
Composite Resection of Posterior Pelvic Malignancy

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Advanced pelvic cancer is a formidable challenge to surgical resection. These tumors commonly invade the bony pelvis, may involve other viscera, and usually have been irradiated previously. The authors are presenting experience with 76 patients who had composite resection of posterior or lateral pelvic malignancy. Fifty-eight patients had secondary cancers involving the musculoskeletal pelvis. This included 47 patients with advanced carcinoma of the rectum (41 curative, 6 palliative), 10 epidermoid cancers of the anorectum (8) or cervix (2), and 1 bladder cancer. Among the 18 patients with primary pelvic tumors were three patients with chordomas, six with bone tumors (osteosarcoma chondrosarcoma, grade III giant cell tumor), and nine with soft tissue tumors. All required major resection of the sacrum or pelvic side walls, and one half had an additional exenterative procedure. The overall mortality rate was 7.9%. Long-term estimated survival was 24% in patients having curative resection of recurrent rectal cancer, and 22.5% in 10 patients with advanced epidermoid cancer. Fifty per cent of patients with primary bone or soft tissue tumors survived from 13 to 88 months. Most patients had reasonable return of function, and were able to return to work or resume their normal previous lifestyle.

EXTENSIVE TUMORS OF the musculoskeletal pelvis are formidable challenges to the surgeon. Depending on location and tumor histology, there are complex biologic considerations, as well as inherent technical difficulties facing the extirpative surgeon, and short- and long-term risks to the patient.¹ The major issue is oncologic control, which requires complete resection of all tumor complemented by radiation therapy or chemotherapy where appropriate.² Of equal importance to surgical resectability and patient tolerance of the procedure is the potential for function preservation,³⁻⁷ and the needs for reconstruction and rehabilitation, and perhaps,

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long-term adjuvant therapy.⁸ The necessity of a multidisciplinary surgical and oncologic approach is obvious.

The nature and location of the tumor largely determine the options for resection. Primary tumors of the lateral pelvis (ileum, ischium) may be resected using a limb-conserving approach (internal hemipelvectomy),³⁻⁷ whereas secondary tumors in these areas are often more invasive into surrounding soft tissues, and are less amenable to conservative resection, requiring a full or modified hemipelvectomy.¹⁻³ Primary tumors of the posterior pelvis (sacrum) are usually amenable to sacral resection with preservation of rectum.⁹⁻¹³ After resection of these lesions, issues of urogenital and anorectal denervation and possible lower extremity weakness may require aggressive efforts at physical therapy and rehabilitation.^{9,12} Secondary tumors in this area are more extensive, requiring composite resection of viscera, soft tissue, and bone. Commonly, an exenterative procedure is done in conjunction with the complete soft tissue and bone resection.¹²⁻¹⁸ In most cases, neuromuscular function can be retained, with extremely aggressive resections or amputations rarely required.¹⁵

This paper emphasizes the surgical approaches and results in treating a group of patients with a variety of primary and secondary tumors involving viscera and musculoskeletal elements of the pelvis.

Materials and Methods

Preoperative Evaluation

Clinical examination included careful assessment of neuromuscular function of lower extremities and any pre-existing deficits related to the tumor. A rectal examination (if feasible) and vaginal examination helped to assess tumor extent, lateral wall fixation, and possible involvement

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of anterior pelvic viscera (bladder). Essential radiologic studies included computed tomography of pelvis and abdomen, chest film, plain films of lumbosacral bones, bone scan, and in selected patients, a magnetic resonance imaging scan. The sagittal view of magnetic resonance imaging was useful to indicate the extent and level of sacral involvement. Arteriograms were done only in patients with extensive tumors. A computed tomography-directed fine needle aspiration cytology was used to confirm presence of advanced rectal cancer or epidermoid cancer. Although fine needle aspiration was less accurate with primary tumors, it was useful in many patients when combined with radiologic findings. In selected cases of primary tumors of the sacrum, an open biopsy was required.

Preoperative Planning

In addition to surgical planning, preoperative therapy was considered in all patients. Patients with large bulky primary sarcomas were considered for preoperative therapy with radiation or chemotherapy. In other primary tumors, such as chordomas, postoperative radiation was generally done. In patients with secondary tumors, either locally extensive, or recurrent rectal adenocarcinoma or epidermoid carcinoma of the anorectum, preoperative therapy was given unless the patient had been irradiated previously. Radiation dosages in the 4500 to 5000 cGy range were administered in addition to sensitizing chemotherapy (depending on tumor type): Adriamycin (Adria Laboratories, Columbus, OH) with sarcomas, 5-fluorouracil/cisplatinum or mitomycin C combinations for adenocarcinoma or epidermoid cancer to facilitate surgical control.^{2,16,17}

In the current study, the following chemotherapy protocols were used:

Primary sarcomas. Radiation 3000 to 3500 cGy in 10 to 15 fractions Adriamycin 30 mg/day \times 3 with continuous infusion (as radiation sensitizer)

