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Case Series

Pain attribution in concomitant rotator cuff tears and proximal humeral enchondromas: outcomes of arthroscopic repair alone at 2-year follow-up — a case series

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ABSTRACT

Enchondromas of the proximal humerus are benign cartilaginous lesions frequently identified incidentally during magnetic resonance imaging (MRI) performed for shoulder pain. Their coexistence with rotator cuff tears, particularly supraspinatus tears, creates diagnostic uncertainty regarding the primary pain generator and may influence management strategies. Evidence guiding treatment in such dual-pathology scenarios remains limited. This case series evaluates five consecutive patients (mean age 47.4 years) presenting with symptomatic full-thickness supraspinatus tears and incidental proximal humeral enchondromas. All patients underwent arthroscopic double-row rotator cuff repair without intervention for the osseous lesion, followed by a standardized rehabilitation protocol. Clinical outcomes were assessed using Visual analog scale (VAS) and Oxford shoulder score (OSS) over a 2-year follow-up period. All patients demonstrated excellent clinical outcomes, with VAS scores improving from 8 to 9 preoperatively to 0 to 1 at final follow-up and mean OSS improving from 24.2 to 46.0. No rotator cuff re-tears or lesion-related complications were observed. Serial imaging confirmed radiological stability of the enchondromas, supporting their benign and incidental nature. These findings suggest that in patients with concomitant rotator cuff tears and proximal humeral enchondromas, symptoms are primarily attributable to rotator cuff pathology. Arthroscopic repair alone yields favourable outcomes, while stable enchondromas can be safely managed with observation. Accurate clinic-radiological correlation is essential to avoid unnecessary surgical intervention for incidental benign lesions.

Keywords: Proximal humerus enchondroma, Rotator cuff tear, Supraspinatus repair, Incidental lesions, Shoulder MRI, Arthroscopic repair, Double-row technique

INTRODUCTION

Enchondromas of the proximal humerus are benign cartilaginous tumours frequently identified incidentally on shoulder Magnetic resonance imaging (MRI), most commonly during evaluation for rotator cuff pathology, with a reported prevalence of up to 2.1% in routine imaging.[1] In the absence of pathological fracture or interval growth, these lesions are typically asymptomatic and managed conservatively. However, when present alongside rotator cuff tears, particularly supraspinatus tears, they introduce diagnostic uncertainty regarding the true source of shoulder pain. This overlap is clinically significant, as previous reports suggest that up to 82% of

patients with painful enchondromas have coexisting shoulder pathology, including subacromial impingement and rotator cuff disease.[2] Consequently, distinguishing whether symptoms arise from the enchondroma or associated soft tissue pathology remains challenging and may influence treatment decisions. Despite this, there is a paucity of literature addressing outcomes when only rotator cuff pathology is treated in the presence of a stable proximal humeral enchondroma. Specifically, no prior case series has evaluated whether arthroscopic rotator cuff repair alone is sufficient to achieve symptom resolution without addressing the enchondroma. In this case series, we present four patients with coexisting supraspinatus tears and radiologically suspected proximal humeral enchondromas, all of whom underwent arthroscopic rotator cuff repair without intervention for the lesion. At two-year follow-up, all patients demonstrated complete pain resolution and satisfactory functional outcomes. These findings support the role of observation for stable enchondromas and highlight the importance of attributing symptoms to concomitant rotator cuff pathology in such clinical scenarios.[3]

CASE SERIES

Study design and patient selection

This case series included five consecutive patients (3 males, 2 females) with a mean age of 47.4 years (range, 42 to 54 years) who underwent arthroscopic double-row supraspinatus repair between 2023 and 2024 at a tertiary care center. The mean duration of symptoms was 8 months (range, 6 to 12 months). Inclusion criteria comprised patients presenting with insidious onset shoulder pain and restricted range of motion, MRI-confirmed full-thickness supraspinatus tears, and the presence of incidental proximal humeral enchondromas. All patients had failed conservative management for a minimum of 6 months. Exclusion criteria included prior shoulder surgery, history of trauma, inflammatory arthritis or significant systemic comorbidities. The dominant shoulder was involved in four patients (80%). Clinically, all patients presented with pain (100%) and restriction of flexion and abduction greater than 80° (100%). A positive Jobe's test was observed in two patients (40%) and Gerber's lift-off test was positive in one patient (20%).

