Review article
https://doi.org/10.18019/1028-4427-2024-30-6-906-915

Stenosing tenosynovitis

G.P. Kotelnikov, A.S. Pankratov, A.N. Nikolaenko, A.P. Borisov✉, A.S. Klyuchnikov, V.V. Piskun, N.A. Knyazev, D.V. Lukshin

Samara State Medical University, Samara, Russian Federation

Corresponding author: Alexander P. Borisov, dr_borisov71@mail.ru

Abstract

Introduction Stenosing tenosynovitis or trigger finger is a common cause of hand disability. With the 174-year history of the condition, treatment strategy and new minimally invasive surgical approaches are essential for researchers around the world.

The **objective** was to determine the current treatment options of the stenosing tenosynovitis using the Russian and foreign literature.

Material and methods The original literature search was conducted on key resources including Scientific Electronic Library (www.elibrary.ru), the National Library of Medicine (www.pubmed.org) and MedLine. Seventy contributions were identified published for the last 10 years.

Results and discussion Treatment of stenosing ligamentitis can be initiated depending on the stage of the disease, the duration, relapses or complications, comorbidities. Conservative orthopaedic treatment includes joint immobilization and/or corticosteroid injections. Although percutaneous dissection of the annular ligament is minimally invasive and has advantages of less tissue trauma, shorter recovery time, absence of painful scars open ligamentotomy can help to minimize complications and relapses of the disease.

Conclusion Conservative treatment of trigger finger is effective in 47 to 93 % and surgical procedures are practical in 94–99 %. Surgical treatment can be employed with failure of conservative treatment and has been shown to be effective and with a low rate of complications and relapses.

Keywords: stenosing tenosynovitis, Nott's disease, annular ligament

For citation: Kotelnikov GP, Pankratov AS, Nikolaenko AN, Borisov AP, Klyuchnikov AS, Piskun VV, Knyazev NA, Lukshin DV. Stenosing tenosynovitis. *Genij Ortopedii*. 2024;30(6):906-915. doi: 10.18019/1028-4427-2024-30-6-906-915

INTRODUCTION

Stenosing ligamentitis (SL) (“snapping finger”, Knott’s disease) is a common disease of the fingers, which is caused by injury to the tendon-ligamentous apparatus leading to impaired motor function [1]. Snapping finger can be described as the sensation or sound of crackling within the affected finger during movement [2]. The disease was first described by the French surgeon Alfred Nott in 1850 [2, 3] and is characterized by a typical “snapping” of the finger or fingers at maximum flexion, limited movements, pain at the base of the fingers when pressing, and morning stiffness of movements in the hand [4]. SL can lead to an impaired hand function and grip strength. As the disease progresses, the patient's quality of life may change [5, 6].

The **objective** was to determine the current treatment options of the stenosing tenosynovitis using the Russian and foreign literature.

MATERIAL AND METHODS

The original literature search was conducted on key resources including Scientific Electronic Library (www.elibrary.ru), the National Library of Medicine (www.pubmed.org) and MedLine using keywords in Russian and in English: stenosing ligamentitis, incidence of pathology, conservative therapy, operative treatment, long-term results, complications.

Inclusion criteria:

— full-text scientific articles reporting fundamental information about stenosing ligamentitis (etiology, pathomorphology, classification);

— full-text scientific publications containing modern information on treatment methods (conservative and surgical) of SL;

— full-text scientific articles reporting the results of multicenter cohort studies, specific clinical examples of the treatment of SL, complications and long-term results of therapy.

Exclusion criteria included abstracts of scientific conferences, articles without a full-text version, publications that did not fully meet the inclusion criteria.

Seventy contributions including 59 foreign and 11 Russian publications brought out for the last 10 years were identified.

RESULTS

Etiology of the disease Several causes of trigger finger have been described in the literature, although the exact etiology has not been identified. Possible causes include repetitive, monotonous finger movements and local trauma [7]. There are associations between trigger finger and an occupation that requires prolonged grasping and bending of the arm, such as the use of scissors or hand tools [7–10]. Knott's disease can be caused by deforming arthrosis of the finger joints, tenosynovitis of the flexor tendons and other inflammatory diseases of the hand [11]. SL can develop with systemic diseases: diabetes mellitus, gout or rheumatoid arthritis [12]. The condition can be caused by monotonous hand movements (typing on a keyboard, driving a car); regular, intense stress on the fingers; inflammatory process localized in the hand; injuries and damages; hereditary predisposition; atherosclerosis; thyroid diseases; constant compression of the ligaments; physical labor associated with a load on the hands [13, 14]. Although the natural history of SL is not fully understood, McKee et al. reported 52 % of patients symptom free at 8 months in a cohort of 348 cases without any treatment [15]. According to statistics, SL occurs in 2–3 % of the population, being common in females aged 40 and older [16]. The condition often occurs in children [17]. SL primarily affects the ring (44 %) and the thumb (26 %) fingers; middle finger is involved in 20 %; little finger, in 7 %; index finger, in 3 % of cases [18].

Pathomorphology In SL, inflammation and hypertrophy of the annular ligament result in gradual restriction of the flexor excursion [19, 20]. The biomechanical basis for the effective functioning of the hand tendons is provided by a system consisting of annular and cruciform pulleys in each finger, which serve to maximize the force produced by the flexor tendon and the efficiency of movement (Fig. 1) [19].

