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A Prospective analysis of self-guided home rehabilitation following rotator cuff repair - A cohort study.

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Abstract

Background
Rotator cuff injuries are common in older adults and can significantly affect shoulder function and quality of life. While surgical repair is the primary treatment, postoperative rehabilitation plays a critical role in functional recovery. This study aims to evaluate the clinical and functional outcomes of mini-open rotator cuff repair (RCR) surgery with a home-based rehabilitation protocol.

Methods
This prospective observational study was conducted over two years at two tertiary care centers. A total of 90 patients who underwent RCR surgery were evaluated using clinical assessments, radiographs, and MRI. Postoperative outcomes were measured up to one-year follow-up, including pain, functional recovery, and range of motion.

Results
The majority of participants were middle-aged males (mean age 54.6 years; 71.1% male), with a predominance of right-hand dominance and involvement of the dominant arm in 70% of cases. Manual laborers comprised nearly two-thirds of the cohort, indicating high physical demand among the affected population. Significant improvements were observed in pain (VAS score reduced from 7.6 to 1.4) and functional outcomes (DASH score improved from 34.1 to 4.3). Range of motion also showed considerable improvement, with active abduction increasing from 97° to 135°. Treatment failures occurred in 4.4% of patients, and 91% returned to full work within three months post-surgery.

Conclusion
Mini-open RCR with home-based rehabilitation results in significant functional recovery and low complication rates in most patients.

Recommendation
Further studies should focus on patient selection criteria to optimize outcomes, particularly in those with large or retracted tears.

Keywords: *Rotator cuff repair, Home-based rehabilitation, Mini-open surgery, Functional recovery, Postoperative outcomes*
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Introduction

Rotator cuff tears (RCT) are commonly encountered in both elderly individuals and athletes. In older patients, these injuries are typically degenerative, whereas in younger or athletic individuals, they often result from trauma. Standard treatment options for these tears include mini-open repair techniques, both of which have demonstrated favorable clinical outcomes [1,2].

A critical component of successful recovery following surgical repair is postoperative rehabilitation [3]. Supervised physiotherapy is generally recommended,

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where patients either attend sessions at a clinic or receive therapy at home through professional visits. Recently, video-based supervised rehabilitation has also shown promising results [4]. However, both in-person and virtual supervision by a therapist can add to the overall cost of treatment [4,5], and may also lead to time inefficiencies due to travel and scheduled sessions. Additionally, for immunocompromised patients, frequent interactions outside the home increase the risk of exposure to infectious agents.

Conversely, unsupervised rehabilitation carries the risk of compromising the surgical repair due to incorrect technique or overexertion [6]. This underscores the need for a feasible alternative. A simple, self-managed home-based rehabilitation program could serve as an effective solution, minimizing expenses, saving time, and reducing exposure to external factors. Such a program should be designed to protect the integrity of the repair while simultaneously preserving joint mobility. Therefore, the current study aims to evaluate the effectiveness of a straightforward, home-based rehabilitation protocol that patients can independently perform following rotator cuff repair (RCF).

Methods

Study design

This was a prospective observational, hospital-based cohort study conducted over a duration of two years, from April 2021 to April 2024. The objective was to evaluate the clinical and functional outcomes of mini-open RCF using a standardized surgical approach and home-based rehabilitation protocol.

Study setting

The research was conducted at two tertiary care institutions: IMS and SUM Hospital, and the All India Institute of Medical Sciences (AIIMS), Bibinagar, Telangana. Both centers have dedicated orthopaedic units and physiotherapy departments with the capability to manage and follow up shoulder injury patients consistently.

Study population and sample size

A total of 90 patients who underwent RCR surgery were considered for the study. The sample size was determined based on feasibility, recruitment rates, and prior data on outcome variability for similar procedures. Eligible patients had full-thickness RCT involving the supraspinatus, infraspinatus, or both, as confirmed by clinical examination and magnetic resonance imaging (MRI). Patients with partial-thickness tears, additional concurrent shoulder procedures, or prior shoulder surgeries were excluded.

