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Partial rotator cuff repair versus debridement for irreparable rotator cuff tears: A systematic review

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ABSTRACT

Introduction: Massive irreparable rotator cuff tears (MIRCT) are a significant cause of shoulder disability and pain, presenting a unique challenge in terms of management with multiple options for care ranging from debridement alone to partial rotator cuff repair. In this study we investigate how clinical outcomes and complications of partial rotator cuff repair compare to simple debridement in the treatment of irreparable rotator cuff tears.

Materials and methods: A total of 1594 publications were identified on PubMed from 1946 to 2017 with 16 level III to level IV studies that were reviewed according to Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines.

Results: A total of 709 shoulders from 706 patients were reviewed, with 380 patients receiving a partial repair and 329 shoulders receiving debridement. Fifteen outcome measures were utilized with visual analog scale (VAS) pain score and patient satisfaction being the most common. Pre- and post-operative mean VAS scores reported in 155 shoulders treated with partial repair were 6.0 (5.1–6.9) and 2.0 (1.7–3.2), respectively. Pre- and post-operative mean VAS scores in 113 shoulders treated with debridement were 6.5 (4.5–7.9) and 1.9 (1–2.9), respectively. Patient satisfaction in 111 shoulders treated with partial repair was reported as 75 % (51.6–92). In 153 shoulders treated with debridement, post-operative satisfaction was 80.7 % (78–83.9).

Conclusion: This systematic review study demonstrates that both partial repair and debridement alone can result in acceptable clinical outcomes with no significant differences noted for patients with irreparable rotator cuff tears in short to mid-term follow up.

1. Introduction

Massive irreparable rotator cuff tears (MIRCT) can result in significant disability and shoulder pain.[1] Patients with this condition present a challenging treatment dilemma for surgeons when non-operative management has failed. Various treatment options have been described depending on activity level, patient age, and degree of disability, in addition to rotator cuff tissue tear and quality patterns. These options include tendon transfers, partial rotator cuff repair, reverse total shoulder arthroplasty, subacromial spacer, superior capsular reconstruction, and debridement alone.[2] Many times it can be difficult to assess the repairability of a rotator cuff tear by MRI alone, leaving the surgeon with a decision to make on whether to attempt repair. When the surgeon arthroscopically assesses the rotator cuff and it is found to be irreparable, at times the surgeon is unable to completely repair the rotator cuff tear and thus left with a partial repair.

Surgical debridement of MIRCT is one treatment option that has been described in the literature with low morbidity and cost.[1] Previous literature supports the role of debridement alone in patients with pain in the setting of preserved shoulder function.[1] Advantages of debridement include an abbreviated rehabilitation protocol, short operative time, and low risk of complications compared to more extensive reconstructive procedures.[1] A debridement procedure typically consists of debridement of the degenerative cuff, bursectomy, and addressing biceps pathology.

Partial rotator cuff repair is another common treatment option when facing MIRCT. This principal was first reported by Burkhart in 1994 with an open procedure and then later described arthroscopically in 2001.[3,4] The force couple between the subscapularis and infraspinatus tendons is thought to be restored through partial repair. The active motion of the shoulder is impaired when this couple is disturbed by a massive rotator

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cuff tear. However, with restoration of this force couple, the shoulder is often provided with adequate function despite a persistent defect in the supraspinatus tear.[5]

To our knowledge, there has been no systematic review evaluating surgical outcomes after partial rotator cuff repair versus simple debridement in the setting of a MIRCT. This study aimed to evaluate clinical outcomes and complications after partial rotator cuff repair in comparison to simple debridement for irreparable rotator cuff tears.

2. Methods

2.1. Research framework

The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines were used during the search and reporting phase of this review.[6]

2.2. Eligibility criteria

Studies were eligible for inclusion if the following criteria were met: (1) patients had irreparable rotator cuff tear; (2) treatment with either partial repair or debridement, (3) minimum one year follow-up, (4) outcome scores (pre- and post-operative) were reported, (5) published in English.

2.3. Information sources

A computerized, systematic search of the literature in the Medline/Pubmed Database (US National Library of Medicine, National Institutes of Health) from 1946 to December 2017 was performed. In order to retrieve relevant articles that may have been missed during the computerized search, the reference lists of all selected articles were assessed. The electronic database algorithm search intentionally used broad terms and was not limited by study design to maximize the capture of articles.

