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## Research Article

# The Management of large and massive rotator cuff tears- Current trends amongst UK shoulder surgeons

## Abstract

**Background:** Management of large and massive rotator cuff tears remains controversial. Such tears are often irreparable, and results of treatment are unpredictable. This study documents the current practice of orthopaedic surgeons in the British Elbow and Shoulder Society.

**Methods:** A questionnaire was prepared pertaining to the management of large and massive rotator cuff tears with minimal degenerative changes in three age groups: Patients of 50 years (young), 65 years (still active), aged 75 years (elderly) were considered. Various risk factors for failure of repair were considered.

**Results:** Physiotherapy and arthroscopic debridement were the most commonly selected management options in young and middle groups in cases of a large/massive rotator cuff tear. Patch repairs were offered by 30% of respondents overall. Latissimus dorsi transfer was utilised by 30%, 8% and 2% respectively in each age group. Reverse shoulder replacement was indicated by 8%, 36% and 76% respectively.

**Discussion:** There was a marked inconsistency in the pre-op planning and number and choice of options between respondents. Most surgeons offered non-augmented repairs in a scenario where they admitted failure was likely. The need for a multicenter trial is widely recognised and 87% of respondents were willing to participate in such a trial.

## Introduction

Large and massive rotator cuff tears, (usually defined as 3-5 cm in any direction for large, greater than 5 cm for massive), can be painful and severely compromise function. They can be difficult to manage in terms of pain relief and restoration of function is not always achievable. Not all large and massive cuff tears are symptomatic and the reasons why some patients are able to cope, maintaining overhead activity, whilst others suffer with a flail or pseudoparalytic shoulder is not understood. There is a spectrum of symptoms not always reflective of the size of the tear [1-3].

Surgical repair of this category of rotator cuff tear has a high rate of re-rupture [4-6]. Several factors affect the outcome of repair including patient age, presence of comorbidities, size and chronicity of tear, quality of tendon tissue, degree of muscle atrophy and the tension applied during the tear [4, 5, 7-10].

There are a large number of treatment options available but there is a general lack of consensus within the surgical

community on how to apply these, and a wide variation has been reported on the perceived need for surgical management [11,12]. Even in our own large orthopaedic centre we observed significant variation in the experience of shoulder fellows in their training on how to manage large and massive rotator cuff tears. There appeared to be little consensus in terms of the options and techniques for management used. In addition, there was concern that a large number of patients were being referred with borderline or non-repairable rotator cuff tears that had been previously managed conservatively or surgically without repair with apparent success for the short to medium term, with subsequent progression to significant symptoms.

The aim of this study was therefore to determine current practices and opinions among upper limb surgeons in the UK regarding management of large and massive rotator cuff tears.

## Methods

### Questionnaire design

The questionnaire (Appendix 1) included 20 items related

to treatment of large and massive rotator cuff tears in patients who have pain, loss of overhead activities and lack of response to conservative treatment (including anti-inflammatory medication and corticosteroid injections). Minimal degenerative glenohumeral joint changes were specified to exclude rotator cuff arthropathy.

The questions were designed by the first author with input from two experienced shoulder surgeons within the department to determine how shoulder surgeons would manage various scenarios and how they would change their treatment strategy for different age groups. Surgeons were able to choose more than one option in a given age category, to determine if there were a hierarchy of interventions that were being considered.

The treatment ages considered in this study were as follows: age 50 (young group), 65 years (middle-aged group) and 75 years (elderly group). Rotator cuff tears of this size would usually be considered unusually large for patients in the young group. The middle-aged group would be considered economically and physically active. Patients 75 years and over were expected to lead a more sedentary lifestyle with fewer functional demands.

The first two questions dealt with availability and opinion of efficacy of the anterior deltoid rehabilitation programme. Questions 3 to 5 enquired as to management of massive tears with pain and loss of function where conservative management had failed and the tendon was not fully repairable at surgery. The question was posed in all three ages. Question 6 asked at what age the respondent would consider a reverse total shoulder arthroplasty (RSA) in a patient with a flail or pseudoparalytic shoulder, again without significant degenerative changes. Question 7 asked the circumstances in which a surgeon would consider augmentation of the repair with a patch. Question 8 asked the nature of any patch considered. Questions 9–12 dealt with the response to known risk factors for failure of surgical repair, including fatty atrophy of the muscle belly of the rotator cuff. Questions 13–18 asked regarding repair with further risk factors in the three age groups which were considered to be highly significant with regard to recurrence of tear, i.e. thinned atrophic tendon and a repair under high tension. A follow-on question asked how the surgeon would manage the patient in the event of failure and recurrence of symptoms. Question 19 asked how the long head of biceps tendon was managed. Question 20 asked whether participants would be willing to participate in a national trial.