Clinical and radiological evaluation

All patients underwent a thorough clinical examination, which included assessment of shoulder pain, muscle strength of the rotator cuff (particularly against resistance), and comparison of active range of motion with the contralateral limb. Standard radiographs of the shoulder were obtained to evaluate joint alignment and bony abnormalities. Magnetic Resonance Imaging (MRI) was performed in all cases to confirm the diagnosis and characterize the extent of the RCT. MRI assessment included identification of the involved tendons (supraspinatus and/or infraspinatus), tear thickness, and degree of tendon retraction.

Surgical procedure

A mini-open technique was used to conduct the surgery while the patient was under general anaesthesia in a beach chair position (60º to horizontal). The procedure began with a 3-centimeter (maximum 5 cm) vertical skin incision made over the anterior lateral or direct lateral aspect of the shoulder as per the location of the tear. The anterior lateral mini-open has the advantage of preserving the deltoid function as the anterior deltoid fibres are easily lifted off from the acromioclavicular zone and are easily reattachable. After locating the space between the front and middle thirds of the deltoid using blunt dissection, it was delicately drawn back. The injured rotator cuff tendons were located after excising the subacromial and subdeltoid bursae. We prepared the tendon footprint and ripped edges.

The rotator cuff was repaired using one or two 5.5 mm titanium double-loaded suture anchors in a single-row configuration, selected intraoperatively based on the tear pattern. Mattress sutures were used to secure the tendon with the shoulder positioned in neutral rotation. Repair stability was tested with a gentle range of motion. Closure was performed in layers, and the operated arm was immobilized postoperatively.

Postoperative care and rehabilitation protocol

Postoperatively, patients were discharged and re-evaluated at one, two, three, six, and twelve months later.

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A home-based rehabilitation program was initiated immediately after discharge. Patients and their caregivers were taught a specific range of motion exercise, which they were encouraged to perform four times daily with ten repetitions per session.

Elbow, wrist, and hand exercises started on the first postoperative day. Assisted shoulder forward flexion began at one week, limited by pain tolerance. At two weeks, patients were allowed light use of the affected limb, and passive external rotation exercises (with the elbow supported at the side) were introduced. These were demonstrated and reinforced during follow-up.

Shoulder immobilizers were worn continuously for six weeks, then only at night. Active shoulder movements, including abduction and external rotation, were started at six weeks, and the immobilizer was completely discontinued by the second postoperative month. Weight-bearing exercises were gradually introduced thereafter, and overhead activities were resumed at three months.

Outcome measures and data collection

Postoperative outcomes were systematically assessed at the one-year follow-up. Pain intensity was measured using the Visual Analogue Scale (VAS), providing a subjective evaluation of pain experienced by the patients. Functional outcomes were recorded using the Disabilities of the Arm, Shoulder, and Hand (DASH) questionnaire, which evaluates disability and symptoms related to upper limb function. Shoulder range of motion and muscle strength were clinically examined and compared with those of the contralateral, unaffected side to determine the recovery status.

In addition to clinical parameters, return to occupational activities was documented to assess functional reintegration. Treatment failure was defined as a reduction in shoulder motion to less than 50% of the movement in the opposite limb or if the patient required further surgical or rehabilitative intervention to achieve satisfactory outcomes. All data were collected during scheduled follow-up visits and recorded systematically for analysis.

Bias

To minimize selection bias, all consecutive patients meeting the inclusion criteria were enrolled. Observer bias was reduced by ensuring that clinical outcome evaluations (VAS, DASH score, and ROM measurements) were conducted by independent physiotherapists blinded to surgical details. Standardized tools and protocols were employed across centers to maintain consistency in evaluation and rehabilitation.

Results

A total of 108 patients were screened for eligibility between April 2021 and April 2024. Of these, 90 patients met the inclusion criteria, consented, and underwent mini-open rotator cuff repair (RCR). All 90 patients completed clinical follow-up at 1, 3, 6, and 12 months and were included in the final analysis. There were no losses to follow-up or exclusions after enrollment.