Recurrent rectal adenocarcinoma. Radiation 4500 to 5000 cGy in 20 to 25 fractions (if not previously treated), and sensitizing 5-fluorouracil 750 mg/M²/d \times 5

Advanced epidermoid cancer. Radiation 3000 cGy, in 15 fractions plus 5-fluorouracil 750 mg/M²/d \times 5, and mitomycin C 15 mg/M² \times 1

Patient Population

A total of 76 patients were treated, including 18 with primary tumors and 58 with secondary tumors involving the true pelvis (Table 1). Among the 18 patients with primary tumors, there were eight women, 10 men, average age 47 years. In all but two patients, there was involvement of the musculoskeletal elements of the pelvis by the visceral tumor necessitating a composite resection. Special approaches were required for access to and safe removal

of the tumor in two patients with extensive soft tissue sarcoma. Patients with extensive cancers who had visceral resections only, such as exenteration, were excluded from this review.

Primary posterior pelvic tumors that invaded the sacrum included three chordomas, three schwannomas, and one of each of the following: osteosarcoma, malignant giant cell tumor, chondrosarcoma, liposarcoma, neurosarcoma, and synovial sarcoma. Two patients had massive presacral space tumors; one hemangiopericytoma and one very extensive liposarcoma. These two required access by an abdominal inguinal incision and one had removal of the accompanying internal iliac artery and vein, to facilitate wide-field resection. Three had lateral pelvic tumors (ileum and ischium), and one patient had primary chondrosarcoma of the symphysis pubis.

Among the secondarily involving cancers of the posterior pelvis, two patients had advanced primary rectal cancer,² and 45 had recurrent rectal adenocarcinoma.^{4,5} Six had palliative resections, and 41 had resection with curative intent (Table 1).

These patients included 17 women and 30 men, with a median age of 56. The characteristics of the 41 patients resected for cure are shown in Table 2 and their previous radiation history in Table 3. In this group, the free interval period (time to recurrence) was 23 months. Twenty-three patients (56%) had previous abdominoperineal resection, and the remaining had a sphincter-saving procedure. Their initial stage was Dukes A in 1, B2 to B3 in 18 patients, and Dukes C in 17 patients. In five, the Dukes stage was unknown. The palliative resections (with known extrapelvic disease) were done in patients who had large bulky tumors that were infected, had fistulized, or had developed open ulcerated, painful, malodorous lesions. In such cases, there was disease outside of the true pelvis.

The CEA level was < 5 ng/mL in 16 patients and > 5.0 ng/mL in 18 patients. Among the latter, 36% were 5 to 20 ng/mL, 45% were 21 to 100 ng/mL, and 9% were > 100 ng/mL. In seven patients, the preoperative CEA levels were unavailable.

TABLE 1. Extensive Pelvic Tumors: Secondary Tumors (n = 58)

Tumor	No.
Posterior pelvis	55
Advanced/recurrent rectal cancer	47
Curative	41
Palliative	6
Epidermoid cancer	8
Advanced anorectal	7
Advanced cervix	1
Lateral pelvis	2
Locally advanced	
Cervix cancer	1
Anorectal cancer	1
Symphysis pubis	1
Locally advanced bladder cancer	

TABLE 2. Rectal Cancer: Pelvic Recurrence, Resections, and Curative Intent

	No. of Patients
Patient characteristic	
Age (mean)	59 yr
Sex (M/F)	26/15
Free interval time to recurrence (median)	23 mo
Time with recurrence (median)	5 mo
Previous surgery	
Anterior resection	16
Abdominoperineal resection	20
AR → APR	2
APR → exenteration	1
Fulguration alone	1
None	1
Original Dukes stage (Astler–Coller)	
A	1
B2	15
B3	3
C	17
Unknown	5
CEA level	
≤5 ng/mL	16
>5 ng/mL	18
N/A	7

AR, anterior resection; APR, abdominoperineal resection.

For purposes of comparison, a group of 30 patients with recurrent rectal cancer has been reviewed (details previously reported)¹⁶ who were treated with irradiation ± chemotherapy without resection. This included 14 men and 16 women, mean age, 60 (range, 33 to 80 years). Previous surgery included abdominoperineal resection, 24 patients, and low anterior resection, six patients. Original stage was A or B in two patients, classic Dukes B in 13 patients, and Dukes C in 15 patients.

Among the patients with epidermoid cancers that invaded the sacrum were seven with advanced anorectal cancer, and one cervical epidermoid cancer. An additional two patients, one with cancer of cervical, the other with cancer of anorectal origin, had involvement of the posterior and lateral pelvis, and one patient with a bladder cancer had involvement of the symphysis.

Operative Procedures

The operative approach was determined by the extent and nature of the primary tumor.¹⁶ In patients with primary tumors of the sacrum, a laparotomy was required to separate the rectum from the presacral tumor and to devascularize the posterior pelvis. In patients with recurrent rectal cancer or advanced cervical carcinoma, the abdominal approach commonly included a pelvic node dissection and frequently an exenteration in conjunction with the posterior resection (Table 4).