2.4. Search

Databases were searched using the following key terms: (((massive cuff tear) OR irreparable cuff tear) OR (debridement and cuff)) OR (partial repair and cuff) OR (biceps and massive cuff) OR (biceps and irreparable cuff).

2.5. Study selection

Titles and abstracts were independently screened by 3 authors (Z. B·H., J.T.M, and S.R.L.) to identify relevant articles. If eligibility could not be determined based on the information in the abstracts, full text articles were read. If the reviewers had disagreements, it was resolved by consensus to reduce any potential bias.

2.6. Data collection process

A data extraction sheet was developed based on the different objective outcome scores of the included articles. One author extracted the data, and a second author extracted and validated the data once completed (Z.B.H. and J.T.M.). Data collected included patient demographics, technique descriptions, outcomes measures and scoring, Hamada classification, and complications of procedures. For outcomes measures, mean scores and descriptive statistics were collected and tabulated. All eligible studies were tabulated in Table 1 and available outcomes measures were listed. Studies with missing data points such as summary statistics were excluded. No additional statistical analysis or meta-analysis was performed.

3. Results

The PubMed database search produced 1594 publications in total. After nonrelevant title exclusion, 147 abstracts were reviewed. From the reviewed abstracts, 27 articles were obtained with full text. After the application of exclusion criteria, 16 publications met inclusion criteria for this systematic review. Fifteen studies were level IV evidence and one study was level III evidence. All studies were single-center studies. After evaluation of the reference lists from the full-text articles, no additional studies were included (Fig. 1).

Of the 16 included studies, seven evaluated partial rotator cuff repair, seven evaluated rotator cuff debridement, and two involved both debridement and partial repair. Eleven studies used arthroscopic techniques, four studies employed open techniques, and one study used a mini-open technique for partial repair and arthroscopy for debridement

Table 1
Publication reporting outcomes of debridement and partial repair for irreparable rotator cuff injuries.

Author	Year	Journal	Level of Evidence	Operation performed	Technique	No. of shoulders	Minimal Follow Up	Mean Follow Up (Mo.)	Outcomes
Cuff	2016	JSES	IV	Partial repair	Arthroscopic	28	5	71.7	ASES, SST, VAS, ROM, Patient satisfaction, Failure rate, Complication rate, AHD
Shon	2015	AJSM	IV	Partial repair	Arthroscopic	31	2	40.5	ASES, SST, VAS, Patient satisfaction, AHD
Kim	2011	Arthoscopy	IV	Partial repair	Arthroscopic	27	2	41.3	SST, Patient satisfaction, AHD, UCLA, Constant
Duralde	2005	JSES	IV	Partial repair	Open	25	2	N/A	ASES, VAS, ROM, Patient satisfaction, Failure rate, Complication rate, AHD, Strength, Night pain
Chen	2016	Arthoscopy	IV	Partial repair	Arthroscopic	37	2	29.6	ASES, VAS, Failure rate, AHD, Night pain
Porcellini	2011	JSES	IV	Partial repair	Arthroscopic	67	5	N/A	SST, Complication rate, AHD, Constant
Godeneche	2016	ESSKA	IV	Partial repair	Arthroscopic	23	2	41	Strength, Constant, SSV
Liem	2008	Arthoscopy	IV	Debridement	Arthroscopic	31	2	47	ASES, Patient satisfaction, Strength, Constant
Lee	2011	Arthoscopy	IV	Debridement	Arthroscopic	32	2	40	VAS, ROM, Failure rate, AHD, UCLA, Constant
Klinger	2005	Arch Orthop	IV	Debridement	Arthroscopic	33	2	31	Patient satisfaction, AHD, Constant
Park	2016	JSES	IV	Debridement	Arthroscopic	16	7	98	VAS, ROM, Patient satisfaction, Failure rate, AHD, UCLA, Constant
Rockwood	1995	JBJS	IV	Debridement	Open	53	3	80	ROM, RC-QOL
Gartsman	1997	JBJS	IV	Debridement	Open	33	2	N/A	ASES, VAS, ROM, Patient satisfaction, Complication rate, UCLA, Constant, RC-QOL
Ellman	1993	Arthoscopy	IV	Debridement	Open	40	2	54	ROM, Patient satisfaction, Complication rate
Franceschi	2012	KSSTA	III	Partial repair	Arthroscopic	68	5	93.6	VAS, ROM, UCLA, RC-QOL
Konig	2017	Open Orthop	IV	Partial repair	Mini-Open	165	2	N/A	ASES, Constant, DASH