Surgical technique

All procedures were performed arthroscopically using standard posterior, anterosuperior, and anteroinferior portals. A systematic diagnostic arthroscopy was carried out in each case to evaluate intra-articular pathology. All patients demonstrated isolated full-thickness supraspinatus tears associated with glenohumeral joint effusion. Repair was performed using a double-row technique with knotless anchors. The incidental proximal humeral enchondromas identified on preoperative MRI were not surgically addressed. Although localized tenderness over the proximal humerus was noted clinically in some cases, no intraosseous intervention was undertaken. Concomitant subacromial decompression was performed in two patients (40%) who demonstrated clinical and arthroscopic features of subacromial impingement.

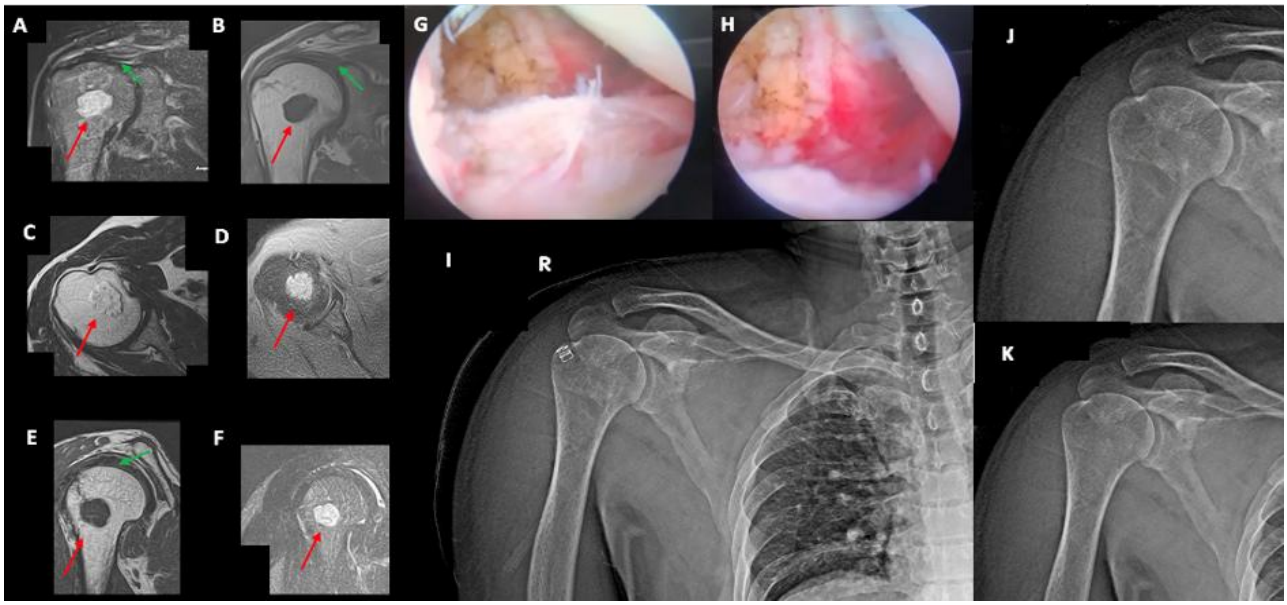


Figure 1: Representative case progression: (A) preoperative MRI demonstrating a proximal humeral enchondroma, appearing hypointense on T1-weighted and hyperintense on T2-weighted sequences, (B-D) arthroscopic images showing a full-thickness supraspinatus tear and subsequent double-row repair technique, (e) immediate postoperative radiograph confirming appropriate anchor placement and repair construct and (F-G) follow-up radiographs at 6 months and 2 years demonstrating maintained repair integrity and radiological stability of the enchondroma without evidence of progression.

Table 1: Baseline characteristics, imaging findings, surgical details and clinical outcomes.

