Late presentation of isolated digital contracture following forearm fracture

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Introduction

The inflammatory response associated with fracture healing induces varying levels of local scarring and adhesions. Associated morbidity from local adhesions is rare in forearm fractures, but entrapment of flexor tendons has been reported in the literature following both-bone forearm fractures in children and adolescents [1–9]. In 14 of the 15 cases of flexor tendon entrapment following both-bone forearm fractures, the flexor digitorum profundus (FDP) tendon was involved. Akita and Kawai [1] reported on a flexor digitorum superficialis tendon entrapment 4 weeks following injury. It is thought that the more superficial location of the flexor digitorum superficialis (FDS) tendon affords some protection from adhesion to the fracture site. We present a delayed presentation of contracture of the index finger in a 15-year-old patient 5 years following a forearm fracture.

Case Report

A 15-year-old girl presented with an inability to fully extend the left index finger proximal interphalangeal joint. This was first noted 6 months earlier. No antecedent trauma involving the finger was reported, but past history was

notable for a distal both-bone forearm fracture treated by closed reduction and casting 5 years previously.

On physical examination, the patient had no scar or deformity of the forearm. A 40° flexion contracture of the left index finger proximal interphalangeal (PIP) joint was evident with wrist extension (Fig. 1). However, when the wrist was placed in full flexion, the index PIP joint was able to be fully extended. Contracture of the FDS to the index finger was suspected. On further examination, a subtle palpable chord in the forearm was present. Her neurovascular examination was normal. Plain radiographs showed no abnormalities.

Reviews of past radiographs revealed a displaced distal radius and ulnar fracture (Fig. 2). She had multiple attempts at reduction in the emergency department and eventually required closed reduction under general anesthesia (Fig. 3).

Adjunctive imaging, including ultrasound of the tendon at the level of the finger, as well as magnetic resonance imaging (MRI) did not reveal any abnormalities. The patient was offered surgical exploration with possible tenotomy or tendon lengthening of the FDS tendon.

At surgery, a volar forearm incision was made at the level of the musculotendinous junction. Exploration revealed a fibrous scar between the index finger FDS musculotendinous junction and the radius (Fig. 4). The scar was excised and full passive range of motion at the finger was confirmed with the wrist in both extension and flexion (Fig. 5). Immediately following recovery from anesthesia, the patient was able to demonstrate active full digital extension of the finger (Fig. 6).

Discussion

Both-bone forearm fractures in children are common; however, the occurrence of tendon entrapment remains markedly low [7]. Previous reports have shown that entrapment is

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Fig. 1 **a, b** PA and lateral plain radiographs 5 years after injury demonstrating complete remodeling of both forearm bones. **c** The patient was unable to extend actively or passively the proximal interphalangeal joint of the index finger with wrist in neutral

most common before puberty [3, 5–7] with the majority of cases involving the FDP tendon and only one case reporting on entrapment of an FDS tendon [1]. Finger flexion contractures following forearm fractures have been associated with Volkmann’s ischemia. In the cases with entrapment, the term “pseudo-Volkmann’s contracture” has been used [6, 10]. These patients differ from the more severe Volkmann’s ischemia in that they do not demonstrate the classic signs and symptoms of a compartment syndrome, such as pain with passive stretch, pain out of proportion to the injury, or nerve palsies [7]. Our case report is unusual in two ways: first, the FDS tendon was involved and second, the delay in presentation from fracture to flexion contracture (the patient only noticed the contracture 4 1/2 years after the injury).

Two mechanisms for entrapment of flexor tendons have been proposed [2, 5]. The first is for acute entrapment, usually involving the FDP tendon, occurring at the fracture site or tethering of the tendon on a bone spike. The second mechanism is for chronic entrapment, when fibrosis and scar tissue develop at the fracture site between the muscle

belly of the flexor tendon and the bone. This is secondary to the injury of the muscle belly during the fracture. The extension lag can develop over weeks to months [2, 5]. The chronicity of the clinical presentation in our case can partly be described by the second mechanism. The relatively sudden onset of contracture is likely due to a growth spurt and tethering of the tendon.

Shaw and Murphy [7] stated that the most common error in patients with tendon entrapment following a forearm fracture is delay in diagnosis. Since most cases are treated with initial closed reduction and immobilization, wrist examination cannot be performed for 4–6 weeks. When reviewing past reports, the delay in diagnosis ranged from 6 weeks [5] to 5 years [6]. To prevent delay in diagnosis for an acute entrapment, careful examination of active and passive range of motion of all digital joints in wrist extension, both before and after manipulation, is recommended [3, 7]. If the child is not cooperative with the exam immediately following the injury and compartment syndrome has been excluded, then re-examination in a more conducive environment several days later is recommended [7]. The key point in diagnosing an entrapped tendon proximal to the wrist is understanding the tenodesis effect [9]. This is the lack of extension of the involved digit with a neutral or

Fig. 2 Initial **a** posteroanterior (PA) and **b** lateral plain radiographs showing fracture of both forearm bones at the distal one-third level with severe volar angulation

Fig. 3 **a, b** Following general anesthetic, fluoroscopic films demonstrate a more anatomic reduction

Fig. 4 The muscle tendon junction of the index finger FDS was scarred to the previous site of the radius fracture. FDS, flexor digitorum superficialis; asterisk indicates radius

extended wrist and full range of motion with the wrist flexed.

The level of the both-bone forearm fracture may determine the tendon involved. The ring finger FDP tendon appears to be entrapped near its origin by a mid-shaft ulna fracture [2, 3, 5, 9]. Akita and Kawai [1] reported a middle finger FDS tendon entrapment in a patient with a distal one-third both-bone forearm with complete dorsal displacement. The fracture required a forcible reduction with the proximal fragment being pushed dorsally and thus snaring the more volar FDS tendon. The location and multiple attempts of reduction in our case seem to parallel the case presented by Akita and Kawai [1].

We present a case of an entrapped index finger FDS tendon following a pediatric both-bone forearm fracture. In this case, careful history and thorough examination were critical to making the diagnosis. Adjunctive sophisticated imaging was not helpful in making the diagnosis. Release of the scarred sublimis muscle belly in the forearm led to an instantaneous correction of the deformity. Every physician

Fig. 5 The scar tissue surrounding the index finger FDS musculotendinous junction was excised

Fig. 6 Immediately following recovery from anesthesia, the patient was able to demonstrate full FDS and FDP function of the index finger with the wrist in neutral

who cares for pediatric both-bone forearm fractures should recognize the signs and symptoms of flexor entrapment.

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