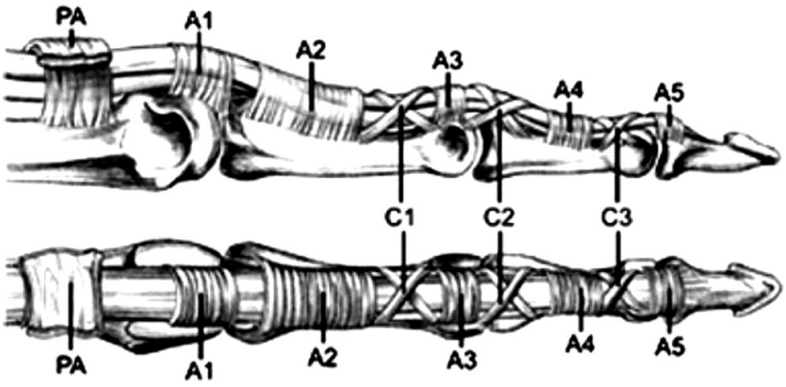

Fig. 1 Diagram of the osteofibrous canal showing (A) ring-shaped pulleys (A1–A5); (C) cruciform pulleys (C1–C3); (PA) palmar aponeurosis

The first annular trochlea (A1) on the metacarpal head is the commonly affected trochlea in LS, and cases have been reported in the second and third annular trochleas (A2 and A3), as well as in the palmar aponeurosis [19]. Due to the location, the A1 pulley is exposed to the highest forces and pressure gradients during normal and power grips. Knott's disease is characterized by thickening of the tendon sheath and A1 ligament, nodules on the tendon and narrowed lumen leading to disruption of the connection between the tendon and its sheath at the level of the metacarpal head.

Classification There are four degrees of severity of SL as graded by Green [11] (Table 1)

Table 1

SL graded by D.P. Green

Stage		Clinical manifestations
I (initial)		Patient-reported pain, pinching, tenderness over A1 pulley
II (active)		Fixation during finger extension on physical examination
III (passive)	III A	Correcting pinched fingers using passive finger extension
	III B	Loss of active flexion
IV (contracture)		Pinching with fixed flexion contracture of the proximal interphalangeal joint

Patients may experience painless clicking or stiffness of the affected finger in the early stages of the disease (stage I) [21]. As the disease progresses, painful pinching or locking of the finger occurs and may require passive extension of the unaffected hand (stage II). On examination, the joints of the affected finger are not swollen or erythematous, despite complaints of pain. With snap finger, a thick and painful A1 pulley can be palpated distal to the transverse palmar crease, which distinguishes it from other hand diseases (rheumatoid arthritis, gout, etc.). The presence of the “painful nodule” and absence of previous trauma confirm the suspicion of stage III SL. Patients with advanced stage of the disease (grade IV) deliberately try to avoid active use of the finger, which leads to the development of a fixed contracture of the proximal interphalangeal joint [21].

Treatment of stenosing ligamentitis The most effective treatment for Knott’s disease is still a matter of debate [23, 24, 25, 26]. A variety of techniques can be used in medical practice depending on the grade of the condition and conservative therapy is applied first [27].

Conservative treatment SL can be primarily treated with non-steroidal anti-inflammatory drugs for pain relief, immobilization of the metacarpophalangeal joint, corticosteroid injections, physical therapy and massage [25, 28, 29].

Immobilization of the metacarpophalangeal joint Splinting is aimed at preventing friction caused by the flexor tendon moving through the affected A1 pulley until the inflammation is controlled [29]. Splinting is a suitable treatment option for patients who refuse corticosteroid injections [30]. The method is less effective in patients with severe triggers or long duration of symptoms. In this case, a variety of tires can be used including custom-made ring tires, tires made of thermoplastic, metal, or ready-made tires (Fig. 2) [29].

Fig. 2 Options for splinting fingers [29]

The finger should be splinted for 6 weeks or longer if inflammation persists. Lunsford et al. recommended immobilization of the joint for 6–10 weeks, with treatment success rates ranging between 47 % and 93 % [27]. As pain and inflammation decrease, the patient can self-splint at night and gradually resume normal hand activities [29]. Some patients may require up to 6 months. Based on the European HANDGUIDE study, it was concluded that there is no optimal orthopedic regimen, and the duration of treatment should be individualized depending on the duration of symptoms, severity and preference of each patient [22].

Corticosteroid injections Treatment of trigger finger by steroid injection was described as early as 1953 by Howard [30]. Some authors reported high effectiveness (up to 93 %) in the initial stages of SL in the absence of concomitant endocrinological diseases, with the disease lasting less than 6 months and one affected finger [31, 32, 33, 34]. Many researchers emphasize that the Knott's disease lasting more than 6 months is associated with chondroid metaplasia of the A1 ligament and conservative therapy cannot be effective [32, 33]. The available literature shows the effectiveness of the therapy ranging between 49 % and 93 % after the first injection [32, 34]. Castellanos et al. reported the long-term effectiveness of corticosteroid therapy at 69 % (follow-up duration was 8 years, 71 patients were included in the study) [35].

The injection is traditionally given directly into the sheath [36]. There are reports of effective extrasynovial injection reducing the risk of tendon injury (Fig. 3) [29].

