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Internal Hemipelvectomy for Primary Pelvic Bone Tumours Surgical Complications and Oncological Outcomes

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Primary bone tumours of the pelvis usually present late, with large tumour size, in proximity to major neurovascular structures and visceral organs. Due to its operative morbidity, prolonged time of surgery, associated blood loss, and inherent anatomical challenges, internal hemipelvectomy is practiced in specialised centers only. This study was designed to evaluate the surgical complications and oncological outcomes in patients undergoing internal hemipelvectomy for primary pelvic bone tumours. A prospectively collected database at our Institute was retrospectively reviewed, and 51 consecutive patients who underwent internal hemipelvectomy for primary pelvic bone tumours from 2005 to 2020 were identified. Ewing's sarcoma and chondrosarcoma (17 each) were the most common diagnoses. Neoadjuvant therapy was offered to 27 patients (53%), with a mean tumour response of 57%. Thirty patients received adjuvant radiation to the operative site, and 87% completed the course of chemotherapy.

Negative surgical margins were obtained in 84.4% patients. 22 patients had flap-related complications. Age more than 20 years, T stage, and the number of segments resected adversely impacted flap-related complications. Three patients needed explantation of the prosthesis, and six patients had nerve injuries. After a median follow-up of 44 months (range, 2-148 months), 23 patients had recurrences. The 3-year event-free survival and overall survival were 47% and 61%, respectively, and at 5 years, they were 39% and 59%, respectively. Patient selection plays an essential role and should be based on accurate preoperative imaging, appropriate neoadjuvant therapy, and effective preoperative planning. Surgical expertise supported by aggressive physiotherapy is essential for rehabilitation. Despite the various challenging perioperative hurdles, it is a viable option for limb salvage for pelvic sarcomas.

Keywords: Internal hemipelvectomy, Limb salvage surgery, Pelvic tumours, Ewing's sarcoma, Chondrosarcoma.

INTRODUCTION

Primary bone tumours of the pelvis usually present late, with a large tumour size, in close proximity to major neurovascular structures and/or visceral organs. Despite diverse histologies and treatment protocols, they all share the same anatomical location and similar surgical resection patterns, which collectively add up to form a large series of primary pelvic sarcomas. The literature available on this topic is relatively sparse, and we felt a need to interpret this heterogeneous group collectively. Historically treated with amputation (external hemipelvectomy), functional and oncological outcomes were poor[1]. In the current era of multimodality treatment, limb salvage is achieved by internal hemipelvectomy, yielding good oncological and acceptable functional outcomes[2-4]. The perceived poor prognosis, as compared to extremity sarcomas[5], adds to the challenge of attempting such a morbid procedure[6]. Reconstruction of the bone with a prosthesis, bone grafts, and 3D-printed models has been attempted; however, the loss of soft tissue cover contributes to wound-related complications.

Due to its operative morbidity, prolonged time of surgery, associated blood loss, and inherent anatomical challenges, it is practiced in very few centers across the globe. This study aimed to evaluate the surgical complications and oncological outcomes of internal hemipelvectomy for primary pelvic bone tumors.

PATIENTS AND METHODS

A prospectively collected database at our Institute was retrospectively reviewed, and 63 consecutive patients who underwent internal hemipelvectomy between 2005 and 2020 were identified. The Institutional Review Board for Ethical Conduct of the study was approved at the onset.

Inclusion criteria:

- Curative-intent internal hemipelvectomy
- Any age or sex
- Any malignant histology suggestive of a primary bone tumour

Exclusion criteria:

- Benign or intermediate grade histology
- Intra-operative conversion to external hemipelvectomy
- Metastatic disease at presentation
- Radical radiotherapy for non-metastatic tumours of the pelvis
- Internal hemipelvectomy for metastatic deposit
- Second primary tumour (previously treated for any cancer with systemic chemotherapy, prior pelvic radiation therapy, or pelvic bone surgery)

Prognostic variables

Medical records were reviewed for the potential clinicopathologic factors that might influence surgical complications and oncological outcomes. For demographic data, patients' sex and age were analysed.

