Pediatric trigger thumb: clinical management update

Dan Gordon[a] *and Pamela J. Sherman*[b,c]

Purpose of review
Pediatric trigger thumb is a common problem in children accounting for 1 in 2000 visits to the pediatric hand clinic. Misdiagnosis as a fracture or dislocation is common, so proper identification is key. The ideal treatment strategy remains a subject of debate, and there are studies documenting successful outcomes with both nonoperative and surgical treatment.

Recent findings
Recent literature highlights that observation is reasonable, as spontaneous resolution can occur in 30–50% of cases over a several-year period, with those having an interphalangeal angle of less than 30° being more likely to resolve. Surgical release of the A1 pulley remains the definitive treatment, with consistently excellent outcomes and minimal complications, particularly for children older than 2 years or those with more severe contractures or failed conservative management. Recent studies have identified certain congenital malformations that occur at a higher rate in children with trigger thumbs.

Summary
This developmental condition is common with spontaneous resolution being frequent. Proper diagnosis includes findings on examination of the volar nodule and flexion at the interphalangeal joint of the thumb. Minimizing misdiagnosis and appropriate observation in mild cases for a certain time frame is acceptable. Awareness of the potential need for surgical intervention, which is highly effective for persistent or severe trigger thumb in children, is important. The choice of management should be individualized based on age, severity, and parental preference, with recent studies supporting both approaches depending on clinical context.

Keywords
developmental trigger thumb, pediatric, treatment

INTRODUCTION

Pediatric trigger thumb is a common problem in children accounting for 1 in 2000 visits to the pediatric hand clinic [1▪▪,2]. Misdiagnosis as a fracture or dislocation is common, so proper identification is key [3▪▪]. Surgical release of the A1 pulley remains the definitive treatment, and outcomes tend to be excellent with minimal complications [3,4–6▪▪]. One in four children with trigger thumb have bilateral involvement [7–9]. This developmental condition should be properly diagnosed and treatment addressed appropriately. While developmental, rather than congenital, it differs from adult presentation and does not truly 'trigger' [10,11].

CLINICAL PRESENTATION

Most evidence suggests cause is a mismatch of size between the flexor pollicis longus (FPL) tendon and the A1 and/or oblique thumb pulley sheath. This leads to difficulty with tendon gliding and the presenting characteristic position of flexion at the interphalangeal joint (IPJ) of the thumb [7,8] (Fig. 1). Misdiagnosis as a fracture or dislocation is common, so proper identification is key [3▪▪]. The FPL tendon thickens with the abnormal gliding from the size mismatch creating a nodule on the tendon that is palpable and visible (Fig. 1). The pathognomonic nodule known as 'Notta's node' at the level of the A1 pulley in association with limitation of full interphalangeal extension is the typical finding [11–13]

[a]Department of Orthopedic Surgery, Baylor University Medical Center, Dallas, [b]Clinical Sciences, Burnett School of Medicine Texas Christian University, Fort Worth and [c]Hand Surgery, Department of Orthopedic Surgery, Cook Children's Healthcare System, Texas, USA

Correspondence to Pamela J. Sherman, MD, Professor, Clinical Sciences, Burnett School of Medicine TCU, Fort Worth, TX 76104, USA. Tel: +1 682 885 4405; e-mail: Pamela.sherman@cookchildrens.org

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KEY POINTS

- Pediatric trigger thumb typically presents in early childhood, not at birth, with the thumb interphalangeal joint locked in flexion and a palpable volar nodule at the metacarpophalangeal joint and is often misdiagnosed at initial presentation.
- Pediatric trigger thumb can resolve spontaneously in a significant proportion of cases, and observation for several years is a reasonable approach with initial presentation and milder cases for many children.
- Surgical release of the A1 pulley is highly effective and preferred treatment for persistent or severe cases with excellent results and minimal complications.

(Fig. 2). Minor antecedent trauma that was previously misdiagnosed as a fracture or dislocation is often a presenting complaint, with one study finding that 41% of patients present to the clinic after first being seen in an emergency department [14]. This presentation is common in practice, and a nodule present at the tendon suggests that the abnormality had been present for some time, just either not definitively locked or not noted to be so until the injury.

INCIDENCE

As multiple studies have highlighted, pediatric trigger thumb is not a condition that is present at birth, but rather develops in early childhood. Most patients present with either triggering or fixed flexion of the

FIGURE 1. Presentation of locked trigger thumb.

