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Research Article

Single Center Retrospective Study of Functional Outcomes after Scapulectomy with Glenohumeral Joint Preservation for No Metastatic Primary Malignant Tumors of the Scapula

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Abstract

Objective: through the present study, we try to evaluate the functional outcomes after scapulectomy with glenohumeral joint preservation for no metastatic primary malignant tumors of the scapula.

Material and Methods: This retrospective study included 9 patients with no metastatic primary malignant tumors of the scapula treated in the Trauma-Orthopedic department B4 of Hassan II teaching hospital in Fez-Morocco between 2012 and 2021. The average age of the series was 36 years (range 25-42 years). The histological diagnosis was chondrosarcomas in the majority of our patients. The functional outcome and the emotional acceptance were evaluated according to the Musculoskeletal Tumor Society scoring system. Our working approach was carried out in total accordance with the Helsinki Declaration.

Results: We found 9 patients with no metastatic primary malignant tumors of the scapula who were treated by the same surgical team and followed postoperatively in consultation for 36 months (range 18-48 months) an average. During surgery and postoperatively, no major complications were occurred. The mean of the Musculoskeletal Tumor Society score was 16.7 (56%). The mean emotional acceptance score was 2.8 (56%). Concerning oncological outcomes, continuously disease-free status was achieved in all cases at the last follow-up.

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Conclusions: Primary malignant tumors of the scapula can be treated successfully by scapulectomy with glenohumeral joint preservation. This procedure constitutes in the case of unavailability of scapular prosthesis and bone bank as in our context a reliable therapeutic option.

Keywords

Shoulder Girdle; Sarcoma; Surgery; Scapulectomy

Introduction

The precision in the placement of the bone tunnels in isometric position is essential for the The shoulder girdle is a common site for malignant bone and soft tissues tumors [1]. Formerly, amputation was the usual treatment for large tumors due to multiple neurovascular anatomical relationships. Nowadays, limb salvage has become the consensus procedure for most cases because of imaging, neoadjuvant therapy and surgical technique improvements [2,3]. In this context, scapulectomy which was first described by Syme in 1864 [4], represents an attractive alternative to amputation when the neurovascular bundle can be preserved. When it is performed for scapular tumors, it provides elbow and hand function preservation. In the literature, only a few studies of scapulectomy for scapular tumors have been published, each involving a limited number of cases.

The objective of this work is to share our experience concerning this procedure performed with glenohumeral preservation in 9 patients for the management of no metastatic primary malignant tumors of the scapula and evaluate its functional, emotional and oncological outcomes.

Patients and Methods

Our study comprised 9 patients (8 men and 1 woman) treated for no metastatic primary malignant tumors of the scapula in our institution between 2012 and 2021. The inclusion criteria referred to the histological diagnosis of primary malignant bone tumors of the scapula without metastases managed by scapulectomy with glenohumeral preservation. All our patients were treated and followed in consultation for 36 months an average by the same surgical team. We excluded from our study, patients treated by other surgical techniques, as well as patients with an incomplete medical file or having refused treatment. The data were collected by the same doctors, using an operating sheet filed in from the medical records of the patients included in the study. Scapular resections were performed according to the Musculoskeletal Tumor

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Society (MSTS) classification [1,5,6]. Postoperatively, the upper limb was supported in an arm sling during 7 days until pain regression. After that, rehabilitation has started gradually under the guidance of physiotherapist. Histological exam of the excisional piece confirmed the biopsy diagnosis with clear margin. Clinical and radiological assessment were achieved regularly in all patients every 3 months in the first 2 years and every 6 months subsequently. The functional outcome and the emotional acceptance were evaluated according to the MSTS scoring system including pain, function, emotional acceptance, hand positioning, strength and manual dexterity [5,6]. All procedures were in compliance with the Helsinki Declaration [7].

Operative Procedure

Positioning: The patients are placed in lateral position and stabilized to the operating table with anterior pubic support and posterior sacral support. The operating field has to include the complete upper limb together with the clavicular and the scapular regions (Fig. 1).

Incision: An “S” shaped incision is started lateral to the acromion, curved posteriorly parallel to the line of the scapular spine towards the medial border of the scapula and then continued vertically down in the direction of the tip of the scapula (Fig. 2).

Approach: The incision is deepened through fat to the fascia overlying the deltoid and trapezius muscles which are separated from their insertions along the scapula. The latissimus dorsi is retracted downwards. The trapezius muscle flap is retracted superomedially, exposing the levator scapulae and the two rhomboids which are detached from their insertions along the spinal border of the scapula after ligating the dorsal scapular vessels at the superior angle of the scapula. The scapula is retracted posterolaterally to access to the serratus anterior which is divided from its scapular insertion along the medial border. To approach the supraspinatus, the infraspinatus, the teres minor, the long head of the triceps and the teres major, the arm is abducted and the deltoid muscle is reflected laterally. The rotator cuff muscles are divided vertically. At this stage, partial scapular resection is carried using an oscillate saw with preservation of the coracoid process and the glenohumeral joint which are not invaded by the tumor. Thus the resection piece is removed in bloc (Fig. 3,4). To reconstruct the excised muscles surrounding scapula, we mostly use a latissimus dorsi flap. Finally, hemostasis is achieved and wound closed in layers over a drain.

