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Case report

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Total reverse shoulder arthroplasty: a strategy for the resolution of multiple pathologies in a single surgical procedure. Case report

Abstract

Background: Rotator cuff arthropathy associated with pathological fractures and bone lesions presents a complex therapeutic challenge. Management must address joint dysfunction, structural compromise, and the nature of the underlying lesion.

Case presentation: A 61-year-old female with chronic right shoulder pain was diagnosed with rotator cuff arthropathy, a pathological humeral fracture, and a diaphyseal aneurysmal bone cyst. A single-stage reverse total shoulder arthroplasty with a long-stem prosthesis was performed to address all three pathologies concurrently. The procedure proceeded without complications. At five months postoperatively, the patient achieved a Constant Score of 89, indicating excellent functional recovery.

Conclusion: Reverse shoulder arthroplasty with a long stem can be considered and safe surgical option in complex cases involving degenerative arthropathy, pathological fracture, and bone lesions, even in the absence of malignancy. This approach broadens the indications for reverse shoulder arthroplasty in non-oncologic scenarios.

Keywords: reverse prosthesis, shoulder, total prosthetic replacement, rotator cuff arthropathy, neoplasm, pathological fracture.

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Andrés Felipe De La Espriella Rosales, Nicole Carolina Lascano Robles
Department of Orthopedic Surgery and Traumatology, Kaizen Medical Care, Colombia

Correspondence: Andrés De la Espriella-Rosales, MD, Department of Orthopedic Surgery and Traumatology, Kaizen Medical Care, Barranquilla, Colombia, Postal code: 080020

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Level of evidence: V

Introduction

The development of shoulder replacement prostheses began in 1950, and in 1951, the first shoulder arthroplasty was performed by surgeon Charles Neer, with a high success rate in improving joint function. It is a successful treatment option for a variety of degenerative and traumatic shoulder conditions.[1]

Since its inception, and especially in recent decades, the volume of procedures and incidence of shoulder arthroplasties have increased exponentially; in 2017, an estimated 823,361 patients were living in the United States with a shoulder replacement. This represents a prevalence of 0.258%, which increased markedly from 1995 (0.031%) to 2005 (0.083%), as described in a review article that used the US National Inpatient Sample (NIS) to count all patients who underwent total shoulder arthroplasty (TSA), including anatomic and reverse TSA, and hemiarthroplasty between 1995 and 2017. Kevin and Jacob describe the prevalence of TSA was 0.197%, or 197 per 100,000 people, while the prevalence of hemiarthroplasty was 0.061%, or 61 per 100,000 people, and the prevalence of any shoulder replacement (anatomic TSA, hemiarthroplasty, and reverse TSA) was 0.258%, or 258 per 100,000 people.[2]

During the period 2004–2015, Jenni and Juha performed the analysis of nationwide data from the Finnish Arthroplasty Register (FAR) and the Finnish National Hospital Discharge Register (NHDR) describing an increase from 9 to 21 per 100,000 person-years in total primary shoulder arthroplasty, meaning that the number of procedures has approximately doubled over 10 years.[3] Therefore, this surgical procedure has evolved to be safe and effective, so much so that it can restore functionality to patients with diagnoses such as glenohumeral osteoarthritis, rotator cuff arthropathy or proximal humerus fractures, which has increased its use in clinical practice.[4]

As mentioned above, there are different prosthetic alternatives for performing a proper shoulder arthroplasty, including anatomical total shoulder arthroplasty (TSA) and reverse total shoulder arthroplasty (RSA). TSA improves patients' physiological joint kinematics; however, the increased range of motion favors joint instability. Only 30% of the humeral head is in contact with the glenoid, so it is necessary to have an intact rotator cuff to act as a stabilizing structure. RSA, on the other hand, was introduced in 1985 and is primarily used for arthropathy in shoulders with rotator cuff deficiencies. In these cases, it is necessary to replace the damage caused by osteoarthritis and improve shoulder mobility due to deficits in tendon structures. To increase abduction and flexion mobility, a reverse prosthesis is chosen that allows recruiting a greater amount of deltoid fibers to compensate for the activity of the rotator cuff, for example, the medial glenoid/lateral humerus design.[5] Other indications for RSA include acute complex fractures of the proximal humerus and bone tumors of the same.[6]

The following study reports a case of rotator cuff arthropathy. It also included a neoplastic-appearing lesion with a pathological fracture. These conditions were treated with total shoulder replacement with a reverse prosthesis in a single surgical procedure.

