left labium majus is palpated with two fingers, one of which is inside the vaginal wound and the other outside. A ridge of the thickness of the finger is clearly perceived which contains the bulbocavernosus muscle

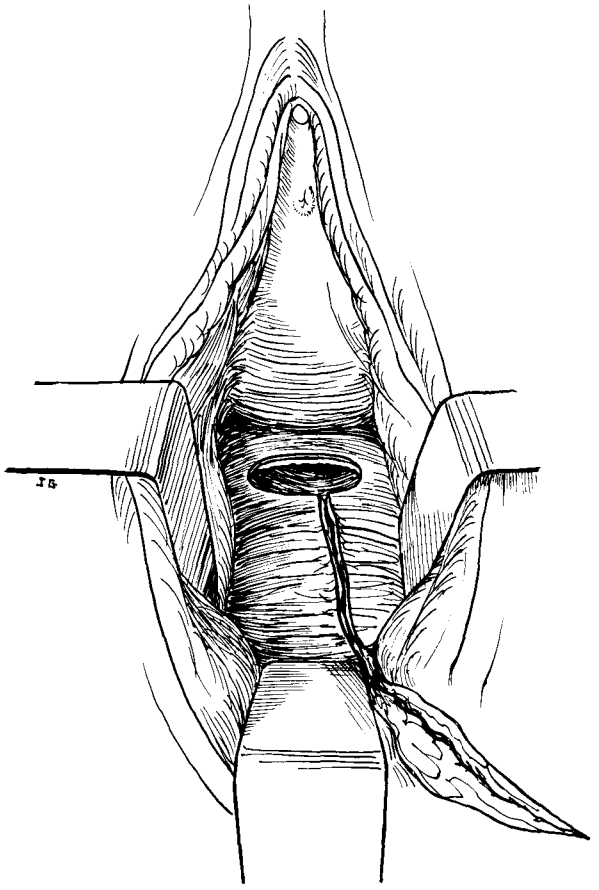

**Fig. 1.** A large rectovaginal fistula with vaginal and rectal walls firmly fused.

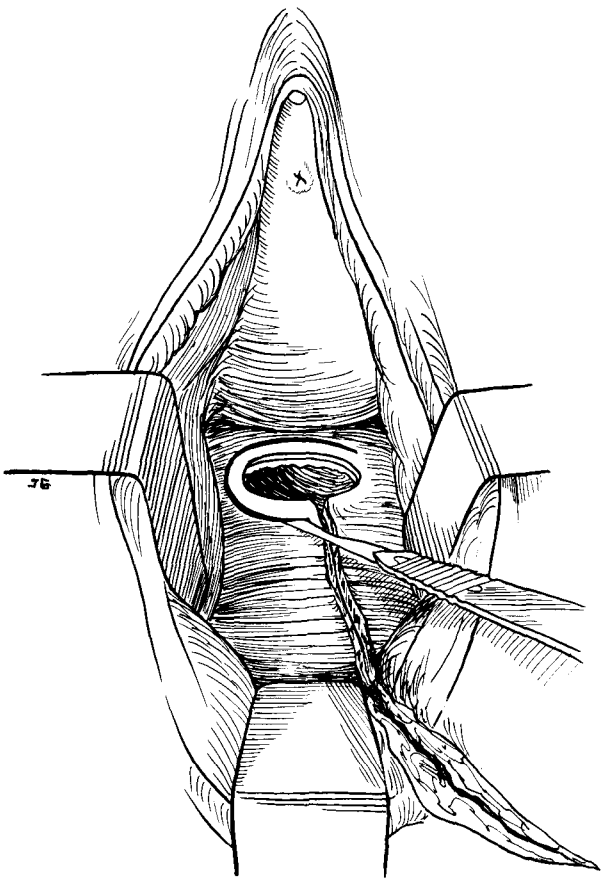

**Fig. 2.** The vaginal wall is sharply divided 0.5–1.0 cm from the fistula margin.

and the vestibular bulb. After this orientation, an incision of the skin is made in the ridge over the labium majus. From there a fatty tissue flap is dissected with a few strokes of the scalpel and scissors, the pedicle of the flap being left posteriorly. This flap contains the portion of the bulbocavernosus muscle which was palpated. Bleeding caused by dissection of the flap is controlled by immediate ligation. The skin between the vaginal wound and the labial incision is tunnelled from within by scissors with closed blades. The tissue flap is drawn through the tunnel and placed around the vesical neck and over the suture line of the fistula. The free end of the flap is sutured to the left side of the vaginal wound angle as high as possible. One or two catgut stitches are sufficient. Then the vaginal wound and the labial skin are closed. The pedicle flap is left attached posteriorly because the supplying vessels and nerves enter the musclature from behind and are therefore preserved. I wish to emphasize that the thick, fat flap and not the bulbocavernosus muscle is the most essential part in transplantation. It is of particular value because it provides an excellent pad and support. The fat flap is utilized as protective filling in all fistula operations where the suture line needs support and padding. In all cases where closing of the fistula is done under tension the bulbocavernosus fat flap should be used. This procedure is also valuable in large fistulae where little tissue is available, resulting in closure under tension and creation of a dead space between the fistula and the vaginal mucosa. The bulbocavernosus fat flap is interposed as a pad to fill this empty space" [12].