A wide variety of treatment options were provided reflecting the current literature, and surgeons were also given the option of making free text comments.

### Study population

The survey was submitted to and approved by the research committee of the British Elbow and Shoulder Society (BESS). The study population was drawn from the BESS UK database. A link to the questionnaire was sent to 470 UK shoulder surgeons (consultants and senior registrars) who were members of BESS email addresses registered with the society.

### Analysis

Questionnaire responses were analysed descriptively and common trends were identified.

### Results

134 complete questionnaires were received (28.5% of the total 470 surgeons surveyed), a comparable response rate to previously published BESS surveys [13–15].

#### Conservative management of rotator cuff tears

Nearly all respondents (93%, n=124) had access to a physiotherapist who could teach an anterior deltoid rehabilitation programme. Most (87%, n=1110/126) considered the rehabilitation programme to be effective.

Management of patients with chronic massive tears with minimal degenerative changes, loss of overhead activity pain and failed conservative treatment.

Physiotherapy and arthroscopic debridement were the most commonly selected management options in the young and middle-aged groups. Their selection by approximately two-thirds of surgeons remained consistent across age groups, including those in the elderly group (Figure 1). The use of acromioplasty also remained constant across all age groups, selected in 20–25% of cases. With increasing age, there was a trend away from rotator cuff repair of any sort, and towards suprascapular nerve block and reverse total shoulder replacement, with the latter the most commonly selected management option in the elderly group.

#### Minimum age for reverse total shoulder arthroplasty

Six percent of respondents reported that they would consider performing a RSA in a patient less than 50 years of age (Figure 2). A further 11% would consider RSA for 50–60 year olds, 33% would consider RSA for patients aged at least 60

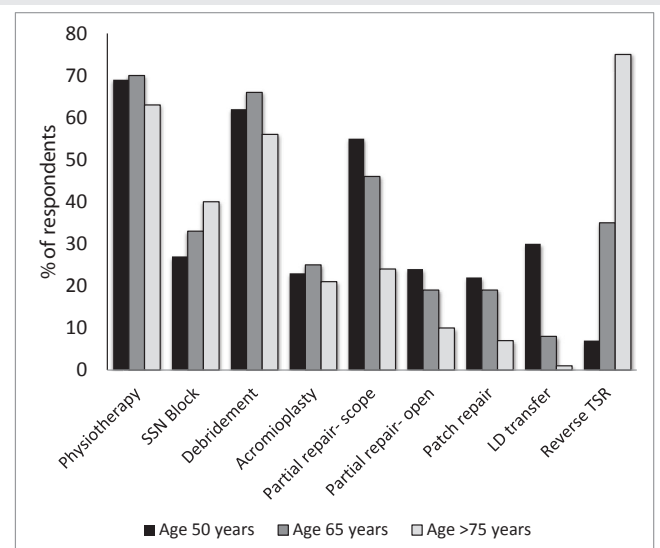


Figure 1: Management choices for chronic rotator cuff tears in different age groups.

years and 38% would only consider a RSA in those aged over 70. Eight percent of the respondents would never recommend RSA.

### Use of patch-augmented repair

Most surgeons (70%, n=92/131) would not consider patch-augmented repair as part of their management strategy. Amongst those who would consider performing patch repair (30%, n=39/131), the choice of patch repair was most often made when repair was possible but the tendon was thin and atrophic (16.8%, n=22/131) and/or when partial repair was possible but the defect was 1-3 cm in dimension (16.8%, n=22/131). Defects less than 1cm (6.9%, n=9/131) or more than 3cm (8.4%, n=11/131) were less commonly considered for patch repair. 10.7% (n=14/131) would consider patch repair regardless of the size of the defect. Dermal tissue allografts were the most common choice of patch (56%), followed by synthetic patches (41%) and xenografts (12.2%).