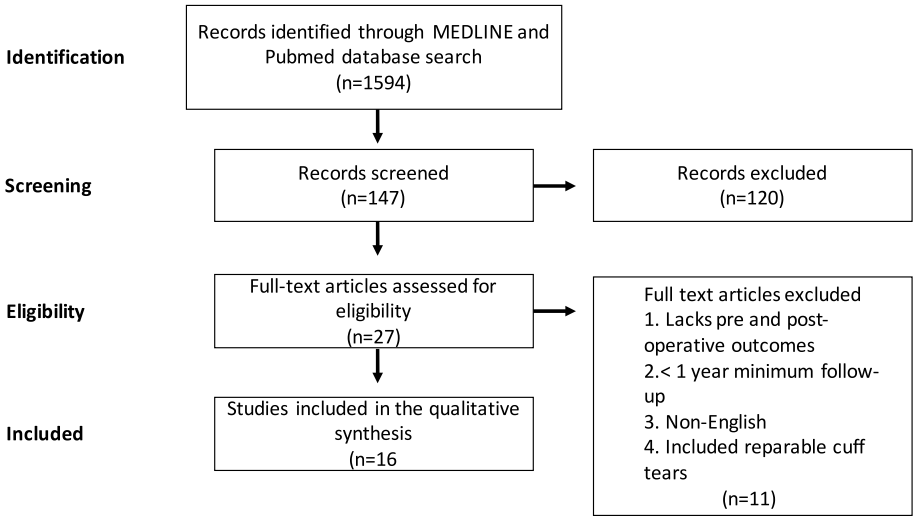

Fig. 1. Literature selection algorithm.

(Table 1).

3.1. Patient demographic data

The 16 studies meeting the systematic review inclusion criteria consisted of 709 shoulders from 706 patients. The partial repair group included 380 patients and the debridement group included 329 shoulders. Of the studies (10) that provided gender demographic data, there were 182 female patients and 353 male patients. For partial repair studies, the mean age was 64.5 years. For debridement studies, the mean age was 72.9. The follow-up mean was 44.8 months for the partial repair studies and 56.5 months for the debridement studies.

3.2. Technique

Among the studies that evaluated partial repair (9), seven were performed arthroscopically, one used a mini-open technique and 1 used an open technique. There was variability between the authors on the appropriate treatment of the biceps tendon at the time of partial repair with 77 reported biceps tenotomies and 23 reported biceps tenodesis in the 380 shoulders. The authors attempted to repair rotator cuff to restore the force couple; however, information is not available for which tendons they were able to repair.

Among the nine studies that evaluated rotator cuff debridement, six were performed arthroscopically and three were performed using an open technique. In these studies, there was also variability in the treatment of the biceps tendon with 64 reported biceps tenotomies and six reported biceps tenodesis. The principal of debridement was focused on pain relief with faster recovery time.

3.3. Outcome measures

A total of 15 different outcome measures were reported in the studies included in this systematic review. The outcomes most frequently reported included the visual analog scale (VAS) pain score and patient satisfaction. Overall outcomes scores are summarized in Tables 2 and 3, stratified by treatment type. (Tables 2 and 3 VAS scores were reported in 155 shoulders (5 studies) treated with partial repair with a mean pre-operative score of 6.0 (5.1–6.9) and post-operative mean of 2.0 (1.7–3.2). It was reported in 113 shoulders (4 studies) treated with debridement with a mean pre-operative score of 6.5 (4.5–7.9) and post-operative mean of 1.9 (1–2.9) giving a 4.6 improvement. Patient satisfaction was reported in 111 shoulders (4 studies) treated with partial repair with a mean postoperative satisfaction of 75 % (51.6–92). It was reported in 153 shoulders (5 studies) treated with debridement with a postoperative satisfaction of 80.7 % (78–83.9).

