CASE REPORT

Treatment of a symptomatic forearm muscle herniation with a wrap-around fascia lata graft

Kamarul A. Khalid · Edward T. Mah

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Abstract Muscle herniation in the extremity is a well-recognized cause of symptomatic pain on exertion. Only 17 cases involving the upper limb has been previously described, 11 of them involving the anterior compartment of the forearm and only 2 were caused by strenuous exertion. Treatment for this condition ranged from nonsurgical, primary closure with palmaris longus interweave, formal fasciotomy, to closure with a tensor fascia lata graft.

This is a study of a 28-year-old man who had a symptomatic swelling on the volar aspect of his left forearm while working on a car-door assembly line that resulted in a significant decreased of his grip strength, work capacity and median nerve symptoms. It did not improve after 6 months of conservative management including hand therapy and splintage. The patient subsequently underwent a tensor fascia lata graft wrap-around. Post-operatively his symptoms resolved with improvement in his grip strength and hand function. The rationale for the treatment option chosen is discussed.

Keywords Muscle hernia · Ocoele · Forearm · Fascia lata graft

Introduction

Muscle herniation, or myocoele, is the protrusion of muscle through a focal defect in the overlying deep fascia. The first description for the condition was probably by Dupuytren in 1839 [1]. Over 200 cases have been reported in the literature since then. It is a condition that almost exclusively affects men.

Muscle herniation occurs mainly in the middle and lower thirds of the leg with tibialis anterior most commonly affected. In contrast, muscle herniation in the upper limb is very uncommon and only 17 such cases have been previously described in the English literature (Table 1).

The surgical treatment of symptomatic muscle hernias in the lower limb is still controversial with many different methods being described in the literature (Table 2) [1, 2], while treatment options for muscle hernias the upper limb has also been varied (Table 1). To our knowledge, this report is the first on the use of a wrap-around fascia lata graft to treat this condition.

Case report

A 28-year-old right hand dominant man was referred to the senior author approximately 10 weeks after developing a painful swelling on the volar aspect of his left forearm while at work. He worked on a car door assembly line where he has to perform forceful grasping and gripping motions approximately 320 times a day. It was sudden in onset and was associated with a ‘popping’ sensation and also scalding pain. Initial treatment at his workplace was minimal and he continued working using his right hand most of the time. The pain experienced varied with activity and could be quite severe at times. It was aggravated by gripping, especially with the index and middle fingers, and by cold weather but relieved with rest and immersing in warm water or after a hot bath/shower. Because of this

Kamarul A. Khalid¹ · Edward T. Mah^{1,2} (✉)

¹Department of Orthopedics and Trauma
The Queen Elizabeth Hospital, Adelaide
Australia

²Calvary Orthopaedic & Hand Care Centre
North Adelaide
53 Gover Street
Australia

e-mail: tedmah@hotmail.com

Table 1. Summary of reported cases of upper limb muscle herniation available in the English literature

Author (year)	No. of cases	Site	Compartment	Muscle involved	Cause	Treatment
Kendi, T.K. et al. (2003) [5]	1	Forearm	Flexor	FDS	Strenuous exertion	Nonsurgical (advised against strenuous activities)
Riordan, C.L. et al. (2002) [6]	1	Forearm	Flexor	FDS	Sharp trauma – unrepaired fascia	Fascia lata onlay graft
Golshani, S.D. et al. (1999) [7]	1	Forearm	Extensor	EDC	Blunt trauma	Fascia lata inlay graft
Olch, C.L. et al. (1996) [4]	7	Forearm	Flexor × 5 Extensor × 2	Not Mentioned	Sharp trauma × 2 Blunt trauma × 3 Postsurgery × 2	Fasciotomy
Roberts, J.O. et al. (1989) [1]	3	Forearm	Extensor × 2 Flexor × 21	EDC FCU + FDS	Strenuous exertion × 1 Sharp trauma × 2	1° closure + Palmaris Longus interweave × 1 Fascia lata onlay graft × 2
Schechter, D.C. et al. (1963) [3]	1	Arm	Extensor	Triceps	Blunt trauma	Fasciorrhaphy
Simon, H.E. (1945) [8]	3	Forearm	Flexor × 3	Not mentioned	Blunt trauma × 2 No treatment × 2 Sharp trauma × 1	Blunt trauma × 2 No treatment × 2 Physiotherapy × 1

Table 2. Different methods of treating muscle hernia reported in the literature

Muscle hernia type	Treatment method
Asymptomatic	No treatment
Symptomatic	Physiotherapy [8] Support stockings [1] Restriction of strenuous activity [5] Direct suturing [3] Direct suturing strengthened with palmaris longus interweave [1] Fasciotomy [4] Synthetic mesh (polyester) [3] Fascia lata weave [1] Fascia lata onlay graft [1, 6] Fascia lata inlay graft [7] Periosteal flaps [1] Botulinum toxin injection [2]

he avoided using his left hand even at home and was not able to pursue his hobby of riding his motorbike. Occasionally the pain disturbed his sleep.

