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REVIEW ARTICLE

Clinical practice guidelines for the surgical management of rotator cuff tears in adults

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KEYWORDS

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Summary

Context: Rotator cuff tears are very common. In 2005, about 45 000 patients in France underwent surgery. Surgical techniques and indications have evolved over recent years with the development of arthroscopic procedures. The lack of visibility on current practice and a request by the French Ministry of Health to assess the fixation devices used in arthroscopic surgery prompted the drafting of these guidelines.

Objectives: To produce guidelines on the indications and limitations of open surgery and arthroscopic surgery.

Methods: A systematic review of the literature (2000–2007) was performed. It was submitted to a multidisciplinary working group of experts in the field ($n=12$) who drafted an evidence report and clinical practice guidelines, which were amended in the light of comments from 36 peer reviewers.

Main recommendations: (i) Medical treatment (oral medication, injections, physiotherapy) is always the first option in the management of degenerative tears of rotator cuff tendons. Surgery is a later option that depends on clinical and morphological factors, and patient characteristics. (ii) Surgery can be considered for the purpose of functional recovery in cases of a painful, weak or disabling shoulder refractory to medical treatment. (iii) Arthroscopy is indicated for non-reconstructive surgery or debridement, and for partial tear debridement or repair. (iv) Open surgery, mini-open surgery or arthroscopy can be used for a full-thickness tear accessible to direct repair by suture. (v) A humeral prosthesis or total reversed prosthesis is indicated for cuff tear arthropathy. (vi) The fixation devices used for bone reinsertion (anchors, screws, staples, and buttons) are indispensable for fully arthroscopic repair. No studies have determined the number of fixation devices to be used according to tear size.

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Introduction

In April 2005, the Haute Autorité de santé (HAS) published clinical practice guidelines on the clinical diagnosis, use of diagnostic imaging tests, and indications for the treatment (medical and surgical) of chronic degenerative rotator cuff tendinitis [1]. The present guidelines address the surgical management of rotator cuff tendinitis tears in adults. They cover indications, outcomes, and the limitations of open surgery and endoscopic surgery, and use of fixation devices.

These guidelines were drafted by HAS upon the request of the French Society of Arthroscopy (SFA), French Society of Orthopaedic and Trauma Surgery (SOFOT), and the Directorate for Hospitals and Organisation of Care (DHOS). They were published on the HAS website (in French) in March 2008 [2].

A companion HAS guideline on "Criteria for choosing rehabilitation after-care following rotator cuff tear surgery or shoulder arthroplasty: Inpatient or outpatient care?" (January 2008) specifies the indications for rehabilitation techniques after rotator cuff surgery for tears [3].

Scope of these guidelines

The questions addressed by these guidelines are given in Table 1. The guidelines are primarily intended for orthopaedic surgeons, rheumatologists, physicians specialising in physical medicine and rehabilitation, occupational physicians, general practitioners, radiologists, and physiotherapists.

Assessment method

The guidelines were produced using a method developed by HAS [4]. A multidisciplinary working group drafted the guidelines, which were submitted to external peer review and then validated by the HAS Board.

The following databases were searched over the period January 2000–2007: MEDLINE, Pascal, Cochrane Library, National Guideline Clearinghouse, and Health Technology Assessment (HTA) database. The keywords were rotator cuff tear and guidelines, or practice guidelines or health planning guidelines or recommendations or consensus development conference or consensus conference or meta-analysis or systematic review or controlled trial or cohort study, longitudinal study or follow-up study. These general keywords were combined with specific keywords relating to orthopaedics, surgical procedures, arthroplasty, prostheses

and implants. Further references were provided by specialty societies and working group members. The grey literature was also searched.

The literature was reviewed and used to draft an evidence report. A total of 552 articles were reviewed and 183 articles were included (see list of references in the *Argumentaire des recommandations* [5]). Priority was given to randomized clinical trial (RCTs) included in clinical practice guidelines, systematic reviews, and meta-analyses that had been updated with the most recent RCTs. If no RCT was found on a specific topic, all available clinical trials were reviewed.

Each study was allocated an evidence level. However, in the present case, the evidence was too inconclusive to be able to establish grades. Recommendations were based on agreement among the professionals within the working group after taking into account the comments of peer reviewers. Working group members are listed in the acknowledgements. The final guidelines were validated by the HAS Board in March 2008.

Definitions

The rotator cuff provides glenohumeral joint stability. It comprises four muscles and their tendons. They are, from front to back, according to their humeral attachment point to the tuberculum minus and majus: the subscapularis, supraspinatus, infraspinatus and teres minor.

Rotator cuff tendon tears may affect one or more tendons. Most tears are degenerative tears and are due to the progression of chronic tendonitis, which may or may not be symptomatic. Acute tears of a healthy tendon seldom occur. Full-thickness tears are through-and-through tears; partial tears do not affect the entire thickness of the tendon.

The work-up documents clinical history (mobility, stability, pain, strength) and patient characteristics (particularly age, smoking, social and occupational context), and establishes the morphological features of the tear by physical examination and medical imaging.

