Endoscopic-assisted Fascial Decompression for Forearm Exertional Compartment Syndrome: A Case Report and Review of the Literature

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Abstract A case of chronic exertional compartment syndrome of the forearm treated with endoscopic-assisted fascial decompression is presented. The diagnosis of exertional compartment syndrome of the forearm was confirmed by direct measurement of intracompartmental pressures. Following endoscopic-assisted fascial decompression, the patient was able to begin rehabilitation therapy within 2 weeks. There were no wound-related complications. The patient reported no recurrence of symptoms after returning to work requiring heavy lifting, and morbidity associated with open decompression was avoided. Endoscopic release is not an option in traumatic compartment syndrome, but a minimally invasive approach may be considered in cases of exertional compartment syndrome. Reports of endoscopic-assisted fascial decompression in exertional compartment syndrome of the forearm are relatively scarce. Confirmation of the safety and efficacy of these evolving techniques in the hand surgery literature remains important.

Keywords Exertional compartment syndrome · Endoscopic · Forearm · Fasciotomy · Minimally invasive

Introduction

The advantages of endoscopic techniques in upper extremity surgery include a reduction in post-operative scarring and a

more rapid recovery. We have applied endoscopic techniques to the treatment of an exercise-induced forearm compartment syndrome. Exercise-induced forearm compartment syndrome has been treated by “mini-open” techniques and balloon-assisted techniques [2, 10]. The technique described here employs full endoscopic visualization unlike “mini-open” techniques and employs standard equipment used in endoscopic carpal tunnel surgery.

Case Report

A 33-year-old right hand dominant truck driver presented with a 10-month history of chronic left-sided proximal volar forearm pain exacerbated by repeated gripping. His job required loading and unloading of packages weighing between 20 and 200 lb. The pain was associated with visible swelling in the left proximal volar forearm and paresthesias in the thumb, index, and long fingers. The patient noted that his arm felt “as hard as a rock” after any significant gripping activity. The patient was unable to work due to the incapacitating nature of this pain. He had no other medical problems and denied any history of upper extremity trauma.

Physical examination revealed no muscular atrophy. Tinel’s sign was elicited over the left ulnar nerve at the elbow and the elbow hyperflexion test was positive. Ulnar nerve function was normal however. A Tinel’s sign was not elicited over the median nerve in the proximal forearm. Provocative tests for pronator syndrome, however, were positive including pain with resisted pronation. Sensation in the distribution of the palmar cutaneous branch of the median nerve was intact. The median nerve motor and sensory function were intact. The two-point discrimination was 5 mm. Grip strength was diminished on the involved

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left side. Obvious swelling in the proximal volar forearm over the flexor carpi ulnaris developed as the patient repetitively made a fist. Forearm pain and paresthesias in the median nerve distribution commenced as the patient continued this activity beyond 5 min.

Nerve conduction studies revealed evidence of mild bilateral carpal tunnel syndrome and ulnar neuropathies at the elbows. Needle electrode studies revealed neurogenic changes in the left flexor carpi ulnaris, first dorsal interosseous, and abductor pollicis brevis muscles.

The diagnosis of an exertional compartment syndrome involving the left flexor pronator muscles superimposed on bilateral carpal tunnel and cubital tunnel syndromes was made. The compartment syndrome, however, was thought to be the most significant problem. The option of compartment pressure measurements to correlate the patient's reported symptoms followed by fascial decompression was discussed with the patient [4]. The patient was apprised of the risks and complications associated with endoscopic and traditional fasciotomy and elected to undergo an endoscopic fasciotomy.

Technique

The patient was brought to the operating room where no narcotic or sedative medication was given. The patient was asked to make a fist until he noted pain in his forearm. Once the patient's pain appeared a Stryker STIC® device was introduced into his left proximal volar forearm compartment. An intracompartmental pressure reading of 22 mmHg was obtained. The patient continued to repetitively contract and relax his left forearm flexor muscles and a second reading was taken from the same left proximal volar forearm compartment revealing an intracompartmental pressure of 28 mmHg. The patient noted tingling in his left index finger as he continued to exercise his left forearm. Given that the patient's symptoms were precisely reproduced and simultaneously correlated with an elevated compartment pressure (>25 mmHg), a diagnosis of exertional compartment syndrome [3] was made. The measurement of multiple compartments is often performed in the forearm. However, in this patient the combination of precisely reproduced symptoms and elevated pressures in the volar compartment was deemed adequate for diagnosis and it was elected to proceed with an endoscopic fasciotomy.