During the posterior approach, a laminectomy was done to visualize the dural sac and the nerve roots. The

TABLE 3. Pelvic Recurrences: Previous Irradiation and Curative Resections

Irradiation	No. of Patients
None	3
3000–4500 cGy	16
5000–6000 cGy	16
6000–7000 cGy	2
>7000 cGy	2
Unknown	2

nerve roots were dissected free at the level of sacral resection, and preserved if there was no gross tumor involvement. For large pelvic schwannomas, most of the posterior nerve roots not involved by tumor could be dissected free and preserved. In the case of primary large tumors of the sacrum (chordoma or sarcoma) or recurrent rectal carcinoma, an *en bloc* resection was required, which included the sacral nerve roots at the level of the tumor.

Results

Recurrent Rectal Cancer Group

Among the patients resected for recurrent rectal carcinoma, 41 were resected with curative intent and six for palliation. In the palliative group, resections were done to control unremitting local disease and, although efforts were made to obtain clear margins, disease beyond the pelvic resection site precluded curative resection. Twenty-two patients required an exenteration or had other organs resected in conjunction with the sacrum. In 36 patients, the surgical margin was clear, and in five there was microscopic involvement in spite of gross clearance of the tumor. The blood loss and operative time is shown in Table 5. In most of the rectal cancer patients, a staged procedure was done (the anterior phase usually requiring 10 hours and the posterior approach 5 to 6 hours). Of patients with long-term follow-up (>6 months), 30 of 31 (96%) had relief of initial symptoms, pain, mass, or fistula. Overall, 23 of 35 patients (66%) returned to previous lifestyle, and 12 of 28 returned to work.

TABLE 4. Pelvic Recurrence: Extent of Resection and Curative Intent

Extent of Resection	No. of Patients
Other organs resected	
Rectum	15
Bladder*	23
Partial bladder resection	1
Prostate/seminal vesicles	16
Vagina	7
Total abdominal hysterectomy	4
Segmental bowel resection	6

* All required ileal conduit.

TABLE 5. Pelvic Recurrences: Operative Details and Curative Resections

Operative blood loss	
Estimated blood loss	10,000 mL mean 8000 mL median
Replaced blood volume	20 units mean 15 units median
Operative time	
	18.5 hr mean 18.0 hr median

Survival

Of the six patients who had palliative resections, the survival ranged from 2 to 12 months (2, 4, 8, 9, 11, 12 months). In the 41 patients resected for cure, the median disease-free survival was 24 months, overall median survival was 36 months, and the 5-year estimated survival was 24% (Figs. 1, 2). There were five patients surviving 67 to 168 months (Table 6). In comparison, in the group of 30 patients with rectal recurrence treated by irradiation, the median survival was 15 months, with 5-year survival of 3% (Fig. 2).

Epidermoid Cancer Group

In the group with epidermoid carcinoma (Table 6), seven had advanced anorectal cancers requiring abdominal sacral resections. All had been pretreated with a regimen of chemotherapy and radiation before operation. One patient developed a second tumor (carcinoma of the gallbladder) that was the cause of death at 28 months. An additional patient with recurrent epidermoid carcinoma required a hemipelvectomy to control disease in the posterior lateral pelvis, and died of disease within 9 months. Two patients were resected for recurrence of cervical cancer involving the posterior pelvis or posterior and lateral pelvis. One is surviving at 48 months with no evidence of disease after hemisacrectomy; the other patient died

after 12 months of metastatic cancer after hemipelvectomy. One patient with a bladder cancer that invaded the symphysis pubis died of numerous complications 90 days after composite resection of the central portion of the pelvis.

Primary Tumors

In the entire group of patients resected for primary tumors of the pelvis, the estimated survival was 52% at 5 years (Fig. 3). The actual survival is listed in Table 7.

Level of Sacral Resection

Among the primary tumor group were two patients with resections at L5-S1 and between L3 and L4. All of the carcinoma patients had resections between S1 and S2 or lower. Three patients had unilateral hemisacrectomy with nerve preservation (Table 8).

Mortality Rate

In the 47 patients resected for pelvic recurrence of rectal cancer, four (8.5%) had perioperative deaths. One patient died of a platelet-induced coagulopathy and myocardial infarction 24 hours after surgery. There were three delayed hospital deaths at 35, 40, and 52 days from cerebrovascular accident (1 patient), and multisystem organ failure (2 patients). One patient died after removal of a recurrent bladder cancer involving the symphysis pubis at 90 days among the 11 patients grouped as "epidermoid cancers." One patient died of a postoperative myocardial infarction at 48 hours after sacrectomy for a chordoma. The total long-term hospital mortality rate was 6 of 76 patients (7.8%).

