

Total Scapular Prosthesis, an Option for the Treatment of Scapular Chondrosarcoma

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Learning Point of the Article:

The total scapular prosthesis in the treatment of scapular chondrosarcoma warrants the successful tumor treatment option as well as a satisfactory and favorable functional prognosis.

Abstract

Introduction: Chondrosarcoma has the highest prevalence among the primary malignant bone tumors in adults over the age of 50, and the scapular region is the most affected anatomical site.

Case Report: We report the case of a 66-year-old female patient, with no previous medical history, who consulted for aggravating mixed, non-specific, and atraumatic pain in the right shoulder, evolving for a year. The radiological assessment, including a computed tomography (CT) scan, a magnetic resonance imaging, and a tumor CT-guided biopsy, confirmed the diagnosis of a Grade 2 chondrosarcoma. A curative surgical treatment was performed, by an extended tumor resection and simultaneous joint reconstruction by a reversed total shoulder prosthesis with a custom-made total scapular prosthesis. This option allows to maintain survival prognosis, associated with the preservation of upper limb function.

Conclusion: The results were conclusive at the curative level and very encouraging from the functional point of view with progressive and partial recovery of the articular amplitudes, allowing the preservation of patient's autonomy and quality of life. No complications such as scapular dislocation or tumor recurrence were documented at 3-year postoperative follow-up.

Keywords: Chondrosarcoma, shoulder, total scapular prosthesis, shoulder prosthesis.

Introduction

Chondrosarcomas usually develop between the fourth and sixth decades of life [1]. They account for approximately 20–25% of all bone sarcomas [2]. They most frequently affect flat bones, such as the scapula and pelvis [3]. They can present as primary or secondary tumors and also as malignant transformation of enchondromas or, more rarely, from the cartilaginous outer layer of osteochondromas [1, 3]. Their origin is not yet completely elucidated [1]. To date, it has been observed that the development of chondrosarcoma could be caused or favored by

benign bone tumors such as chondromas or osteochondromas, bilateral retinoblastomas Paget's disease, or Li-Fraumeni syndrome [4].

Conventional, clear cell, and mesenchymal and dedifferentiated chondrosarcomas are distinguished and are subdivided into three grades: I, II (the most frequent), and III, based on nuclear size, staining pattern (hyperchromasia), mitotic activity, and degree of cellularity [4]. Grade III chondrosarcoma often kills by metastasis, even if an appropriately radical operative procedure is performed with local control achieved [5]. The risk of

Access this article online

Website:
www.jocr.co.in

DOI:
<https://doi.org/10.13107/jocr.2023.v13.i08.3838>

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Submitted: 01/05/2023; Review: 16/06/2023; Accepted: July 2023; Published: August 2023

DOI: <https://doi.org/10.13107/jocr.2023.v13.i08.3838>

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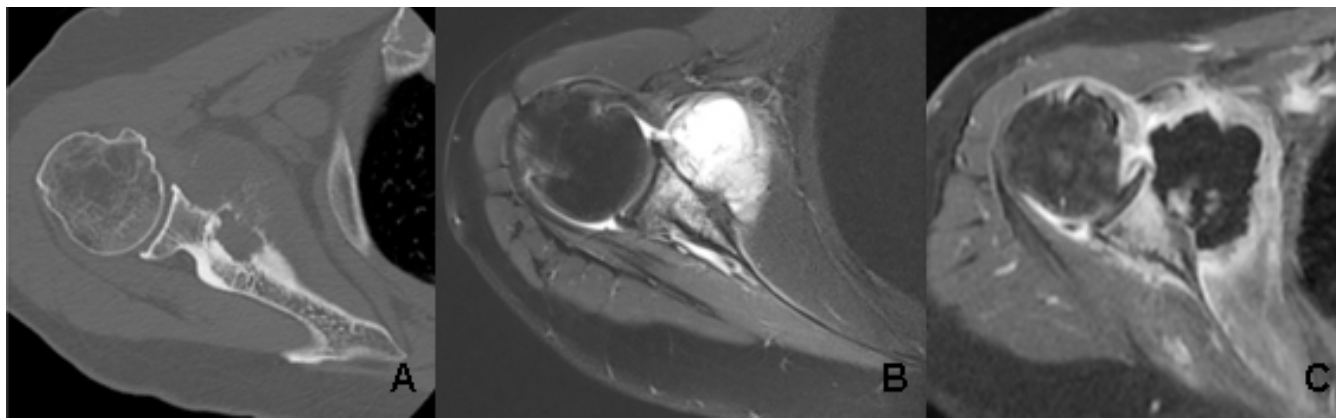


