Radiology Case Reports 16 (2021) 1113–1117

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journal homepage: www.elsevier.com/locate/radcr

Case Report

Lacertus syndrome: Use of pre- and post-exercise MRI to aid in diagnosis and treatment ☆,☆☆

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ARTICLE INFO

Article history:
Received 17 January 2021
Revised 8 February 2021
Accepted 10 February 2021

Keywords:
Lacertus fibrosis syndrome
Lacertus fibrosis
Chronic exertional compartment syndrome
Pre and post exercise MRI

ABSTRACT

Lacertus syndrome is a chronic exertional compartment syndrome of the forearm that is unlike exertional compartment syndrome of the lower extremity. It differs from traditional exertional compartment syndrome in terms of the anatomy, symptoms and physical exam findings. This is a case where dynamic magnetic resonance imaging is used to confirm the diagnosis rather than relying solely on a clinical diagnosis or invasive compartment pressure monitoring. Surgical release of the lacertus fibrosis can effectively relieve the pressure over the pronator and allow the patient to resume previous activities.

Introduction

Lacertus syndrome was first described, in 1959 by George Bennett [1], as a lesion that can occur in overhead throwing athletes, where compression of the pronator teres by the lacertus fibrosis results in disabling pain in the proximal volar forearm [1,2] and can include compressive symptoms of the median nerve [3]. The pain begins as an achy pain at the medial elbow that develops with persistent exertional activity and resolves after a few hours of rest. Without cessation of the offending activity, the severity and duration of the symptoms increase. The delayed onset in combination with the resolution of symptoms with rest make this syndrome unique, and more like exertional compartment syndrome as seen in the legs of runners rather than other proximal forearm neuropathies. While it behaves clinically like exertional compartment syndrome of the legs, the anatomy of the lacertus fibrosis over the pronator teres is what makes the pathophysiology unique [2].

☆ Funding: The authors declare that they have no funding.
☆☆ Competing Interest: The authors declare that they have no conflict of interest.
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https://doi.org/10.1016/j.radcr.2021.02.022

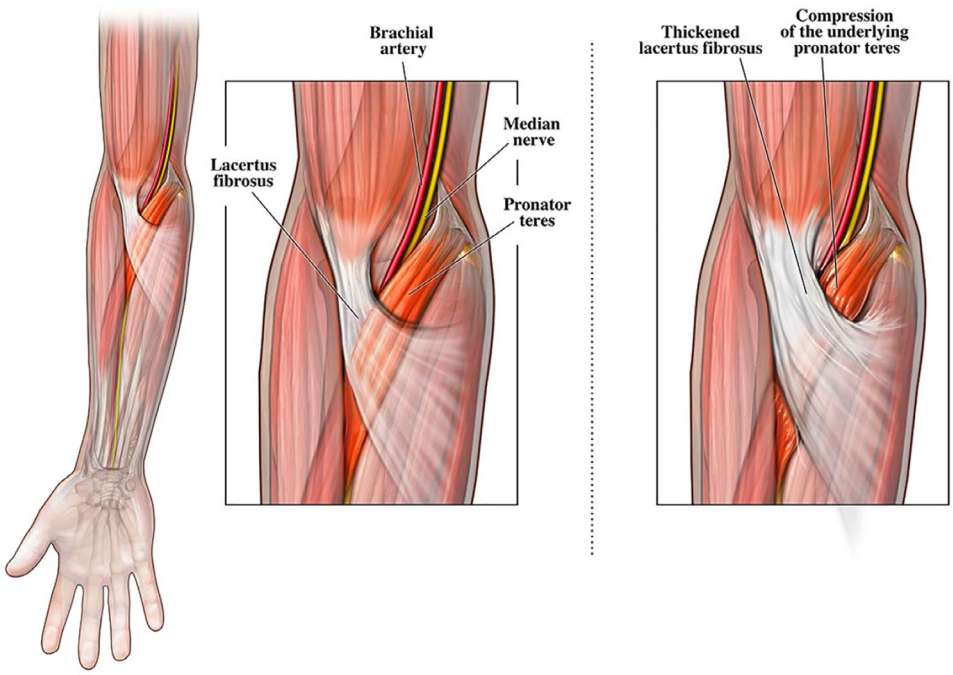

Fig. 1 – Illustration of the volar forearm and the compression that can occur by a thickened lacertus fibrosis of the underlying pronator teres.

