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ARTICLE

The association between trauma and paediatric trigger thumb deformity; experience from a single tertiary referral hospital

Nadia L. Salloum, Pauline McGee and Wee L. Lam

Department of Plastic, Reconstructive and Hand Surgery, St John's Hospital, Livingston, UK

ABSTRACT

Whilst the natural history and management of trigger thumb have been thoroughly investigated, the aetiology of the condition remains poorly understood. There are suggestions that this could be a congenital or acquired condition, but evidence remains limited. A history of trauma has repeatedly been noted in a proportion of patients presenting with trigger thumb. This retrospective study reviewed the presentations of 75 cases of trigger thumb in 65 consecutive children who underwent surgery for trigger thumb. We found that 28% of affected digits presented with a traumatic history to the thumb, of those 90% presented immediately post-injury with a flexion deformity. Those who presented with a traumatic history were typically younger at presentation (median age 27.0 months compared to 37.5 months for traumatic and atraumatic presentations respectively) but also tended to present earlier than the atraumatic group (one day compared to 12.17 months respectively). We conclude that a single traumatic event is unlikely to be the causative factor in the development of trigger thumb in children but it may expediate the development of individuals who are predisposed.

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Introduction

Paediatric trigger thumb is a condition characterized by a flexion deformity of the interphalangeal joint in one or both thumbs. First described by Notta [1], the condition typically presents with a thickening of the flexor pollicis longus proximal to the A1 pulley, now known as 'Notta's nodule' in children with locked or reducible flexion deformity of the thumb. The current estimated incidence is around 3 in 1000 in children of 1 year of age [2].

Whilst most research to date has focused on the natural history and management of the trigger thumb [3,4] the aetiology of the condition remains poorly understood. The earlier literature suggests that the condition may be congenital and present from birth [4], however, more recent studies would indicate that the condition appears to be acquired in the first few months to years of life rather than from birth [5–7], with a reported average age of 24 months [4,7].

More recently as a result, trigger thumb has now been removed from the Oberg-Manske-Tonkin Classification of Congenital Upper Extremities, being deemed to have a symptom onset inconsistent with a congenital condition [8].

The association between trigger thumb and trauma remains inconclusive; several studies reported a history of trauma to the thumb before deformity is noticed [9,10]. However, it has been suggested that the history of trauma is entirely incidental, that the injury merely highlights a pre-existing flexion deformity which was undetected in a young child [9,10]. Unlike adult cases of trigger digit, paediatric trigger thumb is more frequently associated with a fixed rather than intermittent flexion deformity [9,11]. It is generally accepted that the condition develops due to a mismatch in developmental size of the flexor pollicis longus and A1 pulley [11–14] with focal enlargement of the flexor pollicis longus proximal to the A1 pulley but no associated swelling or inflammation. One study has suggested that developmental proliferation of fibrous tissues may account for the discrepancies in FPL and A1 pulley size [15]. A history of trauma has been noted in other smaller studies, 40% of parents reported flexion deformity following trauma to the digit in a series of 17 thumbs treated surgically [7] and a similar finding of 41% in a more recent study of 26 digits including fingers and thumbs in 22 patients all of whom presented to the emergency department [16]. The authors highlighted a high rate of misdiagnosis of 20% and 67% respectively when patients presented in the context of trauma. Although trauma has been reported as an association, it is difficult to prove causation and series with no history of trauma have been reported [17].

In this retrospective study, we have reviewed the initial presentations of 65 children who underwent surgical release of 75 trigger thumbs to examine the role of trauma in their initial presentation.

Materials and methods

Participants

A retrospective analysis was performed of consecutive paediatric patients who underwent surgery for trigger thumb in the South East of Scotland between 2013 and 2020 inclusive.

The study included all paediatric cases of trigger thumb treated surgically. Surgical management was offered to patients with flexion deformity or intermittent painful triggering whose symptoms failed to resolve spontaneously or with passive stretching. Inclusion criteria included triggering of the thumb in those aged less than 18 years of age. Patients with unilateral or bilateral cases were included. None of the patients had a systemic disease known to predispose them to the development of triggering

CONTACT Nadia L. Salloum nadialibersalloum@gmail.com Department of Plastic, Reconstructive and Hand Surgery, St John's Hospital, Livingston, UK