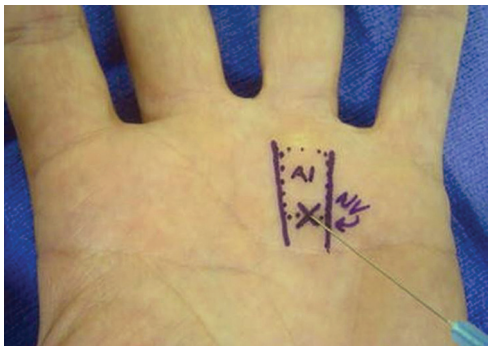

Fig. 3 Steroids injected in the A1 pulley; NV of the neurovascular bundle

Polat et al. reported effective corticosteroid therapy in 43 patients; injections were ultrasound guided [37]. The authors reported the high effectiveness of glucocorticosteroid injections combined with joint immobilization. Shultz et al. reported a prospective study of 99 trigger finger cases and patients with multiple involved fingers were 5.8 times more likely to have no resolution of symptoms compared with those with a single affected finger [38].

Physical therapy and massage include:

— ultrasound effect on the inflamed tendon and vagina to reduce inflammation and scar adhesions;

— friction massage of tendons to address adhesions, nodules and swelling;

— passive range of motion in the metacarpal and interphalangeal joints;

— passive internal and external stretching of the hand and wrist [29].

Ferrara et al. recommended the use of external shock wave therapy (ESWT) with a frequency of 15 Hz and a flow density of 0.1 to 3 bar [39]. ESWT was an effective and safe therapy for the conservative treatment of SL: it seemed to reduce pain and trigger severity and to improve functional level and quality of life.it significantly relieves pain, improves the functional level and quality of life.

Surgical treatment With ineffective conservative treatment and blockades, late stages of the disease, surgical intervention with dissection of the A1 annular ligament at the base of the finger can be recommended [40–43].

The Knott's disease can be surgically treated with:

1) open procedure using a small skin incision, suturing and subsequent dressings (under local anesthesia, the orthopedic surgeon cuts the A1 annular ligament, which limits the movement of the tendon) [44, 45];
2) a minimally invasive method using small skin punctures with a needle, without sutures or bandages [46, 47].

Open surgery is the "gold standard" for the treatment of SL as it allows for a more thorough examination of the surgical site, is highly effective (effectiveness approaches 100 %) and has a low complication rate [48]. There are many techniques for open surgical treatment of SL [49, 50, 51].

Kosiyatrakul and Luenam reported the following surgical technique [52]. The patient's hand is placed in the supinator position, the thumb is positioned in the radial abduction. The incision line is planned before local anesthesia is injected. The radial groove is located between the A1 pulley and the radial sesamoid bone. The flexor pollicis longus and proximal phalanx of the thumb are identified by palpation and marked with a marker (Fig. 4). The skin is infiltrated with 3–4 ml of 1 % lidocaine without epinephrine and a tourniquet is placed around the shoulder. A skin incision is made along the intended line. With incision in the deep dermal layer of the skin, gentle blunt dissection is used to identify the radial digital nerve in the subcutaneous layer. The A1 ligament is cut with a scalpel along its radial edge (Fig. 5). The skin is sutured with 4–0 nylon stitches.

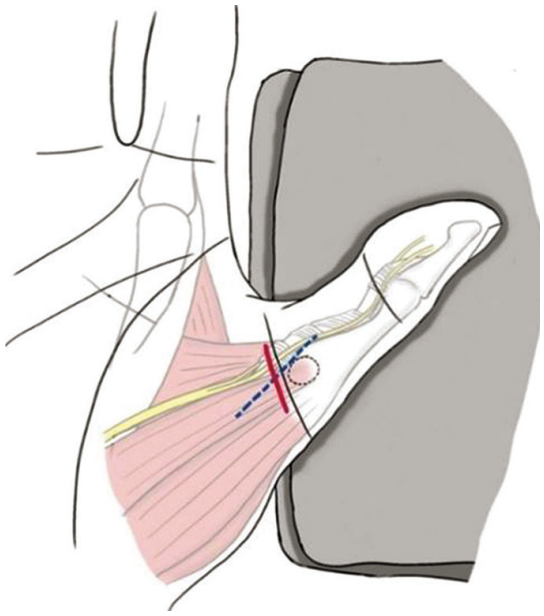

Fig. 4 Illustration of the skin incision (red line), radial sulcus (dashed blue line), and radial sesamoid (dashed black line) [52]

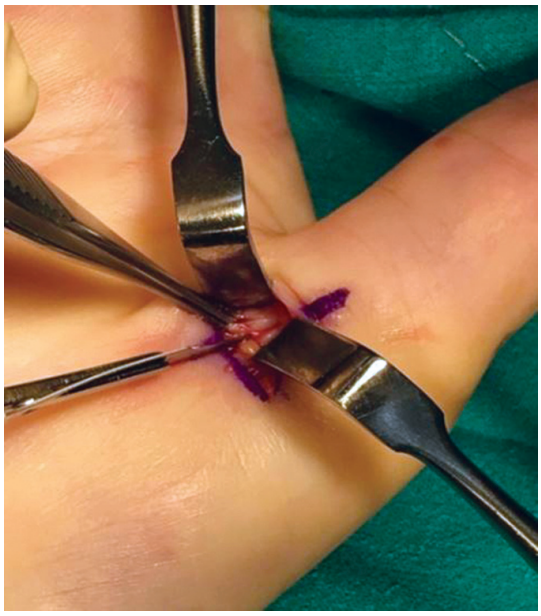

Fig. 5 Dissection of the A1 pulley of the thumb along the radial edge [52]

Open intervention on the A1 pulley can be associated with minor and major complications [53, 54]. Minor complications (pain at the scar, at the A1 pulley and a slight lag in extension) do not require surgical treatment. Major complications cause significant hand dysfunction including persistent or recurrent triggering, flexor tendon strain, and digital nerve injury [55].