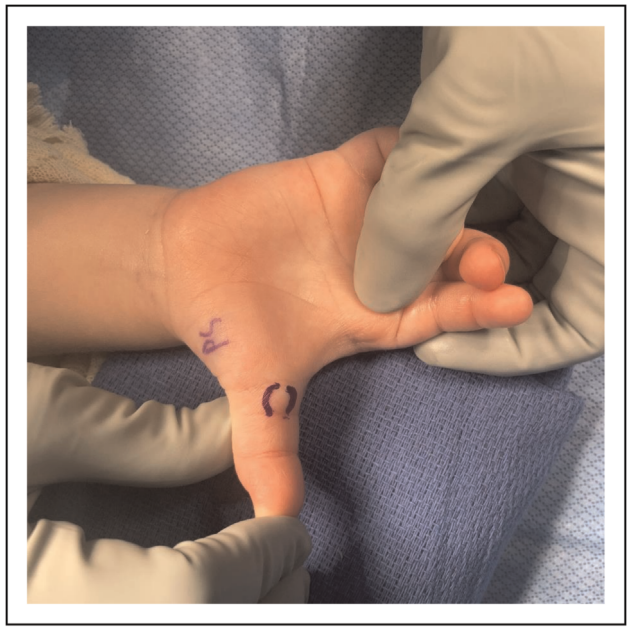

FIGURE 2. Outline of nodule present or 'Notta's node' with trigger thumb.

IPJ at 18 months up to 5 years of age (Fig. 3). The reported incidence ranges from 0.5 to 3 per 1000 children [8–10,15–19]. A recent retrospective national database study by Choi *et al.* [20▪▪] reported a pediatric trigger digit prevalence in South Korea of 0.063 to 0.084% with an age of presentation of 2.76 years. This data combined both pediatric trigger thumb and trigger finger, and trigger thumb is 10 times more common than trigger finger in infants and children [8]. There is also believed to be a higher prevalence of pediatric triggering in Hispanic and Asian populations [21,22]. In another recent 20-year retrospective review, Ray *et al.* reported on their experience treating 381 patients with 468 trigger thumbs. They had an average patient age at presentation of 3.1 years with the majority of thumbs presenting with a fixed flexion deformity [18]. Unilateral triggering is the most common presentation, although initial bilateral involvement is noted in up to 23.5–30% of patients and more common in children under 2 years old [17,18,23,24]. In patients with initial unilateral triggering, 2.5–3.4% eventually develop triggering of both thumbs. Age younger than 3 years and initial left-sided involvement are noted to be risk factors for subsequent contralateral disease [17,24].

A nationwide birth cohort study analyzed over 10 000 cases of trigger thumb diagnosed at an average age of 31 months, with nearly equal representation of male and female individuals, and specifically compared children with trigger thumb to matched

FIGURE 3. Ap and lateral X-ray of the hand with flexion at the interphalangeal joint.

controls for congenital anomalies and developmental milestones. This study found that children with trigger thumb have significantly higher rates of congenital anomalies, including renal agenesis and other kidney reduction defects, cleft palate, and circulatory system malformations compared to matched controls. However, these children did not show significant delays in developmental milestones [25].

One study highlights that multijoint laxity is frequently associated with trigger thumb, particularly in cases presenting with metacarpophalangeal joint hyperextension or instability [26].

ETIOLOGY

Little is known about the underlying cause of pediatric trigger thumb, with limited evidence for a genetic component in a small number of case reports that document either a family history of trigger thumb [27–30], or of triggering that occurred with twins [31–33]. There is a wealth of evidence documenting the pathophysiologic changes seen with this condition. Pediatric trigger thumb is different than adult triggering. In adult trigger digits, there is typically a thickening of the A1 pulley is typical. Ultrasound studies in children demonstrate that the symptoms

of pediatric triggering are instead caused by an increase in the cross-sectional area of the flexor pollicis longus (FPL) tendon in the setting of a normal A1 and Av pulley [21,34,35]. The enlargement of the FPL tendon appears to be idiopathic and demonstrates no signs of traumatic degeneration or inflammation [35] (Fig. 3). A recent study by Ok *et al.* [36] performed preoperative and postoperative ultrasound measurement of the FPL tendon in patients undergoing A1 pulley release for unilateral trigger thumb. They found that the cross-sectional area of the triggering FPL tendon was larger than the contralateral side preoperatively. Postoperatively, the FPL tendon cross-sectional area proximal to the pulley was significantly decreased after release of the A1 bottleneck, and the area of the tendon at the A1 pulley increased with a return of its more natural ovoid shape [36]. Electron microscopy studies, which demonstrate pediatric trigger thumbs with normal FPL tendon architecture without signs of inflammation or degeneration, further support these ultrasound findings of a pathologically enlarged FPL tendon [37].