Case report

A 61-year-old female patient with no significant medical history attended the Orthopedics outpatient clinic at Kaizen Medical Care in Barranquilla, Colombia. She presented with symptoms of chronic right shoulder pain (greater than 3 months) that limited her basic activities of daily living, such as dressing, bathing, and lifting objects. Physical examination revealed grade 1 obesity (BMI: 32 kg/m_2), full range of motion pain in the last few degrees of elevation, Speed up +, O'brian +, Hawkin +, strength 4/5 for elevation, Jobe +, acromioclavicular joint pain +, tenderness on palpation of the long head of the biceps brachii +, and pain on axial compression of the

humerus. X-ray and MRI revealed glenohumeral arthritic changes, a massive rotator cuff tear, and a metaphyseal intramedullary bone lesion with nonspecific behavior (Figure 1). The patient presented a traumatic event days after the initial assessment, triggering crepitus and acute pain. An x-ray was performed, revealing a pathological diaphyseal fracture with displacement (Figure 2). A percutaneous biopsy was indicated to define intramedullary tumor pathology with biopsy results of a diaphyseal tumor compatible with an aneurysmal cyst. It was decided to perform a reverse total prosthetic replacement with a long stem for the treatment of the three conditions (rotator cuff arthropathy, diaphyseal tumor, and acute fracture) (Figure 3).

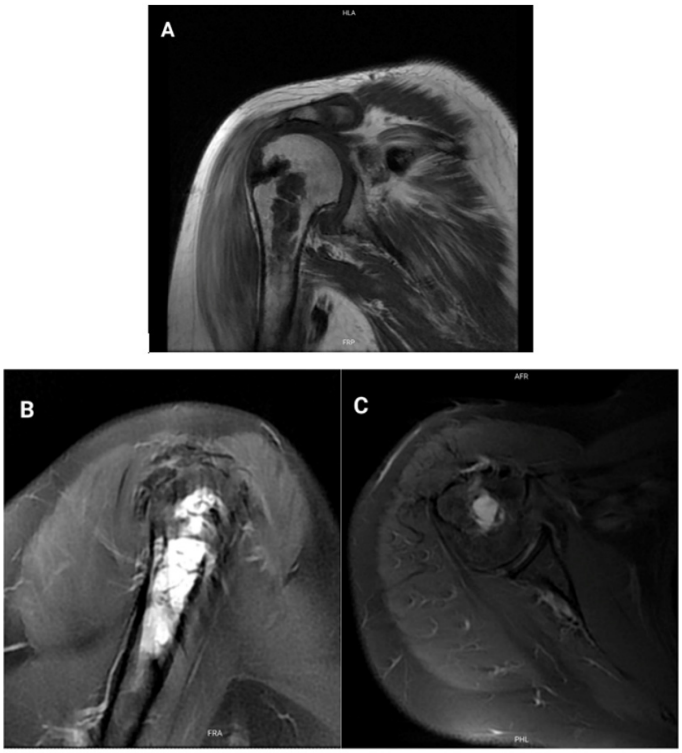

Figure 1 non-contrast MRI of the right shoulder prior to a traumatic event. A. Coronal T1 plane, B. Sagittal plane, C. Axial plane.

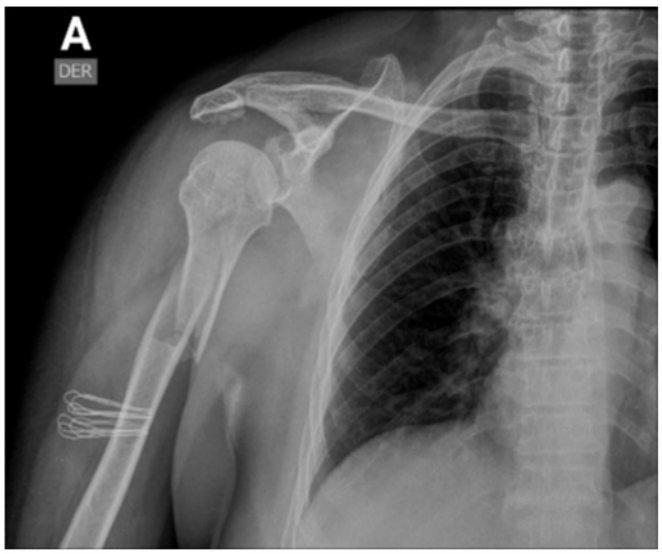

Figure 2 neutral anteroposterior preoperative radiograph of the right shoulder after a traumatic event with displaced diaphyseal fracture.

