Comparison of the Relationship between Peripheral Neuropathy Associated with Massive Rotator Cuff Tear and The Effect of Tendon Repair on Improvement of Neuropathy

Abstract

Background: The association between massive rotator cuff tear (RCT) and peripheral neuropathy has been suggested, but the findings on this subject are often inconsistent. In the present prospective study, we assessed the prevalence of peripheral neuropathy in patients with massive RCT. The effect of surgical repair of rotator tear on the treatment outcomes of neuropathy will also be evaluated.

Methods: In this study, 58 patients were evaluated with a massive tear. All the patients underwent open repair using anchor suture instrumentation. Electromyelography (EMG) and nerve conduction velocity (NCV) tests, to check for neuropathy, were performed before surgery. In addition, before and after the surgery, Quick Disabilities of the Arm, Shoulder and Hand (DASH) score was calculated for all the patients. Pain intensity was measured using visual analogue scale (VAS). The Patients were followed up for 6 months. In the final visit, EMG/NCV was reperformed for those patients with neuropathy.

Results: In the 58 patients, total of 8 patients with neuropathy were observed (13.5%). Presented with supra scapular neuropathy, 2 upper trunk neuropathy and 1 case of axillary neuropathy. In the final visit, all the cases except for one supra scapular and one upper trunk neuropathy had recovered. The average final Quick DASH score reduced to 19.7 from the pre-operative value of 72 <0.001. Similarly, the severity of pain significantly decreased from 5.3 to 1/1 (p <0.001). The most important final patients’ complaint was limitation of motion in 11 patients (19%). Three patients complained of pain, two of whom were the ones whose neuropathy had not improved.

Conclusion: Precise screening for neurological damage is recommended in all the patients with extensive RCT. Moreover, electromyographic and NCV studies can be of benefit in suspected cases of neuropathy before repairing a rotator cuff tear.

Key words: massive rotator cuff tear, arthroscopic repair, neuropathy, supra scapular nerve

Introduction

The shoulder joint is considered as one of the major joints of the upper limb with a wide range of motion and the highest mobility. Rotator cuff tendon is one of the most important tendons of shoulder joint for some movements, especially abduction. Any rupture in this tendon can result in pain and the loss of motor function, and therefore is associated with many abnormalities in shoulder function. Other rotator cuff disorders, commonly known as impingement, are the most common cause of shoulder pain.

After lower back pain, shoulder pain is reported to be the second most common musculoskeletal complaint among patients. Rotator cuff tear is one of the most important reasons for orthopaedic clinic visits, often presented with complaints of shoulder pain and impaired shoulder function. About 10% of shoulder pain related to rotator cuff disorders. In the United States alone, the complications associated with rotator cuff tear cost billions of dollars annually. The rotator cuff tendon helps the joint to remain stable at the same high mobility and absence of stable morphology by creating a concavity-compression mechanism in the shoulder joint. Some studies suggest that this damage can be associated with a variety of peripheral neuropathies.
However, the evidence around any association between the RCT and neuropathy is still inconsistent. In addition, still cannot properly determine whether the rotator cuff tear causes neuropathy, or vice versa. Regarding the controversial findings of previous studies, we examined the prevalence of neuropathy in patients with a massive rotator cuff tear and evaluated the effect of treatment of tendon rupture on neuropathy improvement. Currently, the available evidence around the natural course of RCT and its treatment options is limited and inconsistent (12). In a cadaver study, the incidence of complete and partial rotator cuff tear (RCT) was 11.75% and 18.49%, respectively (11). Massive rotator cuff tear can also be associated with various neuropathies, including suprascapular neuropathy (SSN) with an incident rate ranging from 10% to 54% (13-16). While in some studies, SSN has been introduced as the main type of neuropathy associated with RCT (14,15), there are conflicting findings in other studies suggesting other types of peripheral neuropathies, such as the upper trunk as the most prevalent type of neuropathy associated with RCT (13,16).

Of course, the suprascapular nerve, in its anatomical path, is almost stable and without any displacement, and the probability of neuropathy is due to various trauma, pressure, or iatrogenic causes. However, the association between the rotator cuff retraction and SSN injury remains unclear. It is still questionable that whether the rotator cuff tear and the resulting retraction on the suprascapular nerve lead to neuropathy, or it is the suprascapular nerve injury that results in weakness of the rotator cuff muscles and tendon rupture (13,15). Diagnosis of neuropathy in patients with the rotator cuff tear is difficult because the main sign and complaint of this neuropathy is pain which itself may overlap by the pain of the rotator cuff tearing. Moreover, because of the variety of manifestations of this neuropathy, its diagnosis is challenging. For this particular type of neuropathy, no significant sensory loss or motor loss or reflex disorder is detected and the joint motion limitation is not necessarily due to neurological defects. Therefore, the diagnosis should be based on EMG-NCV findings. In some studies, improvement of neuropathy after rotator cuff tendon repair is seen, and in addition to improving ROM and performance and pain reducing, EMG-NCV has been used to confirm improvement of neuropathy (17). Based on the presentations and considering the lack of information on the interactions between RCTs and associated neuropathies, especially SSN, we intend to consider the prevalence of neuropathy and its types in RCTs. In addition, in this study, we distinguished the effect of rotator cuff tendon repair on neuropathy improvement.