Figure 1: (A) CT scan right shoulder axial section: scapular bone lesion centered on the anterior part of the neck of the scapula and the base of the coracoid process. (B) MRI right shoulder axial T2 sequence: Osteolytic lesion of the base of the neck of the scapula with cartilaginous matrix, centered on the anterior part of the neck of the scapula and the base of the coracoid process measuring $5.6 \times 4.5 \times 5.9$ cm with tumor development toward the subscapular fossa and invasive the anterosuperior part of the glenohumeral joint with reactive synovitis. (C) Right shoulder MRI axial acquisition T1 sequence with injection of gadolinium: Close relationship between the lesion and the tendon of the pectoralis minor, the axillary pedicle, and the bundles of the brachial plexus, a sign of denervation of the supraspinatus and infraspinatus muscles indicating damage to the suprascapular nerve.

recurrence increases with higher grades [5]. Nevertheless, surgery is the only curative treatment [4].

Several different surgical techniques have been developed for the treatment of this specific pathology. However, their main drawback is that they usually result in joint sacrifice with poor functional outcomes.

The goal of this study was to report a rare case of curative surgical treatment of a scapular chondrosarcoma with reconstruction through a total scapular prosthesis.

Case Report

Clinical presentation

We report the case of a 66-year-old female patient who consulted for chronic mixed pain in the right shoulder progressively worsening during the last year. The clinical examination showed rather moderate and increased pain on mobilization, without movement limitation or palpable mass. Bony prominence palpation did not generate pain, and rotator cuff testing was negative.

Radiological diagnosis

The radiological assessment included a CT scan (Fig. 1a) and a magnetic resonance imaging (MRI) (Fig. 1b and c), which showed an osteolytic lesion of the base of the neck of the scapula with a cartilaginous matrix. The lesion was centered on the anterior part of the neck of the scapula and the base of the coracoid process measuring $5.6 \times 4.5 \times 5.9$ cm, with tumor development toward the subscapular fossa and invading the anterosuperior part of the glenohumeral joint with reactive synovitis.

Histopathological diagnosis

Primary bone tumor diffusely infiltrated the bone. As the pathological diagnosis required a tissue sampling, we performed a CT-guided bone biopsy which showed a Grade II chondrosarcoma.

Treatment-surgical technique

After discussion of patient's file in a multidisciplinary meeting, the recommended therapeutic option was a total scapulectomy



Figure 2: (A) Patient positioning, (B) Enlarged Judet approach, (C) Diamond-shaped incision.

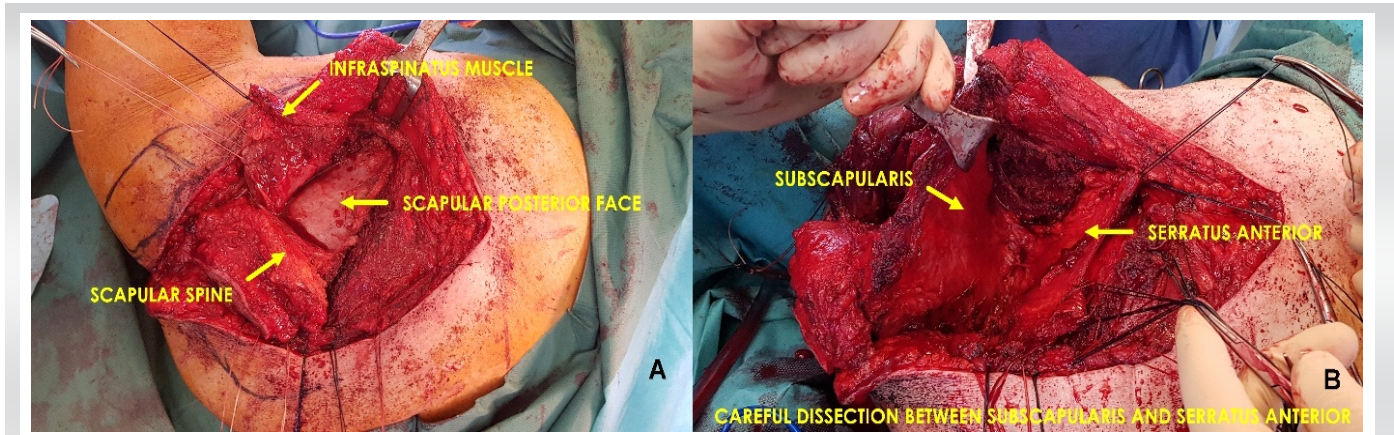


Figure 3: (A) Posterior dissection, (B) Anterior dissection.

with extra-articular resection followed by reconstruction with custom-made scapular prosthesis and total reverse shoulder prosthesis, in a one-stage procedure.

