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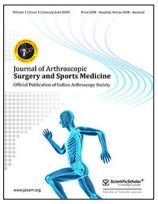

Original Article

Study of functional outcomes of arthroscopic double row repair in degenerative rotator cuff tears in adults aged more than 55 years of age in the Indian population

Abhishek Nighot[1], Bhavika Rajesh Mehta[1], Ashutosh Ajri[2], Nilesh Kamat[2]

Departments of [1]Orthopaedics and [2]Shoulder Surgery and Sports Medicine, Sancheti Institute of Orthopaedics and Rehabilitation, Pune, Maharashtra, India.

ABSTRACT

Objectives: Degenerative rotator cuff tears are one of the most common causes of shoulder dysfunction in the elderly population, significantly impacting quality of life. The advent of arthroscopic repair has revolutionized surgical management, offering less morbidity and faster rehabilitation compared to open techniques.

Materials and Methods: A prospective observational study was conducted on 60 patients above 55 years of age undergoing arthroscopic double-row repair for degenerative tears. Functional outcomes were assessed using the University of California, Los Angeles, and Constant–Murley scores at multiple time points.

Results: Statistically significant improvements were seen in the range of motion and functional scores at 12 months. Factors such as diabetes, age, and tear pattern did not significantly alter outcomes.

Conclusion: Arthroscopic double-row repair provides reliable and satisfactory outcomes in the elderly, with favorable results even in diabetic patients.

Keywords: Arthroscopy, Degenerative rotator cuff tear, Double row repair, Elderly, Functional outcome

INTRODUCTION

Degenerative rotator cuff tears (RCTs) are a major contributor to shoulder pain and disability in adults over 55 years of age, significantly impacting sleep quality and daily function.[1] With rising life expectancy and extended functional demands of the elderly population, the clinical dilemma often revolves around whether to operate in this age group, where healing potential may be impaired. However, advances in arthroscopic repair techniques and robust post-operative rehabilitation protocols now offer the opportunity to pursue improved functional outcomes and quality of life, even in patients previously deemed less optimal candidates for surgery.[2-4]

The double-row arthroscopic repair technique, in particular, has been shown to offer superior biomechanical restoration of the tendon footprint, greater tendon-bone contact area, and potentially lower re-tear rates compared to single-row repairs.[5-7] While numerous studies from Western literature support its efficacy, there remains a significant gap in Indian data evaluating both the functional recovery and safety profile of this technique in an elderly population with comorbidities such as diabetes and variable tendon degeneration. Furthermore, the influence of imaging findings such as fatty infiltration and demographic factors (sex and age) on outcomes following double-row repair remains underexplored in this population.

This prospective observational study aims to address this gap by evaluating the functional outcomes of arthroscopic double-row repair in Indian patients aged >55 years with degenerative full-thickness RCTs. The study additionally examines the impact of clinical and radiological modifiers (e.g., Goutallier grade, sex, and diabetes) on recovery and applies validated scoring systems to assess progress across the 12-month follow-up period. To our knowledge, this is among the few Indian studies that simultaneously consider these variables using both Constant and University of California, Los Angeles (UCLA) scores with a standardized surgical and rehabilitation protocol.

***Corresponding author:** Abhishek Nighot, Department of Orthopaedics, Sancheti Institute for Orthopaedics and Rehabilitation, Pune, Maharashtra, India. abhisheknighot43@gmail.com

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MATERIALS AND METHODS

This was a single-center prospective observational study conducted at Sancheti Institute of Orthopaedics and Rehabilitation, Pune, between August 2020 and August 2021. All patients above the age of 55 years undergoing arthroscopic double-row rotator cuff repair for symptomatic full-thickness degenerative tears were screened. Written informed consent was obtained from all participants.

All patients were assessed in the outpatient department (OPD), with detailed history taking and physical examination. This included measuring the range of motion (ROM), grade of power of the supraspinatus, infraspinatus, and subscapularis muscles. Strength in forward flexion, abduction, and external rotation was measured. Special tests performed included the drop arm test, full and empty can tests, O'Brien's test, Gerber's lift-off test, and belly press test.

Radiographs were obtained to rule out bony abnormalities. All patients with chronic shoulder symptoms suggestive of rotator cuff pathology underwent magnetic resonance imaging (MRI) to confirm the diagnosis. Patients with MRI-confirmed full-thickness degenerative tears who had failed conservative management were considered for surgery.