The radial digital nerve is the most vulnerable structure during release of the A1 pulley of the thumb [56]. The nerve can be damaged if the skin incision is too deep. Anatomical studies have shown that the nerve is located at a depth of 1.29–2.19 mm in the skin. Once the deepest dermal layer of skin has been incised, careful blunt dissection should be performed to identify and protect the radial digital nerve [56].

Koopman et al. performed a retrospective study of 3428 patients who underwent open surgery for trigger finger and reported that 16 % of patients experienced complications and 2 % required surgical treatment [57].

Federer et al. reported a significantly higher complication rate (26.3 % vs. 13.0 %) in patients with diabetes compared with patients without diabetes, which was associated with a significantly higher rate of limited postoperative range of motion in patients with endocrinological pathology [58].

Percutaneous annular ligament intervention is widely covered in the literature, with success rates approaching 95 % [59, 60]. Percutaneous release of the A1 pulley was first performed in 1958 by Lorthioir [61]. Eastwood et al. called it an outpatient procedure back in 1992, showing 94 % success rate [62]. With this intervention, the metacarpophalangeal joint is hyperextended with the palm facing upward, thereby stretching the A1 pulley and displacing the neurovascular structures dorsally. After injection of lidocaine to relieve pain, the needle is inserted through the skin into the A1 pulley. It is then moved to cut the pulley proximal and distal to the injection site [60].

Zhigalo et al. developed a new minimally invasive method for subcutaneous dissection of the A1 ligament using special small-diameter needles (0.6–1.2 mm) [63, 64]. The technique was applied for 215 patients, excellent to good results were obtained in most cases (70 % and 20.3 %, respectively); fair outcomes were seen in 7.5 % and poor results with recurrence were observed in 2.2 % of cases [63].

Chinese researchers Pan et al. reported the effectiveness of ultrasound-guided percutaneous release of A1 pulley by using a needle knife in 21 patients [65], obtaining an effect with a single intervention.

Xie et al. randomized 76 patients to open or percutaneous surgery and found no difference in finger range of motion or symptom recurrence [60]. However, some authors reported an increased risk of incomplete release, scarring, nerve damage, and recurrence [66]. Aksoy and Sir suggested that percutaneous decompression is an intervention performed blindly, and can be associated with a damage to the digital nerve (hypoesthesia), recurrence, painful scar and tendon rupture [66].

Despite the high effectiveness of surgical treatment of SL, which has been identified by many authors, there are publications reporting persistent pain syndrome in long-term studies of patients. Thus, Langer et al. reported moderate or severe pain in 37 % of cases at one year of the intervention [67].

However, not only surgical intervention is fraught with consequences. Oh et al. reported an unusual case of flexor digitorum profundus rupture after a single corticosteroid injection in a 57-year-old male golfer [68]. There were other reports of similar complications [69, 70].

DISCUSSION

Stenosing ligamentitis is a common cause of hand disability and is often encountered in practice of experts; however, the choice of the optimal treatment is still a matter of debate. Conservative

treatment is indicated for grades I–III of the disease. Corticosteroid injections can reduce the thickness of the A1 pulley and are considered first-line therapy. However, many authors report low effectiveness of hormonal therapy (43–57 %) [16, 19, 27, 28, 30, 34, 38]. Corticosteroid injections should be offered to all patients before surgery, regardless of comorbidities [12, 41]. Individual orthopedic splints can reduce pain, but require long-term immobilization of the joint. Success rates with orthosis range from 50 % to 93 %, with less than 50 % success rates for the thumb involvement [22, 29]. However, literature review including randomized cohort studies shows a lack of convincing evidence of high-level effectiveness [4, 14, 15].

Most authors report the preferred surgical treatment [6, 26, 40, 41, 43, 60, 66]. Surgical treatment of SL should not be performed within three months after corticosteroid injection [19, 27]. According to many researchers, effectiveness rates are comparable with open treatment and percutaneous release [24, 27, 42, 52, 57, 60]. The percutaneous release is considered a less invasive procedure, but there is a risk of iatrogenic damage to the radial digital nerve [36, 46, 61, 62, 63]. Although the open procedure is the preferred option according to many authors, it is associated with a risk of infection at a short term and the formation of scar tissue, however, it has higher success rates reported in retrospective long-term studies [1, 45, 52, 53]. In addition to that, the method allows surgeons to identify a rare case of atraumatic rupture of the deep digital flexor tendon [27].

We believe that treatment for Knott's disease should be tailored. Each treatment option has its own benefits, risks, and limitations. These issues should be discussed with the patient before making an informed decision. We agree that treatment should begin with conservative methods for grades I–III SL. Surgical methods have higher success rates, but should be used after failed conservative therapy, for recurrent condition and stage IV of the disease (Fig. 6).