Morbidity Rate

In the 58 patients having abdominal sacral resection for recurrent or advanced epidermoid or rectal cancer, major complications were cardiopulmonary insufficiency

TABLE 6. Status of Patients With Secondary Tumors of the Posterior Pelvis

Secondary Tumor		Procedure		Patient Status			Long-term Survivors	
Type	No. of Patients	Type	No. of Patients	Status	No. of Patients	Duration of Follow-up (mo)	Status	Duration of Follow-up (mo)
Rectal adenocarcinoma	47	Resection with curative intent	41	NED	10	36*	NED	168
				DOD	22		NED	103
				DOC	4		DOD	82
				LWD	1		LWD	75
				POD	4		NED	67
Epidermoid carcinoma of the anorectum	8	Resection with curative intent	8	DOD	6	(2, 4, 8, 9, 11, 12 mo)	—	—
				DOD	6	(7, 9, 11, 13, 24, 28 mo)	NED	
				DOC	1	(7 mo)		
				NED	1	(153 mo)	NED	153

* Median.

NED, no evidence of disease; DOD, dead of disease; DOC, dead of other cause; LWD, living with disease; POD, postoperative death.

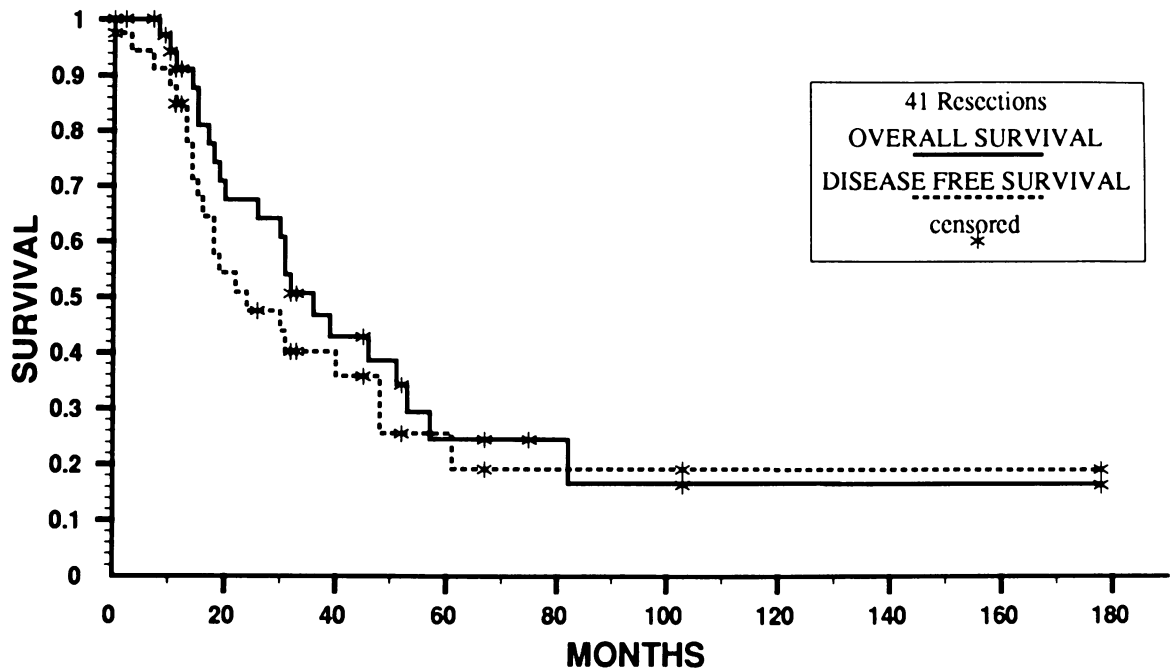


FIG. 1. The median disease-free survival was 24 months, and the overall survival was 36 months in 41 patients who underwent resection of recurrent rectal cancer with curative intent.

requiring prolonged intubation in 10, postoperative hemorrhage requiring a return to the operating room in six patients, and renal failure in five patients. Fistulization of the bowel occurred in eight patients and of the ureter and bladder in three patients. Sepsis was recorded in 14 patients. A variety of wound complications occurred:

wound infection (11 patients) and flap separation (16 patients), all in patients who had been heavily irradiated (Table 9). Among the patients resected for primary pelvic tumors, markedly fewer complications occurred. The operative procedure is shorter and most were not irradiated. In the overall group, perineal nerve palsies occurred in

