Digital Artery Pseudoaneurysm Following Percutaneous Trigger Thumb Release

A Case Report

Samuel A. Taylor, MD, Daniel A. Osei, MD, Sapna Jain, MD, and Andrew J. Weiland, MD

Investigation performed at Hospital for Special Surgery, New York, NY

Stenosing flexor tenosynovitis, or trigger finger, is among the most commonly encountered clinical problems treated by hand surgeons. Corticosteroid injection is the most accepted first-line therapy, with successful resolution of symptoms occurring in 61% of patients[1-5]. Traditionally, trigger fingers unsuccessfully treated with corticosteroid injections have been managed with open surgical release of the A1 pulley[2,3,6,7]. Some surgeons have recommended percutaneous release of the A1 pulley[1,8-10]. Two randomized controlled trials comparing open surgical release with percutaneous release showed equivalent clinical outcomes, but the percutaneous release group had reduced recovery time, fewer wound complications, and lower

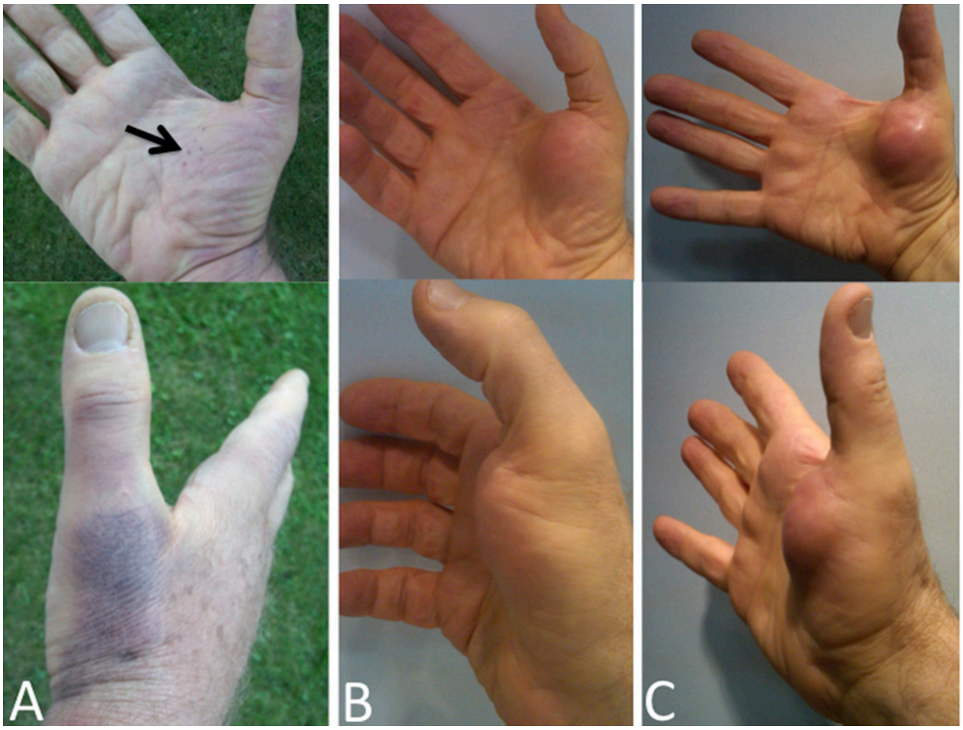

Fig. 1

Figs. 1-A, 1-B, and 1-C Gross appearance of the maturing pseudoaneurysm. **Fig. 1-A** Two days following percutaneous trigger thumb release, volar puncture wounds (arrow) as well as dorsal ecchymosis were noted. **Fig. 1-B** A discrete thenar swelling progressed over the ensuing four weeks. **Fig. 1-C** At six weeks following the percutaneous trigger thumb release, the patient noted a well-defined violaceous ''pulsatile'' mass.