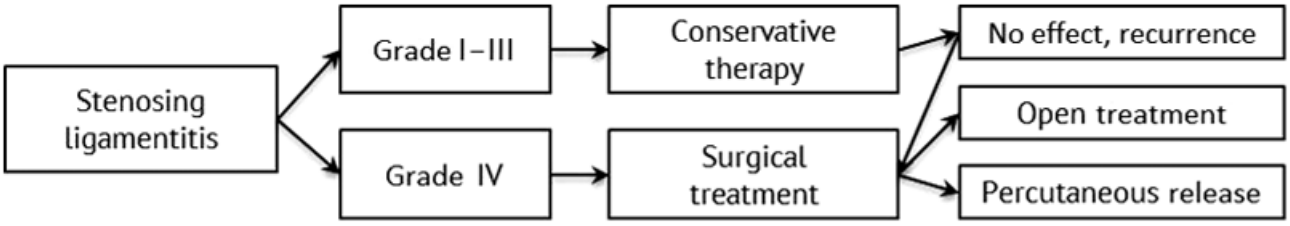

Fig. 6 Treatment algorithm for stenosing ligamentitis

Further study of the etiology, pathogenesis and pathomorphology of LS will help develop new methods of therapy. New minimally invasive methods are essential for treatment of Knott's disease.

CONCLUSION

Analysis of current literature has shown that most cases of trigger finger can be effectively managed without surgery with conservative measures with corticosteroid injections and/or orthopedic immobilization of the metacarpophalangeal or proximal interphalangeal joint.

Open surgery or percutaneous release are indicated for relapse after or failed conservative treatment or initially in cases lasting > 6 months. Open trigger finger release is an elective surgical procedure that serves as the gold standard treatment for trigger digits and is associated with minimal complications.

Conflict of interest statement *None of the authors has any potential conflict of interest.*

Funding *The project was carried out in accordance with the scientific research plan of the Samara State Medical University. The authors received no financial support for the research, authorship, and/or publication of this article.*

