

Swan Neck Deformity: An Unusual Complication Following Trigger Finger Release

Alexander K Hahn¹, John J Corvi¹, Jon E Hammarstedt², Bradley Palmer²

Learning Point of the Article:

Recognition of an uncommon deformity following a routine procedure.

Abstract

Introduction: Swan neck deformity (SND) is a common pathologic finding often observed in patients with severe rheumatoid arthritis. However, it has also been seen in injuries such as mallet finger, flexor digitorum superficialis laceration, and intrinsic contracture. Open surgical release of a trigger finger most commonly involves the release of the A1 pulley to relieve a mechanical impingement. Bowstringing is a rare trigger finger release complication caused by excessive pulley resection, usually due to resection of the A2 pulley. As a result of this complication, the flexor tendons move away from their center of rotation, gaining an increased mechanical advantage over the extensors and can ultimately result in a SND.

Case Report: We present a case report of a 61-year-old patient that presented to our clinic with a SND of the 4th digit following a trigger finger release.

Conclusion: Our case demonstrated that a previous trigger finger release with disruption of the A2 pulley can cause a cascade of events that can result in SND.

Keywords: Swan neck, trigger finger, deformity, bowstringing.

Introduction

Open surgical release of a trigger finger typically involves the release of the A1 pulley to relieve a mechanical impingement, most commonly at the 2nd and 4th digit [1]. Complications of trigger finger release can include incision into the A2 or A4 pulley (Fig. 1), which can result in bowstringing of the flexor tendon [2, 3]. Other common complications include wound dehiscence, scar tenderness, and stiffness. To date, there have been no reported cases in the literature documenting SND as a complication after trigger finger release. We present a case report of a patient that presented to our clinic with a SND of the 4th digit after trigger finger release at an outside facility.

SND is a common pathologic finding often seen with severe rheumatoid arthritis. However, it has also been seen in injuries such as mallet finger, flexor digitorum superficialis laceration, and intrinsic contracture [4]. SND is characterized by proximal interphalangeal (PIP) joint hyperextension, along with flexion of the distal interphalangeal (DIP) joint [4]. A primary lesion of SND is a lax volar plate which caused hyperextension at the PIP. Secondary lesions of SND are caused by an imbalance of muscle forces and hyperextension of the PIP joint [4, 5]. Three sets of muscles and tendons provide the normal anatomic equilibrium and prevent SND occurrence. These include the extrinsic extensor group, the extrinsic flexor group, and intrinsic

Access this article online

Website:
www.jocr.co.in

DOI:
<https://doi.org/10.13107/jocr.2023.v13.i05.3630>

Author's Photo Gallery



Dr. Alexander K Hahn



Dr. John J Corvi



Dr. Jon E Hammarstedt



Dr. Bradley Palmer

¹Drexel University College of Medicine, Philadelphia, Pennsylvania, United States,

²Department of Orthopaedic Surgery, Allegheny General Hospital, Pittsburgh, Pennsylvania, United States.

Address of Correspondence:

Dr. Alexander K Hahn,
Drexel University College of Medicine, MS, 2900 W Queen Ln, Philadelphia, Pennsylvania 19128, United States.
E-mail: ah3389@drexel.edu

Submitted: 08/02/2023; Review: 12/03/2023; Accepted: April 2023; Published: May 2023

DOI: <https://doi.org/10.13107/jocr.2023.v13.i05.3630>

This is an open access journal, and articles are distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 License <https://creativecommons.org/licenses/by-nc-sa/4.0/>, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms



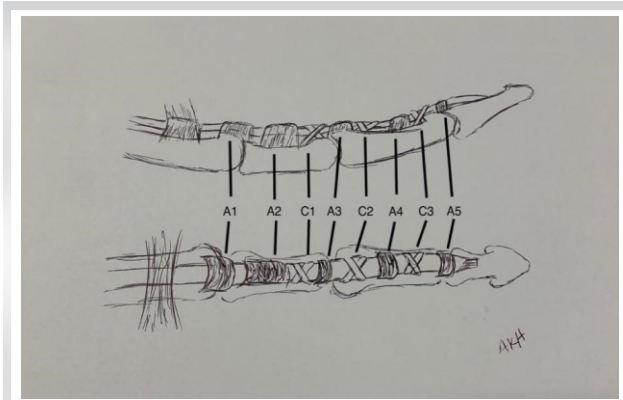


Figure 1: Flexor tendon pulley system of the digits.



Figure 2: (a) Oblique view of swan neck deformity of the right 4th digit; (b) volar view of swan neck deformity of the right 4th digit; and (c) lateral view of swan neck deformity of the right 4th digit.

muscles. SND is thought to result from the extensors' force overcoming the flexor tendons' force, which impairs the balance between these two muscle groups. As a result, it can lead to restrictions in range of motion and can restrict a patient from making a fist [4, 5, 6].