### *Author's Technique*

The medical illustrator's drawings demonstrate the sequence of steps in rectovaginal fistula closure. A generous mediolateral episiotomy is cut, sufficiently deep to assure adequate exposure. We carry the vaginal incision to the margin of the fistula and then accomplish wide mobilization, freshened edges, and fistula closure as described above. This, of course, applies to rectal fistula, but the deep episiotomy is usually necessary for exposure in these irradiated vaginas for good access to vesical fistula closure as well.

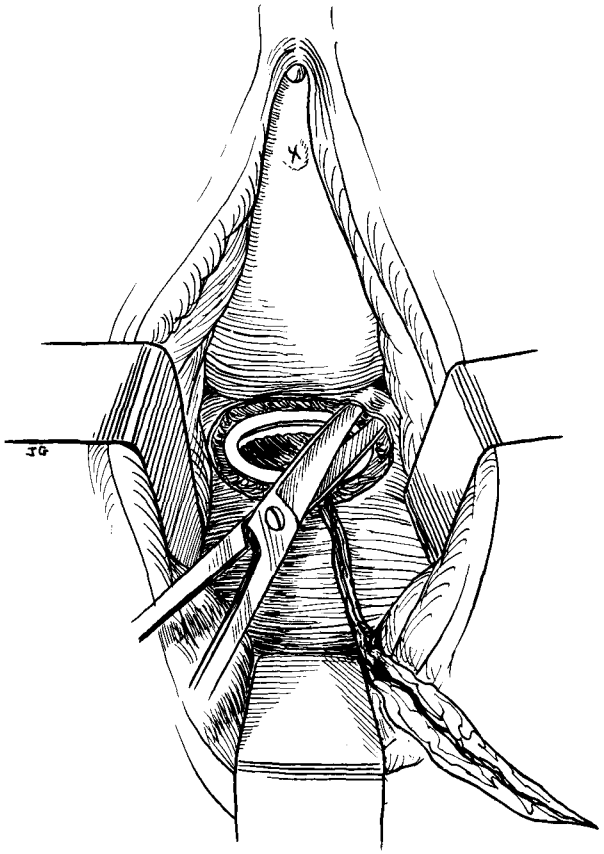

**Fig. 3.** The rectovaginal septum is opened and very widely mobilized cephalad, caudad, and laterally by careful sharp dissection.

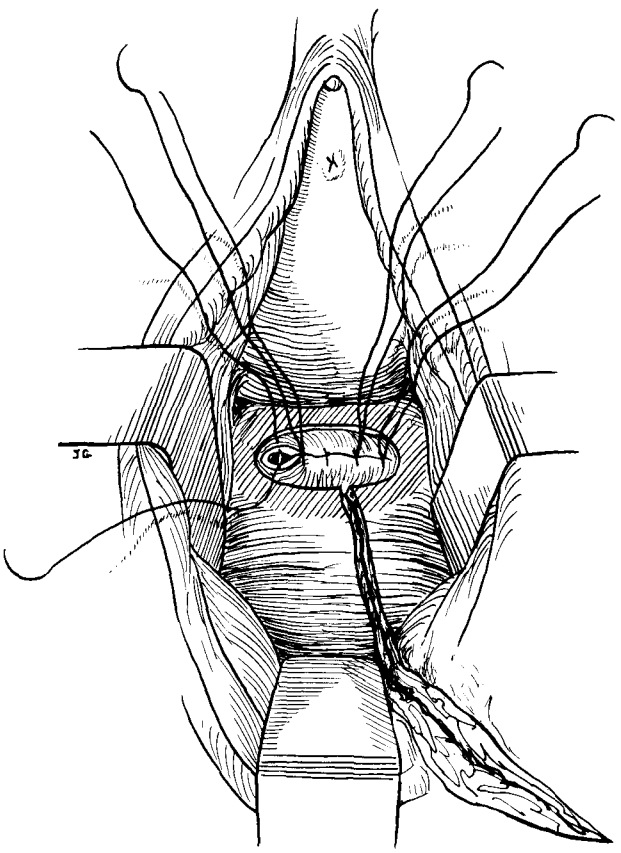

**Fig. 4.** The "collar" is excised and the freshened rectal wall approximated full thickness with through-and-through interrupted sutures of 0-0 chromic. The widely mobilized separation of vaginal and rectal walls is cross-hatched. Sutures are left long with needles attached for later use.

Our original experience closed the rectal wall defect with a full-thickness through-and-through closure utilizing interrupted 2-0 chromic catgut. When possible, with the vesical closure, we used continuous 3-0 chromic in the urothelium, reinforcing a second layer of near full thickness interrupted 2-0 chromic. We had not made a point of avoiding suture material within the lumen of the viscus.

