Lateral Axillary Hiatus Syndrome also known as Quadrangular or Quadrilateral Space Syndrome

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Abstract

In this syndrome, the axillary nerve is compressed where is passes through the lateral axillary hiatus which is also known as the quadrangular or quadrilateral space. This can cause weakness of the deltoid, especially when tested above 90° or in a throwing position. An applied kinesiology protocol for testing and treating this syndrome is described for cases that are due to neurapraxia, or axontemesis.

Key words: Quadrangular, quadrilateral, lateral axillary hiatus, axillary nerve injury

Introduction

This syndrome, originally described by Bateman[1] (1955) involves entrapment or injury to the axillary nerve supplying the deltoid in a space referred to as the lateral axillary hiatus, also known as the quadrangular or quadrilateral space. A chronic compression syndrome of the axillary nerve is a frequent observation in throwing athletes, and may also result from dislocations, blunt trauma, or backpacking.[2] My clinical experience has shown that most physical problems of this type appear on a continuum, and as clinicians we see many cases that are of a more of a functional than a pathological nature. The problems begin as functional ones, which if untreated progress to pathological problems that may require the intervention of orthopedic surgeons. Using a conservative approach to therapy, we can intervene in less severe cases involving neruapraxia, or axontemesis. I will discuss the diagnosis and treatment protocol that I have used with success on a series of 12 patients in my office presenting with shoulder pain and dysfunction.

Material and Methods

Anatomy:

The lateral axillary hiatus (quadrangular space) is created by the relationship of three muscle bellies and the humerus. The axillary nerve enters this space and can be damaged or compressed. The lateral axillary hiatus is limited proximally by the lower margin of the teres minor muscle, distally by the upper margin of the teres major muscle, laterally by the humerus and medially by the long head of the triceps muscle. The axillary nerve and the posterior circumflex artery pass through this opening.

During abduction, the lateral axillary hiatus decreases in size as the teres major and minor as well as the long head of the triceps approach one another.

Diagnosis of the lateral axillary hiatus syndrome

Symptoms and signs frequently present:

- Shoulder pain that is poorly localized[3]
- Symptoms are often vague consisting of a dull ache in the shoulder with progressive use[2]
- Pain on abduction and external rotation[3]
- Paresthesias and hypesthesias around the shoulder and upper arm[3]
- Deltoid atrophy and contour changes around the shoulder[3]
- Compensatory activity of the supraspinatus muscle in conjunction with the long head of the biceps helps diminish the functional disability found with deltoid atrophy[3]
- Chronic compression of the axillary nerve typically presents with tenderness in the posterior shoulder area in the quadrangular space which is exacerbated by placing the arm in the throwing position and resisting internal rotation[2]
- Compression has been demonstrated of the axillary nerve and posterior circumflex humeral artery in the quadrilateral space documented by arteriorgraphy or angis-MR imaging with dynamic maneuvers.[5]
- Deltoid weakness which can be evidenced by shoulder elevation by the trapezius and slight abduction by the supraspinatus[4]
- Palpation of scar tissue and or adhesions in the lateral axillary hiatus.

Etiology:

- Fractures of the humerus and scapula[3]
- Shoulder dislocation[3]
- Abduction of the arm while sleeping[3]
- Muscle and or tendon strains of the long head of the triceps and or the teres minor or major resulting in scar tissue with adhesions. This can result from many different activities from excessive weight training involving activity with the arm elevated overhead, to falling on an outstretched arm without dislocation or some work positions using the arms overhead.

Weakness:

- Deltoid muscle either in the clear or when tested above 90° or in a position as if throwing a ball.
- Weakness of the deltoid if tested at 90° of abduction while digital pressure is applied to the lateral axillary hiatus.
- Weakness of the deltoid muscle in some cases if tested while the long head of the triceps is in a maximum contraction.
- Weakness of the long head of the triceps, teres minor, or teres major after being stretched.
- Weakness of the long head of the triceps, teres minor, or teres major after pincer palpation.

Differential diagnosis[2]

- Higher brachial plexus injury to the posterior cord
- Cervical root injury involving C5 or C6

Treatment protocol in 12 patients:

In a series of 12 patient's who reported shoulder pain and dysfunction in the involved shoulder and who did not have brachial plexus injury or cervical root injury, I observed the following:

- **Patient # 1 male.** The left deltoid tested weak in the position of sleeping with his shoulder abducted and the elbow bent. Pressure over the lateral axillary hiatus with the humerus abducted to 90° caused the left deltoid to test weak. It was treated using myofascial release using post isometric relaxation and proprioceptive neuromuscular facillitation on the left teres minor, teres major and the long head of the triceps. After the treatment, the left deltoid tested stong in the position of sleeping with his shoulder abducted and the elbow bent. Pressure over the lateral axillary hiatus with the humerus at 90° of abduction no longer caused the left deltoid to test weak. The patient reported improved shoulder function.