Management

The natural history of degenerative rotator cuff tendon tears is not completely understood. Their prevalence and extent increase with age, suggesting that lesions develop with time. Progression is not always symptomatic; there is no relationship between anatomy and clinical symptoms. Pain and disability may occur at irregular, momentary intervals during progression.

The first-line treatment for rotator cuff tendinitis associated with tears is medical treatment (oral medication, injections, physiotherapy) as described in the 2005 French guidelines [1]. Indeed, medium- to long-term conservative treatment leads to acceptable improvement in 40 to 80% of patients, especially when treatment is prompt.

It is however reasonable to propose surgery for the recovery of function in cases of a painful, weak, or disabling shoulder refractory to conservative treatment.

Table 1 Scope of the guidelines.

1	What are rotator cuff tendinitis tears
2	What do we know about the natural history of rotator cuff tears in adults
3	What are the prognostic factors for outcomes after surgery
4	Choice of surgical procedure (arthroscopy or open surgery), patient selection, choice of device and number

Choice of surgical procedure

Three types of surgery are used:

- (i) non-repair pain-relieving surgery concerning the sub-acromial bursa, coracoacromial ligament, the lower surface of the acromion, the acromioclavicular articulation, and the tendon of the long head of the biceps brachii;
- (ii) repair surgery (tendon reinsertion, tendon transfer, muscle flaps, etc.), anatomy and context permitting;
- (iii) prosthetic surgery.

Table 2 summarises clinical outcomes according to type of tear and surgery.

Non-repair surgery or debridement

Non-repair surgery or debridement includes several procedures. The main ones are:

- acromioplasty;
- subacromial bursectomy;
- smoothing of tendon lesions;
- excision of the coracoacromial ligament;
- tenotomy or tenodesis of the long head of the biceps brachii;
- procedures on the acromioclavicular joint.

Five case series on arthroscopic debridement have shown consistently very good and good (>50%) outcomes for the Constant or UCLA scores [6]; postoperative recovery periods can be relatively short (evidence level: 4). This does not however apply to open debridement as shown by the inconsistent results of two case series (evidence level: 4).

Despite the lack of comparisons between open surgery and arthroscopy, non-repair surgery or debridement should be performed arthroscopically.

Repair surgery

The specific treatment for rotator cuff tendon tears is repair.

Simple suturing

Simple suture is apposing two macroscopically healthy tension-free tissues (direct repair). This definition determines whether a degenerative tear can be repaired or not. Simple sutures are carried out by open surgery, mini-open repair with arthroscopic assistance, or fully arthroscopic repair.

Open repair is carried out by the deltopectoral, lateral, or superior approach. Repair with arthroscopic assistance has two steps:

- an exploratory, therapeutic step – glenohumeral then subacromial – by arthroscopy;
- tendon repair by reduced surgical approach without deltoid detachment.

Both steps may be carried out purely arthroscopically.

Various fixation devices can be used for bone reinsertion (anchors, screws, staples, and buttons). Such devices are indispensable for fully arthroscopic repair. No studies have determined the number of fixation devices to be used according to tear size.

Muscular advancements, flaps and muscular transfers

Muscular advancement, i.e. advancing the muscle mass in the direction of the tear, is an option for extensive supraspinatus and infraspinatus tears not amenable to direct tension-free repair.

Flaps and muscular transfers are used to treat large full-thickness tears non-reparable by tension-free suture or transosseous reinsertion. The tendon and muscle is transposed to fill the tear with active tissue. The main flaps and muscular transfers used are deltoid flaps, latissimus dorsi muscle transfer, and pectoralis major muscle transfer.

Both techniques have only been studied in case series with small patient numbers and by open surgery. The choice of technique depends on the extent of the tear, the extent of tendon retraction, and fatty degeneration in the muscle(s).

Prosthetic arthroplasty

Two types of prosthesis may be used (open surgery only): a humeral prosthesis (simple or bipolar) and a total reversed prosthesis (concave humeral cup and glenoid sphere).

Management strategy according to type of lesion

Medical treatment (oral medication, injections, physiotherapy) is always the first option in the management of degenerative tears of rotator cuff tendons [1]. Surgery is a later option that depends on clinical and morphological factors, and patient characteristics.

Partial tears

The surgical options for partial tears are debridement and repair. These procedures may be carried out alone or together. They should always be performed arthroscopically.

Despite the lack of comparative data showing superiority of repair over debridement, it is recommended to repair tears affecting over 50% of tendon thickness rather than simply smooth the tendon tear. However, not all working group members were in agreement on this (consensus opinion).

Full-thickness tears

Full-thickness tears amenable to direct repair

A meta-analysis of two randomised clinical trials (133 patients) has shown that repair of full tears by open surgery is superior to arthroscopic debridement according to the reported 5- and 8-year outcomes.

Full-thickness tears amenable to direct repair are per-operative tension-free reducible tears with \leq stage 2 fatty degeneration according to Goutallier's et al. CT scan classification [7], i.e. more muscle than fat.

Table 2 Clinical outcomes according to type of tear and surgery.

