Abdominal Sacral Resection of Locally Recurrent Rectal Cancer

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Local recurrence of rectal cancer develops in the posterior bony pelvis as an isolated event in about half of the patients with recurrence. Although radiation can palliate sacral root pain, the disease is usually progressive and is rarely amenable to conventional resection. We have adapted a surgical technique usually used for primary sacral tumors, which permits a complete *en bloc* excision of recurrent rectal cancer in most instances. This approach consists of a laparotomy with pelvic dissection and mobilization of structures to be resected. The patient is repositioned prone and the posterior pelvis (sacrum and side walls) is then resected with preservation of appropriate nerve roots of the posterior pelvis and the sciatic nerve. Reconstruction is done with muscle and skin flaps. We have done 21 such procedures, of which, 11 were for pelvic recurrence of rectal adenocarcinoma. Seven patients had resections for cure and four had palliative resections of fungating or infected tumors. All but one patient was postabdominal perineal resection and nine patients had been irradiated (3000–9000 rads). Two patients had received up to 9000 rads in separate courses (external beam in one and interstitial radiation in the other). The posterior extent of resection was S1–2 to 5 in six patients; S3 to 5 in three patients, and S4–5 in two patients. Anterior exenteration was performed in three patients and three patients had additional resection of other organs. In the curative resection group, three patients are living free of disease at six, ten, and 52 months, and one patient was NED at 60 months, but has again had tumor recurrance and is living with disease at 65 months. One patient died of disease at 13 months and one patient died of a pulmonary embolus following resection for ureteral obstruction at five months. One postoperative death occurred from a cerebrovascular accident at 52 days. In the palliative resection group, three patients survived with relief of local tumor symptoms four, eight, and 12 months. One patient who had received a total of 9000 rads developed flap necrosis, small bowel fistula and died 60 days after resection. Although this is a small series, it suggests that abdominal sacral resection of locally advanced pelvic cancer is feasible and may provide good palliation in most and possible cure in some patients who develop recurrence after primary resection of adenocarcinoma of the rectum.

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LOCAL RECURRENCE IS the most common type of failure following surgical resection of rectal cancer.[1–7] It occurs alone in about 48% of the patients and in combination with recurrence at other sites in over 90%, according to the second-look data.[4] The sites of involvement may be diffuse and cover the entire pelvic floor, or they may be localized to discrete areas, either anteriorly with involvement of bladder, distal ureters, prostate, vagina and uterus, or posteriorly and laterally with involvement of the sacrum and pelvic side walls and more proximal ureters (Fig. 1). Treatment is usually palliative only, and consists primarily of radiation therapy complemented in many cases with chemotherapy.[8] Occasionally, fulguration and cryosurgery are performed for local control of tumor in the perineum or intraluminal tumor in the rectum. Although reresection of early recurrence after low anterior resection is occasionally possible,[9–11] rarely is it possible to do an adequate curative reresection after abdominal perineal resection (APR).[9,11,12] Occasionally, pelvic exenteration is possible for recurrent lesions limited to anterior pelvic structures *i.e.*, bladder, prostate and female pelvic organs, but not for deeply invading posterior lesions, which are fixed to the pelvic side walls and sacrum. Although many large, relatively immobile pelvic tumors can be resected by the intra-abdominal approach, this is not sufficient for deeply invading and recurrent rectal cancer, which is fixed in the true pelvis. Many of these tumors would be amenable to resection by means of the combined abdominal sacral approach.

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Surgical approaches to tumors of the retrorectal or sacral regions have been well described.[13–19] In general, these were bone or soft tissue tumors limited to the sacrum which were well localized in the presacral space and did not extend to the rectum or other pelvic viscera. Resections as high as the S1–S2 interspace have been performed without incurring musculoskeletal disability.[18] Although there is serious bladder and anorectal dysfunction after resection at that level, it is manageable. For resection levels limited to S3–S4 there are no major problems with bladder or anorectal function.

Historic Perspectives of Sacral Resection

Almost all of the reports to this author's knowledge, have dealt with the use of major pelvic resections in the treatment of sarcomas or other mesodermal tumors of bone and soft tissue.[13–17,20–23] Aside from the curative results on the tumors *per se*, most of these reports have raised questions about three basic areas of concern: 1) musculoskeletal stability and neuromuscular function; 2) bladder function; and 3) anorectal function. In addition, sexual function has been addressed in the highly detailed studies of Gunterberg.[13–15]

Although Pearlman and Friedman reported instability and collapse of the lumbar spine with resections above S3, these sequelae have not been observed by others who have removed the lower four segments of the sacrum and even part of the first sacral segment.[18] Dislocation of the pubic symphysis, which occurred in one of MacCarthy's patients, may be a rare consequence.[22] Wilson has described unilateral resection of the upper part of the sacrum, including the articular surfaces of the sacroiliac joint with bridging of the gap with bone grafts from the posterior third of the ipsilateral ilium.[13] Additional problems secondary to resection of sacral nerves have also been pointed out. Varying amounts of urinary and anorectal dysfunction have been reported. Patients with bilateral loss of sacral nerves at the level of S1 have, generally, had severe urinary bladder dysfunction including varying degrees of incontinence and bladder weakness.[16,18,21,24] This dysfunction can often be com-

TABLE 1. *Abdominal Sacral Resection for Pelvic Recurrence of Rectal Carcinoma (Resection for Cure)*

Patient	Age/ Sex	Init. Rx. Stage	Date	Site of Recurrence, Date, Free interval (FI)	Radiation	Extent of Pelvic Resection of Sacrum & Soft Tissue; Date	Follow-up Status
S.G.	67F	APR Dukes' B	3/64	Pelvis, post sacrum, post perineum 1968 (FI-4 yrs)	6000 rads regression Recurred 1974	Massive tumor over sacrum, buttock. Resected S2–5_1, coccyx & soft tissue (11/75)	NED 2/77 15 mos., 3/77 CEA 18 ng/ml, Resected flap recurr., 6/79 Resect. local pelvic recurr., NED 12/80 61 mos., Biopsy of Recurr. Adeno CA hip-buttock 2/81
N.D.	57M	APR Dukes	4/74	Pain, mass in perineum, pelvis fixation to sacrum 4/76 (FI-2 yrs)	3000 rads pain relief	S3–5, coccyx, perineum	11 mos., flap recurr., 13 mos., DOD
J.G.	46F	none (Duke's B)		Unresectable large primary rectal cancer invading pelvic floor, side walls, sacrum (FI-none)	3000 rads pain relief	Rectum, sacrum S2–S5, coccyx, perineum 1/77	NED 4/81, 51 mos.
L.S.	73F	APR Dukes' C	4/77	Pelvic recurr. Pain, parasacral tumor 4/79 (FI-2 yrs)	4000 rads pain relief	Post.-lat. pelvis S2–S5, hysterectomy, hemivaginectomy	Expired at 50 days, sepsis, renal failure
C.H.	61F	APR Dukes' B	11/76	Pelvic recurr. pain in buttock, post. thigh, retrovesical mass 9/79 (FI-34 mos)	5000 rads	Sacrum S1–2–5, pelvic side walls, TAH, BSO, 10/79	6 mos. partial ureteral obst. resected pelvic recurr. ileal conduit. Expired from pulmonary embolus
L.G.	62M	APR Dukes' B2	3/77	Pelvic recurr; pain, retrovesical mass, CEA 13.6 7/78 (FI-16 mo)	5000 rads	Sacrum 2–5, prostate, bladder, ileal conduit, pelvic LN diss. (2 stage) 7/80	10 mos. NED
J.Q.	57M	APR Dukes' B2	12/77	Pain, pelvic recurr, 17 lb wt. loss, pelvic mass 1/80, 25 mo. increased CEA	5000 rads	Sacrum S1–5, bladder, pelvic LN diss. (2 stage) 9/19/80	6 mo. NED