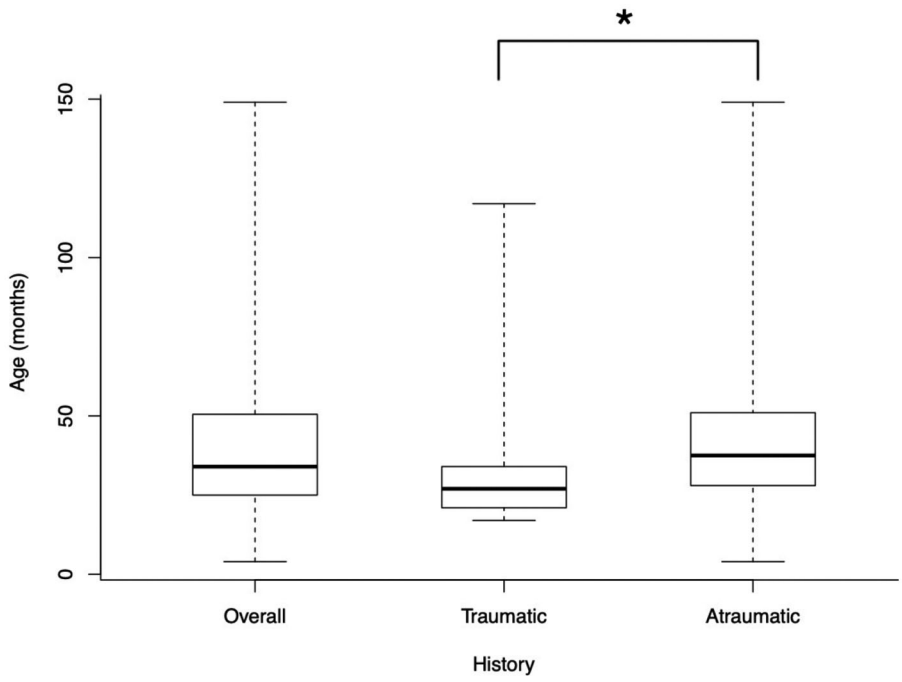

Figure 1. Median age at presentation, comparing traumatic and atraumatic presentation, $^{*}p = 0.011$.

digits such as mucopolysaccharoidosis or juvenile rheumatoid arthritis.

Data collection

Data was obtained from clinical notes including emergency department notes, referral letters and outpatient clinic letters. Data relating to the presentation of the condition were collected including age at presentation/referral, time from symptom onset to presentation and the mode of presentation to healthcare. Additional data pertaining to the trigger thumb was collected including history of trauma to the digit, clinical findings such as the presence of a fixed or intermittent deformity, presence of Notta's nodule and the use of radiologic imaging.

Statistical analysis

Statistical analysis of the data was carried out using R (version 3.6.1) [18]. Data on age at presentation and time to presentation was non-parametric and statistical analysis on this data included identifying the median, interquartile ranges and performing a Mann Whitney U test. Analysis of trigger thumb characteristics including family history, bilateral symptoms, presence of a nodule, intermittent symptoms and pain between the traumatic and atraumatic group was carried out using Fisher's exact test.

Results

75 consecutive paediatric trigger thumb operations in 65 individuals were performed from 2013 to 2020. Of these, ten individuals had bilateral trigger thumbs and the records for one were unable to be accessed.

Demographics

The median age of participants overall was 34 months (IQR: 25−50.5 months). Comparing the age of those with a traumatic history (median age 27 months; IQR 21−34 months) to those without a traumatic history (median age 37.5 months; IQR 28–51 months), there was a statistically significant difference, $p = 0.011$ (Figure 1). Overall, the male to female ratio was 1:1.4 and this appeared consistent between the traumatic (1:1.6) and atraumatic (1:1.3) groups. A family history of trigger thumb was reported in 12 individuals, two who presented with a traumatic history and 10 with atraumatic presentation ($p = 0.491$, 95% CI 0.0456–2.515).

Table 1. Mechanism of traumatic injury.

Mechanism	Number, $n_{\text{total trauma}} = 21$ (%)
Fall onto thumb	7 (33)
Trapped thumb in door or furniture	6 (29)
Injury whist playing	4 (19)
Sibling injury	1 (5)
Other	3 (14)

Presentation to healthcare services

Presentation was taken as the time at which the individual presented to the emergency department or when the GP referral was made. In total, 28% *(n = 21)* presented with a history of trauma. Mechanisms of trauma were varied and ranged from a fall onto thumb to entrapment, to injuring it whilst playing (Table 1). Of those that reported a traumatic history, 90% *(n = 19)* reported a deformity immediately following injury. The distribution of those presenting to the emergency department compared to general practice and the proportion of each who presented following a traumatic injury are detailed in Table 2.

Figure 2 illustrates the variation in time to presentation between those presenting following a traumatic history (median time 1 day; IQR 1–2 days) and those with an atraumatic presentation (median time 12.2 months; IQR 14 days–24.3 months). In those where there was a more prolonged time to presentation, this was reported as the best estimate of time to presentation. There was

Table 2. Symptoms, examination and investigation findings.

