

Original Research Article

PERISCAPULAR TUMORS: UNTANGLING THE INTRICATE WEB OF FUNCTIONAL AND ONCOLOGICAL OUTCOMES

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ABSTRACT

Background: While tumors of the shoulder girdle, encompassing the proximal humerus, scapula, and clavicle, represent the third most common site for bone and soft tissue sarcomas, primary scapular tumors remain an infrequent diagnosis. This study aimed to retrospectively evaluate the functional and oncological outcomes in patients undergoing scapular resection for tumors in the periscapular region.

Material and Methods: This retrospective analysis evaluated 15 patients who underwent scapular resection for periscapular tumors from January 2019 to January 2022, with at least one-year follow-up and data was collected from medical records. The functional outcomes were assessed at least two months after the completion of treatment during the follow-up. All patients who underwent some form of scapular excision were included in the study. Patients were staged using the ENNEKING staging system. Functional outcomes were recorded according to the “Modified Enneking scoring system” (MESS) and “Musculoskeletal Tumour Society” (MSTS) functional score.

Results: The Median age of patients was 41.5 years. 13 patients underwent infrapinuous scapulectomy (JMOG type 5) and 2 patients underwent subtotal scapulectomy (JMOG type 4). The mean modified Enneking Score for all patients is 24.73 and mean MSTS score is 82%. Most adversely affected parameter was lifting ability. The mean functional score depended on the extent of scapular resection. The overall survival estimates were favorable, with estimated 1-year and 2-year rates of 96.4% and 92.9%, respectively, and disease-free survival estimates at 1-year and 2-year were of 85.7% and 78.6%, respectively.

Conclusion: Subtotal scapulectomy with preservation of glenoid and acromion and resection of the lower half of the scapula can be carried out without reconstruction with good functional and oncological outcomes. Functional outcomes are dependent on the remnant scapula.

Keywords: Scapulectomy, Soft Tissue Sarcoma, Periscapular Tumours.

INTRODUCTION

Malignant scapular lesions encompass two distinct categories: primary tumors originating in the scapula itself and secondary tumors that result from infiltration by periscapular soft tissue sarcomas. Although, the shoulder girdle, comprising of the

proximal humerus, scapula, clavicle, and the surrounding soft tissues, is the third most common site for bone and soft tissue tumours, primary scapular tumours are a rare entity^[1]. Periscapular soft tissue sarcomas are relatively rare tumors, accounting for a small percentage of all soft tissue sarcomas. The exact incidence of periscapular soft tissue sarcomas is not

well-defined in the literature. However, studies have reported that sarcomas arising in the periscapular area constitute approximately 5% to 10% of all soft tissue sarcomas. Chondrosarcoma is the most common primary bone sarcoma affecting the scapula and high grade undifferentiated pleomorphic sarcoma is the commonest soft tissue sarcoma in the periscapular region^[2]. Ewing's Sarcoma is the most common tumour in pediatric population^[3].

The treatment approach for malignant tumors of the scapula has shifted away from forequarter amputation, which was associated with significant drawbacks such as the loss of the entire upper limb, cosmetic defects, phantom limb sensations, and psychological distress. Instead, scapulectomy has emerged as a more favorable option, which allows preserving the rest of the upper limb, enabling surgeons to achieve oncologically acceptable wide margins. The first total scapulectomy was performed and described by Syme in 1856^[3]. Since then, several modifications and different indications have been published in small series and case reports. Later, in 1928, Linberg described the interscapulothoracic resection (Tikhoff-Linberg).

Malawer reported the classification of shoulder girdle resections including scapulectomy, but it mainly focuses on joint resection^[4,5]. Based on their retrospective study of 48 patients, the Japanese Musculoskeletal Oncology Group (JMOG) described a new classification of scapulectomy^[6]. This classification system encompasses five categories based on the resection area. Type 1 refers to Total Scapulectomy, Type 2 involves preserving the Glenoid, Type 3 preserves the Acromion, Type 4 preserves both the Acromion and Glenoid, and Type 5 entails resection of the lower half. The JMOG's classification system provides a comprehensive framework for understanding and categorizing scapulectomy procedures based on the extent of resection.

The Musculoskeletal Tumor Society (MSTS) has developed a classification system for shoulder girdle tumors that divides the scapula into two zones^[7]. The acromial–glenoid complex comprises the S2 region and the blade–spine portion comprises the S1 region. In this study, we investigate the functional outcomes of patients undergoing scapular resection either for primary scapular tumours or for soft tissue sarcomas in the peri-scapular region.