Presentation of trigger thumb can be quite varied, and referrals come with many different diagnoses. A recent traumatic event identifies the lack of extension or flexed IPJ of the thumb, but this represents an issue that has been present for some time. When the flexed position with lack of interphalangeal motion is misdiagnosed as a dislocation within the setting of recent trauma, attempted 'reduction' in the emergent setting is met with frustration by both the treating emergency physician and the patient and parents (Fig. 1). This can be a challenging diagnosis with both the flexed position of the IPJ and not yet ossified epiphysis of the distal phalanx (typical ossification is around age 3) on the lateral radiograph. Manipulation is met with pain and may 'reduce' or unlock the locked tendon, but it frequently results in recurrence of the flexed and locked position. In the 'locked' position, the patient is typically asymptomatic and comfortable using the thumb without limitation. Unresolved trigger thumbs can present with extensor lag rather than flexion contracture, so comparison to the contralateral side is important in identification [38]. Initial presentation is commonly pain-free. We perform X-rays to rule out calcific tendonitis, which, while rare, can present with similar motion limitation.

NONOPERATIVE TREATMENT

There is debate regarding the optimal treatment strategy for pediatric trigger thumb. A variety of studies advocate for nonoperative treatment with observation or splinting, while others support surgical treatment with open or percutaneous release. Much of the debate centers on the rate of resolution with nonoperative treatment. In their oft-cited prospective studies in South Korea, Baek and Lee reported a spontaneous resolution rate of 75.9% at an average of 4.1 years of follow-up, and Jung *et al.* reported complete resolution in 80% of patients at an average of 2 years [39,40]. Conversely, a prospective study by Hutchinson *et al.* in the United States found a spontaneous resolution rate of only 32%. They postulated that this difference was possibly due to the use of a competing risk framework that allowed for the inclusion of patients that did not resolve naturally because they underwent surgical release [41▪]. They identify the risks of observation failure include bilateral thumb involvement and IPJ flexion of more than 30° [6]. A recent meta-analysis by Tang *et al.* [41▪] synthesized the data of 11 high-quality studies of 599 trigger thumbs, including the three previously discussed articles, and found a spontaneous resolution rate of 43.5%.

Nonoperative treatment with splinting has been proposed, but there is very limited published data supporting its use. A poorly designed study by Nemoto *et al.* [42] reported a resolution rate of 60% with extension splinting; however, there was no control group to account for the rate of spontaneous resolution in their patient population. A higher quality but still limited study by Lee *et al.* [43] compared observation to splinting and found that splinting had a resolution rate of 38.7%, compared to only 12.8% in the observation group. It should be noted that in this study, splinting treatment was for a duration of only 11.7 weeks, and the resolution rate with splinting was comparable to the reported rate with observation alone. This suggests that a longer period of observation may have been as effective as splinting. In a retrospective study of 64 patients, Koh *et al.* found a resolution rate of 92% with 22 months of splinting, compared to 60% resolution with 59 months of observation. Lastly, in a retrospective study of 129 thumbs, Yano *et al.* [44] reported a resolution rate of 59% with 31 months of splinting, versus 43% with a comparable period of observation. Splinting and other nonoperative modalities have limited evidence for efficacy, and splinting does not appear to improve resolution rates compared to observation alone [5]. In general, splinting of the thumb in extension is not well tolerated during active daytime use. Nighttime splinting can be more acceptable, but this can be a struggle to maintain in the pediatric population.

OPERATIVE TREATMENT

Open surgical treatment of pediatric trigger thumb typically consists of longitudinal release of the A1 pulley, although some studies also recommend

additional release of the Av and/or A0 pulleys as well as partial release of the oblique pulley as needed for persistent triggering [22,45,46]. Multiple studies have demonstrated excellent results and minimal complications with open surgical treatment. A retrospective review by Marek *et al*. of 217 thumbs treated with open surgical release reported a resolution rate of 100% with only four thumbs experiencing transient wound dehiscence or superficial infection. It should be noted that recurrence may be difficult to assess in this study due to the short average follow-up of 27 days [13]. A systematic analysis by Farr *et al.* [47] reporting on 18 studies of 759 thumbs treated with open surgical release, splinting, or passive stretching found that open surgical release demonstrated a resolution rate of 95%, compared to 67 and 55% with splinting and passive stretching, respectively. One retrospective study identified the risk of recurrence following open release to be increased in patients who were operated on prior to the age of 2.5 years [48].