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Figure 1: Installation of the patient on the operating table.

Figure 2: Incision design.

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Figure 3: Intraoperative view with scapula exposure.

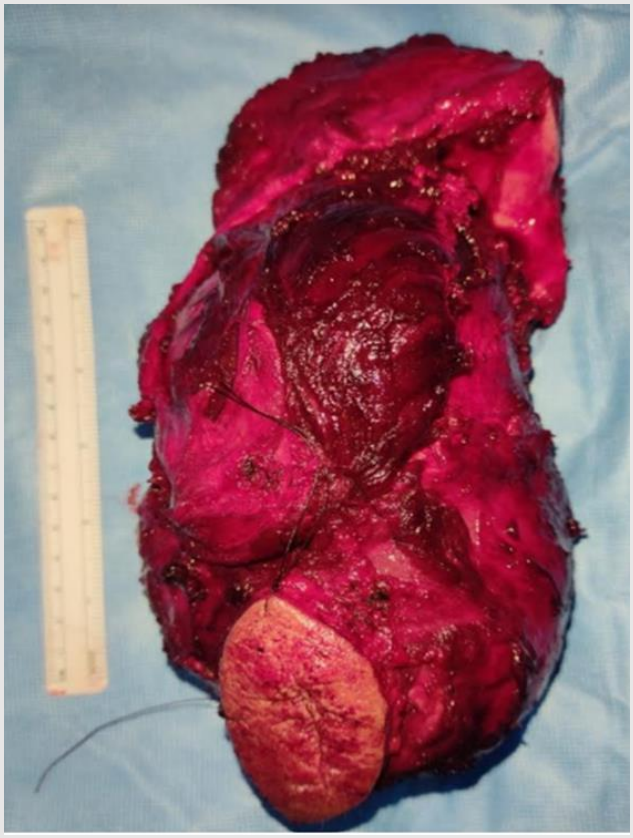

Figure 4: Tumor resection in one piece.

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Results

The average age of our patients was 36 years (range 25-42 years) (Table 1). In our context, the symptoms appeared between 4 and 10 months, with an average of 6.4 months. All 9 cases presented with pain (100%). A palpable mass was detected in 7 of the 9 cases (78%). The bone mineralization was observed in all 9 cases (100%) in the radiographs. On MRI, no bone destruction or extrascapular extension was observed in any of the cases. In our study, the average follow-up period was 36 months (18-48 months). Seven patients had chondrosarcomas and two had a Ewing's sarcoma. In the nine cases, the surgical stage was IIB of the MSTS classification (Table 1) [1,5,6]. The mean operating time was 240 min (120-300) and blood loss was 600 g (300-1500). No major complications occurred during surgery or postoperatively. The range of shoulder motion was relatively preserved in all of the cases (Fig. 5). The average flexion range was 60°, abduction 80° and extension 20° (Table 2) [10-40]. The functional outcome based on pain, emotional acceptance, hand positioning, manual dexterity and lifting ability was satisfactory. The mean Musculoskeletal Tumor Society score was 16.7 (56%) (Table 2). The mean emotional acceptance score was 2.8 (56%) (Table 2). Concerning oncological outcomes, continuously disease-free status was achieved in all cases in our series (Table 1).

Figure 5: The shoulder motion after scapulectomy.

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Characteristic	Patients (n=9)
Age (years)	36 [25-42]
Gender	
Male	8
Female	1
Time of follow-up (months)	36 [18-48]
Histological type	
Chondrosarcoma	7
Ewing's sarcoma	2
Surgical stage (MSTS classification)	
IIB	9
Follow-up	
Continuous diseases free	9

Table 1: Patient characteristics, surgical procedures and postoperative oncological outcomes.

Case	Follow up term (Months)	Shoulder ROM			Functional score (Enneking)							
		Flex	Abd	Ext	Pain	Function	Emotional	Hand position	Dexterity	Lifting ability	Total points	%
1	18	40°	60°	10°	3	1	2	0	4	2	12	40
2	48	60°	80°	20°	4	1	2	1	3	1	12	40
3	28	80°	90°	30°	5	1	3	1	5	3	18	60
4	50	60°	90°	20°	5	2	3	1	5	2	18	60
Average	36	60°	80°	20°								50

Table 2: Postoperative outcomes.

