RESEARCH PAPER

Does arthroscopic transosseous repair of postero superior rotator cuff differ in functional outcomes as with double row suture anchor repair? A comparitive study

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ABSTRACT:

BACKGROUND:

Arthroscopic double row repair of rotator cuff with suture anchors is a common procedure with excellent functional outcomes, however there exist concern with implant cost, utility in osteoporosis especially in rural population and females respectively. recently trans osseous methods have been available for the same with the aim of repairing the rotator cuff like the double row repair. there are limited clinical studies in this regard. the purpose of this study was to demonstrate the clinical efficacy of arthroscopic trans osseous rotator cuff repair as compared with the existing methods of repair with suture anchors.

METHODOLOGY:

This is a randomized prospective comparative study from a single centre between 2022 to 2025. consecutively presenting rotator cuff patients underwent arthroscopic trans osseous double row repair (GROUP A-AT) or with suture anchor (GROUP B-SA). The demographic parameters and disabilities was recorded and post op follow-up of 3 months,6 months,1 year follow-up with constant score , ASES score and oxford scores.

RESULT:

There were 30 patients GROUP A(AT-15); GROUP B (SA-15) with mean age of 56 years (44 to 72 years) of male female ratio 19:11, there was no significance in parameters and comorbidities involvemt of subscapularis of biceps tendon(P-0.59) constant score, ASES score, oxford score. The mean scores after 3,6,12 months in the trans osseous group (30.2,34.40,37.33,40.27).in the suture anchor group (30,34.3,37.67,40.60). the functional outcomes of significantly good improvement in the trans osseous group as like suture anchor group (P-value <0.01).3 cases in suture anchor had anchor pullout, lateral row failure noted in suture anchor.

CONCLUSION:

Arthroscopic repair of the rotator cuff with trans osseous method provides equivalent functional outcome results with double row repair, it also avoids the complication associated with suture anchor.

KEYWORDS: Arthroscopic rotator cuff repair, Trans osseous fixation, Suture anchor, Functional outcomes, Double-row repair

How to cite this article: Dr Praveen K*, Dr Narendran P, Dr Pinnama Reddy Bhargava Reddy, Dr Santhosh Kumar, Dr Balaji S | Does arthroscopic transosseous repair of postero superior rotator cuff differ in functional

outcomes as with double row suture anchor repair? A comparitive study | Int J Drug Deliv Technol. 2026;16(4s): 157-168, DOI: 10.25258/ijddt.16.157-168

Source of support: Nil.

Conflict of interest: None

INTRODUCTION:

Rotator-cuff injuries (RCI), commonly encountered musculoskeletal condition in orthopaedic practice, have symptoms ranging from asymptomatic to severe pain. It has high prevalence, as their natural history suggests a positive correlation between tear incidence and age (beyond 4th decade of life). These conditions are usually due to trauma, sometimes degenerative and accompanied by severe pain, weakness, shoulder abduction dysfunction, and the course of the condition may vary from tendinopathy, which leads to partial tear, eventually complete tears affecting the activities of daily living. Apart from age, smoking habits, hypercholesterolemia, and traumatic injuries are other factors. Several investigators have documented an occurrence of these RCI ranging from 5% - 40%. Pain, reduced shoulder strength, and reduced activity should alert the treating physician topay attention to the onset or severity of an RC tear. Most part of diagnosis is clinical, confirmed using MRI and in rather instances USG. Non-surgical modalities are the first option, are advocated for partial tears; however, studies have found surgical treatment to be more effective than nonsurgical treatment. Surgical repair is chosen in cases of large tears or when these non-surgical modalities fail (symptomatic tears which fail to heal by 3 months). The primary objective of the surgery is to alleviate pain, restore strength, improve function, and enhance flexibility. An RC tear can be repaired through various suturing techniques, including arthroscopic surgery, open surgery, or a hybrid approach combining both methods. Early surgical repair is necessary in view of preventing complications like upward displacement of the humerus head, osteoarthritis & to restore activities of daily living. Gold standard surgical repair of RC involves open & trans osseous repair. Literature supports weakness of deltoid, undermining of subscapularis and biceps tendon. With the advent of arthroscopy these fallacies have been attested. In the recent decade, arthroscopic repair is considered the benchmark technique. The arthroscopic rotator cuff repair (ARCR) uses small incisions and specialized instruments for precise treatment, minimizing tissue disruption. Generally associated with lower complication risks, less postoperative pain, quicker recovery, and smaller scars. Suture anchors are the first choice in ARCR with various materials and patterns being employed; Single row, double row, and trans osseous-equivalent (TOE) double-row techniques. However, ARCR with suture anchors has few technical difficulties: Challenges in revision surgery due to existing anchors in the greater tuberosity, short-term retear, anchor migration, knot impingement, and, though less common, bone osteolysis in the greater tuberosity. Added cost and chance of implant pull outs are the pitfalls. To address these shortcomings, trans osseous repair which originally only possible through an open approach—was adapted for use in an entirely arthroscopic procedure. Since Cicak et al. first proposed arthroscopic trans osseous rotator cuff repair in 2006, numerous techniques have been developed to perform this procedure entirely arthroscopically. However, most of these methods necessitate specialized instruments for tunnel creation or suture passage. Recently, various trans osseous jigs have been developed for arthroscopic use, making arthroscopic repair feasible and enabling the restoration of the original trans osseous technique. Varied aetiology of the tear, symptoms, course of the condition, and status of the function may affect and modify the surgeon decision on choosing the treatment approach. Thereby, to choose an appropriate treatment, the clinician must have sufficient evidence on the functional outcomes of these two All-arthroscopic techniques: Suture Anchors and Trans osseous Method. Given the inadequate research in this area. The present review focuses on these lacunae and seeks to assess and compare the functional results of rotator cuff repair done through trans osseous methods and suture anchors.