Percutaneous release of the A1 pulley has also been investigated as a potential minimally invasive alternative to open surgery with mixed results. Small prospective studies have reported excellent resolution rates of 96–97%, with the only reported complications being treatment failure requiring open release [49,50]. A recently published retrospective review by Çimen *et al*. [51] of 218 trigger thumbs that underwent percutaneous release reported a similar resolution rate of 96.8% with zero reported complications other than three thumbs with recurrence requiring open release. Not all studies, however, agree that this technique is safe, including an excellent prospective study by Masquijo *et al*. [52] that reported on 20 thumbs that first underwent percutaneous release followed by immediate open exploration to judge the results. They found that percutaneous surgery only achieved full A1 release in 20% of cases, and that 80% of cases had longitudinal superficial lacerations of the FDP tendon. Based on their results, they recommended against the use of percutaneous release due to the risk of iatrogenic injury and incomplete release [52]. It is difficult for these authors to support percutaneous release due to the inherent risk of the digital nerve in the thumb. This is believed to be true to both adult and pediatric trigger thumbs, and notable worsened in the situation of a nodule present in most pediatric trigger thumbs, further placing the nerve at risk of injury with percutaneous approach. A network meta-analysis of eight studies comprising of 981 thumbs treated with open surgery, percutaneous release, or splinting similarly found that open surgery was superior to percutaneous release in both the rate of cure and recurrence [53].

TRENDS IN MANAGEMENT

The heterogeneous outcomes in studies of nonoperative management have resulted in a lack of consensus of the optimal treatment strategy for pediatric trigger thumb. A recent survey by MacConnel *et al*. [54▪] of 766 hand, congenital hand and pediatric orthopedic surgeons found that hand-fellowship trained surgeons were much more likely to choose operative intervention as the initial treatment strategy for 3-year-old patients presenting with any stage of trigger thumb, with congenital hand surgeons more likely to trial nonoperative management for flexible thumbs or painless thumbs that can be passively extended. This is consistent with a review of the PearlDiver database by Park *et al.* [19] that found 49% of pediatric trigger thumb patients in the United States undergo surgical treatment, with 65% being treated within 1 year of diagnosis. Ray *et al*. [18] similarly reported a surgical intervention rate of 78% in their 20-year retrospective study. This in contrast to the surgical treatment rate of 8.9% in South Korea reported by Choi *et al*. [20▪▪].

A survey of by the European Paediatric Orthopaedic Society also showed a lack of consensus on treatment strategy, although their members tended to favor initial nonoperative management, with only 30.3% considering surgical intervention during the first visit [21]. For conservative management, 75% recommend exercises only, with 18.6% recommending splints, reporting a high complication rate of 84% (residual triggering, dropout, or contact dermatitis). Of the surgeons who trial nonoperative management, 75% will consider surgical intervention after 6–12 months if patients do not achieve resolution. Finally, when it comes to choosing a surgical intervention, 96% perform open surgery [21]. Percutaneous release techniques are emerging as possible alternatives in select cases.

TREATMENT RECOMMENDATIONS

Treatment recommendations are observation until after age 2, as many will resolve. In our opinion, splinting is not recommended and is frustrating for the parent. In the patient with generalized laxity, the metacarpophalangeal (MP) joint may be hyperextended, especially in the setting of a locked IPJ. In this setting, the findings can present with 'snapping' of the MP joint actively into hyperextension. Typically, these patients also have hyperextension of the MP joint on the opposite side without the 'snapping'. Pediatric patients with 'trigger thumb' do not present with triggering but rather with locked fixed interphalangeal flexion. If the trigger is noted after age 2, then observation after initial presentation for 3–6 months is encouraged, and for 12 months or more is

reasonable. Close attention is paid to the hyperextension of the MP joint. If different than the opposite side and/or worsening, release of the A1 pulley to release the interphalangeal flexion can lessen the hyperextension. Surgical release in this case is recommended. While observation can lead to resolution, it is typically of long duration.

