Case Series

PROXIMAL HUMERUS FRACTURE MANAGEMENT WITH REVERSE SHOULDER ARTHROPLASTY- CASE SERIES

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ABSTRACT
This article delves into the intricate domain of proximal humerus fractures, exploring the efficacy of reverse shoulder arthroplasty as a surgical intervention. Through a meticulous review of literature, we aim to provide a comprehensive understanding of the inclusion and exclusion criteria, investigations, materials, methods, and results associated with this innovative approach.

KEY WORDS
Proximal humerus fracture, reverse shoulder arthroplasty, Neer classification, orthopedic surgery, implant design, postoperative rehabilitation.

INTRODUCTION
Approximately 5% of fractures involve the proximal humerus, ranking it as the third most common fracture type, with its prevalence increasing among aging populations. Although only a small portion of these fractures are complex, older individuals exhibit more intricate patterns.[1] Due to severe comminution, displacement, and compromised bone quality, repairing fragility fractures in the proximal humerus proves challenging with open reduction and internal fixation (ORIF) or hemiarthroplasty. Plate osteosynthesis poses issues like osteonecrosis and loss of fixation.[2] Neer's hemiarthroplasty offers a favorable option, yet outcomes may vary. Tuberosity healing significantly influences hemiarthroplasty results, with adequate healing yielding positive clinical outcomes.

Reverse shoulder arthroplasty (RSA) is recommended for complicated fractures due to its more consistent outcomes compared to hemiarthroplasty. Greater tuberosity healing positively impacts both hemiarthroplasty and RSA results. Unlike hemiarthroplasty, tuberosity healing is not crucial for a successful outcome in reverse shoulder arthroplasty.

Initially designed for rotator cuff tear arthropathy, RSA's applications have expanded to include various shoulder conditions in senior patients.[3] Its nonanatomic design, based on Grammont principles, provides a versatile solution. By medially locating the center of rotation, the deltoid's moment arm is increased, reducing the forces required for arm abduction when the rotator cuff is dysfunctional. Implants with lateralized glenosphere centers improve joint stability and minimize scapular notching while enhancing external rotation. Biomechanical research indicates increased deltoid force for abduction with glenosphere lateralization, showcasing its impact on shoulder mechanics.

Inclusion Criteria

Our study includes patients with proximal humerus fractures, classified as Neer's types III & IV, who underwent reverse shoulder arthroplasty, Elederly individuals, Age group: >50 Years.[4] We consider cases with adequate follow-up data, ensuring a robust analysis of both short-term and long-term outcomes.[5]

Exclusion Criteria

Patients of young age and with contraindications for reverse shoulder arthroplasty, such as active infection, insufficient bone stock, or severe medical comorbidities, are excluded from our analysis.[6] Additionally, cases with incomplete data or lost to follow-up are not considered.

Investigations

Preoperative assessments involve detailed radiographic evaluation, including X-rays, CT scans, and MRI, to precisely characterize the fracture pattern and assess soft tissue involvement. Postoperative assessments encompass regular follow-up with imaging studies to monitor implant position, healing, and potential complications.[7]

MATERIALS & METHODS

Our study employs a retrospective cohort design, analyzing data from a diverse group of patients who underwent reverse shoulder arthroplasty for proximal humerus fractures. Surgical techniques, implant types, and postoperative rehabilitation protocols are thoroughly documented to evaluate their impact on patient outcomes.

Image - Reverse shoulder arthroplasty prosthesis

CASE PRESENTATION

Case 1

In this case study, we explore the intricate diagnostic journey of a 78-year-old female patient who presented with left shoulder pain and restricted movement following a bike accident. The initial evaluation at a nearby hospital revealed a proximal humerus fracture, prompting a referral to a higher center for specialized care. To meticulously assess the extent of the fracture and associated injuries in this osteoporotic patient, a comprehensive imaging approach was employed. The use of X-ray for initial fracture diagnosis was followed by a detailed CT scan of the left humerus and shoulder. The CT findings shed light on specific aspects, including tuberosity displacement, glenoid characteristics, and bone stock. This diagnostic process, although non-urgent, plays a pivotal role in accurately evaluating the condition. The imaging work-up involves standard radiographs, lateral views, and CT with 3D reconstruction to assess the tuberosities, glenoid features, and humeral height restoration. Soft tissue windows provide information on cuff trophicity and fatty degeneration, while cautious evaluation of metaphyseal bone loss guides preoperative planning.