A total of 60 patients underwent surgery by two orthopedic surgeons at a single tertiary care institute. Post-operative follow-up was conducted at 6 weeks, 3 months, 6 months, and 12 months. Functional outcomes were assessed using the UCLA shoulder score.[8] and Constant–Murley score[9] at each time point. Figure 1 flowchart illustrates the patient selection process [Figure 1]

Post-operative rehabilitation protocol

All patients followed a structured rehabilitation protocol. An arm sling was applied for 4–6 weeks to protect the repair. Passive forward flexion exercises and pendulum movements were initiated on post-operative day 1. Active-assisted ROM exercises commenced at 2 weeks, progressing to active ROM by 6 weeks. Muscle strengthening exercises began between 10 and 12 weeks post-surgery.

In diabetic patients, supervised physiotherapy was implemented, with emphasis on early capsular and subacromial stretching to prevent stiffness.

Study design

This is a prospective observational cross-sectional study, conducted at a tertiary trauma and orthopedic care center from August 2020 to August 2021.

The implants used were the BioComposite SpeedBridge system, comprising 4.75 mm vented SwiveLock anchors (Arthrex) with preloaded FiberTape for the medial row and lateral row fixation using BioComposite SwiveLock C 4.75 mm anchors. This knotless suture bridge construct has been shown to provide reliable footprint compression and enhanced tendon-to-bone healing in biomechanical and clinical studies.[10]

Participants

This was a prospective cross-sectional observational study which included patients coming to the OPD with the following inclusion and exclusion criteria:

The inclusion criteria consisted of patients aged more than 55 years with full-thickness degenerative RCTs confirmed on MRI, showing Goutallier grade 1 or 2 fatty infiltration, and a history of either no trauma or trivial trauma.

We excluded patients younger than 55 years, those with partial-thickness tears, isolated subscapularis tears, degenerative arthritic changes, prior intra-articular steroid injections within 3 months, Goutallier grade 3 or 4 fatty infiltration, history of shoulder infection, revision rotator cuff surgery, or shoulder instability.

Operative technique

All the surgeries were done after appropriate cardiological and medical evaluation and optimization. The proper pre-anesthetic check-up was done in every patient before posting for surgery. Diagnostic arthroscopy was performed using the posterior and anterior portal 15-point appropriate review described by Snyder *et al*.[11] using five portals.

Arthroscopic rotator cuff repair was performed using a double-row suture anchor technique in all cases. General anesthesia was given during the procedure. The shoulder was positioned in a lateral position with the affected side up and 30° posterior tilt and traction from the fluid stand. The beach chair position was also used in some cases. Positioning was as per the surgeon's choice. The bony landmarks of the shoulder joint (acromion, scapular spine, clavicle, acromioclavicular joint, and coracoid) were identified and marked [Figure 2a and b].

The first posterior portal was made by making small (8 mm) stab incisions at 2 cm down and medial to the posterolateral tip of the acromion and inserting a trocar with sleeve, followed by arthroscopy. Through the posterior portal, an intra-articular portion of the joint was viewed including the state of the articular cartilage, the glenoid, biceps tendon, synovium, the humeral head, and under the surface of the rotator cuff as well as the rotator interval.

Then, an anterior working portal was made by an 8 mm stab incision halfway between the tip of the coracoid and anterior aspect of acromion under direct vision of arthroscope, through anterior triangle by which synovitis within the joint was debrided (if needed) using a 3.5 mm soft tissue resector or by a radiofrequency probe. The scope was then shifted and directed upward under the acromion outside the rotator cuff toward the subacromial space.

Through a lateral portal, the motor shaver is introduced into the subacromial space. Making sure that it was in place

under the acromion by moving it around the bursa until it touched the undersurface of the acromion or the sheath of the scope introduced through the posterior portal. The bursal tissues were removed until the antero-inferior surface of the acromion, as well as the coracoacromial ligament, were identified. The motorized shaver was then replaced using a 4 mm bony burr, which was used to remove the antero-inferior border of the acromion and any present osteophytes. Bone resection was continued until the undersurface of the acromion was flat. After adequate subacromial decompression, inspection and probing of the RCT took place, and especially saw the mobility of the rotator cuff, and then prepared the footprint by the bony bar.

The type of cuff repair depended on the type and size of the cuff tear. We preferred subacromial decompression and shaving of the degenerated portion.