The catgut ligatures at each lateral angle of the closure as well as 2 more centrally placed, are left long, with the needles intact, for later use in positioning the labial fat pad (Fig. 5). An incision is made centrally over the labia majus from the level of the mons pubis to the level of the posterior fourchette. By the use of thin skin flaps, the fat and fibromuscular content of the labia are freed to the depth of the fascia lata. The operator should not divide the pedicle graft until he/she has determined clearly that adequate length has been developed (Fig. 6). The point has been made by Martius that the pedicle is kept intact at the point at which the perineal branch of the internal pudendal artery enters it. However, contemporary experience suggests the pedicle may also be divided posteriorly, and kept intact anteriorly, to facilitate approximation for a vesicovaginal fistula. Adequate vascular supply is present from the mons via the external pudendal vessels and collaterals.

A generous subcutaneous tunnel is developed through which the pedicle (Fig. 7) may be drawn into the vagina to the site of the fistula closure (Fig. 8). The pedicle is then carefully brought under the skin through the subcutaneous tunnel, care being taken not to twist the base. The pedicle is divided with a length anticipated to be considerably more adequate than needed. After the labial fat pad pedicle is carefully placed over the fistula closure, excess tissue is excised. Bleeding points may be sutured ligated or secured hemostatically with electrocautery.

We then utilize the retained catgut sutures to transfix the pedicle graft at 3 or 4 sites (Fig. 9) with particular attention to the 2 lateral margins of the fistula closure. These ligatures are then tied very gently, to avoid constriction, to assure adequate placement of the graft well over the suture line of the fistula closure.

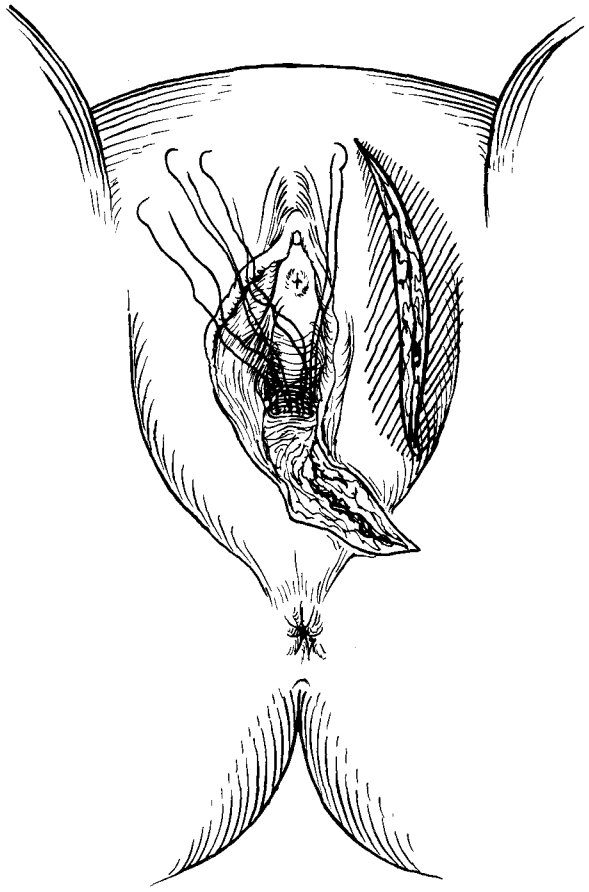

**Fig. 5.** Rectal wall full-thickness closure has been accomplished and the sutures are retained for later use. The skin incision over the mid-portion of labia majus is cut and the skin flap developed (*hatched* area) to develop the labial fat pad flap.

**Fig. 6.** The labial contents are developed utilizing thin skin flaps.

The widely mobilized vaginal mucosa is then carefully reappointed, with interrupted 2-0 catgut sutures. Defects in the closure on the vaginal side are preferable to closure under undue tension. The labial defect is approximated and the episiotomy closed. The labial defect is quite sizable, with considerable dead space, and we use Penrose drains in the episiotomy and the labial with vaginal and labial fluffed gauze pressure dressings for 48 hours, at which time the pressure dressings and drains are removed (Fig. 10).

### *Additional Comments for Vesicovaginal Fistula Closure*

It is obviously essential to identify ureteral orifices carefully, and this is often extremely difficult in heavily irradiated tissues. We have used methylene blue or indigo carmine excretion as an aid to identify ureteral orifices, if they are not readily apparent. Furthermore, while we do not use ureteral catheters in other clinical settings, we do utilize them in this situation prior to the wide mobilization of the bladder. It is occasionally necessary to reconstruct a missing portion of urethra and a tube plastic reconstruction is done developing flaps from the remaining anterior vaginal wall. One may develop a second layer from mobilization of the inner aspects of the labia minora. In dealing with combined vesical and rectal fistulas, both labial fat pad pedicles are used.