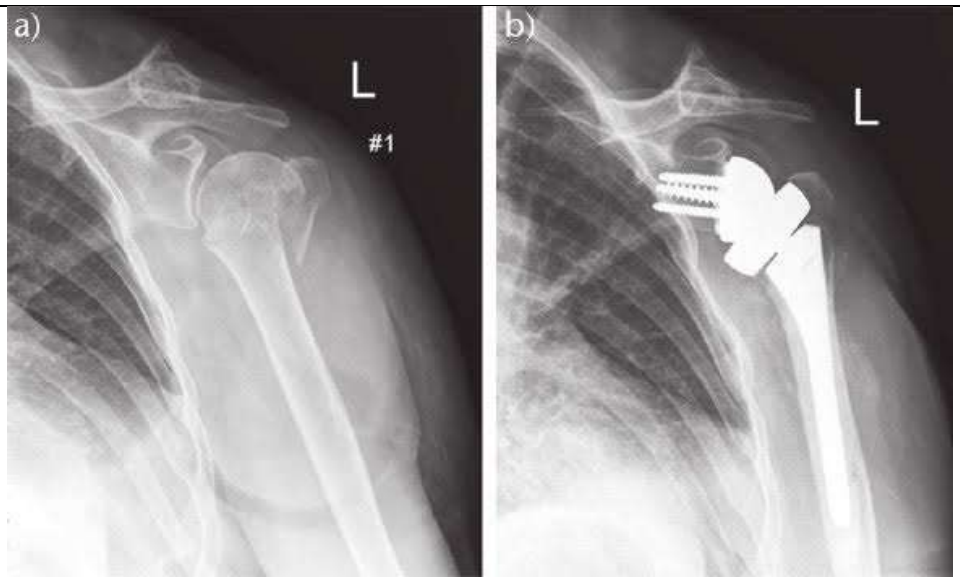

Figure 1

Notably, a radiograph of the complete contralateral humerus may be considered in cases of significant metaphyseal bone loss, aiding in the precise determination of implant height. This comprehensive imaging strategy ensures a thorough understanding of the patient's condition, guiding effective preoperative planning for optimal outcomes in proximal humerus fracture management**.**

Surgical Intervention

For effective post-operative pain control, the surgery is performed under general anesthesia, with or without an interscalene block. The patient assumes a beach chair posture, tilted between 30 and 60 degrees, enabling free anterior and posterior shoulder movements, along with humeral retropulsion. The arm is supported on rest pads, and two approaches can be considered: supero-lateral or delto-pectoral.

The delto-pectoral approach, while challenging for controlling the greater tuberosity, offers advantages in specific cases, such as fracture-dislocation injuries or metaphyseal fractures. It also provides theoretical protection to the anterior deltoid and prevents exposure of the axillary nerve. The upper edge of the pectoralis major tendon serves as a reference point for prosthesis height and tuberosity reduction in this approach.