Physical examination demonstrated development of a prominent 6 × 1.5 cm firm soft-tissue swelling between the flexor carpi radialis and palmaris longus tendons when he clenches his fist (Fig. 1). He showed a full range of movement for the left wrist and hand. Tinel's sign was positive along the median nerve in the distal forearm, which radiated to the middle finger. Sen-

sation in the left hand was normal at the initial examination but grip strength was significantly decreased in the left hand at 37 kg when compared to the right (66 kg) using a JAMAR[®] hydraulic hand dynamometer (Lafayette Instrument Co., Lafayette, Indiana) at setting 2. Pinch grip was also decreased for the left hand, 3 kg as opposed to 12.5 kg for the right side (JAMAR[®] hydraulic pinch gauge, Lafayette Instrument Co., Lafayette, Indiana). Further investigation using ultrasonography and magnetic resonance imaging confirmed herniation of the flexor digitorum superficialis (FDS) muscle at its musculotendinous junction through a defect in the overlying deep fascia (Fig. 2).

Initially, a trial of conservative management comprising of hand therapy and wrist support was initiated. However, after more than 6 months the patient remained symptomatic with a subjective increase in pain. Repeat evaluation of the hand showed a slight increased in grip strength for the left hand because of sustained strengthening program with hand therapist. However, it remained painful and more importantly the median nerve symptoms has worsen. The patient reported decreased pin-prick sensation along the median nerve distribution in the left hand at this stage, although formal nerve conduction testing was normal. Surgery was performed ten months after development of symptoms.

At surgery the defect was identified (Fig. 3) and the size of the graft required to wrap around the FDS was templated and a fascia lata graft of the same size harvested from the left thigh (Fig. 4). The donor site defect

Table 3. Comparison of the grip strength, pinch grip and pain score for the left hand preoperatively and on follow-ups postoperatively

Modality	Pre-op	6 weeks post-op	3 months post-op	6 months post-op
Grip strength (JAMAR® 2)	37 kg	30 kg	30 kg	34 kg
Pinch grip	3 kg	6 kg	6 kg	6.5 kg
Pain score	6/10	3/10	2/10	0–1/10

Fig. 1 No obvious deformity seen with the hand relaxed (a) but when clenched (b), a firm soft-tissue swelling between the palmaris longus (PL) tendon and the flexor digitorum superficialis tendon to the ring finger (FDS-RF) that measures approximately 6 cm in length (c) is demonstrated. Note that the appearance of the swelling is more prominent after 5 months of hand therapy (b) then on first presentation (c)

was covered with a polypropylene mesh (PROLENE®, Ethicon, Inc., Somerville, New Jersey) and closed. The fascia lata graft was flipped over so that its subcutaneous surface is now against the muscle underneath the defect in the deep fascia (Fig. 5). It was fixed to the radius and ulna using multiple bone anchor sutures (TWINFIX®, Smith & Nephew, Memphis, Tennessee) (Fig. 6).

Fig. 2 (a) A dynamic ultrasonographic examination on the volar surface of both forearms, while tensing the forearm musculature, demonstrating herniation of the FDS in the direction of the red arrow. No such herniation is seen on the right forearm. This is better visualized on the MRI scan (b) of the left forearm, at the junction of the middle third and the distal third with the fist clenched, showing herniation of the FDS muscle volarly through a defect in the deep fascia (red arrow). Note the median nerve (yellow circle) being pushed aside together with the PL and FCR by the bulging FDS muscle. Rad = radius, Uln = ulna, IOM = interosseous membrane, FPL = flexor pollicis longus, FDP = flexor digitorum profundus, FCU = flexor carpi ulnaris, FDS = flexor digitorum superficialis, FCR = flexor carpi radialis, PL = palmaris longus, red circle 1 = radial neurovascular bundle, red circle 2 = ulnar neurovascular bundle

Care was taken to make sure that the median nerve remained outside the graft. The surgical wound was then closed in layers using an absorbable monofilament suture

(Monocryl®, Johnson & Johnson, New Brunswick, New Jersey). A wrist splint was applied to protect the graft postoperatively. Active range of motion exercises and local scar management was initiated at 2 weeks follow-up. Six weeks after that the splint was removed and the patient was started on a strengthening program. Six months after surgery the patient continued to improve with mild discomfort, no recurrence of median nerve symptoms or complications (Figs 7, 8 and Table 3).

