



Management of full thickness rotator cuff tears. A survey amongst members of the Flemish Elbow and Shoulder Surgeons Society (FLESSS)

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The purpose of this study was to determine the attitude of the members of the Flemish Elbow and Shoulder Surgeons Society (FLESSS) towards full-thickness tears of the rotator cuff and their treatment in their daily practice.

A survey form was sent to 123 shoulder surgeons between January and March 2008. Seventy-three responses were returned, a 60% response rate. For 40% of the respondents, arthro-CT was the gold standard diagnostic method for assessment, 36% preferred arthro-MRI. Arthroscopic, mini-open and open cuff repair were preferred by 64%, 19% and 16% of the responders respectively. Fewer years in practice, a higher volume of shoulder operations and a higher volume of rotator cuff repairs were significantly correlated with a higher percentage of arthroscopic repairs ($p \geq 0.001$). With respect to the type of fixation, 91% preferred screw-type anchors, and of these 81% were metal anchors.

Our results show that all-arthroscopic techniques are becoming the gold standard for the repair of full-thickness tears of the rotator cuff in Flanders.

Keywords : rotator cuff ; full-thickness tear ; diagnosis ; treatment ; survey.

from 16% to 34% in the general population (13,18). Rotator cuff pathology is the most common condition of the shoulder for which patients seek treatment. In the US, estimates show that rotator cuff problems accounted for more than 4.5 million clinic visits and approximately 40,000 surgeries (11). Despite this huge burden on patients and health care resources, significant controversy persists regarding the role of rotator cuff tears in the generation of shoulder pain, the aetiology of rotator cuff injuries, and their treatment.

The natural history of rotator cuff tears is not well known. Studies have shown a prevalence of asymptomatic full-thickness rotator cuff tears as high as 31% among 70-year-old and up to 50% among 80-year-old individuals (14). Moreover, literature contains contradictory data regarding the efficacy of rotator cuff repair and the role of decompression. Originally, operative repair of a rotator cuff tear was always an open procedure but

INTRODUCTION

Full thickness tears of the rotator cuff are among the most common musculoskeletal problems. Estimates of the prevalence of shoulder pain range

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continuous improvements in implants, instrumentation and surgical techniques have made mini-open and all-arthroscopic repairs attractive options. During the last few years, these all-arthroscopic repairs have gained popularity. The ultimate goal of all these operative procedures is the anatomic restoration of the cuff footprint in a biomechanically stable fashion, thus enabling attachment of the cuff to the bone.

Many other aspects of full-thickness rotator cuff tears also remain controversial. Several studies have shown conflicting results concerning such issues as non-operative management, the role of debridement and postoperative rehabilitation programs (8,10).

In the past, this has been reflected by marked variation in surgical decision-making and a lack of clinical agreement among orthopaedic surgeons about many aspects of rotator cuff surgery (4).

MATERIALS AND METHODS

Between January and March 2008 a website with an 11-page survey was created to determine the attitude of the members of the FLESSS (Flemish Elbow & Shoulder Surgeons Society) concerning full-thickness tears of the rotator cuff and to identify factors that affect their preferred repair technique. The survey involved questions about diagnostic investigations, indications for repair, conservative and operative treatment and postoperative care of full-thickness tears of the rotator cuff. At the end, all surgeons were presented four clinical cases as described by Vitale *et al* (19).

The survey was first pilot-tested by three surgeons and a few minimal adjustments were made. Pilot testing suggested that the survey was understandable and could be completed within 20 minutes. The mailing and e-mail addresses of 123 shoulder surgeons were obtained from the FLESSS. An e-mail link to the website with the survey was sent to these shoulder surgeons. Reminders were sent by post and e-mail after one month. Responses were made anonymous. Only respondents who performed rotator cuff surgery were included.

A 5 point Likert scale (strongly disagree, disagree, indifferent, agree, strongly agree) answer was requested for 12 questions. In the subsequent analysis, these responses were converted to a 3-point scale (agree, indifferent and disagree). The remaining questions were multiple-response questions or had to be completed numerically. In total, 76 questions were asked.