Table 2
Functional outcome measures of partial repair.

Outcome Measure		No. of studies	No. of shoulders	Mean preoperative score	Mean postoperative score	Change in outcome
Hamada class		6	215	7	7.5	0.5
Visual analogue scale		5	155	6	2	−4
ASES		4	121	43.9	77.9	34
Simple Shoulder Test		4	153	4.7	8.2	3.5
Patient satisfaction		4	111	N/A	75.00 %	
Constant score		3	117	39.9	74.1	34.2
Failure Rate		3	90	N/A	14.00 %	
Complication rate		3	120	N/A	3.00 %	
ROM	FF	3	87	131.2	157.2	26
	ER	3	87	40.9	47.8	6.9
UCLA		2	61	9.6	27.4	17.8
Night pain		2	62	73 %	10 %	−63 %
Muscle strength	Unspecified	1	23	1.5	2.6	1.1
	FF	1	25	3.6	4.5	0.9
	ER	1	25	3.5	4.5	1
SSV postoperatively		1	23	N/A	70.2	
DASH		1	108	N/A	25	
RC-QOL		1	34	N/A	73.2	

**Outcomes only included if they had preop and post data available except for SSV.

Table 3
Functional outcome measures of debridement.

Outcome Measure		No. of studies	No. of shoulders	Mean preoperative score	Mean postoperative score	Change in outcome
Patient satisfaction (postop)		5	153	N/A	80.70 %	
ROM	FF	5	168	112.4	136.5	24.2
	ER	4	115	48.4	55	6.7
	IR	2	66	40.9	49.9	9.1
	Abduction	1	16	116	123	7
Visual analogue scale		4	113	6.5	1.9	−4.6
Constant score		4	114	38.9	60.6	21.7
UCLA		4	115	11.2	24.2	13
RC-QOL		3	120	N/A	37	
Hamada class		2	48	5.1	4.6	−0.4
ASES		2	64	25.6	62.6	37
Failure Rate		2	48	N/A	9.40 %	
Complication rate		2	73	N/A	5.80 %	
Muscle strength (Biceps)		1	31	6.1	6.3	0.2
DASH		1	57	N/A	41.3	

3.4. Hamada classification

Changes in the Hamada AHD classification was reported in 215 patients (6 studies) treated with partial repair. The pre-operative score was 7.0 (6.1–8.32) and the post-operative score was 7.5 (5.9–9.1). Only 48 shoulders (2 studies) were evaluated for AHD classification changes in the debridement group. These studies showed a mean preoperative score of 5.1(5–5.1) and a mean postoperative score of 4.6 (4–5.3).

3.5. Complications

In the partial repair group, complication rates were reported in 120 shoulders (3 studies) and failure rates were reported in 90 shoulders (3 studies). Complication rates were 3.0 % (0–9%), and structural failure rates were 14 % (8–41 %) on average. Complications listed in this group were increase in glenohumeral arthritis with persistent pain and stiffness postoperatively that necessitated further surgery. In the debridement group, complication rates were reported in 73 shoulders (2 studies) and failure rates were reported in 48 shoulders (2 studies). Complication rates were 5.8 % (2.5–9.1 %) and failure rates were 9.4 % (6.3–12.5 %) on average. Complications included three seromas and an infection.

4. Discussion

In regard to treating irreparable rotator cuff tears, this systematic review is the first in the literature to evaluate outcomes of partial rotator cuff repairs verses rotator cuff debridement. Previous studies looking at these two treatment modalities have been limited to case series. Both treatment modalities, partial rotator cuff repair or debridement of MIRCTs, demonstrated improvement in clinical outcomes. Furthermore, the overall improvement in patient satisfaction and pain scores was similar without any significant differences in complications or failure rates.