AIM AND OBJECTIVES:

AIM:

Goal of this present research seeks to evaluate the arthroscopic rotator cuff repair outcome between suture anchors And Trans osseous Method

OBJECTIVES

PRIMARY OBJECTIVE: To study and compare the functional outcomes of arthroscopic rotator cuff

repair done through trans osseous and suture anchors methods.

SECONDARY OBJECTIVE:

-To investigate complications derived from both suture anchors and trans osseous techniques

-To evaluate the results with CONSTANT, ASES AND OXFORD scores.

-Study of Impact of Factors on RC repairs. To study and evaluate the impact of multiple factors on the outcome of RC repairs such as patient age & sex, side affected - dominant or non-dominant shoulder along with Duration of symptoms.

MATERIAL AND METHODS

STUDY DESIGN:

This is an in vivo, Prospective, randomized controlled study.

SOURCE OF THE DATA:

The data for the current study were collected from September 2023 through February 2025. This study was performed on patients with RC tears of the shoulder presenting to our OPD and willing for surgery at Orthopaedics Department, VMKVMCH, Salem, India. This study was conducted after getting an Ethical clearance from the Institution Ethical Committee (IEC) of VMKVMCH, Salem, India.

INCLUSION CRITERIA:

-Patients suffering from shoulder problems like pain, abduction deficiencies and with loss of range of movements at shoulder

-Patients with long standing shoulder pain and injury to shoulder

-Patients above age of 18 years

EXCLUSION CRITERIA

-Patients with active infections

-Inflammatory and Infectious conditions of shoulder joint

-Patients having arthroscopy done previously

-Patients with comorbidities that prevent surgical intervention

RESULTS:

Table 1: Mean age distribution among both groups

	Suture anchors group(n=15)	**Trans osseous group(n=15)**	**p-value**
Mean age (in years)	60.20±9.44	56.07±8.36	0.215

Table2: Gender distribution among the groups

Gender	**Suture anchors-group (n=15)**		**Transosseous-group (n=15)**		**p value**
	Number	**Percentage**	**Number**	**Percentage**	
Male	10	66.67%	9	60%	0.58
Female	5	33.33%	6	40%	

Table 3: Distribution of presenting complaints among the groups

Presenting complaints	**Suture anchors group (n=15)**		**Transosseous group (n=15)**		**p value**
	Number	**Percentage**	**Number**	**Percentage**	
pain and restricted external rotation	9	60%	6	40%	0.39
pain and restricted internal and external rotation	4	26.70%	4	26.70%	
pain and restricted internal rotation	2	13.30%	5	33.30%	

Table 4: Distribution - Abduction deficiency of various degrees among the groups

Abduction deficiency	**Suture anchors group (n=15)**		**Transosseous group (n=15)**		**p value**
	Number	**Percentage**	**Number**	**Percentage**	
Abduction <30 degrees	1	6.70%	1	6.70%	
Abduction <40 degrees	0	0%	3	20%	

Abduction <50 degrees	5	33.30%	3	20%	0.132
Abduction <60 degrees	5	33.30%	8	53.30%	
Abduction <70 degrees	3	20%	0	0%	
Abduction <90 degrees	1	6.70%	0	0%	

Table 5: Distribution- Shoulder involved among the groups

Shoulder involved	Suture anchors group (n=15)		Transosseous group (n=15)		p value
	Number	Percentage	Number	Percentage	
Right	8	53.30%	5	33.30%	0.462
Left	7	46.70%	10	66.70%	

