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Full Length Article

Pelvic exenteration and composite sacral resection in the surgical treatment of locally recurrent rectal cancer

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KEYWORDS

Recurrent rectal cancer;
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Abstract *Background:* The incidence of rectal cancer recurrence after surgery is 5–45%. Extended pelvic resection which entails En-bloc resection of the tumor and adjacent involved organs provides the only true possible curative option for patients with locally recurrent rectal cancer.
Aim: To evaluate the surgical and oncological outcome of such treatment.
Patients and methods: Between 2006 and 2012 a consecutive series of 40 patients with locally recurrent rectal cancer underwent abdominosacral resection (ASR) in 18 patients, total pelvic exenteration with sacral resection in 10 patients and extended pelvic exenteration in 12 patients. Patients with sacral resection were 28, with the level of sacral division at S2–3 interface in 10 patients, at S3–4 in 15 patients and S4–5 in 3 patients.
Results: Forty patients, male to female ratio 1.7:1, median age 45 years (range 25–65 years) underwent extended pelvic resection in the form of pelvic exenteration and abdominosacral resection. Morbidity, re-admission and mortality rates were 55%, 37.5%, and 5%, respectively. Mortality occurred in 2 patients due to perineal flap sepsis and massive myocardial infarction. A R0 and R1 sacral resection were achieved in 62.5% and 37.5%, respectively. The 5-year overall survival rate was 22.6% and the 4-year recurrence free survival was 31.8%.
Conclusion: Extended pelvic resection as pelvic exenteration and sacral resection for locally recurrent rectal cancer are effective procedures with tolerable mortality rate and acceptable outcome. The associated morbidity remains high and deserves vigilant follow up.

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Introduction

Although the introduction of total mesorectal excision (TME) [1] and preoperative radiotherapy [2–5] has reduced the number of local recurrences following surgical resection of rectal cancer, these recurrences still occur in over 10% of cases and remain a major concern [6]. Consequentially, most patients with newly diagnosed local recurrences have already had radiotherapy before the primary operation. Radiotherapeutic options will therefore be reduced in future cases of recurrence [7].

While distant disease is the determining factor for prognosis in most of patients with recurrent rectal cancer, local recurrence will generally affect their quality of life [8,9]. Without treatment, these patients with locally recurrent disease have a median survival of about 8 months [10,11]. This can be explained that the uncontrolled local progression is disastrous for the quality of the remaining life; especially in the absence of life threatening metastases which can mean prolonged suffering. Any treatment that could lead to a remission or stabilization of the relapse might well be worthwhile. This could mean that local cure and even prolonged survival might be within reach for some patients [12].

Aim of this study

The aim of this study is to evaluate the surgical and oncological outcome of extended pelvic resection such as pelvic exenteration and abdominosacral composite resection for recurrent rectal cancer.

Patients and methods

Between the years 2006 and 2012, 40 consecutive patients, presented to the outpatient department, with locally recurrent rectal cancer invading the posterior and/or lateral pelvic walls. Disease resection was done with the intent of cure, so that to insure wide resection margins, pelvic organs were removed, if indicated, up to total pelvic exenteration. Similarly, posteriorly, sacral resection was performed if needed, with resection level ranging from S2–3 to S4–5.

Preoperative evaluation

All patients underwent routine full laboratory blood tests including base line Carcino-Emberyonic Antigen (CEA), digital rectal examination (DRE), and diagnostic colonoscopic or direct biopsy under local anesthesia, for pathological confirmation prior to surgery. Additional routine imaging procedures for local, regional and distant staging were performed including: Transrectal ultrasonography (TRUS), chest CT, abdominopelvic thin-section CT, and MRI with a phased-array coil. PET–CT was carried out in selected cases with equivocal metastatic results or to differentiate between extensive local fibrosis and disease recurrence. Cystoscopy was done for patients with suspicious, clinical or radiological, urinary bladder involvement.

Patients with tumor invading the sacrum proximally to the sacral promontory, or encasing the iliac vessels, or passing through the greater sciatic notch, or circumferentially involving the lateral pelvic wall, or causing bilateral ureteric obstruction were excluded. Similarly, patients with unresectable extra-pelvic disease, or those estimated to be poor surgical candidates, were also eliminated.