Compensatory MP hyperextension can develop for grasp compensation over this time. Surgical intervention is with little downside in a healthy child and is associated with a high rate of success and immediate resolution of the flexion position or triggering. Surgical release is performed in the operating room under anesthesia. An incision over the A1 pulley is made, and blunt dissection over the area is performed with care to identify the neurovascular bundle. The nodule of the FPL tendon further places the bundle at risk under the skin. The A1 pulley and its attachment to the oblique pulley are incised. The tendon sheath is examined along with the tendon for any abnormalities. The nodule, a thickening of the tendon itself, is left and typically 'resolves' over time once the pulley has been released. Full passive motion of the IPJ should be noted. The patient is placed in a protective dressing for wound coverage. They typically do well with immediate use and minimal pain, and a protective dressing is helpful. Follow-up is in 1–2 weeks for suture removal and wound care management review. If there is a bilateral presentation, waiting at least 6–8 weeks and preferably longer to proceed with surgical release of the opposite side is recommended. Of note, in children, trigger thumb is different than trigger finger. They are far less common and present as a different clinical situation. Anatomic anomalies of the tendon, nodular thickening, calcific and granulation tissue, or deposition diseases can all cause secondary triggering of the digits. These require a different approach to treatment.

CONCLUSION

As a common diagnosis in early childhood, identifying trigger thumb in the pediatric patient population is important for primary care providers. Understanding the natural history, pathophysiology, and treatment outcomes is important. While a significant portion will resolve spontaneously, those that do not can lead to functional impairment, and surgical intervention may be warranted. Pediatricians play a key role in identifying, counseling families about the condition, and referring for appropriate further specialty care.

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Conflicts of interest

There are no conflicts of interest.

REFERENCES AND RECOMMENDED READING

Papers of particular interest, published within the annual period of review, have been highlighted as:

- ■ of special interest
- ■■ of outstanding interest

1. Chew EM, Sim NYT, Lee NKL, *et al.* The natural history of paediatric trigger ■■ thumbs. A prospective cohort study. J Hand Surg Eur 2025; 50:616–621.

This prospective cohort study followed 79 trigger thumbs in 62 patients for up to 8 years (mean 4.2 years) to evaluate the efficacy of nonoperative management with observation alone in the pediatric patient population. They found that observation alone led to spontaneous resolution in 37% of patients at 5 years, and 50% of patients at 8 years of follow-up. The most significant predictor of spontaneous resolution was an initial IPJ flexion angle less than 30°. This study provides evidence that as long as the IPJ flexion angle is improving, observation alone has a reasonable chance to yield spontaneous resolution beyond the traditional 5-year surgical decision point.

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This retrospective study evaluated 64 trigger thumbs in 52 patients over an 11-year period to identify diagnostic pearls that can help prevent misdiagnosis. They found that there was a surprisingly high misdiagnosis rate of 46% in their study population, and they identified several patients presented with a palpable Notta's nodule, and 73% had a fixed flexion deformity. Importantly, only 27% demonstrated active triggering, which highlights the need for improved primary care provider education on pediatric trigger thumb presentation to help prevent delayed treatment and unnecessary radiographs.

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This nationwide population-based study from South Korea analyzed 2.18 million pediatric patients to determine the prevalence, incidence, and treatment patterns for pediatric trigger finger in this patient population. This represents the largest study of its kind published to date, and it ensured that selection bias was minimized by including an entire national cohort. In contrast to previously published studies, they found a sex-specific predominance in pediatric trigger digits in this patient

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This study is the first systematic review and meta-analysis to evaluate the rate of spontaneous resolution in pediatric trigger thumbs. It pooled data from 11 Level III studies published between 1974 and 2021, and found that the reported rate of spontaneous resolution increases significantly in thumbs that were followed for more than 2 years (58.9% for those followed >2 years vs. 26.8% for those followed <2 years). This provides further evidence that conservative management with extended observation alone is a valid first-line treatment, and provides evidence-based guidance that can be used when counseling patients on the natural course of this condition.
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This study is the largest published survey of pediatric trigger thumb treatment practice patterns, including 766 respondents with varying fellowship training backgrounds (444 hands surgery, 167 pediatric orthopedic surgery, and 155 congenital hand surgery). Respondents were presented with case-based scenarios involving 6-month-old, 18-month-old, and 3-year-old patients. They found that hand fellowship-trained surgeons were more likely than pediatric orthopedic fellowship-trained surgeons to offer surgical intervention for 3-year-old patients with flexible trigger thumbs (39 vs. 23%). In comparison to congenital hand surgeons, hand fellowship trained surgeons were also more likely to offer surgical intervention for 3-year-olds with painless limitation in active extension (63 vs. 49%), painful triggering (88 vs. 79%), and locked digits (90 vs. 81%). This study demonstrates that the heterogeneity in treatment strategies for pediatric trigger thumb is influenced by subspecialty training, and highlights the need for further research to create evidence-based guidelines for this patient population.