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ORIGINAL ARTICLE

Importance of latissimus dorsi muscle preservation for shoulder function after scapulectomy

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Background: Scapulectomy is an inevitable treatment for sarcomas of the scapula. This procedure is unavoidable because it reduces the local recurrence rate but can impair shoulder movements and affect the activities of daily living. This study investigated the factors influencing functional outcomes after scapulectomy.

Materials and methods: The clinical results of 8 patients (5 males, 3 females) who were diagnosed with primary or metastatic sarcomas of the scapula were retrospectively reviewed. The mean age was 49 years (range, 11-86 years). We examined the correlation between the type of excision of the scapula (total, subtotal, or partial) and postoperative functional outcomes according to the Musculoskeletal Tumor Society (MSTS) score. In partial excision, the glenohumeral joint was preserved; in subtotal excision, the glenoid was completely resected and some bony components were preserved; and in total excision, the entire bony component of the scapula was resected. The average follow-up period was 55 months (range, 9-142 months).

Results: The partial, subtotal, and total excision groups had mean functional scores of 96.7%, 76.7%, and 62.2%, respectively. Although the mean functional scores were lower in patients who underwent total and subtotal excisions, 3 patients in whom the latissimus dorsi muscle was preserved had better function (mean MSTS score, 76.7%) than the 2 patients in whom it was not preserved (mean MSTS score, 55.0%).

Conclusion: These results suggest that the latissimus dorsi muscle, along with the deltoid and pectoralis major muscles, is one of the stabilizers of the proximal humerus after scapulectomy.

Level of evidence: Level IV; Case Series; Treatment Study

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Keywords: Scapula; sarcoma; scapulectomy; functional outcome; musculoskeletal tumor society score; latissimus dorsi muscle preservation

The shoulder girdle is the third most common site for primary malignant bone tumors. However, primary malig-

nant tumors of the scapula are uncommon.¹ According to the Rizzoli Institute database, only 248 of all 7830 registered primary malignant bone tumors (3.2%) arise in the scapula.¹⁴

The scapula is a flat bone of the shoulder girdle that articulates with the head of humerus at the glenohumeral joint and with the lateral end of clavicle at the acromioclavicular joint and connects the upper limb to the trunk. Various muscles, such as rotator cuff, deltoid, trapezius, and biceps brachii

The Iwate Medical University Institutional Review Board approved this study.

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muscles, are attached to the scapula and play crucial roles to stabilize the shoulder joint and move the upper extremity. Limb salvage surgery for malignant tumors of the scapula poses a major surgical challenge because of the complexity of the surrounding anatomy and neurovascular structures.

Most malignant tumors of the scapula contain an extracompartmental extension that requires complete resection of the periscapular muscles. Wide resection with scapulectomy for malignant tumors can cause instability of the shoulder joint and loss of muscle strength at the upper extremity. In addition, instability around the shoulder joint that is loosening to the downward direction can cause traction neuropathy, which is a severe complication. Several studies have described the outcomes of reconstruction after scapulectomy, but little attention has been paid to functional outcomes of the upper extremity.^{2,3,6-12,14-21} Several methods for reconstruction after scapulectomy have been reported; however, which method is superior for reconstruction is unclear.^{2,3,6-12,14-21}

The purpose of this study was to investigate and identify the factors influencing functional outcomes after scapulectomy.

Materials and methods

We retrospectively reviewed clinical outcomes of 8 patients (5 males and 3 females) with sarcomas arising from the scapula or from the soft tissues surrounding the scapula. The patients were a mean age of 49 years (range, 11-86 years). The clinical data are summarized in Tables I-III. With regard to the surgical margins, a wide excision; that is, the removal of the entire tumor along with at least 1 to 2 cm of the normal tissue surrounding the tumor, was performed in all patients. Patients were not reconstructed with prosthetic scapular or allograft, and the remaining muscles were sutured side to side. Major vessels, such as the axillary artery and vein, and nerves, such as median, ulnar, and radial nerves, were preserved.

Histopathologic diagnoses included chondrosarcoma, Ewing sarcoma/primitive neuroectodermal tumor, and undifferentiated pleomorphic sarcoma in 2 patients and osteosarcoma and metastasis of clear cell sarcoma each in 1 patient. Neoadjuvant chemotherapy was administered to 1 patient with osteosarcoma and to 2 with Ewing sarcoma.

We examined the type of excision of the scapula (total, subtotal, or partial), surgical margin, preserved tissue, local recurrence, metastasis in lymph nodes and lung, survival, and postoperative

Table I Summary of the clinical course

Patient	Age/sex	Diagnosis	Type of scapulectomy*	Surgical margin (cm)	Preserved tissue	MSTS score (%)	Metastasis (lung, bone)	Survival	Follow-up period (mo)
1	35/M	Chondrosarcoma	Subtotal	3	LD muscle, lower third of the scapular body	76.7	--	NED	142
2	11/M	Ewing sarcoma	Total	3	–	56.7	++	DOD	74
3	26/F	Osteosarcoma	Total	5	–	53.3	--	NED	130
4	55/F	Metastasis of clear cell sarcoma	Partial	2	GH joint	90.0	+ –	DOD	12
5	86/M	UPS	Partial	3	GH joint	100.0	++	DOD	27
6	78/M	UPS	Partial	3	GH joint	90.0	+ –	DOD	9
7	74/F	Chondrosarcoma	Total	1	LD muscle	76.7	--	NED	30
8	30/M	Ewing sarcoma	Subtotal	3	LD muscle, acromion	76.7	--	NED	18

MSTS, Musculoskeletal Tumor Society; M, male; LD, latissimus dorsi; NED, no evidence of disease; DOD, died of disease; F, female; GH, glenohumeral joint; UPS, undifferentiated pleomorphic sarcoma.

* Subtotal: the acromion or a part of the scapular body, or both was resected; Total, the entire bony component of the scapula was resected; Partial, the glenohumeral joint was preserved.

Table II Musculoskeletal Tumor Society score of upper limb*

Score	Pain	Function	Emotional acceptance	Hand positioning	Dexterity	Lifting ability
5	None	No restriction	Enthused	Unlimited	Normal	Normal
4	–	–	Intermediate	–	–	–
3	Modest	Recreational restriction	Satisfied	Not above shoulder or no pronation/supination	Loss of fine movements	Limited
2	–	–	Intermediate	–	–	–
1	Moderate	Partial disability	Accepts	Not above waist	Cannot pinch	Helping only
0	Severe	Total	Dislikes	Flail	Cannot grasp	Cannot

* Table created using data from Enneking et al.⁴

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