Discussion

The etiology for muscle herniation is believed to be secondary to muscle hypertrophy and increased intra-compartmental pressure from the forced exertion of strenuous activity. This resulted in herniation of the muscle at relatively weak areas of the deep fascia, usually where the neurovascular structures traverse through. That

probably explained why many previous reports on muscle herniation are mostly amongst military personnel and also athletes [3]. Less commonly it can also be due to a tear in the deep fascia from either a penetrating injury or blunt trauma. However, for the upper limb, most of the reported cases (88%) are secondary to some sort of trauma and only 2 out of the 17 previously reported cases were from strenuous exertion (Table 1).

Development of compartment syndrome in the lower limb after direct repair of the fascial defect is a known complication. For this reason a formal fasciotomy had been advocated as the treatment of choice for symptomatic muscle hernia in the past [1]. However, the results of fasciotomy in the upper limb do not seem to be as predictable as in the lower limb. This is highlighted in the 7 cases of symptomatic forearm muscle hernia treated by Watson [4] with fasciotomy, only 3 were asymptomatic at a minimum period of 1 year follow-up (mean of 5 years). Furthermore, unlike in the lower limb, the result of having a fasciotomy done in the forearm is markedly more noticeable and also unappealing to the patient.

Pain from a symptomatic muscle hernia is believed to be caused by the protrusion and contraction of the muscle belly against the proximal edge of the fascial defect. This is probably more so in the upper limb where there is a

Fig. 3 Incision of the skin over the site of the swelling (a) immediately exposed a prominent palmaris longus (PL). Retraction of the palmaris longus radially (b) demonstrates a defect in the deep fascia (yellow arrows) that corresponds to the size of the swelling. MN = median nerve, FCR = flexor carpi radialis, FDS = flexor digitorum superficialis, FCU = flexor carpi ulnaris

Fig. 4 The size of the fascial graft required was templated (a) and a fascia lata graft of the same size was harvested from the left thigh via two parallel transverse incisions (b). The defect at the donor site is covered with a polypropylene mesh prior to closure (c). MN = median nerve

Fig. 5 The fascia lata graft was used ‘inside out’ with the subcutaneous surface now on the underside (a) before it is sutured to the radius using multiple bone anchor sutures (b). The tension of the graft is adjusted (c) prior to having the other side sutured to the ulnar. The wrap around graft is placed underneath the palmaris longus (PL) and flexor carpi radialis (FCR) tendons and the median nerve (MN) (d) to prevent irritation or compression to the median nerve

Fig. 6 Placement of the bone anchors is shown on the postoperative radiograph

large excursion of the flexor tendon upon muscle contraction. In this patient there are also signs of median nerve irritation, a heretofore unreported symptom of forearm muscle herniation, which probably contribute to his pain. This is not surprising considering the site of the muscle herniation. Furthermore, even though the grip strength improved with a conservative strengthening exercises program initially, the patient’s symptoms were becoming more severe and disabling. Therefore, closure of the defect in the fascia by direct suturing or use of a synthetic

mesh was decided against as the median nerve could be irritated further by the mesh. In the end, the decision was made to perform a wrap-around fascia lata graft to treat this case of recalcitrant muscle hernia in the forearm as it prevents protrusion of the affected muscle without increasing the intra-compartmental pressure; allows for differential gliding of the underlying and overlying tendons; and avoids irritation of the median nerve.

In summary, using a wrap-around fascia lata graft is a viable option for a symptomatic muscle herniation with

Fig. 7 At 6 months after surgery the surgical wound is well-healed with no evidence of muscle herniation on clenching the fist (**a**) or flexing the wrist (**b**)

Fig. 8 Appearance of the donor site at 6 months (**a**) with no evidence of muscle herniation upon contracting the quadriceps (**b**)

nerve compression symptoms in the forearm that does not respond to conservative measures.

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