

TREATMENT OPTIONS IN FULL THICKNESS ROTATOR CUFF TEARS

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Increasing interest in shoulder pathology during the last decades has considerably diversified the possible treatment options of full thickness rotator cuff tears. This review of the recent literature combined with information gathered during recent European shoulder meetings attempts to summarize present trends. Every full thickness cuff tear, except for the acute traumatic tear in younger patients, should always benefit first from a conservative rehabilitation program. In case of failure of the latter, reparable tears should be repaired, except perhaps in a low-demand population. This latter group of patients, presenting with a massive, irreparable tear may be satisfied with an arthroscopic debridement, but interposition techniques provide better results in activities of daily living and also give better strength. Salvage procedures such as muscle tendon transfers are technically demanding and must be reserved for the younger age group. For arthroplasty, the choice between a nonconstrained total prosthesis and a hemiprosthesis can be difficult ; the early functional results of the reversed prosthesis seem to be very promising in an elderly but still active population.

Keywords : rotator cuff ; treatment ; repair ; arthroscopy ; arthroplasty.

Mots-clés : coiffe des rotateurs ; traitement ; réparation ; arthroscopie ; arthroplastie.

Twenty years ago, if an old lady was sent to the orthopedic surgeon with disabling shoulder pain and a so-called pseudoparalytic shoulder, the surgeon would probably have put her arm in a sling and sent her back home with a prescription for analgesics, saying “we cannot do anything more for you”. Nowadays, thanks to increasing knowl-

edge and improvement in diagnostic and treatment techniques, surgery would probably be considered.

In Continental Europe, the orthopedic community was influenced for a long time by the concept of “périarthrite scapulo-humérale”, as stated by Duplay and by the French Rheumatologic School of de Sèze ; at the same time however, in the English-speaking countries, pioneers such as Codman and MacLaughlin in the early thirties and Charles S. Neer later on had an early clear vision of the various pathogeneses underlying shoulder problems and developed different surgical approaches to the treatment of the torn rotator cuff.

Increasing interest in the shoulder joint during the last two decades has led to an ever-increasing number of articles focusing on rotator cuff ruptures and their treatment. This does not mean however that every single lesion detected by a refined sonographic investigation or by an MR-arthrogram now comes under consideration for surgery !

There is no doubt that the rare (< 5% according to Neer (18) and Habermeyer (12)) acute traumatic tears, caused by a violent traction injury or a “superior dislocation” in a younger active population need early recognition and surgical repair. Bak *et al.* recently stated that the incidence of significant rotator cuff pathology is high in acute shoulder injuries without fracture or dislocation (1).

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On the other hand, there is little doubt that an elderly patient presenting with persistent shoulder pain and with signs that Neer called spinatus atrophy, a “shrugging sign” or even a “dropping sign” (supraspinatus lag sign), with an xray showing “rotator cuff arthropathy”, would benefit more from an arthroplasty than from an arthrodesis (18). The grey zone in between these extreme situations is very wide, and surgical options are varied.

Indications will not only depend on patient-related factors, such as timing and severity of symptoms, failure of conservative measures, age and personal or professional demand, anatomical lesion, duration of the rupture and side dominance. They will also depend on the experience, affinities and skills of the surgeon. It is clear that a well-trained arthroscopist will push the indications of debridement, arthroscopic subacromial decompression, arthroscopic cuff repair and even arthroscopic biceps tenodesis to the extreme, whereas the classic “shoulder surgeon” will favor open exploration, cuff mobilization and repair, “simple” muscle transfer methods and shoulder arthroplasty. Only a few “reconstructive” surgeons will attempt techniques such as a latissimus dorsi transfer (7). It is clear that all these treatment options are not applicable to every cuff tear and will depend on the type of tear and its extent. A mix of careful listening to the demands of the patient, good clinical examination, precise information from the complementary investigations (sonography, CT-scan, MR-arthrogram) and personal feeling and experience on the part of the surgeon is needed for good decision making in cuff surgery.

Except for the *acute traumatic tear* in the young active patient (< 50 years) treatment should always start with conservative measures consisting in medical treatment and a good rehabilitation program. Based on the “suspension bridge model” proposed by Burkhart (4) and the premise that balanced force couples in both the coronal and the transverse plane allow the shoulder to function asymptotically despite a rotator cuff defect, a conservative treatment philosophy can be adopted. This rehabilitation program consists of three phases : the first step is restoring full, painless passive range of motion ; the second consists in strengthening the remaining

muscles of the cuff, the scapular stabilizers and the deltoid muscle ; the last phase involves reintegration of patients into their normal activities including work, hobbies and sports (22). Since some series report up to 80% success without the need for further surgery (22), this conservative treatment should last for at least 6 weeks and, in case of obvious success, it can surely be extended to another 6 weeks according to Gschwend (11). If symptoms persist after this treatment, the surgeon will have to consider a surgical approach.