The patient was placed in left lateral decubitus, under general anesthesia (Fig. 2a). A Judet approach was performed, widened into the acromioclavicular joint (Fig. 2b). A diamond shape incision was made into the incision to completely excise the biopsy scar (Fig. 2c). Careful and progressive muscular disinsertion was performed plan by plan. Then, muscles of the upper angle of the scapula were secured with the trapezius muscle and the muscles of the lower angle were secured with the latissimus dorsi, major and minor teres (Fig. 3a). Then, the scapula's anterior face (including the brachial plexus and the subclavian artery) was uncovered (Fig. 3b). The subscapularis muscle was preserved (Fig. 3b). The scapula was excised, preserving the acromion (Fig. 4). As the tumor invaded the anterior capsule, we performed a humeral neck (extra-articular) osteotomy to leave the joint capsule closed. Once the neck was removed, the humeral shaft was prepared (Fig. 5a). Then, a reversed humeral prosthesis was implanted (Fig. 5b).

A custom-made MUTARS from IMPLANTCAST® (implantcast GmbH Lüneburger Schanze 26 D-21614 Buxtehude Germany) scapular prosthesis was implanted (Fig. 6a). The periscapular muscles were reattached to the scapular prosthesis (anterior serratus, rhomboid muscles, and trapezius) (Fig. 6b). The posterior edge of the deltoid was sutured on the acromion. Satisfactory stability of the prosthetic complex was achieved (Fig. 7a and b).

Follow-up

Shoulder was immobilized with an elbow splint for 6 weeks followed by progressive rehabilitation. At 3-year follow-up, there was a complete remission of the tumor, and the patient had a good shoulder function, allowing him independence for basic daily life activities (Fig. 8).

Discussion

Chondrosarcomas are malignant bone tumors characterized by the production of neoplastic cartilage and are the second most common variety of matrix-producing malignant bone tumor [4]. They usually develop as intramedullary lesions, and they commonly affect the scapula as well as the pelvis [4].

The behavior of these tumors is inconstant, ranging from a slowly growing form with lower possibility of metastasis, to an aggressive sarcomatous form with a higher probability of metastatic transformation. They affect men and women equally and the fourth and sixth decades of life are the most common, as the patient we report [1]. Clinically, they are characterized by insidious, progressive, and long-lasting pain.

Osteochondromas, which make part of the differential diagnosis, are usually asymptomatic, so patients are unaware of the existence of the lesion, so persistent and permanent pain may be the cause. A malignant transformation may occur in 5% of patients [6].

The diagnosis of scapular chondrosarcoma is radiological and

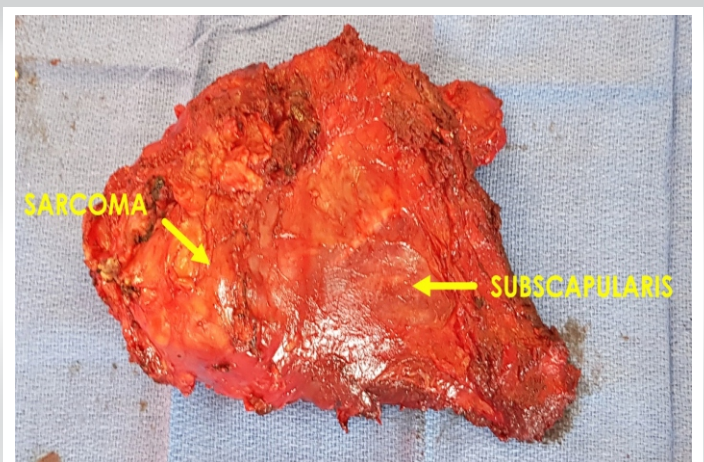


Figure 4: Excised scapula.