Imaging and staging investigations: All patients underwent X-ray and magnetic resonance imaging (MRI) of the pelvis, as well as a preoperative biopsy, as part of their diagnostic investigations. Staging investigations included high-resolution computed tomography (HRCT) of the chest and 99m-Tc MDP Single-Photon emission computed tomography (SPECT) bone scintigraphy. Positron Emission Tomography (18-FDG PET/CT) was performed as indicated, on a selective basis.

Tumour-related factors analysed were anatomic site, histologic diagnosis, histologic grade, and tumour size. The size of the primary tumor was defined as the largest diameter measured on preoperative magnetic resonance imaging or as stated in the pathologic examination report. Indeterminate lung nodules, defined as the presence of uncalcified, subcentimeter (less than or equal to 10mm in the greatest dimension) nodules in the lung parenchyma, at the time of diagnosis, were documented, followed up, and analysed as an independent variable.

The treatment strategy for all patients was discussed in the institutional multidisciplinary sarcoma tumour board. Chemotherapy and radiation therapy were administered as indicated, both in the neoadjuvant and adjuvant settings.

Surgical resection of the pelvis was classified as Types 1 - 4, based on the Enneking and Dunham classification[6] (Figure 1). The operative technique was as described in the standard textbooks[7]. Primary closure of the defect was achieved in the resection of segments I and III. However, periacetabular resections were reconstructed using the hip transposition technique, wherein the femoral head or proximal femur was suspended to the available segment of ilium, pubis, or sacrum using Prolene mesh (meshplasty)[8]. This approach was designed to maintain acceptable limb length discrepancy, provide stability, and support long-term functional outcomes.

The primary endpoints of the study were overall and disease-free survival. Overall survival (OS) was measured from the date of diagnosis to the date of death from disease or any other cause, or to the date of last follow-up. Event-free survival (EFS) was measured from the date of diagnosis to the date of disease recurrence, either local or systemic, death, or last follow-up. The disease-free interval (DFI) was defined as the period from the completion of treatment to the date of recurrence, death, or last follow-up.

Secondary endpoints included surgical outcomes. The surgical factors analyzed included intraoperative blood loss, flap-related complications, postoperative distal neurological deficits, and microscopic margin status. Flap-related complications included edge necrosis or wound dehiscence. Infections were defined according to CDC criteria[9]. They were classified as superficial or deep based on the criteria described. Based on the Clavien-Dindo score[10], the group was dichotomized into those with a score of less than 3 and those with a score of 3 or higher. Reoperation was defined as any secondary procedure required to expedite wound healing. It included debridement, implant removal, wound wash, and secondary closure by advancement, local flaps, or skin grafting. They were classified as major if the surgery required regional or general anesthesia. The use of local anesthesia or procedures performed bedside was classified as minor reoperations. Postoperative distal neurological deficit was defined as a permanent loss of function in either the sciatic or femoral nerves.

Post-treatment surveillance consisted of a clinical examination every three months, supplemented by chest and pelvic x-rays. MRI was done selectively