Only the cases with tumor recurrences following primary R0 resection, received pre-operative (neoadjuvant) radiotherapy, since all the other cases with primary R1 resection already received prior adjuvant radiotherapy.

Surgical technique [13]

In all cases, the abdominal sacral resection, which requires a combined approach, was used. The abdominal part consists of exploration with careful examination to exclude liver metastases, or signs of extrapelvic spread. Dissection begun at the lower aortoiliac tree and continued along the hypogastric artery and vein and includes the obturator nodes. These node groups 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. However, the finding of easily dissectible, though enlarged, obturator nodes would not preclude resection. Ileal conduit is done whenever involved ureters or bladder, co-existed with resectable pelvic tumor. The divided rectum (usually using the stapler) would be left in the pelvis. Pelvic devascularization is accomplished by dividing after 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, which prevents injury during the resection for the posterior approach. The abdomen is closed and the patient is repositioned prone.

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 sacrospinous 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 (Fig. 1). If it is possible, the proximal sacral roots are identified and an effort is made to preserve them by dissecting them free from the portion to be resected from the sacrum (Fig. 2). 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. 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 approxi-

mated (Fig. 3). Skin flaps are mobilized according to the amount of skin removed and are sewn together with suction catheters in place (Fig. 4). Skin grafting may be needed to cover donor sites if rotational flaps are used.

Postoperative follow-up

Postoperatively, patients were followed up until the end of 2012. For the first 2 years, patients were reviewed every 3 months for clinical examination, and serum CEA level. Abdomino-pelvic US and CXR were done every 6 months. CT chest, abdomino-pelvic MRI, and full colonoscopy were carried out on annual basis. PET–CT was done to investigate any suspicious findings during the regular follow-up protocol. For the following 3 years, patients were checked every 6 months then annually thereafter.

Statistical methods

Data management and analysis were performed using Statistical Package for Social Sciences (SPSS) vs. 17. Disease free and overall survival times were estimated using the methods of Kaplan and Meier. Differences between survival curves were assessed for statistical significance with the log-rank test. All p-values are two-sided. p-Values < 0.05 were considered significant [14].

Results

In total, 40 patients were operated upon. Among whom, 25 (62.5%) were males while 15 (37.5%) were females, with a male to female ratio of 1.7:1, with a median age of 45 years (range 25–65 years), and 21 (52.5%) patients recorded to be above 50 years of age. Primary tumor stage and management, time interval before recurrence, and patterns of recurrence's pathological confirmation, are detailed in Tables 1 and 2, respectively.

In total, abdominosacral resection (ASR) was done in 18 (45.0%) patients, extended pelvic exenteration in 12 (30.0%) patients, and total pelvic exenteration with sacral resection in 10 (25.0%) patients. Full surgical details are explored in Table 3.

Median operative time was 210.3 min (180–390 min). Median blood loss was 3800 cc (range 500–6000 cc). Median hospital stay was 21 (range 7–52) days. Postoperative complications are detailed in Table 4.

Figure 2 The proximal sacral roots are identified and an effort is made to preserve them by dissecting them free from the portion to be resected from the sacrum.

Patients were followed for a median of 50 months, a range of 22–60 months. The relation of patients' age, sex, Duke's stage at first diagnosis, and primary surgery to 4-years' disease-free survival (DFS) and 5-years' overall survival (OS) is presented in Tables 5 and 6, respectively.

Discussion

The therapeutic value of reoperation in cases with isolated localized rectal cancer recurrences has been hard to assess because of the widely known pessimistic view that surgical treatment of these patients is of no value [15]. However, since it has a tremendous impact on quality of life [6], due to the often accompanied intractable pain and serious complications [7], it is worth treatment by aggressive surgical procedures as this will determine the quality of the remaining life [16], and the literature shows that only complete resection of the

