

## A RETROSPECTIVE STUDY TO EVALUATE FUNCTIONAL OUTCOME AFTER ARTHROSCOPIC ROTATOR CUFF REPAIR USING SINGLE-ROW TECHNIQUE

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### Abstract

**Background:** Arthroscopic repair of rotator cuff tear is standard care of rotator cuff repair. The purpose of this retrospective study was to evaluate the functional outcome of arthroscopic rotator cuff repair using single-row technique. **Materials and Methods:** This retrospective study included cases of rotator cuff tear patients operated at the Orthopedic department of PGIMS, Rohtak over a period of 5 years, with a minimum follow up of 6 month. Patient included were between 18 to 70 years of age with MRI proven full thickness rotator cuff tear who underwent arthroscopic rotator cuff repair using single-row technique. Patients with partial tear and massive degenerative unrepairable tears were excluded from the present study. Postoperative evaluation was done at 3 weeks, 3 months and 6 months. Range of motion, DASH, ASES and WORC scoring done during preoperative and postoperative follow-ups. **Result:** Mean age of the patients was  $51.80 \pm 13.01$  year. Statistically significant difference was observed for Jobe's test ( $p < 0.001$ ). Preoperative abduction was  $86.25 \pm 7.4^\circ$  which was drastically improved after 1 week of surgery ( $122.38 \pm 17.25^\circ$ ,  $p < 0.001$ ). At 3 months and 6 months after surgery, abduction movement was  $134 \pm 16.42^\circ$  and  $144.38 \pm 19.05^\circ$ . Preoperatively, WORC score was  $55.55 \pm 5.14$  which was significantly improved to  $66.78 \pm 3.93$  after 3 weeks of surgery. At 3 months and 6 months after surgery, WORC score was significantly improved to  $77.4 \pm 4.99$  and  $89.7 \pm 7.94$  ( $p < 0.001$ ). Similarly, preoperative ASES score ( $50.75 \pm 6.14$ ) was significantly improved at 3 week ( $57.88 \pm 5.84$ ), 3 months ( $67.15 \pm 5.5$ ) and 6 months post operative period ( $80 \pm 8.18$ ,  $p < 0.001$ ). Preoperative DASH score was  $64.13 \pm 8.74$  and significantly improved at 3 weeks of surgery ( $56.45 \pm 7.9$ ), 3 months of surgery ( $43.95 \pm 6.79$ ) and 6 months of surgery ( $30.63 \pm 7.91$ ). **Conclusion:** Arthroscopic rotator cuff repair surgery with single row technique is minimally invasive procedure which along with early aggressive physiotherapy and rehabilitation protocol, allows patients to return to their pre-injury level with good range of motion, excellent outcomes and minimal complications.

## INTRODUCTION

The rotator cuff is a structural integration at a musculotendinous junction and functional co-ordination of four scapulohumeral muscles, attached at tuberosities of humerus and acts as a steerer of shoulder joint<sup>1</sup>. Rotator cuff disease encompasses a wide range of pathologies from tendinitis to rotator cuff arthropathy. It may lead to mild shoulder discomfort to several painful restriction of movement with weakness. The supraspinatus

muscle and tendon can be considered the weak link in the shoulder, since the supraspinatus muscle is the most commonly injured part of the rotator cuff. Shoulder joint has high range of motion at the risk of dislocation and instability due to its biomechanics and bone geometry. Lesions of the rotator cuff (RC) are a common occurrence affecting millions of people across all parts of the globe<sup>2</sup>. The population prevalence of having at least one full thickness tear was 22.25% and 4.5% bilateral tear with increasing chances of tear with age. Other associated factors

include a history of trauma, limb dominance, contralateral shoulder, smoking-status, hypercholesterolemia, posture and occupational dispositions.<sup>[1,2]</sup>

The challenge lies in early diagnosis since a high proportion of patients are asymptomatic or mildly symptomatic. Shoulder pain is one of the most common complaints encountered in clinical practice and frequently results in considerable morbidity. A complete history, physical examination and review of plain radiograph by an experienced examiner were found to be sufficient for establishing the diagnosis and treatment plan. Magnetic resonance imaging still had a significant impact on clinical decision making a large subset of patients with shoulder pain.<sup>[3]</sup> Given the great improvement in resolution achieved by high-frequency ultrasound, it is expected to serve as an important tool for the accurate evaluation of painful shoulder. Even before advanced imaging (USG & MRI) is performed, the diagnosis of rotator cuff tear can be suggested at clinical examination & with radiography of the shoulder.