TABLE 2. *Abdominal Sacral Resection for Pelvic Recurrence of Rectal Cancer (Palliative Resection)*

Patient	Age/ Sex	Initial Rx. Stage	Site of Recurrence, Date Free Interval (FI)	Radiation	Extent of Pelvic Resection of Sacrum & Soft Tissue; Date	Follow-up Status
E.H.	65F	APR, BSO, Excis. of liver metastases, Dukes' D 4/75	Saccrococcygeal carcinoma with abscess-posterior cutaneous fistula, liver mets. 12/75 (6 mos)	5000 rads	Sacrum (S3–5), coccyx perineum, vagina 1/9/76	12 mos. DOD
J.M.	56F	APR 1973, Dukes' C	Carcinoma of perineum with fistula into sacrum pelvic mass, liver mets. 2/76, CEA 280, 30 mos.	4100 rads	Sacrum ($S5_1$), coccyx perineal sacral abscess fistula 3/76	4 mos. DOD
W.F.	39M	APR 4/76, Dukes' C, post-op 4500 rads	Posterior pelvic floor, perineum, large necrotic ulcer extending into sacrum, liver mets. 12/76 (8 mos)	Interstitial radiation ~4500 r. (1/77)	Sacrum (S4,5), coccyx, perineum 4/77	8 mos. DOD
O.B.	55M	APR 11/75, Dukes' C2 11/25 LN+, invaded prostate	Extensive carcinoma of posterior pelvis, mass involving bladder, prostate 1/78 (27 mos)	9000 r. (in separate courses)	Pelvic floor, side walls, sacrum (S2–5) coccyx, bladder, prostate, perineum, ileal conduit	2 mos., died of renal failure & sepsis, delayed hemorrhage

pensated by intermittent abdominal wall contraction and external abdominal wall pressure. Three such patients reported by Localio apparently had "satisfactory function."[16] Two of his patients had cystometric examinations which showed "good emptying but hypotonicity." One of MacCarthy's patients who had resection of S3, 4 and 5 bilaterally had satisfactory urinary control, but could not feel the urine being voided.[22]

Anorectal function in the eight patients reported by Gunterberg has been described as being satisfactory in four patients and poor in two patients who were managed by a constipating diet.[13] The remaining two patients required a colostomy. The best overall study of the problem is that by Stener and Gunterberg who reported detailed studies of urinary bladder function, anorectal function, and sexual function in a group of ten patients who had had high sacral resections for sarcoma.[18] We have previously reported our experience with the abdominal sacral resection in the management of selected patients with locally extensive epidermoid carcinoma of the anorectum which involved the perineum, posterior pelvis and pelvic sidewalls.[19] This report deals with an effort to surgically resect pelvic recurrence of rectal adenocarcinoma using principles developed for resection of primary sacral tumors.

TABLE 3. *Pelvic Recurrence of Rectal Carcinoma (Radiation Factors)*

3000 r	2 pt
4000 r	2 pt
5000 r	4 pt
6000 r	1 pt
9000 r*	2 pt

* In two Separate Courses.

Materials and Methods

There were 11 patients with advanced rectal adenocarcinoma of whom ten had locally recurrent carcinoma in the posterior pelvis following previous abdominal perineal resection. One patient had a very

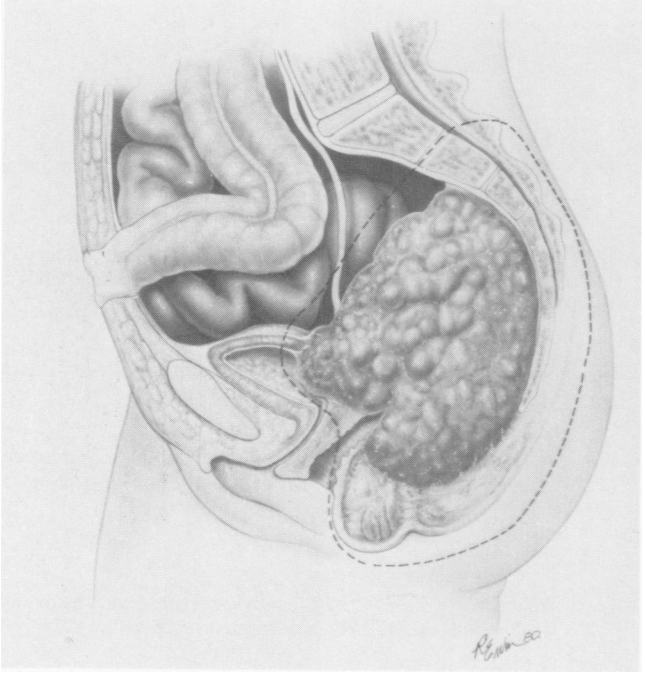

FIG. 1. Recurrence of cancer in the pelvic area following abdominal perineal resection frequently involves the posterior pelvis and is not amenable to conventional intraabdominal resection technique.

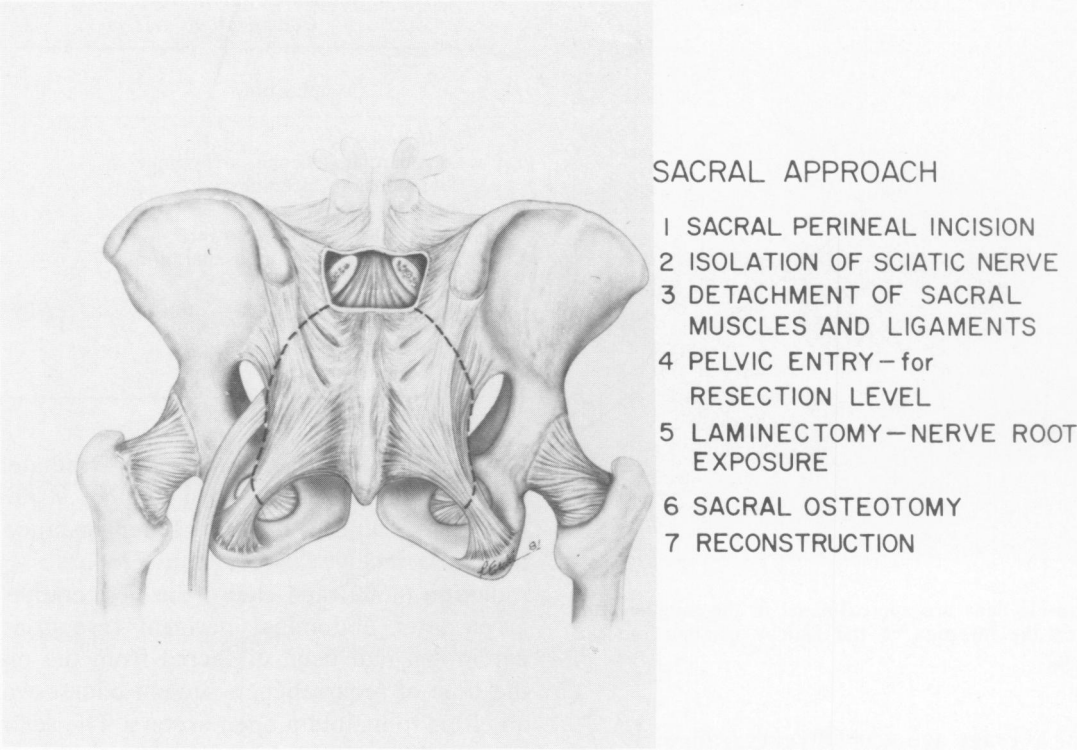

FIG. 2. The posterior approach to sacral resection is schematically outlined.

