# Analysis of failed rotator cuff repair – Retrospective survey of revisions after open rotator cuff repair

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## RESEARCH

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## ABSTRACT

### Background
Rotator cuff defects are frequently occurring shoulder pathologies associated with pain and movement impairment.

### Aims
The aim of the study was to analyse the pathologies that lead to operative revisions after primary open rotator cuff repair.

### Methods
In 216 patients who underwent primary rotator cuff repair and later required operative revision between 1996 to 2005, pathologies found intraoperatively during the primary operation and during revision surgery were collected, analysed and compared.

### Results
The average age at the time of revision surgery was 54.3 years. The right shoulder (61.6 per cent) was more often affected than the left, males (63.4 per cent) more often than females. At primary operation – apart from rotator cuff repair – there were the following surgical procedures performed: 190 acromioplasty, 86 Acromiclavicular joint resections, 68 tenodesis, 40 adhesiolysis and 1 tenotomy. If an ACJ-resection had been performed in the primary operation, ACJ-problems were rare in revision surgery ($p<0.01$). Primary gleno-humeral adhesions were associated with a significant rise in re-tearing rate (p=0.049). Primary absence of adhesions went along with a significant lower rate of adhesions found at revision (p=0.018). Primary performed acromioplasty had no influence on re-tearing rate (p=0.408) or on the rate of subacromial impingement at revision surgery (p=0.709).

### Conclusion
To avoid operative revision after rotator cuff repair relevant copathologies of the shoulder have to be identified before or during operation and treated accordingly. Therefore, even during open rotator cuff repair, the surgeon should initially start with arthroscopy of the shoulder joint and subacromial space to recognise co-pathologies.

### Key Words
Rotator cuff, failed surgery, repair

## What this study adds:

### 1. What is known about this subject?
The present study analyses the reasons for the revision of a patient group with previous care for a rotator cuff repair.

### 2. What new information is offered in this study?
As the present work shows, the co-pathologies which significantly influence the outcome must be considered as well as the quality of the RM reconstruction itself in order to avoid a revision operation.

### 3. What are the implications for research, policy, or practice?
Even if a rotator cuff reconstruction is performed openly, an arthroscopy should always be carried out first, in order to correctly assess co-pathologies.

## Background

Defects of the rotator cuff are one of the commonest shoulder pathologies causing pain and restricted range of movement presented to the orthopaedic surgeon. Peak incidences are found in the age range of 55–59 years. Recurrent defects can occur after primary operative repair, often leading to chronic complaints, need for revision surgery, loss of employment or unfitness to work with socioeconomic consequences.

This retrospective study looks at the data of 216 patients, who underwent primary open rotator cuff repair and later revision operation of the same shoulder from 1996–2005. Of particular interest were the following pathologies (rotator cuff defects, adhesions, subacromial impingement, pathology of the acromioclavicular joint or the long tendon of biceps) which were identified and treated during primary operation compared with those identified during the revision surgery.

## Methods

Included in the study were 216 patients, who underwent revision operation of the shoulder following primary open rotator cuff repair.

Not included in the study were cases with post-operative infections or complicated wound healing following primary surgery, cases where the primary surgery consisted of side to side sutures, cases where rotator cuffs could only be partially repaired, also all cases of traumatic rotator cuff lesions and cases which already required tendonshift or transposition surgery during the primary operation.

## Results

Medium age at revision surgery was 54.3 years. The right shoulder joint was more often affected than the left (61.6 per cent *vs.* 39.4 per cent), males more often than females (63.4 per cent *vs.* 36.6 per cent).

Revision surgery used arthroscopy in 65 cases (30.1 per cent), arthroscopy followed by open access in 81 (37.5 per cent), and primary open access in 70 cases (32.4 per cent).

Primary surgery used open access in all cases and - apart from rotator cuff repair - also performed were: acromioplasty in 190 cases (88 per cent), tenodesis in 68 cases (32 per cent), tenotomy in 1 case (here six tendons were already ruptured), ACJ-resection in 86 cases (41 per cent) and adhesiolysis in 40 cases (19 per cent). 7 cases (3 per cent) were in addition diagnosed with cartilage damage.

During revision surgery, the following pathologies were found:

Re-tears of rotator cuff in 124 (57 per cent), subacromial impingement in 76 (35 per cent), long biceps tendon problems in 84 (39 per cent), adhesive capsulitis in 61 (28 per cent), chondromalacia in 56 (26 per cent) of cases.

In some patients pathologies were isolated, as in 23 cases (11 per cent) with isolated rotator cuff re-tears, in 13 cases (6 per cent) with isolated ACJ-problem, 12 cases of adhesive capsulitis (6 per cent), in 10 cases (5 per cent) with isolated long tendon of biceps problem and 6 cases (3 per cent) of insufficient acromioplasty.

In 16 cases (7 per cent), none of the evaluated pathologies were present. Hence, multifactorial causes were found in 62 per cent of the cases.