### Modifications of the Martius Technique

In 1969 Symmonds [13] presented a technique for urethral reconstruction when there was loss of the urethral floor and total urinary incontinence. Among the 20 patients, 6 were repaired utilizing his modification of the Martius technique which keeps intact the anterior skin of the fibro-fatty pedicle. This provides the same benefit in terms of support, obliteration of dead space, and neovascularization, but also provides a myocutaneous skin flap to bridge extensive loss of vaginal epithelium. His experience was updated with a report of 50 patients

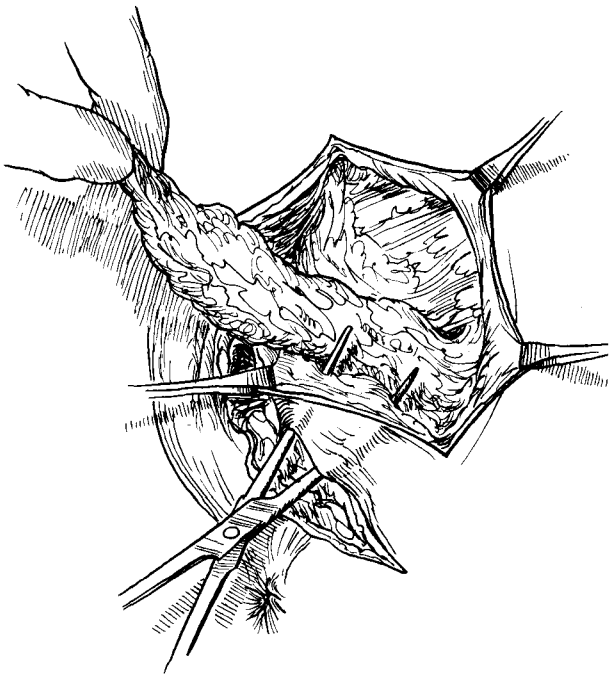

Fig. 7. A generous, non-constricting, subcutaneous tunnel is developed.

Fig. 8. The pedicle is brought into the fistula wound and excess length is trimmed after preliminary placement.

in 1978 [14]. Ten had the usual Martius bulbocavernosus muscle flap used, and 12 had his modification of the myocutaneous labial skin flap described in the earlier publication. Only 1 of these

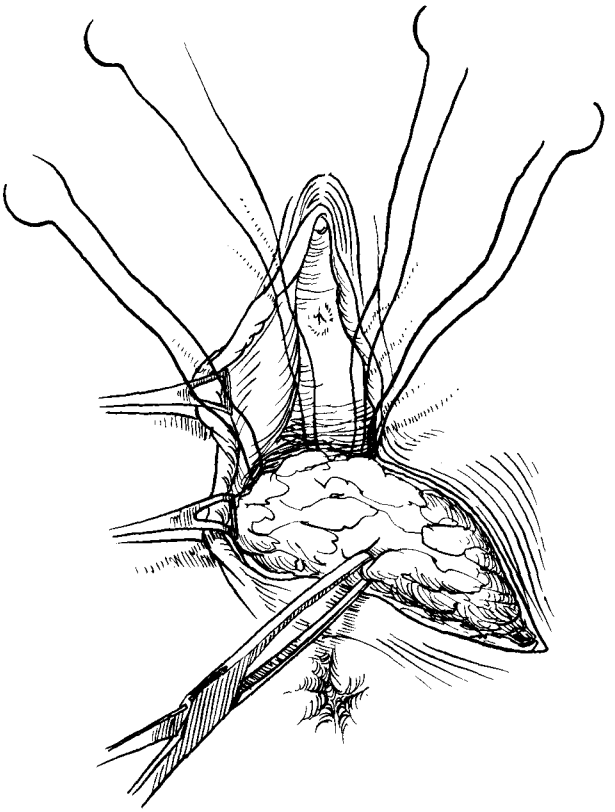

Fig. 9. The retained fistula closure sutures are then used to secure the labial pedicle over the fistula closure.

cases, however, was an irradiation injury. In 2 of our closures, this technique was employed.

Recently, Hoskins and co-workers [15] describe a further modification of the bulbocavernosus myocutaneous flap in 2 patients. In their technique, a smaller skin "island" was kept intact with the underlying fibro-fatty tissue. This skin "island" was cut to a size deemed adequate to bridge the loss of vaginal epithelium, as contrasted to Symmonds' procedure of maintaining all of the anterior skin of the pedicle intact. One of the 2 cases presented was an irradiation injury.

## Personal Experience

This is a personal review of utilization of the Martius technique in the repair of 25 radiation-induced vaginal fistulas in 22 patients. There were 16 rectovaginal fistula repairs, 3 vesicovaginal fistula repairs, and 3 patients each had combined vesicovaginal and rectovaginal fistula repair utilizing this technique. Of the 22 patients, 11 were black and 11 were white. The average age was 51.5 years (range 30–76) (Tables 1 and 2).