large primary cancer fixed to the sacrum and pelvic sidewalls which was considered unresectable by conventional techniques. Six patients underwent operations at Memorial Sloan Kettering Cancer Center and five underwent operations at the University of Virginia Medical Center. Seven patients underwent curative operations (Table 1) and four patients had palliative resections (Table 2). There were five males and six

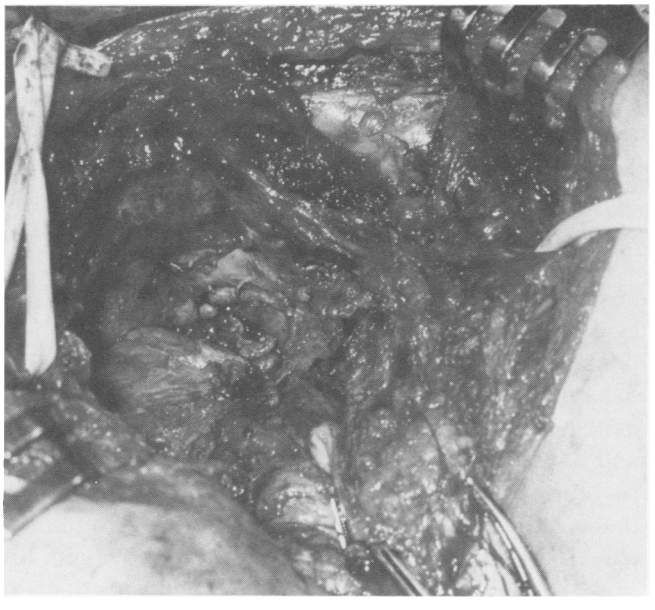

FIG. 3a. An operative picture showing the postsacral resection view and specific features: the laminectomy above the line of resection, the resection line through the sacroiliac joints; the tapes outline the protected sciatic nerves. The posterior aspects of the common iliac vessels are seen in the depths of the wound.

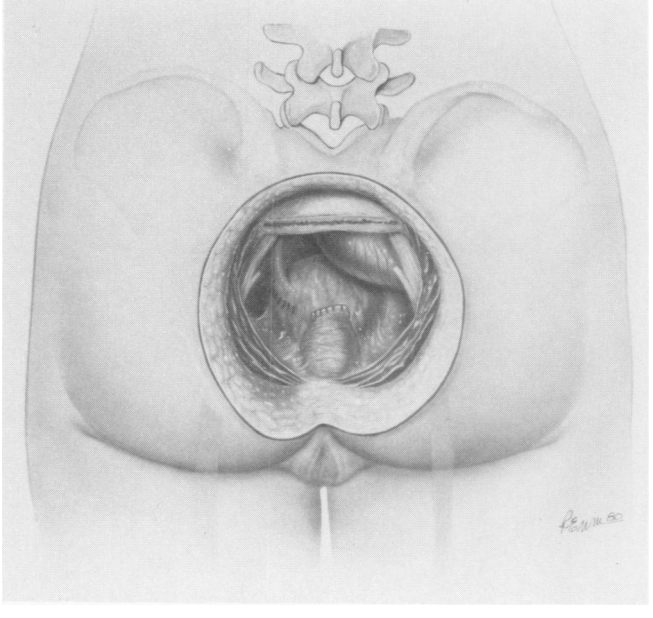

FIG. 3b. The operative defect after sacral resection. Here the bladder and anterior vaginal wall are retained.

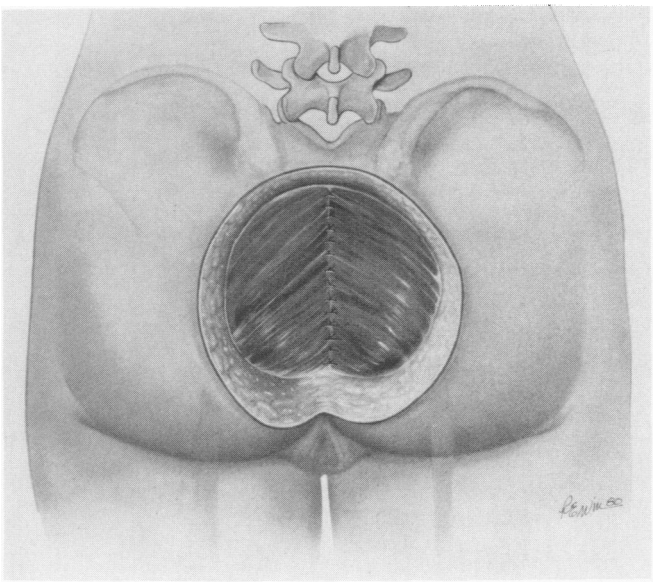

FIG. 4. The muscle flaps are approximated in the midline after laterally incising the insertion of the gluteus maximus on the greater trochanter.

females, their average age was 58 years (range: 39–73 years).

The initial stage was Dukes' B in four patients and Dukes' C in four patients. One patient was staged as Dukes' D (solitary liver metastasis) and in two patients the primary stage was unknown. The average interval in which the patients were free from disease was 27 months.

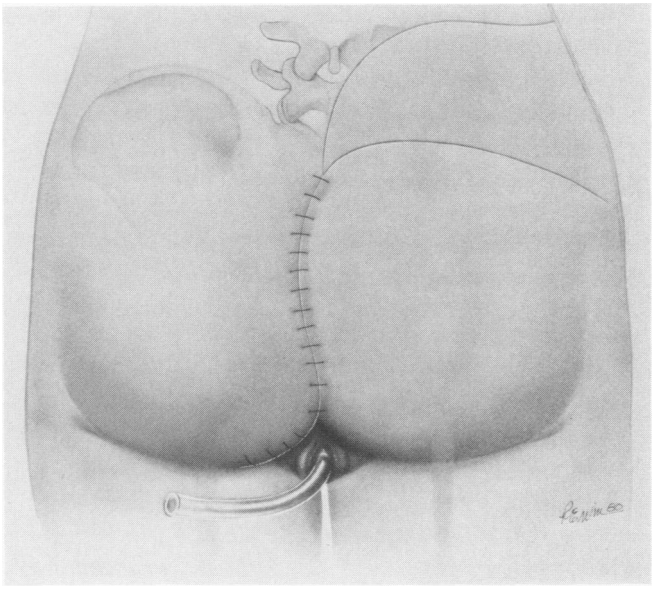

FIG. 5. Skin flaps are rotated as needed and a skin graft may be required at the donor site of the rotated flap (upper shaded area on right).

TABLE 4. *Abdominal Sacral Resection (Postoperative Complications—11 pts)*

Complication	Number of Patients
Cardiovascular	
myocardial ischemia–arrhythmia	1
hypotension–bleeding	1
Sepsis–abscess	2
Fistula–bladder–small bowel	2
Wound breakdown–flap separation	5
Bowel obstruction	1
Deaths	
Sepsis–renal failure (60 days)	1
CVA (52 days)	1

All patients had been previously irradiated in doses ranging from 3000 rads to a total of 9000 rads (in 2 patients) (Table 3). In the latter instance, one patient had received two separate courses of external radiation (4500 rads each); the first course had been given after abdominal perineal resection in which carcinoma had been dissected from the prostate. At the time of recurrence, a second course was given in an effort to maintain open ureters. The second patient had received 4500 rads as part of an adjuvant program in conjunction with 5-Fluorouracil and Methyl CCNU chemotherapy. At the time of recurrence in the perineum, an interstitial implant device was inserted into the perineal mass and radon seeds were inserted giving a local dose of 4500 rads. In both of these patients, there was tumor regression for a limited time but recurrence rapidly supervened.