Table6: Distribution - Mode of Injury among the groups

Mode of Injury	Suture anchors group (n=15)		Transosseous group (n=15)		p value
	Number	Percentage	Number	Percentage	
Degenerative	3	20%	2	13.30%	0.692
Heavy weight lifting	2	13.30%	5	33.30%	
Self fall	8	53.40%	8	53.40%	
RTA	2	13.30%	0	0%	

Table 7: Distributi0n of duration of signs and symptoms among the groups

Duration of signs and symptoms	Suture anchors group (n=15)		Transosseous group (n=15)		p value
	Number	Percentage	Number	Percentage	
<2 months	3	20%	6	40%	0.656
2 months -<4 months	7	46.70%	5	33.30%	
4 months-<6 months	1	6.70%	1	6.70%	
6 months-<8 months	0	0.00%	2	13.30%	
8 months - 10 months	1	6.70%	0	0.00%	
10 months- <1year	0	0.00 %	0	0.00 %	
1year-5years	3	20%	1	6.70%	

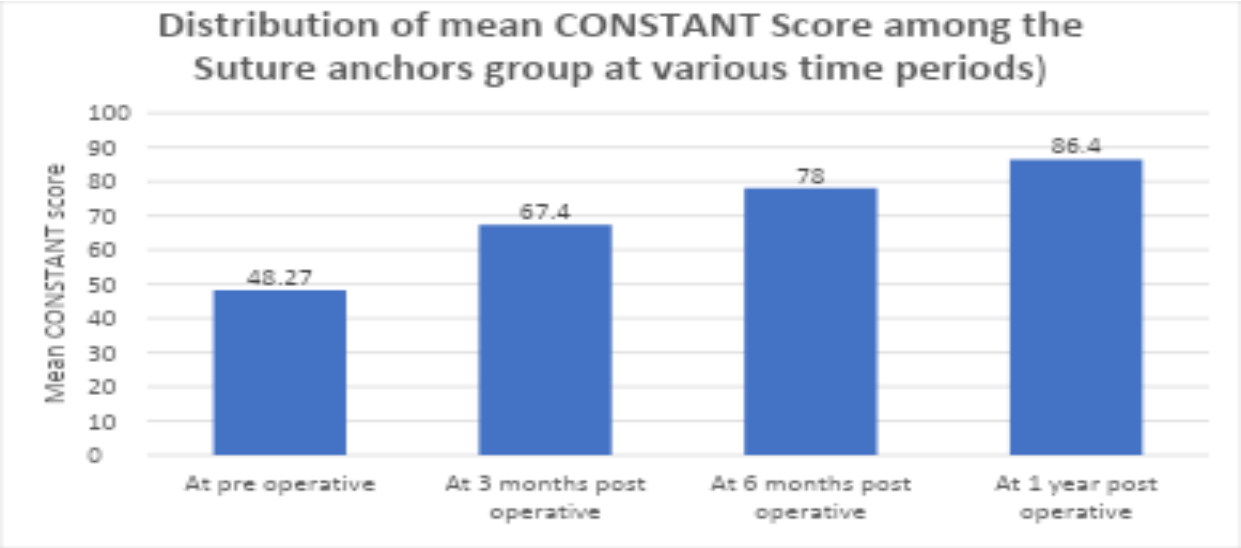
Table 8: Distribution of Comorbidities among the groups

Comorbidities	Suture anchors group (n=15)		Transosseous group (n=15)		p value
	Number	Percentage	Number	Percentage	
Nil	**10**	**66.70%**	**10**	**66.70%**	**0.518**
CAD	**1**	**6.70%**	**0**	**0%**	
HTN,T2DM	**0**	**0%**	**2**	**13.30%**	
Hypothyroidism	**1**	**6.70%**	**0**	**0%**	
HTN	**3**	**20%**	**2**	**13.30%**	
T2DM,RA	**0**	**0%**	**1**	**6.70%**	