The 19 rectovaginal fistulas ranged from 1 to 5 cm with a mean of 3 cm. The 6 vesicovaginal fistulas ranged from 1 to 6 cm with a mean of 4 cm. The 2

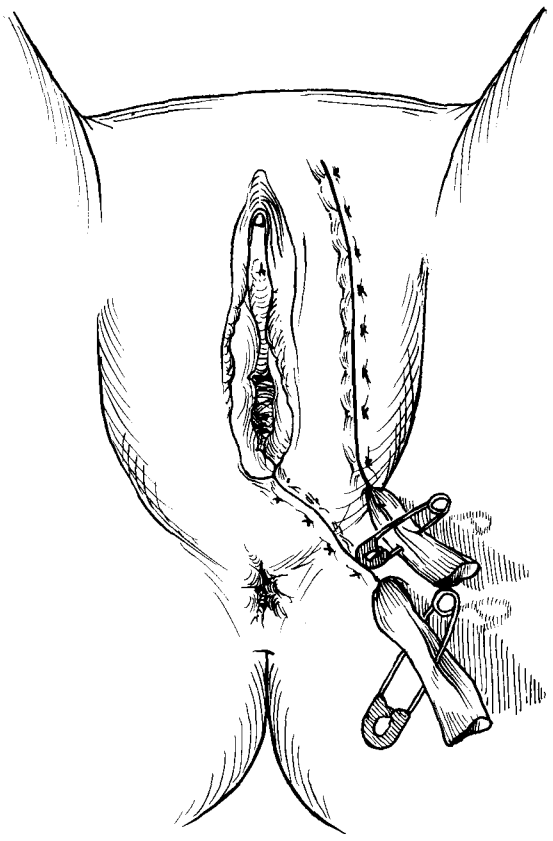

**Fig. 10.** The vaginal, vulvar, and episiotomy defects are approximated and drained.

**Table 1.** Personal experience.

| | |
|---|---|
| Total patients | 22 |
| Total fistulas | 25 |
| Rectovaginal fistula | 19 |
| Average size (cm, range 1–5 cm) | 3 |
| Vesicovaginal fistulas | 6 |
| Average size (cm, range 1–6 cm) | 4 |
| Average age of patient (range 30–76 years) | 51.5 |

**Table 2.** Results.

| | | |
|---|---|---|
| Anatomic closure | 19/25 | 76% |
| Rectovaginal fistula | 16/19 | 84.2% |
| Vesicovaginal fistula | 3/6 | 50% |
| Second vaginal operation | 1 | |
| Operative mortality | 0 | |
| Major morbidity | 0 | |
| Subsequent colostomy | 0 | |

large 6-cm defects involved a portion of urethra as well.

Nineteen of the patients had cervical cancer, 2 endometrial cancer, and 1 vaginal cancer. Eighteen of the patients were treated for primary disease and 4 for recurrent cancer. Five of the patients were treated elsewhere and seen at our clinic with the fistula. Of the total of 22 patients, 15 had radiation therapy only as primary treatment, 1 had radiation therapy for recurrent disease, 2 had radiation therapy primarily and had surgery for recurrence, 3 had combined radiation therapy and hysterectomy for their primary disease, and 4 patients had postoperative radiation therapy given when the conservative hysterectomy revealed unanticipated invasive cervical cancer in the specimen.

### *Dosimetry Review*

The records were reviewed both qualitatively and quantitatively to assess dosimetry considerations to determine if the radiation therapy dose administered was consistent with the general standards of the day and whether with retrospection, doses were excessive. Among the 6 patients treated outside our parent institution, records were incomplete in 3, dosimetry seemed appropriate in 1, and doses seemed high in 2 instances. Among the 16 treated at our parent institution, 9 appeared to have had appropriate therapy and 7, again on retrospection, appeared to have had excessive doses. In both a qualitative and quantitative sense, it is of interest to note that among the 22 patients, 6 had radium therapy with an Ernst applicator, acknowledged for high vaginal surface doses, and 2 had complex disease presentations treated locally with Bloedorn vaginal applicators with very high surface doses.

### *Interval to Fistula*

Of the 15 patients treated with radiation therapy only, the fistula developed from 5 to 120 months after completion of therapy for a mean of 20 months. If one deletes the fistula occurring at 10 years, the mean for these 14 patients is 12.9 months. Of the 3 patients receiving combined radiation therapy and postradiation hysterectomy, the range was 4–8 months with a mean of 6 months. For the 4 receiving postoperative radiation therapy for invasive cancer found after conservative hysterectomy, the range for fistulization was 9–17 months with a mean of 12 months. The 2 patients who had had full radiation therapy and then surgery for recurrence, both developed the fistula within the immediate postoperative period.

### *Biopsy of Radiation Necrosis*

Among the 22 patients, liberal biopsy of radiation necrosis antedating fistulization could be documented in 13 records. If one deletes the 2 immediate postoperative fistulas, the incidence of this form of manipulation was 65%.

