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Do Flaps Reduce Infection in Pelvic Sarcoma Surgeries? A Retrospective Analysis from Tertiary Care Cancer Center in Nepal

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Abstract

Background: Pelvic resections are complex and challenging in oncologic practice and infection is the most common complication. Our study aims to evaluate whether flap coverage procedures influence infection rates compared to primary closure after major pelvic resection for sarcomas.

Methods: A retrospective comparative study was conducted among pelvic sarcoma patients who underwent surgery between Jan1 2019 and Jan 1 2025 at Nepal Cancer Hospital and Research center. Patients were divided into two groups: Flap group and No flap group. Outcomes measured included wound dehiscence, superficial SSIs, and deep infections requiring surgical intervention.

Results: Total 36 patients were included in the study. 20 were in Flap group and 16 were in No Flap group. While there was no significant difference between the groups regarding minor complications like wound dehiscence or superficial infection (p = 0.4217. Deep infection occurred in 31% (5/16) of the No Flap group, whereas no deep infections (0/20) were recorded in the Flap group (p = 0.0135). One patient in the Flap group experienced flap necrosis requiring revision flap coverage.

Conclusion: Vascularized muscle transfers significantly reduce deep pelvic infections following major pelvic sarcoma resections.

Keywords: Infection; Internal Hemipelvectomy; Muscle Flaps; Pelvic Sarcoma

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Introduction

Pelvic Sarcoma resection is complex and a formidable challenge in Musculoskeletal Oncology due to complex anatomy and proximity to major neurovascular structures and visceral organs. External hemipelvectomy (hindquarter amputation) was the standard practice for high grade pelvic sarcomas in the past. However, due to advances in the chemotherapy regimens, imaging modalities and surgical techniques, limb sparing surgery with internal hemipelvectomy became possible and standard of care in past three decades.[1,2] Pelvic skeletal reconstruction (using endoprosthesis, allografts or autografts) versus no reconstruction (hip transposition or flail hip) remains a major debate in orthopedic oncology, superiority of one over other is conflicting in literature.[3] Moreover, pelvic resections are associated with higher complication rates with infection being most prevalent.[4,5] Various factors are at play for infection viz. Immunosuppression with chemotherapy, compromised local tissue quality with radiation therapy, prolonged duration of surgery and huge dead space following high volume tumor resections.[6-8]

Across many centers in the developing world including Nepal, pelvic reconstruction is not performed in view of high costs of implants, prolonged surgery duration and increased risks of infection. In absence of major skeletal reconstruction, management of soft tissue envelope becomes paramount. Soft tissue reconstruction using vascularized pedicled muscle flap, in theory, help to reduce the dead space and provide a biological barrier thereby reducing infection rates.[9] Various pedicled muscle/Myocutaneous flaps such as Vertical Rectus Abdominis Myocutaneous (VRAM) flap, Rectus Femoris (RF) flap , Vastus lateralis (VL) flap and Gracilis flap are commonly used for soft tissue reconstructions after pelvic resections.[10-11]

There is paucity of literature whether vascularized pedicled flaps reduce infection rates in major pelvic sarcoma resections. This study aims to evaluate impact of flap coverage on wound complications following major pelvic sarcoma resections in cohort of Nepalese patients where skeletal pelvic reconstruction was not done thereby contributing to the literature on this topic of study.

Methods

Ours was a hospital based retrospective comparative study conducted after obtaining approval from Nepal Cancer Hospital and research center Institutional Review Committee [Ref No: 022/82/83]. All cases of pelvic sarcoma patients who underwent pelvic resection between January1-2019 and Jan1-2025 at Nepal Cancer Hospital and Research Center were included in the study. Pelvic resections for benign/intermediate tumors and metastatic disease as well as those with incomplete clinical data/ follow up records were excluded from the study. Resections were classified as iliac resections (Type I), periacetabular resections (Type II), pubic bone resections (Type III) and sacral resections (Type IV).[12] The cohort was divided into two groups: No Flap group whom surgical defect was closed primarily and Flap group who underwent soft tissue reconstruction using a muscle flap. Type of flap was also noted. Superficial infection, wound dehiscence, deep infections and need for surgical debridement /revision were recorded in patients from both the groups.

All patients underwent routine postoperative wound inspection on postoperative day three and subsequently every four days until suture removal at three weeks. Intravenous antibiotics (cefuroxime and amikacin) were continued until removal of the surgical drain, after which oral cefuroxime was administered for an additional two weeks. Patients with discharge from the surgical site and/or persistent fever underwent microbiological evaluation, with wound swab culture and sensitivity (C/S). Radiological assessment with ultrasonography (USG) and/or computed tomography (CT) was performed when clinically indicated to identify any underlying collection. Patients were initially managed with empirical intravenous antibiotics while awaiting culture results. A collection confined to the tissues superficial to the deep fascia was classified as a superficial surgical infection (SSI), whereas a collection extending beneath the deep fascia was classified as a Deep infection (DI). Patients with persistent fever, continued wound discharge, or failure to demonstrate clinical improvement after 48–72 hours of antibiotic therapy were considered for surgical debridement. Wound dehiscence was diagnosed clinically and defined as separation of previously approximated wound edges in the absence of clinical evidence of infection.