The previous literature has described a lack of full extension at the MCP due to bowstringing after trigger finger release [7]. Bowstringing is a rare trigger finger release complication caused by excessive proximal pulley resection, usually due to resection of the A2 pulley. As a result, the flexor tendon moves away from its center of rotation, gaining an increased mechanical advantage over the extensors, thereby limiting extension [7]. This causes the finger to be slightly flexed due to the untethered tendons. As presented in our case, we suspect that this SND occurred due to initial bowstringing from a resected A2 pulley during our patient's trigger finger release. This mechanical shift changed the force applied to the finger joints by the tendons and ultimately resulted in a SND.

Case Report

We present a case of SND of the right fourth finger in a 61-year-old female who had undergone an A1 pulley release at an outside facility and presented for evaluation of a right 4th digit swan-neck deformity (Fig. 2a-c). The patient had a right-hand carpal tunnel release and a 4th and 5th trigger finger release done 9 months prior at an outside hospital. She was approximately 2 months into her post-operative physical therapy when she first noticed swan necking off her 4th digit. She presented to her original surgeon at the outside medical center, who recommended continued observation. She subsequently completed her physical therapy and was given a metal double-ring splint, which she wore for approximately 2 weeks before discarding. She presented to our facility 9 months after the initial surgery as a referral from her primary care

physician. She denied any numbness, tingling, or weakness at that time. Her medical history included a history of deep vein thrombosis. Her past surgical history included bilateral carpal tunnel release, open reduction internal fixation of a left distal radius fracture, as well as radical tenosynovectomy and first compartment release of the right first dorsal compartment. The patient stated that she drank alcohol occasionally but denied any history of smoking or drug use. Physical examination revealed a right-hand swan-neck deformity of the 4th digit with



Figure 3: T1-weighted MRI lateral view of the right 4th digit demonstrating bowstringing of the flexor tendon and swan neck deformity.

5° of flexion contracture of the MCP joint, 10° extension at the PIP, and 5–10° of flexion contracture at the DIP joint. These findings were all passively correctable, and pressure of the A2 pulley region also passively corrected the deformity. In addition, the patient was able to flex and extend the digit actively. However, the patient could not make a full fist and had a tip-to-palm distance of approximately 1 cm of the ring finger.

Due to the previous A1 pulley release, our suspicion was raised for possible extension into the A2 pulley. Therefore, an MRI was ordered to evaluate further. The MRI results revealed that the A2 pulley had been disrupted, with bowstringing of the flexor tendons and an increase in the distance between the flexor tendons and the proximal phalanx and metacarpal. The resulting flexion of the MCP resulted in a stepwise progression to SND of the right 4th finger with no acute fracture or dislocation (Fig. 3). The 4th finger flexor and extensor tendons were intact; however, the flexor tendons were slightly separated from the proximal phalanx and metacarpophalangeal joint. This interesting finding appeared to be bowstringing at the proximal phalanx.

Results

Our case report demonstrates a 61-year-old female who presented with a passively correctable swan-neck deformity of the right ring finger in the setting of the previous A1 pulley release of the digit. MRI demonstrated disruption of the A2 pulley, bowstringing of the flexor tendons at the metacarpal and proximal phalanx level resulting in MCP flexion and a SND. In addition, a physical examination revealed that passive pressure at the level of the A2 pulley corrected the deformity. Considering these findings, the patient was trialed on an A2 pulley ring splint, continued motion, and therapy to work on flexion. The patient followed up in 4 weeks with improvement in her deformity. In addition, she was not tolerating the ring splint; therefore, a new one was fabricated, and she will follow up in another 4–6 weeks.

Discussion

Trigger finger release surgery is a common procedure performed in hand surgery. It is a release of the A1 pulley, which is a fibrous band at the level of the MCP [2]. These pulleys tether the flexor tendons to the phalanx bones to provide structural support. In addition, the pulleys allow for proper balance between the flexor and extensor tendons on each finger joint [8]. Trigger finger in the adult patient is a common cause of hand pain and can result in a permanent flexion of the digit due to a disruption in the usual smooth gliding of the flexor tendon past these pulleys. Trigger finger is caused by fibrocartilaginous metaplasia at the level of the A1 pulley, which impedes the

movement of the flexor tendons passing through the pulley [1]. Therefore, when performing a trigger finger release, care must be taken not to extend into the A2 pulley to prevent bowstringing [2, 3, 7]. Bowstringing presents as limited extension of the affected digit, in addition to passive flexion of the digit, due to increased mechanical advantage of the flexor tendons. In addition, to cosmetic and functional concerns of the digit, bowstringing may also present with pain [9].

