Massive rotator cuff tears in patients younger than 65 years. Epidemiology and characteristics


In close cooperation with the Société d’Orthopédie de l’Ouest (S.O.O)

Summary  
Currently, there is little information on the clinical, radiographic and electric profile of patients younger than 65 years of age with large rotator cuff tear. According to our hypothesis, massive rotator cuff tear, when discovered after recent traumatism, do not provide typical radiographic findings and suprascapular nerve impairment in large rotator cuff tears is uncommon. This is a prospective, descriptive, multicenter study of a series of 112 patients younger than 65 years, including 66 males and 46 females with extensive or massive cuff tear. Duration of symptoms was less than 6 months in 28 cases and secondary to trauma in 57 cases. Patients had loss of elevation or external rotation or both in 57 cases. An electromyogram (EMG) of supraspinatus nerve was performed in 50 cases. A higher incidence of advanced fatty infiltration of the infraspinatus muscle (> stage 2 according to Goutallier) was observed in case of long-term symptomatology or in the absence of known trauma. Traumatic status was commonly found in patients with functional deficit in shoulder elevation, thus reporting a significantly lower Constant score ($p < 0.0001$). Patients with both loss of shoulder elevation and external rotation had a significantly narrower subacromial space (5 mm versus 7.2 mm). No significant relationship could be established between electric impairment and massive cuff tear. According to the present study, in case of traumatic context and recent symptomatology, subacromial height and fatty infiltration of the infraspinatus muscle are better prognostic factors despite a pseudoparalytic shoulder. Repair should thus be considered. Moreover, the interest of a preoperative suprascapular nerve EMG is questionable.

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Introduction

Massive rotator cuff tears are therapeutically challenging injuries. Medical or surgical palliative management is easy to implement in patients aged over 65–70 [1] whereas choice of appropriate treatment options in young and active patients is quite complex. Repair of the cuff tear and proper management should be considered in patients less than 65 years of age especially as they report better chances of tendon healing [2,3].

Actually, these elements depend upon various factors. According to Cofield et al. [4], cuff ruptures over 5 cm diameter after degenerative tissue resection is considered as unrepairable. Gerber et al. [5] consider as unrepairable cuff tears which involve complete detachment of at least two tendons from the greater tuberosity. Walch [6] considers height of the acromio-humeral interval (AHI) when less than seven millimeters as a bad prognostic factor which, according to Nove-Josserand [7], shows impairment of at least two tendons, supraspinatus and infraspinatus. Goutallier [8–10] believes that repair of the rotator cuff is closely dependent on the degree of fatty muscle infiltration which reflects the age of cuff tear and is evaluated by a global fatty infiltration index (GFDI). Just as the degree of tendon retraction influences the overall rotator cuff repairable or unrepairable status.

Other factors might influence the therapeutic management: The traumatic aspect of cuff rupture and timing of surgical repair [11,12], work injury or work disease, cuff tear clinical impact, some patients report satisfactory mobility whereas others have pseudoparalytic shoulder. However, the relationship between these different elements and radiographic findings is little-known.

During the surgical procedure, besides the ability or not to repair cuff tear, the interest of an arthroscopic release of the suprascapular nerve is more and more commonly evoked [13]. This latter appear to be frequently damaged in retracted postero-superior cuff tears and Costouros [14] reports a 38% incidence of suprascapular neuropathy associated with massive rotator cuff tears.

Therefore, there is little information on the clinical, radiographic and electric pattern in patients less than 65 years of age with extensive rotator cuff tear. Our first hypothesis is that massive rotator cuff tear, when discovered after recent trauma, does not provide typical radiographic findings. According to our second hypothesis, suprascapular neuropathy in massive rotator cuff tears is rare.

Material and Methods

This is a prospective, descriptive, multicenter study conducted within the frame of the Société d’Orthopédie de l’Ouest.

Inclusion criteria

Patients aged less than 65 years, suffering from a massive rotator cuff tear featuring the following criteria:

- isolated supraspinatus detachment with stage III retraction in the sagittal plane according to Thomazeau [15] and Boileau [2] (Fig. 1);
- supraspinatus tear associated with infraspinatus or subscapularis tendon detachment or both;
- AHI lower than 7 mm (Fig. 2);
- tear of the supraspinatus associated with greater than stage II fatty infiltration of infraspinatus or subscapularis muscles according to Goutallier [8] (Fig. 3).
Massive rotator cuff tears in patients younger than 65 years

Figure 3  Example of stage III fatty infiltration in the supraspinatus muscle according to the Goutallier classification (8).

Exclusion criteria

- Gleno-humeral or acromio-humeral arthritis;
- previous history of proximal humeral fracture whereas traumas without fracture and gleno-humeral dislocations were included in the study.