Parameters	Case 1	Case 2	Case 3	Case 4	Case 5	N (%)/ mean±SD
Age (years)	44	47	42	54	50	47.4±4.6
Gender	Male	Female	Male	Female	Male	Male: 3 (60) Female: 2 (40)
Dominant side	Yes	No	Yes	Yes	No	Yes: 3 (60) No: 2 (40)
Symptom duration (months)	6	12	8	10	6	8.4±2.5
Pain	Present	Present	Present	Present	Present	5 (100)
Restricted motion (>80°)	Present	Present	Present	Present	Present	5 (100)
Jobe's test	Positive	Negative	Positive	Negative	Negative	Positive: 2 (40%) Negative: 3 (60)
Gerber's lift-off	Negative	Positive	Negative	Negative	Negative	Positive: 1 (20) Negative: 4 (80)
Proximal humerus tenderness	Present	Present	Present	Absent	Present	4 (80)
Lesion location	Surgical neck	Surgical neck	Surgical neck	Surgical neck	Surgical neck	Surgical neck: 5 (100)
MRI: T1/T2 signal	Hypo/ hyper	Hypo/hyper	Hypo/hyper	Hypo/hyper	Hypo/hyper	Loculated: 5 (100)
Glenohumeral effusion	Present	Present	Present	Present	Present	5 (100)
Subacromial decompression	Yes	No	Yes	No	No	Yes: 2 (40) No: 3 (60)
VAS pre-op	8	9	8	8	9	8.4±0.5
VAS 6 months	3	3	4	4	3	3.4±0.5
VAS 2 years	1	0	0	0	0	0.2±0.4
Oxford score 2 Y	46	44	48	46	47	46±1.8
FU Imaging stable	Yes	Yes	Yes	Yes	Yes	Yes: 5 (100)

Table 2: Arthroscopic findings and structural outcomes.

Parameters	Case 1	Case 2	Case 3	Case 4	Case 5	N (%)
Effusion	Present	Present	Present	Present	Present	5 (100)
Chondral damage	None	Grade 1	None	Grade 1	None	Grade 1:2 (40)
Biceps pathology	None	Partial tear	None	None	None	Partial: 1 (20)
Re-tear	No	No	No	No	No	No: 5 (100)
Lesion visualized intra-op	No	No	No	No	No	No: 5 (100)

Postoperative rehabilitation and outcome measures

Postoperatively, all patients were immobilized in a shoulder brace for 4 weeks, during which only pendulum exercises were permitted. Rehabilitation was subsequently progressed to active-assisted range of motion exercises at 4 weeks (flexion up to 90°, abduction up to 60°), followed by full range of motion by 8 weeks. Rotator cuff strengthening exercises were initiated at 12 weeks, and unrestricted activities were allowed at 6 months. Failure was defined as recurrence of pain, persistent stiffness, or rotator cuff re-tear requiring revision surgery. Clinical outcomes were assessed using the VAS for pain and the OSS), recorded preoperatively, at 3 months and at final follow-up of 2 years.

Findings and outcomes

Arthroscopic evaluation revealed glenohumeral joint effusion in all cases (100%), with no significant chondral lesions or biceps tendon pathology (Table 1). The enchondromas were not visualized intra-articularly. All

repairs demonstrated successful healing, with no cases of re-tear. VAS scores improved from 8 to 9/10 preoperatively to 1 to 2/10 at 3 months and 0 to 1/10 at final follow-up in all patients. The mean OSS improved from 24.2 preoperatively to 46.0 at 2 years. The enchondroma lesions remained clinically and radiographically stable throughout the follow-up period, with serial radiographic assessment performed in all the patients (Figure 1). No lesion-related complications were observed. All the key result findings are summarised in (Table 2).

DISCUSSION

Supraspinatus tears typically manifest in patients over 60 years of age through degenerative mechanisms, demonstrating a male predominance, preferential involvement of the dominant shoulder and associations with risk factors such as smoking, diabetes, hyperlipidaemia and repetitive overhead activity.[4] In contrast, enchondromas of the proximal humerus occur across a broader age spectrum, commonly between 20 and 60 years, without a clear sex predilection and are frequently detected incidentally during routine shoulder MRI performed for rotator cuff evaluation, with a reported prevalence of up to 2.1%.[1] Notably, painful enchondromas are often associated with concurrent shoulder pathology, including impingement or rotator cuff tears in up to 82% of cases, closely paralleling the clinical presentation observed in our cohort.[2] In our series, patients were relatively younger (mean age 47.4 years), with a mild male predominance (60%) and high dominant-side involvement (80%), yet notably lacked conventional metabolic or lifestyle-related risk factors. This demographic profile suggests that the supraspinatus tears likely represent early degenerative or activity-related pathology in otherwise low-risk individuals. The coexistence of enchondromas in this context appears coincidental, with rotator cuff pathology serving as the primary pain generator and the incidental lesions being unmasked during imaging rather than contributing independently to symptomatology.

