RESEARCH ARTICLE

Comparison of Anterior and Posterior Transfer of Latissimus Dorsi Tendon to Humeral Head in Patients with Massive and Irreparable Rotator Cuff Tear

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Abstract

Objectives: Latissimus dorsi tendon transfer is a treatment option in patients with irreparable rotator cuff tears. This study aimed to compare the effectiveness and safety of anterior and posterior transfer of latissimus dorsi tendon for anterosuperior or posterosuperior massive irreparable rotator cuff tears.

Methods: In this prospective clinical trial, 27 patients with irreparable rotator cuff tears were treated with latissimus dorsi transfer. The transfers in 14 and 13 patients were from the anterior for anterosuperior cuff deficiency (group A) and from the posterior for posterosuperior cuff deficiency (group B), respectively. Pain, shoulder range of motion in forward elevation, abduction, external rotation, and functional scores were evaluated 12 months after the surgery.

Results: Two and one patients were excluded from the study due to not referring in time for follow-up and infection, respectively. Therefore, 13 patients remained in group A and 11 patients in group B. Visual analog scale scores decreased from 6.5 to 3.0 in group A (P=0.016) and from 5.909 to 2.818 in group B (P=0.028). The constant scores improved from 41 to 50.2 (P=0.010) in group A and from 30.2 to 42.5 (P=0.001) in group B. There was a significant improvement in the abduction and forward elevation in both groups which was more significant in group B. The posterior transfer made significant improvement in external rotation; however, the anterior transfer did not change external rotation. No radial or axillary nerve injury was observed in any of the two groups.

Conclusion: Latissimus dorsi transfer in patients with irreparable rotator cuff tears has a significant effect on recovery. It improves shoulder function and range of motion and reduces pain. Improvement of shoulder elevation and abduction is more significant in posterior transfer. The anterior transfer is as safe as the posterior transfer for nerve injury.

Level of evidence: II

Keywords: Latissimus dorsi, Rotator cuff tear, Shoulder, Tendon transfer

Introduction

The rotator cuff is a set of muscles that play a key role in the motion and stabilization of the shoulder joint. These muscles include teres minor, infraspinatus, supraspinatus, and subscapularis[1]. The shoulder joint is prone to injury due to its great range of motion and the anatomical shape of the surrounding bone structure[2]. Nevertheless, rotator cuff injury is an important cause of inefficiency and shoulder. Pain.[3-6]

There are several methods to treat rotator cuff tears. In many cases, non-surgical treatment can improve the symptoms. Selection of a non-surgical or surgical treatment depends on the rupture extent, injury duration, activity level, presence of comorbid symptoms or injury, and the response to treatment[7, 8]

Many options have been proposed for the treatment of irreparable rotator cuff tear. They vary according to the

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condition of patients in terms of activity level, age, expectation, and cooperation. Moreover, factors related to the degree of shoulder joint injury, such as the presence or absence of joint osteoarthritis, joint cartilage injury, tear size, associated injuries, and presence of nerve damage, are influential in deciding the type of suitable surgical procedure. Reverse shoulder arthroplasty is a suitable option for older adults or patients with articular cartilage damage.[7-9]

In patients with healthy articular cartilage, surgical treatment focuses on preserving the shoulder joint. The treatments vary from simple debridement and partial rotator cuff repair to tendon transfer, placement of subacromial balloon, and reconstruction of superior capsule[10-12]. Tendon transfers in patients with irreparable rotator cuff tear include the lower trapezius, pectoralis major, teres major, and latissimus dorsi. Latissimus dorsi tendon is a very desirable option due to its proper muscle fiber direction, sufficient strength, and proper length.[13, 14]

Latissimus dorsi transfer can be performed alone or with other tendons. It was previously used for posterosuperior cuff deficiency while pectoralis major transfer was used for anterosuperior rotator cuff deficiency. Recently, transfer of latissimus dorsi from the anterior has been reported for patients with anterosuperior cuff deficiency instead of pectoralis major transfer. It is believed to improve joint stability, compared to pectoralis major transfer; however, studies are limited in this regard.[5-7]

From a surgical point of view, none of the available transfers is definitely better than others for irreparable rotator cuff tears. Therefore, studying different methods and comparing the results of different tendon transfers in these patients is important in guiding surgeons to choose the preferred method[15-19]. Posterior latissimus dorsi transfer has been approved for posterosuperior cuff deficiency, while the efficacy of anterior transfer for anterosuperior cuff deficiency requires more study to replace other transfers. In comparison with pectoralis major and trapezius transfers, the tendency to use this method has increased due to the appropriate strength of latissimus dorsi, lack of need for tendon grafts, and less disability due to tendon position change.[20-23]

To the best of our knowledge, no previous study has compared the results of anterior and posterior latissimus dorsi transfer. Therefore, this study aimed to compare the clinical results of anterior and posterior transfer of latissimus dorsi tendon for anterosuperior and posterosuperior rotator cuff deficiency, respectively, in patients who were not candidates for reverse shoulder arthroplasty yet.