- **Patient #2 male.** The left deltoid tested weak in the position he usually assumed when sleeping, with the humerus abducted at approximately 110° and the elbow bent. The left deltoid tested weak if tested with the humerus at 90°of abduction if digital pressure was applied to the lateral axillary hiatus. A myofascial release was done to the teres minor, teres major and long head of the triceps. As in the case above I also used post isometric relaxation and proprioceptive neruromuscular facilitation to improve the result. After the treatment, the left deltoid no longer tested weak with the humerus abducted to approximately 110°. Pressure over the lateral axillary hiatus with the humerus elevated to 90° of abduction no longer cause the left deltoid to test weak. The patient reported improvement in shoulder function.

- **Patient #3 female.** She presented with right shoulder pain. Her right. deltoid tested weak if the right humerus was abducted above 120°. Her right deltoid also tested weak if tested with her right humerus abducted to 90° position with digital pressure on the lateral axillary hiatus. In this case I got more specific and tested each of the muscles involved with the lateral axillary hiatus for weakening after being stretched. This response of testing weak after being stretched was only found with the teres major. She was treated with myofascial release of the teres major muscle using post isometric relaxation and proprioceptive neuromuscular facilitation. The right deltoid no longer tested weak when the right humerus was abducted above 120°. The right deltoid no longer tested weak when the humerus was abducted to 90° with digital pressure over the lateral axillary hiatus. The patient reported improvement of shoulder function however there were other contributing factors involved with her shoulder symptoms which were treated as well.

- **Patient #4 female.** This patient complained of right shoulder pain and dysfunction. Her right deltoid tested weak if her arm was in the overhead position that she used to sleep on her back. Her right deltoid also tested weak in the usual test position with the humerus abducted to 90° with digital pressure applied to the lateral axillary hiatus. I found that the long head of the triceps weakened after being stretched and did a myofascial release using post isometric relaxation and proprioceptive neruromuscular facilitation. To make sure that I did not miss anything and because I was in a hurry, I also did a myofascial release involving post isometric relaxation and proprioceptive neruromuscular facilitation to the teres minor and major. After the treatment, her right deltoid tested strong if her arm was placed in the overhead sleep position that she used to sleep on her back. Her right deltoid now tested strong if her humerus was abducted to 90° with pressure over the lateral axillary hiatus. She also had other factors that needed treatment for her shoulder, which were also treated. The lateral axillary hiatus syndrome was therefore a contributing factor of her shoulder problem.

- **Patient #5 Female.** She had left shoulder and arm pain on waking in the morning with pain in the left shoulder and arm to the elbow. Her left deltoid tested weak if her humerus was in abducted over her head with her elbow flexed. That would be at approximately 160° of abduction as if she were lying on her back with her arms up with her elbows flexed. Her left deltoid tested weak if tested with the humerus at 90° of abduction while digital pressure was applied to the lateral axillary hiatus. The long head of the triceps tested weak after it was stretched. I did a myofascial release of the long head of the triceps using post isometric relaxation and proprioceptive neruormuscular facilitation. I did the same treatment to the teres minor and major to free any adhesions in case that was needed as well. On retesting, the left deltoid no longer tested weak with the humerus abducted to 160°. Her left deltoid no longer tested weak when tested at 90° of abduction while digital pressure was applied to the lateral axillary hiatus. The patient reported that her left shoulder and arm felt much improved.

- **Patient #6 Female.** Her left shoulder and arm had pain with some pain that radiated to her left thumb. Her left deltoid tested weak with the humerus above 120° of abduction. The left deltoid also tested weak with the left humerus in the normal test position of 90° abduction with digital pressure over the lateral axillary hiatus. I also found that her left deltoid tested weak with her humerus at 90° of abduction while contracting the long head of the triceps (elbow extended). The left long head of the triceps tested weak after stretching it. I did a myofascial release of the left long head of the triceps using post isometric relaxation and proprioceptive neuromuscular facilitation. The teres minor and major were treated in the same manner on the speculation that some adhesions may be present. Her left deltoid now tested strong when tested with the humerus above 120° of abduction. Her left deltoid now tested strong when tested with the humerus at 90° of elevation while digital pressure was applied to the lateral axillary hiatus. She had two other syndromes complicating the pattern of symptoms which were treated as well.