REFERENCES

1. Chulovskaya IG, Egiazaryan KA, Badriev DA, et al. Stenosing ligamentitis of the annular ligaments in hand fingers (Nott's disease): a modern approach to diagnosis and treatment. *Surgical practice*. 2023;8(3):73–86. (in Russ.) doi: 10.38181/2223-2427-2023-3-6
2. Chulovskaya IG, Egiazaryan KA, Lyadova MV. Diseases of the hand in the elderly and senile age. In: Tkacheva ON, Frolova EV, Yakhno NN. eds. *Geriatrics. National guidelines*. Moscow: GEOTAR-Media Publ.; 2018;486-500. (in Russ.)
3. Clapham PJ, Chung KC. A historical perspective of the Notta's node in trigger fingers. *J Hand Surg Am*. 2009;34(8):1518-1522. doi: 10.1016/j.jhsa.2009.04.041
4. Saldana MJ. Trigger digits: diagnosis and treatment. *J Am Acad Orthop Surg*. 2001;9(4):246-252. doi: 10.5435/00124635-200107000-00004
5. Lin YN, Chiu CC, Huang SW, et al. Association Between Manual Loading and Newly Developed Carpal Tunnel Syndrome in Subjects With Physical Disabilities: A Follow-Up Study. *Arch Phys Med Rehabil*. 2017;98(10):2002-2008. doi: 10.1016/j.apmr.2017.02.008
6. Hammert WC, Boyer MI, Bozentka DJ, Calfee RP. *ASSH Manual of Hand Surgery*. Lippincott Williams & Wilkins; 2012:656.
7. Volkova AM. *Surgery of the hand*. Vol. 1. Ekaterinburg: Middle Ural Book Publishing House; 1991:123-124. (In Russ.)
8. Karateev AE, Karateev DE, Orlova ES, Ermakova YA. Minor rheumatology: Nonsystemic rheumatic disease of juxta-articular soft tissues of the upper extremity. Part 1. *Modern Rheumatology Journal*. 2015;9(2):4-15. (In Russ.) doi: 10.14412/1996-7012-2015-2-4-15
9. Sampson SP, Badalamente MA, Hurst LC, Seidman J. Pathobiology of the human A1 pulley in trigger finger. *J Hand Surg Am*. 1991;16(4):714-21. doi: 10.1016/0363-5023(91)90200-u
10. Gorsche R, Wiley JP, Renger R, et al. Prevalence and incidence of stenosing flexor tenosynovitis (trigger finger) in a meat-packing plant. *J Occup Environ Med*. 1998;40(6):556-560. doi: 10.1097/00043764-199806000-00008
11. Wolfe SW. Tendinopathy. In: Wolfe SW, Hotchkiss RN, Pederson WC, Kozin SH, Cohen MS, eds. *Green's Operative Hand Surgery*. 7th ed. Philadelphia: Elsevier; 2017:1903-1925.
12. Kuczmarski AS, Harris AP, Gil JA, Weiss AC. Management of Diabetic Trigger Finger. *J Hand Surg Am*. 2019;44(2):150-153. doi: 10.1016/j.jhsa.2018.03.045
13. Novikov AV, Shchedrina MA. Evaluation of rehabilitation efficacy in patients with hand pathology. *N.N. Priorov Journal of Traumatology and Orthopedics*. 2007;(1):78-83. (In Russ.)
14. Lee YK, Kam BS, Lee KW, et al. Ten trigger fingers in an adult man: a case report. *J Korean Med Sci*. 2007;22(1):170-172. doi: 10.3346/jkms.2007.22.1.170
15. McKee D, Lalonde J, Lalonde D. How Many Trigger Fingers Resolve Spontaneously Without Any Treatment? *Plast Surg (Oakv)*. 2018;26(1):52-54. doi: 10.1177/2292550317740691
16. Gil JA, Hresko AM, Weiss AC. Current Concepts in the Management of Trigger Finger in Adults. *J Am Acad Orthop Surg*. 2020;28(15):e642-e650. doi: 10.5435/JAAOS-D-19-00614
17. Ashmead D 4th, Okada H, Macknin J, et al. Trigger Fingers After Open Carpal Tunnel Release. *Plast Surg (Oakv)*. 2020;28(4):192-195. doi: 10.1177/2292550320928554
18. Farr S. Open Release of Pediatric Trigger Thumb. *JBJS Essent Surg Tech*. 2022;12(2):e21.00053. doi: 10.2106/JBJS.ST.21.00053
19. Makkouk AH, Oetgen ME, Swigart CR, Dodds SD. Trigger finger: etiology, evaluation, and treatment. *Curr Rev Musculoskelet Med*. 2008;1(2):92-96. doi: 10.1007/s12178-007-9012-1
20. Bayat A, Shaaban H, Giakas G, Lees VC. The pulley system of the thumb: anatomic and biomechanical study. *J Hand Surg Am*. 2002;27(4):628-635. doi: 10.1053/jhsu.2002.34008
21. Ng NYY, Sirisena R, Chua YX. Management of stenosing flexor tenosynovitis in primary care. *Singapore Med J*. 2023;64(4):255-261. doi: 10.4103/SINGAPOREMEDJ.SMJ-2021-262
22. Huisstede BM, Hoogvliet P, Coert JH, et al. Multidisciplinary consensus guideline for managing trigger finger: results from the European HANDGUIDE Study. *Phys Ther*. 2014;94(10):1421-1433. doi: 10.2522/ptj.20130135
23. Flatt AE. Notta's nodules and trigger digits. *Proc (Bayl Univ Med Cent)*. 2007;20(2):143-145. doi: 10.1080/08998280.2007.11928272
24. Ryzewicz M, Wolf JM. Trigger digits: principles, management, and complications. *J Hand Surg Am*. 2006;31(1):135-146. doi: 10.1016/j.jhsa.2005.10.013
25. Golas AR, Marcus LR, Reiffel RS. Management of Stenosing Flexor Tenosynovitis: Maximizing Nonoperative Success without Increasing Morbidity. *Plast Reconstr Surg*. 2016;137(2):557-562. doi: 10.1097/01.prs.0000475789.46608.39
26. Huisstede BM, Gladdines S, Randsdorp MS, Koes BW. Effectiveness of Conservative, Surgical, and Postsurgical Interventions for Trigger Finger, Dupuytren Disease, and De Quervain Disease: A Systematic Review. *Arch Phys Med Rehabil*. 2018;99(8):1635-1649.e21. doi: 10.1016/j.apmr.2017.07.014
27. Lunsford D, Valdes K, Hengy S. Conservative management of trigger finger: A systematic review. *J Hand Ther*. 2019;32(2):212-221. doi: 10.1016/j.jht.2017.10.016
28. Teo SH, Ng DCL, Wong YKY. Effectiveness of proximal interphalangeal joint-blocking orthosis vs metacarpophalangeal joint-blocking orthosis in trigger digit management: A randomized clinical trial. *J Hand Ther*. 2019;32(4):444-451. doi: 10.1016/j.jht.2018.02.007
29. Mandel C. *Conservative Management of Trigger Finger*. 2023. Available from: https://www.medbridge.com/blog/2023/01/conservative-management-of-trigger-finger/. Accessed Sept 5, 2024.
30. Howard LD Jr, Pratt DH, Bunnell S. The use of compound F (hydrocortone) in operative and non-operative conditions of the hand. *J Bone Joint Surg Am*. 1953;35-A(4):994-1002.
31. Matthews A, Smith K, Read L, et al. Trigger finger: An overview of the treatment options. *JAAPA*. 2019;32(1):17-21. doi: 10.1097/01.JAA.0000550281.42592.97

