Deltoid detachment consequent to open surgical repair of massive rotator cuff tears

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Abstract Deltoid detachment is one of the complications in open rotator cuff repair. Although it is often described, the actual prevalence, time at which it occurs and the predisposing causes are still unknown. We prospectively studied 112 patients with massive rotator cuff tears with a mean age of 67. The surgical approach was performed with a lateral para-acromial incision. Clinical assessment was performed with Constant's method. Of the 112 patients, 9 (8%) had deltoid detachment. It occurred about 3 months after surgery. Of the nine patients, two underwent revision surgery for the deltoid trans-bone reattachment. At the follow-up, the patients with deltoid detachment had a mean increase of only 5.5 points in the Constant score compared to that of 16.9 obtained by the control group. Deltoid reattachment, performed on the two patients, provided a mean increase of 7 points only with respect to the post-operative control at the 4th month. Considering the unsatisfactory functional result consequent to deltoid detachment and the slight improvement obtained with the reattachment, we recommend the following: use suture thread thicker than #2, do not use a simple stitch and avoid extending acromioplasty to the lateral margin of the acromion.

Résumé La rupture du deltoïde est une des complications des réparations de coiffe de rotateur à ciel ouvert. Bien que cette complication soit souvent décrite, l'incidence actuelle, le moment d'apparition et les facteurs favorisant de cette lésion ne sont pas bien connus. Nous avons réalisé une

étude prospective, à partir de 112 patients, avec rupture massive de la coiffe des rotateurs, d'âge moyen 67 ans. L'abord chirurgical était de type para-acromial latéral. La revue clinique a été réalisée avec le score de Constant. Sur les 112 patients, 9 (8%) avaient une rupture du deltoïde. Cela s'est produit environ trois mois après l'intervention. Sur les 9 patients, deux furent réopérés avec une suture trans-osseuse du deltoïde. A la révision, les patients avec une rupture du deltoïde avaient un gain moyen de 5.5 points dans le score de Constant et ceux sans rupture avaient 16.9. La refixation du deltoïde, réalisée sur les deux patients, n'a permis de gagner que 7 points par rapport au contrôle post opératoire à 4 mois. Compte tenu des résultats fonctionnels non satisfaisants consécutifs à la rupture du deltoïde et le faible gain, après réparation, nous recommandons : l'utilisation de fil de suture de diamètre supérieur à 2; de ne pas utiliser de points simples et d'éviter les acromioplasties extensives du bord latéral de l'acromion.

Introduction

Deltoid detachment, re-tear and infection are the most common complications in open surgical repair of the rotator cuff. It is a common belief that the detachment occurs if, after the rotator cuff repair, the reattachment onto the acromion is performed improperly or if there is an excessive and sudden traction on the suture. It is maintained that muscle detachment typically occurs in the first 6 weeks after surgery, during the active shoulder rehabilitation period [7]. The detachment may be responsible, besides the aesthetic defect, for decreasing active arm mobility. Matsen and Arntz [8] indicate that small detachments do not require revision surgery; however, when it is greater

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than 3 cm, reattachment of the muscle onto the acromion within a short period is necessary, as a functionally valid reattachment may be difficult to obtain when the lesion is inveterate.

Although deltoid detachment is often described in scientific works referring to surgical failure of rotator cuff repair, its actual prevalence, the period when the lesion occurs and the predisposing causes of the detachment are still unknown. We prospectively followed a high number of patients who underwent open surgical repair of the rotator cuff. The number is considered high because it consisted only of patients who, for the type of lesion, were not considered suitable for arthroscopic surgical repair.

Materials and methods

The studied group consisted of 112 patients with massive rotator cuff tears with a mean age of 67 (range: 50–75 years). All patients had pain for an average period of 1 year (range: 8 months–2.2 years), a significant decrease in active shoulder mobility, positive signs on posterosuperior cuff tests and significant decrease in strength in external rotation (3–4/5) [9]. In all cases, magnetic resonance imaging (MRI) showed involvement of two tendons, supra and infraspinatus, and a fatty degeneration (Goutallier 3–4) of the corresponding muscles.

In all patients the surgical approach was performed with a lateral para-acromial incision. The length of incision depended on the shoulder dimension. The deltoid was always detached from the bone insertion by using electrocautery. After the rotator cuff repair, it was always reattached with 4 or 5 simple non-reabsorbable #2 stitches.

During the frequent post-operative controls, the range of motion and deltoid conditions were evaluated. In the case of deltoid detachment, we registered the presumed period when the detachment occurred and the possible causes. Shoulder assessment was performed with Constant's method [3]. Statistical analysis was conducted using the chi-square test. A value of $p < 0.054$ was considered to be significant.

Results

Of the 112 patients, 9 (8%) (mean age: 63, range: 47–77 years) had deltoid detachment from the acromion (Fig. 1); 4 were males and 5 females. The right shoulder was involved in seven cases. The nine patients were all right-handed and none of them had undergone previous shoulder surgery. In all these cases an acromioplasty was performed.