MATERIAL AND METHODS

This retrospective study comprises of 15 patients who underwent scapular resection for tumours in periscapular region from January 2019 to March 2022 and were followed up for at least one year. The study includes 10 males and 5 females with a mean age of 41.5 years who underwent some form of scapular resection for tumours in periscapular region. [Table 1]

Preoperatively, staging was done using MRI/CT of tumour site along with CECT thorax and routine general examinations. Core needle biopsy was performed on all patients pre-operatively. Among the cohort of 15 patients included in the study, 4 patients were diagnosed with chondrosarcoma, 3 with pleomorphic sarcoma, 3 with neurofibroma, 2 with fibromatosis, 2 with Ewing's Sarcoma, and 1 patient had pleomorphic liposarcoma. The staging of patients was determined using the Enneking staging system. Among the cohort, 7 patients were classified as Stage IA, 6 patients were categorized as Stage 2A, and 2 patients were classified as Stage 2B. [Table 1]

Of the 15 patients, two patients underwent subtotal scapulectomy with preservation of the glenoid, while six patients underwent complete infra-spinous scapulectomy. Five patients underwent partial infraspinous scapulectomy with removal of the lateral border, and two patients underwent excision of the inferior angle of the scapula [Table 2]. The remaining muscles were sutured. None of the patients underwent prosthetic reconstruction.

The functional outcomes of the patients were assessed using two established scoring systems: the Modified Enneking Scoring System (MESS) and the Musculoskeletal Tumor Society (MSTS) functional score. These scoring systems evaluate various aspects of function, including pain levels, functional abilities, emotional acceptance, hand positioning, manual dexterity, and lifting ability. Each category is assigned a score of up to five points, with a higher score indicating normal or full function. The maximum overall score possible is 30 points, reflecting optimal functional outcomes.

Data was entered into Microsoft Excel data sheet and was analyzed using SPSS 22 version software. Categorical data was represented in the form of frequencies and proportions. The Chi-square test was used as a test of significance for qualitative data. Continuous data was represented as the mean and standard deviation. Normality of the continuous data, was tested by Kolmogorov–Smirnov test and the Shapiro–Wilk test. Independent t test was used as test of significance to identify the mean difference between two quantitative variables.

RESULTS

Functional Outcomes

The mean modified Enneking score for all patients is 24.73 and the mean MSTS score is 82%. Of the 6 parameters assessed in scoring system, the worst affected was lifting ability and the least affected were manual dexterity and pain.

We found that the functional outcomes were directly related to residual scapula. [Table 3] Patients undergoing infraspinous scapulectomy had significantly better outcomes as compared to patients undergoing subtotal scapulectomy. Patients who underwent only an inferior angle of scapula resection had the best functional outcomes. [Figure 1]

Patients who received adjuvant RT had poorer functional outcomes as compared to those who did not, but this did not reach statistical significance. [Table 4]

Adjuvant Therapy

Of the 15 patients, 9 received adjuvant radiotherapy, 1 patient of Ewing's sarcoma received peri-operative chemotherapy along with adjuvant RT and another patient of Ewing's sarcoma received peri-operative chemotherapy only.

Surgical Margins

Negative margins were attained in 14 out of 15 patients (93.3%). Only one patient of Ewing's Sarcoma had a single positive margin. Patient received adjuvant RT.

Local Recurrence

Mean follow up period was 27 months. 2 patients developed local recurrence after a mean time of 15 months after surgery. First patient had only local recurrence for which he underwent surgery. The recurrent growth was along the chest wall without infiltration and wide local excision was done. The second patient had defaulted and hadn't taken adjuvant RT, presented with lung metastases along with local recurrence.

Distant Metastasis

2 patients developed lung metastasis during follow up. One patient had Ewing's sarcoma and lung metastasis was detected one year after surgery. The second patient had local recurrence along with distant metastasis.

Oncological Outcomes

The overall survival (OS) estimates indicate a favorable prognosis, with the median OS not reached, implying that most patients were alive at the last follow-up, and the estimated 1-year and 2-year OS rates were 96.4% and 92.9%, respectively.

However, the disease-free survival (DFS) estimates suggest a significant risk of recurrence or progression, with a median DFS of 30.5 months and

estimated 1-year and 2-year DFS rates of 85.7% and 78.6%, respectively.

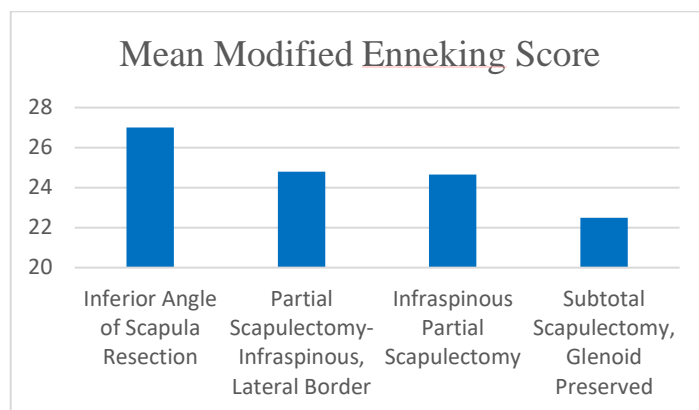


Figure 1: Functional Outcomes



Figure 2: Case of Right Scapular STS. Patient initially underwent infra-spinous partial scapulectomy. Patient developed recurrence after 15 months for which re-surgery was done. Patient had good functional outcome even after second surgery