Statistical Methodology

A possible correlation was examined between the five general questions and the gold standard for diagnostic assessment, the absolute age limit for rotator cuff surgery, the generally preferred technique, the postoperative use of non-steroidal anti-inflammatory drugs and the answer to the clinical questions. Also answers to the demographic questions from the surgeons preferring an open, mini-open or arthroscopic technique were statistically analysed.

In literature there is no unanimity about the criteria to define clinical agreement. Wright *et al* used 90% as the cut-off denoting agreement among orthopaedic surgeons' opinions regarding knee arthroplasty surgery (21). According to the criteria of Tierney *et al*, we defined general agreement as > 60% of the surgeons answering similarly and strong agreement as a consensus value of > 95% (15).

Descriptive statistics in the form of means, median, minimum, maximum and standard deviations were collected for all responses to the survey. Kruskal-Wallis tests followed by Mann-Whitney U tests for pair-wise comparisons were used to compare the distribution of answers on 5 demographic questions between the levels of various factors. A Spearman correlation was used to explore the relation with an ordered predictor (e.g. absolute age limit for RCT surgery). Fisher Exact tests were used to compare the answers on the four clinical questions about the preferred technique. McNemar's tests were used to compare paired proportions (e.g. difference in use of arthroscopy for a full-thickness tear of 2-5cm tear versus a massive tear). All analyses were performed with SPSS for Windows software (version 16.0; SPSS, Chicago, Illinois). All p-values were two-sided and considered significant when smaller than 0.05.

RESULTS

Seventy-three responses were returned, a response rate of 60%. The demographic data of the respondents are summarized in table I.

The investigations systematically used in the diagnostic assessment of a full-thickness tear of the rotator cuff were conventional radiographs used by 89%, ultrasonography by 75%, arthrography by 7%, CT-scan by 1%, arthro-CT by 55%, MRI by 6% and arthro-MRI by 22%. Arthro-MRI and arthro-CT were considered the gold standard in the

Table I. — Demographic data of the respondents

	Mean	SD	Min	Max
Years in practice	11.5	6.3	1	27
Annual number of shoulder operations	208.1	129.5	15	650
Years performing shoulder arthroscopy	9.9	5.6	0	22
Annual number of shoulder arthroscopies	145.2	106.1	0	500
Annual number of rotator cuff repairs	82.8	65.6	3	334

Table II. — Relative importance of different factors in decision making for rotator cuff repair

	IMPORTANT	NEUTRAL	NOT IMPORTANT
Pain	98.6%	1.4%	0%
Age of the patient	72.6%	16.4%	10.9%
Regaining functionality	65.8%	30.1%	4.1%
Prevention of tear progression	36.1%	37.5%	26.4%
Prevention of osteoarthritis	12.5%	30.6%	57.0%

diagnostic assessment of a full-thickness tear of the rotator cuff by 40.3% and 36.3% of the surgeons respectively ; ultrasonography by 9.7%, MRI by 9.7%, arthrography by 4.1% and CT scan by 0%. No significant relation was found between the demographic data of the respondents and the choice of gold standard for diagnosis.

Overall, surgeons indicated that conservative treatment was the initial treatment of choice for 44% of patients presenting with a full-thickness tear of the rotator cuff. The duration of the conservative treatment averaged 9 weeks. Physiotherapy was found to be useful by 53% of the surgeons. When used, its mean duration was 7.8 weeks. Seventy-nine percent of the responders believed there is a place for corticosteroids in the treatment of full-thickness tears of the rotator cuff. On average 2.9 steroid infiltrations were administered annually, the majority of them (97%) in the subacromial space. Fifty-two percent of the surgeons believed that steroid infiltrations are contra-indicated in possible candidates for rotator cuff repair, whereas 42% did not. Twenty-three percent considered hyaluronic acid infiltrations to be a useful treatment option for full-thickness tears of the rotator cuff.