Type of surgery	Type of tear	Studies (total pts)	Follow-up (years)	Preoperative score	Postoperative score	Good/and excellent outcomes (%)	Satisfied patients (%)
<i>Arthroscopic debridement</i>	Partial	2 MRS 1 RS (214)	2 to 10	Constant: 50 and 54/100	Constant: 82/100	79 ^b	82 to 89
	Complete	2 SRM 4 RS (935)	2 to 5	Constant: 38 to 48/100	Constant: 58 to 68/100	51 to 72 ^a	78 to 94
<i>Direct repair</i> Open repair	Complete	2 PS 1 MRS 11 RS (1,068)	2 to 6	Constant: 21 to 56/100 UCLA: 9 and 16/35	Constant: 63 to 83/100 UCLA: 30 to 32/35	56 to 88 ^a 78 to 84 ^b	84 to 100
Arthroscopic assistance Fully arthroscopic repair	Complete	3 RS (175)	3 to 7	NA	NA	80 to 93 ^b	NA
	Partial	2 RS (46)	2 and 3	UCLA: 17 and 23/35	UCLA: 33/35	NA	NA
	Complete	2 PS 1 MRS 6 RS (1079)	2 to 6	Constant: 46 to 52/100 UCLA: 11 to 17/35	Constant: 78 to 87/100 UCLA: 30.5 to 33/35	90 and 94 ^a 64 to 96 ^b	86 to 98
	Complete	1 PS 1 RS (46)	2.5 to 5	Constant: 56 and 58/100	Constant: 68 and 74/100	NA	NA
<i>Myotendinous advancements</i>	Complete	8 RS (223)	3.5 to 10	Constant: 22 to 46/100	Constant: 47 to 74/100	NA	75 to 90
<i>Flaps</i>	Complete	3 RS (50)	1 to 5	Constant: 18 and 24/100 UCLA: 11/35	Constant: 37 and 47/100 UCLA: 22/35	NA	84 to 88
<i>Arthroplasty</i> Hemiprosthesis	Complete	2 MRS (120)	3	Constant: 23 and 30/100	Constant: 60 and 66/100	NA	NA
Total inverted prosthesis	Complete						

PS: prospective series; RS: retrospective series MRS: multicentre retrospective series; NA: not available; UCLA: University of California, Los Angeles.

^a Constant score rating: excellent: $\geq 80/100$; good: 65 to 79/100; not very good: 50 to 64/100; poor: < 50/100.

^b UCLA score rating: very good: 34–35/35; good: 28 to 33/35; not very good: 21 to 27/35; poor: 0 to 20/35.

Very few studies (all case series) have analysed prognostic factors for outcome following tear surgery. Univariate analyses have indicated that the following may be associated with a higher rate of secondary tearing and/or poorer clinical outcomes after repair by open surgery or arthroscopy: extent of tear (extension to infraspinatus muscle), tendon retraction, decrease in preoperative subacromial height on X-ray, extensive fatty degeneration (assessed by CT scan), and occupation (heavy labour). Multivariate analyses suggest that the main negative prognostic factors for direct open repair of full-thickness tears are a long-standing preoperative signs, poor general health (American Society of Anesthesiologists [ASA] grade), former or current smoker (>40 pack-years), and a large tear ($\geq 5\text{ cm}^2$) found during the procedure. Furthermore, a tear of the subscapularis can be a negative prognostic factor for postoperative recovery.

Similar results have been obtained for open repair, mini-open repair, and full arthroscopic repair in case series. Any of the three procedures may be used. The choice depends on the surgeon's preference and on local technical facilities.

The indications for tendon repair of full-thickness degenerative tears are symptomatic cuff tears on a non-stiff shoulder in active motivated patients, with healthy muscles (fatty cuff degeneration \leq stage 2).

Full-thickness tears not amenable to direct repair

Full-thickness tears, not amenable to direct repair, are tears that are not reducible without tension or tears with > stage 2 fatty degeneration.

Arthroscopic debridement is a treatment option. Evidence-based prognostic factors for full-thickness tears debridement are fatty degeneration of the infraspinatus and subscapularis (poorer clinical outcomes when degeneration is extensive) and initial Constant score (better clinical outcomes when the preoperative Constant score is high). Prosthetic surgery is an option for a shoulder that is pseudoparalytic due to a massive rotator cuff tear. However, a prosthesis is only indicated if all other treatment options have been exhausted.

Full-thickness tears with omarthritis

Two types of arthroplasty are options in this indication: humeral prosthesis and total reversed prosthesis. Total reversed prostheses have undergone more extensive study.

Cuff tear arthropathy is an indication for humeral or total reversed arthroplasty. There are no reliable data on prognostic factors. However, the rate of successful clinical outcomes after humeral prosthesis is low in the following cases: small subacromial height, cuff tear arthropathy, eroded glenoid cavity, anterior glenohumeral subluxation, and fatty degeneration of the infraspinatus or subscapularis.

The unreliability of 10-year outcomes for prostheses suggests that arthroplasty should not be offered too early to patients and that life expectancy should be taken into account.

Rehabilitation

Rehabilitation is recommended for all patients after shoulder arthroplasty or rotator cuff surgery, regardless of the surgical technique used [3].

Conflict of interest statement

None.

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