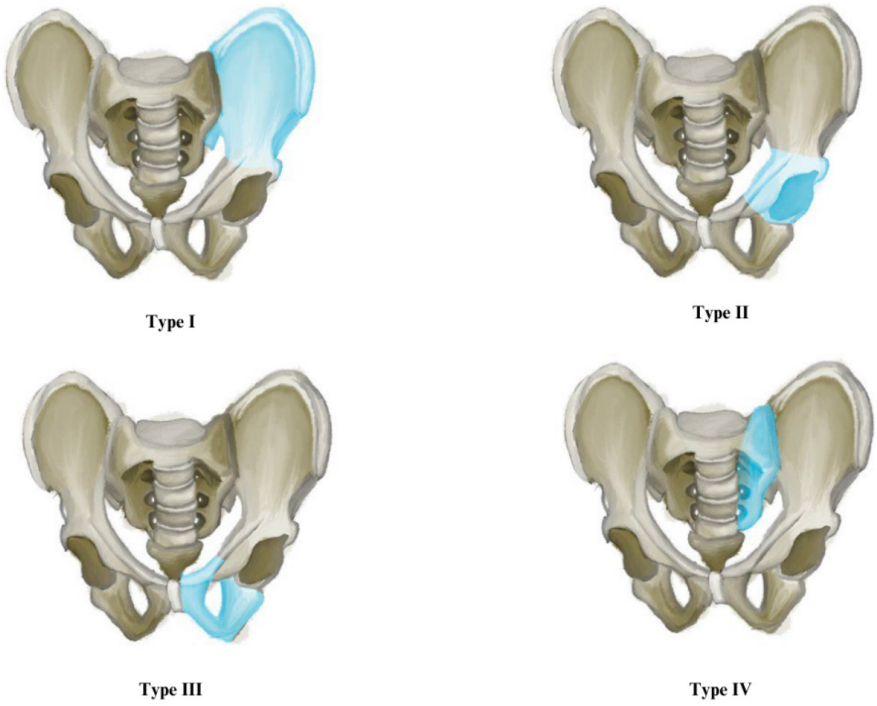

Fig. 1 — Enneking and Dunham classification of pelvic resection.
Type I: The iliac wing; Type II: The periacetabular region; Type III: The pubic rami; Type IV: The sacrum. The blue area in each type indicates the bony area to be resected.

based on the suspicion of local recurrence. HRCT of the chest was indicated for a suspicious new nodule on chest x-ray or follow-up of previously noted lung nodules.

Statistical analysis

Continuous variables were presented as a mean with SD, and categorical variables as frequencies with percentages. Logistic regression analysis was conducted for both univariate and multivariate analyses of factors related to flap-related complications. A p-value of <0.05 was considered significant.

Multiple clinical and pathological factors were analyzed for their potential association with oncological outcomes. Recurrence of disease, either local or systemic, and the treatment for recurrences were documented and analysed. Survival curves were estimated using the Kaplan-Meier method and plotted for each histology. Statistical analyses were performed using the SPSS software (Version 20.0; IBM Co., Armonk, NY).

RESULTS

Between 2005 and 2020, 63 patients were planned for internal hemipelvectomy at our center. Due to vascular or sciatic nerve involvement, three patients underwent upfront amputation. Two patients with metastatic deposits in the pelvis and one patient with a post-irradiated second primary in the pelvic bone were excluded. Six patients with benign or intermediate histology were excluded from the study, which left 51 patients for analysis (Figure 2).

Thirty-five patients (61.4%) were male, and 22 patients (38.5%) were female. The details regarding histology, neoadjuvant, and adjuvant treatment have been summarized in Table I. The mean blood loss during the surgical procedure was 1,500ml (range, 200ml – 4,000ml) - 1,896ml for periacetabular resections compared to 1,200ml for other resections, with a mean tumour size of 14cm (range, 8cm - 19cm) as determined by the final histopathological examination. The mean tumour response to neoadjuvant therapy (n=27) was 62% (range 0-100%). Negative histological margins were obtained in 43 patients (84.4%). Eight patients (15.6%) had microscopic positive surgical margins. Of the eight patients, five received adjuvant radiation therapy, while three refused it. Post-resection, the pelvis was reconstructed with a free fibula graft in one patient, a saddle prosthesis in two patients, and an ice cream cone prosthesis in three patients. Twenty patients achieved acceptable functional outcomes without any reconstruction (Types I and III), while the periacetabular resections (31 patients) were reconstructed with hip transposition as described.

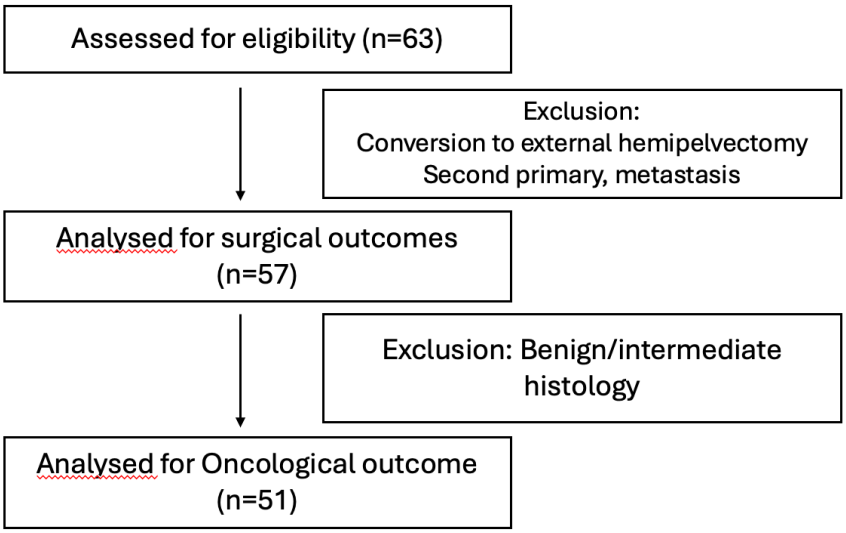

Fig. 2 — STROBE flow chart.