Anatomy

The median nerve runs along the medial aspect of the brachial artery between the biceps, which lies volar to the nerve and the brachialis which lies deep to the nerve. The nerve courses under the ligament of struthers and will often give a variable branch off to the pronator teres muscle just distal to the elbow joint [4]. It remains medial to the biceps tendon and the brachial artery in its course (Fig. 1). The median nerve is also found deep to the lacertus fibrosis (bicipital aponeurosis) and the pronator teres [4]. Overlying the lacertus fibrosis is the anterior branch of the medial antebrachial cutaneous nerve. This is the most volar structure to be encountered during dissection in the volar ulnar proximal forearm. The lacertus fibrosis fascia is not the primary muscle fascia for the superficial volar compartment and does not define the entire compartment [2]. However, it does act as a muscle constrictor to the pronator teres during muscle expansion. Pain and elevated post exertional pressures, of the pronator teres specifically, can be seen with lacterus syndrome without elevating the entire compartment [2].

Physical exam findings

Lacertus syndrome often presents with an increasing pain and fullness in the flexor-pronator muscles with continued high-level activity. Symptoms resolve with rest, anywhere from 8 hours to 4 days after the cessation of activity [2], and symptoms can include intermittent median nerve neuropathy [3]. Baseball pitchers and American football quarterbacks are the most common position players to present with this issue, since the repetitive nature and mechanism of stress to the extremity puts them at the highest risk for compression [2].

A careful history is the first step to diagnosis. Other more common pathologies about the elbow must be ruled out, to include: cubital tunnel syndrome, ulnar neuritis, anterior interosseous nerve and pronator syndrome, stress fractures, medial epicondylitis, ulnar collateral ligament injuries, and valgus posterolateral rotatory instability. If there is a high index of suspicion based on the history, the athlete must be examined after a workout. Clinicians must look for swelling and pain of the flexor-pronator mass as well as unusual contour that results from the compression of the lacertus fibrosis over the pronator teres. Flexion and pronation at the wrist, with simultaneous elbow flexion, will exacerbate this unusual contour and increase pain to the area [2].

The dynamic nature of lacertus syndrome, presenting after exertional activity, makes it distinct from anterior interosseous nerve and pronator syndrome and other median nerve compression neuropathies. It also makes it difficult to diagnose with objective data. Prior to the use of pre and post-exercise magnetic resonance imaging (MRI), the compartment pressures are measured as with exertional compartment syndrome of the lower extremity. This invasive and painful procedure is not without risk to surrounding neurovascular structures. Our case shows an alternative objective and reliable means to diagnose lacertus fibrosis syndrome.

Case report

A 55-year-old male, avid golfer, with no other pertinent medical history, presented to our clinic with a 4-year history of proximal medial forearm pain. He endorsed pain, and inter-

mittent radiating numbness, tingling and weakness in the median nerve distribution. He also noted that the pain was exacerbated with wrist flexion activities and forearm pronation and was minimal at rest.

Work up prior to presentation included cervical spine radiographs and MRI, cervical spine and distal electromyography and nerve conduction studies, as well as therapeutic neck, shoulder, and elbow ultrasound. All prior investigations were negative and prior therapy was unhelpful. On exam, all provocative maneuvers at the neck, shoulder, wrist, and hand were negative with full active and passive range of motion. At the elbow, there was pain over the medial epicondyle and flexor pronator. This pain was not exacerbated with resisted digital flexion. Pain was elicited over the flexor pronator mass with resisted flexion and pronation (cobra position) and flexion and supination of the forearm. There was no evidence of ulnar collateral ligament instability or valgus extension overload at the elbow.

Radiographs obtained in the office were negative for bony abnormalities. The plan going forward was to acquire pre and post exercise MRI to obtain a dynamic picture of the flexor pronator mass. The reason for this was a high suspicion for lacertus syndrome, that is, chronic exertional compartment syndrome of the pronator teres.

Diagnostic imaging

Imaging modalities have developed so that now we have a means to evaluate this condition beyond history and physical exam. Advanced imaging has been used in other studies to further evaluate forearm exertional compartment syndrome [5] as well as forearm neuropathies [6,7] with appreciable success. Gielen et al described their prospective study of 5 symptomatic and 5 asymptomatic motor cross racers and their findings pre and post eccentric forearm exercise on MRI [5]. The difference in signal intensity was evaluated by a musculoskeletal radiologist in both cohorts and was noted to be homogenously increased in the turbo spin echo T2-weighted image (TSE T2-WI) series on each symptomatic athlete post exercise and was not present in the asymptomatic cohort [5].

