The Safety of Percutaneous Trigger Finger Release

J. Mark Schramm · Minhthly Nguyen ·
Montri D. Wongworawat

Received: 15 April 2007 / Accepted: 6 July 2007 / Published online: 14 September 2007
© American Association for Hand Surgery 2007

Abstract This study attempted to determine the safety of percutaneous release of trigger fingers, with particular attention given to border digits and the thumb. We performed percutaneous release of the A1 pulley in six fresh frozen cadaveric hands utilizing established surface landmarks. After freezing all specimens, we performed cross-sections at the A1 pulley, avoiding dissection of soft tissues, which could alter the natural position of the digital nerves. There was no difference in the distance from the needle tract to the neurovascular bundle when comparing between digits, and the closest distance was 2.7 mm. There was no significant difference between the needle tract and the radial and ulnar digital nerves. Based on our findings, percutaneous trigger finger release can safely be performed on all digits, including the thumb, small fingers, and index fingers.

Keywords Trigger finger · Percutaneous · Release · Safety · Neurovascular bundle

Introduction

The treatment of trigger fingers has ranged from nonsteroidal anti-inflammatory drugs (NSAIDs) to surgical release. If identified early, that is less than 6 months after onset of

symptoms, triggering can be effectively treated by NSAIDs and other conservative measures [6]. For more long-standing symptoms, however, surgical release is often indicated. While open release allows full visualization of the A1 pulley, several authors have proposed percutaneous release as a viable alternative, noting successful rates of up to 100% [3]. Some authors caution that the proximity of the neurovascular bundle in the border digits, as well as the thumb, makes the procedure unsafe for these digits [1, 12]. In addition, cadaveric studies to date have used dissection to determine distance to the neurovascular bundle, possibly compromising the accuracy of these measurements [1, 4, 12, 14]. This study, then, was designed to provide a more precise measurement of the distance between the needle tract and the neurovascular bundle by taking frozen cross-sections of each specimen.

Materials and Methods

We released 30 A1 pulleys in six fresh frozen cadaveric hands, including six thumbs. We utilized the landmarks described by Wilhelmi et al. and Ha et al. and the technique described by Eastwood et al. [5, 7, 14]. Specifically, Wilhelmi recommended utilizing the scaphoid tubercle and the middle of the proximal digital crease for the starting point in the small finger and the radial edge of the pisiform and the middle of the proximal digital crease for the starting point in the index finger. Eastwood utilized the distal palmar crease as the starting landmark in the long and ring fingers, and Ha recommended starting at the metacarpal phalangeal crease for the thumb.

We allowed India ink to fill the 18-gauge needle by capillary action before introducing the needle into the skin. After puncturing the skin, the needle was advanced until it

J. M. Schramm · M. D. Wongworawat (✉)
Department of Orthopaedic Surgery,
Loma Linda University Medical Center,
11406 Loma Linda Drive, Suite 218,
Loma Linda, CA, USA
e-mail: wwwortho@yahoo.com

M. Nguyen
School of Medicine, Loma Linda University,
Loma Linda, CA, USA

was located in the tendon, as confirmed by paradoxical movement of the needle with flexion of the digit. The needle was then withdrawn slightly and moved proximally and distally to release the pulley. To assess proximal and distal extent, we followed the guidelines given by Wilhelmi et al. [14]. The pulley was deemed to be released when there was no more grating sound, and the needle moved freely.

The specimens were then frozen to -80°C for over 24 h. We then removed the specimens and took them for cross-sectioning at the level of the A-1 pulley. We measured the distance between the marking from the needle and the radial/ulnar digital nerves. We also visualized if there was any excoriation of the tendon. The amount of excoriation of the tendon was then recorded as a percentage.

After assessing normality, the results were analyzed utilizing analysis of variance (ANOVA). We defined a distance of less than or equal to 2 mm between the needle stick and the digital nerves as posing significant risk to the neurovascular bundle. Furthermore, we assessed radial and ulnar digital nerve distance differences using the paired analysis.