The detachment occurred about 3 months after surgery (range: 1–5 months) during the active functional rehabilitation. None of the patients felt a tearing sensation or a sudden pain in the lateral shoulder region; on the contrary, all the patients noticed a progressive deformity of the deltoid profile, represented by a lateral subacromial depression, emphasized in abduction movement (Fig. 2). Nobody attributed the detachment to an excessive effort performed during physiotherapy treatment or during daily activities. In one case (a 54-year-old man), detachment occurred as a consequence of a superficial post-operative infection which healed after taking antibiotics for 1 month.

The average pre-operative Constant score of the nine patients was 61.6%; the post-operative score, evaluated during the 6th month after surgery (in two cases, during the 4th month), was 67.1%. The causes responsible for a low score increase were the persistent decrease in strength and pain during flexion and abduction movements. In fact, none of the nine patients was able to hold 6 kg weight during a 90° abduction due to pain and/or to strength deficit. The average Constant pre- and post-operative score of the control patients, similar in age (average: 65, range: 51–75) and tear dimensions, but without deltoid detachment, was 59.9 and 76.8%, respectively. The difference in the average Constant score increase in the nine patients with deltoid detachment and that of the control group proved to be statistically significant ($p < 0.05$).

Of the nine patients, two (Constant score 62) accepted to undergo revision surgery for the deltoid trans-bone reattachment. The operation was performed less than a month after the detachment diagnosis. In both cases, a deep deltoid fascia detachment was evident, while a thin layer of superficial muscular fibres maintained the connection with the lateral margin of the acromion. Some of the suture

Fig. 1 Clinical data

Fig. 2 Clinical appearance of a post-operative deltoid detachment

stitches previously used had untied and were found on the deep deltoid fascia. This latter and the detached muscle were reattached with trans-bone U-shaped stitches, using non-reabsorbable #5 suture thread. Six months after the deltoid reattachment, the two patients obtained a mean increase of 7 points compared to the score calculated in the follow-up. Both reported having pain regression and a slight improvement in abduction strength.

Discussion

The actual prevalence of post-operative deltoid detachment is not well known. In prospective studies, Groh et al. [5] and Sher et al. [11] observed, respectively, 36 and 12 cases with deltoid detachment; however, there is no information provided on the number of patients operated. Post [10] believed that deltoid detachment is the cause of continuous pain and scarce shoulder mobility. However, also in his article there are no data provided to permit obtaining information about lesion prevalence. Although our group is not numerous, considering the extreme selectivity used in choosing the population to study, it is the only group which can be considered for information regarding deltoid detachment prevalence. Of our patients who underwent open surgery for rotator cuff repair, 8% sustained this complication.

The data obtained from our study exclude a correlation between deltoid detachment, patient age and gender. In fact, detachment occurred in patients aged 47–77 and in 44% of male subjects. Except for the case where the superficial

infection was believed to be the cause of deltoid detachment, in all the other cases, the cause of the complication is not known. As none of the other eight patients reported feeling a sudden tear consequent to an excessive effort during their daily activities or during rehabilitation with the physiotherapist, we believe that the deltoid detachment occurred progressively. In all eight cases, it occurred after starting active re-education. As the detachment cannot be due to the suture thread reabsorption, seeing that in all cases a non-reabsorbable thread was used, it is plausible that it depends on the type of stitch used for the reattachment, on the thread size, on the acromion osteopenia degree or on the excessive thinness of the latter consequent to an excessive lateral acromioplasty. All the cases belonging to the studied groups had undergone the same deltoid reattachment (simple trans-bone stitches; on the average 4 or 5 depending on the width of the surgical field) with non-reabsorbable #2 thread. We believe that the suture rupture depends on the thinness of the thread and on the fact that this, penetrating an osteopenic acromion or having become too thin after acromioplasty, can progressively penetrate through the bone losing its grip. This would explain the presence of the suture residues found in the deep deltoid fascia.

At the follow-up, the patients with deltoid detachment had a mean increase of only 5.5 points in the Constant score compared to that of 16.9 obtained by the control group. The difference may be only slightly influenced by the fact that in two re-operated patients shoulder assessment was made earlier than the 6th month.

Decreases in pain and strength frequently occur after deltoid detachment. Some of the nine patients have also reported being unsatisfied with the deformity caused by the detachment. For all these reasons, it would seem appropriate to propose revision surgery with the aim of reattaching the deep fascia and the muscle onto the acromion. Our two cases, after revision surgery, obtained an average increase of 7 points compared to the evaluation seen 4 months after the first operation. However, the final value obtained by the two patients was in any case inferior to that of the control group. These data, although not significant, would confirm the observation by Sher et al. [11] who reported having almost 70% unsatisfactory results and only 4% excellent results after revision surgery.

Considering the unsatisfactory functional result consequent to deltoid detachment and the slight improvement obtained with the reattachment we recommend the following: use suture thread thicker than #2, use a “U-type” suture or others that achieve biomechanically efficient results (for example sutures used in cuff reinsertion on the greater tuberosity) and avoid extending acromioplasty to the lateral margin of the acromion in order to prevent it becoming too thin and making it too easily crossable by the suture thread.

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