Disclosure: None of the authors received payments or services, either directly or indirectly (i.e., via his or her institution), from a third party in support of any aspect of this work. One or more of the authors, or his or her institution, has had a financial relationship, in the thirty-six months prior to submission of this work, with an entity in the biomedical arena that could be perceived to influence or have the potential to influence what is written in this work. No author has had any other relationships, or has engaged in any other activities, that could be perceived to influence or have the potential to influence what is written in this work. The complete **Disclosures of Potential Conflicts of Interest** submitted by authors are always provided with the online version of the article.

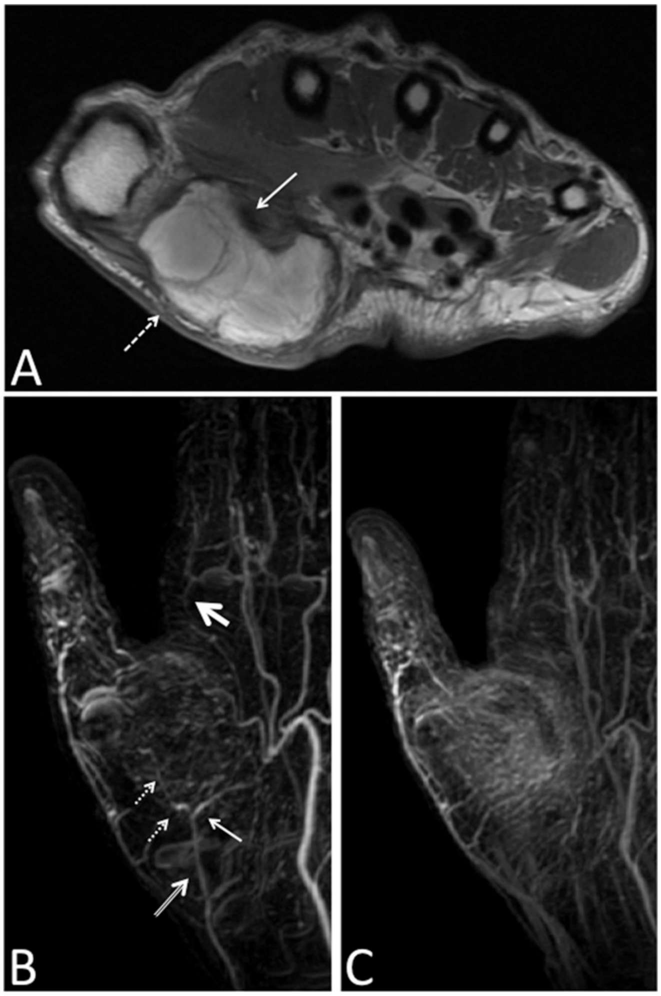

Fig. 2

Figs. 2-A, 2-B, and 2-C MRI/MRA images. **Fig. 2-A** Axial proton density image demonstrates a large heterogeneous soft-tissue mass in the palmar margin of the thenar eminence. The soft-tissue mass displaces regional structures, including the flexor pollicis longus tendon (solid arrow) and adjacent radial branches of the radial nerve distribution (dashed arrow). **Fig. 2-B** Coronal contrast-enhanced MRA of the right hand demonstrates ulnar artery dominance with the bulk of the digital vessels arising off the metacarpal branches from the ulnar distribution. The radial artery (hollow arrow) is attenuated but patent to its contribution to the deep palmar arch (thin solid arrow). Corresponding marked attenuation of radial artery branches including the radialis indicis (thick solid arrow) and princeps pollicis (dashed arrows) is noted. The princeps pollicis branch extends directly into the soft-tissue mass. **Fig. 2-C** Delayed contrast-enhanced coronal MRA demonstrates contrast enhancement within the mass, indicative of a pseudoaneurysm.

costs[7,11]. To our knowledge, no neurovascular complications with the percutaneous release technique have been previously reported in the literature; we report the case of a patient with an iatrogenic pseudoaneurysm of the digital artery during percutaneous trigger finger release (PTFR) surgery. The patient was informed that data concerning his case would be submitted for publication.