Previous literature has supported partial repair of the rotator cuff as an effective treatment option for irreparable rotator cuff tears.[2,7–12] The advantages of partial repair were first described by Burkhart et al. as restoring the force couple of the infraspinatus to the subscapularis.[4] This study showed that despite having large rotator cuff tears, patients were able to maintain shoulder function, made possible by balancing the axial and coronal forces of the glenohumeral joint. The goal in a partial repair is to repair the rotator cuff enough to achieve a functional state of the shoulder.[3] There are pre-operative factors that negatively affect partial repair outcomes. Within these studies, both preoperative superior humeral head migration and high-demand patients did poorly following partial repair. Patients with AHD changes pre operatively did better with debridement.[13] Restoration of strength is another potential advantage of partial repair compared to debridement.[5,8] In studies by Duralde et al. and Konig et al. the authors suggest that such an improvement in strength may factor into the higher functional scores at long term follow up compared to patients undergoing debridement alone.[8,14] In this review we were unable to compare strength of the patients in the two groups due to a lack of data collected in the previous studies. Another advantage seen from our data was a slight improvement of AHD in the partial repair group versus progression of the AHD in the debridement group. In our review, the partial repair group had an average constant score improvement of 34.2 compared to 21.7 in the debridement group.

One potential disadvantage of partial repair in irreparable rotator cuff tears is the association of fatty atrophy in many irreparable cuff tears.[14] Many large, retracted tears are chronic in nature and have a significant amount of atrophy seen on MRI. This has been associated with higher re-tear rates at long term follow up.[14] Partial repair is also associated with longer surgery time and prolonged recovery after surgery.[14] This is an important consideration in this elderly population. The last disadvantage of partial repair is the need for post-operative immobilization and rehab protocols. Many low demand patients need to be able to use their arm immediately postoperatively and may not have the ability to effectively participate in rehab.[15]

Rotator cuff debridement has been shown to be an effective treatment option for low demand patients.[1,16–21] Advantages of debridement include lower reported complication rates and the use of an accelerated rehabilitation program.[22] Patients that undergo rotator cuff debridement have been shown to have improved pain scores and high satisfaction in the immediate post-operative period.[14] Liem et al. showed that after arthroscopic debridement of irreparable rotator cuff tear, there was a patient satisfaction rate of 83.9 %.[1] The decreased operative time and decreased cost of the procedure are other important considerations when choosing between partial repair and debridement. Our study showed similar VAS, patient satisfaction, and ASES scores in the two groups.

The main disadvantage associated with debridement alone is the lack of improvement in strength seen post-operatively.[1] This weakness points to the need for appropriate patient selection. In the face of proper patient selection, debridement can be an appropriate treatment option for low demand patients with irreparable rotator cuff tears.

This systematic review is not without limitations. The only studies available for the review have a low evidence level. Also, there are no randomized control trials between the two treatment strategies. There is also a potential for selection bias as those older and lower functioning patients may be more likely to have undergone debridement as the mean age was older than the partial repair group. There is also heterogeneity in how the different surgeons addressed the biceps causing it to be hard to tease out the effect that it may play in these patients. The last limitation is in possible differences within the partial repair group regarding which tendons could be repaired.

5. Conclusion

Our systematic review study demonstrates that in patients with irreparable rotator cuff tears, both partial repair and debridement alone can result in acceptable clinical outcomes. Although the two treatment modalities demonstrated no significant differences in short to mid-term follow up, the appropriate treatment must be individualized to the patient. Each treatment strategy presents its own advantages and disadvantages, and patient selection and goals remain crucial when selecting the appropriate surgical option.

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Ethical statement

This is not human subject research. The authors agree that this systematic review represents honest and original research.

Guardian/patient's consent

This is a systematic review and therefore a parent/guardian consent is not applciable

CRediT authorship contribution statement

Zane B. Hyde: Conceptualization, Investigation, Writing – original draft, Visualization. **James T. McMurtrie:** Investigation, Writing – original draft, Methodology. **Sung R. Lee:** Investigation, Writing – review & editing, Visualization. **Sudarsan Murali:** Investigation, Writing – original draft, Writing – review & editing. **Mathew D. Hargreaves:** Writing – review & editing, Visualization. **Brent A. Ponce:** Conceptualization, Supervision, Writing – review & editing. **Eugene W. Brabston:** Conceptualization, Supervision, Writing – review & editing. **Amit M. Momaya:** Conceptualization, Methodology, Writing – review & editing, Project administration.

Declaration of competing interest

The authors have no relevant conflicts of interests to report.

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