Demographic profile and histological diagnosis were also recorded. Relevant data was collected using a prefixed proforma and tabulated in Microsoft Excel spreadsheet. Statistical analysis was done using SPSS software. Chi-square test and Fishers exact test were used to analyze the statistical variations.

Results

Thirty-nine patients diagnosed with pelvic sarcoma on biopsy who underwent Surgery at our center between 1st Jan 2019 – 31st Dec 2025 were included in the study. One patient died immediately in the postoperative period and was excluded. Two patients lost to follow up after surgery and were excluded from the study. 36 patients were available for evaluation. 20 patients were in Flap group whereas 16 patients were in No Flap group. Table 1 shows demographic details of the patients included in the study.

Mean age of patients in Flap group was 34.7 years (range 4-55 yrs) as compared to 42.9 yrs (range 8-70 yrs) in No Flap group. 9 patients were males in Flap group compared to 8 males in No Flap

Table 1. Demographics, Tumor Characteristics, and Resection Extent (N=36)

Baseline Characteristic	Total (N=36)	Primary Closure (No Flap) (n=16)	Flap Coverage (n=20)
Age (Years)			
Mean (Range)	38.3 (4-70)	42.9 (8-70)	34.7 (4-55)
0–20	9 (25.0%)	3 (18.8%)	6 (30.0%)
21–40	12 (33.3%)	5 (31.3%)	7 (35.0%)
41–60	12 (33.3%)	5 (31.3%)	7 (35.0%)
>60	3 (8.3%)	3 (18.8%)	0 (0.0%)
Sex			
Female	19 (52.8%)	8 (50.0%)	11 (55.0%)
Male	17 (47.2%)	8 (50.0%)	9 (45.0%)
Histological Diagnosis			
Chondrosarcoma	17 (47.2%)	5 (31.2%)	12 (60.0%)
Osteosarcoma	8 (22.2%)	7 (43.8%)	1 (5.0%)
Ewings Sarcoma	5 (13.9%)	2 (12.5%)	3 (15.0%)
Undifferentiated Pleomorphic Sarcoma (UPS)	3 (8.3%)	1 (6.3%)	2 (10.0%)
Rhabdomyosarcoma	2 (5.6%)	1 (6.3%)	1 (5.0%)
Synovial Sarcoma	1 (2.8%)	0 (0.0%)	1 (5.0%)
Surgical Resection Extent			
Type I	9 (25.0%)	4 (25.0%)	5 (25.0%)
Type III	6 (16.7%)	3 (18.8%)	3 (15.0%)
Type I + II	3 (8.3%)	2 (12.5%)	1 (5.0%)
Type I + II + III	9 (25.0%)	5 (31.3%)	4 (20.0%)
Type II + III	3 (8.3%)	0 (0.0%)	3 (15.0%)
Type I + IV	2 (5.6%)	0 (0.0%)	2 (10.0%)
Type I + II + III + IV	1 (2.8%)	1 (6.3%)	0 (0.0%)
External Hemipelvectomy (EH)	3 (8.3%)	1 (6.3%)	2 (10.0%)

Table 2. Flaps used for reconstruction (N=20)

Flap Selection	Frequency n(%)
Vastus Lateralis (VL)	6 (30.0%)
Rectus Femoris (RF)	5 (25.0%)
Tensor Fasciae Latae (TFL)	1 (5.0%)
Gracilis	2 (10.0%)
Free Fillet	2 (10.0%)
Reverse Latissimus Dorsi (LD)	2 (10.0%)
Rectus Abdominis (RA)	1 (5.0%)
VL + TFL	1 (5.0%)

group. The most common histological diagnosis was Chondrosarcoma in Flap group (12/20) whereas Osteosarcoma was the most common diagnosis in the No Flap group (7/16). Three patients in both the groups underwent Type 3 resection. 5 patients in Flap group underwent Type I pelvic resection as compared to 4 patients in No Flap group. 5 patients in No Flap group underwent Type I+II+III pelvic resection as compared to 4 patients in Flap group. 2 patients in No Flap group underwent Type I+II pelvic resection as compared to 1 patient in Flap group. 3 patients who underwent Type II+III pelvic resection as well as 2 patients who underwent Type I+IV resections were from Flap group whereas 1 patient who underwent

Table 3. Postoperative Wound Complications, Re-interventions, and Statistical Efficacy (N=36)

Wound Complications	Primary Closure (n=16)	Flap Coverage (n=20)	p-value
Minor Wound Complications	**5 (31.3%)**	**3 (15.0%)**	**0.4217**
Superficial Surgical Site Infection (SSI)	3 (18.8%)	2 (10.0%)	
Wound Dehiscence	2 (12.5%)	1 (5.0%)	
Major Wound Complications	**5 (31.3%)**	**1 (5.0%)**	
Deep Infection	5 (31.3%)	0 (0.0%)	0.0135
Flap Necrosis	N/A	1 (5.0%)	
Revision Surgery Required	**4 (25.0%)**	**1 (5.0%)**	**0.0600**
Operative Debridement	4 (25.0%)	0 (0.0%)	
Secondary Reconstruction	0 (0.0%)	1 (5.0%)	

Type I+II+III+IV resection as from No Flap group. There were 3 external hemipelvectomies and 2 of those needed free fillet flap for closure (Table 2).