- **Patient #7 Male.** He had right shoulder problems. He complained of pain when he positioned his right arm as if to throw a ball. His right deltoid tested weak when his humerus was abducted to over 120°. His right deltoid tested weak if his right humerus was abducted to 90° test position if digital pressure was directed into the lateral axillary hiatus. His right deltoid tested weak if his right humerus was abducted to 90° while his right triceps was strongly contracted. His right triceps – long head tested weak after being stretched. The long head of the triceps was treated with myofascial release using post isometric relaxation and neuromuscular facilitation. This treatment was also done to the teres minor and major to free up any possible adhesions. He no longer complained of pain if his right arm was positioned as if to throw a ball. The right deltoid no longer tested weak if the humerus was abducted to 90° with digital pressure over the lateral axillary hiatus. The right deltoid no longer tested weak if his humerus was abducted to 90° while the triceps was strongly contracted. He reported that his arm movement felt better. He had two other dysfunctions with his right shoulder that were attended to on that visit that fully improved his shoulder symptoms.

- **Patient #8 Female.** She had right shoulder pain and neck pain. Her right deltoid tested weak in the clear and was treated by approximating the acromio clavicular joint as described by Leaf.[8] I then tested the deltoid at 120° of humeral abduction and it again tested weak. The right deltoid tested strong if the humerus was abducted to 90° but tested weak if digital pressure was directed at the lateral axillary hiatus while in that position. Her right long head of the triceps weakened after being stretched. I did a myofascial release of the long head of the triceps using post isometric relaxation and proprioceptive neuromuscular facilitation. Her right deltoid now tested strong above 120° of humeral abduction. She was also treated for a second shoulder area syndrome on this visit. She reported improvement in shoulder and neck pain as well as improved mobility.

- **Patient #9 Female.** She had a right frozen shoulder. I determined that part of her problem was probably due to a lateral axillary hiatus problem. Her right lateral axillary hiatus was very tender to palpation. Her right shoulder abduction capability was very restricted (approximately 60°. Her right deltoid tested weak if I had her abduct as much as she could with external rotation as much as she could. I had her abduct her right humerus as much as possible without causing severe pain, a position in which her right deltoid did not test weak. I then directed digital pressure to the lateral axillary hiatus and retested the deltoid. It now tested weak. The long head of the triceps tested weak after being stretched and was treated with a myofascial release utilizing post isometric relaxation and proprioceptive neuromuscular facilitation. The teres minor and major were palpated for adhesions and myofascial release was done where needed. She had some improved motion in her shoulder. Her abduction improved to about 70–80°

- **Patient #10 Female.** She had a frequent pain pattern of right neck and shoulder pain. Her right deltoid tested weak when her humerus was abducted to about 110–120°. Her right deltoid tested weak when her right humerus was abducted to 90° and digital pressure was applied to the lateral axillary hiatus. Her right triceps-long head tested weak after being stretched. I treated her right long head of the triceps with myofascial release using post isometric relaxation and proprioceptive neuromuscular facilitation. On retesting her, her right deltoid tested strong when her humerus was abducted to between 110–120°. Her right deltoid tested strong when her humerus was abducted to 90° while digital pressure was applied to the lateral axillary hiatus. She is a patient who had surgery for a scoliosis when a teenager with metal rods preventing movement for most of her spine and therefore she has many recurring problems. I also treated other problems at the same time which occur at the ends of the fusion areas. This treatment of the lateral axillary hiatus was one factor in reducing her recurring pain.

- **Patient #11 Male.** He had left shoulder pain. His left deltoid tested weak in the clear. He had a horizon sign and approximating the left acromial clavicular joint caused the left deltoid to test strong as per Leaf.[8] On abduction of the humerus to about 110° the left deltoid again tested weak. The left deltoid tested strong at 90° abduction of the humerus, but tested weak in this position when digital pressure was applied to the left lateral axillary hiatus. The left long head of the triceps, the left teres minor and left teres major each tested weak after stretching. The left long head of the triceps, the teres minor and major were treated with myofascial release incorporating post isometric relaxation and proprioceptive neuromuscular facilitation principles. On retesting, his left deltoid tested strong when the humerus was again abducted to approximately 110°. His left deltoid also tested strong when abducted to 90° while digital pressure was applied to the lateral axillary hiatus. He reported some improvement in shoulder motion and pain relief which was made pain free when a series of other shoulder related problems were corrected on that visit.