Swan neck deformity (SND) is more commonly seen in patients with debilitating joint diseases such as rheumatoid arthritis. The main mechanism behind SND is hyperextension of the proximal interphalangeal (PIP) joint, which can occur due to various intrinsic or extrinsic factors. In primary SND, hyperextension can be caused by trauma, inflammation, or other factors that lead to volar plate laxity. The volar plate is a fibrocartilaginous structure that normally provides stability to the PIP joint [4, 6]. In secondary SND, imbalanced forces between the flexors and extensors at the PIP joint result in hyperextension of the joint. This imbalance can be due to various causes such as mallet injuries, FDS tendon rupture, intrinsic contracture, or MCP joint volar subluxation [6]. In normal swan neck occurrences, the addition of flexion at the MCP is variable, with most presenting with no MCP flexion. Our case is the first known to describe an incidence of SND following a 4th digit trigger finger release at the A1 pulley. A proposed mechanism of how this occurred is a possible transection of the A2 pulley during our patient's previous A1 pulley release at an outside hospital. This resulted in bowstringing of the finger, for which she received a splint. She then presented to our clinic with a SND, for which we ordered an MRI. The MRI showed bowstringing at the A2 pulley of the right ring finger. The prolonged bowstringing she experienced caused a flexion contracture at the MCP. This flexion contracture then caused a compensatory hyperextension at the PIP. The combined flexion at the MCP and hyperextension at the PIP caused a flexion at the DIP and resulted in the SND [10].

The cascade of events that occurred in our patient has not been described in the literature that an A2 pulley release during trigger finger surgery can cause a SND. However, the order of events described earlier in this report demonstrates how the mechanics can result in SND. Identifying the underlying cause of SND is crucial for determining the appropriate treatment plan. Therefore, when patients present with SND it is essential to do history and physical and include the previous trigger finger releases in the differential for possible causes.

Conclusion

SND is mainly caused by debilitating arthritis such as

rheumatoid arthritis, volar plate laxity, or a disruption of the equilibrium of the flexors and extensors that act at the level of the PIP. Our case demonstrated that a previous trigger finger release with disruption of the A2 pulley can cause a cascade of events that can result in SND. Therefore, completing a good history and physical exam and being cautious of patients developing a SND post-trigger finger is critical.

Clinical Message

SND can be a complication following a trigger finger release. Due to the given the frequency of this procedure, this case report serves to increase the surveillance of such deformities in patients.

Declaration of patient consent: The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given the consent for his/ her images and other clinical information to be reported in the journal. The patient understands that his/ her names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

Conflict of interest: Nil **Source of support:** None

References

- Makkouk AH, Oetgen ME, Swigart CR, Dodds SD. Trigger finger: Etiology, evaluation, and treatment. *Curr Rev Musculoskelet Med* 2008;1:92-6.
- Finsen V, Hagen S. Surgery for trigger finger. *Hand Surg* 2003;8:201-3.
- Turowski GA, Zdankiewicz PD, Thomson JG. The results of surgical treatment of trigger finger. *J Hand Surg Am* 1997;22:145-9.
- Dreyfus JN, Schnitzer TJ. Pathogenesis and differential diagnosis of the swan-neck deformity. *Semin Arthritis Rheum* 1983;13:200-11.
- Harrison SH. Swan's neck deformity of the fingers. *Br J Plast Surg* 1965;18:79-87.
- De Salamanca FE. Swan-neck deformity: Mechanism and surgical treatment. *Hand* 1976;8:215-21.
- Heithoff SJ, Millender LH, Helman J. Bowstringing as a complication of trigger finger release. *J Hand Surg Am* 1988;13:567-70.
- Alanazi G, Langschmidt J, Rust P. Investigation into the functional anatomy of the flexor tendon pulley system of the hand. *Int J Surg* 2017;47:S68.
- Leeflang S, Coert JH. The role of proximal pulleys in preventing tendon bowstringing: Pulley rupture and tendon bowstringing. *J Plast Reconstr Aesthet Surg* 2014;67:822-7.
- McKeon KE, Lee DH. Posttraumatic boutonniere and swan neck deformities. *J Am Acad Orthop Surg* 2015;23:623-32.

Conflict of Interest: Nil
Source of Support: Nil

Consent: The authors confirm that informed consent was obtained from the patient for publication of this case report

How to Cite this Article

Hahn AK, Corvi JJ, Hammarstedt JE, Palmer B. Swan Neck Deformity: An Unusual Complication Following Trigger Finger Release. *Journal of Orthopaedic Case Reports* 2023 May;13(5):20-23.