Free text comments indicated that whilst some surgeons had rejected patch repair after attempting the procedure in the past, others appeared to be interested in considering this treatment in the future.

### Risk factors for recurrence of tear: fatty infiltration

Surgeons were asked whether they assessed and measured muscle wasting and fatty infiltration in patients with massive tears who are considered for surgical intervention. The majority of participants (70%) reported that they would investigate their patients for fatty infiltration, whilst 30% based their management decisions purely on clinical grounds. Of those using magnetic resonance imaging, 51% use the Goutallier score [16], 12% the Thomazeau classification [17] and 37% did not use a grading system. Other modalities used were ultrasonography (22%) and computed tomography (9%). Nearly half of those using ultrasound did not grade the fatty infiltration.

In the presence of fatty infiltration 15% of respondents would not attempt a repair, 64% would attempt a repair with a grade 1-2 Goutallier score and 29% would attempt a repair of a patch with a score of 3-4. The majority of respondents (70%) would not consider augmentation repair with a patch in this scenario, 22% would consider a patch repair if the Goutallier score was 1-2 and 15% would consider a patch with a grade 3-4 tear.

### Risk factors for re-tear: incomplete repair of atrophied tendons under tension

Surgeons were asked their anticipated outcome of a thinned and atrophied rotator cuff tendon with an incomplete repair under high tension. Most surgeons expected the repair to fail within one year in all age groups, rising from 68% in the young group to 85% in the middle-aged group, and 94% in the elderly group. Healing was anticipated in the young group by 22% of surgeons, by 10% in the middle-aged group, and by 7% in the elderly group.

Surgeons were asked how they would manage these failures in the presence of recurrence of symptoms (Figure 3). In the young group, muscle transfer (44%) and conservative treatment only (34%) were the treatments of choice, with 27% considering repair with a patch and 23% attempting revision arthroscopic repair. In the middle group, surgeons were most likely to consider reverse TSA (44%) or conservative treatment (44%), whilst for the elderly group, the majority of surgeons would consider reverse TSA (82%).

Free text comments indicated a belief amongst some that increased tension would not make a significant clinical impact on the treatment outcome. There was scepticism regarding the use of the term repair failure, which is why the caveat recurrence of symptoms was used in this scenario. Others

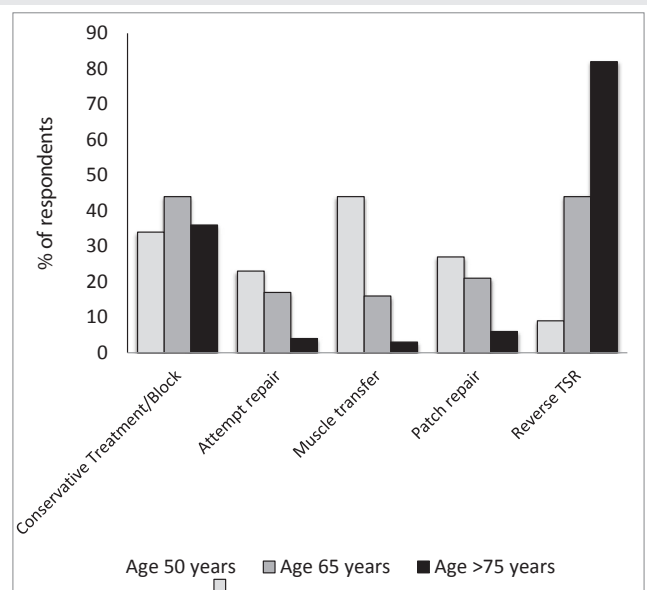


Figure 2: Age considerations for reverse total shoulder arthroplasty.