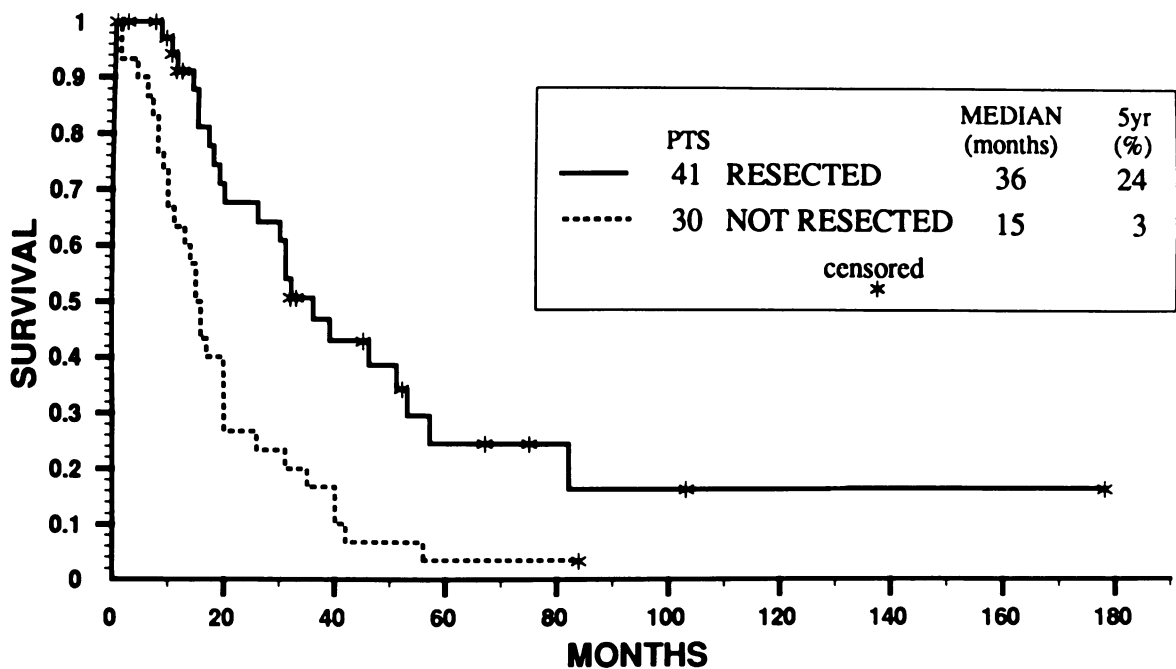


FIG. 2. Estimated 5-year survival was 24%, and median survival was 36 months after resection of recurrent rectal cancer in 41 patients compared with 3% and 15 months median survival in 30 patients treated by radiation alone. $p < 0.001$.

TABLE 7. Status of Patients With Primary Tumors of the Posterior Pelvis

Primary Tumor	Age	Sex	Patient Status	Follow-up (mo)
Chordoma	58	F	DOD	179
	70	M	POD	—
	55	M	DOD	30
Schwannoma	46	F	DOD	15
	27	M	NED	26
	40	M	NED	14
Liposarcoma	70	M	DOD	13
	83	F	DOD	25
	20	M	DOD	19
Osteosarcoma	54	F	NED	136
Neurosarcoma	40	F	NED	48
Synovial sarcoma	22	F	DOD	27
Giant cell tumor	45	M	NED	92
Hemangiopericytoma	38	M	NED	27
Lateral/posterior pelvis				
Liposarcoma	70	F	DOD	16
Giant cell tumor	47	F	NED	101
Giant cell tumor	45	F	NED	69
Chondrosarcoma	63	M	NED	112

DOD, dead of disease; POD, postoperative death; NED, no evidence of disease.

five patients and one patient had a femoral nerve injury secondary to ischemia associated with an occluded right femoral artery. Six patients had documented venous thromboses, but no recognized episodes of pulmonary embolism.

Functional Results After Sacrectomy

The functional results after resection in patients with primary posterior pelvic tumors depended on the extent

and level of sacral resection (Table 10). Anorectal function was normal in patients having low sacral resections (at or distal to the S3 level) or in patients who had unilateral resection of sacral roots. Anorectal and urogenital function was compromised by bilateral resection levels of S3 and above. One male patient who had resection of the S2 and 3 nerve roots on one side had essentially no deficit of urogenital or anorectal function. A second male patient who had a hemisacrectomy with preservation of S1, S2, and S3 on one side had moderate retention of urogenital function, in other words, bladder tone was good, and he had sensation of bladder distention at 200 mL, but did not have erectile capacity and had essentially absent anorectal tone and anorectal function. A woman with hemisacrectomy involving sacral roots S1 through S5 had numerous rectal and urologic problems mostly related to fistulae in irradiated tissue. She did have persistent leg weakness (S1 root removal). Generally, female patients had less urinary retentive problems, for anatomic reasons. Patients with resection at the S1, S2 level could manage urologic function by practicing Credé at defined periods. In male patients with a high sacral resection, (through the S1 level), periodic catheterization was additionally required. In some cases, the patients did have incontinence, which was improved by taking ephedrine. One patient after resection of sacral chondrosarcoma had persistent incontinence and required placement of a periurethral device for control with moderate effectiveness (this required subsequent removal because of infection). The patients with impairment of anorectal function could be managed by rectal irrigation every other day to control

