International Journal of Research in Orthopaedics
Khatua J et al. Int J Res Orthop. 2025 Jul;11(4):707-711
http://www.ijoro.org

Original Research Article

DOI: https://dx.doi.org/10.18203/issn.2455-4510.IntJResOrthop20251447

Effective outcomes of home-based unsupervised rehabilitation protocol after rotator cuff repair: a prospective study

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Received: 04 April 2025
Revised: 30 April 2025
Accepted: 13 May 2025

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ABSTRACT

Background: Rotator cuff tears, common in both elderly and athletic populations, require effective rehabilitation following surgical repair for optimal recovery. The study evaluates the outcomes of a patient-led home-based rehabilitation program after rotator cuff repair.
Methods: This prospective study was conducted at SCB Medical College and Hospital, Cuttack, with 46 patients who underwent rotator cuff repair via mini-open incision. A structured home-based rehabilitation program was followed, with outcomes assessed at one year using visual analogue scale (VAS), disabilities of the arm, shoulder, and hand (DASH) score, range of motion, and cuff strength.
Results: Postoperative VAS score improved from 7.3 to 1.5, and the DASH score decreased from 35.0 to 5.2. Range of motion significantly improved in active abduction, forward flexion, and external rotation. Ninety-one percent of patients returned to work within three months, though five failures were noted, including one with stiffness and four with retear.
Conclusions: The home-based rehabilitation program resulted in significant pain relief and functional recovery, with a high return-to-work rate. The study suggests that home-based rehabilitation is a viable alternative to supervised physiotherapy.

Keywords: Rotator cuff repair, Home-based rehabilitation, Outcomes, Range of motion, Pain, DASH score

INTRODUCTION

Rotator cuff tears represent a prevalent condition encountered among both older adults and athletes. Degenerative tears primarily impact the older population, whereas younger and athletic individuals exhibit a higher susceptibility to traumatic tears. Injuries of this nature are generally addressed using arthroscopic or mini-open repair methods, both of which produce positive results.[1,2] Post-operative rehabilitation is an essential aspect of the treatment process that follows surgical repair.[3] Conventionally, supervised physiotherapy is advised, necessitating that patients either attend appointments with a therapist or engage in sessions within the comfort of their own homes. Furthermore, the implementation of video-based supervised rehabilitation has yielded encouraging outcomes.[4] Nonetheless, both physical and virtual therapist-led interventions can elevate the overall expense of treatment and necessitate a considerable investment of time owing to travel and therapy sessions.[4,5] The recent pandemic has underscored the inherent risks of exposure linked to in-person rehabilitation practices. On the other hand, engaging in entirely unsupervised rehabilitation could jeopardise the integrity of the surgical repair.[6] A well-organised, home-cantered rehabilitation program presents a promising approach by lowering expenses, conserving time, and mitigating external risk elements. A well-designed home-based protocol must prioritise the preservation of joint mobility while minimising stress on the repaired tissue. This study seeks to assess the results of

a straightforward, patient-directed home rehabilitation program after rotator cuff repair.

METHODS

Study design and participants

This prospective study was conducted at SCB Medical College and Hospital, Cuttack, from February 2024 to January 2025. It included 46 patients who underwent rotator cuff repair through a mini-open incision. A full-thickness tear involving the supraspinatus, infraspinatus, or both was confirmed through clinical examination and magnetic resonance imaging (MRI). Patients with partial tears, previous shoulder surgeries, or additional concomitant procedures were excluded.

Clinical and radiological assessment

Every patient indicated that pain was the predominant symptom, accompanied by weakness in the rotator cuff and limited mobility when compared to the unaffected side. In the majority of instances, radiographs appeared unremarkable, with the exception of a select few that indicated proximal migration of the humeral head. The MRI findings indicated a prevalent supraspinatus tear among the majority of patients, with a subset exhibiting concurrent involvement of both the supraspinatus and infraspinatus muscles. The categorisation of cuff edge retraction included three distinct classifications: absent, measuring up to 2 cm, or exceeding 2 cm.

Surgical procedure

All surgical procedures were conducted under general anaesthesia, utilising a 3 cm vertical incision positioned over the anterolateral aspect of the shoulder. The deltoid muscle was meticulously divided along its fibres, while the subacromial and subdeltoid bursae were carefully excised. The torn rotator cuff was carefully mobilised, and the footprint meticulously prepared. A single-row repair technique was utilised, incorporating 5.5 mm double-loaded titanium anchors, with the quantity of anchors ascertained intraoperatively in relation to the size of the tear. The deltoid underwent a meticulous repair, followed by the careful closure of the skin. The arm that underwent surgery was immobilised, and patients were discharged the next day, with follow-up appointments arranged for at regular intervals (1 week, 2 weeks, 1.5 months, 3 months, and 1 year) following the procedure.