Various modalities include analgesics, anti-inflammatory medications, physical therapy, activity modification, acupuncture, shock-wave therapy and sub-acromial injections of local anesthetics and/or steroids.<sup>[4]</sup> Conservative treatment consists primarily of physical therapy emphasizing activity modification to minimize the risk of further injury; stretching of the shoulder capsule to restore flexibility and maintain motion; and strengthening of the periscapular, rotator cuff, and deltoid muscles to stabilize the glenohumeral joint and improve shoulder function.<sup>[5]</sup> Surgical management of rotator cuff included total arthroscopic repair. Fixation techniques with Arthroscopic rotator cuff tear (ARCR) are centered around restoring anatomy, recreating biomechanics with strong fixation, promoting healing, and improving function. To fulfill these aims, numerous fixation methods have been developed over time, differing in terms of the quantity of anchors, suture material, region of fixation, and biomechanical qualities. Fixation techniques include single-row repair, double-row repair, linked versus unlinked double-row repair, conventional sutures versus suture tapes and knotted versus knotless constructs.<sup>[5]</sup>

The present study was designed to evaluate the functional outcome to evaluate functional outcome after arthroscopic rotator cuff repair using single-row technique.

## **MATERIALS AND METHODS**

This retrospective study included cases of rotator cuff tear patients of either sex fitting the inclusion criteria at the orthopedic department of PGIMS, Rohtak over a period of 5 years, with a minimum follow up of 6 month. We included forty patients (40) aged between 18 to 70 years with MRI proven

full thickness rotator cuff tear who underwent all arthroscopic rotator cuff repair using single-row technique. Patients with massive degenerative unrepairable tears. Standard postoperative rehabilitation protocols were followed. Postoperative evaluation was done at 3 weeks, 3 months and 6 months. Range of motion, DASH, ASES and WORC scoring done during preoperative and postoperative follow-ups.

### **Preoperative Evaluation**

All patients were subjected to preoperative clinical assessment for the presence of pain during activities, range of motion of shoulder and special tests like Impingement sign, Jobe's test, Speed test, Belly press test. With prior informed consent, a preoperative anesthetic evaluation was done.

### **Surgical Technique**

All the surgeries were done after appropriate cardiological and medical evaluation and optimization. The shoulder was positioned on a lateral position with the affected side up and 30° posterior tilt and traction from the fluid stand. The bony landmarks of the shoulder joint ( acromion, scapular spine, clavicle, acromioclavicular joint and coracoids ) were identified and marked. The first posterior portal was made by making stab incisions at 2 cm inferior and medial to the posterolateral tip of the acromion and trocar was inserted with sleeve followed by arthroscopy. Through the posterior portal, an intraarticular portion of the joint was viewing systematically. 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 rotator interval. Then, anterior working portal was made by 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 debrided (if needed) using a 3.5 mm soft tissue resector. The scope was then shifted and directed upwards under the acromion outside the rotator cuff towards the subacromial space. Through a lateral portal, the motor shaver 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 acromion or sheath of the scope introduced through the posterior portal. The bursal tissues were removed until the anteroinferior surface of the acromion, as well as the coracoacromial ligament, were identified. The motorized shaver was then replaced by using a 4 mm bony burr which was used to remove the anteroinferior 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 rotator cuff tear took place and especially see the mobility of rotator cuff and then prepare the footprint by the bony bar. The type of cuff repair depended on the type and size of the cuff tear. Biceps tenotomy was done in all patients with age more than 50 years. After adequate

inspection of a full-thickness tear and detecting its size and extension. We prepared the foot-print area by the shaver first and then by bony burr. One or more bone anchors (bioabsorbable, double loaded with number 2 fibre wire) depending on the size and extent of the cuff tear was inserted at the foot-print area. An anterograde suture passing instrument was used to pass one limb of each suture thread through the margins of the rotator cuff tear and back again through the lateral portal. An arthroscopic knot was then tied outside and pushed inside to close the defect.<sup>[4]</sup>

### Post-operative Rehabilitation

All patients were immobilized in a Universal Shoulder Immobilizer for six weeks and pendulum exercises were conducted, stitches were removed at 2 weeks. Gradually gentle passive assisted flexion-extension exercises and abduction up to 90° or as tolerated were conducted for two weeks. Gradually from eight to twelve weeks active flexion-extension and abduction exercises with added weight or as tolerated were started. Theraband resistance exercises were started from twelve to eighteen weeks like hand behind the back and posterior capsular stretches and then gradually increased theraband resistance and strength training of rotator cuff, latissimus dorsi and biceps till full rehabilitation of the patients.