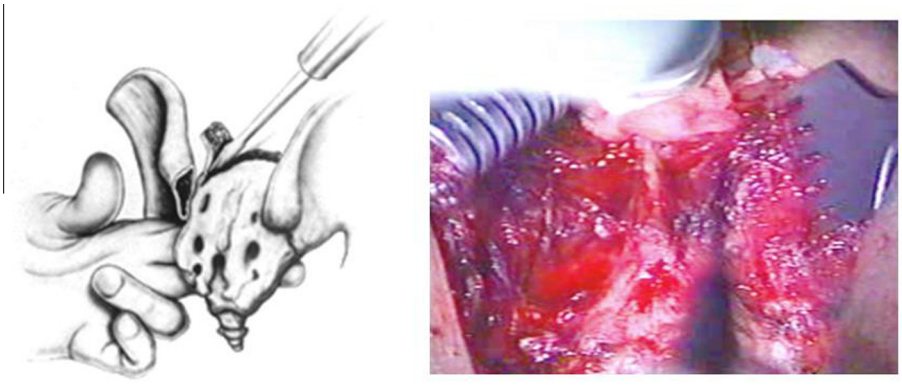

Figure 1 After inserting a finger medial and underneath the sciatic nerve (diagram), a laminectomy is performed proximal to the planned level of sacral resection in order to ligate the terminal end of the dural sac (picture).

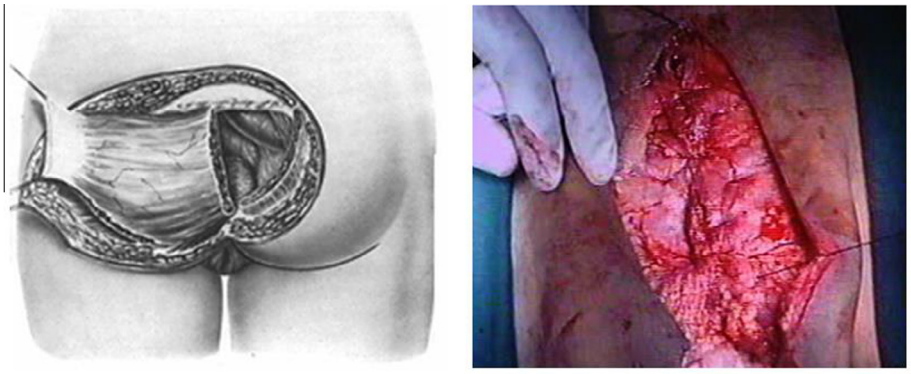

Figure 3 The muscle flaps are approximated in the midline after laterally incising the insertion of the greater trochanter on the gluteus maximus.

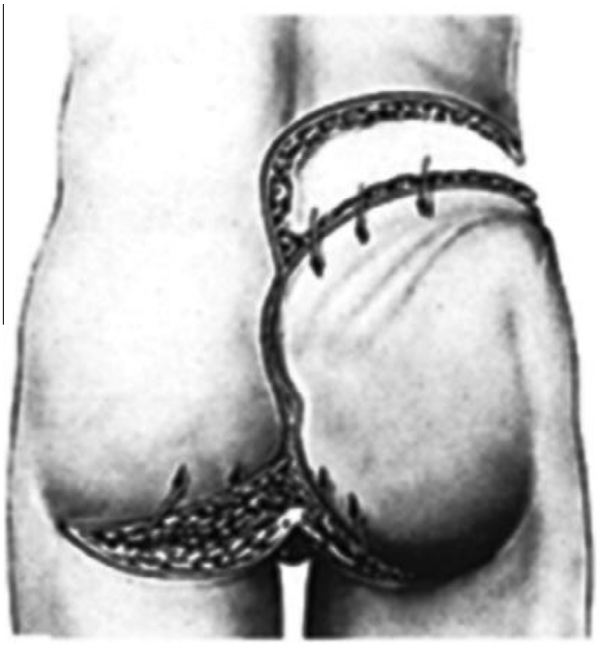

Figure 4 Skin flaps are rotated as needed and a skin graft may be required at the donor site of the rotated flap (upper shaded area on the right).

recurrent disease is the best and single effective option for these patients [17–26]. Thereby, aggressive attempt has to be made to obtain a microscopically radical resection [15,20]. Consequently, posterior or total exenteration may be indicated in case of an anteriorly located recurrence, while an abdominosacral resection may be indicated when dealing with a posteriorly located recurrence [27–29].

Primary stage

In this study, we found no statistical difference between stage B and C on presentation, on the 5-year overall survival or disease-free survival, following local resection of the recurrent disease. These findings correlate with other authors' findings [30,31], emphasizing the importance of selection of isolated local pelvis recurrences for this type of aggressive salvage procedures.

Table 1 Primary tumor status.