32. Dardas AZ, VandenBerg J, Shen T, et al. Long-Term Effectiveness of Repeat Corticosteroid Injections for Trigger Finger. *J Hand Surg Am*. 2017;42(4):227-235. doi: 10.1016/j.jhsa.2017.02.001
33. Clark DD, Ricker JH, MacCollum MS. The efficacy of local steroid injection in the treatment of stenosing tenovaginitis. *Plast Reconstr Surg*. 1973;51(2):179-180. doi: 10.1097/00006534-197302000-00014
34. Wang AA, Hutchinson DT. The effect of corticosteroid injection for trigger finger on blood glucose level in diabetic patients. *J Hand Surg Am*. 2006;31(6):979-981. doi: 10.1016/j.jhsa.2006.03.022
35. Castellanos J, Muñoz-Mahamud E, Domínguez E, et al. Long-term effectiveness of corticosteroid injections for trigger finger and thumb. *J Hand Surg Am*. 2015;40(1):121-126. doi: 10.1016/j.jhsa.2014.09.006
36. Panghate A, Panchal S, Prabhakar A, Jogani A. Outcome of percutaneous trigger finger release technique using a 20-gauge hypodermic needle. *J Clin Orthop Trauma*. 2020;15:55-59. doi: 10.1016/j.jcot.2020.10.043
37. Polat CS, Onat SS, Kulakli F, et al. The effectiveness of ultrasound guided local corticosteroid injection combined with orthosis in the treatment of trigger digit: a randomized controlled study. *J PMR Sci.* 2023:26(2):125-132. doi: 10.31609/jpmrs.2022-90423
38. Shultz KJ, Kittinger JL, Czerwinski WL, Weber RA. Outcomes of Corticosteroid Treatment for Trigger Finger by Stage. *Plast Reconstr Surg*. 2018 Oct;142(4):983-990. doi: 10.1097/PRS.0000000000004761
39. Ferrara PE, Codazza S, Maccauro G, et al. Physical therapies for the conservative treatment of the trigger finger: a narrative review. *Orthop Rev* (Pavia). 2020;12(Suppl 1):8680. doi: 10.4081/or.2020.8680
40. Hansen RL, Søndergaard M, Lange J. Open Surgery Versus Ultrasound-Guided Corticosteroid Injection for Trigger Finger: A Randomized Controlled Trial With 1-Year Follow-up. *J Hand Surg Am*. 2017;42(5):359-366. doi: 10.1016/j.jhsa.2017.02.011
41. Stirling PHC, Jenkins PJ, Duckworth AD, et al. Functional outcomes of trigger finger release in non-diabetic and diabetic patients. *J Hand Surg Eur Vol*. 2020;45(10):1078-1082. doi: 10.1177/1753193420925027
42. Fiorini HJ, Tamaoki MJ, Lenza M, et al. Surgery for trigger finger. *Cochrane Database Syst Rev*. 2018;2(2):CD009860. doi: 10.1002/14651858.CD009860.pub2
43. Dzatseeva DV, Titarenko IV. Stenosing ligamentitis of the fingers. Grekov's Bulletin of Surgery. 2006;165(6):63-68. (In Russ.)
44. Deikalo VP, Tolstik AN, Boloboshko KB. Clinical anatomy of the hand and surgical accesses. Vitebsk: VSMU; 2013:123. (In Russ.) Available from: https://core.ac.uk/download/pdf/53873562.pdf. Accessed Sept 5, 2024.
45. Ho SWL, Chia CY, Rajaratnam V. Characteristics and Clinical Outcomes of Open Surgery for Trigger Digits in Diabetes. *J Hand Microsurg*. 2019;11(2):80-83. doi: 10.1055/s-0038-1670927
46. Sahu R, Gupta P. Experience of Percutaneous Trigger Finger Release under Local Anesthesia in the Medical College of Mullana, Ambala, Haryana. *Ann Med Health Sci Res*. 2014;4(5):806-809. doi: 10.4103/2141-9248.141558
47. Twu J, Patel N, Wolf JM, Conti Mica M. Impact of Variation of Corticosteroid Dose, Injection Site, and Multiple Injections on Blood Glucose Measurement in Diabetic Patients. *J Hand Surg Am*. 2018;43(8):738-744. doi: 10.1016/j.jhsa.2018.06.005
48. Vasiliadis AV, Itsiopoulos I. Trigger Finger: An Atraumatic Medical Phenomenon. *J Hand Surg Asian Pac Vol*. 2017;22(2):188-193. doi: 10.1142/S021881041750023X
49. Mohd Rashid MZ, Sapuan J, Abdullah S. A randomized controlled trial of trigger finger release under digital anesthesia with (WALANT) and without adrenaline. *J Orthop Surg* (Hong Kong). 2019;27(1):2309499019833002. doi: 10.1177/2309499019833002
50. Dzatseeva DV, Titarenko IV. Method of surgical treatment of stenosing ligamentitis of the fingers of the hand. *Grekov's Bulletin of Surgery*. 2008;1:72-74. (in Russ.)
51. Tyllianakis M, Kasimatis G, Athanaselis S, Melachrinou M. Rice-body formation and tenosynovitis of the wrist: a case report. *J Orthop Surg* (Hong Kong). 2006;14(2):208-211. doi: 10.1177/230949900601400221
52. Kosiyatrakul A, Luenam S. Surgical Treatment for Trigger Thumb Using a Radial Approach. *J Hand Microsurg*. 2022;15(5):388-394. doi: 10.1055/s-0042-1749421
53. Will R, Lubahn J. Complications of open trigger finger release. *J Hand Surg Am*. 2010;35(4):594-596. doi: 10.1016/j.jhsa.2009.12.040
54. Baek JH, Chung DW, Lee JH. Factors Causing Prolonged Postoperative Symptoms Despite Absence of Complications After A1 Pulley Release for Trigger Finger. *J Hand Surg Am*. 2019;44(4):338.e1-338.e6. doi: 10.1016/j.jhsa.2018.06.023
55. Bruijnzeel H, Neuhaus V, Fostvedt S, et al. Adverse events of open A1 pulley release for idiopathic trigger finger. *J Hand Surg Am*. 2012;37(8):1650-6. doi: 10.1016/j.jhsa.2012.05.014
56. Laing TA, Sierakowski A, Elliot D. Management of painful scar-tethered cutaneous nerves of the upper limb. *Hand Surg Rehabil*. 2017;36(3):208-214. doi: 10.1016/j.hansur.2017.03.001
57. Koopman JE, Zweedijk BE, Hundepool CA, et al. Prevalence and Risk Factors for Postoperative Complications Following Open A1 Pulley Release for a Trigger Finger or Thumb. *J Hand Surg Am*. 2022;47(9):823-833. doi: 10.1016/j.jhsa.2022.04.017
58. Federer AE, Baumgartner RE, Cunningham DJ, Mithani SK. Increased Rate of Complications following Trigger Finger Release in Diabetic Patients. *Plast Reconstr Surg*. 2020;146(4):420e-427e. doi: 10.1097/PRS.0000000000007156
59. Shastin NP. Ten-year experience of using minimally invasive ligamentotomy for stenosing ligamentitis in children. *Current Pediatrics*. 2006;5(1):659. (In Russ.) URL: https://cyberleninka.ru/ article/n/desyatiletniy-opyt-primeneniya-mal0invazivn0y-ligamentotomii-pri-stenoziruyuschem-ligamentite-u-detey/viewer
60. Xie P, Zhang QH, Zheng GZ, et al. Stenosing tenosynovitis : Evaluation of percutaneous release with a specially designed needle vs. open surgery. *Orthopade*. 2019;48(3):202-206. doi: 10.1007/s00132-018-03676-4
61. Lorthioir J Jr. Surgical treatment of trigger-finger by a subcutaneous method. *J Bone Joint Surg Am*. 1958;40-A(4):793-795.
62. Eastwood DM, Gupta KJ, Johnson DP. Percutaneous release of the trigger finger: an office procedure. *J Hand Surg Am*. 1992;17(1):114-117. doi: 10.1016/0363-5023(92)90125-9