### Data Analysis

The data was collected with predesigned proforma and entered in Microsoft Excel 2010. The data was analyzed with Epi info version 7.1.4.0. Continuous data (age, various movements, various scores) was presented with mean and standard deviation while categorical data (gender, injuries) was presented with frequency and percentage. Results were graphically represented where deemed necessary. Comparison of various scores at different time point were analysed with ANOVA test. Proportion positive test at different time point was compared Z test. P value less than 0.05 was considered as significant.

## RESULTS

A Prospective study with 40 patients is undertaken to study the functional outcome of Arthroscopic rotator cuff repair.

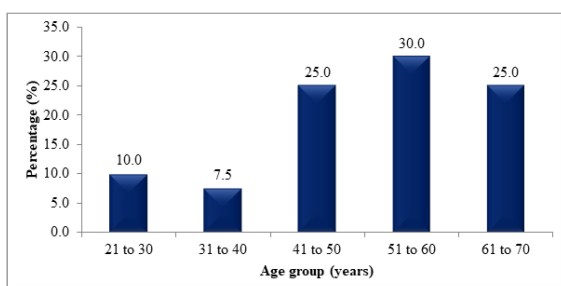


Figure 1: Distribution of patients according to age group

In our study, Mean age of the patients was  $51.80 \pm 13.01$  year. The most common age group was 61–70 years (12, 30.0%), followed by 51–60 years and 71 to 80 years (10, 25.0% for each group).

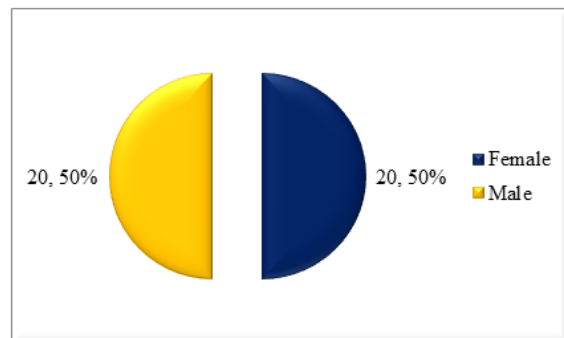


Figure 2: Gender wise distribution of patients

Out of 40 patients, 20 (50.0%) were female and 10(50.0%) were male.

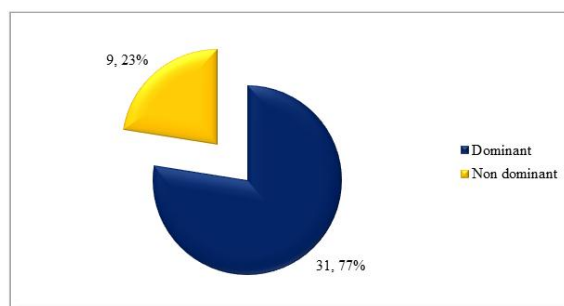


Figure 3: Site of tear distribution

In our study, 31 patients (77.5%) had dominant side rotator cuff tear.

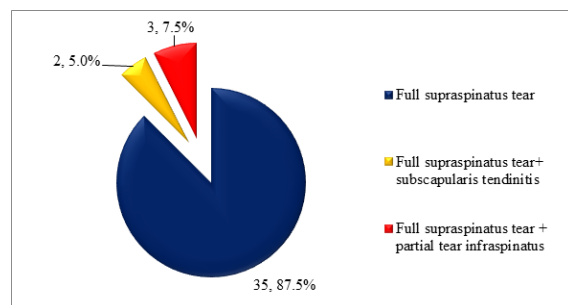


Figure 4: Rotator cuff Injuries

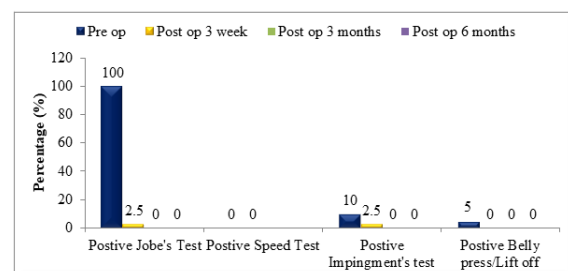


Figure 5: Comparison of various tests results between pre operative and post operative period