Shoulder pain with restriction of flexion and abduction represents a classic presentation of rotator cuff pathology, wherein clinical examination remains a key determinant in identifying the primary pain generator. The Jobe's test demonstrates a sensitivity of 68% to 79% and specificity of 56% to 74% for supraspinatus tears, while the Gerber's lift-off test shows a sensitivity of approximately 62% for subscapularis involvement, underscoring their selective but valuable diagnostic utility.[5,6] In comparison, the Hawkins–Kennedy test has been reported to demonstrate higher sensitivity (up to 71%) for impingement-related pathology compared to Jobe's test (53%) when correlated with MRI findings.[6,7] Conversely, proximal humeral tenderness, often attributed to enchondromas, is reported in 18% to 88% of cases but shows poor correlation with lesion size or biological activity and is frequently confounded by coexisting subacromial bursitis or rotator cuff irritation.[8] This overlap creates a diagnostic dilemma, as both intraosseous lesions and soft tissue pathology may present with similar clinical findings, potentially leading to misattribution of symptoms. In our series, all patients demonstrated restricted range of motion (100%), with selective positivity of Jobe's test (40%) and Gerber's lift-off test (20%), along with proximal humeral tenderness in 80% of cases. This pattern closely aligns with primary rotator cuff dysfunction rather than isolated osseous pathology. Importantly, the complete resolution of symptoms following arthroscopic rotator cuff repair, despite no intervention for the enchondromas, strongly supports the rotator cuff as the principal pain generator and highlights the limited clinical significance of stable enchondromas in such scenarios.

MRI plays a pivotal role in differentiating soft tissue and osseous contributors to shoulder pain, often revealing incidental findings that may confound clinical interpretation. Proximal humeral enchondromas characteristically appear as well-defined, ovoid lesions that are hypointense on T1-weighted sequences and hyperintense on T2-weighted images, with a lobulated architecture and chondroid matrix. These lesions are reported in approximately 1.6% to 2.1% of routine shoulder MRI and arthrogram studies, with no consistent correlation to symptom severity or lesion size.[1,9] In contrast, glenohumeral joint effusion is a well-recognized imaging feature of full-thickness supraspinatus tears, observed in up to 78% of cases and reflects reactive synovitis rather than primary intraosseous pathology.[10] This distinction is critical, as the coexistence of effusion and rotator cuff tear may misleadingly be attributed to adjacent osseous lesions such as enchondromas. Current evidence supports the use of plain radiographs over routine MRI surveillance for stable, asymptomatic enchondromas less than 5 cm in size, given their indolent behaviour, minimal growth rates (<1% annually) and exceedingly low risk of malignant transformation (<0.3%).[11]

In our series, all patients demonstrated uniform MRI findings of T1 hypointense and T2 hyperintense lesions located at the surgical neck of the humerus, consistent with benign enchondromas, along with associated glenohumeral effusion. Serial radiographic follow-up confirmed lesion stability, with no progression or aggressive features. These findings reinforce that such enchondromas represent incidental, non-contributory lesions, while the imaging features of rotator cuff pathology correlate more reliably with clinical symptomatology. Consequently, our observations support a management strategy prioritizing arthroscopic rotator cuff repair while adopting a conservative, observational approach for stable enchondromas. Current guidelines recommend observation for asymptomatic proximal humeral enchondromas measuring less than 5 cm in the absence of cortical breach or aggressive radiological features, with surgical intervention such as curettage and bone grafting, reserved for cases demonstrating interval growth, pathological fracture or persistent pain

unresponsive to treatment of coexisting shoulder pathology.[11] In parallel, arthroscopic double-row supraspinatus repair has consistently demonstrated superior structural healing rates (85% to 92% at 2 years) compared to single-row techniques (~75%), particularly in medium-sized tears exceeding 2-cm, owing to improved footprint restoration and biomechanical stability.[12,13]