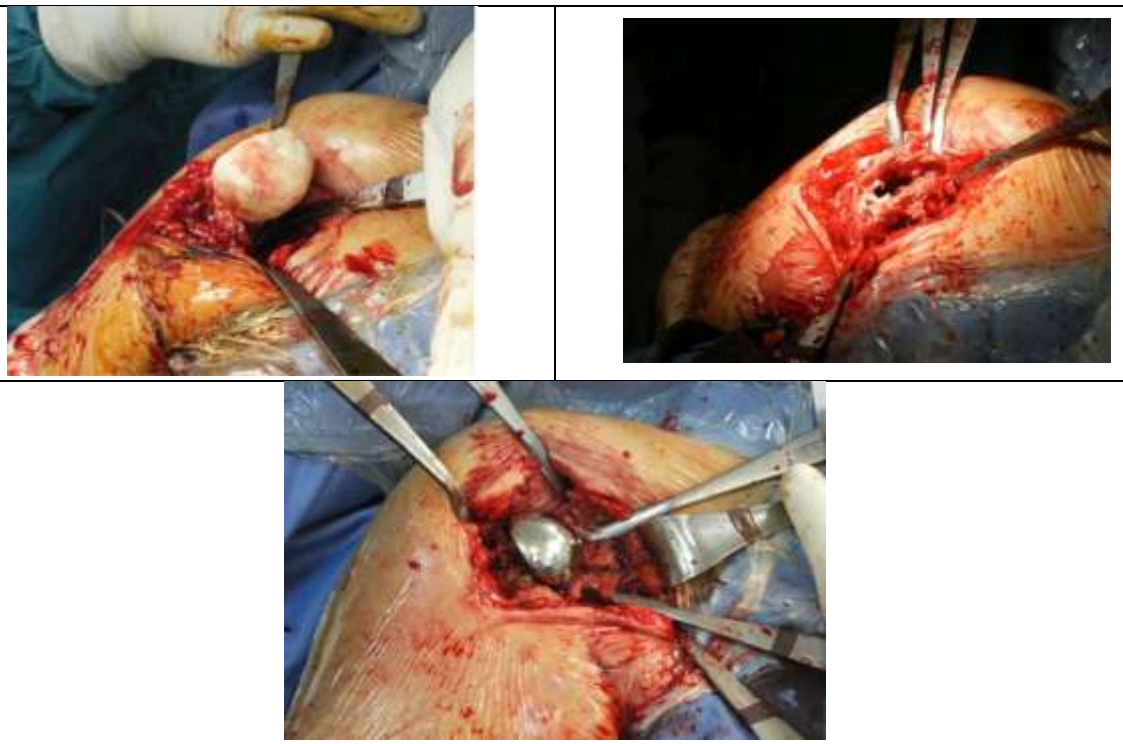

Figure 2

The delto-pectoral approach involves a lateralized 8 to 10 cm incision from the acromio-clavicular joint to the tip of the deltoid V. To mobilize the deltoid, the deep surface must be released, and ligaments are cut flush with the coracoid process. For the supero-lateral approach, an incision along the anterior edge of the acromion is made, not extending beyond 38 mm under the lateral edge to protect the axillary nerve. Fibers of the middle and anterior deltoid are divided, and an optional suture protects the axillary nerve.

During the procedure, acromioplasty enhances exposure, and the sub-acromial bursa is excised. The bicipital groove is opened, and the long head of the biceps tendon may be tenotomized. Fracture lines are addressed, and the rotator interval is opened to reach the glenoid. The supra-spinatus tendon is excised to access the glenoid, while preserving the periosteal attachments of the greater tuberosity. Suture loops are strategically inserted through the postero-superior cuff to maintain tendon attachments. The humeral head is freed for grafts during reconstruction, emphasizing the preservation of anatomical structures.

Case 2

Muthu, a 68-year-old male, presented with severe pain and limited range of motion in his right shoulder following a fall from standing height. Imaging revealed a displaced three-part proximal humerus fracture with significant comminution. Given his history of rotator cuff tears and chronic shoulder instability, traditional surgical options were deemed unsuitable. After thorough discussion of risks and benefits, Muthu opted for reverse shoulder arthroplasty. The procedure was performed successfully, utilizing a reverse shoulder prosthesis to compensate for the

compromised rotator cuff function and provide stability. Postoperatively, Muthu underwent a comprehensive rehabilitation program to optimize his shoulder function and regain mobility. Follow-up assessments demonstrated satisfactory clinical outcomes with improved pain relief and functional range of motion, facilitating his return to activities of daily living. This case underscores the importance of tailored surgical management in complex proximal humerus fractures, highlighting the efficacy of reverse shoulder arthroplasty in select patients with pre-existing shoulder pathology.

Figure 3

Case 3

Mrs Selvi, a 66-year-old female, presented with severe pain and limited range of motion in her right shoulder following a fall. Imaging revealed a displaced three-part proximal humerus fracture. Given her age, medical comorbidities, and the complexity of the fracture pattern, she was deemed a suitable candidate for reverse shoulder arthroplasty. After thorough discussion of risks and benefits, including the potential for decreased range of motion and implant-related complications, Selvi elected to proceed with surgery. The procedure was performed successfully, with meticulous attention to preserving soft tissue and achieving stable fixation. Postoperative rehabilitation was initiated promptly, focusing on restoring range of motion and strengthening the surrounding musculature. At the six-month follow-up, Selvi demonstrated satisfactory pain relief and functional improvement, with radiographs showing appropriate alignment and integration of the implant.