Primary tumor (n = 40)	Patient No.	(%)
Duke's stage of primary cancer		
B	27	(67.5)
B2	16	(40.0)
B3	11	(27.5)
C	13	(32.5)
Primary tumor management		
Primary surgical resection		
APR	24	(60.0)
LAR	16	(40.0)
Radiotherapy		
Previous adjuvant RT for primary (R1)	15	(37.5)
Neoadjuvant RT for recurrence (R0)	25	(62.5)

APR: abdomino-perineal resection; LAR: low anterior resection; RT: radiotherapy.

Table 2 Tumor recurrence interval and methods of its tissue diagnosis.

Tumor recurrences (n = 40)	Patient No.	(%)
Free time interval after primary resection		
Less than 12 months (1st year)	6	(15.0)
From 13–24 months (2nd year)	14	(35.0)
From 25–36 months (3rd year)	12	(30.0)
From 37–48 months (4th year)	6	(15.0)
From 49–60 months (5th year)	2	(5.0)
Recurrent tumor tissue diagnosis		
Biopsy at laparotomy	1	(2.5)
Biopsy per rectum	10	(25.0)
Pre-sacral biopsy	26	(65.0)
True-Cut biopsy	22	(55.0)
FNAC (CT guided)	4	(10.0)
PET–CT*	3	(7.5)

FNAC: fine needle aspiration cytology; CT: computerized tomography; PET: positron emission tomography.

* Though PET–CT is not a standard tissue diagnosis method, it was used for tissue differentiation, in addition to the clinical surgery, to take the decision of surgery. Postoperative final pathology supported the decisions.

Table 3 Study surgery details.

Detail	Patient No.	(%)
Procedure classification (n = 40)		
Curative intent	35	(87.5)
Palliative intent	5	(12.5)
Completeness of surgical resection		
R0	25	(62.5)
R1	15	(37.5)
Extent of resection (n = 40)		
Abdomino-sacral resection (ASR)	18	(45.0)
Pelvic-exenteration and sacral resection	10	(25.0)
Extended pelvic-exenteration (bladder/rectum/perineum/soft tissue)	12	(30.0)
Level of sacral resection	28	(70.0)
S2/3	10	(25.0)
S3/4	15	(37.5)
S4/5	3	(7.5)
Pelvic lymph node dissection (PLND)	10	(25.0)
Pelvic organ(s) resected with recurrent rectal cancer (n = 22)		
Total	22/40	(55.0)
Rectum	5	(22.7)
Bladder + prostate	10	(45.5)
Bladder + uterus, tubes and ovaries	5	(22.7)
Uterus, tubes and ovaries	2	(9.1)

Primary surgery

In this study, as in other studies [15,32], there was no effect of primary surgery, on recurrence or survival, between the APR and the sphincter preserving techniques as LAR, as long as it maintained a 2 cm clear surgical margin.

Table 4 Complications after resection of pelvic recurrence.

Postoperative complication	Patient No. (%)
Morbidity (n = 22)	22/40 (55.0%)
Cardiovascular	4
Myocardial ischemia	1
Hypotension	1
Pneumonia	2
Wound complications	9
Perineal dehiscence	3
Flap sloughing	4
Wound infection	2
Urinary complication	4
Small bowel obstruction	5
Mortality (n = 2)	2/40 (5.0%)
Massive myocardial infarction[a]	1
Perineal flap sepsis[b]	1
Hospital re-admission[c] (n = 6)	6/40 (15.0%)
Perineal bleeding	3
Intestinal obstruction	2
Perineal hernia	1

[a] Massive myocardial infarction lead to immediate postoperative death.
[b] Perineal flap sepsis, caused pelvic sepsis, which lead to septicemia with resultant death after 20 days.
[c] All managed conservatively.

Extent of surgery for recurrence

In this study, the rate of R0 achievement was 62.5%, compared to that reported by other authors ranging between 51% and 68% [33]. Many surgeries reported that achievement of clear operative margins (R0) conferred a large and significant benefit for disease-free survival compared with R1 and R2 resections (median 45 months vs. 19 and 8 months, respectively, which makes the R1 and R2 surgery practically useless [31,34]. Thereby, the resection in this type of surgery is usually extended, since a clear microscopic margin is mandatory, accordingly we reported other organs' resection in 55% of cases. A posterior or total exenteration may be indicated in case of an anteriorly located recurrence; while an abdominosacral resection may be indicated when dealing with a posteriorly located recurrence [7].