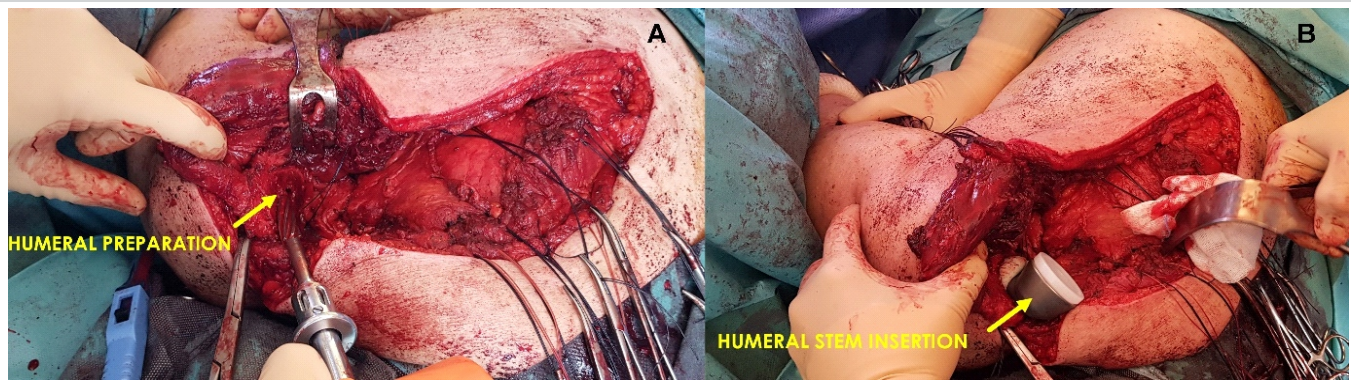


Figure 5: (A) Reaming of the humeral shaft. (B) Implantation of the humeral prosthesis.

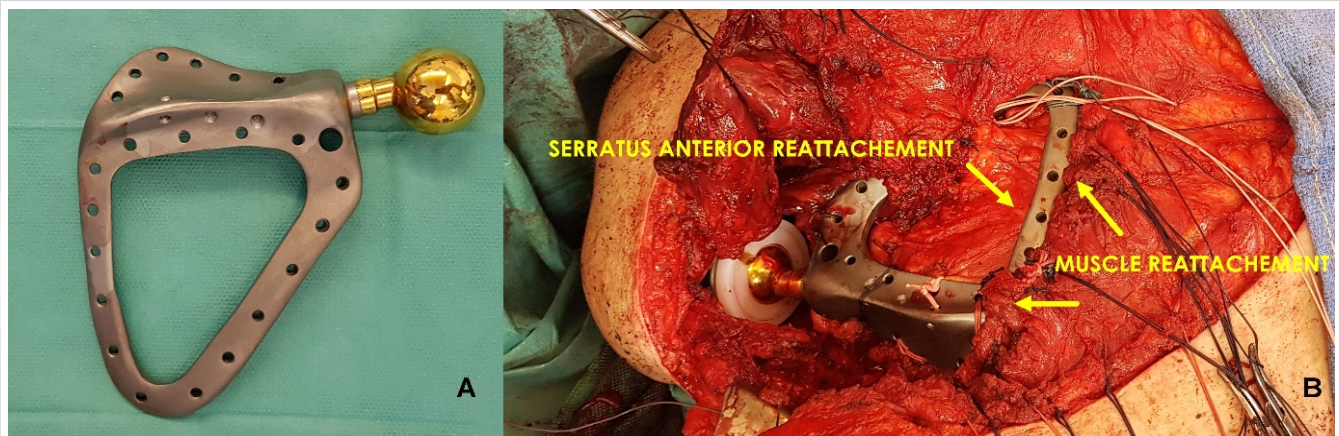


Figure 6: (A) Custom-made Mutars (Implantcast®) scapular. (B) Scapular prosthesis placement.

histological. Several methods are used to detect these tumors, such as conventional radiography, computed tomography (CT), and MRI [7]. The radiographic appearance of chondrosarcomas, observed on CT, can help the final histopathological diagnosis, thanks to the individual characteristics of these lesions, such as their radiographically prominent endosteal nodular scalloping, the calcified matrix appears as foci of flocculent density, and mottled, “popped”,

spotty or ring-like calcification of the cartilaginous matrix [2].

On the other hand, the PET scan does not have high sensitivity or specificity in the differential diagnosis of a benign and low-grade malignant chondrogenic lesion. Although, it is more efficient in identifying high-grade chondrosarcomas that show increased glucose metabolism [8,9].

To define the best treatment for these tumors, it is important to classify them. Thus, after radiological and histological evaluation, the tumor needs to be classified into a localized and/or aggressive malignant tumor [4]. Hence, localized lesions rather are low histological grade, with little possibility of metastases. Their treatment consists of a wide resection, preserving the adjacent bone to the tumor [10]. On the other hand, aggressive cases with histological intermediate-to high-grade tumors are treated by a segmental amputation, if possible. Complete resection can heal classic lesions, avoiding the need for adjuvant radiation therapy [9].