The relative importance of different factors in the decision to proceed to rotator cuff surgery is represented in table II. The absolute age limit for rotator

cuff repair was 70 years or older for 73% of the respondents and between 60 and 70 years for 25%. Fifty-nine percent of the responders said they proceed faster to rotator cuff surgery in manual labourers.

Twenty-eight percent of the surgeons operated under general anaesthesia alone, 72% combined general anaesthesia with a scalene block. An all-arthroscopic repair was most popular among the shoulder surgeons (64%) ; only 16% preferred an open repair and 19% a mini-open repair. The results regarding the preferred repair method according to the size and localisation of the tear are presented in table III. A significantly smaller percentage of surgeons preferred an arthroscopic repair of large tears (2 cm to 5 cm tears and massive tears) when compared to a 2 cm tear ($p < 0.008$). Also, a significantly smaller percentage of surgeons preferred an arthroscopic repair of a full-thickness tear of the subscapularis (SSC) when compared to a tear of the supraspinatus (SSP) ($p < 0.001$) or infraspinatus (ISP) ($p < 0.001$). Furthermore, a two-tendon tear of the SSP and SSC was less likely to be treated arthroscopically when compared to a two-tendon tear of the SSP and ISP ($p < 0.013$). A three-tendon tear was less likely to be repaired arthroscopically compared to a two-tendon tear ($p < 0.004$) and a one-tendon tear ($p < 0.001$).

Table III. — Preferred repair method for a full-thickness tear of the rotator cuff according to size and localization of the tear

	OPEN	MINI-OPEN	ARTHROSCOPIC
OVERALL PREFERENCE	16.4%	19.2%	64.4%
2 cm tear	11.1%	16.7%	72.2%
2 to 5 cm tear	18.3%	21.1%	60.6%
Massive tear (> 5 cm)	35.7%	21.4%	42.9%
One tendon tear of the...			
... SSP	12.5%	16.7%	70.8%
... ISP	14.3%	20.0%	65.7%
... SSC	35.3%	22.1%	42.6%
Two tendon tear of the...			
... SSP and ISP	22.2%	19.4%	58.3%
...SSP and SSC	36.2%	20.3%	43.5%
Three tendon tear of the...			
... SSP, ISP and SSC	46.4%	20.3%	33.3%

Table IV. — Surgical experience and preferred repair technique. Data are presented with mean and standard deviation (SD)

	Open	Mini-open	Arthroscopic
Years in practice	16.7 (5.4)	12.8 (4.3)	9.5 (5.8)
Shoulder operations/year	89.2 (90.9)	238.8 (188)	231.4 (104.8)
Shoulder arthroscopies/tear	43.5 (70.2)	142.1 (128.1)	172.7 (92.4)
Cuff repairs/year	31.5 (26.2)	108.1 (92.9)	88.3 (57.6)

Fewer years in practice, a higher volume of shoulder operations and a higher volume of rotator cuff repairs were significantly correlated with a higher percentage of arthroscopic repairs ($p \geq 0.001$).

Demographic data distribution according to the preferred technique are presented in table IV. Younger surgeons were more likely to perform all-arthroscopic repair, whereas 'older' surgeons were more likely to prefer open or mini-open repair ($p < 0.001$). Surgeons preferring a mini-open or arthroscopic repair technique performed annually a larger number of shoulder operations, of rotator cuff repairs and of shoulder arthroscopies when compared to surgeons preferring open repair ($p < 0.01$). No significant differences were found between the arthroscopic and mini-open repair group in terms of the number of shoulder operations, rotator cuff repairs and shoulder arthroscopies performed annually. Twenty-three percent of the responders never performed an all-arthroscopic rotator cuff repair.

Forty-four percent of the surgeons always performed a subacromial decompression when performing a rotator cuff repair, 23% only when impingement lesions were noted on the coracoacromial ligament, 32% when there was spur formation on radiographs. Only 1% never performed a subacromial decompression when repairing the cuff.

Fifty-five percent of the respondents occasionally used an open repair technique to treat a full-thickness tear of the rotator cuff. Surgeons using this technique performed on average 20.9 open rotator cuff repairs annually. Surgical preferences are presented in table V.