In pre operative period, there were positive Jobe's test in all patients (40, 100%), positive Impingment's

test in 4 patients (10.0%) and positive Belly press in 2 patients (5.0%). After 3 weeks of surgery, positive Jobe's test in only 1 patients (2.5%), positive

Impingment's test in only 1 patients (2.5%), whereas Speed test and Belly press were negative in all 40 patients.

**Table 1: Distribution of patients according to age group**

Age group (year)	Frequency	Percentage (%)
21 to 30	4	10.0
41 to 50	3	7.5
51 to 60	10	25.0
61 to 70	12	30.0
71 to 80	10	25.0
Total	40	100.0
Mean $\pm$ SD	51.80 $\pm$ 13.01	
Median	55.00	

**Table 2: Gender wise distribution of patients**

Gender	Frequency	Percentage (%)
Female	20	50.0
Male	20	50.0
Total	40	100.0

**Table 3: Site of tear distribution**

Site of tear distribution	Frequency	Percentage (%)
Dominant	31	77.5
Non dominant	9	22.5
Total	40	100.0

**Table 4: Rotator cuff Injuries**

Rotator cuff Injuries	Frequency	Percentage (%)
Full supraspinatus tear	35	87.5
Full supraspinatus tear+ subscapularis tendinitis	2	5.0
Full supraspinatus tear + partial tear infraspinatus	3	7.5
Total	40	100.0

Full thickness supraspinatus tear was present in all 40 patients. Two patients (5.0%) had subscapularis tendinitis with full thickness supraspinatus tear and three patients (7.5%) had partial thickness tear of infraspinatus with full thickness supraspinatus tear.

**Table 5: Comparison of various tests results between pre operative and post operative period**

Test	Pre op	Post op 3 wk	Post op 3 months	Post op 6 months	Z& p value
<b>Jobe's Test</b>					
Positive	40 (100%)	1 (2.5%)	0 (0%)	0 (0%)	Z – 8.72, p < 0.001
Negative	0 (0%)	39 (97.5%)	40 (0%)	40 (0%)	
<b>Speed Test</b>					
Negative	40 (100%)	40 (100%)	40 (100%)	40 (100%)	NA
<b>Impingment's test</b>					
Positive	4 (10%)	1 (2.5%)	0 (0%)	0 (0%)	Z – 1.38, p – 0.16
Negative	36 (90%)	39 (97.5%)	40 (0%)	40 (0%)	
<b>Belly press/Lift off</b>					
Positive	2 (5%)	0 (0%)	0 (0%)	0 (0%)	Z – 1.43, p – 0.15
Negative	38 (95%)	40 (0%)	40 (0%)	40 (0%)	

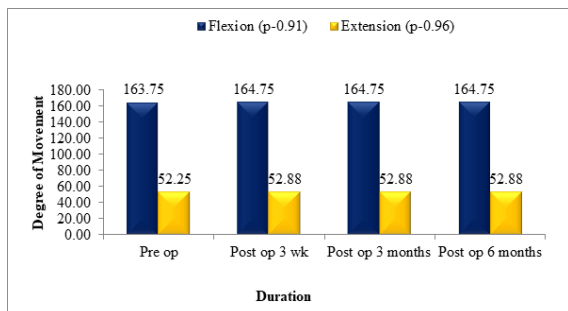
**Table 6: Comparison of various movements between preoperative and postoperative period**