The bladder is usually the most involved organ, though many of these involvements could have been simply prevented during the primary surgery by positioning the ureters up at the lateral pelvic floors, instead of leaving them hanging down [31]. In cases of bladder involvement, especially in those heavily irradiated patients, it is always better to go for planned cystectomy from the beginning, rather than trying partial cystectomy, with its subsequent frequent urinary fistulae, a note that has been also advised by other authors [31].

In this series, all cases of abdomino-sacral resection were performed below the level of S2, which is technically feasible and can be performed safely [27,28].

Postoperative complications

In this study we report a median operative duration of 3.5 h compared to 6–14 h reported by other authors [7,13,31], with a comparative median blood loss 3800 cc vs. 2500–11,500 cc in the literature [7,24,31,35]. We also report postoperative complications comparative to other authors, like wound infection (8.1% vs. 10.0%), wound dehiscence (13.6% vs. 7.5%), urinary complications (18.2% vs. 20.0%) [7]. Our overall complication rate of 55% was compared to that of 82% reported by other authors [34]. This marked lower complication rate might be related to the fact that some series included a much higher percentage of sacral resection then ours; moreover all our resections were at lower level than S2, with subsequent lower complications.

In this study we could not comment on the difference in the post-operative complication rate between the low ($\leqslant$S3) and high ($\geqslant$S2–3 disk) level of sacrectomy, since all cases were resected below S2 level, though some recent studies are reporting no significant difference between both [34].

The postoperative mortality rate was 5% in our study coinciding with 0–10.7% reported in other publications [31,33,35].

Patients' survival

In this study, a 5-years' overall survival of 22.6% was found compared to 11–51% reported in other studies [7,13,31,33]. This represents a valuable addition when compared to the 4% 5-year survival of palliated patients [13]. Moreover, a 4-year recurrence free survival of 31.8% was obtained compared to 20–26% in other studies [7,34,35], which can be explained by the 1 year difference in the follow-up period. These small

Table 5 Primary tumor stage and surgery type relation's to 4-years' local recurrence free.

Primary tumor management	Total patients No.	Patients with Recurrences No.	4-Years Rec. FS%	Median	*p*-Value
Total	40	27	31.8	40	
Age groups					
⩽50 years	19	12	41.4	39	0.622
>50 years	21	15	37.0	42	
Sex					
Female	15	10	38.9	39	0.966
Male	25	17	38.8	42	
Duke's stage*					
B	27	16	46.9	48	0.081
C	13	11	23.1	37	
Primary surgery					
APR	24	17	30.7	40	0.934
LAR	16	10	46.1	38	

* At primary diagnosis. Rec. FS: recurrence free survival; APR: abdomino-perineal resection; LAR: low anterior resection; RT: radiotherapy.

Table 6 Primary tumor stage and surgery type relation's to 5-years' survival.

Primary tumor management	Total patients No.	Patients with recurrences No.	5-Yrs OS%	Median	*p*-Value
Total	40	27	22.6	54	
Age groups					
⩽50 years	19	12	30.2	50	0.497
>50 years	21	15	13.7	54	
Sex					
Female	15	10	19.4	50	0.906
Male	25	17	24.4	54	
Duke's stage*					
B	27	16	30.8	54	0.368
C	13	11	8.8	54	
Primary surgery					
APR	24	17	18.2	55	0.977
LAR	16	10	36.7	50	

* At primary diagnosis. Yrs: Years; OS: overall survival; APR: abdomino-perineal resection; LAR: low.

differences between the overall survival and the disease free survival, undermine the value of such aggressive procedures in the amelioration of the quality of life. Overall survival and disease free survival were not influenced by the age, sex of the patients, which is coinciding with other studies [7]. Most authors demonstrated that R0 resection is the most important predictor for survival on 5-year survival [33,34,36,37].

Conclusion

Extended pelvic resection as pelvic exenteration and sacral resection for locally recurrent rectal cancer are effective procedures with tolerable mortality rate and acceptable outcome. The associated morbidity remains high and deserves vigilant follow up.

Disclosure statement and conflict of interest

The authors deny any actual or potential conflict of interest; financial or otherwise.

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