Results

One-sample Kolmogorov–Smirnov analysis rejected normality in the measurements for the index finger. Therefore, log transformation (to normalize the data) was utilized before ANOVA calculations.

All digital nerves were greater than 2 mm from the needle stick (see Table 1). In the index finger from two specimens, the distances from the needle path to the digital nerve were 2.7 and 2.9 mm. In addition, in the small finger of one specimen, the distance from the digital nerve to the needle path was 2.7 mm. There was no significant difference between fingers utilizing ANOVA.

The radial digital nerves were located 5.1 ± 1.4 mm from the needle path. The ulnar digital nerves were located 5.3 ± 1.7 mm from the needle path. There were no statistically significant differences ($p=0.77$ for both the paired t test and the Wilcoxon signed-rank test).

Table 1 Average difference (range) between needle tract and digital nerves.

Location	Radial Digital Nerve (mm)	Ulnar Digital Nerve (mm)
Thumb	4.74 (3.94–5.53)	4.26 (3.66–4.93)
Index finger	4.89 (2.87–5.97)	5.46 (2.71–10.74)
Long finger	5.58 (3.52–7.43)	5.89 (3.93–7.91)
Ring finger	4.90 (3.05–6.96)	5.42 (3.84–7.53)
Small finger	5.59 (2.66–9.11)	5.26 (3.81–7.20)

There were 28 of 30 specimens (93%) that had complete release of the A1 pulley, and the tendon in each was scored. Two index fingers had incomplete releases.

Discussion

Up to 85% of all trigger fingers can be successfully treated with nonsurgical measures, including steroid injections and NSAIDs [13]. For conditions lasting for more than 6 months, nonsurgical management has not been as successful [6]. While open release gives full visualization of both the A1 pulley and the neurovascular structures, attention has been given to the percutaneous release of the A1 pulley as an office procedure. Lorthioir first described a percutaneous release of the A1 pulley in 1958 in his series of 52 patients [9]. He reported good results with no long-term complications. Patel and Moradia and Maneerit et al. have also noted successful results, 96 and 91%, respectively, utilizing a percutaneous technique augmented by cortisone injection [10, 11]. In addition, Dunn and Pess noted a 98% successful release of the A1 pulley in cadaveric specimens utilizing a specially designed push knife [4]. This study is an attempt to clarify the safety of percutaneous release, particularly in relation to the thumb, index, and small fingers.

There are several potential pitfalls with the A1 pulley release. Heithoff et al. noted bowstringing of the tendon when part of the A2 pulley was released along with the A1 pulley [8]. Maneerit et al. and Pope and Wolfe noted stiffness, continued pain, loss of full extension, and need for repeat surgery as complications in their studies [10, 12]. More severe complications, including transaction of the digital nerves, have been reported [2].

We chose to use cross-sections of the A1 pulley from frozen cadaveric specimens, so that we could preserve the anatomical positions of the digital nerves. Previous studies have attempted to identify landmarks to minimize the risks to the digital nerves. Bain et al., in their cadaveric study of 17 thumbs and 66 fingers, found the digital nerves to be within 2 mm of their needle tract in seven thumbs and two small fingers [1]. Pope and Wolfe noted in their cadaveric study of 5 thumbs and 20 fingers that the digital nerve was within 2 mm of the needle site in three thumbs and in all the index fingers [12]. However, these studies utilized dissection to identify the neurovascular bundle, possibly altering the position of the digital nerves and/or the needle tract.

Our study demonstrated that there were no differences between fingers with regard to distance from the needle tract and the digital nerves. In addition, we found the radial digital nerve to be as safe as the ulnar digital nerve in all digits, including the thumb. Utilizing the landmarks defined by Eastwood et al. and Wilhelmi et al., we were able to avoid coming closer than 2.7 mm to any digital nerves [5, 14].

While Bain et al. found the thumb and small fingers and Pope and Wolfe found the thumb and index fingers to be at risk for injury, i.e., less than 2 mm from the needle tract, their use of dissection potentially altered the normal anatomy [1, 12]. Our study demonstrated that all fingers, including border digits and the thumb, can be safely released percutaneously.

