

# Volar Forearm Compartment Syndrome Following Flexor Digitorum Profundus Muscle Rupture in a 3-Year-Old Girl

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In the pediatric population, compartment syndrome in the upper extremity is a potentially devastating complication associated with many different etiologies, including fracture complications, vascular insufficiency, burns, and osteomyelitis.<sup>1-3</sup> Fractures account for the majority of compartment syndromes described in children.<sup>1,3-7</sup>

We describe a case of forearm compartment syndrome in a 3-year-old girl with a flexor digitorum profundus muscle belly rupture and no associated fracture. To our knowledge, there have been no such reported cases of this type of injury causing compartment syndrome in this age group.

## CASE REPORT

A 3-year-old girl was brought to the emergency room with a left upper extremity injury several hours after playing tug-of-war on a bed and falling off it. On initial presentation, she was holding the extremity at her side, with fingers and wrist extended, and was irritable with any arm movement. There was mild swelling along the volar aspect of the wrist and around the elbow. On further evaluation, the patient would not move her wrist and fingers, and elbow movement was minimal, despite extensive coaxing. Sensory examination was difficult, as responses were inconsistent. The patient reacted to palpation throughout the upper extremity, so localizing the injury was difficult. She did not allow assessment of passive range of motion at the elbow or wrist. Capillary refill was good in all digits, and radial pulse was strong. There was no pain with passive extension of the fingers, but the patient would not actively range her fingers. There was mild swelling over the volar aspect of the wrist and the

elbow, but the dorsal and volar compartments in the forearm were soft. X-rays of the wrist and elbow showed no bony or soft-tissue abnormalities (Figure). Manipulation was performed to rule out nursemaid's elbow but failed to relieve the patient's symptoms. Further questioning of the parents did not help determine whether she had been moving the upper extremity before the examination. The patient was placed in a posterior splint, admitted to the hospital for further observation, and scheduled for a magnetic resonance imaging scan to evaluate for possible cartilaginous or soft-tissue injury.

After several examinations throughout the night, the patient was becoming more anxious and irritable. She clenched her fingers and thumb and exhibited pain with passive extension of the fingers. The volar compartment had become tense, and the fingers were dusky in appearance with decreased capillary refill. The patient was taken emergently to the operating room for volar compartment release and exploration.

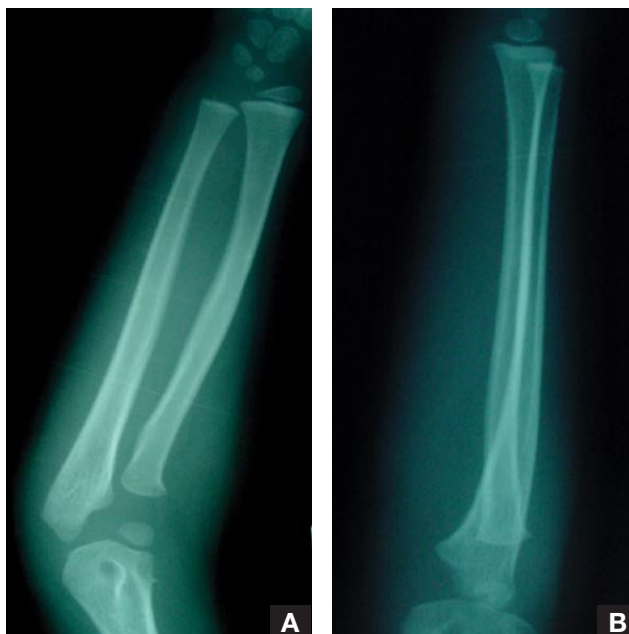
In the operating room, forearm compartment pressures were measured with a Stryker Intra-Compartmental Pressure Monitor System (model 295-1; Stryker Instruments, Kalamazoo, Mich). Pressure was 82 mm Hg in the volar

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**Figure.** Anteroposterior (A) and lateral (B) x-rays of left forearm show no evidence of bony injury.

compartment and 4 mm Hg in the dorsal compartment. The forearm was then prepped and draped, and a volar approach of Henry was used. The investing muscular fascia was incised through the entire length of the incision; the volar forearm compartment musculature expanded from the relief of pressure. The fingers extended to a more normal position, and capillary refill returned immediately after release. Exploration of the volar compartment revealed a fusiform hematoma within the flexor digitorum profundus muscle belly to the index finger. The hematoma was opened and evacuated. Examination of this muscle belly revealed a partial tear at the musculotendinous junction. The muscle bellies and tendons of the remaining flexor muscles appeared normal. As the hematoma appeared to enter the carpal canal, a separate incision was made over the palm, and carpal tunnel release was performed. The median nerve was intact, and the tendons appeared healthy.

The palmar incision was closed primarily with interrupted 4-0 nylon sutures, and the volar forearm incision was approximated loosely with interrupted 2-0 nylon sutures. The patient was monitored closely in the hospital for the next 2 days. Although she still refused to move the fingers, she was less irritable with passive stretching, and capillary refill was good (pink, healthy-looking fingers). She was discharged from the hospital in stable condition. A week after discharge, she was brought back to the operating room for delayed closure of the volar forearm wound. By her last, 3-month follow-up visit, the wound was well healed, and she was moving all her fingers without difficulty.

## DISCUSSION

Upper extremity compartment syndrome is a potentially devastating complication of forearm and supracondylar humerus fractures in the pediatric population, and several other causes have been described in the literature.<sup>1,3-7</sup> Diagnosis of compartment syndrome in an upper extremity injury without fracture requires a high degree of suspicion on the part of the examiner. Thorough examination of soft tissues, and assessment of vascular and sensorimotor status, should be performed. In young children, making the diagnosis can be more difficult. Some authors have recommended using the child's level of anxiety and pain, along with an increasing analgesia requirement, as an indicator of compartment syndrome.<sup>1</sup> Tissue-pressure recording has also been found to be a valuable tool in diagnosis when the clinical examination is inconclusive.<sup>8</sup>

In our patient's case, the physical examination initially did not reveal any evidence of compartment syndrome. An inability to console the patient and the patient's high level of anxiety are what led the examiner to have her admitted

to the hospital for observation. It was not until several hours later that compartment syndrome became clinically evident. Tissue-pressure recordings made just before surgery revealed elevated pressures, but, given the clinical picture, exploration of the forearm and release of the compartments would have been performed even if the recordings had not been made. It is possible that tissue-pressure recording performed at initial presentation would have aided in making an earlier diagnosis of impending compartment syndrome.

Two aspects of this case report should be highlighted. The first is the unique nature of the injury and the cause of compartment syndrome. The patient's initial presentation and history led us to believe that her falling on the extremity caused the injury. In retrospect, she more likely sustained a traction injury to the flexor digitorum profundus muscle while playing tug-of-war before falling. To our knowledge, only a single case of upper extremity compartment syndrome involving rupture of a flexor muscle has been described—involving an adult's digitorum superficialis<sup>9</sup>—and none has been described in the pediatric population.

The second and more important aspect of this case is that seemingly minor injuries of the upper extremity can lead to compartment syndrome in the pediatric population. The clinical picture can initially be misleading, and it is up to the examiner to maintain a high degree of suspicion, especially when evaluating a child who is inconsolable or whose pain seems out of proportion to the examination.

## AUTHORS' DISCLOSURE STATEMENT

The authors report no actual or potential conflict of interest in relation to this article.

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*This paper will be judged for the Resident Writer's Award.*

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