The posterolateral portal is established as a viewing portal, and the lateral portal is used as a working portal [Figure 3]. Each tail of the suture tape is passed through the tendon anterior and posterior to the anchor fixation site using any preferred suture shuttling or direct passing device. About a 15-mm bite of tendon should be obtained, as this determines how much tendons will be pulled over the tuberosity. Special care is taken to incorporate the deep lamina in delaminated tears to add structural strength to the repair. Both suture tape tails from each anchor are maintained in the posterior portal. These steps are then repeated for the posteromedial anchor. At this point, 1 suture tape tail from each medial anchor is retrieved from the lateral portal. The suture tapes are then loaded into the eyelet of another knotless anchor that will be used for lateral fixation. These sutures are retrieved through a 7-mm cannula and are then loaded into the anchor. A total of two additional anchors are placed for lateral row fixation, 1 anteriorly and 1 posteriorly. The ideal placement of these anchors was approximately 5-10 mm lateral to the edge of the greater tuberosity, where the bone quality improves. It is important to tension each limb from the medial row before complete seating of the lateral anchor. These steps are then repeated for the posterolateral anchor. A four-strand self-reinforcing interconnected construct was thus created. Care is taken to prevent confluence/convergence of the anchors to reduce weakness of the construct. One limb from the medial anterior and posterior anchors is secured to the center lateral anchor. The remaining limbs from each medial anterior and posterior anchor are secured to their respective counterpart anchors laterally. The additional ultra-high-molecular-weight polyethylene suture in the lateral anchor is used to reduce any inadvertent dog ear formation.

Furthermore, any concomitant subscapularis tear is repaired in a standard fashion using a single row repair, and long head of bicep pathology was addressed concomitantly either by tenodesis/tenotomy.

Study size

Sample size was determined using the effect sizes from the previously published study (Dukan *et al*.,[5] The *Journal of Arthroscopic and Related Surgery* 2019) and with the help of the following formula:

Where n = Sample size.

P = Student's t quartile with V (df) and probability, $P = 1.96$.

V (df) = Degrees of freedom

a = 0.05 (5%) fixed.

$\beta = 0.20$.

tb = Cut-off value for Power $(1 - \beta) = 0.842$.

= Delta/standard deviation (SD) = 7 units of the constant score (estimated pre-op and post-op difference per unit SD).

Delta: Estimated difference in pre- and post-procedure means to be detected.

SD = Estimated SD of paired response difference.

Thus, the required minimum sample size was

$n = ([1.96 + 0.842]/0.44)\ 2$

$= (2.802/0.44)\ 2$

= 40.55 n @ 41 (rounded off to the closest integer minimum sample size).

Considering a 10% drop-out rate over a period of 1 year, the minimum sample size would be

41/0.9 = 46. A sample size of 60 patients was taken for this study.

Sampling technique - convenience sampling method.

Statistical method

Functional outcomes were measured at times pre-surgery, 3-, 6-, and 12-month post-surgery. Baseline demographic and clinical data were summarized using frequencies and percentages for categorical variables and medians and inter-quartile range (IQR) for continuous variables. UCLA and Constant–Murley scores at each measurement time by demographic and clinical variables were summarized using median and IQR and distributions compared using a rank-sum test. Functional outcomes pre-surgery and 12-month post-surgery were summarized using medians and compared using a rank-sum test. STATA 17.0 was used for all the analysis.

Participants

The flowchart illustrates the screening, inclusion, and exclusion process for patients enrolled in the study. Patients presenting with symptomatic rotator cuff pathology underwent MRI evaluation. Those aged >55 years with full-thickness degenerative RCTs and Goutallier grade 1 or 2 fatty infiltration were included after failing conservative management. Patients with partial tears, isolated subscapularis tears, advanced fatty infiltration (Goutallier grade 3 or 4), or a history of arthritis, infection, or steroid injections were excluded. Sixty patients met the criteria and underwent arthroscopic double-row repair. The screening

and selection process is illustrated in the participant flowchart [Figure 1], following recommendations for transparent reporting in clinical studies.[12]

Figure 1 flowchart illustrates the patient selection process for the study. Out of 72 patients initially screened between August 2020 and August 2021, 12 were excluded based on predefined criteria. Sixty patients who met the inclusion criteria underwent arthroscopic double-row repair and completed 12 months of follow-up for functional outcome assessment using UCLA and Constant–Murley scores.

RESULTS

Out of 60 cases studied, 30 patients were over the age of 60 years, with the highest frequency between 55 and 60 years and the second highest between 65 and 70 years. 32 (53.3%) were males and 28 (46.6%) were females [Figure 4].