*Results*

Sixteen of the 19 rectovaginal fistulas were successfully closed. One required a second procedure for successful closure. Two of the patients had had prior unsuccessful closure attempts using conventional techniques. The success rate for closure of rectovaginal fistulas was 84.2%. Of the 16 successfully closed, colostomy closure was carried out anywhere from 3 to 13 months later with an average of 6 months' interval. Four of the patients with anatomically successfully closure did not have their colostomy closed. One refused, 2 were lost to follow-up, and 1 very shortly thereafter developed massive progression of metastatic disease.

Three of the 6 vesicovaginal fistulas were anatomically closed. Two were functionally satisfactory and 1 maintained persistent incontinence in spite of subsequent unsuccessful Marshall-Marchetti-Krantz procedure, anterior colporrhaphy, and a Pereyra procedure. A fascial sling procedure was contemplated but not done. One of the patients experiencing unsuccessful closure had only minimal leakage and was unwilling to undergo any further surgery, moderately satisfied with the improvement. The anatomic success rate with the vesicovaginal fistulas was 50% (3 of 6), but the functional success was only 33.3% (2 of 6).

*Complications*

There were no postoperative deaths. The only postoperative morbidity incurred was occasional mild febrile morbidity and, of course, the lack of success of the cases that failed. None of the patients whose colostomy was closed refistulized or required colostomy for stricture. Incomplete information about sexual rehabilitation was available. Six of the patients reported postoperative sexual activity as occurring with varying degrees of satisfactory function. In 4 instances intercourse was not possible and in 12, the record not clear. Based on a review of the records, it appeared that only about half of the patient population had been sexually active.

*Arteriograms*

In an effort to define the altered course and perfusion of the perineal branch of the internal pudendal artery, selective hypogastric arteriograms were done on 2 patients early in our experience. However, these were not successful in defining any variations of these small terminal vessels.

*Undiversion*

One of the vesicovaginal fistulas successfully repaired was dealt with after ileal conduit diversion.

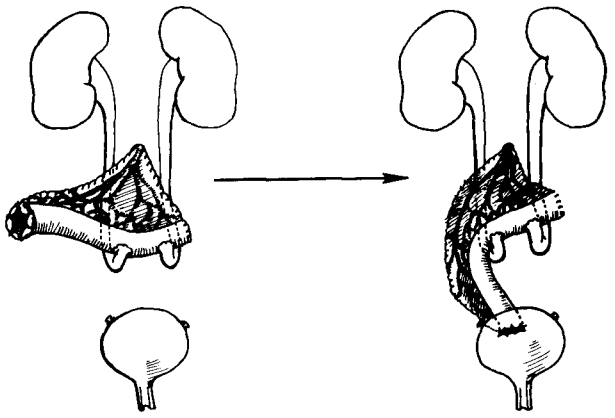

**Fig. 11.** Schematic drawing of the undiversion procedure, with take down of the ileal conduit and ileoneocystostomy, after successful closure of the bladder fistula. From Kwon, T.H., Boronow, R.C., Urinary undiversion: Use in management of radiation induced bladder fistula. Gynecol. Oncol. *8*:164, 1979. With permission from the publisher, Academic Press.

In the late 1970's the patient presented with a bulky so-called barrel-shaped stage IIB carcinoma of the cervix and was treated with external beam, one radium application and postradiation extrafascial hysterectomy. She developed a large vesicovaginal fistula that was felt too large to correct and ileal conduit diversion was carried out. At each follow-up clinic visit, the patient regularly asked, "When are you going to fix my bladder?" After about a year of her persistence, the situation was reviewed and she was willing to undertake an effort at correction. The large bladder defect was successfully closed using the technique described here. After extensive testing both for continence and for voiding function of instilled normal saline, the conduit was taken down and simply anastomosed side-to-side to the bladder dome. Follow-up bladder function and pyelograms were normal. This serendipitous experience with ileoneocystotomy raised the interesting question of the potential benefit of prior diversion (as we routinely do with colostomy for rectal fistula), particularly for very large difficult vesical fistulas. We had an occasion to treat a second case in a similar fashion with similarly good results [16]. This approach may represent just one more technique for the armamentarium of the surgeon dealing with these types of injuries (Fig. 11).

*Analysis of Failures*

While it is likely that in some instances we endeavored to correct the "uncorrectable," it seems reasonable to review the failures in search of any clues for further clinical guidance. Among the 4 rectovaginal fistula failures, 1 was subsequently

successfully closed. This patient had a large 4-cm defect, but was otherwise young and healthy. Following the Martius procedure there was only a pinpoint leak and this was actually corrected easily with a Latzko procedure with satisfactory sexual rehabilitation. A second patient, also anticipated to have a good result, had a 4-cm fistula that was closed satisfactorily in a technical sense, but broke down at 1 month. She was an obese diabetic and several months after the breakdown, metastatic cancer was evident. These factors may have been contributory. The other 2 patients with unsatisfactory results underwent surgery with guarded prospects for success. One had been treated with radiation therapy primarily and had an anterior exenteration for central recurrence and had one prior unsuccessful rectovaginal fistula repair attempt. The defect was large and very little healthy tissue could be mobilized. The other patient had huge rectal (4 cm) and vesicourethral (6–7 cm) fistulas with very intense radiation effect. She had had a conservative hysterectomy for invasive cancer followed by central recurrence 1 year later and then received heavy-dose radiation therapy at our institution. There was also very significant fibrosis in the anal sphincter as well. The latter patient probably should not have had this procedure. In the other case, it seemed reasonable to make the surgical effort.