Between 1st January 2007 and 25th April 2008, 112 patients were enrolled in the study and examined by 11 orthopaedic surgeons specializing in shoulder surgery. The study group included 66 males and 46 females. Mean age was 56.3 years, ranging from 35 to 65, with no significant differences between men and women. There were 104 right-handers, six left-handers and two ambidexters. The dominant side was involved in 77.6% of cases. The contralateral shoulder had already been operated on in 11 patients or was considered as pathological in 15 patients. Thirty-one percent of patients were retired among whom 83% used to have a heavy or light manual work prior to retirement. Of the remaining patients, 50% were heavy manual workers, and the others were non-manual workers or non-working. One third of patients reported regular sporting activity among whom 16% in competition. Thirty percent of shoulder pathologic conditions were work-related injuries (16%) or occupational illnesses (14%). Fourteen patients had previous history on the affected shoulder. Four of them had already undergone acromioplasty with rotator cuff tendon repair surgery, two of whom had associated acromioclavicular joint resection. Six patients had previous history of gleno-humeral dislocation and one of homolateral hemiplegia on the affected shoulder.

Main discomfort resulted from pain in 81 patients (71.4%), lack of strength in 27 (24.1%) and stiffness in 4 (3.5%).

Mean duration of symptoms was 36.8 months and follow-up visit took place after a mean period of 14 months after worsening of symptomatology. This worsening was sponta-aneous in 47 cases, secondary to minor trauma in 37 cases and to major trauma in 20 cases. Patients were thus subdivided in four groups according to the duration of symptoms (short or long) and to the appearance or not of a trauma responsible for clinical worsening. An arbitrary threshold of 6-month duration of symptoms was defined.

- Recent symptomatology with known traumatism (RT+): 24 cases;
- Recent symptomatology without known traumatism (RT−): four cases;
- Long-term symptomatology with known traumatism (AT+): 33 cases;
- Long-term symptomatology without known traumatism (AT−): 51 cases.

A comparative evaluation between passive and active mobility of injured and contralateral shoulders was conducted during physical examination. Results are shown in Table 1. Assessment of mobility provided classification of patients according to their deficit in elevation and external rotation. Patients were considered as having a deficit in elevation if they couldn’t raise their arm actively beyond 90° and if the difference between passive and active mobility exceeded 30°. Patients were considered as having a loss of external rotation, the elbow by the side, if it did not exceed 30° and if the difference between passive and active mobility was superior or equal to 30°. Four functional statuses could be identified. Therefore, grade A patients (55 cases) had no loss of mobility, grade B patients (19 cases) had an

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Patient mean passive and active mobilities.</th>
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<tbody>
<tr>
<td></td>
<td>Abduction</td>
</tr>
<tr>
<td>Passive</td>
<td>153°</td>
</tr>
<tr>
<td>Active</td>
<td>119°</td>
</tr>
</tbody>
</table>

ER1: external rotation, elbow at the side; ER2: external rotation in elevation; IR1: internal rotation, with elbow at the side according to Constant [16]; IE2: internal rotation in elevation.

Figure 4  Loss of active elevation of the arm.
isolated loss of elevation (Fig. 4), grade C patients (28 cases) had an isolated loss of external rotation (Fig. 5), grade D patients (10 cases) had a loss of external rotation and elevation.

Function was rated according to the Constant scoring system [16]. Mean pain score was 6.8 (1—12), the daily living activities score averaged 8 (0—17), mean mobility score was 25.7 (4—40) and muscular strength 4.3 (0—18). The mean overall Constant score was 44.6 (9—80) whereas contralateral shoulder Constant score was 81.9 (0—100).

Testing of the rotator cuff was systematically performed. Jobe’s test [17] was negative 97 times, loss of external rotation force with the elbow by the side was noted 68 times and loss of external rotation in elevation force was reported 46 times. A positive dropping sign was observed in 27 cases and hornblower’s sign in 26 of cases. The lift-off test was abnormal in 18 patients and the Belly-press-test [17] was weak in 20 cases. The mean loss of external rotation was $19^\circ$ during shoulder examination with “external rotation lag sign” described by Hertel [18].

On standard radiography, the mean height of AHI, evaluated in neutral rotation, was 7.15 mm. The acromioclavicular joint was impaired in 1/4 of cases. The supraspinatus tendon was torn in all 112 cases, the infraspinatus in 76 cases and subscapularis in 28. Hundred and four tears (93%) involved two or more tendons and more than 90% of supraspinatus tendons were retracted to the glenoid level. On the whole series, supraspinatus and infraspinatus reported an advanced fatty infiltration:

- Supraspinatus grade 3 and 4 = 67.9%;
- Infraspinatus grade 3 and 4 = 47.3%;
- Subscapularis grade 3 and 4 = 7.1%.