Table I. — Treatment details – Stratified by histology.

	All cases	CS	ES	OstS	Others
Total number	51	17	17	9	8
NACT	26	0	17	6	3
Pre-op RT	6	0	3	1	2
Margin positivity	8	2	3	2	1
Periacetabular resection	28	10	8	7	3
Wound morbidity	21	11	2	5	3
Completed adjuvant treatment	27	1	15	7	4
Isolated Local recurrence	6	3	3	0	0
Isolated Systemic recurrence	9	2	5	1	1
Both local and systemic recurrence	8	1	4	2	0
Treated for Local recurrence	2	Surgery 2	-	-	-
Treated for lung metastasis	3	Surgery 1	Chemo 1	-	Surgery 1
*CS: Chondrosarcoma; *OstS: Osteosarcoma; *ES: Ewing sarcoma; NACT: Neoadjuvant chemotherapy; *RT: Radiation therapy.					

Surgical Complications

Flap-related complications were the single most common cause of post-operative morbidity (n=20). A Clavian-Dindo score of 3 or more was noted in 16 patients, who required multiple surgical procedures for wound healing. The average number of procedures was 1.54, with a range of 1 to 6 procedures. Two patients required explantation of the infected prosthesis, and one patient required removal of the infected fibular graft. Flap-related complications stratified by resection types have been tabulated in Table II.

In the univariate analysis (Table III), age more than 20 years had an odds ratio of 3.250 (95% CI: 0.88-12.0, p=0.07). Ewing sarcoma histology was associated with reduced flap-related complications (odds ratio = 0.11; 95% CI: 0.01-0.77; p = 0.026). Resection of larger tumours and multiple pelvic segments was associated with higher complications. Classified based on AJCC 8th edition(11), (y)pT3b (6 out of 10 patients) and (y) pT4a (10 out of 20 patients) tumours had statistically significantly higher complications (p = 0.05, 0.08). In terms of the pelvic segment being resected, flap-related complications increased with the number of pelvic segments resected. Resection of three segments (I, II, III or I, II, IV) carried an odds ratio of 4.95 (95% CI: 0.98-24.88, p=0.05) and resection of all four segments increased the odds ratio to 10.83 (95% CI: 1.37-85.44, p=0.024). Preoperative radiation did not impact surgical complications (p = 0.95). On multivariate analysis (Table IV), only Ewing histology reduced the flap-related complication rate with an odds ratio of 0.09 (95% CI: 0.07-1.22, p = 0.07). Age more than 20 years, T stage, or segment of pelvic resection did not impact it.

Post-operative permanent nerve injury was noted in six patients: foot drop (n=5) due to sciatic nerve palsy and knee extensor weakness (n=1) due to femoral nerve palsy. One patient had an intraoperative injury to

Table II. — Flap-related surgical complications (n=51).

Segment(s) of pelvis resected	Number of surgeries	Flap-related Complications	Percentage
I	11	0	0
II	4	2	50
III	1	0	0
IV	-	-	-
I-II	5	1	20
I-IV	2	0	0
I-II-IV	13	7	53.8
II-III	6	4	66.6
I-II-III	2	1	50
I-II-III-IV	7	5	71.4
Segments as classified by Enneking and Dunham.			

Table III. — Univariate analysis of Factors affecting Flap-related complications.