In cases with partial tear at primary surgery, findings of re-rupture rate was significantly lower at revision surgery (p=0.07), whereas in cases with primary triple-tendon-defect, re-rupture rate was high at 57.1 per cent (p=0.006).

Following primary ACJ-Resection, there were significant less ACJ-problems recorded at revision surgery (*p*<0.071).

Adhesions, which already required arthrolysis during primary operation, were found to lead to a significantly greater re-rupture rate of the rotator cuff. The group of patient, who did not require primary arthrolysis, subsequently also had a significantly smaller rate of frozen shoulder (Table 1).

## Discussion

Eighty-eight percent of the patient cohort had subacromial impingement to some degree during primary surgery, prompting the surgeon to perform an acromioplasty. This approach goes conform to one of the targets promoted by Neer,[1] i.e., removal of impingement. Newer studies by Nyffeler et al.[2] confirm the significant connection between presence of a lateral acromial osteophyte and rotator cuff defects.

Work by Goldberg et al.[3] although shows that refraining from acromioplasty and thereby preserving the integrity of the coracoacromial ligaments, using an open surgical approach, leads to a good functional outcome in selected patients.

A modern technique to circumvent this apparent contradiction may be to perform an arthroscopic

intervention as shown by Lo et al.,[4] achieving good functional results. Nho et al.[5] performed acromioplasty in all participating patients who underwent arthroscopic repair of rotator cuff defects.

Tenodesis was found to be necessary in only 10.5 per cent at follow-up of 105 shoulders with chronic rotator cuff defects compared with 2.8 per cent primary LBS-rupture and 31.5 per cent tenodesis at primary surgery.[6]

Remarkably Nho et al.[5] – using an arthroscopic approach – performed tenodesis in only 4.7 per cent.

Cofield et al.,[6] using open surgery, found 53.3 per cent of ACJ – Resections, which is slightly more than the rate of 40.8 per cent found in our study. This contrasts with a rate of only 11.8 per cent in arthroscopic rotator cuff repair by Nho et al.,[5] but notably a smoothing of the ACJ was performed in 22.0 per cent of cases here.

19.4 per cent of primary adhesiolysis in our cohort compares with a rate of 4-17 per cent frozen shoulder in the literature.[7] The adhesive capsulitis is thought of as a multifactorial process, which is, according to Ewald,[8] still poorly understood and has a tendency to resolve spontaneously.

Retearing of the rotator cuff is a well-known and often recorded problem.[9] For primary small defects the re-tearing rate following open repair is reported to be 10–36 per cent. The figures correspond well to those following primary arthroscopic repair. For primary large defects and massive ruptures re-tearing rates have been found to be in the range of 65 per cent and more.[10-12] Hedtmann et al.[13] performed sonography in 200 consecutive patients who underwent rotator cuff reconstruction and found that re-tearing took place almost exclusively within the first three months postoperatively, in all probability related to poor healing. The following risk factors are said to adversely affect healing rate post reconstruction: age,[14] nicotine abuse,[15] follow up and compliance of the patient, suture technique,[16] impingement, subluxation of the long biceps tendon, balance between solidity of reconstruction, freedom from tension and sufficient vascularisation, infection of the gleno-humeral joint, intake of NSAIDs[17] and glucocorticoids, diabetes mellitus etc.[18,19]

In our study, we found that in patients who underwent additional acromioplasty during primary surgery, the ACJ-problem recurred in 27.9 per cent, whereas in patients with no primary intervention, the ACJ- problem recurred in 75 (2 per cent) (Figures 1-3).

Oh et al.[20] also found significant better results in view of re-operation rates, pain reduction and function at the 2 year follow up of the group who underwent additional ACJ-resection compared with the no-intervention group.

With 8.3 per cent persisting frozen shoulder our results are in line with findings by Halbgewachs and Buess,[21] who in contrast though already used an arthroscopic approach for the primary surgery. Huberty et al.[22] reported a persisting frozen shoulder in only 4.9 per cent of 489 cases of arthroscopic reconstruction.

Their study is an example of the increasing numbers of arthroscopic operations heralding a change in operative strategy and reaping evidently excellent results.

Our cohort presented with 38.9 per cent long tendon of biceps-problems at revision. Because of a lack of corresponding data in the literature, this could not be evaluated. It is, however, well known, that the rupture of the Long Tendon of Biceps relates closely to degenerative changes of the shoulder joint and in particular to those of the rotator cuff. A study by Boszotta and Prunner[23] of 216 minimal open rotator cuff reconstructions confirmed this, as primary existing long tendon of biceps -pathology corresponded to significant worse postoperative outcomes.

The revision of 667 rotator cuff ruptures by Watson and Sonnabend[24] indicated though, that a rupture of the long tendon of biceps did not adversely affect the outcome of the rotator cuff repair. These findings concur with our results.