Forty-seven percent of the responders occasionally used a mini-open repair technique to treat a full-thickness tear of the rotator cuff. Surgeons using this technique performed on average 35 mini-open rotator cuff repairs annually. Surgical preferences are presented in table V. During the arthroscopic phase of the procedure 74% of the surgeons

Table V. — Open RTC repair vs Mini-Open rotator cuff repair

	Open	Mini-open
Preferred positioning		
Beach chair	73.3%	41.2%
Lateral decubitus	26.7%	58.8%
Skin incision		
Longitudinal	68.9%	85.7%
Transverse	31.1%	14.3%
Approach		
Deltoid split	90.9%	
Deltopectoral	9.1%	
Fixation method		
Transosseous : Resorbable	2.2%	0%
Transosseous : Non resorbable	28.3%	16.7%
Anchors : Single row	32.6%	44.4%
Anchors : Double row	37%	38.9%
Type of anchor		
Screw type	81.1%	87.5%
Suture anchor	16.2%	9.4%
Suture tack	0%	0%
Knotless	2.7%	3.1%
Material of the anchor		
Metal	86.8%	93.3%
Bioresorbable	10.5%	3.3%
PEEK	2.6%	3.3%
Reason why this technique is preferred		
– Reliability of the results	27.3%	29.4%
– Massive cuff tears	18.2%	5.9%
– More confident with this technique	11.4%	17.6%
– Works faster	9.1%	11.8%

performed a subacromial decompression, 56% of the surgeons mobilised the cuff and 62% prepared the footprint arthroscopically. Fifteen percent of the surgeons already placed the fixation anchors before converting to the mini-open phase of the procedure.

The all-arthroscopic repair technique was used by 28% of the respondents because there is no need for desinsertion of the deltoid, by 22% because of a better exposure of the cuff defect and by 22%

because it allows for intra-articular evaluation. Finally 18% of surgeons preferred the all-arthroscopic technique because they were most familiar with it.

The beach chair position was used by 37%, whereas 63% positioned the patient in lateral decubitus.

Forty-nine percent of the responders occasionally used an arthroscopic single row repair. For the fixation, the majority (97%) preferred screw-type anchors with non-resorbable wires. Ninety percent favoured metal anchors and 10% bioresorbable anchors. Thirty-two percent used the easy knot, 24% the fisherman's knot, 20% the Nicky's knot and 5% the SMC knot.

Fifty-six percent of the respondents occasionally used an arthroscopic double-row repair. For the fixation of the medial row, 97% preferred screw-type anchors, 92% favoured metal anchors. For the lateral row fixation, 32% preferred screw-type anchors, 3% suture anchors, 24% suture tacks and 42% another type of knotless anchor. Twenty-four percent favoured the easy knot, 20% the fisherman's knot, 24% the Nicky's knot and 20% the SMC knot. The majority (89%) chose a non-resorbable wire to repair the cuff.

The preferred treatment for 4 different types of biceps tendon lesions (fraying, a rupture of < 50%, a rupture of > 50% and instability) is presented in table VI. The mean age limit for performing a biceps tenodesis was 55 years. When confronted with a massive cuff tear, 71% of the surgeons thought that debridement of the cuff (without repair) was a valuable treatment option whereas 20% believed that a debridement was useless. Debridement of a massive cuff tear consisted of stabilisation of the cuff borders (72%), a biceps tenotomy (72%), a tuberculoplasty (30%), a bursectomy

Table VI. — Biceps tendon policy in case of 4 different types of biceps tendon lesions

	<i>NOTHING</i>	<i>DEBRIDEMENT</i>	<i>TENODESIS</i>	<i>TENOTOMY</i>
Fraying	19.7%	40.8%	14.1%	25.4%
A rupture of < 50%	7.2%	11.6%	26.1%	55.1%
A rupture of > 50%	2.9%	1.4%	20.3%	75.4%
Instability	8.7%	0%	39.1%	52.2%

Table VII. — Postoperative immobilisation protocols. Data are presented with mean and standard deviation (SD)

	Mean (SD)
Duration of immobilisation (in weeks)	4.6 (1.7)
Passive mobilisation from day ...	4.3 (6.6)
Active mobilisation from week ...	4.2 (2.4)
Strengthening exercises from week ...	8.6 (3.2)

(7%), a resection of the coraco-acromial ligament (11%) and a resection of the coraco-acromial ligament together with a bony decompression of the antero-lateral corner of the acromion (28%).