Additionally, concomitant subacromial decompression has been shown to yield meaningful functional improvement, with reported increases in Constant scores of approximately 12 points in patients with confirmed impingement, without a corresponding rise in complication rates.[14,15] In our series, a uniform double-row repair strategy combined with selective subacromial decompression (40%) resulted in excellent outcomes, with complete tendon healing (0% re-tear rate) and marked symptomatic improvement, as reflected by a reduction in mean VAS scores from 8.4 preoperatively to 0.2 at final follow-up. Importantly, no intervention was directed toward the enchondromas, which remained clinically and radiographically stable throughout the study period. These findings align with existing recommendations and further reinforce that, in the presence of concomitant rotator cuff pathology, management should be directed toward the primary soft tissue lesion.[16,17] Stable enchondromas can be safely observed, avoiding unnecessary surgical intervention, while achieving optimal functional outcomes through targeted rotator cuff repair.

Contemporary rotator cuff rehabilitation protocols advocate an initial period of immobilization for 4 weeks, followed by a phased progression to full range of motion by 8 to 12 weeks and initiation of strengthening at approximately 3 months. With appropriate compliance, such protocols achieve satisfactory functional outcomes in nearly 90% of patients at 2-year follow-up.[18] Deviations from this structured approach have demonstrated inferior results, with accelerated rehabilitation associated with higher re-tear rates (12% vs 4% with conventional protocols), while prolonged immobilization beyond 6 weeks delays functional recovery without conferring additional protection against failure.[19] In contrast, surveillance of incidental enchondromas during the rehabilitation period remains straightforward, with current evidence supporting annual plain radiographic follow-up for stable lesions, as serial MRI changes show poor correlation with clinical outcomes or lesion behaviour.[11] In our series, a standardized rehabilitation protocol, comprising 4 weeks of immobilization with pendulum exercises, progression to full range of motion by 8 weeks and strengthening from 12 weeks, resulted in uniformly excellent outcomes, with a mean Oxford shoulder score of 46 and near-complete pain resolution (VAS 0.2) across all patients. Importantly, these favourable outcomes were achieved without any intervention directed toward the enchondromas, which remained stable throughout follow-up. Collectively, our findings underscore that, in cases of concomitant rotator cuff tears and incidental proximal humeral enchondromas, adherence to evidence-based rehabilitation following targeted cuff repair yields optimal outcomes, while the osseous lesion can be safely managed with conservative surveillance. This dual-pathology approach reinforces the principle of prioritizing the true pain generator and avoiding unnecessary surgical intervention for benign incidental findings.

This case series documents five consecutive patients from initial presentation through a 2-year follow-up period; however, the small sample size (n=5) limits statistical power and restricts generalizability across broader and more diverse patient populations. The absence of preoperative OSS further constrains comprehensive baseline functional assessment and limits the ability to quantify the magnitude of postoperative improvement. Additionally, selective serial radiographic follow-up, although demonstrating clinical stability, precludes precise quantification of enchondroma growth dynamics over time. The single-surgeon design ensures technical consistency but introduces the potential for selection and performance bias, while the absence of a comparative control group limits the ability to isolate the independent contribution of the enchondroma to symptomatology versus resolution attributable to rotator cuff repair alone. Furthermore, although the 2-year follow-up period adequately captures tendon healing and medium-term clinical outcomes, it remains insufficient to evaluate rare long-term risks such as delayed malignant transformation of enchondromas or late rotator cuff re-tears beyond the conventional recovery window.

CONCLUSION

This case series demonstrates that in patients with concomitant full-thickness supraspinatus tears and incidentally detected proximal humeral enchondromas, shoulder pain is most likely attributable to rotator cuff pathology rather than the osseous lesion. Arthroscopic double-row rotator cuff repair, combined with structured rehabilitation, resulted in excellent functional outcomes and complete pain resolution at 2-year follow-up, despite no surgical intervention for the enchondromas.

The consistent clinical and radiological stability of these lesions supports a conservative, observation-based approach for asymptomatic enchondromas without aggressive features. Our findings emphasize the importance of accurate clinic-radiological correlation to identify the true pain generator and avoid unnecessary surgical treatment of benign incidental lesions. In such dual-pathology scenarios, prioritizing rotator cuff repair while maintaining vigilant but non-interventional surveillance of stable enchondromas represents a safe and effective management strategy. Further larger, controlled studies are warranted to validate these findings and refine treatment algorithms.

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