## Conclusion

The presented study indicates, that to avoid revision operations, identifying co-pathologies known to significantly influence outcome is just as important as the quality of the rotator cuff reconstruction itself.

Therefore, good planning is paramount, before and during primary operation, as well as in case of revision surgery. Planning should include pre-operative clinical examination and imaging as well as intra-operative diagnostic procedures to screen for and identify common co-pathologies, which could be multiple.

If an open approach is chosen for rotator cuff repair, it should be preceded by arthroscopy, to recognise pathologies such as partial tears adjacent to the articular surface, long tendon of biceps problems, chondromalacias and adhesions of the gleno-humeral joint. To avoid revision

operations it is important to exclude with certainty, or identify and treat, possible co-pathologies of the ACJ, the LB tendon, chondromalacia or frozen shoulder during primary surgical repair of rotator cuff defects.

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## PEER REVIEW

Not commissioned. Externally peer reviewed.

## CONFLICTS OF INTEREST

The authors declare that they have no competing interests.

## ETHICS COMMITTEE APPROVAL

By letter dated 11.12.2014 consent is given by the ethics committee of the FAU Erlangen 372_14Bc

**Table 1: Localisation of Retearing depending on initial lesion at primary surgery**

| Affected tendons at revision surgery | | | | | |
|---|---|---|---|---|---|
| Affected tendons at primary surgery | Partial tear | SSP | SSP+ISP | SSP+SSC | SSP+ISP+SSC |
| partial tear | 0 | 6 | 1 | 0 | 1 |
| SSP | 3 | 54 | 24 | 5 | 3 |
| SSP+ISP | 1 | 6 | 5 | 0 | 1 |
| SSP+SSC | 0 | 4 | 1 | 0 | 0 |
| SSP+ISP+SSC | 0 | 5 | 1 | 1 | 1 |

Tendon of–M. supraspinatus=SSP, M. infraspinatus=ISP, M. subscapularis=SSC

**Figure 1: Frequency of ACJ – problems present at revision surgery with or without ACJ - resection during primary surgery**
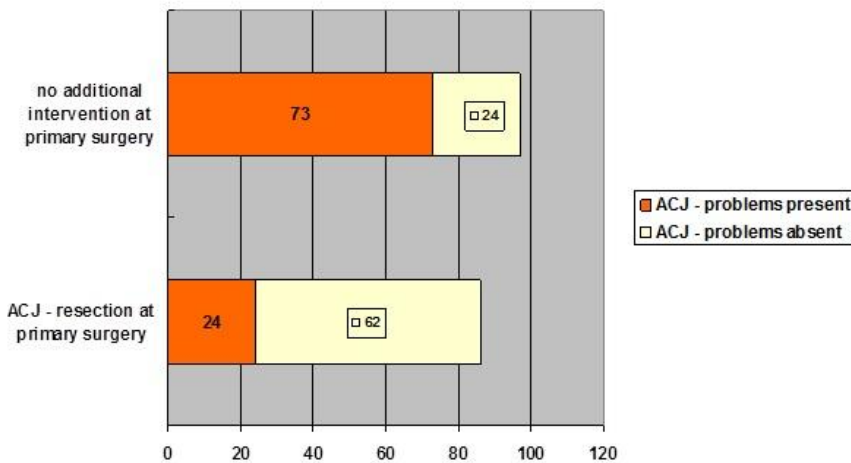


**Figure 2: Frequency of frozen shoulder present at revision surgery with or without adhesiolysis during primary surgery**
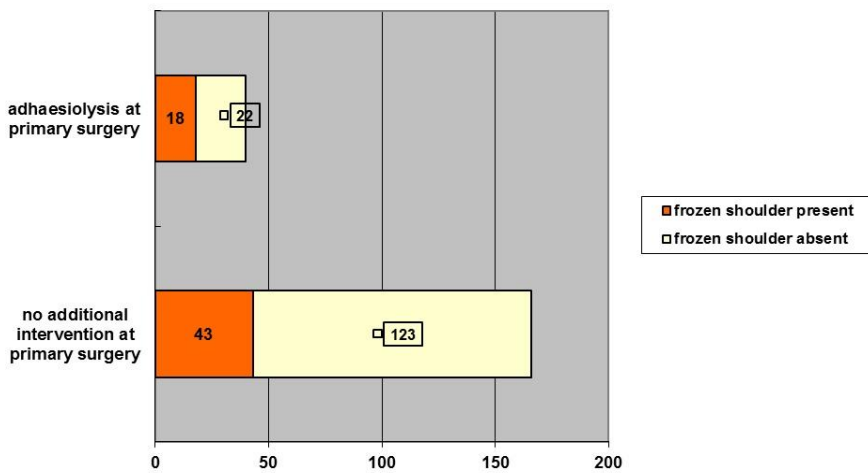
**Figure 3: Frequency of subacromial impingement in patients with or without acromioplasty at primary surgery**