Surgical Technique

The abdominal sacral resection requires a two-part approach. The abdominal part consists of exploration with careful examination to exclude liver metastases, or signs of extrapelvic spread. It is important to exclude subtle evidence of multiple liver metastases, serosal seeding, or extrapelvic nodal metastases (aortoiliac or external iliac). These would mitigate against obtaining a truly curative resection by abdominal sacral removal of pelvic recurrence. The hazards of the procedure would outweigh potential benefit. The next step is to carefully pack the bowel and confine it to the middle and upper abdomen. Dissection is begun of the lower aortoiliac tree and continued along the hypogastric artery and vein and includes the obturator nodes. These node packets are sent separately for pathologic diagnosis (usually permanent section unless large suspicious nodes are encountered). Extensive nodal involvement in the lower pelvis would generally preclude continuing with the resection. The finding of easily dissectable,

TABLE 5. *Urinary Function (Postsacral Resection)*

Resection Level	Patient	Bladder Function		Urinary Continence (0–4)	Function Voiding (0–4)	Catheter Required
		Residual	Detrusor			
S2-5	J.G.	↑↑	↓↓	3+	3–4	No
S2-5	C.H.	↑↑	↓↓↓	0–1	1	Yes
S3-5	S.G.	↑↑	↓↓	3	3–4	No
S4-5	E.H	↑	↓	2	2–3	No
S4-5	W.F.	↑↑	↓	2–3	3+	Turp-No
S-5	J.M.	↑↑	↓↓	0	1+	Yes

Residual: ↑ ≥ 100 cc; ↑↑ ≥ 200 cc; ↑↑↑ ≥ 300 cc; detrusor: ↓ reduced; ↓↓ marked reduction; ↓↓↓ no activity.

though enlarged, obturator nodes would not preclude resection. If the ureters or bladder are found to be involved and the posterior pelvic tumor is considered resectable then an ileal conduit is formed. If by chance a previous anterior resection has been performed, an end sigmoid colostomy would be performed. The divided rectum (usually using the stapler) would be left in the pelvis.

Pelvic devascularization is accomplished by bisecting and suture ligating the hypogastric artery and vein. Additional branches are bisected and suture-ligated if they would lie in the plane of planned resection. The middle sacral artery and veins, if identifiable, are also bisected and ligated. If the ureters are to be preserved, these are dissected free from the pelvic floor and fixed anteriorly to the lateral pelvic wall just below the external iliac artery and vein. (This prevents injury during the resection for the posterior approach.) The abdomen is closed and the patient is repositioned prone (Fig. 2). A posterior sacral incision is made with one limb curving about the buttock crease and subcutaneous flaps are raised. The sciatic nerve is located by splitting the gluteus maximus muscle in the direction of its fibers (between the ischial tuberosity and the greater trochanter) and is encircled by a penrose drain. The gluteus maximus and medius are dissected from the sacrum and the sacrotuberous and sacrospinus ligaments are incised at their attachments to the ischial tuberosity and ischial spine. The muscles surrounding the sciatic nerve (pyriformis, obturator internus and gemelli) are identified. By inserting a finger underneath the sciatic nerve (medial to it) the surgeon then breaks through the pyriformis muscle and investing endopelvic fascia to assess the level of resection. A laminectomy is performed proximal to the planned level of sacral resection in order to ligate the terminal end of the dural sac. If it is possible, the proximal sacral roots are identified and an

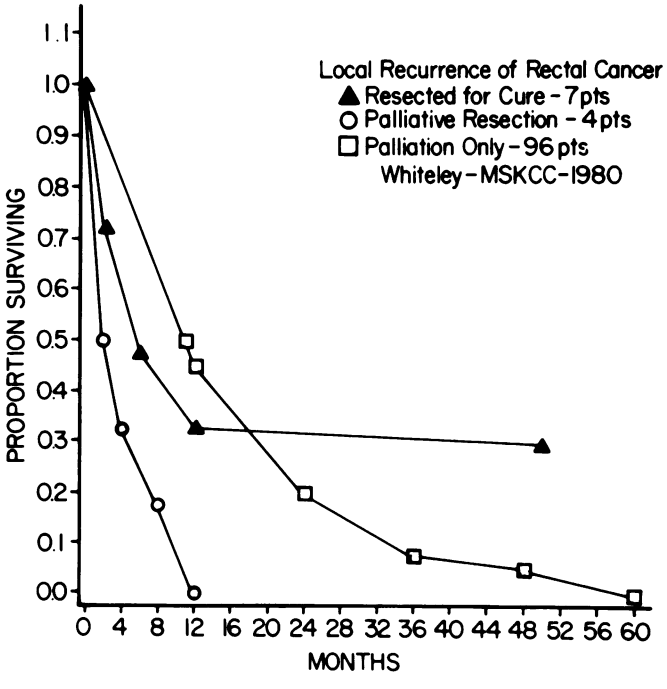

FIG. 6. Survival curves (Kaplan-Meier) showing survival rates of the resected patients compared with those of 96 patients treated by palliation only. The survival rate of the patients resected for cure approximates 30% vs. 4% for the palliated group.

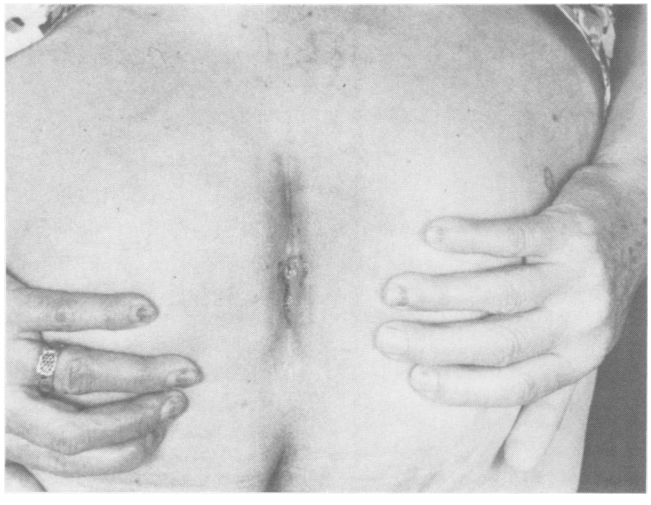

FIG. 7a. Patient S.G.—showing extensive tumor involving large area of sacrum, with sinus tract containing viable tumor cells in center of mass. Perineum is actually at lower end adjacent to inferior buttock crease.

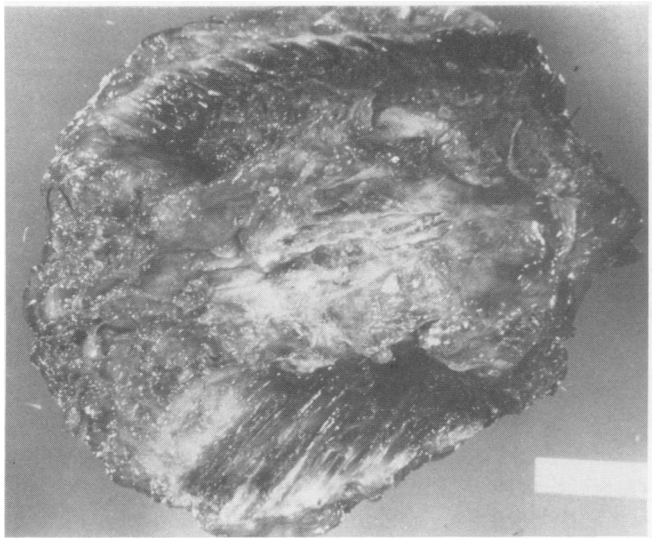

FIG. 7b. Patient S.G.—resected specimen showing tumor, with adjacent gluteus muscles. Cut end of sacrum is to right of figure.

effort is made to preserve them by dissecting them free from the portion of the sacrum to be resected.