Isolated distal tears of the supraspinatus will be the easiest to treat and will respond best to surgical treatment (14). Recent reports of full arthroscopic repairs using anchors, staples, harpoons or other specially designed devices, show results comparable to those of conventional open repair technique with sutures through a bony trough (14, 15). The choice of the technique will depend on the surgeon’s experience, and the arthroscopic assisted mini-open technique finds its place somewhere in between. Lehmann did not find any significant differences regarding functional results between mini-open and all arthroscopic repair using the Parachute-Corkscrew-system, except the mini-open procedure had a shorter operation time (15). Simple debridement combined with subacromial decompression is only indicated in the few cases among these where repair is contraindicated for reasons related to age, physiology or motivation.

So-called “*reparable full thickness tears*” of the *supraspinatus* are tears with a size intermediate between distal tears and retracted tears. These should first be analyzed very accurately, since posterior extension towards the infraspinatus tendon is a negative predictive factor for outcome (16). A motivated, cooperative patient, not responding to functional treatment, may benefit from an acromioplasty and usually tenotomy of the long head of the biceps combined with conventional repair of the tear following precise rules : appropriate timing, mobilization of cuff and adequate stitching (modified Mason-Allen stitches are preferred) (8, 16). Fatty degeneration of the muscles is an important prognostic factor in the anatomical outcome of the cuff repair (9, 14), but it is difficult to evaluate with sufficient reproducibility and is therefore of limited

value for the therapeutic indication (17). Although several studies showed high rates of tear recurrence, the latter does not always impair shoulder function (13, 14, 25). Some maestros of shoulder arthroscopy will probably be capable of achieving a full arthroscopic repair in this kind of lesion.

Chronic, retracted, irreparable tears of the supraspinatus and infraspinatus are probably the most challenging to treat. It is indeed in this group of which the end stage is true cuff arthropathy, that different patterns of thought were explored. The "functional rotator cuff tear" concept (anatomically deficient but biomechanically intact) as proposed by Burkhart (4) is probably one of the keys to the treatment. A functional cuff tear will probably respond well to a standardized conservative treatment, and if not, to arthroscopic debridement and decompression in cases where pain relief is the most important goal to achieve, i.e. in an elderly population. Arthroscopic tenotomy of the long head of the biceps, as proposed by Walch *et al.* (24), can be combined with this procedure in this low-demand population. The debridement will consist in clearing the edges of the remaining cuff, but care should be taken to remove only acromial and clavicular spurs without interrupting the coracoacromial arch, so as to keep the humeral head centered. The question is whether initially acceptable results with this palliative technique remain acceptable over the long term.

"Covering the hole" procedures, including supraspinatus muscle slide, biceps interposition, fascial grafts or allografts, prostheses and probably even deltoid muscle flaps or subscapularis transfers ignore and even violate the mechanics of the shoulder (4). Acting as a temporary spacer, they provide pain relief and will facilitate the postoperative rehabilitation to achieve a "functional shoulder" by enhancing the compensatory mechanism of muscles.

Partial rotator cuff repair, as also advocated by Burkhart (4), can be done with a view to convert massive dysfunctional tears into functional tears, without transferring an intact rotator cuff tendon from its anatomic position.

Since massive tears tend to involve the posterior cuff rather than the anterior, some technically more

demanding procedures may really functionally improve a dysfunctional shoulder, as long as the subscapularis muscle is intact (4). Paavolainen (20) reported 90% successful results with teres minor transfer, and Gerber *et al.* obtained pain-free daily function in more than 75% of their patients with latissimus dorsi transfer (7).

We will not discuss glenohumeral arthrodesis, which fortunately needs to be considered only if the deltoid is nonfunctioning; furthermore according to Neer, this technique is usually contraindicated because of concomitant rotator cuff disease in the contralateral shoulder and because the aftercare program is too arduous (18). Resch proposed an alternative in combined deltoid and rotator cuff deficiency by performing transfer of the pectoralis major muscle (21).

Neer also thought that a constrained shoulder prosthesis, which opposes the upward shear forces during early abduction, is a logical procedure in case of loss of cuff function, but he abandoned the fixed fulcrum design in 1974 because of many mechanical failures. Cofield had the same experience with the constrained Bickel glenohumeral arthroplasty: function at short term was good, but all loosened (5). Neer's 200% and even 600% larger, hooded glenoid components, in an attempt to center the humeral head, were also abandoned since they interfered with closure of the remaining cuff. The same author finally favored the nonconstrained total arthroplasty, combined with as much covering of the prosthesis as possible, with a limited goal (18). Others preferred to perform hemiarthroplasty, using a large head to try to recenter the head under the progressively reshaped acromioglennoidal arch, which acts as one articulation plane. However, the long-term evolution of anatomical prostheses threatens wear of the coracoacromial arch (6). A small prosthetic head should be chosen if one can get enough rotator cuff closure to stabilize the implant and thus restore shoulder function (2). Bigliani *et al.* (2) observed on average 43° more active elevation in shoulders in which complete rotator cuff repair could be achieved as compared to incomplete repairs of the cuff.