		Number	Univariate Odds ratio	95% CI	Significance (p-value)
Age	<20 years	17	1.00		
	>20 years	34	3.250	0.88-12.0	0.07
Histology	OstS	9	1.00		
	ES	17	0.11	0.01-0.77	0.026
	CS	17	1.47	0.28-7.63	0.65
	Others	8	0.48	0.69—3.35	0.48
T stage	T2a	10	1.00		
	T2b	6	0.8	0.06-11.30	0.87
	T3a	6	0.8	0.06-11.3	0.87
	T3b	9	8.0	1.00-63.96	0.05
	T4a	20	4.889	0.82-29.06	0.08
Pelvic resection	1 segment	16	1.00		
	2 segments	13	2.708	0.50-14.54	0.24
	3 segments	15	4.952	0.98-24.88	0.05
	All 4 segments	7	10.83	1.37-85.44	0.024
Pre op RT	No	46	1.00		
	Yes	5	0.947	0.14-6.22	0.95
**CS: Chondrosarcoma; *OstS: Osteosarcoma; *ES: Ewing sarcoma; *T stage: Tumour stage; *RT: Radiation therapy.					

the common iliac vein, which required reconstruction with a vascular graft. In the three patients who underwent resection of the proximal femur, one patient had sciatic nerve injury, one had an infection of the modular prosthesis requiring explantation, and the third patient developed prosthesis head dislocation on follow-up, requiring closed reduction. The timing of complications was not analysed in the present manuscript.

Among patients with short follow-up (less than 4 months), three patients were able to mobilize with two crutches. In those with longer follow-ups, acceptable functional outcomes were achieved. Twenty patients were able to mobilise without any support. Six patients required two crutches, and the remaining needed a single elbow crutch for assistance. There was no objective documentation of functional outcomes, such as the MSTS score, in the reviewed database.

Oncological Outcomes

Event-free survival

Tumour recurrences were identified at the local site based on clinical evaluation and radiology. On long-term follow-up, a total of 23 recurrences were observed. Isolated local recurrences were noted in six patients (10.5%), systemic recurrences in nine patients (15.7%), and eight patients (14%) had both local and systemic recurrences. The event-free survival was 47% at 3 years and 39% at 5 years. A histology-specific stratification has been tabulated in Table V and illustrated in Figure 3.

Of the six isolated local recurrences, none of them had a microscopic margin-positive resection. Three patients had a histological diagnosis of Ewing sarcoma (DFI - 3.33 months). Two patients received palliative radiation to the regional site, and one patient

Table IV. — Multivariate analysis of Factors affecting Flap-related complications.

		Odds ratio	95% CI	Significance (p-value)
Age	<20 years	1.00		
	>20years	2.07	0.15-27.8	0.58
Histology	OstS	1.00		
	ES	0.09	0.07-1.22	0.07
	CS	2.29	0.18-28.8	0.52
	Others	0.24	0.02-2.92	0.26
T stage	T2a	1.00		
	T2b	0.17	0.004-3.05	0.20
	T3a	0.514	0.014-18.28	0.71
	T3b	4.494	0.27-73.73	0.29
	T4a	6.45	0.29-145.6	0.24
Pelvic resection	1 segment	1.00		
	2 segments	0.99	0.026-37.147	1.00
	3 segments	2.23	0.202-24.66	0.51
	All 4 segments	6.49	0.286-145.56	0.24
**CS: Chondrosarcoma; *OstS: Osteosarcoma; *ES: Ewing sarcoma; *T stage: Tumour stage; *RT: Radiation therapy.				

Table V. — Survival Outcomes.

		Overall	CS	ES	OstS	Others
EFS	3 year	47	72	35	33	47
	5 year	39	55	35	33	31
OS	3 year	61	79	46	38	75
	5 year	59	79	30	38	56
*EFS: Event free survival; *OS: Overall survival; *CS: Chondrosarcoma; *OstS: Osteosarcoma; *ES: Ewing sarcoma.						