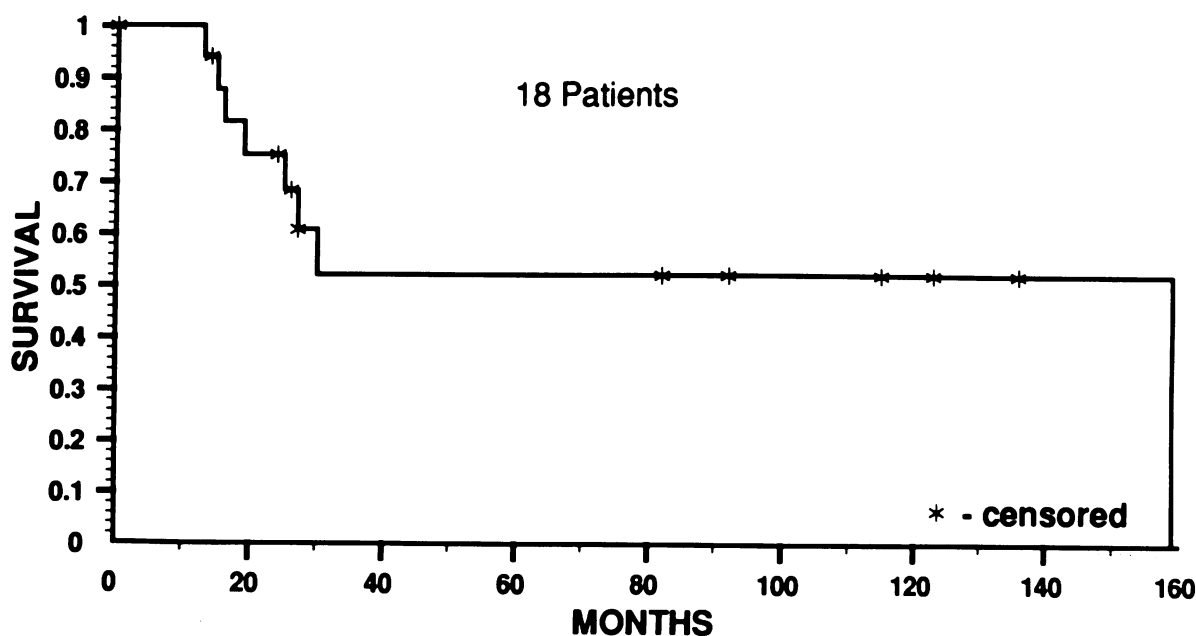


FIG. 3. Survival in patient with primary pelvic tumors after abdominal sacral resection. Median survival is not yet reached. Estimated 5-year survival was 52%.

TABLE 8. *Posterior Pelvic Tumors: Sacral Resection Level*

Primary Tumors		Secondary Tumors*	
L3-4	1	S1-2	47
L5-S1	1	S3	5
S1-2	7	S4-5	2
Partial removal			
S2-5	1*	S1-5	1*
S2-5	1*		

* Hemisacrectomy.

bowel function. The practice of Kegel (natural birth exercises) possibly aided rectal tone. The problem of impotency was managed by urologic placement of a penile prosthesis.

Long-term functional results were evaluable in 35 of 41 patients having curative resection of recurrent rectal cancer. These patients all had pain in the perineum or perineal area before resection. In all but one patient (30/31), there was relief of this burning, boring pain. In 12 patients, however, this pain was replaced with a secondary pain related to the surgery, either a phantom pain or a musculoskeletal pain, or sciatic pain (causalgia): these symptoms generally abated within 3 months. All patients were referred for rehabilitation and generally required physical therapy in a rehabilitation center and subsequent aggressive outpatient therapy.

Discussion

This report has emphasized the role of surgical extirpation of primary or recurrent malignancy that involves the major musculoskeletal elements of the posterior or posterolateral pelvis. Although these are diverse tumors, surgical considerations are similar. Whatever the tumor type, it is essential to obtain microscopically clear margins with resection. In patients resected for pelvic recurrence of rectal cancer in which all disease is resected (curative intent), the actuarial survival was 24%, and five patients survived beyond 5 years. These results are paralleled by other reports,^{18,19} and suggest that in well-selected patients with advanced primary or recurrent rectal cancer, complete removal of the tumor by abdominal sacral resection can achieve respectable long-term control rates. The long-term results are similar to those reported after resection of liver metastases from colorectal cancer.²⁰ The results of resection of advanced epidermoid carcinoma that is fixed in the pelvis and invades the bony elements are less favorable (approximately 15% survival). Although patients with early epidermoid carcinoma of the anorectum generally have high response rates to chemotherapy and radiation (frequently obviating need of radical resection), those with very large tumors are less responsive and require extended resections to obtain local control.¹⁷ Re-

current epidermoid cancers of the cervix rarely present with isolated pelvic bone invasion. Selected patients may merit an aggressive resection (one of two patients in this series is surviving with no evidence of disease for more than 48 months). In patients with primary sacral tumors, either chordoma or sarcoma or the variety of giant cell tumors that occur in this region, resection with complete removal of the tumor is possible by abdominal sacral resection by the lateral approach²¹ or by a combination of these approaches, as used by various authors.^{4-7,11-13}

The management of extensive pelvic tumors commonly requires interaction among surgeons from different disciplines to effectively accommodate total tumor removal, reconstruction, and restoration of function. Rehabilitation is a major portion of the postoperative care, and most patients require a comprehensive rehabilitation program.