Swanson *et al.* (23) already tried the bipolar hemiarthroplasty in the seventies in cuff deficient

shoulders, but without real success. Although pain relief was good, active elevation remained rather poor. Worland later on revived the same concept, but only the designer himself reported good results (26), in contrast to poor results obtained by the Nottingham school (19), since all bipolar arthroplasties in their series resulted in worse pain than before operation. According to Neumann *et al.* (19) the overall results from shoulder arthroplasty (hemi, total or bipolar) for cuff tear arthropathies are poor and unpredictable.

Grammont (10) revived the idea of a reversed, but nonfixed fulcrum prosthesis and thus a less constrained design. Using a large "glenosphère" he was able to medialize the center of rotation of the joint, enhancing the function of the deltoid, the only remaining muscle for abduction of the arm. Furthermore, the distalization of the center of rotation and medialization of the humeral prosthesis to this center alters the direction of the vector forces to centripetal. The deltoid will thus act as a starter of the abduction movement. Very early functional results are astonishing. Despite early problems of loosening of this spherical glenoid component, which were corrected later on, one still has to worry about osteolysis underneath the glenoid (glenoid notching), as a result of friction of the humeral component against the scapula during adduction movements. However larger series with long-term results are still needed to establish whether this affects loosening (3,6). Boutens *et al.* (3) presented midterm results and observed a 15% complication rate, with 10% implant related complications. Favard *et al.* (6) found a significantly better Constant score as compared to a series consisting essentially of hemiprostheses of the Aequalis type ; these better results were mostly related to activity and strength parameters of the score. The same authors conclude that this prosthesis should preferentially be used for elderly patients with a damaged coraco-acromial arch (6). Personal experience, shared with other Belgian colleagues, has led to identical observations concerning glenoid notching. We also observed that the use of a "glenosphère" as large as possible improves the range of motion of the shoulder. Neutral positioning, or even slight (5°) anteversion of this glenoid

component, also seems beneficial to the function. Slight downward inclination of the sphere enhances the distalization of the rotation center and thus the abduction moment. Furthermore, the presence of a functional subscapularis muscle is desired, since it is essential for stability of the prosthesis. The use of retaining, more constrained humeral polyethylene components, in order to enhance stability, has resulted in some of these to loosening from their metallic socket, producing severe metallosis if not recognized early. Therefore, the use of these retaining cups should be avoided. These observations are hints to modification of this original spherical glenoid component, which is actually under investigation.

To summarize, except for acute traumatic tears in the younger population, every cuff tear should first benefit from a conservative rehabilitation program. If not responsive to the latter, reparable tears should be repaired except perhaps in low-demand elderly patients. Massive, irreparable tears in a low demand group may benefit from arthroscopic debridement, but interposition techniques, to cover the hole, provide better results in activities of daily living and better strength. Salvage muscle tendon transfer techniques must be reserved for the younger age group, whereas reversed arthroplasty is very promising in an elderly but still active population.

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SAMENVATTING

F. HANDELBERG. Behandelingsopties bij perforerende scheuren van het rotatorenkapsel.

Elke perforerende scheur van het rotatorenkapsel, behalve de traumatische bij een jonge patiënt, zou eerst een conservatieve aanpak d.m.v. een goed revalidatieprogramma moeten genieten. Bij falen van deze behandeling moeten herstelbare scheuren worden gehecht, behalve eventueel bij oudere patiënten met beperkte behoeften.

Massieve, onherstelbare scheuren kunnen bij deze laatste groep gunstig behandeld worden d.m.v. een arthroscopische subacromiale uitruiming, maar interpositie-technieken blijken toch betere resultaten te behalen wat betreft kracht en activiteiten tijdens het dagelijks leven. Peetransfer-technieken moeten worden voorbehouden als reddingsoperatie bij jongere patiënten, daar waar de geïnverseerde artroplasiëk zeer beloftevol schijnt bij oudere maar nog steeds actieve patiënten.

RÉSUMÉ

F. HANDELBERG. Options thérapeutiques dans les ruptures totales de la coiffe des rotateurs.

Toute rupture perforante de la coiffe des rotateurs, à l'exception des ruptures traumatiques chez le sujet jeune, devrait bénéficier d'abord d'un programme conservateur de revalidation. En cas d'échec de ce traitement, les ruptures réparables devraient être réparées chirurgicalement, sauf peut-être chez des patients agés aux exigences fonctionnelles limitées.

Chez ceux-ci, les ruptures massives irréparables peuvent bénéficier d'un débridement arthroscopique, mais les techniques d'interposition semblent donner de meilleurs résultats en ce qui concerne la force et les activités de la vie courante. Les techniques de sauvetage par transferts musculo-tendineux doivent être réservées aux sujets jeunes, alors que les prothèses inversées sont prometteuses chez les patients agés, mais toujours actifs.