Table 1: Patient Demographics

Patient Characteristics		Count	%
Age	<20 years	3	20.0%
	21 to 40 years	5	33.3%
	>40 years	7	46.7%
Sex	Female	5	33.3%
	Male	10	66.7%
Side	Left	8	53.3%
	Right	7	46.7%
Grade	1	7	46.7%
	2	0	0
	3	8	53.3%
Enneking Stage	1A	7	46.7%
	1B	0	0
	2A	6	40.0%
	2B	2	13.3%
	3	0	0

Table 2: Type of scapulectomy

Surgery	JMOG TYPE	Count	%
Subtotal Scapulectomy, Glenoid & Acromiion Preserved	4	2	13.30%
Infraspinous Partial Scapulectomy	5	6	40.00%
Partial Scapulectomy- Infraspinous, Lateral Border	5	5	33.30%
WLE (Inferior Angle of Scapula Resection)	5	2	13.30%

Table 3: Functional Outcomes

Surgery	Count	Mean MESS		MSTS	
		Mean	SD	Mean	SD
Inferior Angle of Scapula Resection	2	27.00	0.0	90.00	.00
Partial Scapulectomy- Infraspinous only Lateral Border resection	5	24.80	2.168	82.62	7.23
Infraspinous Partial Scapulectomy	6	24.67	4.131	80.5	15.96
Subtotal Scapulectomy, Glenoid Preserved	2	22.50	0.707	75.00	0.00
P value		<0.001		<0.001	

Table 4: Enneking Functional Score and MSTS Score with respect to Adjuvant RT

	Adjuvant RT	N	Mean	SD	P value
Enneking Functional Score	No	6	25.83	2.483	0.259
	Yes	9	24.00	3.202	
MSTS Score	No	6	84.417	12.22	0.579
	Yes	9	81.100	10.28	

DISCUSSION

Tumors in the periscapular region are rare and the literature on these are limited. The studies specifically addressing the oncological and functional outcomes of partial scapulectomy only are limited to few case series and case reports^[8,9,10]. In this study we found that partial scapulectomy with preservation of glenoid has good functional and oncological outcomes. The functional outcomes are directly related to the residual scapula with patients undergoing only infraspinous scapulectomy having significantly better outcomes as compared to patients undergoing subtotal scapulectomy with preservation of glenoid cavity.

In this study, all the patients underwent primary repair in form of re-suturing of remaining muscles after resection. None of the patients underwent prosthetic reconstruction. Despite this, most patients had good functional outcomes.

Vahanan et al.'s study of 25 patients demonstrated that preserving the glenohumeral articulation during scapulectomy yields superior functional outcomes compared to total scapulectomy^[11].

In the study conducted by Gibbon's et al^[8], 9 of the total 14 patients underwent more than 80% scapular resection with mean MSTS score being 71.6. They concluded that scapulectomy gives an excellent functional result if glenohumeral joint is preserved. The study also indicated that patients undergoing only infraspinous scapular resection had better outcomes compared to supraspinous scapular resection. Our present study concluded the same.

The JMOG study by Hayashi et al [6], which included 48 patients, 12 patients underwent subtotal scapulectomy. They found that resection of lower half of scapula had better functional outcomes as compared to subtotal scapulectomy.

Yang et al,^[11] in their study showed that 6 patients who underwent partial scapulectomy without reconstruction had mean MSTS score of 85%. Our present study showed the similar results.

The study has several limitations worth noting. Firstly, it is a retrospective study, which may introduce inherent biases and limitations in data collection and analysis. Secondly, the sample size of

15 patients is relatively small, which could limit the generalizability of the findings. Additionally, the study includes patients with heterogeneous tumor types, making it challenging to draw specific conclusions for each individual tumor type. Lastly, the follow-up period in the study was relatively short, which might restrict the assessment of long-term outcomes and potential complications. These limitations should be taken into consideration when interpreting the study results.

CONCLUSION

In conclusion, our study suggests that subtotal scapulectomy with preservation of the glenoid and acromion, as well as resection of the lower half of the scapula, can be performed successfully without the need for reconstruction. This approach yields favorable functional outcomes. The functional outcomes are notably influenced by the remaining scapula. Furthermore, our findings indicate that infraspinous scapulectomy results in less functional impairment compared to supraspinous resection. These insights contribute to the understanding of surgical options and their impact on functional outcomes in scapular resections for malignant tumors.

Contribution

All authors contributed to the study's conception and design. Material preparation, data collection, and analysis was done by Dr Suraga Belakawadi and Dr Jyotsana Goyal and first draft was written by Dr. Suraga Belakawadi. All authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

Ethics declarations

Institutional ethical committee approval taken.

Conflict of Interest

The Authors declare that there is no conflict of interests.

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