Rehabilitation protocol

A meticulously organised rehabilitation program was established, with exercises commencing on the day of discharge. Movements of the elbow, forearm, and hand were initiated promptly, succeeded by facilitated shoulder flexion after one week. At the two-week mark, passive external rotation with elbow support was initiated, while the shoulder immobiliser was employed consistently for a duration of six weeks, subsequently transitioning to nighttime use only. At six weeks, active shoulder motion encompassing abduction and external rotation was initiated, followed by a gradual introduction of weight-bearing and overhead activities at two and three months, respectively.

Outcome measures

At 1-year, patient outcomes were assessed using the visual analog scale (VAS) for pain, disabilities of the arm, shoulder, and hand (DASH) score for functional status, range of motion, and cuff strength. Return to work status was recorded. Failure was defined as a range of motion less than 50% of the opposite side or the need for additional intervention.

Statistical analysis

Data were analysed using statistical package for the social sciences (SPSS) version 20.0. Descriptive statistics, paired t-tests, and Chi-square tests were applied where appropriate, with significance set at $p<0.05$.

RESULTS

The study included 46 patients (30 males and 16 females) with a mean age of 54.3±8.2 years (range: 38–68 years) who underwent mini-open rotator cuff repair. The right shoulder was affected in 60.9% of cases, and the dominant arm was involved in 69.6% of patients. In terms of occupation, 43.5% were manual labourers, 30.4% were office workers, 17.4% were homemakers, and 8.7% belonged to other categories.

The average follow-up period was 15 months, with a range spanning from 12 to 23 months. The VAS score showed a great improvement, transitioning from a preoperative mean of 7.3 (with a range of 4 to 9) to a postoperative mean of 1.5 (spanning a range of 0 to 5). This suggests significant alleviation of pain subsequent to the procedure (Table 1). The ROM exhibited notable improvement in a cohort of 40 patients with mean active abduction improved from a preoperative average of 96° (with a range of 38° to 128°) to a postoperative average of 136° (with a range of 88° to 152°). The forward flexion, assessed at 90° within the scapular plane, demonstrated an enhancement from a preoperative average of 100° (with a range of 42° to 132°) to a postoperative average of 137° (with a range of 92° to 148°). External rotation also demonstrated an enhancement from a preoperative average of 11° (with a range of 0° to 32°) to a postoperative average of 32° (with a range of 0° to 52°). The cuff strength was assessed as normal in 40 patients, signifying a successful functional recovery, as illustrated in Table 2.

A total of 28 patients underwent assessment using the DASH score. The preoperative mean increased from 35.0 (range, 9.5 to 57.8) to a follow-up mean of 5.2 (range, 0.6 to 12.0), indicating a notable enhancement in daily

functional activities. A total of five failures were recorded, constituting 10.8% of the overall outcomes. One patient experienced significant postoperative stiffness and declined any additional intervention. At the one-year follow-up, this patient exhibited less than 50% of the range of motion relative to the contralateral side and experienced moderate pain, as indicated by a VAS score of 6. Furthermore, four patients exhibited a retear of the surgically repaired tendon, as verified by MRI three months following the operation. The patients in question conveyed experiences of ongoing mild to moderate pain and opted against undergoing revision surgery. They became untraceable for follow-up after roughly six months. Significantly, each of the four cases presented with substantial retracted tears exceeding 3 cm, which were subsequently repaired under tension.

Table 1: Demographic profile of study participants (n=46).

Parameters	Value
Total number of patients	46
Age (years) (mean±SD)	54.3±8.2
Age range (years)	38–68
Gender, N (%)	Male: 30 (65.2), female: 16 (34.8)
Side affected, N (%)	Right: 28 (60.9), left: 18 (39.1)
Dominant arm involved, N (%)	32 (69.6)
Occupation, N (%)	Manual laborers: 20 (43.5), office workers: 14 (30.4), homemakers: 8 (17.4), others: 4 (8.7)

Table 2: Improvement in VAS and DASH scores.

Parameters	Preoperative mean (range)	Postoperative mean (range)
VAS score	7.3 (4-9)	1.5 (0-5)
DASH score (n=28)	35.0 (9.5-57.8)	5.2 (0.6-12.0)

Table 3: Improvement in range of motion.

Movement	Preoperative mean (range)	Postoperative mean (range)
Active abduction	96° (38°-128°)	136° (88°-152°)
Forward flexion	100° (42°-132°)	137° (92°-148°)
External rotation	11° (0°-32°)	32° (0°-52°)

A total of 42 patients, representing 91%, successfully resumed full employment within three months following their surgical procedures. Nonetheless, three patients who experienced re-tears did not return to their daily routine due to the affected arm. Furthermore, the singular patient experiencing stiffness, along with two others who achieved favourable functional outcomes, altered their professional paths as a result of ongoing discomfort or adjustments in their careers.