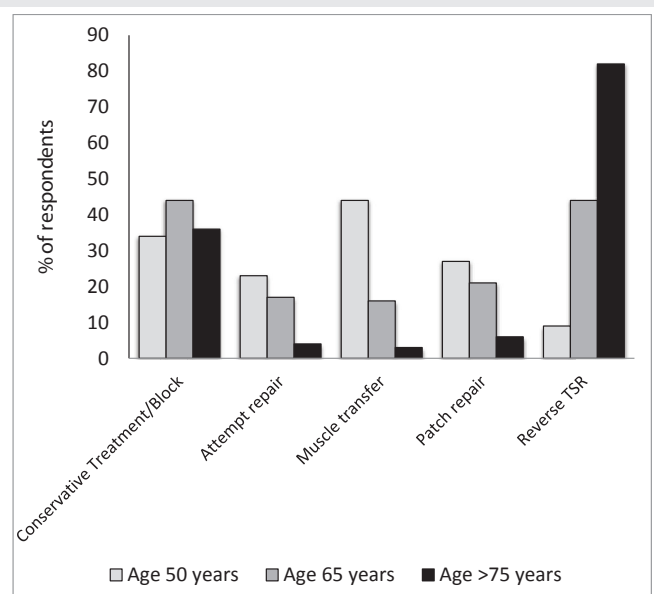


Figure 3: Options considered following recurrence of symptoms after treatment for irreparable rotator cuff.

commented that long-term follow-up might not always be possible.

### Management of Biceps tendon

With regards to management of the biceps tendon, 55% did not take any action if it appeared normal. 11% would undertake a tenotomy regardless of appearance, 5% would undertake a tenodesis. 63% of surgeons performed tenotomy if the tendon appeared abnormal and 30% performed a tenodesis. 29% would consider incorporating the tendon in to the repair.

### Willingness to participate in a multi-center trial

Eighty-seven percent (n=115) of the respondents indicated their willingness to participate in a large scale, multi-centre trial to investigate the treatment of irreparable rotator cuff tears.

### Discussion

Several treatment options have been proposed for management of large and massive rotator cuff tears. This survey demonstrated that there is a huge variation in the way similar patients are managed amongst UK shoulder surgeons in terms of the number and variety of options chosen.

Though only 28.5% of all surgeons replied to the survey, the total number submitted (134) is comparable to similar previously published surveys [13-15].

Some studies have shown the benefits of conservative treatment [18-21]. The anterior deltoid rehabilitation programme is a widely used management strategy for these patients and is researched with a good evidence base [22, 23]. The non-availability of this treatment option in the upper limb units of 8% of participants and the belief that it does not work by 13% of others, suggests that there may be a need for further education to ensure appropriate use of rehabilitation in patients with large to massive rotator cuff tears.

Other studies advocate a surgical approach, with arthroscopic repair often demonstrating that despite high failure rates of the repair, functional outcomes were satisfactory following surgery [4,5,21-24]. Mini-open repair demonstrates similar results in the literature [28-30]. There are some advocates of partial repair of large and massive rotator cuff repairs [31,32]. Arthroscopic debridement was commonly selected across all age groups. Whilst the results in the literature are encouraging for this technique [30], they should be interpreted with some caution given current controversies with regard to arthroscopic debridement for osteoarthritis of the knee [34].

The use of routine subacromial decompression by a fifth of surgeons across all ages is interesting given that results are variable in the literature [35,36]. This procedure could be regarded as contraindicated in this patient group. This is because the cortex of the undersurface of the acromion acts as the block to superior migration of the humeral head, and replacing this with soft cancellous bone and this, together with

division of the coraco-acromial ligament, can lead to further superior migration with subsequent loss of function of the deltoid and antero-superior escape. Similarly the choice of suprascapular nerve block, increasing slightly with age, is also questionable since this offers pain relief only, with no return of function and without nerve ablation would be a temporary effect [37].

The use of reverse total shoulder replacement was the subject of a recent BESS research committee session where it was recommended that the minimum age for these implants should be 70 years. Use in patients under the age of 70 was not recommended since outcomes deteriorate after 10 years, possibly due to the deltoid muscle losing the ability to move the shoulder [38]. 10 year survival data suggests survival rates of around 80%, although there is evidence that implants are failing although still in situ [39]. Whilst it is encouraging to see that the bulk of reverse TSAs are considered for patients over the age of 75, the willingness to consider these implants in patients as young as 50 by over 10% of BESS members should be the subject of further study.