After the resection line is determined on both sides of the sacrum, an osteotome is used to cut across the sacrum. For higher resections above S3, the line of resection is taken through the sacroiliac joint. Removed *en bloc* are the sacrum, pelvic sidewalls, and the tumor, along the attached structures; bladder and retained rectum, if indicated (Figs. 3a and b). Hemostasis is obtained after initially packing the wound to obtain temporary control. The defect is irrigated and then reconstructed. The insertions of the gluteus maximus on the greater trochanter are incised allowing the gluteus maximus on each side to be moved medially and to be approximated (Fig. 4). Skin flaps are mobilized according to the amount of skin removed and are sewn together with suction catheters in place (Fig. 5). Skin grafting may be needed to cover donor sites if rotational flaps are used.

FIG. 7c. Patient S.G.—reconstruction 10 months postresection showing well healed flaps.

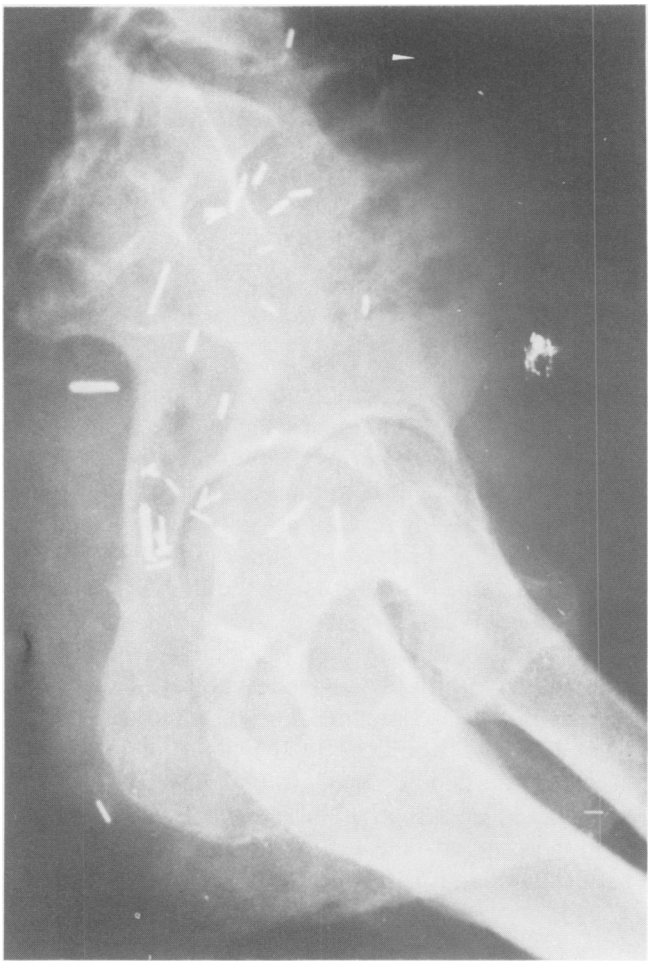

FIG. 7d. Patient S.G.—side view of pelvic defect showing L-5, S-1 and the residual portion of S-2.

Results

The level of sacral resection was at S1–2 to S5 in six patients, S3 to S5 in three patients, and S4–5 in two patients. Additionally, exenteration was done in three patients and resection of other organs (small bowel, female reproductive organs) was done in three other

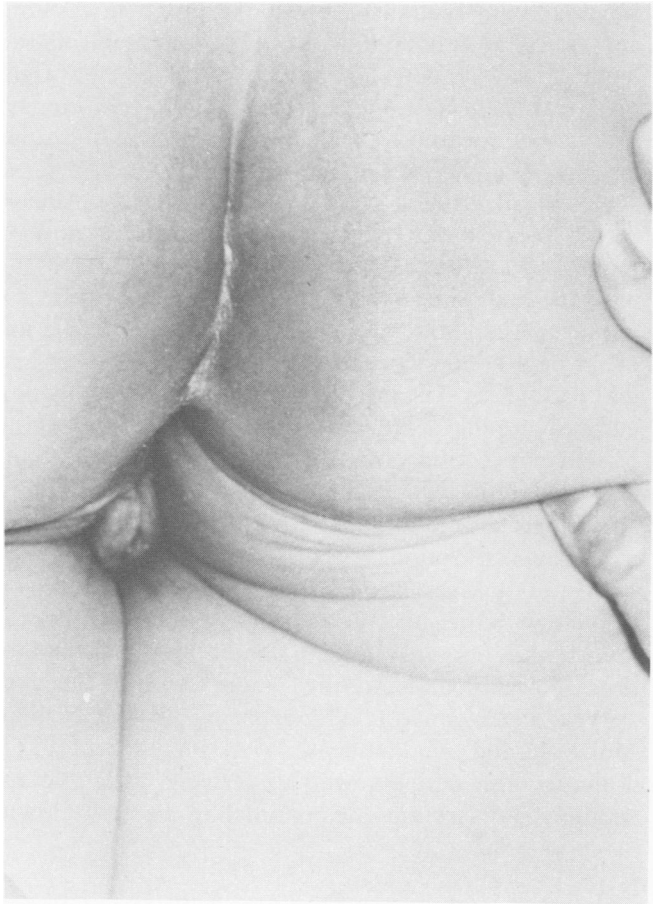

FIG. 8a. Patient E.H.—developed an absess within a large posterior pelvic recurrence, which communicated to the outside through the sacrum (sinus tract in mid sacrum).

FIG. 8b. Patients E.H.—lateral films of pelvis shows air outlining the abscess cavity.

patients. The blood loss averaged 11.5 units (average: 2–22 units). The operative time averaged 11 hours (average: 8–16 hours). In the curative group, the tumor had been grossly resected and all margins were clear. In the palliative group, resection of the local tumor mass was complete but there was disease at other sites *i.e.* liver, or nodes. Of five specimens re-examined pathologically all showed extensive soft tissue involvement by cancer, but no invasion of bone was demonstrated (possibly due to limited studies of sacrum). Nerve sheath invasion was found in three of five specimens.

Complications are listed in Table 4. Two delayed deaths occurred. One patient had an apparent cerebrovascular accident which complicated problems with an intermittent bowel obstruction and ultimately died on the fifty second day after operation. One patient developed severe problems of total wound breakdown of the pelvic wound, small bowel fistula, hemorrhage from the posterior pelvic wound and died of sepsis and renal failure on the sixtieth day after operation. This patient had been treated with a total of 9000 rads in two separate courses and had total dissolution of what had appeared to be healing skin and muscle flaps. Five other patients had major difficulties with wound breakdown and flap separation. Of note, we have not observed long-term complications, *i.e.*, perineal hernias, perhaps because of efforts to ensure proper use of muscle flaps or myocutaneous flaps.

FIG. 8c. Patient E.H.—resected specimen, posterior view showing central sinus tract through sacrum.