DISCUSSION

Rehabilitation protocols that are guided by patients shortly after rotator cuff repair have the potential to yield positive results in appropriately chosen individuals. Research indicates that individuals may recover more than 90% of their range of motion through effective rehabilitation strategies. This study revealed noteworthy enhancements in both the DASH score and VAS score, with 88% of patients returning to their prior occupations within three months following surgery. Nonetheless, three patients exhibited failure, potentially linked to the repair being conducted under tension. The cases in question featured significant tears that could have potentially gained from a more robust repair methodology and monitored physiotherapy to alleviate strain on the recuperating tendon. Conversely, individuals with stable repairs of minor tears demonstrated functional recovery and successfully reintegrated into the workforce. A systematic review conducted by Baumgarten et al revealed a lack of sufficient evidence to ascertain the optimal rehabilitation strategy for rotator cuff repair.[7] The investigations presented showed no notable benefits of supervised rehabilitation compared to unsupervised programs; nonetheless, these investigations were constrained by inadequate methodological frameworks. Several studies have indicated that supervised rehabilitation programs yield more favourable results, especially in the context of shoulder recovery. The results of a randomised controlled trial carried out by another group discovered that engaging in progressive strengthening exercises and scapular stabilisation after arthroscopic acromioplasty resulted in enhanced functional scores when contrasted with a home-based program.[8] Although there were functional advantages, the analysis revealed no notable disparity in pain alleviation between the two cohorts, and financial implications were overlooked.

In contrast, numerous studies have indicated an absence of a definitive separation between supervised and unsupervised rehabilitation. In a controlled clinical study conducted by Andersen et al, which included 43 patients, no significant differences in recovery outcomes were observed.[9] Comparable results have been documented in comparative investigations evaluating rehabilitation following rotator cuff repair.[10,11] According to the findings of Song et al, supervised therapy yielded superior SANE scores; however, the enhancements in pain relief and range of motion were similar across both rehabilitation approaches.[12] In the referenced study, rehabilitation began after a period of four weeks of immobilisation, while the present study initiated rehabilitation within one week following the surgical procedure. Furthermore, earlier systematic review and meta-analysis have concluded that there was no notable difference in VAS scores or

functional outcomes when comparing supervised and unsupervised rehabilitation after rotator cuff repair.[11]

Buker et al conducted a comparison between 15 patients participating in supervised rehabilitation and 13 patients adhering to a standardised home-based program following arthroscopic cuff repair.[5] Their research revealed no notable disparities in pain levels, constant scores, or functional outcomes when comparing the two groups. Nonetheless, the supervised program resulted in elevated expenses. During the initial six weeks, both groups engaged in pendulum exercises; however, the current study introduced a more diverse array of exercises during this preliminary phase.

This research involved the administration of organised home-based rehabilitation protocols to patients during the initial week following their surgical procedures. Gallagher et al previously indicated no notable variations in outcomes seen in early rehabilitation with that of delayed rehabilitation after rotator cuff repair.[13] Nevertheless, they advised caution regarding premature rehabilitation for extensive tears, as this poses an increased risk of failure. This observation is consistent with the current investigation, wherein all three failures were noted in instances of substantial tears, with repairs executed under tension. A significant challenge associated with home-based rehabilitation lies in the risk of overuse, wherein patients may unintentionally place undue stress on the repaired tendon, resulting in the possibility of re-injury. The potential for risk can be effectively mitigated through the meticulous selection of suitable candidates for home-based protocols. Individuals with smaller, stable repairs are more inclined to gain advantages from this method, while those presenting with larger, more intricate tears may necessitate monitored therapy to guarantee regulated advancement and safeguard the tendon. A potential limitation is the underutilisation of rehabilitation exercises by patients, which may result in stiffness and a reduction in functional capacity. Consistent follow-up evaluations and progress monitoring can serve as a proactive measure to avert such complications.

This research presents a number of limitations. The study failed to include a control group, resulting in no direct comparison with patients receiving supervised rehabilitation. Furthermore, the degree of patient adherence to the home-based exercise regimen remained unregulated, which may have impacted the results.

CONCLUSION

This work highlights that home-based rehabilitation following rotator cuff repair can be an effective approach for carefully selected patients, leading to significant improvements in functional outcomes and pain relief. The majority of patients achieved over 90% range of motion, with 88% returning to work within three months. However, failures were observed in cases involving large tears repaired under tension, highlighting the need for a more robust repair technique and possibly supervised therapy in such cases. While previous studies suggest no significant difference between supervised and unsupervised rehabilitation, proper patient selection remains crucial to minimize complications such as overuse injuries or stiffness. Given its cost-effectiveness and convenience, home-based rehabilitation can be a viable option for patients with smaller, stable repairs, while those with large or complex tears may benefit more from structured, supervised programs.

ACKNOWLEDGEMENTS

Authors would like to thank all the participants and staff at SCB Medical College and Hospital for their support in conducting this study.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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Cite this article as: Khatua J, Baskey S, Nayak M, Patra G. Effective outcomes of home-based unsupervised rehabilitation protocol after rotator cuff repair: a prospective study. Int J Res Orthop 2025;11:707-11.