Using this same methodology, we further evaluated our patient with a 1.5-Tesla magnet MRI both before and immediately following multiple golf swings. The pre-exercise MRI was obtained without contrast. The patient was then instructed to continue his swings until the usual pain commenced and at that time the study was performed. The post-exercise study was performed with the patient supine and the elbow extended and obtained with contrast that was administered 10 minutes post-exercise. This was a multiplanar, multisequence MRI of the elbow to include a fat-saturated T2-WI series in order to highlight the presence of edema. As compared to the pre-exercise MRI, the post-exercise MRI has an increase in signal intensity within the pronator teres (Figs. 2–5). This increase in signal, consistent with intramuscular edema, is highly suggestive of dynamic exertional edema like that of the previously described motor cross racers.

Surgical technique

A release of the compression to the pronator teres has been described with excellent results to treat lacertus fibrosis syndrome [1,2]; thus, after failure of nonoperative modalities in our patient, we proceeded with surgical release. A 7-cm incision was made anterior to the medial epicondyle from just proximal to the antecubital fossa down to the mid forearm (Fig. 6). The 2 branches of the anterior branch of the medial an-

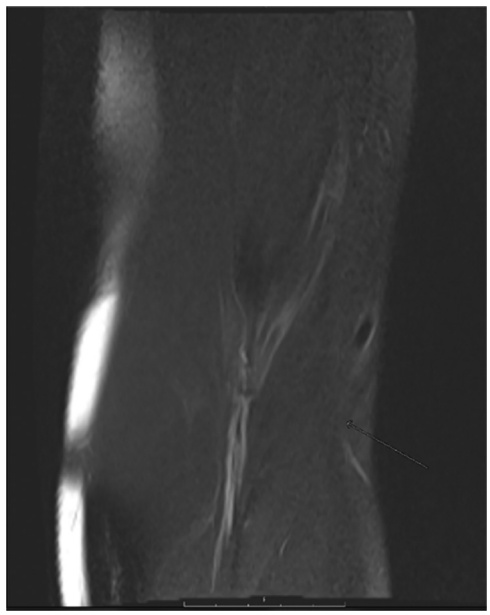

Fig. 2 – Pre-exercise coronal fat saturated T2 MRI sequence of the patient's forearm, demonstrating the neurovascular bundle centrally without evidence of increased signal intensity in muscle.

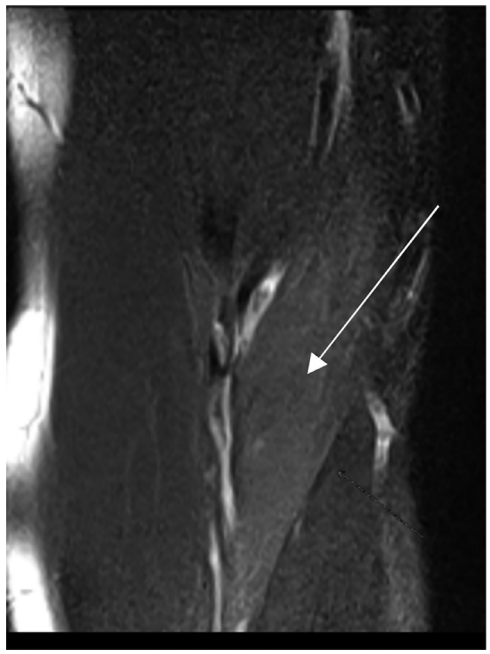

Fig. 3 – Postexercise coronal with IV contrast fat saturated T2 MRI sequence of the patient's forearm, demonstrating increased signal intensity in the pronator teres.

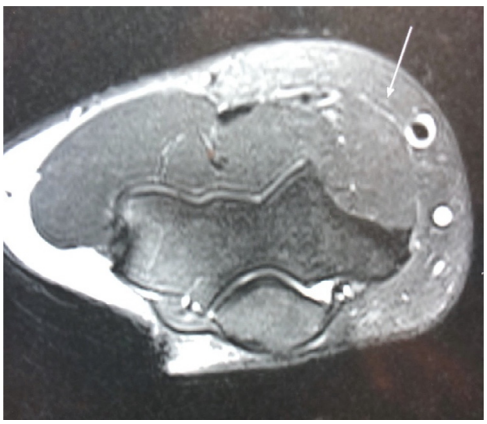

Fig. 4 – Pre-exercise axial fat saturated T2 MRI sequence of the patient's forearm, demonstrating the forearm compartments without evidence of increased signal intensity.