	Overall (n) $n_{total} = 75$ (%)	Traumatic presentation (n) $n_{total} = 21$ (%)	Atraumatic presentation (n) $n_{total} = 54$ (%)	Traumatic compared to Atraumatic p value
Mode of presentation				$p < 0.001$
GP referral		4 (19)	44 (81)	
ED presentation		17 (81)	10 (19)	
Intermittent triggering	13 (17)	1 (5)	12 (22)	$p = 0.095$
Bilateral symptoms	20 (27)	2 (10)	18 (33)	$p = 0.043$
Pain	13 (17)	3 (14)	10 (19)	$p = 1.000$
Swelling	4 (5)	4 (19)	0 (0)	$p = 0.005$
Notta's nodule reported	41 (55)	13 (62)	28 (52)	$p = 0.454$
X-ray performed	27 (36)	17 (81)	10 (19)	$p < 0.001$
Bony injury on x-ray	0 (0)	0 (0)	0 (0)	–

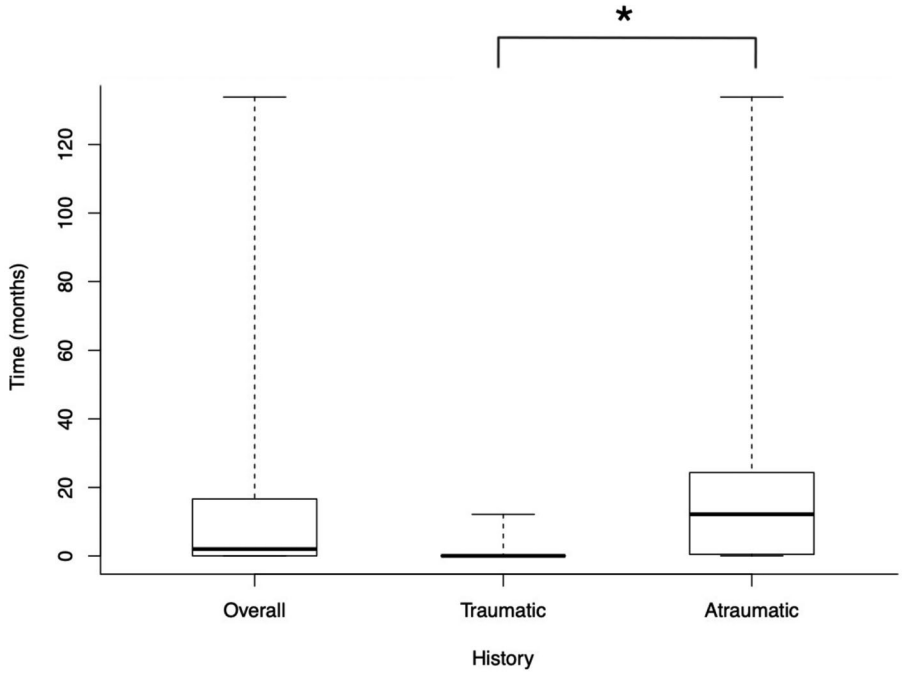

Figure 2. Median time to presentation at healthcare services comparing traumatic and atraumatic presentation, $^{*}p < 0.001$.

no data on this timeframe for two of the atraumatic presentation individuals.

Symptoms, examination and investigation findings

A summary of symptoms, examination findings and x-ray findings are presented in Table 2. Symptoms were noted to be unilateral or bilateral with bilateral symptoms identified in 10 individuals, accounting for 20 thumbs. Two children presented with a history of trauma on one side who subsequently developed symptoms in the contralateral thumb in the absence of trauma. Flexion deformity was reported as either fixed, where it could not be extended, or intermittent. Where pain was associated with the trigger thumb, this was either at rest or on attempted passive extension of the thumb. The presence of Notta's nodule was not always commented on but where it was documented, this was included as reported in findings in Table 1. The overall proportion of individuals who had x-rays performed is shown in Table 1. All x-rays carried out were formally reported as normal by a radiologist. The only additional examination finding of note was a minor subungal haematoma in one case with a traumatic history. All patients underwent release of the A1 pulley through a transverse incision with complete resolution of symptoms.

Discussion

This retrospective study shows a considerable number of children present to the emergency department with trigger thumb, often following a traumatic event to the hand. Whilst the retrospective nature of the study means it is not possible to determine whether the trauma played a causative role in the resulting trigger digit, the frequency in which trauma is reported on presentation with a trigger thumb suggests the trauma cannot be excluded as a potential contributing factor. Previous studies have excluded trauma as a contributing cause, suggesting that the traumatic presentation was a co-incidental finding or the reason for which a trigger thumb was identified [7,9,10]. It was noted that for a number of the cases reviewed here, the parents were clear there was no deformity prior to injury. Furthermore, to date there have been no studies which have completely discounted trauma as a possible cause for trigger thumb and therefore, whilst its aetiology remains uncertain, this cannot be excluded.