In addition, from these axial sections, we were able to precisely identify the percentage of tendon excoriation. While Bain et al. and Dunn and Pess noted that nearly 80% of tendons were excoriated utilizing a percutaneous technique in cadaveric specimens, Pope and Wolfe did not see any complications from tendon scoring in their clinical study [1, 4, 12]. This study confirmed these earlier findings, noting the presence of scoring in all tendons when the A1 pulley was completely released.

Some possible limitations of the study are the lack of clinical correlation and the significance of tendon scoring. Some patients who have had percutaneous A1 pulley release have continued to have various problems, including pain, stiffness, and cellulitis [5, 10]. In addition, Pope and Wolfe found that while 15% of their releases were incomplete, the patients did not have triggering symptoms [12]. While all tendons in our study demonstrated some degree of scoring, the functional significance of the tendon excoriation is not known. In two of our specimens where the release was incomplete, no tendon scoring was noted. However, this is most likely due to judgment in selecting the procedural endpoint (in the clinical situation, the resolution of triggering helps in identifying the endpoint); this has little bearing on the focus of assessing distance from the neurovascular bundles.

This study offers a unique look at the distance from needle stick to digital nerves by utilizing frozen cross-sections at the level of the A-1 pulley. Utilizing established guidelines

for needle placement, we demonstrated that percutaneous release of trigger fingers is safe for all digits, including the thumb and border digits.

References

1. Bain GI, Turnbull J, Charles MN, Roth JH, Richards RS. Percutaneous A1 pulley release: a cadaveric study. *J Hand Surg* 1995;20A:781–784.
2. Carrozzella J, Stern PJ, Von Kuster LC. Transection of radial digital nerve of the thumb during trigger release. *J Hand Surg* 1989;14A:198–200.
3. Cihantimur B, Akin S, Ozcan M. Percutaneous treatment of trigger finger. *Acta Orthop Scand* 1998;69:167–8.
4. Dunn MJ, Pess GM. Percutaneous trigger finger release: a comparison of a new push knife and a 19-gauge needle in a cadaveric model. *J Hand Surg* 1999;24A:860–5.
5. Eastwood DM, Gupta KJ, Johnson DP. Percutaneous release of the trigger finger: an office procedure. *J Hand Surg* 1992;17A:114–7.
6. Freiburg A, Mulholland RS, Levine R. Nonoperative treatment of trigger fingers and thumbs. *J Hand Surg* 1989;14A:553–8.
7. Ha KI, Park MJ, Ha CW. Percutaneous release of trigger digits. *J Bone Joint Surg* 2001;83B:75–7.
8. Heithoff SJ, Millender LH, Helman J. Bowstringing as a complication of trigger finger release. *J Hand Surg* 1988;13A:567–70.
9. Lorthioir J. Surgical treatment of trigger-finger by a subcutaneous method. *J Bone Joint Surg* 1958;40A:793–5.
10. Maneerit J, Sriworakun C, Budhraj N, Nagavajara P. Trigger thumb: results of a prospective randomized study of percutaneous release with steroid injection versus steroid injection alone. *J Hand Surg* 2003;28B:586–9.
11. Patel MR, Moradia VJ. Percutaneous release of trigger digit with and without cortisone injection. *J Hand Surg* 1997;22A:150–5.
12. Pope DF, Wolfe SW. Safety and efficacy of percutaneous trigger finger release. *J Hand Surg* 1995;20A:280–3.
13. Saldana MJ. Trigger digits: diagnosis and treatment. *J Am Acad Ortho Surg* 2001;9:246–52.
14. Wilhelmi BJ, Mowlavi A, Neumeister MW, Bueno R, Lee WP. Safe treatment of trigger finger with longitudinal and transverse landmarks: an anatomic study of the border fingers for percutaneous release. *Plast Reconstr Surg* 2003;112:993–9.