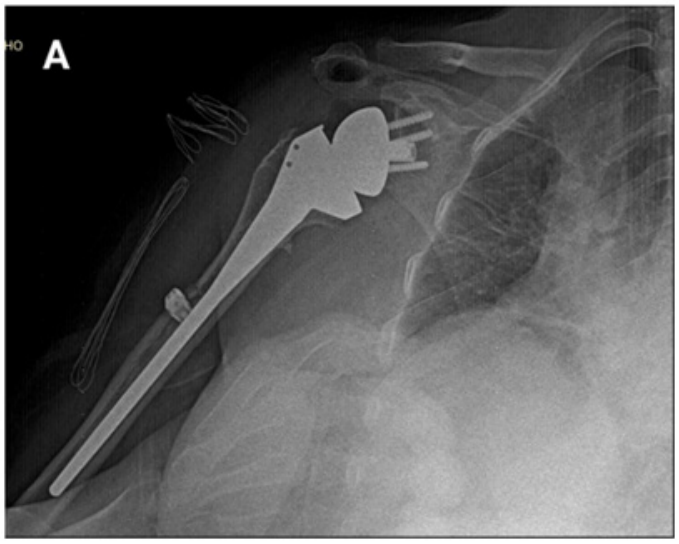

Figure 3 follow-up radiograph of the right shoulder after reverse total prosthesis replacement with a long stem. Stabilization of the metadiaphyseal humerus fracture with osteosynthesis material (isoelastic supercable) is observed. A. Anteroposterior radiograph.

Surgical technique

The patient is placed in the beach chair position, proceeding to the first phase with sterile drapes on the right upper limb. A prolonged delto-pectoral incision is made inferiorly to the middle third of the humerus, dissected in layers until the deltoid insertion and pectoral insertion are visible in the lower region. A proximal humerus arthrotomy is performed, along with tenotomy of the long head of the biceps brachii tendon and the subscapularis tendon, revealing the absence of the supraspinatus tendon. In the second phase, a fracture site is identified in the metadiaphyseal region with displacement and rotation. The intramedullary tumor is resected by curettage for confirmatory pathology. Upon completion, direct reduction is performed between the fracture fragments and subsequent internal fixation, maintaining alignment and length with osteosynthesis with isoelastic supercable to prepare for total replacement. A glenohumeral dislocation was performed using a guide, a 15-degree retroversion osteotomy, and metaphysis reaming. The glenoid was then reamed, a metaglene was placed, secured with two cortical screws and two locked screws; and a 36-mm glenosphere was secured with a central screw. A definitive 6.5 mm x 150 mm stem was then inserted through the fracture site.

After insert placement and reduction, adequate clinical stability and full mobility were observed in all three planes. A subscapularis tenorrhaphy was performed in the lesser tuberosity region with high-strength suture, revealing complete closure of the humeral head and good prosthetic stability. The procedure was closed in layers, good distal perfusion was assessed, and a sling was placed.

After the procedure, the shoulder was immobilized for 4 weeks, allowing full range-of-motion exercises for the elbow, wrist, and hand immediately after the procedure.[7] Passive mobility and stretching exercises were initiated from the fourth postoperative week. After the eighth postoperative week, strengthening exercises for the deltoid and periscapular muscles were initiated.

The patient presented no intraoperative or postoperative complications. Follow-up x-rays were taken at the first, second, third,

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and fifth months (Figure 4& Figure 5) showing good appearance and satisfactory progress in range of motion, achieving functionality from the second postoperative month. At the fifth postoperative month, the Constant Score[8] was 89 points indicating an excellent degree of functionality.

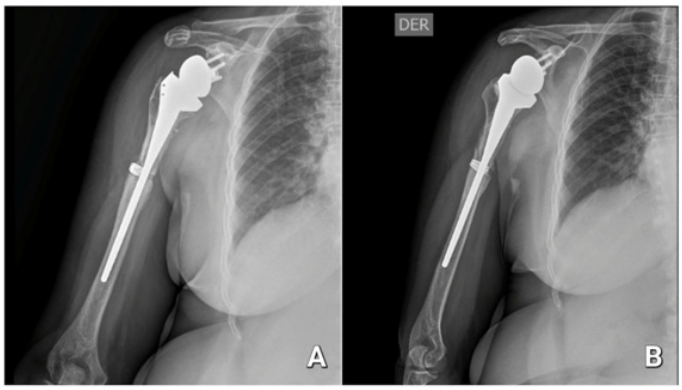

Figure 4 anteroposterior control radiograph of the right shoulder at five months postoperatively in proper position. A. Front. B. External rotation.

Figure 5A Internal rotation.

Figure 5B Active elevation

Figure 5C External rotation.

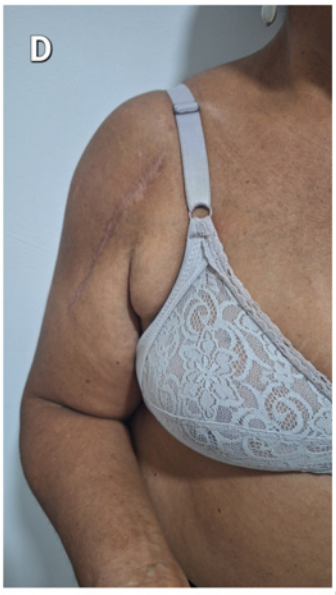

Figure 5D Additionally the wound

Figure 5 Patient performing active elevation, internal rotation, and external rotation two years post-surgery. Additionally, the wound has healed properly.