Materials and Methods

This prospective clinical trial was approved by our national board of clinical trials (No: IRCT20141209020258N152). The statistical population of this study consisted of the patients who had referred to our shoulder clinic with shoulder pain or weakness due to an irreparable rotator cuff tear from April 2019 to April 2021. In total, 27 patients were included in this study according to the required sample size.

The inclusion criteria were a massive irreparable rotator cuff tear and being younger than 70 years old. Diagnosis of massive irreparable rotator cuff tear was based on grade 3 fat infiltration of at least two tendons on magnetic resonance imaging, massive tear after repair, tendon contraction of more than 2.5 cm in cases of anterosuperior deficiency with intact infraspinatus and teres minor, and posterosuperior deficiency with intact subscapularis tendon.

The exclusion criteria were: a) evidence of shoulder osteoarthritis, brachial plexus injury, or nerve defect involving latissimus dorsi, b) preoperative adhesive capsule, septic arthritis, or active site infection, c) lack of cooperation as required, d) cognitive impairment, e) combined tear of the subscapularis tendon and posterosuperior cuff deficiency, f) combined tear of the infraspinatus and anterosuperior cuff deficiency, and g) lack of participation in the last follow-up.

After signing a consent form, the preoperative range of motion of the shoulder, visual analog scale score, and constant score were recorded. The first author (H.S.), who is an experienced shoulder surgeon, conducted latissimus dorsi tendon transfer surgery on all patients. Patients were coded based on surgery type. Therefore, the second author (M.A.) evaluated the patients 6 and 12 months after surgery. He examined the patients while they were dressed in order not to be aware of the type of surgical incision.

Two patients were excluded from the study due to a lack of in-time referrals for follow-up. One participant was excluded because of site infection and failure to perform the scheduled post-surgery plan. The post-surgery immobilization was achieved through the use of an abduction/external rotation pillow for posterior transfer and a sling and swathe for anterior transfer. Patients were discharged up to two days after surgery based on their clinical condition. Performance of active wrist and elbow movements was recommended. They started an active assisted range of motion of the shoulder after six weeks and strengthening exercises eight weeks after surgery. Patients were recalled in the 6th and 12th months after surgery to be re-examined regarding pain based on a visual analog scale, range of motion with a goniometer, and shoulder function with a constant score. The collected data were analyzed in SPSS software (version 26).

Surgical technique

Posterior transfer: First, the posterior inferior axillary approach separated the insertion site of the latissimus dorsi tendon from the humerus. Afterward, the muscle was mobilized with neurovascular pedicle protection as much as possible. The rotator cuff footprint was then prepared from the deltoid splitting site. The latissimus dorsi tendon was pulled out and set at the new site under the deltoid muscle. Afterward, it was fixed in a bone tunnel to the footprint of the deficient rotator cuff.

Anterior transfer: Starting with the deltopectoral approach, the latissimus dorsi tendon was found under the pectoralis major tendon. External rotation of the humerus made it easier to find. It was detached from the humerus and pulled up to the footprint of the subscapularis tendon to be fixed in a bone tunnel in that region. Tenodesis of the long head of the biceps tendon was performed in both groups as it is unstable in both anterosuperior and posterosuperior cuff deficiency.

Results

There were 6 women and 18 men among the 24

participants who remained in the study. Mean age of the participants was 58.7 years old [Table 1]. Tendon transfer was from the anterior in 14 patients for anterosuperior cuff deficiency (group A) and from the posterior in 13 patients for posterosuperior cuff deficiency (group B) [Tables 2 and 3].

Table 1. Demographic data of patients

Age (years old)	Youngest : 27	Oldest : 68	Mean: 58.7
Sex	Male : 18	Female : 6	
Transfer side	Anterior : 13	Posterior : 11	
Pain duration before surgery (month)	Lower : 5	Upper : 96	Mean: 37

Table 2. Clinical results of anterior latissimus dorsi transfer for anterosuperior rotator cuff deficiency (group A)

Variable	Before surgery	After 12 months	P value
Forward flexion	101 15	122.30	0 034
Abduction	111.15	126.92	0.003
External rotation	55.7	56.1	0.104
Pain	6.500	3.000	0.016
Constant score	41.07	50.23	0.010

Table 3: Clinical results of posterior latissimus dorsi tendon transfer for posterosuperior rotator cuff deficiency (group B)

Variable	Before surgery	After 12 months	P value
Forward flexion	73.63	109.09	0.001
Abduction	84.54	115.45	0.000
External rotation	12.7	41.36	0.003
Pain	5.909	2.818	0.028
Constant score	30 27	42.54	0.001

Visual analog scale scores decreased from 6.5 to 3.0 in group A (P=0.016) and from 5.909 to 2.818 in group B (P=0.028). Therefore, alleviating pain was significant in both groups after latissimus dorsi tendon transfer; however, the difference in improvement was not significant between the two groups (P=0.104). The constant scores improved from 41 to 50.2 (P=0.010) in group A and from 30.2 to 42.5 (P=0.001) in group B. Hence, although the improvement of function was significant in both groups, there was no difference between them (P=0.61) in terms of functional improvement.