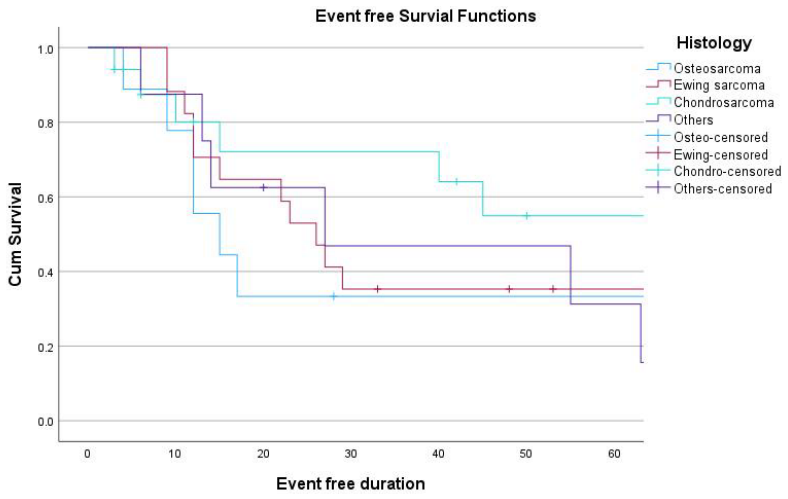

Fig. 3 — Event-free survival curves (stratified by histology).
**BLUE: Osteosarcoma; *RED: Ewing's sarcoma; *GREEN: Chondrosarcoma; *Purple: Others.*

received oral metronomic chemotherapy with the best supportive care. Three patients had a histological diagnosis of chondrosarcoma (DFI - 20.33 months). Two patients underwent revision surgery and were disease-free at the time of the last follow-up, five years after the second surgery. One patient defaulted on the revision surgery option and was alive at the time of the last follow-up, 13 months after the detection of local recurrence.

Of the nine patients who presented with isolated systemic recurrences (Ewing sarcoma (n = 5), chondrosarcoma (n = 2), synovial sarcoma (n = 1)), all were margin-free resections. However, two patients had upfront indeterminate lung nodules that progressed

after completion of therapy (DFI - 13 months). Six candidates were deemed for the best supportive care due to a short DFI or poor general condition. Two candidates underwent lung metastasectomy for an isolated site of metastasis (histology: synovial sarcoma, DFI - 2 years; chondrosarcoma, DFI- 5 years), who were both alive at the time of last follow-up, 72 months from the date of diagnosis.

Eight patients had both local and systemic recurrences {Ewing's sarcoma (n = 4), osteosarcoma (n = 2), chondrosarcoma (n = 1), and sarcoma of other types (n = 1)} at a median DFI of four months. Two of these patients had microscopic positive surgical margins, and 2 had upfront indeterminate lung nodules. All eight patients were offered the best supportive care.

Overall Survival

The median follow-up period was 44 months (range, 3 -148 months). The overall survival was 61% at 3 years and 59% at 5 years. Histology-specific survival outcomes have been tabulated in Table V and illustrated in Figure 4.

In the univariate analysis, age group (p-value 0.10), gender (p-value 0.88), histology (p-value 0.159), and tumour T staging (p-value 0.84) did not affect oncological outcomes (Table VI). Since none of the variables were statistically significant in the survival

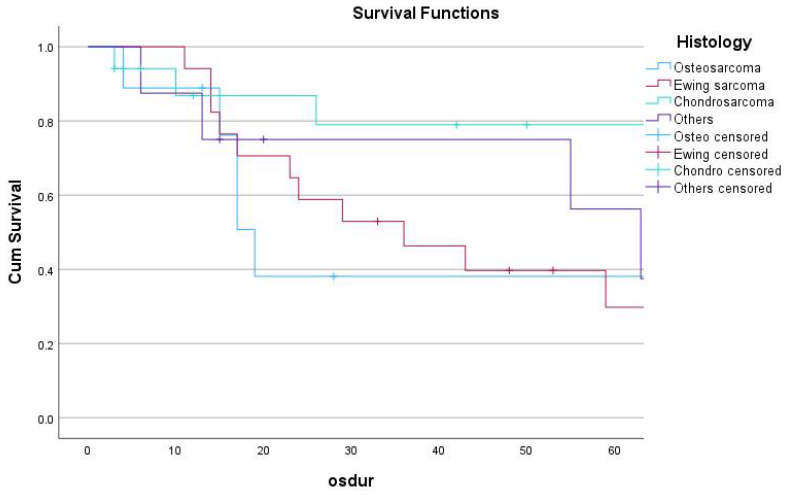

Fig. 4 — Overall survival curves (stratified by histology).
***BLUE: Osteosarcoma; *RED: Ewing's sarcoma; GREEN: Chondrosarcoma; *Purple: Others.*

Table VI. — Univariate analysis of factors affecting survival outcomes.