This study showed a similar overall age at presentation to that found in previous studies [4,7] and is also consistent with the updated Oberg-Manske-Tonkin Classification [8] which classified trigger thumb as an acquired rather than congenital condition. However, the study also highlighted a disparity in age at presentation between those who presented following a traumatic injury and those who did not. Whilst those with a history of trauma

presented at a younger age, they also typically presented more quickly than those with an atraumatic history which may account for the difference. There is a statistically significant difference (p value = 0.001) in the time to presentation between the two groups, it is difficult to determine whether there may be any other factors to account for this. One possible suggestion, however, is that the trauma may accelerate the changes in the digit, resulting in trigger thumb, earlier than may otherwise have occurred without trauma in someone who may be predisposed to the condition. This study is unable to determine whether or not this may be the case, but something that further research could explore.

The study also showed that those who presented with a traumatic history were more likely to have unilateral symptoms and a fixed, rather than intermittent, deformity compared to those with an atraumatic history. The majority of our bilateral cases reported no prior traumatic event suggestive that these children may be predisposed to developing triggering and two of these children developed triggering on one side after trauma with subsequent development on the other non-traumatised side later. There was no difference between in sex, family history and the presence of Notta's nodule between the two groups examined in this study.

Radiological imaging was frequently performed, particularly in those presenting to the emergency department and after a reported traumatic event, despite there often being no ongoing reported pain or other clinical findings apart from the fixed flexion deformity. In this study, all x-rays performed showed no evidence of any bony injury. While it may be necessary for emergency department practitioners to request an x-ray to exclude fracture or dislocation in the context of trauma it is not indicated in those presenting with an atraumatic history when ultrasound imaging, which is able to confirm a diagnosis of trigger thumb [13], may be more appropriate.

One of the limitations of this study is its retrospective nature and the inability to determine causation of trigger thumb, one of the ongoing difficulties in fully understanding trigger thumb in the paediatric population [3]. Other potential pathophysiological mechanisms, such as the previously proposed theories linked to sesamoid bone crowding [14] or that proliferation of fibrous tissues at the tendon results in a mismatch in A1 pulley size and flexor pollicis longus size [16], have not been able to be excluded or proven in this study. It is also conceivable that the size discrepancy between tendon and pulley is a result of deposition of additional molecules similar to the pathophysiology seen in individuals with inherited mucopolysaccharoidoses disorders who are more prone to trigger finger and carpal tunnel compared to the general population [19], however none of the patients in our study were known to have any systemic disorder.

Another limitation is that this study only explored the presentations of those who underwent surgery and, therefore, did not include any patients who were managed conservatively or had not presented to healthcare services. By including only surgically managed cases, however, it was possible to ensure all included digits had a definitive diagnosis of trigger thumb, as confirmed on direct visualisation during surgery. Interestingly Tadisina et al. found that 88% of digits in their study of 26 digits (including affected fingers and thumbs) that presented with a history of trauma ultimately ended up requiring surgical intervention [16]. Conservative management of trigger thumbs with stretching and splinting for thumbs of stage 2 and below is well documented in the literature however the rate of any background trauma is not explored [20]. Finally, data obtained in the study was dependent on the quality of clinical notes resulting in potential gaps in data such as examination findings and timings of symptom and presentation onset.

In conclusion, the findings of this study show that a large proportion of children with trigger thumb symptoms severe enough to require surgical release present following a history of trauma. From the results presented here, it is theorised that trauma may accelerate the development of trigger thumb in individuals predisposed to the condition. It is possible that trauma may also act as a direct cause of trigger thumb in some individuals although further prospective studies would be required to determine this. Age at presentation and time to presentation varied significantly (p values = 0.011 and 0.001 respectively) between those with and without a history of trauma to the hand. Many individuals present to the emergency department and undergo x-rays to exclude bony injury although the lack of positive findings on x-rays in this study throws into question the value of performing these routinely. Overall understanding of the aetiology of paediatric trigger thumb remains incomplete, however, and further prospective research is necessary to fully explore the role of trauma in its development.

Ethical approval

This study did not meet the local criteria for review by the research and ethics committee in NHS Lothian, Edinburgh.

Disclosure statement

The authors declare no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Author contributions

All authors contributed equally to the data collection, analysis, writing, editing, and review of the manuscript and approved the final version of the manuscript.

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