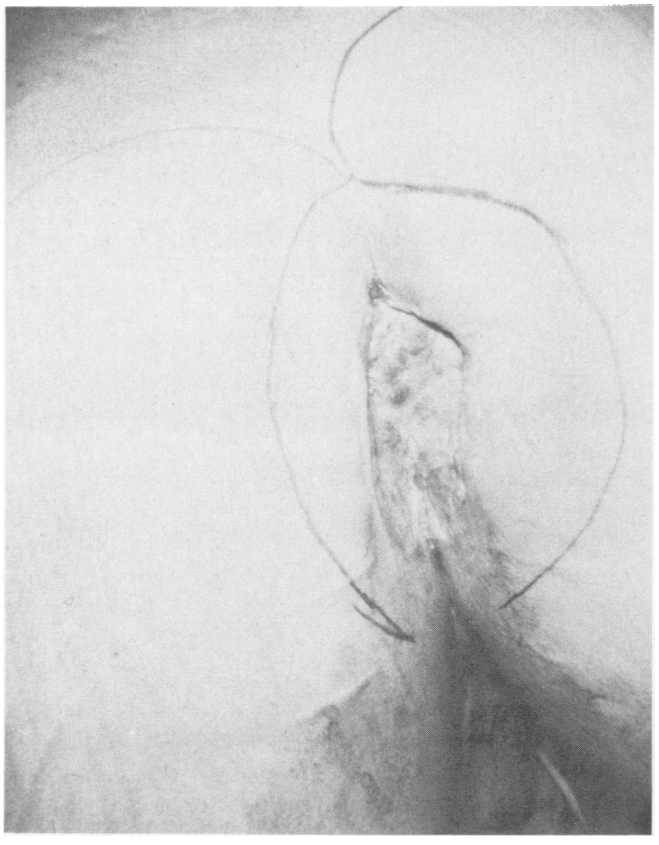

FIG. 9a. Patient W.F.—had a persistent necrotic perineal recurrence after abdominoperineal resection and post operative radiation (4500 rads). He received additional 4500 rads of interstitial radiation.

Urinary function is generally compromised by higher sacral resections. There are minimal losses if S3 is preserved bilaterally, and probably minimal deficit if only one of the S3 roots is incised. If both S2 roots are incised, bladder function is compromised with increased residual and decreased detrusor function. The practice of Crede', and use of alpha agonists (ephedrine, tofranil) permit a reasonable return of function. Intermittent self catheterization is a reasonable alternative. Of six patients in whom the bladder was retained, there was general loss of bladder function and a neurologically impaired bladder (increased residual, decreased detrusor), impaired continence and in some, poor voiding capability (Table 5). Four of these patients were able to develop adequate bladder function inspite of the neurogenic bladder and were able to be without a catheter. Two patients did require an indwelling catheter.

Survival Results

Of seven patients resected for cure, four were alive at six months, 10 months, 52 months (all NED) and 65 months (living with disease). The last patient was considered NED at 60 months but then was confirmed to have a new recurrence which involved the right proximal thigh and adjacent pelvis, and had biopsy-proven adenocarcinoma at 63 months. She still does not have evidence of distant metastases and the disease seems localized. One patient had an extensive primary rectal carcinoma invading the sacrum. She is now 52 months postresection and continues NED. Three of the patients died; one at 12 months (of disease); one at six months (of a pulmonary embolus) following formation of an ileal conduit because of ureteral stricture; and one patient, as described, had died at 52 days from a cerebrovascular accident. Of the four patients having palliative resections, three died of disease at four, eight, and 12 months. One patient had died of renal failure and sepsis 60 days after his resection, as described in a previous section.

To put this series into perspective, a comparison is made with the survival rates of 96 patients with local recurrences only who were palliated by radiation only at Memorial Sloan Kettering Cancer Center.[11] Survival curves were constructed according to the Kaplan Meier method[25] and all deaths were included. (Fig. 6). Although the patients who underwent palliative resections had survival rates paralleling the rapid down-

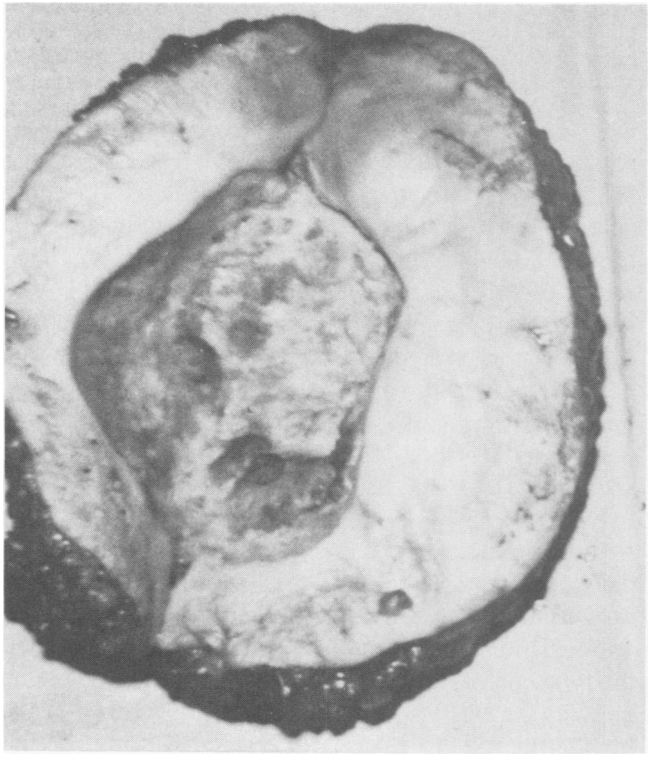

FIG. 9b. Patient W.F.—specimen following resection of necrotic tumor.

ward slope of the large series, the patients in the group resected with curative intent have a survival rate approximating 30% compared with a five-year survival rate of 4% in the palliated group. These data are quite preliminary, however, and could change drastically considering the small numbers involved.

Case Reports

Case 1. S.G. (67-year-old female) developed an extensive sacral tumor recurrence five years after abdominoperineal resection which was treated with 6000 r. but the disease continued to grow (Fig. 7a). An abdominosacral resection was performed (Figs. 7b–d) and patient did well but developed local recurrences at 16 months and 40 months which were both resected. She was thought to be free of disease at 60 months but had swelling of her right buttock and thigh, and was found to have adenocarcinoma demonstrated by examination of a biopsy specimen at the sixty-third month. The patient is currently alive with disease 65 months after abdominal sacral resection.

Case 2. E.H. (65-year-old female) had liver metastases and a large recurrent posterior pelvic carcinoma, which had formed an abscess and drained through the sacrum (Fig. 8a). This was resected (Figs. 8b and c) and reconstructed only by suturing posterior flaps to anterior vaginal wall. The patient did well for 11 months before dying of distant metastases 12 months after resection.

Case 3. W.F. (35-year-old male) salesman developed perineal-pelvic tumor recurrence at 12 months after abdominoperineal resection and 4500 rads adjuvant (Fig. 9a). He was retreated with interstitial implant (4500 rads by afterloading technique). The patient underwent a right palliative resection for a fungating large necrotic tumor and after operation returned to work until his death from liver metastases eight months after resection (Figs. 9b–d).

FIG. 9c. Patient W. F.—operative defect following lower abdominal sacral resection (S-4 and S-5). Flaps being prepared for reconstruction; upper flap will be rotated into defect.

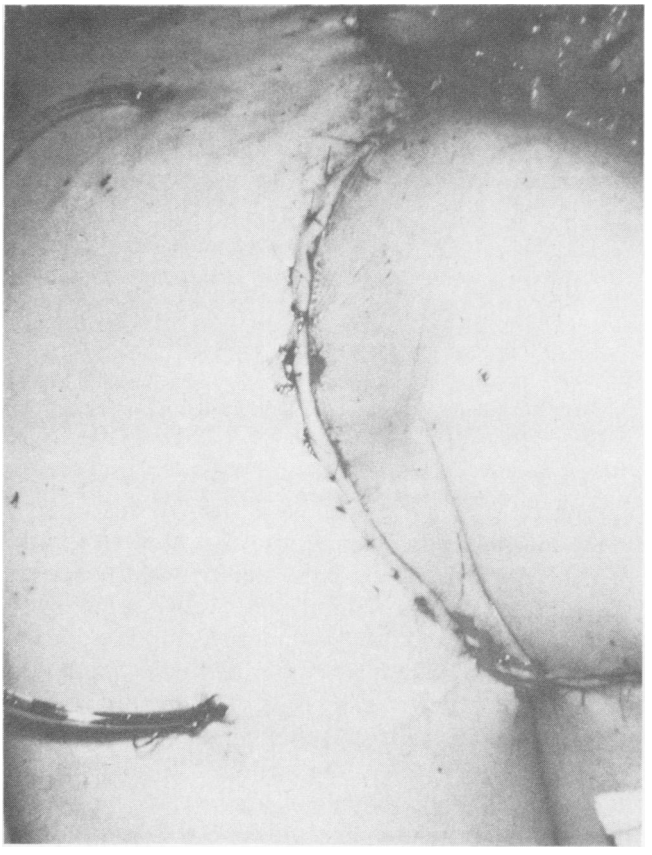

FIG. 9d. Patient W.F.—reconstruction after mobilization of flaps the upper flap donor site has been skin grafted.