Factor		Number	Median survival (months)	5-year OS	Significance (p-value)
Age	<20 years	17	43.5	24	0.10
	>20 years	34	88.0	61	
Gender	Male	31	75.9	46	0.887
	Female	20	57.5	52	
Histology	OstS	9	37.3	38	0.159
	ES	17	45.8	30	
	CS	17	111.6	79	
	Others	8	61.2	56	
T stage	T2a	10	60.7	55	0.844
	T2b	6	97.8	60	
	T3a	6	46.3	33	
	T3b	9	60.4	57	
	T4a	20	49.6	42	
Margin status	Positive	8	50.0	31	0.277
	Negative	43	80.3	53	

*OS: Overall survival; OstS: Osteosarcoma; ES: Ewing sarcoma; CS: Chondrosarcoma; T stage: Tumour stage.

analysis, a Cox regression was not performed to determine the hazard ratio.

DISCUSSION

Pelvic tumours are anatomically complex in their morphology, with delayed presentation contributing to large tumour size, and proximity to major neurovascular structures adding to the challenge of surgical resection[12]. Limb salvage, though more difficult than extremity bone resection, maintains a patient's body image, enhances limb function, and improves the patient's quality of life. Oncologically safe resection, in limb salvage, is attempted whenever possible, despite the potential for higher operative complications and a prolonged recovery period[13]. The type of reconstruction varies according to the resected segments of the pelvis, the soft-tissue component, the patient's functional demands, and the operating surgeon's expertise.

The procedure involves significant blood loss with resultant morbidity. Our set of patients had an average loss of 1,500ml (1,896ml for periacetabular vs 1,200ml in other resections), which was less than that of the other similar series. Puri et al.[14] demonstrated a significantly higher blood loss in periacetabular resections (4,500 ml vs 2,500 ml). Salunke et al.[13] report a mean blood loss of 3,000ml (range, 2,500-4,200ml). Guder et al.[15] documented a mean substitution of 10 erythrocyte components in their case series, which can be estimated to a blood loss of about 3000-4000ml per case. At our center, the procedure is performed by surgeons with expertise in musculoskeletal oncology, who emphasize meticulous dissection and hemostasis. The soft tissues are dissected all around the tumor, and the proposed bone cuts are the final steps of the resection, allowing for pressure hemostasis of the marrow ooze. This is likely the reason for the lower estimated blood loss in comparison to other studies.

Post-resection, the pelvis was reconstructed with a free fibula graft in one patient, a saddle prosthesis in two patients, and an ice cream cone prosthesis in three patients. Patients without acetabular resection (n = 20) achieved acceptable functional outcomes without reconstruction, whereas patients with periacetabular resections underwent hip transposition as described. Reconstruction techniques using ilio-sacral fixation, iliofemoral arthrodesis, and 3D printing have been described in the literature[16,17].

The surgical complications were primarily related to the flap's healing, with 16 patients (31%) requiring a repeat surgical procedure for complete wound healing, a rate comparable to that in similar studies worldwide[14,18]. Deep infection rates, however, were limited to three patients (5%). Two patients required explantation of the infected prosthesis, and one required removal of the infected free fibula graft. Farfali et al. had a post-operative complication rate of 34.5% with deep infection carrying the larger burden of morbidity at 25%[19]. In a small sample, Salunke et al. reported wound-related complications in 13% of their 23 patients. In an elderly population, Guder et al reported a flap-related complication in 69.2% of their patients[15]. Larger tumour volume and resection of multiple segments of the pelvis contributed to higher flap-related complications in our analysis (Table III), similar to the description by Senchencov, where the extent of hemipelvectomy impacted flap-related complication rates. Involvement of the sacrum, as seen in 22 of the 51 patients (43%), was higher in our study sample than in other studies[14,20]. However, it was not an independent predictor of flap-related complications, although it did increase operative complexity and blood loss. Various scoring systems for assessing functional outcome have been described, such as the Musculoskeletal Tumour Society Score (MSTS), Toronto Extremity Salvage Score (TESS), and the University of California, Los Angeles (UCLA) Activity Scale[21]. Unfortunately, objective data regarding any of them were not uniformly available across the long study period and were omitted from the analysis.