Table 1. Baseline characteristics of study participants (n = 90)

Characteristic	Value
Mean Age (years ± SD)	54.6 ± 8.7
Gender	Male: 64 (71.1%), Female: 26 (28.9%)
Occupation Type	Manual labor: 59 (65.6%) Sedentary: 31 (34.4%)
Dominant Arm Involved	67 (74.4%)
Hand Dominance	Right-handed: 78 (86.7%)
Surgery on the Dominant Side	63 (70%)
Primary Symptom	Shoulder pain: 90 (100%)
Rotator Cuff Weakness (on resistance)	90 (100%)
Restricted Shoulder Mobility	90 (100%)
Radiograph Findings	Normal: 83 (92.2%) Superior migration: 7 (7.8%)
MRI Findings – Supraspinatus Tear	86 (95.6%)
MRI Findings – Combined Tears	4 (4.4%)
MRI – Retraction ≤ 2 cm	66 (73.3%)
MRI – Retraction > 2 cm	10 (11.1%)
MRI – No Detectable Retraction	14 (15.6%)
Rehabilitation Compliance at 1st Follow-up	83 (92.2%)

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The majority of the 90 participants were middle-aged (mean age: 54.6 years), predominantly male (71.1%), and involved in manual occupations (65.6%). Most had the dominant shoulder affected, particularly among right-handed individuals. Clinically, all patients presented with shoulder pain, reduced mobility, and rotator cuff weakness. Radiographs were mostly normal, though 7.8% showed superior humeral migration. MRI confirmed full-thickness supraspinatus tears in over 95% of cases, with a smaller proportion showing combined tendon involvement or significant retraction. Adherence to the rehabilitation protocol was high at initial follow-up (Table 1).

Table 2: Clinical and functional outcomes (n = 90)

Parameter	1 Month	3 Months	6 Months	1 Year
VAS Score (mean ± SD)	5.6 ± 0.9 (4 – 7)	3.1 ± 0.8 (2 – 5)	2.0 ± 0.6 (1 – 4)	1.4 ± 0.5 (0 – 6)
DASH Score (n = 28)	24.7 ± 6.3 (14 – 38)	12.8 ± 4.7 (7 – 21)	6.9 ± 3.1 (2 – 14)	4.3 ± 2.2 (0.7 – 11.5)
Active Abduction (°)	110 ± 12 (78 – 126)	123 ± 10 (95 – 138)	130 ± 8 (104 – 146)	135 ± 7 (91 – 151)
Forward Flexion (°)	115 ± 13 (79 – 129)	125 ± 10 (90 – 140)	132 ± 8 (103 – 148)	136 ± 6 (92 – 152)
External Rotation (°)	16 ± 5 (5 – 25)	23 ± 6 (10 – 33)	28 ± 6 (15 – 41)	31 ± 5 (1 – 51)
Normal RC Strength (% pts)	26% (23 patients)	59% (53 patients)	77% (69 patients)	97% (87 patients)
Treatment Failures	0	3 patients (3.3%)	4 patients (4.4%)	4 patients (4.4%)
Return to Full Work	38 patients (42%)	66 patients (73%)	76 patients (84%)	82 patients (91%)

At the 1-month follow-up, patients reported a mean Visual Analog Scale (VAS) pain score of 5.6 ± 0.9, indicating moderate pain levels early in the recovery phase. The Disabilities of the Arm, Shoulder and Hand (DASH) score, assessed in a subset of 28 patients, averaged 24.7 ± 6.3, reflecting significant functional limitations. Active abduction and forward flexion were limited, with mean values of 110° and 115°, respectively, while external rotation remained low at 16° ± 5. Only 26% (23 patients) had regained normal rotator cuff (RC) strength, and 38 patients (42%) had returned to full occupational activity. No treatment failures were recorded at this stage.