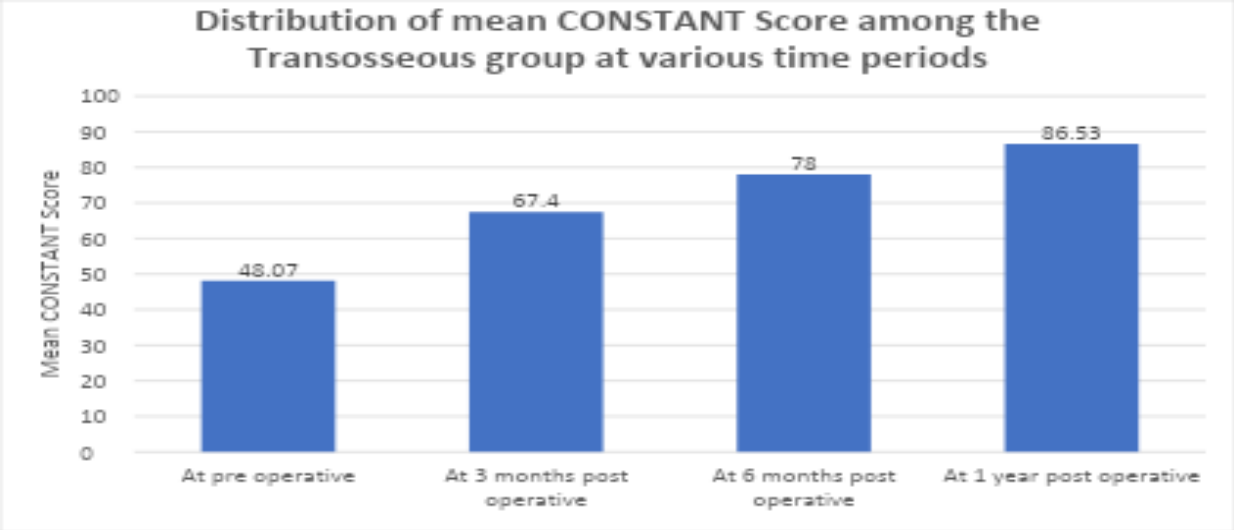
Table 9 : Distribution of Arthroscopic findings among the groups

Arthroscopic findings	Suture anchors group (n=15)		Transosseous group (n=15)		p value
	Number	Percentage	Number	Percentage	
Supraspinatus tear	14	93.30%	11	73.30%	0.59
Infraspinatus tear	8	53.30%	5	33.30%	
Subscapularis tear	6	40%	7	46.70%	
Long head biceps tear	0	0%	1	6.70%	

GRAPH 1: Distribution of mean CONSTANT Score among the Suture anchors group at various time periods



GRAPH 2: Distribution of mean CONSTANT Score among the Transosseous group at various time periods



GRAPH 3: Distribution of mean ASES Score among the Suture anchors group at various time periods

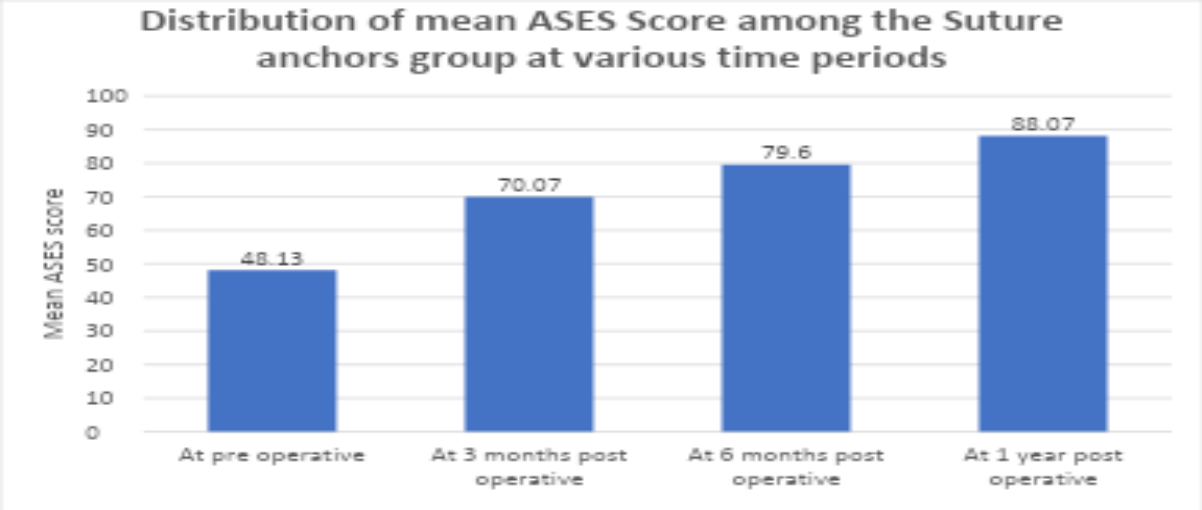
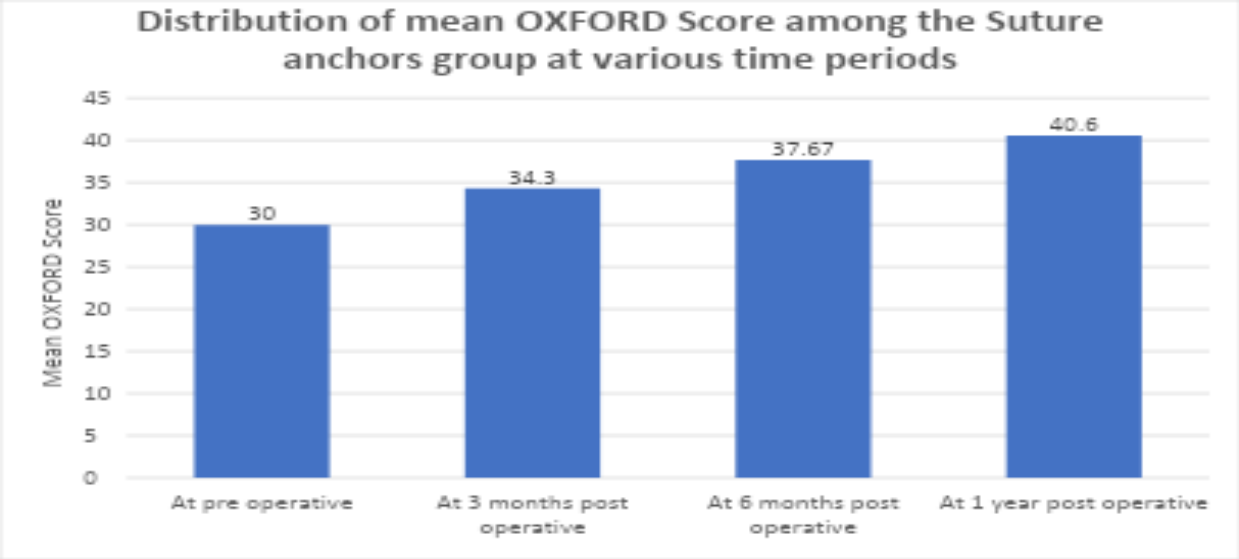