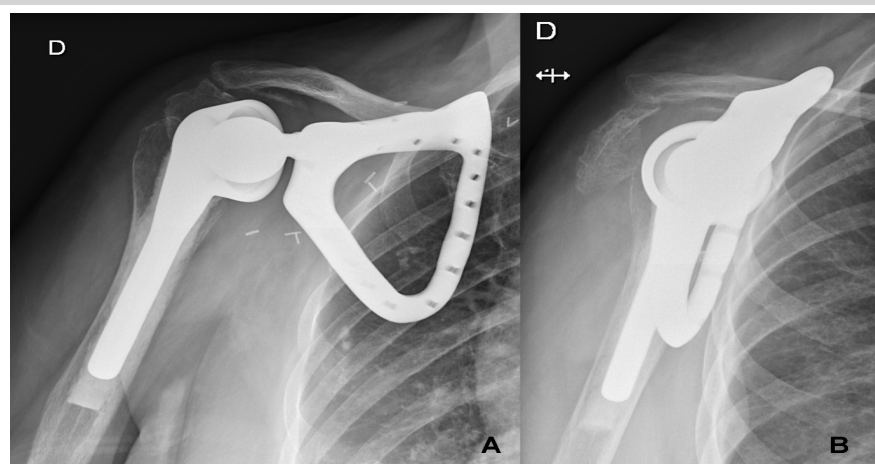


Figure 7: (A) Post-operative right shoulder AP X-ray. (B) Post-operative right shoulder lateral X-ray.



Figure 8: Shoulder range of motion: (A) Flexion 20°, (B) Abduction 50°, (C) External rotation-5°, (D) Internal rotation hand on the buttock.

In the present case, the malignant tumor was localized at the scapular level. Although it did not present metastasis, there was a soft-tissue invasion. To avoid a limb amputation, it was therefore decided to perform a curative surgical treatment by total resection of the tumor with a total prosthetic scapular and humeral reconstruction. Other types of surgical procedures, such as amputation and especially isolated scapulectomy and acromio-humeral arthrodesis, were excluded, due to their poor functional results.

Nevertheless, it should also be noted that the role salvage surgery is yet to be clear, especially for tumor around the shoulder with often massive invasion of the proximal part of the upper limb. In this situation, the vast majority of surgeons tend to choose tumorectomy and limb amputation. However, in our case, the size and location of the tumor in the scapula, where surgical margins could be achieved and surrounding neurovascular structures remained intact. Such situation offers the possibility of tumor resection followed by reconstruction and limb salvage, using custom-made scapular and total reverse shoulder prosthesis, ensures the patient to keep the upper limb function.

At 3-years post-surgery, there was no tumor recurrence or appearance of metastatic lesion. The upper limb function was satisfactory, allowing the patient to maintain her autonomy. Nevertheless, such a short follow-up does not allow us to affirm with certainty that this therapeutic approach is the best. Considered questionable by some authors, this therapeutic

option can, in many cases, be the best choice in the management of these tumors and promote a favorable evolution with significant impact on the patient's quality of life.

Conclusion

Chondrosarcoma is the second primary malignant bone tumor after osteosarcoma and should be thought of when located in the scapula. Chemotherapy and radiotherapy have already been used without success. The gold standard curative treatment remains surgery. The challenge in this context lies both in ensuring a complete tumor resection for the survival prognosis and a prosthetic reconstruction of the osteoarticular components for the functional prognosis. The utilized technique in the treatment of our patient warrants the successful tumor treatment as well as a satisfactory and favorable functional prognosis.

Clinical Message

Our differential diagnostic approach regarding scapular located pain, should include the possibility of a malignant pathology. A thorough imaging and histopathological assessment will allow for the most appropriate application of treatment modality. Our surgical technique warrants limb salvage and satisfactory functional results.

Declaration of patient consent: The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given the consent for his/ her images and other clinical information to be reported in the journal. The patient understands that his/ her names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

Conflict of interest: Nil **Source of support:** None

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Conflict of Interest: Nil

Source of Support: Nil

Consent: The authors confirm that informed consent was obtained from the patient for publication of this case report

How to Cite this Article

Himer N, Antoni M, Soares S, Brinkert D, Marco AD. Total Scapular Prosthesis, an Option for the Treatment of Scapular Chondrosarcoma. Journal of Orthopaedic Case Reports 2023 August;13(8): 111-116.