Case Report

A sixty-year-old right-hand-dominant man presented with a persistent right thenar mass; this mass had been present for two months following PTFR of the right thumb. The patient, who was on chronic anticoagulation therapy with Coumadin (warfarin) because of a mechanical St. Jude aortic valve replacement, underwent a percutaneous release of the A1 pulley of the right thumb.

During the first week following the PTFR, the patient noted substantial ecchymosis and minimal swelling on the dorsal part of the hand (Fig. 1-A). Over the next four weeks, he reported progressive thenar swelling (Fig. 1-B) as well as the onset of hypesthesia in the radial digital nerve distribution of the thumb. A hematoma or pseudoaneurysm was suspected on the basis of clinical examination. Magnetic resonance imaging (MRI) demonstrated a round lesion measuring 3.0 × 3.4 × 2.9 cm with a swirled appearance, consistent with pseudoaneurysm, although the non-contrast study could not identify any feeding vessels.

By six weeks following the PTFR, the swelling had matured into a discrete violaceous thenar mass that the patient described as “throbbing” and “pulsating” (Fig. 1-C). An exploration and repair was performed in the operating room. The radial digital nerve was noted to be intact. A branch of the radial digital artery was identified distally; because it was thought to be the feeder vessel of the pseudoaneurysm, it was ligated with a silk suture. A 4.0 × 3.5 × 1.5-cm mass, along with a portion of the thenar muscle, was excised; pathologic evaluation confirmed that it was a pseudoaneurysm.

Despite this surgical procedure, the thenar mass rapidly returned on postoperative day one. On postoperative day two, the hematoma was evacuated in the operating room. The radial

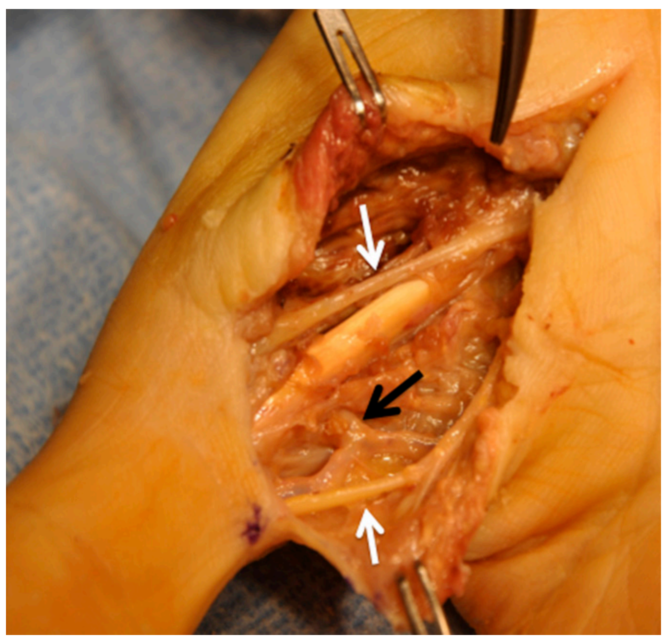

Fig. 3

An articular branch of the princeps pollicis (black arrow) was identified as the offending vessel and ligated. The digital nerves were identified (white arrows), and a neurolysis of the radial digital nerve was performed.