Table10: Distribution of mean ASES Score among the trans osseous group at different time periods

Mean ASES Score	trans osseous group (n=15)	
	Mean	Standard deviation
At pre operative	50.67	6.17
At 3 months post operative	68.67	4.76
At 6 months post operative	80.4	6.19
At 1 year post operative	88.2	7.60

GRAPH 4: Distribution of mean OXFORD Score among the Suture anchors group at various time periods



GRAPH 5: Distribution of mean OXFORD Score among the trans osseous group at various time Period

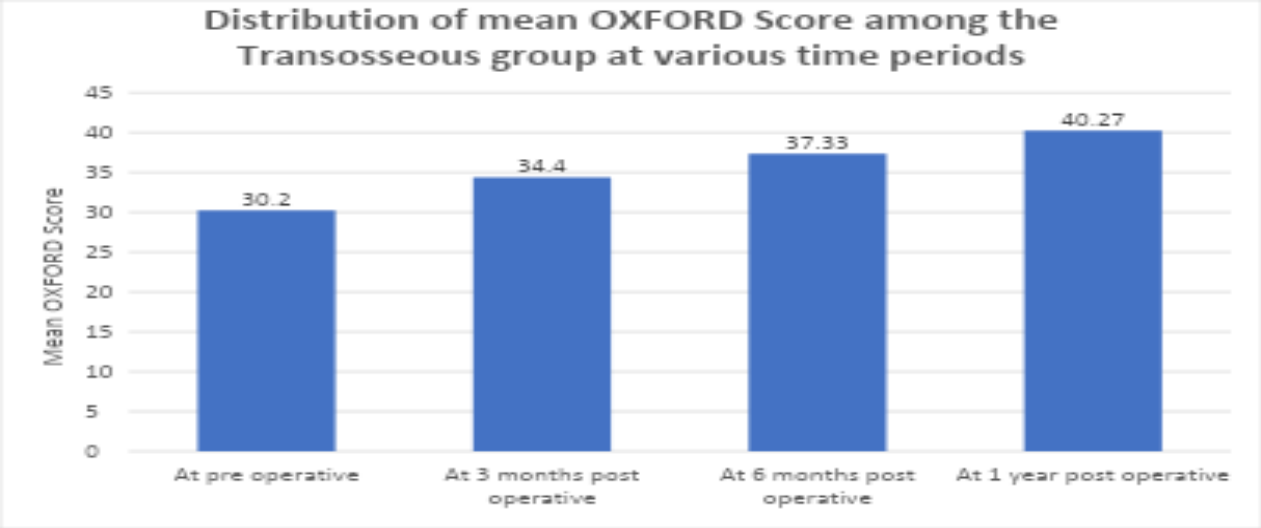


Table 11: Distribution of paired difference of various scores among the groups at various time periods