Wound dehiscence occurred in 2 patients in No Flap group as compared to 1 patient in Flap group. Superficial Surgical site Infection occurred in 3 patients in No Flap group as compared to 2 patients in Flap group. No patients with dehiscence or superficial infection required further surgical intervention, and all the patients were managed conservatively. Flap coverage did not significantly lower the minor wound complications (p=0.4217) (Table 3).

Deep infection occurred in 5 patients from non-flap group whereas no patient in Flap group developed deep infection (p=0.0135), whereas one patient in Flap group had a flap necrosis which required additional revision flap coverage. All deep infections were treated with surgical debridement. The need for revision surgery was higher in patients in No Flap group, although there was no conventional statistical significance (p=0.06) (Table 3). All the wound complications (wound dehiscence, Superficial or deep infection as well as flap necrosis occurred within 6 weeks from surgery). On follow up ranging from 3months-68 months (median follow up 42 months), no patients developed late infection.

Discussion

Pelvic resection for sarcoma is challenging. Limb salvage surgery with internal hemipelvectomy is the current standard of care.[4] Only 3/36 patients underwent external hemipelvectomy and our limb salvage rates for pelvic sarcoma resections is 91.6 percent. It is well established in literature that infection rates are higher in cases where skeletal reconstruction is used for periacetabular Type II resections.[2,4] We performed spinopelvic fixation using pedicle screws and rods was done for two patients in Flap group who underwent Type I+IV resections. All the patients who underwent periacetabular resections were managed without any reconstruction and all patients had flail hip.

In absence of skeletal reconstruction after pelvic resection, the internal pockets dead space created might lead to formation of hematoma and infection. Deep infection in our study was seen in 5/16 patients (31%) in No flap group compared to nil deep infection in the Flap group. We believe vascularized muscle transfer obliterates the dead space and promote local vascularity thus minimizing the infection rates. Interestingly wound dehiscence/superficial surgical site infection rates were not significantly different in both the Flap and No Flap groups.

Use of myocutaneous or muscular rectus abdominis and gracilis flaps has been well established for closure of perineal/pelvic defects.[13,14] Rectus femoris and vastus lateralis flaps also can be utilized for the same purpose.[15,16] Vastus lateralis was more commonly used flap in our study (7/20) followed by rectus femoris flap (5/20). 2 patients where type I+IV resection was performed, reverse latissimus dorsi flap was done for closure of posterior abdominal wall defect. Rectus abdominis flap was done in only two cases, one of which was a case of revision surgery following flap necrosis of vastus lateralis. Free fillet flaps were done in two cases of external hemipelvectomy.

With advancements in newer surgical techniques, customized 3D printed implants for pelvic resections are available across various centers across the globe. Infection rates have gone down to 10-12%[17] as compared to 20-26% cited earlier.[4] Although, soft tissue management is also equally crucial to minimize the infection rates after major pelvic resections, there is scarcity of literature covering this aspect. Muscle cover or Flaps provide better coverage but demands significant surgical hustle requiring additional operative time and specialized microsurgical expertise goes by the mantra “Muscle is a Hustle”. However, Orthoplasty, orthopedic onco-surgeons and plastic surgeons collaborating for resection and soft tissue

reconstruction in the same sitting has proven to be feasible without any added risks.[18] Of the 21 flap coverages, plastic surgeon was involved only for two free fillet flaps, rest were performed by orthopedic oncology team alone as pedicled rotational muscle flaps don't need microvascular expertise. Despite small sample size and retrospective nature, this study highlights the importance of soft tissue management with vascularized muscle transfers reduce deep infection rates in pelvic sarcoma surgeries. In absence of skeletal reconstruction after pelvic resection, muscle cover to obliterate dead space becomes paramount.

This study has certain limitations. Being a retrospective, single-center study, it carries an inherent risk of selection bias. The wide age range of patients included, along with variability in comorbidities, type and duration of surgery, and intraoperative blood loss, were not analyzed as independent confounding factors for infection and could have influenced our results. Larger prospective, multi-centric studies controlling for these variables are needed to further validate our findings.

Conclusion

Vascularized muscle transfers were associated with a significantly lower rate of deep pelvic infections following major pelvic sarcoma resections in our cohort. A proactive soft tissue reconstruction (Orthoplasty) approach may be considered while planning major pelvic resections; however, given the retrospective design and unaccounted confounding factors such as age, comorbidities, and surgical variables, these findings should be interpreted with caution and validated in larger prospective studies before being adopted as a standard of care.

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