**Method**

In this case series study, 65 patients who referred to Akhtar Hospital between 1394-1395 with RCT were considered potentially eligible for inclusion in this study. All the patients gave a written consent according to the approved ethical agreement (Shahid Beheshti Medical University ethics committee). The inclusion criteria were: (1) patients’ age between 20 and 70, (2) a tendon rupture in the past 6 weeks, (3) absence of any musculoskeletal underlying conditions such as diabetes associated with muscle atrophy or peripheral neuropathy. After applying the inclusion criteria, 58 patients were eventually selected for the study. Massive RCT was diagnosed by physical examination (the range of motion) and MRI. The criteria of Gerber et al. and Cofield and colleagues (18,19) were used to diagnose massive tears; characterized by Supraspinatus and Infraspinatus tendon damage, with undamaged Teres minor and Subscapular tendons with rupture size over 5cm (19).

Subsequently, patients underwent electro physiologic studies to be assessed for any neuropathies (figure1). The patients’ functional status was also evaluated using quick DASH score. The range (abduction, external rotation, and internal rotation) was measured using goniometer. Pain severity was also measured by visual analogue scale (VAS). Then patients underwent open tendon repair surgery using anchor suture. After surgery, a routine similar rehabilitation program was performed for all the patients. Patients were re-evaluated for pain intensity using VAS and function using DASH score and also performing EMG / NCV to re-examine the status of possible neuropathy 6 months after the surgery. Finally, the obtained data were analyzed statistically. Quantitative data was presented as mean ± SD and data was presented as numbers and percentages.
Paired t-test was used to compare fast DASH score before and after surgery. Wilcoxon signed-rank test was also used to compare the VAS before and after surgery and Pearson t-test for testing the final results. SPSS ver.16 software was used for the analyses and p <0.05 was considered as the level of significance.

Results

A total of 58 patients enrolled in the study were examined, consisting of 32 (55.2%) men and 26 (44.8%) women. The mean age of the patients was 36.2 ± 17.1 years (range 20-70 years).

Eight patients had peripheral neuropathy (13.8%). Of these, 5 patients had suprascapular neuropathy (8.6%), 2 (3.5%) upper trunk and one (1.7%) axillary neuropathy (Fig.1).

In the follow-up post-operative examinations, all cases except one suprascapular neuropathy and one upper trunk neuropathy fully recovered (Fig.2). Moreover, the average quick DASH score and the severity of pain decreased significantly (p <0.001). The pre-operative DASH score of 72.6 improved to 19.7 in the final post-operative evaluation. In the final visit, the most important complication of the patients was limited range of motion which was seen in 11 patients (19%). Also, 3 complained of pain, two of whom were those whose neuropathy had not improved.

Discussion

Our findings in this study showed that the prevalence of neuropathy is not as high as previous studies and is rarely seen in the patients with RCT. This is in contrast with the findings from previous studies that reported a high prevalence of peripheral neuropathy in patients with massive RCT. To date, several studies have been conducted to determine the incidence of peripheral neuropathy in patients with a massive rotator cuff tear, and each one has studied a different field. In this regard, some studies have reported very high prevalence of these neuropathies. For example, Shi and colleagues evaluated neuropathies associated with RCT in their 2014 study. Electrophysiological studies showed 32 patients had SSN. In MRI, it was observed that supraspinatus fatty degeneration was significant in 28 patients. Investigations showed that tendon rupture severely correlated with fatty degeneration tendon. Interestingly, Shi and colleagues observed that infraspinatus tendon rupture correlates with SSN incidence, while there is no correlation between SSN and fatty infiltration of two muscles (15).
In another study, Costouros et al. (2007) examined the relationship between arthroscopic repair of massive RCT and improvement of associated neuropathy. In this study, 26 patients with massive RCT were entered. That 14(54%) underwent an electromyographic examination of peripheral nerves including 7 suprascapular nerve injury isolately (38%), three cases of axillary nerve injury, three cases of upper trunk of the arterial system and one cervical roots injury (14).

Vad and his colleagues found 7 of 25 patients with neuropathies (28%). Four of these 7 patients had upper trunk lesions that involved the axillary nerve. In 2 patients, SSN was observed. one patient had cervical radiculopathy. Vad and his colleagues also suggested that the atrophic percentage was associated with the incidence of neuropathy (16).

Contrary to these studies, some researches have reported a widespread outbreak of peripheral neuropathy associated with RCT. Collin and colleagues in 2014 examined the relationship between the massive RCT and SSN in a prospective study. They evaluated 50 patients, for whom RCT severity was measured with CT arthrography and fatty infiltration was measured with MRI. In general, 6 (10%) neuropathy cases were confirmed using EMG / NCV, in one case due to a history of CVA and the remainder including SSN in one case, radicular damage of C5 in one case and partial paralysis of the nerve and a history of dislocation in three items. Eventually, the researchers stated that there was no link between the extended RCTs and SSNs (13).

In the present study, the prevalence of peripheral neuropathy was 13.8% of patients, which, as in Costouros et al. (14), and Shi et al. (15), had the highest incidence of SSN, and Collin et al. (13) vs Vad His colleagues (16) had the most incidence for the axillary nerve.

One of the most important questions regarding neuropathy associated with massive RCT is whether tendon repair can be associated with improvement of neuropathy or not. In a study by Mallon et al. In 2006 in 8 patients, the cuff repair was associated with an improvement in peripheral nerve injuries and patient function (17).

In a study by Costouros et al. on 6 patients, repair was performed by arthroscopic repair. After months, electrophysiological studies showed that in all of these subjects, relative or complete improvement was achieved, which was accompanied by a significant reduction in pain intensity and improvement in performance (14).

In our study, neuropathy was resolved by repair of the tendon, followed by improvement of function and relief of pain in 75% of patients. Another point is that, neuropathy can be accompanied by chronic and debilitating pain that affects the quality of life and function of the patient. This study was subject to some limitations. In this study, only EMG / NCV was used for screening which could have significant limitations.
and in some cases it was possible to detect the presence of neuropathy, especially SSN, or to report a mistake. Increasing the sample size would also produce more reliable results.

References