Active forward flexion improved from 101 to 122 (P=0.034) in the anterior transfer (group A) and from 73.6 to 109 degrees (P=0.001) in the posterior transfer (group B). The difference between the two methods was significant (P=0.01). Therefore, although both groups had significant forward flexion improvement, the posterior transfer led to the better improvement of forward flexion, compared to anterior transfer.

Shoulder abduction increased from 111 to 126 degrees (P=0.003) in group A and from 84.5 to 115.4 (P=0.000) in group B. The rate of increase in shoulder abduction in the posterior transfer was significantly more than that in the anterior transfer (P=0.03).

Active external rotation change was not significant after the anterior transfer (group A). In group B, the mean of active external rotation significantly increased from 12.7 before surgery to 41.3 six months after the surgery (P=0.003). There was no complication related to anterior or posterior latissimus dorsi tendon transfer, including axillary and radial nerve injuries.

Discussion

This study investigated the results of latissimus dorsi tendon transfer in patients with irreparable rotator cuff tear and compared the results of posterior and anterior transfers. In total, 24 patients (13 patients with anterior and 11 patients with posterior transfers) were included in this study. Constant score, visual analog scale score, and shoulder range of motion were recorded before and 12 months after surgery.

Visual analog scale score improved significantly in both groups after surgery, and there was no significant difference between anterior and posterior transfers in terms of relief of pain. In a study conducted by El Azab et al., pain reduced from 7.8 to 2.4 after posterior transfer of latissimus dorsi.[13] Moreover, in another study performed by Gerber et al, the pain improved significantly after anterior latissimus dorsi transfer.[14]

In patients who underwent anterior transfer, the constant score improved from 41 to 50.2. Furthermore, in patients with a posterior transfer, this change was from 30.2 to 42.5. Improvement of function was significant in both groups, but the difference was not significant between them in terms of functional improvement. Castricini et al. reported an improvement in the performance of patients with open surgery combined with arthroscopic surgery.[24] In a study carried out by El-Azab et al., the constant score increased from 44 to 71.[13]We also investigated the relationship of age with the improvement in performance or pain. Although Elhassan mentioned the relationship between better results and younger age in latissimus dorsi transfer, no such relationship was found in the present study.

Improvement of range of motion was also different between the two groups. The shoulder abduction rate increased from 111 to 126 degrees on average in the anterior transfer and from 84.5 to 115.4 degrees in the posterior transfer. According to these statistics, the difference between the increases in shoulder abduction was significant.

Forward elevation improved transfer from 73.6 to 109 degrees in the posterior transfer and from 101 to 122 in the anterior transfer. Therefore, although both anterior and posterior latissimus dorsi transfers significantly improved forward elevation, it seemed that the posterior transfer was more efficient than the anterior transfer in increasing forward elevation. In a study performed by Habermeyer et al., after the transferral of latissimus dorsi with minor teres to the infraspinatus insertion site (posterior transfer), 20 patients were evaluated regarding forward elevation and external rotation after surgery. Their improvement in

forward elevation was from 119 to 169 after posterior latissimus dorsi transfer.[25] In addition, Mun et al. evaluated clinical results of anterior latissimus dorsi tendon transfer and reported improvement of forward elevation from 135 to 166. They mentioned that 17 out of 24 patients had concomitant posterior cuff tear that can affect the degree of forward elevation improvement.[26]

The external rotation in the anterior transfer was 55.7 on average before surgery, which increased to 56.1 after 12 months. As a result, it seems that the anterior transfer had no significant effect on the improvement of the external rotation of the shoulder. In the posterior transfer group (group B), this average increased from 12.7 before surgery to 41.3 after 12 months, which was significant. Gerber et al. reported an increase from 22 to 29 degrees in the external postoperative shoulder rotation after the surgery.[14] Habermeyer et al. reported improvement of external rotation from 12 to 35 after the transferral of latissimus dorsi with minor teres to the infraspinatus insertion site (posterior transfer).[25] In a study conducted by Mun et al., external rotation did not change significantly after anterior latissimus dorsi tendon transfer.[26]

There was no complication related to anterior or posterior latissimus dorsi tendon transfer, including axillary or radial nerve injuries. Hence, the anterior transfer is as safe as the posterior transfer and in agreement with what other authors have mentioned in their studies.[13, 14, 24-26]

Limitations

Although this seems to be the first study that compared the results of doing latissimus dorsi transfer from anterior and posterior, the limited number of patients and follow-up time were two of its limitations.

Conclusion

Anterior latissimus dorsi transfer is effective and safe for the improvement of the function and range of motion of the anterosuperior rotator cuff deficient shoulder. However, it is not as efficient as a posterior transfer for restoration of shoulder abduction and forward elevation and seems to have no negative or positive effect on shoulder external rotation. It should be mentioned that the posterior transfer significantly improved the external rotation. It is suggested to perform more studies with a greater number of cases and long-term follow-up to assess these findings.

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