Among the vesicovaginal fistula cases one, the combined fistula above, has been described. She is the patient mentioned earlier who weighed 120 lb when initially treated, dropped to 64 lb at the peak of her radiation injury, and now weighs 137 lb 20 years after her primary treatment. She manages her ileal conduit and colostomy quite satisfactorily. The second breakdown had combined rectal and vesical fistula and the rectal fistula repair was successful and her colostomy was closed. Prior to anticipation of the second effort for the small remaining defect in the bladder, metastatic cancer was documented. It is reasonable that a second procedure might have rendered this patient continent. The third anatomic failure was a 6-cm defect that leaked postoperatively. She was 70 years old, was content to live with the leakage since it represented a clear improvement over her earlier status, and she died of other causes within 1 year. One of the anatomic successes, but functional failures was the case illustrated in Fig. 12. A large 6-cm urethrovaginal fistula that was anatomically intact, but functionally unsatisfactory despite subsequent surgical efforts as described above.

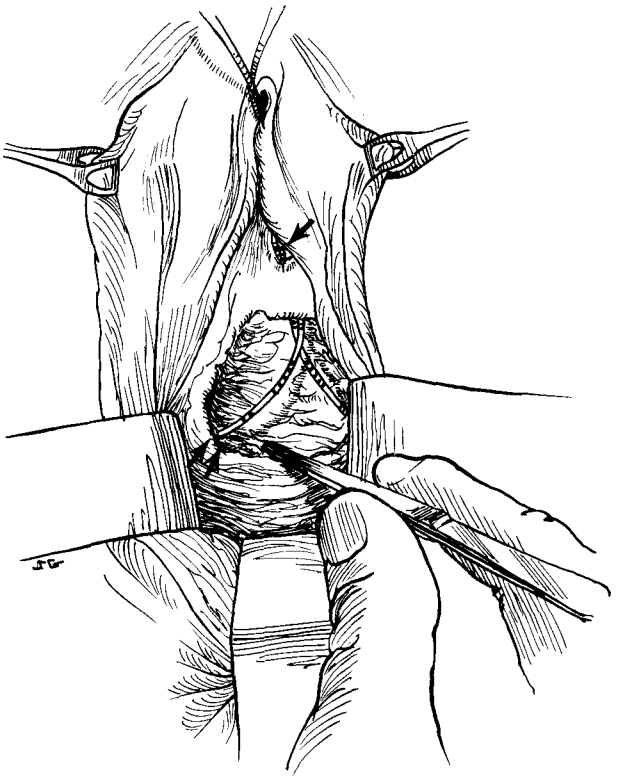

**Fig. 12.** Artist's reproduction of an actual Kodachrome® of a large urethral vaginal fistula that was anatomically closed with the first effort; a cynecystogram was done with spontaneous voiding, the ability to discontinue the stream, and satisfactory emptying. Nevertheless, in time, in spite of anatomic integrity, the patient became totally incontinent as described in the text.

## Discussion

A modest literature has accumulated in the last several decades on the use of the Martius procedure. The most experience reported has not, however, been associated with radiation injury. Webster and associates [17] reported 11 urethrovaginal fistula repairs, 5 of which were successfully closed using the Martius technique. None were radiation-induced fistulas. Steg and Chiche [18] report 75 vesicovaginal fistula repairs and the Martius technique was employed in 11 patients with 10 successes. Several had had preoperative irradiation before hysterectomy. Patil et al. [19] report good results using the Martius procedure in 11 patients, but none had radiation therapy. An earlier report of Betson [20] utilized the Martius technique primarily for increasing bulk and support in 4 cases of stress incontinence and for 5 cases of vesicovaginal fistula, 2 of which were associated with radiation therapy. In a large experience of surgical management of rectovaginal fistulas and complete perineal tears (but none associated with radiation therapy), Hibbard [21] reported 3 successful cases utilizing the Martius graft, and preoperative colostomy was not required. The only sizable experience with the Martius procedure for radiation injury was reported

recently by White and associates [22] in which 11 of 12 patients with radiation induced rectovaginal fistula were successfully repaired. Two patients required 2 operations.