Whenever possible, an EMG was performed to obtain a motor neurography of supracapular and circumflex nerves by measurement of latency and ROM after stimulation, and a myography by measurement of voluntary supraspinatus, infraspinatus and deltoid muscle activity. Fifty EMG were performed. Forty-nine examinations could be interpreted; one examination had to be interrupted due to pain. Therefore, 44% of patients included in this series were explored.

Results

Analysis of patients according to their symptomatology subgroup (RT+, RT-, AT+, AT-) leads to the following findings. Age, sex ratio, functional discomfort, Constant score and presence or not of infraspinatus clinical amyotrophy did not differ between subgroups. The bad prognostic factors such as height of AHI and fatty muscle degeneration are shown in Table 2. Height of AHI does not appear to be correlated with duration of symptoms. There was a significantly ($p < 0.05$) higher rate of advanced fatty infiltration of the infraspinatus muscle (> 2) in patients with long-term symptomatology (75% of patients). There was also a significantly ($p < 0.05$) higher rate of fatty degeneration of the infraspinatus muscle when no trauma was found in the patient’s anamnesis. Moreover, it was observed that early patient consultation often took place following trauma. Only four RT — patients, with no trauma, did rapidly consult.

Analysis of the different functional groups of patients (A, B, C, D) leads to the following findings. Age, sex ratio or duration of symptoms did not differ between functional subgroups. Grade C patients had the longest duration of symptoms (about 41 months) whereas grade A patients did consult more rapidly (about 35 months). Trauma mostly occurred in grade B and D patients. The mean overall Constant score was significantly lower ($p < 0.0001$) in patients with loss of active elevation (B) or combined loss (D) (Fig. 6). Strength and mobility were found to be significantly lower in these two patient subgroups when compared with both other groups. On the other hand, pain was similar except

<table>
<thead>
<tr>
<th>Number</th>
<th>AHI</th>
<th>AHI &lt; 7 mm</th>
<th>% FI &gt; 2 IS (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>AT-</td>
<td>51</td>
<td>7 mm (0—15)</td>
<td>40%</td>
</tr>
<tr>
<td>AT+</td>
<td>33</td>
<td>7.03 mm (2—12)</td>
<td>38.5%</td>
</tr>
<tr>
<td>RT-</td>
<td>4</td>
<td>6.5 mm (0—12)</td>
<td>Below strength</td>
</tr>
<tr>
<td>RT+</td>
<td>24</td>
<td>7.83 mm (1—12)</td>
<td>33%</td>
</tr>
</tbody>
</table>

AHI: acromio-humeral interval; IS: infraspinatus.
RT+: short symptomatology with known trauma.
RT-: short symptomatology without trauma (RT–).
AT+: long symptomatology with known trauma (AT+).
AT-: long symptomatology without trauma (AT–).
in the grade C subgroup which sustained a lower pain level, particularly at night.

The bad prognostic indicators such as AHI and fatty muscle degeneration are shown in Table 3. Grade D patients had a significantly narrower AHI and a higher fatty muscle infiltration rate superior to two other subgroups.

Table 3  Radiographic findings according to the functional subgroups.

<table>
<thead>
<tr>
<th>Number</th>
<th>AHI</th>
<th>AHI &lt; 7 mm (%)</th>
<th>FI &gt; 2</th>
<th>IS (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A 55</td>
<td>7.58 mm (2—15)</td>
<td>31</td>
<td>31</td>
<td></td>
</tr>
<tr>
<td>B 19</td>
<td>7.15 mm (3—12)</td>
<td>37</td>
<td>31.5</td>
<td></td>
</tr>
<tr>
<td>C 28</td>
<td>7.07 mm (0—12)</td>
<td>46.5</td>
<td>89.5</td>
<td></td>
</tr>
<tr>
<td>D 10</td>
<td>5 mm (0—10)</td>
<td>60</td>
<td>60</td>
<td></td>
</tr>
</tbody>
</table>

AHI: acromio-humeral interval; IS: infraspinatus; FI: fatty infiltration.
A: patients with no shoulder deficit.
B: patients with loss of elevation.
C: patients with loss of external rotation.
D: patients with loss of elevation and external rotation.

The bad prognostic indicators such as AHI and fatty muscle degeneration are shown in Table 3. Grade D patients had a significantly narrower AHI and a higher fatty muscle infiltration rate superior to two other subgroups.

Among electromyographic findings, one reported a suprascapular nerve entrapment at the spinoglenoid notch. This patient showed no deficit in elevation or external rotation but only a decrease in external rotation strength. Three EMG reported a minima impairment of the circumflex artery secondary to a gleno-humeral dislocation. One was pathological secondary to hemiplegia. One demonstrated a C5 radicular damage.