The compartment pressure equipment was removed and the patient underwent general anesthesia. His left arm was prepped and draped and a tourniquet applied to the proximal arm and inflated to 250 mmHg. A 2-cm-transverse skin incision was made at the junction of the middle and distal thirds of the left forearm in line with the flexor pronator muscles. The fascia of the volar forearm

compartment was exposed by blunt dissection and a 4.5-mm, 30° endoscope introduced and advanced proximally, superficial to the antebrachial fascia. Several branches of the medial antebrachial cutaneous nerve were readily visualized. A 5-mm-longitudinal incision was made in the antebrachial fascia to permit the probe blade of the Chow dual-port endoscopic carpal tunnel set to engage the fascia. A longitudinal fasciotomy was then made under direct endoscopic control by pushing the blade from distal to proximal. A second 2 cm transverse incision was made in the skin approximately 4 cm distal to the elbow crease. Again the fascia was exposed using blunt dissection and a small entry portal created in the fascia. The probe blade was once again introduced and the proximal fascia was incised connecting the proximal fasciotomy with the distal fasciotomy.

No other procedures were performed. The tourniquet was released; minimal bleeding was noted. A bulky compressive dressing was applied. Immediately post-operatively the patient was noted to have normal sensation in the distribution of the medial antebrachial cutaneous nerve. No herniation of the flexor muscle mass was evident but the edge of the cut volar fascia was palpable. The post-operative rehabilitation program consisted of immediate early range of motion exercises followed by a graded strengthening program.

Results

Six months after surgery the patient reported complete resolution of both forearm pain and paresthesias in the fingers. No numbness was noted in the distribution of either the lateral or medial antebrachial cutaneous nerves. He was capable of lifting 105 lb from floor to chair level ten consecutive times with discomfort rated at 2 out of 10. Overhead dumbbell press with 65 lb in each hand was completed ten times without pain or paresthesias. Additionally, when asked to perform repetitive gripping for 3 min with his left hand, the patient noted no pain or paresthesias. The patient was released to return to full work duties. After 2 months of full work duties the patient reported no pain or swelling in his left forearm. The patient voiced no further complaints regarding the median and ulnar nerves.

Discussion

Endoscopic-assisted fasciotomy of the forearm fascial compartments has been confirmed to provide compartmental decompression in experimentally induced forearm compartment syndrome in cadavers [6]. While supplemental dermatomy has been shown to provide additional reduction in compartmental pressures, fascial release alone

has been reported to return compartmental pressures to near physiologic levels [4, 7–9]. Subcutaneous fasciotomy has been clinically confirmed to be adequate in cases of exertional compartment syndrome in the lower leg [1] but has previously been a blind procedure in the forearm. Post-operative dissection of cadaveric specimens decompressed with full endoscopic visualization has shown no damage to any nervous or vascular structures, suggesting this is an anatomically safe procedure [6]. This case report clinically supports these experimental findings.

Endoscopic-assisted decompressive fasciotomy of the forearm has been previously described for forearm fascial herniation in conjunction with ulnar nerve decompression [5]. Reports using “mini-open” [2] and balloon-assisted techniques [10] have also been published. This report aims to describe a case of endoscopic-assisted decompressive fasciotomy for exertional compartment syndrome of the forearm confirmed by intracompartmental pressure measurement, which provides full endoscopic visualization unlike “mini-open” techniques and requires nothing more than standard endoscopic carpal tunnel surgery equipment. Techniques will continue to evolve in the management of exertional compartment syndrome as we strive to minimize morbidity while maintaining patient safety. It is critical to evaluate the efficacy and safety of those changing techniques in the hand surgery literature.

We feel current endoscopic technology provides excellent visualization of neurovascular structures. Complications related to wound management, scarring, and extended recovery are avoided. In the case of chronic exertional

compartment syndrome of the forearm, we feel endoscopically assisted fascial decompression is a reasonable alternative to open fasciotomy.

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