Case 4. J.Q. (57-year-old male) developed presumed recurrence of rectal cancer 25 months after abdominal perineal resection, which was palliated by 5000 rads. Initial pain relief was followed by recrudescence of pain. Fine needle aspiration cytologic examination demonstrated a large posterior pelvic recurrence (Fig. 10a). This was completely resected by the abdominal sacral approach. The specimen showed nerve root invasion (Figs. 10b and c). The patient is doing well six months after resection.

Discussion

Locally recurrent or advanced rectal cancer is classically an inoperable lesion which is best treated by irradiation, and rarely lends itself to resection. Occasionally, patients with anteriorly invasive lesions involving genitourinary structures can undergo resections via anterior exenteration. Recurrent rectal cancer which is invading posteriorly and laterally with fixation cannot be resected by using the standard intra-abdominal methods. Resection of this type of lesion can be accomplished via the abdominal sacral

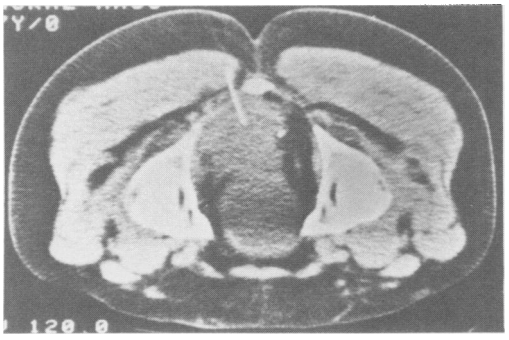

FIG. 10a. Fine needle aspiration cytology specimen under CTT guidance permitted diagnosis of this large posterior pelvic recurrence (patient J.Q.).

approach. This permits a wide field of resection of many tumors in the true pelvis, as it allows resection of the large part of the bony pelvis posteriorly, *i.e.*, the sacrum and the lateral side walls including the sacrotuberous and sacrospinous ligaments and the investing intra-abdominal fascia and investing muscle of the lateral pelvic side wall. The major problems of these resections are: 1) the technical consideration of these rather extensive resections, 2) the neurologic defects involving bladder, anorectal and genital functions, 3) potential musculoskeletal defects relating to possible instability because of high resections of the sacrum. Penetration of the lower spinal canal, the dural sac, the filum terminale, has not been a problem, although it is a consideration in resections near S-1. If such is encountered, this could precipitate a spinal fluid leak and potentiate possible meningitis. This has not been a problem in our hands, as the dural sac is ligated at the level of resection. The musculoskeletal strength and pelvic support have generally not been compromised by resections even where part of S-1 is involved. This is somewhat surprising from a superficial inspection of the pelvis, but this question has been examined in depth by Gunterberg who applied graded strains to the L-5 lumbar vertebra overlying the first sacral vertebra in cadaver pelvises in which submaximal sacral resections had been performed, *i.e.*, resection through S-1 or immediately between S-1 and S-2.[15] Applying large forces and forces under acceleration to mimic naturally occurring stress showed that the lumbar sacral joint and the remaining sacrum S-1 could withstand strain loads several times that produced naturally by the body. Perhaps the most severe problems in combined sacral resections are those related to sacral root denervation necessitated by high sacral resections. The key here is the level of the resection. There is no serious neurologic defect with bilateral resection of S-4 and 5. Bilateral resection of S-3, however, will produce major urinary bladder dysfunction, specifically loss of detrusor muscle power and loss of bladder sensation, including pain induced by muscosal fulguration and thermal sensation, and the sensation of bladder distensibility. There is also some loss of anorectal continence and sensation, fine muscle control of liquid contents and poor expulsion of solid stools. Unilateral resection of S-3 is accompanied by some defects, both genitourinary and anorectal, but apparently patients may still have adequate function. Bilateral resection of S-2 is accompanied by total bladder paralysis and anorectal dysfunction, loss of strength of urinary bladder detrusor muscle, bladder sensation and loss of anorectal control. Unilateral loss of sacral roots S-1 to S-5 is associated with suprisingly good urinary bladder function, anorectal function and even sexual function. Of note, sexual function is normal with resection of S-3 bilaterally. With resection of S-3 and a unilateral resection of S-2, there is further inhibition of sexual function including decrease in unilateral sensation of the glans penis and labia and weak erections.

The above urinary bladder defects can be ameliorated by use of periodic abdominal wall pressure and contraction with initial use of periodic self-catherization and urinary detrusor stimulants, *e.g.*, urecholine. Use of alpha receptor agonists such as ephedrine may improve continence problems by stimulating urethral tone. One can develop satisfactory urinary bladder function in one to two months after operation. Usually one can redevelop functioning better in women than in men. Anorectal dysfunction is managed easily by rectal irrigations every other day as for a colostomy. This is the same kind of ap-

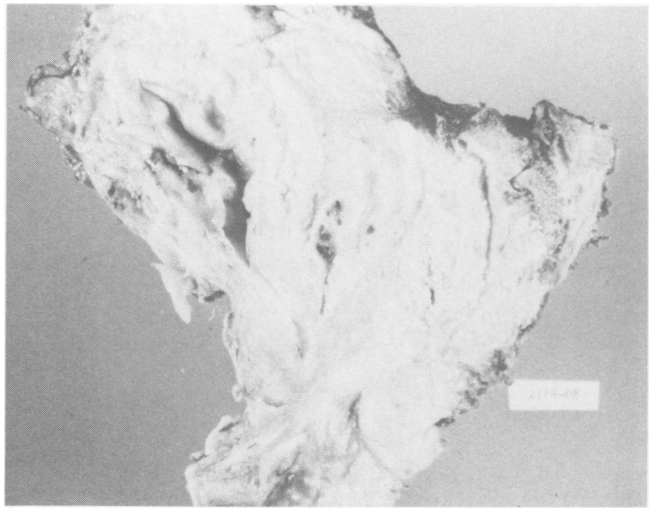

FIG. 10b. Para saggital section of resected specimen shows a portion of the sacrum (near marker) and a portion of the bladder anteriorly.