Bricker et al. [23] have called attention to the fibrotic web in the posterior rectum at the level of the fistula as a source of potential lumen compromise, and as one of the obstacles overcome by Bricker's elegant transabdominal approach to the difficult radiation fistula, as described elsewhere in this symposium. We have frequently observed this narrowing and in some instances it was quite prominent. We concede the innocence of inexperience in our initial case material: one of the first patients closed using our technique was one with a very significant web, and at the completion of the procedure the lumen only admitted one finger, and snugly. This was anticipated prior to closure and the patient was warned that the damage might not allow adequate bowel function and colostomy might later be required. To this author's pleasure—and to some extent, surprise—bowel function was adequate and has remained so. Frequently, the surgeon will examine a patient after a low anterior resection, either hand sewn or by autostaple instrumentation, and find an unanticipated degree of narrowing at the anastomotic site. In time, these relative strictures dilate to some extent, but often remain relatively narrow. Clearly, the fibrosis in the irradiation injury does not improve appreciably with time, but in our experience, the relative lumen compromise of this web has not deterred us from following through with the procedure. In all instances normal stool evacuation occurred and none have required subsequent surgery. It seems reasonable to postulate that improvement of the anterior rectal wall with the technique we describe subsequently allows more pliability and "give" in these tissues rather than actually introducing further lumen compromise. Indeed, Patchell and Bradford [24] report 2 cases of rectal stricture that had required colostomy and were successfully repaired by use of the Martius technique with reconstruction of the anterior rectal wall.

Sexual rehabilitation among those previously sexually active has been reasonably satisfactory. Sexual dysfunction may be only in part a result of the surgical technique per se. Other factors include the previous sexual activity and motivation of the patient as well as the profound compromise of tissue in the area secondary to the radiation insult itself.

The absence of surgical mortality and the negligible surgical morbidity coupled with relative ease with which the procedure can be accomplished and the relative success that it produces have been gratifying, and allow us to recommend this procedure as first-line therapy for these difficult management problems. Frustration and abandonment to permanent diversion are not justified until all efforts have been expended. This procedure seems well suited for the first surgical effort; in the majority of instances these patients will be rewarded with successful rehabilitation.

Our success with the vesicovaginal fistulas by no means equal the success with rectal fistula closures. Yet as mentioned, one anatomic success was a functional failure that might conceivably have lent itself to a sling procedure, but the patient was unwilling to pursue this.

When one adds the 84.2% success rate with rectal fistulas and the 50% anatomic success rate with the vesical fistulas, this results in an overall anatomic success rate of 76% and, correcting for the functional failure of the one vesical closure, the functional success rate of 72% with these difficult fistulas. We had identified 3 other patients with small defects that appeared to lend themselves to a high confidence of success with second closures, which were not done for reasons of noncompliance or metastatic cancer. Had that been accomplished (admittedly conjecture), the anatomic success rate would have been 21 of 25 or 84%.

**Résumé**

La cure des fistules vaginales secondaires à l'irradiation est particulièrement difficile. Dans le passé en raison des mauvais résultats obtenus par les différents procédés de fermeture de la fistule, les chirurgiens eurent souvent recours en désespoir de cause soit à la colostomie, soit à la dérivation des urines. Cet article fait état d'une série de 25 cas de fistules vaginales secondaires à l'irradiation qui furent observées chez 22 malades et traitées par l'opération de Martius employant un lambeau graisseux provenant de la région labiale bulbocaverneuse. La guérison fut obtenue dans 84.2% des cas de fistules rectovaginales et 50% des cas de fistules vésicovaginales. Une seul opérée fut l'objet d'une réintervention. La morbidité fut peu importante et la mortalité nulle. Il ne fut jamais observé de sténose postopératoire qui aurait imposé une colostomie. Ces résultats et la simplicité relative de l'intervention permettent de considérer cette technique comme l'opération de choix d'autant que le réhabilitation de la malade est toujours satisfaisante.

**Resumen**

La fístula vaginal inducida por irradiaciones significa un desafío de rehabilitación particular-

mente difícil para el cirujano. Históricamente ha ocurrido un sentido de frustración sobre las perspectivas de éxito en el manejo de esta lesión, y muchos pacientes han sido manejados con colostomía o derivación urinaria permanentes. En este informe se revisa la experiencia personal con 25 fístulas vaginales inducidas por irradiación en 22 pacientes, utilizando la técnica del colgajo bulbocavernoso-labial de Martius. Se logró el cierre exitoso de la fístula en el 84.2% de las fístulas rectovaginales y en el 50% de las fístulas vesicovaginales. Sólo una paciente requirió un segundo procedimiento quirúrgico para el logro del cierre. No se presentó mortalidad quirúrgica y no hubo morbilidad quirúrgica de significación. Ningún paciente con la fístula rectovaginal ya cerrada requirió colostomía ulterior por estrechez. Estos resultados, junto con la relativa simplicidad del procedimiento, nos permiten recomendar esta técnica como una modalidad terapéutica de primera línea para estos problemas de difícil manejo. La mayoría de las pacientes se verá recompensada con una exitosa rehabilitación.

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