Movements	Pre op	Post op 3 wk	Post op 3 months	Post op 6 months	p value
Flexion	163.75 $\pm$ 7.74	164.75 $\pm$ 8.16	164.75 $\pm$ 8.16	164.75 $\pm$ 8.16	0.92
Extension	52.25 $\pm$ 7.16	52.88 $\pm$ 6.39	52.88 $\pm$ 6.39	52.88 $\pm$ 6.39	0.96
Internal rotation	69.25 $\pm$ 7.97	70.75 $\pm$ 7.81	71.25 $\pm$ 7.74	71.25 $\pm$ 7.74	0.62
External rotation	80.75 $\pm$ 6.66	81.5 $\pm$ 5.91	81.88 $\pm$ 6.17	82.13 $\pm$ 6.09	0.77
Adduction	40.88 $\pm$ 2.97	40.75 $\pm$ 3.11	41.13 $\pm$ 3.3	41.13 $\pm$ 3.3	0.93
Abduction	86.25 $\pm$ 7.4	122.38 $\pm$ 17.25	134 $\pm$ 16.42	144.38 $\pm$ 19.05	< 0.001

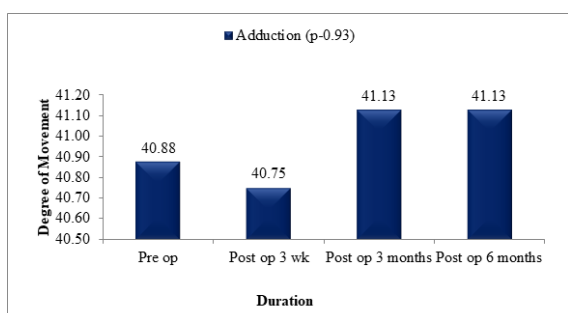
There was no significant difference in flexion, extension, internal rotation, external rotation and adduction after surgery. However, abduction was significantly improved after surgery. Pre operative abduction was 86.25  $\pm$  7.4° which was drastically improved after 1 week of surgery (122.38  $\pm$  17.25°, p < 0.001). At 3 months and 6 months after surgery, abduction movement was 134  $\pm$  16.42° and 144.38  $\pm$  19.05°.

**Table 7: Functional outcome following arthroscopic rotator cuff repair.**

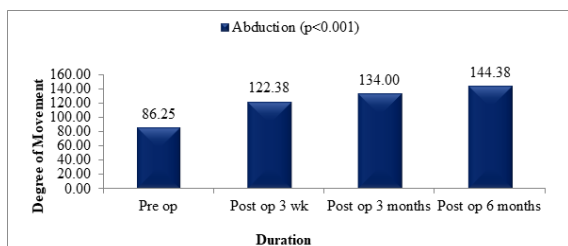
Outcome	Pre op	Post op 3 wk	Post op 3 months	Post op 6 months	p value
WORC score	55.55 ± 5.14	66.78 ± 3.93	77.4 ± 4.99	89.7 ± 7.94	< 0.001
DASH score	64.13 ± 8.74	56.45 ± 7.9	43.95 ± 6.79	30.63 ± 7.91	< 0.001
ASES score	50.75 ± 6.14	57.88 ± 5.84	67.15 ± 5.5	80 ± 8.18	< 0.001



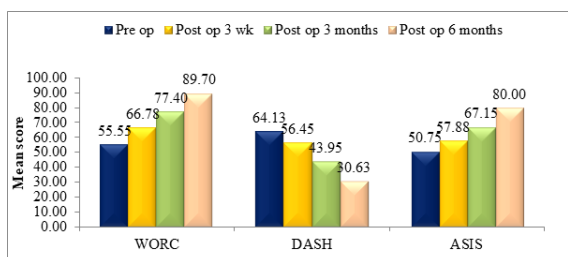
**Figure 6: Improvement in Flexion and extension movements after surgery**



**Figure 7: Improvement in adduction movement after surgery**



**Figure 8: Improvement in abduction movement after surgery**



**Figure 9: Functional outcome following arthroscopic rotator cuff repair.**

Pre operatively, WORC score was  $55.55 \pm 5.14$  which was significantly improved to  $66.78 \pm 3.93$  after 3 week of surgery. At 3 months and 6 months after surgery, WORC score was significantly improved to  $77.4 \pm 4.99$  and  $89.7 \pm 7.94$  ( $p < 0.001$ ). Similarly, pre operative ASIS score ( $50.75 \pm 6.14$ ) was significantly improved at 3 week ( $57.88 \pm 5.84$ ), 3 months ( $67.15 \pm 5.5$ ) and 6 months post

operative period ( $80 \pm 8.18$ ,  $p < 0.001$ ). Pre operative DASH score was  $64.13 \pm 8.74$  and significantly improved at 3 week of surgery ( $56.45 \pm 7.9$ ), 3 months of surgery ( $43.95 \pm 6.79$ ) and 6 month of

surgery ( $30.63 \pm 7.91$ ). p value was statistically significant.