63. Zhigalo AV, Silaev AK, Pochtenko VV, et al. New minimally invasive technique of treating patients with “trigger” finger. *Issues of Reconstructive and Plastic Surgery*. 2017;(2(61)):53-60. (in Russ.) doi: 10.17223/ 1814147/60/06
64. Zhigalo AV, Pochtenko VV, Morozov VV, et al. Features of minimally invasive ligamentotomy of the thumb A1 pulley (our experience). *Issues of Reconstructive and Plastic Surgery*. 2021;24(2):64-73. (In Russ.) doi: 10.52581/1814-1471/77/07
65. Pan M, Sheng S, Fan Z, et al. Ultrasound-Guided Percutaneous Release of A1 Pulley by Using a Needle Knife: A Prospective Study of 41 Cases. *Front Pharmacol*. 2019;10:267. doi: 10.3389/fphar.2019.00267
66. Aksoy A, Sir E. Complications of Percutaneous Release of the Trigger Finger. *Cureus*. 2019;11(2):e4132. doi: 10.7759/cureus.4132
67. Langer D, Luria S, Michailevich M, Maeir A. Long-term functional outcome of trigger finger. *Disabil Rehabil*. 2018;40(1):90-95. doi: 10.1080/09638288.2016.1243161
68. Oh J, Jo L, Lee JI. Do not rush to return to sports after trigger finger injection. *Am J Phys Med Rehabil*. 2015;94(4):e26-30. doi: 10.1097/PHM.0000000000000267
69. Tanaka T, Ogawa T, Yanai T, et al. Disruption of Flexor Tendon after Intrasheath Triamcinolone Acetonide Injection for Trigger Digits: Two Case Reports. *J Hand Surg Asian Pac Vol*. 2017;22(3):380-383. doi: 10.1142/S0218810417720285
70. Yamada K, Masuko T, Iwasaki N. Rupture of the flexor digitorum profundus tendon after injections of insoluble steroid for a trigger finger. *J Hand Surg Eur Vol*. 2011;36(1):77-78. doi: 10.1177/1753193410382377

The article was submitted 19.08.2024; approved after reviewing 27.08.2024; accepted for publication 21.10.2024.

Information about the authors:

Gennady P. Kotelnikov — Academician of the Russian Academy of Sciences, Doctor of Medical Sciences, Professor, Head of the Department, kaf_travma@samsmu.ru, https://orcid.org/0000-0001-7456-6160;

Alexander S. Pankratov — Candidate of Medical Sciences, Associate Professor, Associate Professor of the Department, a.s.pankratov @samsmu.ru, https://orcid.org/0000-0002-6031-4824;

Andrey N. Nikolaenko — Doctor of Medical Sciences, Associate Professor, Director of the Research Institute of Bionics and Personalised Medicine, nikolaenko.83 @inbox.ru, https://orcid.org/0000-0003-3411-4172;

Alexander P. Borisov — Candidate of Medical Sciences, Associate Professor, Chief Specialist of the Research Institute of Bionics and Personalised Medicine, dr_borisov71@mail.ru, https://orcid.org/0009-0008-9562-6394;

Aleksey S. Klyuchnikov — resident of the Department, zif1111111 @yandex.ru, https://orcid.org/0009-0009-5320-5142;

Vyacheslav V. Piskun — resident of the Department, i@vpiskun.ru, https://orcid.org/0000-0003-3246-4953;

Nikita A. Knyazev — resident of the Department, n.knyazev.bass@gmail.com, https://orcid.org/0000-0003-1770-965X;

Denis V. Lyukshin — student, deniss2001@inbox.ru, https://orcid.org/0009-0008-2089-2604.