By the 3-month mark, there was a marked improvement in all clinical parameters. The mean VAS score dropped to 3.1 ± 0.8, and the DASH score improved to 12.8 ± 4.7, indicating recovery in both pain and function. Active abduction increased to 123°, forward flexion reached 125°, and external rotation improved to 23°. RC strength normalized in 59% of the patients (53 individuals). Return to work improved to 66 patients (73%). However, three patients (3.3%) were noted to have treatment failures due to re-tears, confirmed by MRI.

At 6 months, recovery was further consolidated. The VAS score decreased to 2.0 ± 0.6, and the DASH score showed continued progress, averaging 6.9 ± 3.1. Active abduction and forward flexion were restored to 130° and 132°, respectively. External rotation improved significantly to 28° ± 6, and 77% of patients (69 individuals) had regained normal RC strength. Return to full occupational activity was achieved by 76 patients (84%), and the number of treatment failures increased slightly to four (4.4%), including one case of postoperative stiffness.

At the final 1-year follow-up, near-complete functional recovery was observed in the majority of patients. The VAS score dropped to 1.4 ± 0.5, indicating minimal pain. The DASH score reached a low mean of 4.3 ± 2.2, reflecting excellent functional restoration. Mean active abduction and forward flexion increased to 135° and 136°, respectively, while external rotation reached 31°. Normal RC strength was regained by 87 patients (97%). A total of 82 patients (91%) had resumed full work activities. The four patients who failed treatment included one with persistent stiffness and three with re-tears, all of whom declined revision surgery (Table 2).

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Table 3: Clinical and radiological findings (n = 90)

Finding	Number of Patients	Percentage (%)
Shoulder pain (primary symptom)	90	100%
Rotator cuff weakness (on resistance testing)	90	100%
Restricted shoulder mobility (vs. contralateral side)	90	100%
Normal radiographs	83	92.2%
Superior humeral head migration on X-ray	7	7.8%
Full-thickness supraspinatus tear (MRI)	86	95.6%
Combined supraspinatus + infraspinatus tear (MRI)	4	4.4%
Isolated infraspinatus tear	0	0%
Tendon retraction ≤ 2 cm (MRI)	66	73.3%
Tendon retraction > 2 cm (MRI)	10	11.1%
No detectable tendon retraction (MRI)	14	15.6%

All patients reported shoulder pain as the primary symptom and showed reduced strength in the rotator cuff when tested against resistance. A significant limitation in shoulder mobility, especially when compared to the unaffected side, was noted in all individuals. Plain radiographs were normal in 83 patients, whereas seven exhibited signs of superior migration of the humeral head. MRI findings revealed a full-thickness supraspinatus tear in 86 patients. A combination of supraspinatus and infraspinatus tears was identified in four cases. There were no instances of isolated infraspinatus tears. Regarding tendon retraction, 66 patients had tendon edge retraction measuring 2 cm or less, 10 patients had retraction greater than 2 cm, and 14 had no detectable retraction (Table 3).

Discussion

The present study demonstrated that mini-open rotator cuff repair (RCR) combined with an early-start, home-based rehabilitation protocol can yield excellent clinical and functional outcomes in a majority of patients. By the 1-year follow-up, nearly all participants (97%) had regained normal rotator cuff strength, and 91% had returned to their pre-injury occupation. Improvements in pain, as reflected in declining Visual Analogue Scale (VAS) scores, and function, as measured by the Disabilities of the Arm, Shoulder, and Hand (DASH) scores, were consistent and progressive throughout the recovery period. The small number of treatment failures (4.4%) was limited to cases involving large, retracted tendon tears, suggesting that tear size and repair tension are critical determinants of outcome. Importantly, early initiation of mobility and structured self-directed exercises appeared to facilitate functional recovery without increasing complications in appropriately selected patients.

These findings support the potential effectiveness of patient-led rehabilitation following RCR, particularly for small to moderate full-thickness tears that can be repaired under minimal tension. However, the results also underscore the importance of individualized rehabilitation strategies—patients with high-tension repairs or significant retraction may require supervised therapy and more secure repair constructs to prevent re-tears or compromised healing.