Discussion

Shoulder girdle resection for scapular tumors with or without reconstruction are some of the most demanding surgeries in the field of orthopedic oncology due to the proximity of neurovascular structures [8]. Before 1970, and for this tumor localization, the treatment was generally based on shoulder girdle amputation introduced by Nancrede, et al., [9]. Nowadays, and thanks to the development of imaging modalities and adjuvant therapies, limb-sparing surgery techniques are increasingly adopted and this between 80%-90.4% of the cases [10-13]. This conservative approach consists, according to many authors, first of all of a tumor resection then of a bone and soft tissue reconstruction for which the necessity and the feasibility are judged the case by case [14-16].

Concerning shoulder girdle resection, several classifications have been proposed. The evolution has been made from the earlier systems which were purely descriptive related

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exclusively to the bones resected towards surgical classification systems, in particular that described by the MSTS based on the relationship of the tumor to anatomic compartments, surgical margins, the status of the glenohumeral joint and functions considerations [16-20].

In total scapulectomy, where almost all of the shoulder function is eliminated, the neural bundles should be preserved to maintain an acceptable level of total limb function. In the literature, the functional score of this procedure ranges between 40 and 60% [21].

The limb function is better when the glenohumeral joint is preserved as Gibbons, et al., and many other authors have reported [22-25]. In most studies, functional score ranges with this procedure between 72-88% [10,26].

After scapulectomy, three reconstruction methods are available: humeral suspension, total endoprosthesis and bone allograft.

Humeral suspension was the most popular reconstructive procedure after scapulectomy until the early 1990s. For purely functional reasons, the proximal humerus should be stabilized to the clavicle and if possible muscle reconstruction should be performed [22,27,28]. In effect, Nakamura, et al., reported following muscle reconstruction an average good functional result of 64.8% [29]. However, Mayil Vahanan, et al., described good to excellent results in 57% of the cases in a series of 23 patients who have not benefited from soft tissue reconstruction [23]. In a comparative study, there were no significant differences between soft tissue reconstruction and non-reconstruction [21].

The preservation of shoulder function after scapulectomy requires theoretically bony reconstruction. About that, scapular prosthesis can be an option although it is not a common surgery [21]. In addition to its interest in the bony defect filling remained after scapula resection, this technique connects the arm and the chest wall, prevents traction on the brachial plexus, lateralizes the reconstructed shoulder and preserves its offset [30]. Baran, et al., and Tang, et al., described with scapular prosthesis, functional scores ranging from 73.3% to 76.7% [31,32]. Although scapular prosthesis appears promising in terms of postoperative outcome, its implementation confronts surgeons with many difficulties including availability issues, a demanding surgical technique, postoperative dislocation risk and wound infection which are the most frequent complications deplored in 10% to 20% [33-35]. In the attempt to prevent these, some authors have used massive bone grafting including allograft and recycled auto graft [36,37]. Zhang, et al., described in this context scapular allograft reconstructions of 7 patients [24]. The functional score was 80% with a better functional results when gleonoid-saved reconstruction was done. More recently, Capanna, et al., presented a series of 6 cases of scapular massive bone allograft reconstructions after total scapulectomy [38]. The functional score of their series was 66.7%. Biazzio, et al., announce a similar functional results with a score around 73% an average for a longer follow-up period (average 60 months) [39].

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To avoid tumoral dissemination that results in functional loss, there are several options. Firstly, we describe the Carbon-ion radiotherapy which shows superior depth and dose distribution when compared to conventional radiotherapy [40]. With this procedure, the overall local control rates were for Kamade, et al., 88% and 73% at 1 and 3 years of follow-up respectively. Secondly, intraoperative radiotherapy constitutes a real therapeutic alternative which is provided after tumor excision [41]. Turnbull, et al., mentioned that this technique diminished the likelihood of local recurrence and avoided amputation in marginal situations of scapular sarcoma [42].

In the present study, we report nine cases of scapulectomy with glenohumeral joint preservation (Fig. 6) resulting in 56% functional score, which is equivalent to other reports. Continuously disease-free status was achieved in all cases during follow-up period.

Several limitations exist in this study. The first limitation corresponds to its retrospective nature which considerably reduces its level of evidence. In second, we recognize our small sample size related to the fact of having conducted this study in a single center. Finally, long-term follow-up was not done because of the short time for data collection.

Figure 6: Post-operative X-ray.

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Conclusion

Malignant tumors of the scapula can be treated successfully with limb-sparing surgery procedures. In our context and in the absence of scapular prosthesis and bone bank, scapulectomy with glenohumeral joint preservation constitutes a reproducible and reliable therapeutic option on the functional and oncological levels that we practice with great conviction in view of a larger and prospective series.

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Author Contributions

HA, ME contributed to study concept and design, analysis and interpretation of data, drafting of the manuscript and statistical analysis. AE and AEL were involved in critical revision of the manuscript for important intellectual content and correction of the paper. All authors read and approved the final manuscript.

Conflict of Interest

The authors declare no conflict of interests.

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