## DISCUSSION

The goal of rotator cuff surgery is to alleviate shoulder pain and improve shoulder function. Arthroscopic management of rotator cuff tears has become the standard technique globally for the treatment of such lesions.

In the present study, the age of patients varied from 18 years to 80 years with a mean age of 51.80 (13.01) years which is comparable with the literature.<sup>[5,6]</sup> It can be correlated to the fact that incidence of rotator cuff tear occur most frequently in older population and found to be maximum in sixth and seventh decade in present study in accordance with the preview literature. Involvement of the right shoulder joint (in 77.5%) was found to be more than left shoulder (in 22.5%) in this study which is linearly correlated with more involvement of dominant over non-dominant shoulder. Other previous studies also showed similar trend of increased involvement of right over left shoulder or dominant over non-dominant shoulder. This trend can be attributed to the fact that the dominant hand takes as important role in performing heavy activities and also the aggressor and defending side.

In the present study, full thickness supraspinatus tear was present in all patients. Supraspinatus was most commonly involved tendon in rotator cuff tears. Similar observation was seen in study Vikram et al and Anurodh Shandily et al. In this study, we compared various test like Jobe's test, Speed's test, Impingement's test and Hawkin's test in preoperative and post operative period. In present study, all patient were positive for Jobe's test preoperatively (100%), Speed's test negative in all patient pre and post-operatively, Impingement test positive in 10% and Belly press test positive in 5% cases. In post-operative period, Jobe's test and Impingement test found positive in 2.5% cases, Belly press's test was negative. Statistically significant difference was observed for Jobe's test ( $p < 0.01$ ). Similar study showed that pre-operatively, clinical test which was Impingement sign positive in 95% whereas 81.58% of patients showed negative Impingement's sign and in 92.5%. Hawkin's positive whereas 3% were negative which were statistically non-significant.<sup>[6]</sup> Similar observation was seen in Vikram et al study, SW Khoo et al and Brian et al. In the present study, initially patients



underwent physical therapy and subacromial steroid injection. In the follow up of conservative management, patients had complaints of pain, stiffness and weakness in shoulder. MRI revealed rotator cuff tear, so, we took up the patients for surgery to improve the functional outcome of the patients. Similar observations were seen in various studies.<sup>[6,7]</sup>

All patients showed good range of motion postoperatively. In all patients, abduction was significantly improved after surgery. Preoperative abduction was 86.25 which was drastically improved after 3 week of surgery (122.38 p < 0.001). At 3 months and 6 months after surgery, abduction movement was 134 and 144.38. There was no significant difference in flexion, extension internal rotation, external rotation and adduction preoperatively and after surgery. Similar observation was seen in study Vamsinath P et al and Hannu E et al. In present study, functional outcomes was assessed with various scoring system like WORC score, DASH score and ASES score score preoperatively, at 3 week of surgery, 3 months of surgery and 6 months of surgery. Preoperatively, WORC score was 55.55 which significantly improved to 66.78 after 3 week of surgery. At 3 months and 6 months after surgery, WORC score was significantly improved to 77.4 and 89. Preoperative ASES score (50.75) was significantly improved at 3 week (57.88), 3 months (67.15) and 6 months post operative period (80, p < 0.001). Preoperative DASH score was 64.13 and significantly improved at 3 week of surgery (56.45), 3 months of surgery (43.95) and 6 month of surgery (30.63). p value was statistically significant in all score8. Our study showed very similar result to that performed by A. Diniz Lopes et al, Brian. Cole et al., and SW Khoo et al.<sup>[8-10]</sup>

In present study, superficial skin infection and stiffness were noted in a single case (2.5%). Although sample size was quite small in present study, which is a limitation of the study and hence we recommend a study with large number of patients and longer follow up period for.

## CONCLUSION

We concluded that arthroscopic rotator cuff repair surgery with single row technique is minimally invasive procedure which along with early aggressive physiotherapy and rehabilitation protocol, allows patients to return to their pre-injury level with good range of motion, excellent outcomes and negligible complications.

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