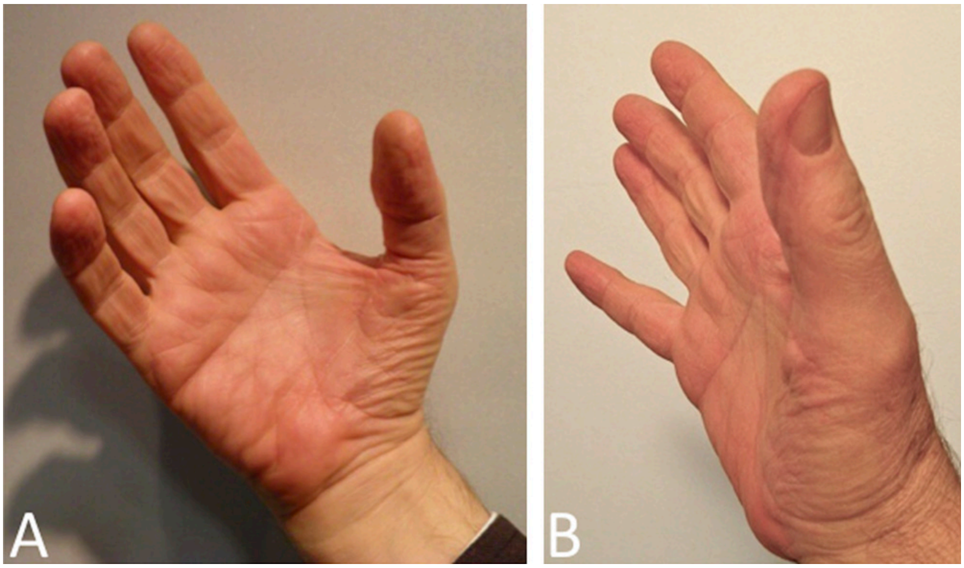

Fig. 4

Clinical photographs six weeks following surgery for the pseudoaneurysm.

digital sensory deficit persisted and, within days after the second surgical procedure, the thenar mass recurred yet again.

The patient presented to the senior author (A.J.W.) the following week for a second opinion. Physical examination revealed a moderately firm 3.0 × 2.5 ×1.0-cm mass in the thenar eminence of the right hand. There was a large eschar with dark sanguineous drainage from the surgical incision without evidence of infection. There was also hypesthesia and diminished two-point discrimination in the radial digital nerve distribution of the thumb distal to the metacarpophalangeal joint. MRI/magnetic resonance angiography (MRA) (Figs. 2-A, 2-B, and 2-C) was performed at our institution with use of a clinical 1.5-T system (GE Signa HDx, Milwaukee, Wisconsin) with an eight-channel transmit-receive phased-array extremity knee coil (transmit-receive knee PA coil; MEDRAD, Indianola, Pennsylvania). This imaging demonstrated a large heterogeneous soft-tissue mass in the palmar margin of the thenar eminence, with mass effect on regional structures including the flexor pollicis longus tendon and adjacent radial branches of the radial digital nerve. A princeps pollicis branch extending directly into the soft-tissue mass was noted, indicative of a pseudoaneurysm. Additionally, evidence of an A2 pulley injury and a flexor pollicis longus tendinopathy was noted.

A surgical exploration and pseudoaneurysm repair was planned. Preoperatively, the patient was administered temporary anticoagulation therapy with low-molecular-weight heparin while Coumadin was withheld and the INR (international normalized ratio) normalized. By the time of this procedure, the original wound had dehisced. Evaluation of the affected thenar muscle revealed a substantial hematoma as well as necrosis of the opponens pollicis, both of which required thorough debridement. There was no evidence of infection, and intraoperative cultures ultimately proved negative. An incomplete release of the A1 pulley was encountered and, subsequently, the A1 pulley was completely released. A partial injury to the oblique pulley and A2 pulley was noted intraoperatively. The ulnar and radial digital nerves were in continuity. Neurolysis was performed on the radial digital nerve to release it from the surrounding scar tissue. Arterial exploration revealed an exposed lumen measuring approximately 2 mm in diameter from a large articular branch of the princeps pollicis artery along the ulnar border of the metacarpophalangeal joint of the thumb (Fig. 3). This arterial branch was coagulated with bipolar electrocautery. The tourniquet was released, and hemostasis was achieved prior to wound closure. Distal digital capillary refill was brisk.

Postoperatively, a thumb spica splint was used, and anticoagulation medication was withheld for forty-eight hours. On clinical follow-up, there was no recurrence of the pseudoaneurysm and the wound healed uneventfully (Figs. 4-A and 4-B). The patient continued to have mildly restricted thumb extension and abduction as well as radial sensory nerve dysesthesias.