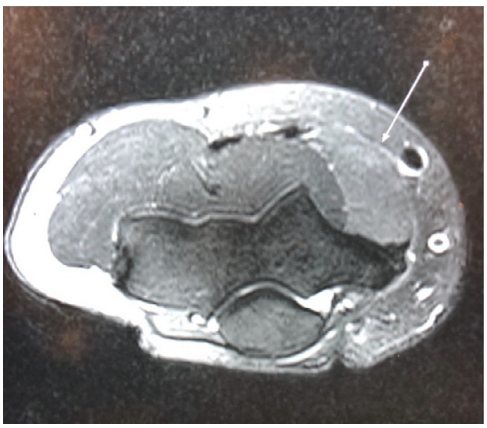

Fig. 5 – Postexercise axial with IV contrast fat-saturated T2 MRI sequence of the patient's forearm, demonstrating generalized muscle edema in the pronator teres.

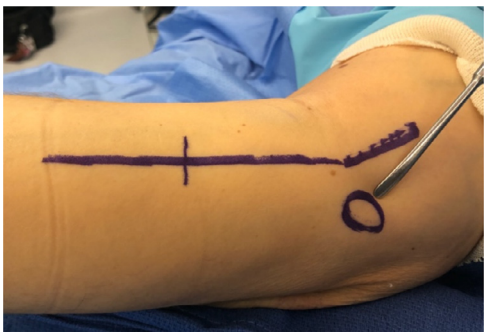

Fig. 6 – Surgical incision anterior to the medial epicondyle (indicated by marking pen and freer elevator) and crossing the antecubital fossa.

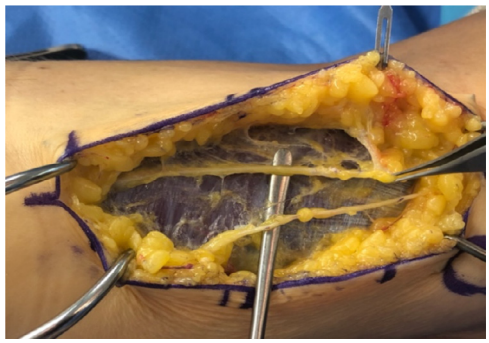

Fig. 7 – Two anterior branch of the medial antebrachial cutaneous nerve identified.

Fig. 8 – Release of the lacertus fibrosis.

tebrachial cutaneous nerve were identified (Fig. 7), dissected and mobilized to protect them. The basilic vein was identified proximally and protected. We identified the lacertus fibrosis beginning just proximal and medial to the biceps tendon insertion and running over a 6 cm span medially and distally towards its insertion along the antebrachial fascia. We completely released the lacertus fibrosis with 2 parallel and longitudinal fasciotomies incisions (Fig. 8).

We further isolated the superficial volar fascia around the humeral head of the pronator teres and completely released this. We dissected proximally to identify the median nerve and brachial artery to ensure that they freely passed as they entered the antecubital fossa and passed underneath the humeral head of the pronator teres. The patient's wounds were irrigated and closed. He was placed in a long arm splint, returned to clinic 2 weeks postoperatively, and advanced his range of motion to full at 4 weeks postoperatively. At 3 months postoperative, he was asymptomatic and returned to all activities without recurrence of symptoms and limitations.

Discussion

Chronic exertional compartment syndrome of the leg has been well documented. The compressive ischemic nature of lacertus syndrome is similar to chronic exertional compartment syndrome, but the specific pathophysiology is unique to

that of the lacertus fibrosis as it tends to specifically compress the pronator teres rather than the entire compartment. This is due to the fact that it functions as a secondary fascial layer and does not encompass the entire superficial volar compartment of the forearm [2]. The onset of symptoms here, like that with classic exertional compartment syndrome is often insidious and persists and worsens over a period of months to years [5]. Symptoms tend to abate when the activity in question is stopped and persists when the activity is resumed [5]. Complete cessation of the offending activity is often not possible in high level athletes or in competitive recreational athletes. Surgical management and lacertus fasciotomies are indicated for these patients and can provide adequate symptom relief and permit continuation of athletic activities. Additionally, pre- and postexercise MRI is a way to supplement the patient's clinical picture with reliable objective data that does not require an invasive or painful procedure.

Patient consent

Written and informed consent for publication of the case was obtained from the patient.

Ethical approval

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Acknowledgments

The authors would like to acknowledge Brian F. Wilson, a Medical Illustrator at Nucleus Medical Media, for his assistance in creating the medical illustrations for this study.

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