Paired difference between	Suture anchors group (n=15)			Transosseous group (n=15)		
	Mean	Standard deviation	p-value	Mean	Standard deviation	p-value
Mean-CONSTANT Score (At Pre operative - At 1 year Post operative)	-38.13	7.83	<0.01	-38.47	6.99	<0.01
Mean ASES Score (At Pre operative - At 1 year Post operative)	-39.93	7.67	<0.01	-37.53	6.88	<0.01
Mean OXFORD Score (At Pre operative - At 1 year Post operative)	-10.60	4.32	<0.01	-10.07	2.82	<0.01

Table 12: Distribution of Final result/Outcomes among the Suture anchors group

Final result/Outcome	Suture anchors group (n=15)	
	Number	Percentage
Excellent	10	66.7%
Good	3	20%
Poor	2	13.3%

Table 13: Distribution of Final result/Outcomes among the trans osseous group

Final result/Outcome	Trans osseous group (n=15)	
	Number	Percentage
Excellent	9	60%
Good	4	26.7%
Poor	2	13.3%

Table 14: Distribution of Post -operative complications among the Suture anchors group

Complications	Suture anchors group (n=15)	
	Number	Percentage

Nil	11	73.30%
Suture anchor pull out	4	26.70%

Table 15: Distribution of post-operative complications among Transosseous group

Complications	**Transosseous group (n=15)**	
	Number	**Percentage**
Nil	**15**	**100%**
Suture anchor pull out	**0**	**0%**

Table 16: Association of Various factors on the Final Outcome

Factors		**Final Outcome**						
		Excellent (n=19)		**Good (n=7)**		**Poor(n=4)**		**p value**
		No.	**Percentage**	**No**	**Percentage**	**No.**	**Percentage**	
Age	41-50 years	2	10.5%	2	28.6%	2	50%	0.04
	51-60 years	13	68.4%	1	14.3%	1	25%	
	61-70 years	4	21.1%	2	28.6%	1	25%	
	>70 years	0	0%	2	28.6%	0	0%	
SEX	M	12	63.2 %	6	85.7 %	1	25%	0.315
	F	7	36.8 %	1	14.3 %	3	75%	
Shoulder involved	Right (Dominant Shoulder)	8	42.1%	3	42.9%	2	50%	0.959
	Left (Non dominant Shoulder)	11	57.9%	4	57.1%	2	50%	
Duration of symptoms	<2 months	11	57.9%	4	57.1%	1	25%	0.466
	>2 months-6 months	6	31.6%	1	14.3%	2	50%	
	>6 months-1 year	2	10.5%	1	14.3%	1	25%	
	>1 year	0	0%	1	14.3%	0	0%	
Comorbidities	Nil	14	73.7%	4	57.1%	2	50%	0.086
	CAD	0	0%	0	0%	1	25%	
	HTN,T2DM	1	5.3%	1	14.3%	0	0%	
	Hypothyroidism	1	5.3%	0	0%	0	0%	
	HTN	3	15.8%	2	28.6%	0	0%	
	T2DM,RA	0	0%	0	0%	1	25%	

DISCUSSION:

The comparison of functional outcomes between arthroscopic RC repair using trans osseous and suture anchor methods has been a topic of interest in orthopaedic research for management of RC tears. Both techniques aim to restore shoulder function and alleviate pain, yet they differ in biomechanical properties and healing potential. Studies suggest that the trans osseous technique, which avoids hardware-related complications, may provide a more natural healing environment, whereas suture anchors offer a more straightforward and reproducible method with less surgical time. The evaluation of outcomes using CONSTANT, ASES, and OXFORD scores provides a comprehensive assessment of pain, strength, and overall shoulder function. Complication rates and influencing factors, such as patient age, sex, dominance of the affected shoulder, and symptom duration, play a crucial role in determining surgical success. Older patients may have compromised tendon healing, while dominant shoulder involvement can impact post-operative rehabilitation. The trans osseous method may reduce

implant-related issues but could be technically demanding, while suture anchors carry a risk of anchor pullout or cyst formation. A thorough evaluation of these factors helps in patient selection and tailoring surgical approaches to optimize functional recovery The current review addresses this gap and reviews and compares the functional outcomes of RC repair performed via trans osseous techniques & those performed by suture anchors. The current randomised controlled trial included thirty patients with RC tears who were willing to undergo surgical repair. they were randomly categorized into 2 equal groups; GroupA: 15 patients underwent ARCR with suture anchors and Group B: 15 patients underwent ARCR with trans osseous method.RC tears have a wide range of severity from very minor issues like a tendinopathy to very serious things like full-fledged tears. [1-6] Whereas acute trauma causes some of these RC tears, most are degenerative in nature, correlating with aging and repetitive polymerization. [7,8]. The existence of these injuries can be traced back to great apes meaning they have long played a role in the musculoskeletal system. Athletes, people doing manual labour and those over 50 years old will experience RC tears frequently. [9]

