Visual Journal of Emergency Medicine 24 (2021) 101063

Contents lists available at ScienceDirect

Visual Journal of Emergency Medicine

journal homepage: www.elsevier.com/locate/visj

Visual Case Discussion

Infectious tenosynovitis diagnosed on POCUS

Lilien Socorro [a], Raghav Sahni [b,*], Karima Sajadi-Ernazarova [b]

[a] Drexel University College of Medicine Philadelphia, PA, USA
[b] Crozer Chester Medical Center Emergency Department Chester, PA, USA

ARTICLE INFO

Keywords:
Tenosynovitis
Kanvel
POCUS
IVDA
Water bath

1. Case discussion

28-year-old female, past medical history of IV drug abuse, presented with 4 days of pain, and swelling in her left forearm and hand. On initial exam, patient had track marks on left forearm. There was tenderness and swelling across the left thenar eminence, and volar aspect of thumb extending to distal forearm with mild erythema overlying area of swelling. Grip strength was moderately decreased in comparison to her unaffected right hand due to pain. Patient displayed decreased active and passive ROM with opposition of her left thumb, as well pronation and supination of left hand and forearm. Sensation was intact across radial, ulnar, and median nerve distributions. Radial pulses were 2+, and capillary refill was less than 2 s bilaterally.

In an attempt to distinguish cellulitis versus abscess from a more concerning pyogenic tenosynovitis, a water bath point of care ultrasound was conducted by an emergency medicine resident using the linear probe. Anechoic fluid was seen surrounding the flexor tendon of the thumb. There was associated tenderness on probe pressure at area of fluid collection. Hand surgery was consulted and the patient was sent for a confirmatory radiology ultrasound study. A 2.8 × 1.0 × 1.4 cm fluid collection surrounding the tendon sheath in the dorsal forearm and wrist extending to the palm was found. The hand surgeon agreed with the diagnosis and the patient was started on IV Vancomycin, and Zosyn but did not complete her treatment as she left the hospital against medical advise.

2. Discussion

Infectious flexor tenosynovitis (FTS) requires timely diagnosis and hand surgery consultation in the emergency department (ED) and is essential for preservation of hand function. There is a wide differential for the presentation of a painful, swollen digit, including: FTS, cellulitis, abscess, felon, septic arthritis, gout, pseudogout, herpetic whitlow, and paronychia. The prevalence of FTS has been estimated to range from 2.5 to 9.4% of all hand infections.[1]

The majority of hand tendon sheath infections are typically introduced through direct inoculation, with trauma, animal bite wounds, and IV drug abuse. FTS occurs with the accumulation of purulent fluid between the visceral and parietal layers of the flexor tendon sheath. In FTS the accumulation of fluid or pus creates the potential for local infection spread to adjacent tissue/ bursae and increased pressure within the sheath, which may lead to tendon vascular compromise/rupture. This can result in significant morbidity secondary to loss of function and may lead to amputation.

Differentiating FTS from other infections of the hand can be difficult and has historically relied upon Kanavel's four cardinal signs: Flexion of the finger, pain on finger extension, tenderness over the course of the sheath and uniform finger swelling. However, the usefulness of these signs in ruling in or ruling out FTS has yet to be established. Dailana et al. conducted a retrospective review of 41 patients with a final diagnosis of FTS and found that only 54% of patients had all four signs at the time of presentation. Pang et al's analysis of 75 patients with FTS found that fusiform swelling was the most common sign, reporting its presentation in 97% of patients, while another study by Neviaser and

* Corresponding author.
E-mail address: raghav.sahni@crozer.org (R. Sahni).

https://doi.org/10.1016/j.visj.2021.101063
Received 10 March 2021; Received in revised form 29 April 2021; Accepted 9 May 2021
Available online 26 May 2021
2405-4690/Published by Elsevier Inc.

Fig. 1. Axial picture of large amount of anechoic fluid (red arrow) collection surrounding flexor tendon (yellow arrow) of the left thumb. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

Gunther found that pain on finger extension was the earliest finding on exam. A 2017 retrospective study by Kennedy et al. determined the sensitivities and specificities of Kanavel's signs by comparing the clinical presentations of 74 patients with hand infections referred to hand surgery. The sensitivities ranged from 91.4 to 97.4% for all four signs, with pain on passive extension having the highest sensitivity at 97.4%. The specificities, however, were poor, ranging from 51.3 to 69.2%, with tenderness on palpation of tendon sheath having the highest specificity at 69.2%. Interestingly, the study was also able to determine three independent predictive factors: pain with extension, tenderness of the flexor tendon sheath, and duration of symptoms less than five days. They reported an 87.9% predicted probability of FTS when all three factors were present.[2]

The diagnostic uncertainty of FTS on clinical presentation alone calls for a greater reliance on labs, and imaging in order to arrive at appropriate ED management. Regarding imaging, magnetic resonance imaging (MRI) can be used to visualize soft tissue infections, however limited ED access, time needed for evaluation, and cost make MRI a less

Fig. 2. Axial video of anechoic fluid collection (black) surrounding flexor tendon (white) of the left thumb. As the probe is moved up and down the thumb, the extent of fluid surrounding a long distance of tendon can be visualized.

desirable option than point of care ultrasound (POCUS).