No statistically significant correlations could be established between functional class, symptomatology subgroup, radiographic criteria and electromyographic findings.

**Discussion**

Most patients younger than 65 years of age, with a large rotator cuff tear, are men, of mean age 56 years, heavy manual workers, active, with the dominant shoulder affected. This typical patient may be classified according to the duration of symptoms and traumatic or not appearance or worsening of clinical signs. In the 3/4 of cases, the duration of symptoms exceeds 6 months. Trauma is found in half of the cases (51%). It is a work-injury or work-related disease in one out of three times.

A thorough questioning should be performed on each patient cuff tear history. The main difficulty lies in the distinction between traumatic cuff tear, acute extension of a pre-existing tear and rotator cuff tear with acute symptoms [12]. Management of traumatic cuff tears provides better outcomes when rotator cuff repair takes place within 3 weeks after trauma [11,12]. Our study demonstrates that traumatic cuff tears and short duration of symptoms provide better prognostic factors such as the AHI and fatty infiltration of the infraspinatus muscle [5—7,9] for repair of rotator cuff tear. Fatty degeneration of supraspinatus and infraspinatus muscles and narrowing of the AHI are greater when symptom duration exceeds 6 months. Moreover, traumatic aspect of injury is associated with a lesser degree of fatty infiltration of the infraspinatus muscle. Therefore, beyond the uncommon, complete traumatic rotator cuff tear, early therapeutic management of massive rotator cuff tears, of less than 6 month duration of symptom and secondary to trauma, in patients younger than 65 years, is highly advisable. It directly influences functional recovery [19].

This typical patient could also be classified according to the degree of his loss of active mobility. Four functional profiles, first described by Favard [20], could be identified. They define the various clinical presentations of patients suffering from a massive rotator cuff rupture, from isolated pain to complete pseudoparalytic aspect.

In most cases, patient presents with a painful shoulder showing no deficit. This type of patient will generally present early, despite a similar pain level to patients with shoulder deficit. On the contrary, patient with only external rotation deficit (C) will consult later on while reporting a less painful shoulder. Therefore, the functional impact of such deficit appears to be a lesser handicap than an isolated deficit or when associated with loss of elevation, this mobility range being very under stress daily. Grade B and D patients with shoulder deficit report the worst Constant score demonstrating the lowest strength and range of motion scores. These patients have the highest rate of previous trauma history and in complete traumatic ruptures, loss of active elevation is common [12]. Their management thus reveals challenging. A pseudoparalytic shoulder is commonly reported immediately after trauma, however it appears more challenging to accurately determine its origin: pain induced by acute trauma, muscular sideration, loss of fragile balance in patients with pre-existing cuff tear, or real pseudoparalytic shoulder due to the degree of rupture. Progressive recovery of shoulder elevation is commonly obtained with time, physical therapy and decrease of initial pain. The question is whether it should be better to temporize or carry out early management. The use of imaging is of great importance in this case. If imaging examination reveals bad prognostic factors thus giving evidence of a long-term massive rupture and aggravated condition, a functional treatment should be considered. If imaging helps to predict favorable prognostic factors, repair should be performed without delay.

Patients with loss of external rotation and who present late, show a fatty degeneration of supra- and infraspinatus muscles greater than for other studied cases. Therefore, they have bad prognostic factors for cuff tear repair and their moderate functional discomfort and pain encourage...
resorting to a non-surgical management. Moreover, contrary to those who progressively recover shoulder elevation, patients with loss of external rotation never show spontaneous recovery.

Grade A patients, the most numerous ones, but also those with the lowest level of functional discomfort, are challenging to manage. Appropriate management of these patients should take into account the fact that duration of symptoms which exceeds 6 months and old traumas are pejorative factors since the rate of fatty infiltration of the infraspinatus muscle will double in such clinical context.

Electromyography

EMG of the suprascapular nerve did not provide convincing data. Other impairments are not induced by massive cuff rupture. Therefore, our results differ from those published by Lafosse [13].

Conclusion

Clinical suspicion of massive rotator cuff tear after trauma requires the need for early investigations to provide proper diagnosis of lesions. These investigations generally confirm a massive cuff tear with $\text{AHI} \text{ higher than } 7 \text{ mm}$ and a fatty degeneration of the infraspinatus muscle lower than 2. Based on our observation, we were thus able to validate our first hypothesis that massive rotator cuff tears, when discovered secondary to recent traumatism, do not provide typical radiographic findings. Our second hypothesis — that suprascapular nerve entrapment in massive rotator cuff tears is rare — was also confirmed.

Conditions are thus favorable on the whole for rotator cuff repair, even in the presence of massive rupture and loss of active elevation, the patient is young and prognostic factors are good enough to expect proper tendon healing.

Conflict of interest

None (for all authors).

References