Group A presented with pain + restricted external rotation in 60% and in group B 40%; pain + restricted internal rotation in group A 13.30% and group B 33.30%; pain + restricted internal + restricted external rotation presenting symptoms in group A 26.70% and group B 26.70%. Pain particularly the night pain that disturbs the sleep is the most common symptom, which predominantly describes as tender localizes just outside the overlying deltoid muscle. Multiple researches have showed that, amount of RC tear size or severity is not directly related to the level of pain experienced. Dunn et al [10] reported no association of anatomic characteristics determining the severity of atraumatic RC tears in relation to pain level. Abduction deficiency of0.05), the results were statistically not significant. Common symptoms identified in literature is reduced functional range of motion, muscle weakness, and some pain on special movements, namely between 60 and 120 degrees of abduction. [11].In current study group A common shoulder involved was right shoulder while group involved was left shoulder, which correlates with study of Dunn et al, who found dominant shoulder involved in 69% patients.

In our study Self fall was the most (common model of injury) group A- 53. 4%; and group B-53. 4%), then heavy weight lifting (group A-13. 3%; and group B-33. 3%), and less RTA and degenerative changes were noted among the groups. Traumatic injuries, such as shoulder dislocations or avulsion injuries, especially in high-impact activities, can lead to rotator cuff tears. Many patients have a clear event or incidents that they can recall that preceded the onset of their acute symptoms. [11]. In contrast, degenerative tears are usually multifactorial in nature with age-related degeneration also being common — the tendons lose resilience with aging and become more susceptible to injury. Dynamic changes can occur due to both external and internal factors that eventually lead to chronic tendon degeneration with or without overt rupture culminating in a complete tear. [11]

In the current study, most patients in both group A and group B, 65.1% in group A and 79.8% in group B reported having signs and symptoms for 2-4 months, and 19.5% in group reported having signs and symptoms for<2 months. This contrasts with Dunn et al's study. A quarter of the patients had symptoms lasting between one and three months, 20 percent for 4-6 months, 15 percent 7-12 months, and 36 percent for greater than one year. [10] Supraspinatus was the most common tear noted in both the groups in the present study (group A-93. 30%, and group B-73. 3% respectively), and then infraspinatus tear (group A-53. 30%, and group B-33. 3%) and subscapularis tear (group A-40%, and group B-46. 7%). Them least was Long head bicep tear (group A-0%, and group B-6. 7%). Where complete tears occur in the rotator cuff, symptoms correlate closely with the location of injury. Patients with these tears have five times the likelihood of having symptoms than those with stable tears. Furthermore, anterior tears can involve rotator cuff fibers and are degenerative [7]. These tears are displaced with less stiffness than posterior crescent tears, which is associated with increased tone pressure in the region [12].In Dunn et al study, the tear was limited to the supraspinatus in 72% patients; the supraspinatus& infraspinatus, +/- teres minor, in 21%; & to subscapularis in 7%. [10]In this study in both the groups, the constant scores were increased with time, highest during 1 year. Castanga et al [13] observed a significant increase in constant scores with time with an overall greater constant score in favour of double anchor arthroscopic group versus the transosseous

arthroscopic groupThe ASES score, which evaluates pain, satisfaction, and function, indicates high rates of good to excellent outcomes for both the groups in the present study. ASES scores increased with time, and the highest was noted during 1 year. Studies by Sauerbrey [68], Weber [69], Severud [70], and Verma [71] demonstrate significant improvements in ASES scores for both techniques, with no significant difference between them. These findings suggest that all types of arthroscopic approaches are effective for rotator cuff repairs, offering similar benefits in terms of patient-reported outcomes.

In the present study, the OXFORD scores increased with time in both the groups, and highest was noted during 1 year. These were in accordance with Sandow et al [14], Giorgi et al [15] and Rajsirish et al [16]. In this study, in 66.7% of the patients in group A had excellent results, 20% had good results, while 13.3% had poor results, while 60% of the patients in group B had excellent results, 26.7% good results and 13.3% poor results. In study by Castanga et al [13] good and fair results were obtained in 3 and 1 patients, respectively, very good and excellent results were observed in 11 and 7 patients, respectively. The results were excellent-10, very good-9, good-2, & fair in 1 patient for the shoulders treated with the suture-anchor technique. This part was consistent with the present study. Giorgi et al [15] found the Arthroscopic trans osseous rotator cuff repair technique and the SA (suture-anchor) technique to be associated with significant short-term improvement and satisfactory subjective outcome scores with low complication & failure rates. There was no difference in outcome between techniques. In the present study, in group A, 26.7% had Suture anchors pull out, while in the Trans osseous group no complications were noted. This was in accordance with Castanga et al [13]. Suture anchor pull-outs were observed primarily in postmenopausal women, patients with osteoporotic bones, and those with underlying rheumatoid arthritis. These factors contribute to poor bone quality, reducing the stability of suture anchors. Osteoporosis and rheumatoid arthritis weaken the bone structure, making it less capable of holding the anchors securely. This highlights the need for alternative techniques like the trans osseous method in patients with compromised bone density.