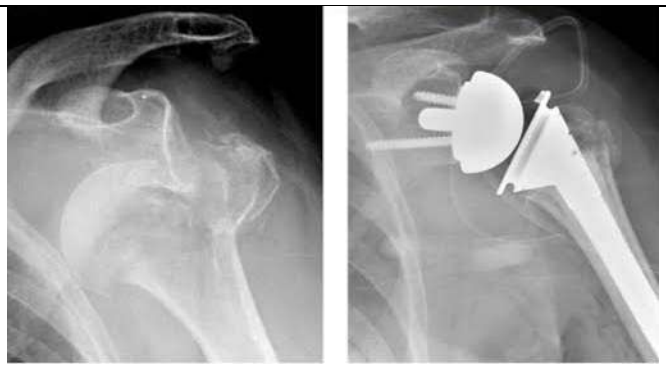

Figure 4

Case 4

Shanthi, a 67-year-old female, presented with severe right shoulder pain and limited range of motion following a fall at home. Imaging revealed a displaced proximal humerus fracture. Given her age, poor bone quality, and preexisting rotator cuff tear, conservative management was deemed unsuitable. After thorough discussion of risks and benefits, Shanthi underwent reverse shoulder arthroplasty. Postoperatively, she underwent a structured rehabilitation program focusing on early mobilization and strengthening. At the six-month follow-up, Shanthi demonstrated significant improvement in pain relief, shoulder function, and range of motion, allowing her to regain independence in activities of daily living. This case underscores the effectiveness of reverse shoulder arthroplasty as a viable option for managing complex proximal humerus fractures in elderly patients with compromised rotator cuff integrity.

Figure 5

Case 5

Mr Hari, 70-year-old male, who sustained a severe proximal humerus fracture following a fall. Given his age and the complexity of the fracture, traditional management options such as open reduction and internal fixation were deemed suboptimal. Thus, after thorough evaluation and discussion of risks and benefits, Hari underwent reverse shoulder arthroplasty. This surgical intervention offered improved stability and function compared to conventional methods,

particularly in cases of compromised rotator cuff function. Postoperatively, Hari underwent a structured rehabilitation program to optimize outcomes and restore range of motion. At 6-month follow-up, Hari demonstrated satisfactory pain relief, improved shoulder function, and radiographic evidence of fracture healing, highlighting the efficacy of reverse shoulder arthroplasty in managing complex proximal humerus fractures in select patients like Hari.

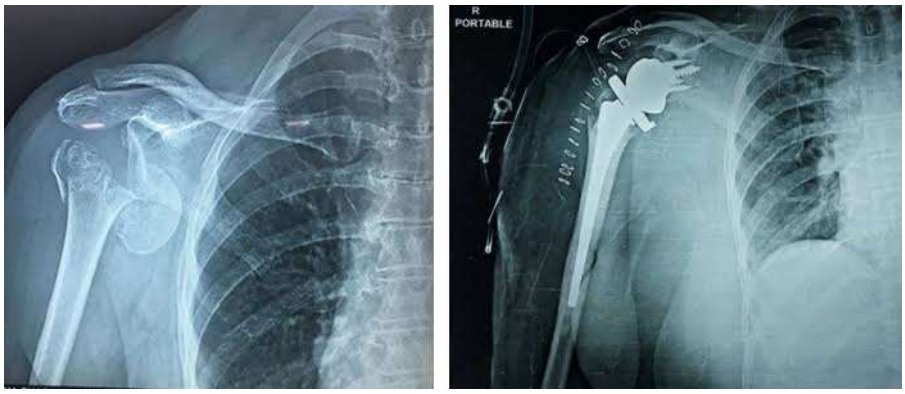

Figure 6

DISCUSSION

The decision to opt for Reverse Shoulder Arthroplasty in recent proximal humerus fractures relies on various factors, including the patient's age, comorbidities, and specific fracture characteristics. Considerations encompass tuberosity displacement, comminution, cuff and calcar health, degree of displacement, and the risk of avascular necrosis.[8]

For patients aged over 70 with a three- or four-part displaced fracture, high avulsion necrosis risk, poor-quality comminuted tuberosities, and/or a pre-existing rotator cuff rupture, Reverse Shoulder Arthroplasty becomes a viable choice.[9] However, it is not the primary option for treating younger, more active individuals. Contraindications include the presence of axillary nerve injuries, scapular spine or acromion fractures susceptible to displacement by increased deltoid muscle tension, and concurrent glenoid fractures hindering the implantation of a glenoid baseplate.[10]

RESULTS

Preliminary findings suggest that reverse shoulder arthroplasty yields favorable outcomes in patients with proximal humerus fractures, particularly in cases with comminuted or displaced fractures. Analysis of functional outcomes, complication rates, and radiographic assessments provides a comprehensive understanding of the procedure's success.

Acknowledgment
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Author Contributions
Dr. P. Thiagarajan contributed towards treatment protocol and follow up. Dr. Ranjith M. G. contributed in preparing the case series and collecting clinical and radiological images. Dr. Manish Khadke contributed in editing and drifting case report.

Informed consent
Written and oral informed consent were obtained from the participant in the study.

Ethic committee approval
Proper ethical committee approval was taken for the study.

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Conflict of interest
Conflict of interest declared none.

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