Over the past decade, there have been advances in the development of biological and synthetic materials for use as scaffolds which can be used as a treatment option for rotator cuff tears [40]. However, these advances do not yet appear to have translated into surgical practice, with seventy percent of surgeons indicating that they would not use a patch for a large or massive non-repairable tendon. Free text comments suggested that lack of use is due to lack of supporting evidence and surgeons being unconvinced of the efficacy of augmented repairs. Whilst this lack of popularity may be attributed to advancements in this field occurring only recently, studies have demonstrated the benefits of this approach and strategies to improve uptake and confidence in outcomes from patch-augmented surgery should be examined [41]. Those who do use these implants would generally use them for larger defects, continuing to repair defects of less than 1cm without a patch. Although most surgeons would select a dermal implant, the use of Xenografts by 12% of surgeons is of some concern given reports of unfavourable histological reactions and poorer outcomes than for equivalent repairs without patch [42-45].

Fatty atrophy and muscle wasting are known risk factors for recurrence of tear and poorer outcomes, with functional outcomes reduced in the presence of fatty atrophy below Goutallier grade 2 [16,47]. However, despite evidence that investigation of fatty atrophy is an important component of decision making with regard to outcome, a third of surgeons based their decision making purely on clinical grounds. Of those that did investigate, the vast majority used MRI scanning and measured the Goutallier score, however, 36% did not specifically measure the Goutallier score, which does not appear logical given what is known with regard to outcome. Only 12% used ultrasound scanning, a far cheaper means of investigation and adequate for a crude score such as the Goutallier. Whilst some surgeons would not consider a repair in the presence of any fatty infiltration, nearly a third appeared to ignore the



evidence that non-augmented repairs do well with the lower scores, but not the higher grades of fatty infiltration [48, 49].

Despite evidence to the contrary, some surgeons believed that, particularly in younger patients, a surgical repair of a thinned, atrophic large or massive rotator cuff tendon would heal. There was some doubt expressed as to the relevance of tension as a risk factor despite the evidence available [7-9]. Notably the majority of surgeons would still choose to operate in the younger age groups despite a belief that the repair would fail within 1-2 years. This is significant since it demonstrates that surgeons are undertaking surgery which they accept will fail in a fairly short time scale, possibly reflecting reports that in general symptoms do not necessarily follow recurrence [50]. However, we would argue that the scenario of a rigorous examination of repairs with some leaking of radiographic dye to demonstrate a failure of repair is far removed from this situation where a partial repair of a poor quality tendon with significant tension will lead to a total recurrence of tear and probable return of symptoms. When asked how they would manage such a patient with recurrence of tear and symptoms, over a third indicated that they would pursue conservative management, whilst a quarter would attempt a revision with non-augmented repair. In the older age groups there was recognition of even higher failure rates and less expectation of healing. Consequently, fewer surgeons would attempt revision repairs either with or without augmentation as age increased, instead offering a reverse TSA.

The biceps tendon is a potential source of pain in rotator cuff disease. Most surgeons would leave the tendon intact if it appeared normal, with tenotomy the favoured option if the appearance was abnormal. Notably, 10% indicated that they would perform tenotomy regardless of appearance, dividing a normal tendon, and 5% would perform a tenodesis.

There are limitations to this study. The response rate was low, with only a quarter of surgeons responding to the survey, and therefore may not be fully representative of UK practice. This may in part be due to mass emails such as this survey being treated as spam by NHS servers and therefore not reaching the intended recipients. The response rate is, however, in accordance with other published BESS surveys [14].

## Conclusion

Large and massive tears of the rotator cuff present a difficult problem for the shoulder surgeon. Patient's symptoms will vary from minor to a debilitating level of pain and disability with a flail or pseudoparalytic shoulder. There are a variety of options available to manage the symptomatic patient. This survey demonstrated that there is a huge variation in the way similar patients are managed amongst UK shoulder surgeons in terms of the number and variety of options chosen.

Of concern is that some surgeons are offering treatments which may potentially cause harm in the medium and longer term, and there appears to be a poor understanding of the literature in terms of risk factors for recurrence of tear in this category of patient. Notably, this survey suggests that surgeons

are undertaking repairs in the full expectation that they will fail. The use of patch augmentation is not widely practiced, surgeons unconvinced by the current literature. This is an area which requires further good quality research. Perhaps the fact that 87% of respondents would be willing to participate in a trial to investigate treatment of large and massive tears is recognition of the difficulties faced by the shoulder surgeon. Further research into this area to inform an evidence-based algorithm for practice is needed.

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