19 (31%) patients had involvement of all three muscles, while 32 (53%) patients had supraspinatus and infraspinatus tendon tears on MRI. The functional outcomes were the same irrespective of the number of muscles involved, and there was no statistical difference between the groups involving one muscle, two muscles, or all three tendons.

33 (55%) patients underwent acromioplasty along with rotator cuff repair for acromial impingement, while 27 (45%) patients did not need it.

Distribution of pre-operative forward flexion differed significantly between pre-operative and post-operative analysis ($P = 0.005$), with mean pre-operative flexion being 134° and 12-month follow-up flexion being 146°.

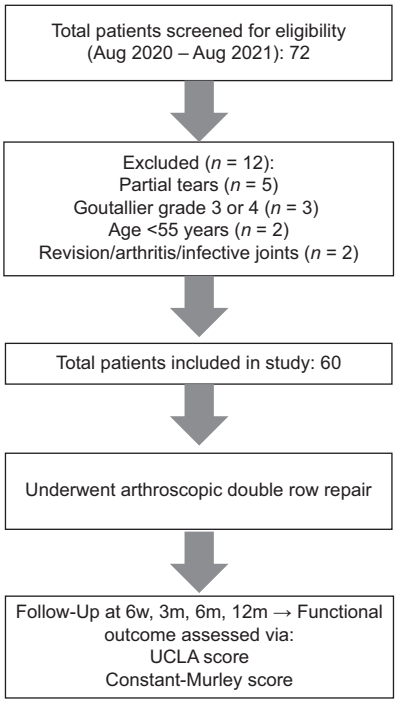

Figure 1: Participant flow through the study. UCLA: University of California, Los Angeles Shoulder score.

Distribution of abduction was significantly greater in post-operative group versus pre-operative group ($P < 0.005$), with mean pre-operative abduction being 91° and 12-month follow-up flexion being 127°.

Distribution of external rotation was also significantly greater in post-operative group versus pre-operative group ($P < 0.005$), with mean pre-operative external rotation being 41° and 12-month follow-up external rotation being 81° [Table 1].

The post-operative UCLA score was 34.4 which was significantly greater than the pre-operative UCLA score which was 17 ($P < 0.001$). Furthermore, the post-operative functional score at 12 months was graded as excellent (more than 33). The post-operative Constant–Murley score was 36.9 which was significantly better than the pre-operative score which was $P < 0.001$. Furthermore, the post-operative functional score at 12 months was graded as excellent (<11) [Table 2] [Figure 5].

The pre-operative and post-operative UCLA and Constant–Murley scores in diabetics and non-diabetics were similar [Figure 6]. There was no statistically significant difference between diabetes and non-diabetes in the post-operative functional scores.

Comparison of mean pre-operative and post-operative shoulder ROM (forward flexion, abduction, and external rotation) with statistical significance at 12-month follow-up.

Pre-operative and 12-month post-operative UCLA and Constant–Murley scores with mean, standard deviation, and significance values. Improvements were statistically significant across all parameters.

Box plots illustrating the improvement in UCLA and Constant–Murley scores from pre-operative baseline to 12-month follow-up post double-row arthroscopic rotator cuff repair.

Box plots comparing pre-operative and 12-month post-operative UCLA and Constant–Murley scores between diabetic and non-diabetic patients. No statistically significant difference was noted.

DISCUSSION

Degenerative RCTs impair shoulder kinematics and contribute significantly to pain, weakness, and disability in the elderly population. In our study of 60 patients undergoing arthroscopic double-row repair, the mean age was 61.7 years,

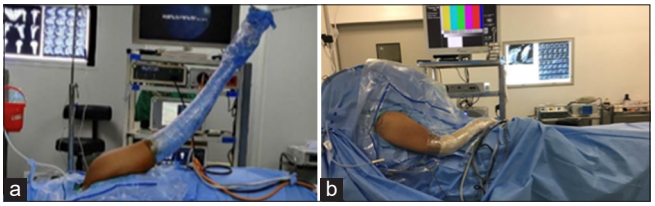

Figure 2: (a) Left and (b) right. Intraoperative setup for arthroscopic double-row rotator cuff repair.