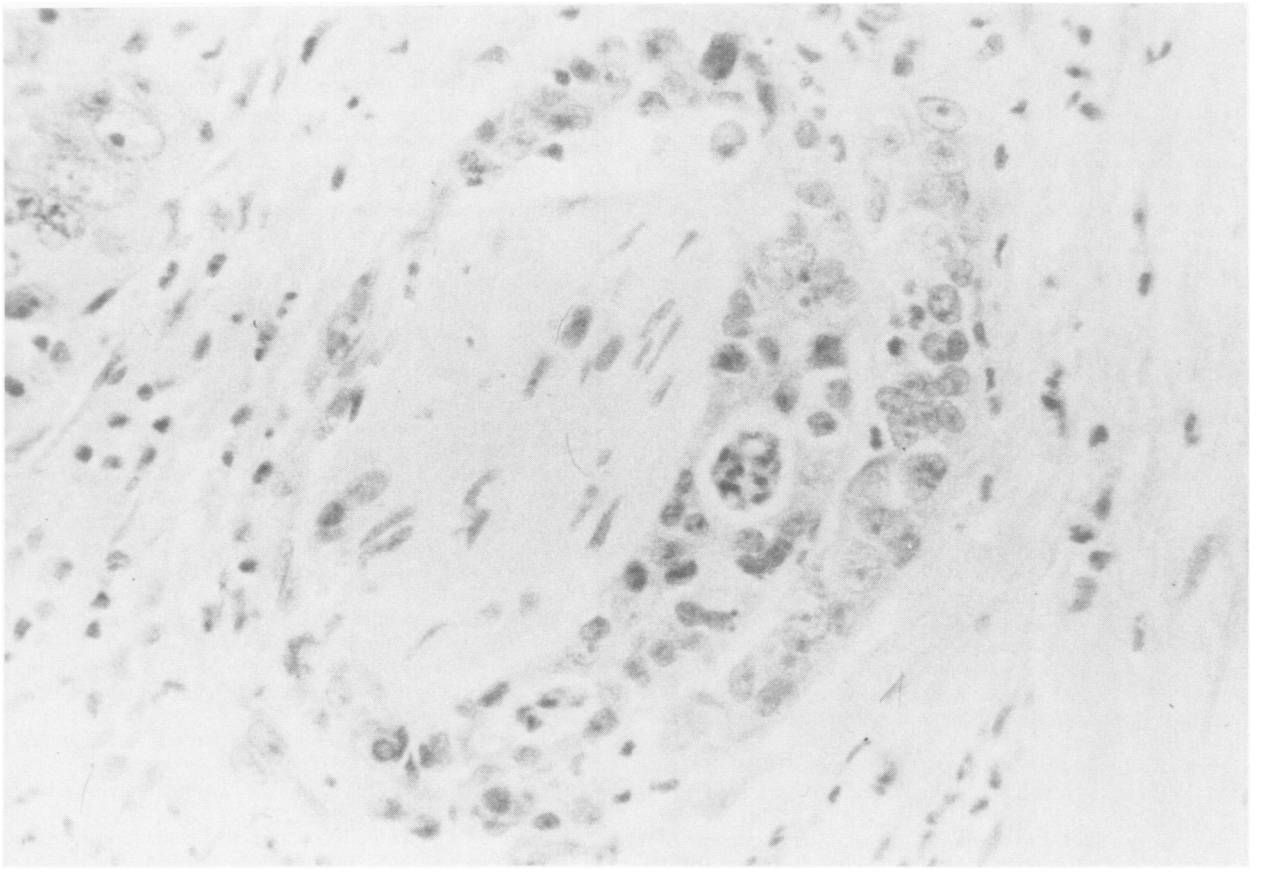

FIG. 10c. Nerve root invasion is a frequent accompaniment of pelvic recurrence as shown above (100×).

proach that is satisfactory for patient use after a pull-through procedure.

The long-term effects of these rather extended operations on patients with locally advanced disease cannot be fully assessed at this time. Four of seven patients having curative resection are alive at six months, 12 months, 52 months (all NED) and 65 months (living with disease). The latter patient has had pelvic floor recurrences at 16 months and 40 months which have been reresected and was still considered NED at 60 months although a swelling and mass lesion in the buttock was documented to be recurrent adenocarcinoma at 63 months. She has had a good functional result however. Of the four other patients who had palliative resections, three had good technical and functional results, following resection of locally massive, abscessed and painful tumors for the remaining 4–12 months of life. The fourth patient died of renal failure and sepsis associated with breakdown of flaps and small bowel fistula 60 days after operation. He had received a total of 9000 rads in separate courses which appeared to contribute to the cascading series of wound complications. In this type of patient, resection is associated with too high a risk for wound healing to warrant extensive surgery of this nature, and we would no longer consider such a patient for abdominosacral resection in the future. Although there are difficulties in the postoperative management of some of these patients, the effort at resection appears warranted when this technique is applied to selected patients. Perhaps the most important aspect of this operation is that it is available as a procedure for treatment of highly selected patients with locally advanced disease who are otherwise incurable and often even only poorly palliated.

Our current criteria for patient selection includes: patients with localized recurrence, who have had a reasonably long free interval (approximately 18 months) and whose initial tumor may have been locally invasive or who had limited or no nodal metastases (and certainly no nodal metastases beyond the bowel mesentery). If these patients have not been radiated then this should be done. In patients with large tumors one should plan for a total pelvic exenteration to facilitate adequate tumor removal and prevent further recurrence in order to justify undertaking these extensive procedures.

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Discussion

Dr. Richard E. Wilson (Boston, Massachusetts): Biologically, rectal cancer tends to remain localized in the pelvis. In a review that we did of an 11-year experience at our hospital, looking at the patterns of metastases after colorectal cancer, rectal cancer was the only one where the local/regional recurrence exceeded distant metastases, and I think this is what makes this a potentially useful approach.

As more patients are receiving radiation therapy either before or after resection, and also are participating in adjuvant studies for radiation and chemotherapy, the surgeon is then left with a set of challenging, but still surmountable problems of dealing with patients who have had all of their modes of therapy administered in a prophylactic method before they show up with their recurrence. There is a limitation as to what else could be done for them except for an aggressive surgical approach.

Collaboration with plastic surgeons, urologists, orthopedists, and neurosurgeons is really essential for us to make use of in devising these types of procedures, as you have heard this morning. We, too, have attacked a few of these patients, and made use of extensive myocutaneous flaps of gracilis and gluteal muscles, with or without bone resection. It is dramatic how relieved these patients can be of their symptoms, with at least a chance for longer survival.

Finally, the role of the surgeon has, clearly, been strengthened by experiences with multimodal therapy. As I think all of you would expect, dirty margins in tumor resections cannot usually be made up by radiation or chemotherapy. Every attempt to do that has failed. In lesions in which the disease tends to remain localized, like rectal cancers, head and neck cancers, and low grade sarcomas of the extremities, the value of an extensive surgical approach has been reiterated in each of the trials that has been attempted.

Dr. Wanebo, is there any difference in your operative procedure when you are using a palliative approach, as compared with an attempted curative resection? What features of the operative procedure, or of the patient, would deter you from making an attempt at this resection?

Third, in the seven patients operated on for cure, what was the pattern of recurrence in those whose tumors recurred? How many tumors recurred regionally, and how many recurred at a distant site?

Dr. S. Arthur Localio (New York, New York): Pelvic recurrence of rectal cancer is, unfortunately, too familiar to all of us. The cancer can recur as part of a generalized process for which surgical treatment is not going to be useful. It may recur extensively in the pelvis, like some of the cases that have been reported today. There might be a possibility that individuals with such a cancer might benefit by a radical pelvic operation, resection of the sacrum and exenteration of the urinary bladder. Occasionally, this disease will recur in the pelvis and remain local. If the lesion is posterior and adherent to the sacrum, sacral resection may offer good palliation or even cure.

My associates and I have a long follow-up study of patients who had sacral resections for primary tumors: most of the tumors were chordomas. Patients with resections at the S-1 to S-2 level frequently have urinary bladder problems that require urologic operations. Most men undergoing resections at the S-1 to S-2 level have sexual problems. A number of the patients have posterior hernias through the area where the sacrum was removed. It has been necessary and difficult on one occasion to reoperate on this area. These problems need to be considered when thinking about the operation that Dr. Wanebo described today.

Philosophically, I can justify sacral resection for recurrent cancer when there is a possibility for cure. I am not so sure that I can philosophically justify an operative procedure of this magnitude for a short period of palliation. It seems to me that the key to this whole concept is going to be the proper selection of the patient.

I would like to suggest to those of you who are interested in this