- **Patient #12 Male.** This patient on this visit had pain in his shoulders mainly on the left side. I had him place his left arm in the position that would be used to throw a ball and it created pain in the posterior deltoid area. His left deltoid tested weak when his humerus was abducted to approximately 120° of humeral abduction. His left deltoid tested weak if tested in the throwing position. His left deltoid tested strong if his humerus was abducted to 90° but when digital pressure as applied on the lateral axillary hiatus in this position the left deltoid tested weak. I compared the length of the triceps left to right by having him reach over the back of his head to try and touch the opposite scapula and the left one was more restricted. As I was aware that shortness of the long head of the triceps could be a reason for an ulnar sulcus syndrome Leaf,[8] I tested the flexor digitorum profundus to the 5th finger while he was in that positon and it tested weak. When I retested it in the neutral (arm at the side)

position, the left flexor digitorum profundus to the 5th finger tested strong. The long head of the triceps tested weak after stretching it. I therefore treated the long head of the triceps with myofascial release using post isometric relaxation and proprioceptive neruromuscular facilitation. The left teres minor and major did not test weak after being stretched and were not treated. The left deltoid now tested strong if the humerus was abducted to approximately 120°. The left deltoid tested strong if the humerus was abducted to 90° when digital pressure was applied to the lateral axillary hiatus. The length test for the left triceps demonstrated that it had balanced itself to that of the right triceps. The flexor digitorum profundus to the 5th finger now tested strong when in the position that was used to compare the length of the triceps. He had reduced pain and increased mobility and was treated further for two other shoulder related syndromes and then reported full pain free shoulder function. In this case the treatment of the long head of the triceps treated two syndromes at once, a left lateral axillary hiatus syndrome and an ulnar sulcus syndrome.

Discussion

I've described an approach to the diagnosis and treatment of quadrilateral space syndrome that has been effective across many patients. Treatment will likely be refined as more variations of diagnosis and treatment are discovered in the future.

The myofascial release technique, a form of soft tissue manipulation, post isometric relaxation (a form of muscle energy technique), and proprioceptive neuromuscular facilitation (a form of therapeutic muscle stretching), are described by Hertling.[9] I chose to combine these methods in the treatment as I felt they would give the maximum therapeutic benefit to the patient. In the case of a triceps involvement, where the long head of the triceps tested weak after being stretched, I would have the patient do an isometric contraction of the long head of the triceps by having the patient sit with their arm at their side with the elbow bent to 90°. I would contact the posterior of the upper arm on the soft tissues over the humerus and have the patient try and pull the elbow in a posterior direction while I resisted this for about 10 seconds. The patient is then told to relax and I take contact on the soft tissues of the triceps and begin to passively elevate the patients arm with one hand while the other does a deep tissue massage (mobilization) up the entire length of the muscle from insertion to origin. During the time that I am doing this I instruct the patient to reach behind their head neck area to try and touch their opposite shoulder blade which requires activation of the antagonist muscles. I do this about 3-5 times as necessary as I feel for release of adhesions in the fascia and or muscles, thereby lengthening the muscle. I treat the teres minor and major in a similar fashion when necessary. The diagnostic factor that I used, taking a muscle that tested strong and stretching if followed by retesting it for a weakening effect is a method that was originally discovered by Goodheart, and has been reported by Walther.[10] It indicates the need for fascial release, trigger point therapy, and or percussion to clear what is referred to as myofascial gelosis. There are further diagnostic signs for the need for trigger point therapy and or percussion which were not addressed in the approach I used in this study.

The findings indicate that at least in this small study group, dysfunction of the deltoid related to the lateral axillary hiatus can be found and treated by conservative means. There will likely be other cases that I will find that will require a surgical intervention. I first learned of this syndrome from cases which I found cited in the medical literature which often required surgery.[3] These cases were what stimulated me to try a non invasive conservative approach.

In my experience, I have noticed that most health problems are on a continuum between normal functioning and pathology. It therefore made sense to me that shoulder joint problems involving the deltoid should be detectable at an early stage before pathology requiring surgery happens. This is the reason I approached this topic in a conservative fashion in the hope that by using conservative therapy long before pathology requiring surgery happens, we can help the patient to improved function and achieve freedom from pain. This will hopefully reduce or eliminate the likelihood that some patients would progress to the final pathological changes that would require surgery at a future date.

There is one case I read by Redler et al[6] which resulted in the patient attempting to change his pitching technique to correct the problem rather than having surgery. A review of surgical cases can be found in Bonnard et al.[7]

Conclusion

In a differential diagnosis and treatment of shoulder problems involving problems with abduction such as impingement syndrome, etc., the lateral axillary hiatus should be considered for a conservative approach. If this problem is diagnosed, and no serious injury such as a neuotmesis is found, a reasonable conservative trial therapy such as described should be attempted. If this approach has little or no success, a referral for a possible surgical intervention is recommended.

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