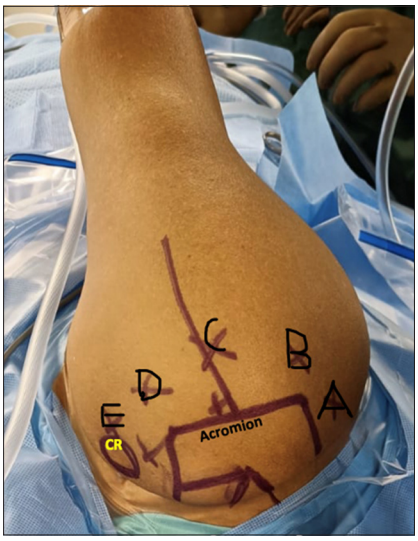

Figure 3: Labeled portals (A to E). CR: Coracoid process.

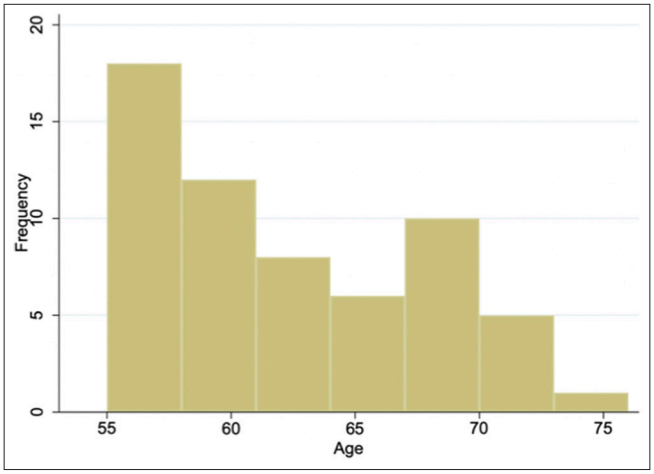

Figure 4: Age distribution of patients with degenerative rotator cuff tears.

comparable to previously reported cohorts.[9] No sex-based differences in outcomes were observed, consistent with earlier findings.[9,13] While some literature notes delayed recovery in female patients,[11] uniform rehabilitation protocols in our cohort may have mitigated such disparities.

Tear configurations varied, with over half the patients presenting with combined supraspinatus and infraspinatus tears. Functional outcomes were not significantly influenced by the number of tendons involved, mirroring earlier series.[9,10] Statistically significant improvements were recorded in forward flexion, abduction, and external rotation postoperatively. These gains align closely with prior data on double-row repairs,[5,14,15] reinforcing the biomechanical advantages of this technique in enhancing tendon-to-bone healing and restoring function.

Table 1: Statistical analysis of shoulder range of motion.

Movement	Baseline mean (SD)	Month 12 mean (SD)	Difference mean (SD)	p-value
Flexion	134 (28)	146 (18)	-11 (31)	0.005
Abduction	91 (27)	127 (14)	-0.5 (33)	p<0.001
External rotation	41 (19)	82 (9)	-41 (20)	p<0.001

SD: standard deviation, Significant p-values, Flexion: 0.005 (significant), Abduction: $p < 0.001$ (highly significant), External Rotation: $p < 0.001$ (highly significant).

Table 2: Statistical analysis of functional outcome scores.

Scores	Baseline mean (SD)	Month 12 mean (SD)	Difference mean (SD)	p-value
UCLA	17 (2.0)	34.4 (2.5)	-17.4 (3.3)	p<0.01
Constant	36.9 (2.0)	9.7 (2.8)	27.2 (3.5)	p<0.001

SD: standard deviation, UCLA: University of California, Los Angeles Shoulder score, Significant p-values, UCLA: $p < 0.01$ (significant), Constant: $p < 0.001$ (highly significant).

However, surgical decision-making in elderly patients remains a nuanced process. Historically, age and comorbidities often deterred surgical intervention due to concerns over healing potential and post-operative recovery. With evolving surgical techniques, improved rehabilitation protocols, and increased life expectancy, there is growing justification to pursue anatomical repair even in elderly populations, aiming for better quality of life and durable functional outcomes.

One of the key debates in rotator cuff surgery is the choice between single-row and double-row techniques. While earlier studies have documented favorable outcomes following single-row repair,[16] biomechanical evidence continues to support superior footprint coverage, tendon compression, and possibly better healing with double-row constructs, particularly in multitendon tears. Our results support this hypothesis within the Indian elderly population, which remains underrepresented in global literature.