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Discussion

This clinical case describes a 61-year-old female patient who presented with a rare but clinically challenging combination: an aneurysmal bone cyst (ABC) of the proximal humerus, associated with a fracture and a massive rotator cuff tear, in the context of severe shoulder functional impairment. This triple entity (aggressive bone tumor, massive rotator cuff tear and proximal humerus fracture) warranted the indication of reverse total shoulder replacement (RTS) as a comprehensive surgical strategy.

An aneurysmal cyst is a benign, expansive, highly vascularized lesion with local destructive potential, especially in weight-bearing bones or joints. There are limited reports in the literature describing the use of RTS in patients with ABC of the humerus. Sánchez-Sotelo et al. (2011) and Mankin et al. (2005) have documented the use of humeral prostheses for resection of aggressive bone tumors, although more commonly in sarcomas or metastatic lesions.[9,10] However, in this case, the choice of an RSA allowed not only the resection of the tumor, but also the restoration of joint function in a shoulder without tendon integrity and fixation of a proximal humerus fracture.

The presence of a massive rotator cuff tear, confirmed intraoperatively, limited conventional reconstructive options. Techniques such as hemiarthroplasty or anatomical replacement are associated with poor functional prognosis in the absence of the cuff. The literature broadly supports the use of RSA in these settings. Boileau et al. (2006) and Favard et al. (2011) have shown favorable results in terms of pain, active anterior elevation, and satisfaction in patients with massive rotator cuff tears, even in complicated settings such as fractures or advanced arthropathy.[11,12]

In this case, RSA not only addressed the pathological tumor lesion and the pathological fracture, but also compensated for the absence of the cuff, reversing the muscle force vector to restore mobility through the deltoid. This resulted in a satisfactory postoperative outcome, with progressive functional recovery, adequate pain control, and no mechanical or infectious complications.

In contrast to other reports of RSA in tumors, which frequently involve cancer patients with limited life expectancy or metastatic lesions with satisfactory functional evolution,[13] the present case highlights the functional benefit of this strategy in patients with aggressive tumors, whose long-term prognosis allows prioritizing joint restoration and quality of life.

A retrospective observational study conducted by the Institute of the Catholic University of Rome analyzed 20 patients with proximal humerus metastases complicated by pathological fracture, treated with reconstruction using modular anatomical shoulder prostheses. All interventions were performed by the same surgeon, and cases in which a reverse prosthesis was used were excluded.[14] Although treatment with anatomical prosthesis showed clinical improvement in terms of pain and function, the authors concluded that this type of implant is more prone to instability, which can lead to complications in the medium and long term. For this reason, the use of reverse shoulder prosthesis has gained prominence as a safer and more effective alternative for managing complex and coexisting pathologies. It is important to note that, in the systematic review of the literature, no studies were identified that analyze the outcome of patients with a clinical presentation as complex as ours, who included an acute pathological fracture, advanced arthropathy with a massive rotator cuff tear, and a bone tumor treated with reverse total shoulder prosthesis replacement. This case, therefore, provides relevant evidence on the functional efficacy of this surgical strategy, expanding the spectrum of indications for RSA in a only one surgycal time and underscores its value as a single-stage surgical solution that reduces risks such as infections, increased anesthetic events, and the psychological impact associated with multiple surgical procedures in operating rooms. Furthermore, it reduces hospital costs, which is why it was considered an appropriate surgical alternative in this clinical setting.

Conclusion

This report presents the comprehensive management of multiple pathologies through a single surgical intervention in a 61-year-old patient. The strategy to treat many pathologies with just one devise was complex and carefully planned, assessing risks and benefits in an effort to address the patient's diverse needs in a single surgical procedure, taking into account efficacy and safety. Therefore, a reverse total shoulder replacement was chosen. The procedure was successful, and the patient experienced favorable, complication-free results, optimizing functional recovery and reducing perioperative risks. Therefore, we propose that surgeons facing similar situations consider this technique, and we emphasize the importance of a thorough patient evaluation. This case highlights the importance of continuing to investigate the long-term outcomes of this type of intervention and suggests its consideration in similar clinical settings.

Ethical responsibilities

Human and animal rights: The authors declare that this research did not involve experiments on humans or animals.

Informed consent and patient data: The authors state that written informed consent was obtained from the patient for publication of this case report and accompanying images. All patient information has been anonymized to preserve confidentiality.

Ethical approval: The authors confirm that the procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation and with the Declaration of Helsinki.

Conflict of interest

The authors declare no conflicts of interest.

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