Because of the high risk for recurrence, multidisciplinary therapy is essential, depending on tumor type, the stage of disease, and whether a primary or recurrent tumor is involved. The patients with primary sarcomas, when

TABLE 9. *Mortality and Complications After Resection of Tumors of the Musculoskeletal Pelvis*

	Rectal Adenocarcinoma (n = 47)	Epidermoid Carcinoma (n = 11)	Primary Tumors (n = 18)
Perioperative mortality	4 (8.5%)	1	1
Complications			
Cardiovascular			
Myocardial ischemia, arrhythmia	2	1	0
Pneumonia	2	0	0
Pulmonary insufficiency (prolonged enterbation/ ARDS)	8	2	0
Intraoperative coagulopathy	1	0	2
Postoperative hemorrhage	6	0	3
Fistula			
Small bowel/large bowel	5	3	1
Bladder/ureteral	3	0	2
Infection			
Sepsis	14	1	0
Urinary tract	5	0	0
Wound complications			
Wound infection	7	5	1
Posterior wound infection/ flap separation	15	1	1
Bowel/urinary			
Small bowel obstruction	4	0	0
Renal failure	5	0	1
Hydronephrosis, ureteral stricture	0	1	0
Urinary incontinence	0	0	3
Urinary retention	0	0	1
Vascular/nerve			
Perineal nerve palsy	3	1	0
Deep venous thrombosis	2	2	2
Arterial transection/ ischemia			
Myonecrosis	0	0	1

TABLE 10. *Function After Posterior Resection for Primary Tumors*

Sacral Resection Level	Age	Sex	Sensory Locomotion	Function 0-4 (normal)		
				Anorectal	Bladder	Sexual
L3-4	20	M	Lower extremity paralysis Has hip flexion Anesthesia below hip	0	0	0
L5-S1	45	M	Plantar flexion Sensation foot/ankle	0-1	1-2	0
S1/S2	48	F	Plantar flexion Sensation foot/ankle	0-1	0-1	NE
S1/S2	55	M	Plantar flexion	0-1	0-1	NE
S1/S2	54	F	None	1-2	0-1	NE
Unilateral S1->5	40	M	Lower leg weakness, transient	0	2	0
Unilateral S2, 3, 4	27	M	Normal leg function	4	4	4
S2-3	24	F	Normal leg function	1-2	1-2	NE

NE, not evaluated.

possible, were treated with a protocol consisting of pelvic radiation 3000 cGy in 10 fractions and a 72-hour continuous infusion of Adriamycin 30 mg/M²/d (as originally described by Eilber et al.⁴). This therapy was generally well tolerated but was restricted to patients not previously irradiated. This type of protocol, coupled with adequate resection with achievement of microscopically clear margins, appears to have value in the patients with high-grade sarcomas.² Perhaps more aggressive chemotherapeutic programs would produce better control of distant disease, although the issue of adjuvant therapy for sarcomas is still controversial.⁸

Patients with locally advanced or recurrent epidermoid carcinoma of the anorectum that presented as massive tumors also were treated with radiation 3000 cGy plus continuous infusion fluorouracil (750 mg/M²/d) for 4 days, plus a single injection of mitomycin C 10 mg/M², or injection of cisplatin (25 mg/M²/d × 3).¹⁷ Patients with recurrent adenocarcinoma of the rectum generally had been radiated previously. In the event that patients with locally advanced rectal cancer had not been irradiated, we would advocate the use of preoperative radiation 4500 rads plus sensitizing fluorouracil.²² In general, 4500 to 5000 cGy in conjunction with sensitizing fluorouracil (15 mg/kg/d × 3 days, or continuous infusion dose of 750 mg/M²/d × 4 days) is well tolerated.

The optimum combined chemoradiation protocol is still not well defined, especially in these patients with locally extensive tumors. Because of the extensive nature of these tumors, the use of preoperative radiation appears obligatory if the patient has not been previously treated, to minimize the chance for recurrence in the pelvis. In this series, all but two of the patients with recurrent rectal

cancer had been previously irradiated, and both patients were irradiated before abdominal sacral resection. Thus, nothing could be said about the true benefit of preoperative irradiation with these tumors. The long-term tumor control in patients with advanced cancers of the rectum is a major problem. In this series, there is a high failure rate, with 76% of the patients recurring locally, regionally, or at distant sites. Although there are promising adjuvant therapy data for patients after resection of primary rectal cancer,^{23,24} or colon cancer,^{25,26} there are no applicable data in patients resected for recurrent colorectal cancer. Continued consultation with oncologists knowledgeable in this area is recommended.