There is currently not a large pool of data concerning the reliability of ultrasound as a diagnostic adjunct for FTS. Two case series published in the 1980s reported ultrasound findings of hypoechoic/anechoic fluid surrounding the flexor tendon, as well as increased tendon sheath diameter (as compared to the contralateral unaffected tendon) in patients with an operative diagnosis of purulent tenosynovitis. A recent 2018 prospective study by Jardin et al. examined 57 patients referred to an emergency hand center for possible FTS. Patients with positive ultrasound findings (hypoechoic effusion around tendon and thickened synovial sheath) were taken to the operating room (OR), while those with negative findings were given a diagnosis of cellulitis and started on a course on antibiotics. In total 27 patients had positive ultrasound findings, but only 17 were confirmed to have PTS in the OR. One patient had a false negative on initial ultrasound and was later taken to the OR. These results yielded a sensitivity of 94.4%, and specificity of 74.4% for FTS on POCUS.[3] A retrospective case series by Hubbard et al. found that ED physicians were able to successfully recognize the finding of fluid around the tendon sheath on POCUS.[4]

Although FTS is largely a clinical diagnosis, as seen in the studies demonstrated above, Kanavel's signs lack specificity, and the presence of all four is not consistent in all cases. Studies have demonstrated the utility of POCUS in the diagnosis of FTS in the ED, with its high sensitivity and the ability for ED physicians to recognize abnormal findings on exam. Flexor tenosynovitis continues to be a clinical diagnosis that can be substantially augmented with bedside ultrasound, yielding a better clinical outcome for patients in the Emergency Department. (Figs. 1–2)

3. Questions and answers with a brief rationale

1) Which of the following is *NOT* considered to be one of the four Kanavel's signs for the presentation of pyogenic flexor tenosynovitis (FTS)?
   a Fusiform swelling
   b Finger held in partially flexed position
   c Pain on passive finger flexion
   d Pain on palpation of the flexor tendon sheath

2) What is a common finding of FTS on POCUS?
   a Anechoic fluid surrounding the flexor tendon
   b Increased flexor tendon thickness
   c Hyperechoic fluid collection surrounding flexor tendon sheath
   d Decreased flexor tendon sheath diameter

Question 1 - Answer: C

All of the above are considered part of Kanavel's cardinal signs for FTS, with the exception of C. The answer option should read pain on passive stretch or extension of the flexor tendon.

Question 2 Answer: A

Past studies have reported FTS findings on POCUS to include: anechoic/hypoechoic fluid surrounding flexor tendon, thickened synovial sheath, and hyperemic tendon sheath on color doppler.

Declaration of Competing Interest

Lilien Socorro has nothing to disclose. Raghav Sahni has nothing to disclose. Karima Sajadi-Ernazarova has nothing to disclose.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.visj.2021.101063.

References

1 Kennedy CD, Huang JI, Hanel DP. In brief: Kanavel's signs and pyogenic flexor tenosynovitis. *Clin Orthopaedics Related Res*. 2016;474(1):280–284. https://doi.org/10.1007/s11999-015-4367-x.
2 Kennedy CD, Lauder AS, Pribaz JR, Kennedy SA. Differentiation between pyogenic flexor tenosynovitis and other finger infections. *Hand*. 2017;12(6):585–590. https://doi.org/10.1177/1558944717692089.
3 Jardin E, Delord M, Aubry S. Usefulness of ultrasound for the diagnosis of pyogenic flexor tenosynovitis: a prospective single-centered study of 57 cases. *Hand Surg Rehab*. 2018;37(2):95–98. https://doi.org/10.1016/j.hansur.2017.12.004.
4 Hubbard D, Joing S, Smith S. Pyogenic flexor tenosynovitis by point-of-care ultrasound in the emergency department. *Clin Practice Cases Emerg Med*. 2018;2(3):235–240. https://doi.org/10.5811/cpcem.2018.3.37415.