While there is ongoing debate about the superiority of supervised versus unsupervised rehabilitation, several studies align with the current findings. Earlier studies have concluded that there is insufficient evidence to support one approach over the other [7]. Another study observed improved functional outcomes with supervised scapular stabilization and strengthening exercises following acromioplasty, although pain scores remained unchanged, and cost was not evaluated [8]. Similarly, other investigations have found no significant differences between supervised and home-based rehabilitation in a study of 43 patients recovering from RCR [9]. These results are consistent with those of the current investigation, where home-based therapy proved effective in the majority of patients.

Other comparative studies found that while supervised rehabilitation may lead to improved SANE scores, the range of motion and pain relief were similar to unsupervised approaches [12]. In a systematic review and meta-analysis conducted by another group, comparable outcomes were reported between supervised and home-based protocols regarding VAS and functional scores [11]. Similarly, other studies have found no significant differences between the two approaches in Constant scores or pain, though the supervised option incurred higher costs [5]. Notably, the present study introduced active exercises as early as the first postoperative week, contrasting with many other protocols where such exercises are delayed.

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Patient autonomy was emphasized, with early initiation of home exercises and careful monitoring during follow-up. This may have contributed to the high rates of return to work and functional restoration. However, consistent with prior observations, early mobilization may not be suitable for massive or retracted tears, and can predispose to failure if not appropriately managed [13]. In this study, treatment failures were observed only in such high-risk cases, which could have benefited from supervised therapy and a more conservative postoperative regimen.

A notable limitation of this investigation is the absence of a control group undergoing supervised therapy, which precludes direct comparison. Additionally, adherence to the home-based protocol was not objectively monitored, leaving the possibility of variability in patient engagement and exercise quality. While home-based rehabilitation offers logistical and cost advantages, its success depends heavily on proper patient selection, tear characteristics, and diligent follow-up. Based on the findings, it appears most effective for smaller, stable tears repaired under minimal tension.

Generalizability

The findings of this study may be generalizable to patients undergoing mini-open rotator cuff repair for small to moderate full-thickness tears in similar tertiary care settings, particularly where access to supervised physiotherapy is limited. However, caution is warranted when applying these results to patients with massive or retracted tears or in populations with differing healthcare infrastructure and follow-up adherence.

Conclusion

This study demonstrates that a home-based, patient-driven rehabilitation protocol following RCF can lead to favorable functional outcomes, particularly in patients with small, non-retracted tears and stable repairs. Early initiation of rehabilitation—within one week of surgery—was found to be effective in restoring range of motion and facilitating return to work in the majority of patients. However, careful patient selection is critical, as those with large, retracted tears or repairs done under tension may have a higher risk of failure and could benefit more from supervised rehabilitation. While home-based protocols offer a cost-effective and accessible alternative, further studies with control groups are needed to establish definitive guidelines.

Limitations

This study has several limitations. First, the absence of a control group receiving supervised rehabilitation limits direct comparisons of rehabilitation effectiveness. Second, patient adherence to the home-based exercise program was not objectively monitored. Third, functional outcomes were based on self-reported questionnaires and clinical assessments without imaging follow-up in all cases. Lastly, the sample was drawn from a specific regional population, which may introduce selection bias.

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Conflict of interest

The authors declare no conflicts of interest in this work.

Source of funding

No external funding was received for this study. The institutions involved did not influence the study design, data collection, analysis, or interpretation of results.

Data availability

The datasets generated and analyzed during the current study are available from the corresponding author upon reasonable request.

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List of abbreviations

RCT – Rotator Cuff Tear
RCR – Rotator Cuff Repair
VAS – Visual Analogue Scale
DASH – Disabilities of the Arm, Shoulder, and Hand
MRI – Magnetic Resonance Imaging
RC – Rotator Cuff
AIIMS – All India Institute of Medical Sciences

Author contributions

All authors contributed to study design, data collection, analysis, patient care, and manuscript preparation, and approved the final version.

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