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DISCUSSION

DR. KIRBY I. BLAND (Gainesville, Florida): President Ochsner, Secretary Jones, Fellows and Guests, I rise to congratulate Dr. Wanebo and his colleagues on this presentation, which I think would be appropriately termed a formidable challenge with an aggressive, radical approach to an advanced posterior pelvic malignancy. I thank the authors for the opportunity to review their manuscript in advance, and I recommend to the membership that you review this because it contains a wealth of material that Harry has not had time to present to you. My experience, however, is considerably different in terms of the types of tumors we have approached. The challenge of this operative resection to me is not in the volume of the tumor that presents for resection, but in the anatomic location of the primary or the metastatic lesion. And I think that the overwhelming majority of surgeons nationally, and internationally, for that matter, would consider that adequate resection can be accomplished if three tenets are preserved. And that is, the lesion is midline in the distal or midpelvis; and, secondly, the lesion has a minimal volume, and you can encompass it; and, thirdly, that the lesion does not have a volume that extends significantly to the pelvic sidewalls. If any of these anatomic tenets are breached, I believe that most would deny resection in those patients. Further, I believe that composite resection should not be attempted for patients in whom distant or regional metastases have been documented. And I think, Harry, you have well documented that.

We go through enormous effort to do gastrointestinal series, computed tomography scans of the abdomen and pelvis, magnetic resonance imaging or whatever, to make certain these persons do not have regional or systemic disease, metastatic disease. In fact, we will do computed tomography scans of the chest as well to make certain these patients do not have pulmonary metastases, which as you know are established in about 30% of patients with colorectal primaries. But I now believe that it is inappropriate to embark on a major composite resection for palliative purposes in individuals in whom you cannot expect cure. In my own personal experience of 18 composite resections for posterior midline lesions, 16 of these were adenocarcinomas, advanced adenocarcinoma with primaries or recurrent adenocarcinoma of the rectum, and two leiomyosarcomas, many of whom I have not followed beyond 3 years. We have performed composite resections with curative intent in 14 of these patients and two with palliative intent. Although there were no operative deaths in our series, I must tell you my operative morbidity rate was 100%. In these 16 patients with midline fixed lesions, I was able to perform *en bloc* resections of S2, 3, 4, and 5 coccyx, *en bloc* with an anterior and a posterior pelvic approach. And as a consequence of sacrifice of S2, 3, and 4, which is the nerve erigentes, and as you know supplies the bladder and prostate, you would expect essentially 100% of men to

have major urogenital problems; therefore, these individuals are going to require prolonged catheter intubation, daily intubations, or multiple times or permanent diversions, particularly when the bladder or the prostate are invaded. And I think this is a major consideration in men where they have either recurrent disease or perhaps a T3 or a T4 primary. Still some patients desire the palliative benefit of the procedure because of persistent pain, drainage, or these genitourinary dysfunction symptoms.

Well, I commend you, Harry, on your mortality rate of 8% in these patients with extended resections, in which as we saw in your slides you had a prolonged operative time, over 18 hours. I presume you did this in 1 day, or was that a 2-day operation? How do you do this? You had an enormous blood loss in these cases, and I presume you use cell saver in these individuals. My operative time is much less — again it is a different approach — and I am very conservative about these being midline posterior lesions. I have a couple of questions for you.

I could not determine from your abstract or the paper if there is a difference in resectability as a curative procedure with regard to tumor location. So for similar histologic tumor types, did patients with pelvic sidewall lesions fair worse than individuals who had purely posterior or anterior lesions? Our experience suggests that these are very different operations, and the morbidity and mortality rates are also very different in these patients. And I think you have mentioned to us that in a great percentage of the patients you had given preoperative irradiation. Some of these were failed chemotherapeutic patients. What do you do with a positive surgical margin when you find yourself operating, or do you even attempt to extend those margins with pelvic resection?

The other issue I was very interested in and impressed with was the figures in your manuscript and the slides you have shown us with reconstructions. You have used primarily gluteus medialis cutaneous flaps. I have had a fairly sizable experience with bilateral and single gracilis muscle myocutaneous flaps, which was pointed out to me long ago by Dr. John McCraw of Norfolk. And I have found that this has been very advantageous to fill massive pelvic defects.

And, finally, Harry, I commend you on what I do not believe has previously been achieved or reported. You have reported a 24% long-term survival rate in advanced rectal cancer. That has not previously been reported in my readings. In fact, this exceeds the survival rates for solitary lung and liver metastases from colorectal primaries. So I guess the question I would have is, what is the denominator of your patients in the population in which you have chosen this? I enjoyed the paper, and I thank you for the opportunity to discuss this.

DR. WILLIAM C. WOOD (Atlanta, Georgia): President Ochsner, Dr. Jones, Members and Guests, I appreciate the opportunity to have seen