Inadequate surgical margins are an adverse prognostic factor for local control[22,23]. Clear margins were achieved in 84.4% of our study population. This figure is on par with the high standards set by Puri et al.[14], who achieved 81% margin-free resections in a similar set of patients in recent times. A comparison table across diverse operating teams around the globe has been summarized in Table VII. In our series, three patients defaulted in the post-op period when advised for adjuvant radiation therapy. Five patients received adjuvant radiation to the resection bed. Two of them (both Ewings) developed local and systemic recurrences within 6 months of treatment completion, while three remained disease-free at the time of last follow-up. The most extended disease-free follow-up was 114 months in a patient with chondrosarcoma who received adjuvant radiation for margin positivity.

The rate of local recurrences in our study was 27.4% which is on par with data published worldwide, as summarized in Table VII. It is surprising to note that the recurrences in our study did not correlate with

Table VII. — Comparison of Oncological Outcomes across the Globe.

Study	Wirbel	Hoffman	Puri	Farfali	Dramis	Salunke	Guder	Breden	Current study
Year	2000	2000	2014	2015	2016	2017	2019	2024	2025
Country	Ger	UK, Ger	India	Arg	UK	India	Ger	Swiss	India
Number ofvpatients	51	50	106	52	31	23	34	70	51
Margin negative	84.3	70	81		83.9	91.3	88	73	84.4
LRR	20.8	16.6	23	30	48.2	9	8.8	26	27.4
5-year OS	-	32*	67	37.5	44.7	60	35.5	76	59
Histology	CS	ES	Mixed	Mixed	Mixed	Mixed	Mixed	CS	Mixed

*Ger: Germany; *UK: United Kingdom; Arg: Argentina; Swiss: Switzerland; LRR: Local recurrence rate; OS: Overall survival; CS: Chondrosarcoma; ES: Ewing sarcoma.

microscopic margin-positive resections. A higher incidence of local recurrence was seen in Ewing sarcoma (7 out of 17 patients), which was attempted to be salvaged by locoregional radiation therapy. In the series by Puri et al., higher local recurrences were observed in cases of chondrosarcoma, which were attributed to the absence of multimodality treatment options[14]. Chondrosarcoma, however, had lower local recurrences in our study (4 out of 17, 23.5%) and were amenable to re-resection with good overall outcomes, likely due to the more aggressive surgical margins employed during primary resection, given the lack of alternative treatment options. The operative bias, smaller numbers, and role of adjuvant radiation cannot be ascertained as factors contributing to local recurrence due to the small sample size in the study.

Systemic recurrences were predominantly observed in the lungs, presenting as single or multiple nodules. Two patients who underwent lung metastasectomy for localised resectable disease had a very good oncological benefit, being alive at 72 months after diagnosis of metastatic disease. Most other patients were declared for the best supportive care. The overall survival rate in our case series was 59% at 5-year follow-up, which is comparable to other case series[13-15,19,24-27]of a similar design (Table VII).

As in every study, this study also has its limitations. This is a retrospective study, and limb-salvage surgery was not offered to all candidates with primary pelvic sarcomas. Operative time was not documented in the operative charts, and the incision was not standardised. The flap-related complications were noted in significant numbers; however, the operative technique regarding the flap and the preservation of the gluteal vascular pedicles was not standardized or documented in the surgical notes. The timing of complications was not analysed in this study. In this study, although long-term oncological data were available, functional outcomes were not assessed using standardized questionnaires or documented at follow-up visits.

CONCLUSION

Internal hemipelvectomy is associated with long operative times, significant blood loss, postoperative flap complications, and technical difficulty in achieving an R0 resection due to its complex anatomy. Patient selection plays a crucial role and should be based on accurate preoperative imaging, appropriate neoadjuvant therapy, effective preoperative planning of reconstruction techniques, and surgical expertise supported by aggressive physiotherapy for rehabilitation. Despite the various challenging perioperative hurdles, it is a viable option for limb salvage for pelvic sarcomas.

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Author contributions: The first and second author contributed equally to the drafting of the manuscript.

Ethics approval: This study was performed with the principles of the Declaration of Helsinki. The Institution Ethical Board review was taken prior to initiation of the study.

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