Discussion

In 1958, Lorthioir[12] first described the technique of percutaneous release of the A1 pulley. Since that time, other hand surgeons have proposed methods for PTFR ranging from the use of large-bore needles[8,9] to the use of specially designed blades[13]. On average, successful outcomes have been reported after 94% of procedures[1,8-10]. Despite these excellent outcomes, the safety of percutaneous release has been questioned. The digital neurovascular structures are in proximity to the A1 pulley and are not visualized or directly protected during percutaneous release. Several authors have demonstrated the vulnerability of these neurovascular structures, particularly in the thumb and index finger, given their volar and oblique courses. Pope and Wolfe[14] evaluated the functional anatomy during PTFR in a cadaveric model and showed that the radial digital nerve was within 2 mm of the penetrating needle in three of five specimens. Additionally, in all five specimens, the radial digital nerve of the index finger was within 2 to 3 mm of the needle track with the finger in hyperextension. They concluded that PTFR in the thumb and index finger was contraindicated given the proximity of the neurovascular structures. In a cadaveric study, Bain and et al.[15] found that the radial digital nerve in the thumb was within 2 mm of the needle track in seven of seventeen specimens. More recently, a sonographic study[16], which did not differentiate among digits, showed similar proximity of the digital neurovascular structures.

Despite these anatomic considerations, authors of clinical outcome studies have reported very few neurovascular injuries with PTFR. Reported complications associated with PTFR are incomplete A1 pulley division, damage to the oblique pulley and A2 pulley, and longitudinal lacerations of flexor tendons, all of which were observed in our patient[1,8-10]. Cebesoy et al.[17] prospectively studied twenty-five patients treated with percutaneous trigger thumb release and found that 17% of patients subsequently required an open release because of persistent trigger finger symptoms. At the time of the open release, it was noted that all patients had had an incomplete A1 pulley release. Additionally, three of the four patients had superficial tendon lacerations. No neurovascular injury was reported.

To our knowledge, we are the first to report a case of a pseudoaneurysm as a complication of PTFR. A pseudoaneurysm is also known as a "false aneurysm." It most commonly is associated with iatrogenic arterial trauma in which the arterial perforation remains patent, resulting in an active hematoma contained by the surrounding tissue. Pseudoaneurysm of a digital artery is very uncommon; to the best of our knowledge, it has been previously described in the literature only sixteen times. Reported etiologies include penetrating trauma[18-21], repetitive microtrauma[22], blunt trauma[23], index finger amputation[24], and iatrogenic injury during surgery[25,26].

In 2006, Symes and Stothard[26] reported pseudoaneurysm as a complication following percutaneous needle fasciotomy in a patient with Dupuytren disease of the fifth digit. This seventy-two-year-old man was on anticoagulation therapy for treatment of a deep vein thrombosis in an axillary vein. The patient first presented with excessive bruising and pain with a resultant mass in the fourth web space over a two-week period. On surgical exploration, the involved branch of the common digital artery was identified and ligated, and the pseudoaneurysm was excised.

While ultrasound, MRI, and MRA studies are important adjuncts to establish the diagnosis of pseudoaneurysm, an initial clinical suspicion and awareness are paramount, especially given the continued movement in the direction of minimally invasive and percutaneous techniques. Anticoagulation therapy should be temporarily discontinued prior to PTFR, if possible, to limit bleeding sequelae. If PTFR is performed in a patient on anticoagulation therapy, close periprocedural follow-up is necessary. We recommend performing trigger finger releases in the thumb and index finger in an open fashion since percutaneous techniques can place nearby neurovascular structures at undue risk. ■

Note: The authors thank Dr. Hollis Potter for her consultation and assistance with MRI interpretation.

Samuel A. Taylor, MD
Daniel A. Osei, MD
Sapna Jain, MD
Andrew J. Weiland, MD
Hand Surgery Service, Hospital for Special Surgery,
535 East 70th Street, New York, NY 10021.
E-mail address for S.A. Taylor: taylors@hss.edu

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