Diabetes mellitus, a known risk factor for poor healing, did not adversely affect outcomes in our cohort. This may be attributed to intraoperative capsular release and early mobilization strategies tailored for diabetic patients. Only one case of adhesive capsulitis was noted, and no clinical re-tears were observed. In contrast, higher complication rates have been reported in diabetic cohorts over extended follow-up durations.[17] In addition, patients with comorbid disabilities involving other extremities may present greater functional challenges during recovery – an issue that warrants further prospective evaluation.[18]

Our findings reaffirm the efficacy of arthroscopic double-row repair in elderly patients with degenerative cuff tears, including those with comorbidities. With appropriate

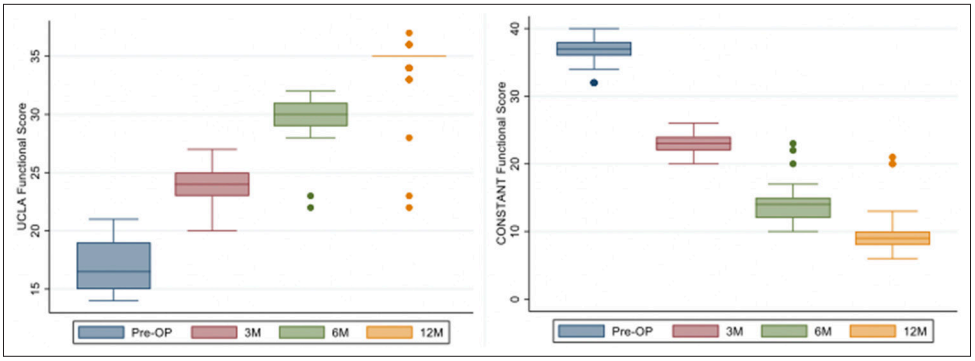

Figure 5: Improvement in functional outcome scores at 12 months. Colored dots are outliers in the box plot.

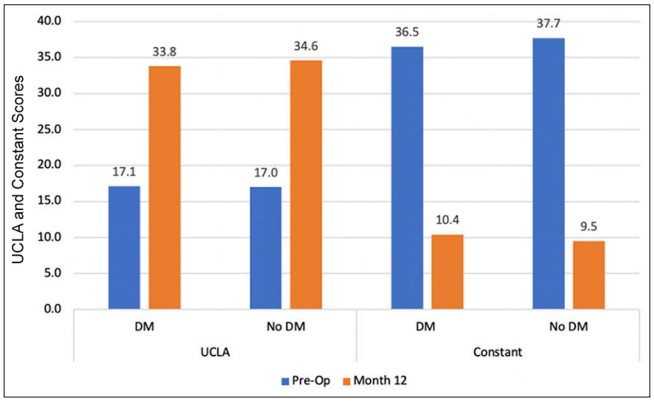

Figure 6: Comparison of functional outcomes in diabetic versus non-diabetic patients. DM: Diabetes mellitus in patients/ no diabetes mellitus. UCLA: University of California, Los Angeles shoulder score

surgical technique and structured rehabilitation, predictable and satisfactory results can be achieved. Nevertheless, a nuanced, patient-specific approach remains essential.

Limitations of this study include the lack of a control group (e.g., single-row repairs), relatively short-term follow-up, and absence of imaging confirmation of tendon healing. The sample size, while adequate for initial observations, limits generalizability. In addition, outcome measures such as minimal clinically important difference (MCID) and patient acceptable symptom state (PASS) were not evaluated.[19] Future directions include long-term multicenter trials comparing single- versus double-row techniques, incorporation of MRI-based healing assessment, and correlation of clinical outcomes with MCID/PASS thresholds. Adjunctive use of biologics, individualized rehabilitation protocols, and assessment of recovery in patients with systemic or musculoskeletal comorbidities also merit exploration.

CONCLUSION

Arthroscopic double-row rotator cuff repair provides excellent functional outcomes in elderly patients with degenerative tears. Both Constant and UCLA scores showed statistically significant improvement postoperatively. Importantly, diabetic status, age, and fatty infiltration grade did not appear to adversely affect outcomes in this cohort. With appropriate capsular release and early physiotherapy, double-row repair can be considered a reliable surgical option in older adults with degenerative cuff pathology.

Author contributions: AN: Data acquisition, data analysis, manuscript editing and review, statistical analysis, manuscript preparation, concepts, definition of intellectual content, design, clinical studies, literature search; BRM: Manuscript editing and review, manuscript preparation, and literature search; AA: Manuscript editing and review; NK: Manuscript editing and review. All the authors approve of the final version of the article.

Ethical approval: The Institutional Review Board approval is not required since it was a retrospective study evaluating outcomes.
Declaration of patient consent: The authors certify that they have obtained all appropriate patient consent forms. In the form, the patients have given their consent for their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.
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