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Is rehabilitation effective in massive rotator cuff tears?

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ABSTRACT

Background: Irreparable massive rotator cuff tears are challenging to treat. Our objective here was to evaluate the efficacy of a specifically designed rehabilitation programme.
Hypothesis: We hypothesised that outcomes of the rehabilitation programme would vary with the site of the tears.
Materials and methods: Patients with irreparable massive rotator cuff tears and shoulder pseudoparalysis were included prospectively. They followed a five-session specific rehabilitation programme. The outcomes were analysed according to the site of the tears.
Results: We included 45 patients with a mean age of 67 years. At last follow-up after rehabilitation, 24 patients had recovered more than 160° of anterior shoulder elevation. Treatment failure was common in patients with massive anterior rotator cuff tears or tears involving three or more tendons. Patients with massive posterior tears, in contrast, often experienced substantial improvements, even in the medium term.
Conclusion: Outcomes of rehabilitation therapy in patients with irreparable massive rotator cuff tears and shoulder pseudoparalysis vary according to the site and number of the tears. Failure of rehabilitation therapy is common in patients with massive anterior tears or tears involving at least three tendons. In contrast, in patients with isolated massive posterior tears, substantial benefits from rehabilitation therapy can be expected.
Level of evidence: III.

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1. Introduction

Rotator cuff tears are common [1]. Tears are considered massive when they involve multiple tendons [2,3]. The impact of rotator cuff tears on range of motion depends on the site of the lesions [4]. Patients with irreparable tears and shoulder pseudoparalysis may be offered rehabilitation therapy. The outcomes of this treatment approach are variable.

Here, our objective was to assess outcomes after a rehabilitation programme specifically designed for irreparable massive rotator cuff tears with pseudoparalysis. We hypothesised that the outcomes would vary with the site of the tears.

2. Material and methods

2.1. Patient selection

Patients were recruited prospectively between 2007 and 2011 then followed-up for at least 2 years. Inclusion criteria were full-thickness tears of at least two rotator cuff tendons [3]; stage 3 or 4 fatty muscle degeneration as described by Goutallier [5] in the muscles with torn tendons, indicating loss of function of the muscle-tendon units; shoulder pseudoparalysis [6,7] defined as less than 90° of active anterior elevation with full passive motion

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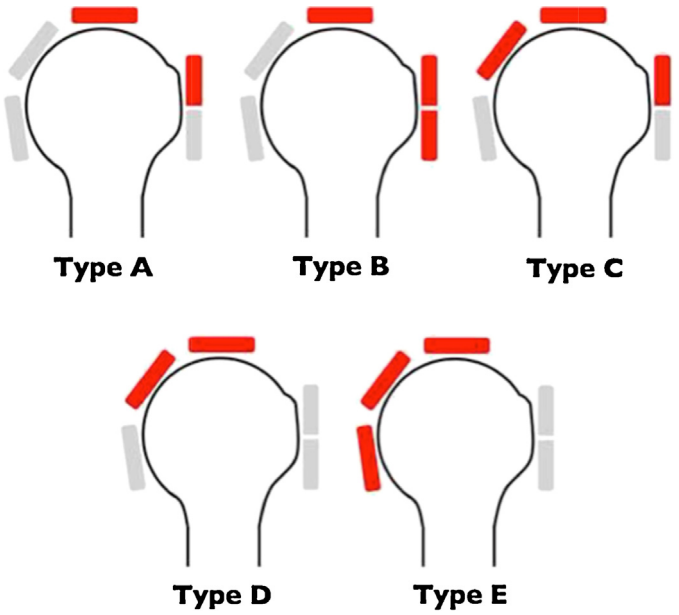

Fig. 1. The five groups defined based on the site of the tears: type A: incomplete antero-superior tear (superior subscapularis and supraspinatus); type B: complete antero-superior tear (subscapularis and supraspinatus); type C: antero-posterior tear (superior subscapularis, supraspinatus and infraspinatus); type D: postero-superior tear (supraspinatus and infraspinatus); type E: complete postero-superior tear (supraspinatus, infraspinatus and teres minor).

ranges, and a pain score lower than 4 on a visual analogue scale from 0 (no pain) to 10 (worst imaginable pain). We excluded patients with gleno-humeral osteoarthritis, a history of deltoid muscle surgery, or missing data. We distinguished five rotator cuff tendons by distinguishing between the superior and minor parts of the subscapularis [4], and we classified the patients into five groups as shown in Fig. 1.

2.2. Physical assessment

All patients were assessed by the same surgeon and same physical therapist, who measured active range of shoulder elevation and external rotation with the elbow by the side (ER1). The Constant score [8] was determined at baseline and at last follow-up.

2.3. Rehabilitation programme

The rehabilitation programme was designed to achieve five objectives:

- to relieve the pain and muscle tension in the scapular and neck area in order to restore mobility of the scapula on the rib cage, thereby ensuring proper glenoid position during active movements. The muscles targeted were the pectoralis minor, upper trapezius, and elevator scapulae;
- to correct faulty humeral-head centring (superior, anterior, and rotational displacements) in order to optimise scapula-humeral mobility. Gentle manual recentring techniques promote the restoration of arthroceptive and biomechanical conditions that allow the intact rotator cuff muscles to fulfil their stabilising function during shoulder elevation;
- to strengthen the muscles that stabilise and move the shoulder, in order to eliminate lower trapezius dyskinesia, thereby correcting the anterior tilt of the scapula; to strengthen the upper portion of the serratus anterior muscle, in order to ensure optimal glenoid position during anterior arm elevation; and to strengthen the intact rotator cuff muscles with special emphasis on the external rotator (teres minor) and on the coaptation role of the deltoid when the arm is elevated;
- to work the muscles that stabilise the gleno-humeral joint by performing exercises with the arm elevated. In this position, the deltoid muscle, which acts synergistically with the intact rotator cuff muscles, does not elevate the arm and contributes to coaptation of the gleno-humeral joint;
- to recover proprioception and movement automatism via neuromotor rehabilitation targeting movement integration. Patients with shoulder pseudoparalysis often underuse their shoulder, thereby deactivating the motor programmes used in everyday activities. Vision plays a crucial role in these exercises. The patient should look at the object to be reached then concentrate on the hand, keeping the eyes on it without paying attention to the fact that the shoulder moves also. Thus, the hand is used to rehabilitate the shoulder. Initially, bilateral symmetric movements may be easier to perform, as motor commands are then coupled via inter-hemispheric cerebral communication.

Table 1
Distribution of the 45 patients among the five groups defined based on the site of the tears.

	A	B	C	D	E
n	5	9	7	15	9

Table 2
Numbers of patients in each tear-site group with greater than 160° of anterior elevation 2 years after the rehabilitation programme.

	A	B	C	D	E
n	3	0	3	14	4

3. Results

We included 45 patients (28 women and 17 men) with a mean age of 67 ± 5.2 years (range, 56–76 years). Mean anterior elevation at baseline was 76 ± 14° (range, 50–80°).

Tables 1 and 2 report the outcomes. At last follow-up 2 years after the five rehabilitation sessions, 24 patents had more than 160° of anterior elevation. ER1 was preserved in groups A and B (Fig. 1). The rehabilitation programme failed to restore ER1 in groups C, D, and E. Overall, the Constant score improved significantly, from 43 at baseline to 56 after 2 years ($P < 0.05$). The Constant score improvement was significantly larger in group D (from 41 to 66, $P < 0.05$).

4. Discussion

The surgical management of patients with shoulder pseudoparalysis has been described in detail [9–11]. Primary shoulder pseudoparalysis occurring as an acute event, often after an injury and in a young individual, requires arthroscopic treatment [9,10]. Fatty muscle degeneration grade 3 or higher contraindicates surgical repair of the involved tendons [3,12]. When neither partial repair nor muscle transfer is possible, and when reverse shoulder arthroplasty is not desirable [13], non-operative treatment including rehabilitation sessions may be offered. No consensus exists regarding non-operative treatment modalities such as indications, methods, and duration. Few studies of rehabilitation therapy are available [14–18]. We therefore designed a study to evaluate the effects of a standardised rehabilitation programme on range of motion recovery in patients with massive rotator cuff tears. We first classified the patients into five groups based on the site of the tears. Major differences were found among these groups. The poor outcomes at last follow-up in patients with massive anterior tears (minor and superior subscapularis and supraspinatus)

indicate that rehabilitation therapy should not be used in this situation. In contrast, rehabilitation therapy is a treatment of choice for massive posterior tears (supraspinatus and infraspinatus), as shown by the recovery of active anterior elevation in most cases. Moreover, the number of torn tendons also influenced the functional outcomes. Recovery was very often achieved in patients with full-thickness tears involving only two tendons (3/5 group-A patients and 14/15 group-D patients). In contrast, recovery was less common in patients with tears in three of the five tendons, and none of these patients recovered when the minor and superior subscapularis tendons had full-thickness tears (0/9 group-B patients). These results are consistent with earlier reports and highlight the major role of the minor subscapularis in active anterior elevation [4,19].

A systematic review on non-operative treatments for rotator cuff lesions identified ten observational studies and no randomised trials, highlighting the dearth of high-quality evidence on this topic [20]. Only four of the ten studies focussed on massive tears and their results allowed no definitive conclusions [20]. However, the rehabilitation programme was described in detail in some of the reports. Ainsworth [14] and Levy et al. [16] identified anterior deltoid strengthening as a priority, a finding not supported by our study. Strengthening the anterior deltoid exacerbates the natural tendency towards anterior decentring, thereby worsening the situation. Strengthening the eccentric humeral-head depressors (pectoralis major and latissimus dorsi) has the same effect. We therefore prefer to strengthen the muscles that stabilise the scapula and the entire deltoid muscle with the arm elevated.

The outcomes of rehabilitation therapy should be evaluated over time. In our study, the improvements were sustained over time in groups A and D. The only other study with sufficient follow-up included 19 patients, who were evaluated after 48 months [18]. Improvements were noted in pain and in the global and subjective shoulder evaluations (subjective shoulder value) [21] but not in range of motion. Although the results were sustained over time, the acromio-humeral distance decreased, tear size increased, and fatty degeneration worsened over the 48-month follow-up period [18].

The absence of control groups is a limitation of our study. Nevertheless, we provide the first evidence on outcomes of rehabilitation therapy according to the site and number of tears. Thus, our study should help to select patients for rehabilitation therapy when non-operative treatment is in order.

5. Conclusion

Outcomes of rehabilitation therapy in patients with irreparable massive rotator cuff tears and shoulder pseudoparalysis vary according to the site and number of the tears. Failure of rehabilitation therapy is common in patients with massive anterior tears or tears involving at least three tendons. In contrast, in patients with isolated massive posterior tears, substantial benefits from rehabilitation therapy can be expected.

Disclosure of interest

The authors declare that they have no conflicts of interest concerning this article.

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