Only 4% of the surgeons indicated that they sometimes used biomaterials for augmentation of the cuff in cases with massive tears.

Only 23% of the responders performed tendon transfers, on average 4.3 annually. The most commonly performed procedures were the pectoralis major transfer for antero-superior defects (81%) and the latissimus dorsi transfer for postero-superior defects (75%). Only one surgeon performed teres major transfer.

For postoperative pain management, a single shot scalene block, a scalene block with constant infusion and classic analgesics as monotherapy were used by 58%, 18% and 24% of the respondents respectively. Interestingly, 56% of the surgeons used NSAIDs in the early postoperative phase. Postoperatively an adduction sling was used by 47%, an abduction brace by 53% (table VII).

Case presentations

The surgeons were presented 4 different clinical cases and could choose one of the 4 different treatment options.

CASE 1 : A 2 cm full-thickness (FT) tear on the dominant side in a 45 year-old labourer with mild weakness (4/5) and no pain, who had sustained a traumatic injury three months previously ;

CASE 2 : A 1 cm FT tear in a 55-year-old man with a one-year history of mild discomfort ;

CASE 3 : A 5 cm, retracted, painful FT tear with fatty infiltration of the cuff muscles and weakness for abduction (2/5) in an active 65 year-old patient

Table VIII. — Distribution of the responses to the clinical questions

	Case 1	Case 2	Case 3	Case 4
Physiotherapy	19.2%	15.5%	26.4%	91.3%
Corticosteroid infiltration	0%	29.6%	40.3%	8.7%
Surgery without cuff repair	0%	2.8%	5.6%	0%
Surgery with cuff repair	80.8%	52.1%	27.8%	0%

who had sustained a traumatic injury one week previously ;

CASE 4 : A massive, non-traumatic FT-tear of the RTC in a 70-year-old lady with no pain and minor weakness.

The results of the responses to the four clinical questions are presented in table VIII.

DISCUSSION

It is clear from this survey that standard radiographs and ultrasonography are the investigations most commonly performed to diagnose a full thickness tear of the rotator cuff. In daily practice, further diagnostic work-up is most commonly performed with arthro-CT. However, when surgeons were asked what they considered to be the gold standard for diagnostic assessment, there was only a slight preference for arthro-CT over arthro-MRI. This probably reflects the reduced availability and long waiting lists for arthro-MRI.

Although rest, activity modification, physical therapy and corticosteroid injections are considered important in the management of this disorder, their value remains controversial. The lack of solid clinical evidence about conservative treatment of full-thickness tears of the rotator cuff is reflected in the absence of clinical agreement on this topic. Corticosteroids may reportedly have deleterious effects on collagen, further tendon degeneration and even tendon rupture (1,12,16,17,20), and its efficacy remains controversial (2,5,9). The number of infiltrations that can be given safely also remains unclear. Current clinical recommendations often limit their use to no more than two or three injections a year, spaced three or more months apart. We found general agreement about corticosteroid injections being

useful in treatment of full-thickness tears, but 52% believed that corticoid infiltrations are contraindicated in possible candidates for rotator cuff repair.

In this study, we found no clinical agreement about the use of physiotherapy and hyaluronic acid injections in the conservative treatment of full-thickness tears of the rotator cuff.

Pain complaints are considered the most important factor to proceed to rotator cuff surgery. It was generally agreed that age and function restoration are important decision factors. No agreement was found for prevention of tear progression and prevention of glenohumeral osteoarthritis.