A statistically significant association between the outcome and age was noted. (P value =0.04) No significant association was noted between outcome and other factors such as gender, shoulder involved, duration of symptoms and comorbidities. Literature reveals that Tear size and age are major determinants of the disease's progression. Small tears of a single tendon may remain stable over time, while large tears of two tendons may progress and cause structural deterioration. Younger patients (<60 years) with complete tears tend to be better able to cope with pressure and resistance to spread than older patients. (>60 years).[12] In contrast to the present study, Dunn et al [72] studied increased comorbidities ($p = 0.002$), lower education level ($p = 0.004$), & race ($p = 0.041$) as the only strong factors related with pain on presentation. No measure of RC tear severity co-related with pain ($p > 0.25$). Surgical repair techniques for RC tears have significantly evolved, noticeably from open to arthroscopic approaches. The development of RCR techniques started with ORCR in 1911, which yielded good to excellent results with significantly reduced pain and improved shoulder function. However, it was associated with certain limitations, such as increased pain, risk of infection, and a longer recovery time due to the extensive nature of the surgery and the need for deltoid muscle healing. [11] Consequently, mini-open (MO) surgery lessens the invasiveness of conventional open procedures by integrating the benefits of both open and arthroscopic techniques. It uses a smaller open incision and often includes arthroscopic evaluation and decompression. This technique offers similar functional outcomes as open repair but with potentially less postoperative pain and quicker recovery due to minimal deltoid disruption, facilitating an earlier return to activities. The arthroscopic rotator cuff repair (ARCR) uses small incisions and specialized instruments for precise treatment, minimizing tissue disruption. Generally associated with lower complication risks, less postoperative pain, quicker recovery, and smaller scars. However, it requires significant surgical expertise, and long-term data on its efficacy is still limited. To overcome difficulties of Trans osseous RC repair, such as difficulty with revision surgery due to anchors remaining in the greater tuberosity as well as anchor dislodgement, an mechanistic arthroscopic trans osseous technique has been developed to combine the minimal invasiveness of the arthroscopic procedures together with the biomechanical advantages of the open procedures. Objective of RC repair is to alleviate pain & enhance the function and strength of the affected shoulder. A successful repair necessitates strong repair integrity

with minimal to no residual gaps, ensuring stability under repeated stress, and promoting effective tendon healing on the bone. To determine the outcome of the two commonly used techniques, it is necessary to compare them both in the short and long term to determine which surgical technique can provide the appropriate results. Analysing these can let the surgeon choose a tailored plan for each patient. The limitations of the study are the small sample of subjects and the short follow-up. However, we find that both suture anchors and trans osseous arthroscopic are equally effective in repair of RC tears.

CONCLUSION:

Rotator cuff tears, ranging from tendinopathy to full-thickness tears, impair shoulder function and cause significant pain, impacting daily activities. The progression of RC repair techniques has drastically improved results, reducing invasiveness & recovery times. Tear size and age is a critical factor influencing surgical outcomes. Despite this, both these AR techniques are effective in addressing tears of varying sizes, with the specific repair method being less impactful on long-term outcomes compared to the tear size itself. Long Term study rate is needed due to the degenerative tear caused due to the construct of the study which is outside the boundaries of this research. The results of this study suggests that both suture anchors and trans osseous arthroscopic are equally effective in repair of RC tears. However, considering the complications in these two techniques, our study found fewer complications in the trans osseous arthroscopic group. Both the trans osseous arthroscopic RC Repair and the suture anchors are promising techniques and are equally reliable in RC repair with high success rate showing improvement in the postoperative period with faster recovery enabling return to resume daily activities (measured with CONSTANT SCORE). However, research with larger sample size & longer follow-up must be performed to further validate our result. In conclusion, advancements in RC repair techniques have enhanced surgical outcomes &patient rehabilitation. The choice between the techniques depends on individual patient needs and surgeon expertise. Continued innovation in surgical methods and rehabilitation strategies will further optimize results and patient satisfaction.

CONFLICT OF INTEREST: NIL

FINANCIAL SUPPORT: NIL

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