Although more than 95% of the surgeons considered age as an important factor in decision making for rotator cuff surgery, 73% believed the absolute age limit for repair to be above 70 years. Physiological age is obviously considered to be the determining factor.

Originally, operative repair of a rotator cuff tear was always an open procedure but continuous improvements in implants, instrumentation and surgical techniques have made mini-open and all-arthroscopic repairs an attractive solution. Our results indicate that an increasing number of surgeons are performing all-arthroscopic repair of full thickness rotator cuff tears. In 2003, 700 respondents in a survey of the Arthroscopy Association of North America (AANA) and the American Orthopaedic Society for Sports Medicine reported that they performed 24% of their rotator cuff repairs with an all-arthroscopic technique. In a survey five years previously, only 5% of cuff repairs were performed arthroscopically (7). More recently in 2006, a survey of the members of the AAOS revealed that for the primary repair of a 2-cm full-thickness rotator cuff tear, 53% of the surgeons preferred an all-arthroscopic technique, 38% preferred a mini-open repair and 9% preferred an open technique. For a 5-cm full-thickness rotator cuff tear, 29% preferred an all-arthroscopic repair, 36% preferred a mini-open repair, and 35% preferred an open technique (19).

Our results confirm the expected further evolution to more and more all-arthroscopic techniques. As in previous studies (19), we also observe a clear

correlation between the number of years in practice as an orthopaedic surgeon, and the number of shoulder operations, shoulder arthroscopies and rotator cuff repairs performed annually, and the preferred technique. The most likely explanation is that 'older' surgeons did not have intensive arthroscopic experience during their training. Moreover, the fact that they obtain good results with a relatively easy open technique may render them less susceptible to make the shift towards the arthroscopic procedure. The annual numbers of shoulder operations, of shoulder arthroscopies and of rotator cuff repairs are positively associated with more arthroscopic repairs. Of these, the number of shoulder arthroscopies is the strongest determining factor: the more shoulder arthroscopies one performs, the more likely an arthroscopic repair of a full-thickness tear of the rotator cuff ($p < 0.0001$). This survey also identified clear demographic differences between the surgeons preferring an open technique and those favouring mini-open and arthroscopic repair. Surgeons performing open repair were significantly older and performed less cuff repairs yearly. Although surgeons preferring the mini-open technique were significantly older than those preferring an arthroscopic technique, no significant differences could be observed between these groups in terms of number of shoulder operations, shoulder arthroscopies and cuff repairs performed yearly. We therefore believe that the mini-open repair method can be looked at as a learning stage before proceeding to an all-arthroscopic repair.

Overall, the preferred arthroscopic fixation method was a suture anchor in metal with a non-resorbable suture. Size and localisation of the tear were identified as important determinants for the preferred repair technique. Massive tears and tears of the subscapularis were least likely to be repaired arthroscopically (table III).

Based upon several studies, it was stated that acute inflammatory response seen after surgery is important to the tendon-to-bone healing process and that the administration of either non selective or COX-2 specific NSAIDs in the immediate postoperative period could have detrimental effects on this healing process (3, 6). Nevertheless 56% of our

respondents used NSAIDs in the postoperative pain management after cuff repair.

Our study has several limitations. First of all, the number of surgeons polled was relatively small. Nevertheless, the response rate was 60% so that the opinion of more than half of the Flemish shoulder surgeons is represented. Secondly, the numerical data were obtained on basis of the surgeons' self report, which is subject to recall bias. Nevertheless, we can assume that recall bias is equally distributed among surgeons preferring an open, mini-open or arthroscopic technique. No demographic data were obtained from the non-respondents so that no conclusion can be made about a possible selection bias. It could be, for example, that the non-respondents were significantly older because they are less likely to respond on an email survey. We tried to eliminate this bias by sending the reminder by email and by mail. Misinterpretation of the questions may also explain part of the variation in responses. For the sake of brevity, not all items were defined (for example open, mini-open and arthroscopic repair). We tried to reduce this bias by pilot testing the survey to see if it was understandable.

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