



Subungual hematoma: nail bed repair or nail trephination? A systematic review

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Abstract

Background Nail bed injuries are a major cause of presentation in the emergency department, accounting for 15 to 24% of all fingertip injuries, but management lacks consensus. Different methods have been published for the treatment of subungual hematoma, which leads to an important controversy among hand surgeons. The objective of this study was to conduct a systematic review to compare nail trepanation with nail avulsion and matrix repair, deciding which is the most appropriate according to each injury pattern.

Methods We carried out a systematic review of the literature using MEDLINE via PubMed, Virtual Health Library, Embase, and Cochrane Library through September 2021. Inclusion criteria were journal articles published in the last 11 years (2010–2021) in English, French, Portuguese, and Spanish and conducted in humans. Case reports, case series studies, and pre-clinical studies were excluded, in addition to those which are still in progress, did not report primary outcome or full-text was not available.

Results The search resulted in the screening of 599 records. Of these articles, 16 were eligible for the review. As shown in some literature reviews, the traditional approach to subungual hematoma is to remove the nail, analyze the sterile matrix, and repair the injury. According to many authors, this can depend on the size of subungual hematoma and if there is any fracture associated. On the other side, subungual hematomas also can be relieved by simple trephination, yielding good pain relief and satisfactory nail plate regeneration.

Conclusions With our review, we can determine more accurate recommendations regarding the possible treatment for unguinal complex injuries with subungual hematomas. In this sense, nail trephination alone is recommended whenever possible and nail removal with matrix repair is better when there is fracture or hematoma covers greater than 50%. In addition, small non-painful bruises do not require intervention, as knowing that it is incorporated into the nail and progressively migrates to the free edge of the nail plate.

Level of evidence: Not ratable.

Keywords Nail complex · Nail bed · Nail removal · Trephination · Subungual hematoma · Systematic review

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Introduction

Nail complex has an evident protective function for the fingertip, ensuring fine motor skills such as the pincer grip, dexterity, and sensitivity of the region [1]. Nail bed injuries are a major cause of presentation in the emergency department, accounting for 15 to 24% of all fingertip injuries [2]. More specifically, subungual hematomas are one of the most common injuries to the hand [3].

Without proper primary treatment, trauma to the nail complex can result in significant deformity, sequelae, functional morbidity, and debility of the affected finger, which

is often irreversible [1, 4, 5]. Typically occurring after crush wounds to the fingertip, subungual hematomas are the result of a direct injury to the nail bed resulting in a collection of blood under the nail. The underlying hematoma may cause the nail plate to separate from the nail bed, creating pressure, which is significantly painful for the patient [4, 6, 7].

Different methods have been published for the treatment of subungual hematoma, which leads to an important controversy among hand surgeons. According to some literature, it is believed that the size of the hematoma is related to the degree of involvement of the nail matrix, with 50% being a limit defined by most surgeons. Some doctors follow the principle that after 50% of hematoma involvement it is indicated to remove the nail and repair the nail matrix for better healing and reduction of potential nail deformities [4, 7, 8]. On the other side, other authors indicate trephination, believing that removing the nail plate can lead to more scars and deformities caused by manipulation of the nail bed, in addition to adding unnecessary costs [4, 7]. There are still those who believe that expectant conduct is the most correct.

Knowing that this condition is extremely prevalent and that there is no consensus regarding management [9], it is highly necessary to define the best conduct to be followed in each situation, evaluating the cost–benefit of each treatment. Thus, the aim of this systematic review is to compare nail trepanation with nail avulsion and matrix repair, deciding which is the most appropriate according to each injury pattern.

Nail trephination vs nail avulsion and matrix repair

Simple trephination usually is done by creating a hole in the nail plate using a device to drain the blood, reducing the pain and pressure associated with subungual hematomas. On an intact nail, decompression can be done with a needle, a heated paper clip, and a portable micro cautery device for pain relief, among other described materials [5, 10]. This is a simple and quick method, but very effective [4].

The repair of nail bed lacerations that requires the elevation of the nail plate must begin with skin preparation with an antiseptic solution. Then, the finger should first be anesthetized with a digital nerve block or general anesthetic in children [9]. After being prepped and draped in a sterile fashion, a drain clamped at the base of the finger with a hemostat can be used to create a bloodless field, allowing complete visualization of the injuries, and custom-made digital tourniquets can also be used. The nail should be removed and the eponychial fold should also be lifted back to remove the rest of the nail plate. A crescent area of skin is excised and the eponychium is recessed and advanced proximally to expose more matrix [11]. The nail bed needs to be irrigated and all foreign bodies debrided, so lacerations could be repaired. Any laceration involving the skin surrounding

the nail bed needs to be approximated, and then, the patient's nail plate or another material should be replaced under the proximal nail fold to act as a rigid splint. Finally, the fingertip and nail bed should be dressed with a nonadherent material [4, 10].

Materials and methods

This study is a systematic review based on the PRISMA protocol [12] and registered on the PROSPERO platform (CRD42021214602).

The PICO strategy was used to develop the research question: (P) we included every patient with subungual hematoma; (I) intervention was the surgical treatment; (C) the comparison was the clinical indications of nail trephination and nail avulsion and matrix repair; (O) the outcome was the best treatment to relieve a subungual hematoma.

We searched for nail complex trauma causing a subungual hematoma at any age in the following databases: MEDLINE via PubMed, Virtual Health Library, Embase, and Cochrane Library; in September 2021, adapting for each database the search terms: (nail complex OR *complexo ungueal* OR nail bed OR *leito ungueal* OR nail matrix OR *matriz ungueal* OR fingertip OR *ponta do dedo* OR subungual hematoma OR hematoma subungual) AND (historical trauma OR historic trauma OR *injur** OR *traum** OR *wound** OR wounds and injuries OR *lacerat** OR *surger** OR *treph**).

Inclusion criteria were journal articles published in the last 11 years (2010–2021) in English, French, Portuguese, and Spanish and conducted in humans. We included studies such as literature reviews, systematic reviews, meta-analysis, clinical studies, clinical trials, comparative studies, controlled clinical trials, randomized controlled trials, multicenter studies, and observational studies. Case reports, case series studies, and pre-clinical studies were excluded, in addition to those which are still in progress, did not report primary outcome or full-text was not available.

Two authors (ASB/EK) were responsible for the analysis of PubMed and Cochrane Library, while two others (CB/NK) of Virtual Health Library and Embase. They dually and independently reviewed titles, then abstracts, before conducting a full-text review of all potentially eligible studies. At each stage and database, decisions between the two raters were compared and discrepancies resolved by a third person. In addition, duplicates between databases have been removed. An Excel spreadsheet was used for record decisions and data.

As data collection was undertaken with articles already published and freely accessible in the databases noted here, approval was not requested from the institutions' review boards.

Results

The search was completed in September 2021 and resulted in the screening of 476 records and, after the entire selection process, in the inclusion of 16 studies for the systematic review (Fig. 1).

As shown in some literature reviews, the traditional approach to subungual hematoma is to remove the nail, analyze the sterile matrix, and repair the injury. According to many authors, this can depend on the size of subungual hematoma and if there is any fracture associated [4, 6, 7, 10, 13–15]. Lee et al. said that nail removal is more appropriate for patients with concomitant nail margin damage or distal phalanx fracture, since it facilitates debridement [7]. However, Dean et al. cited an article which said that this management is not necessary for every subungual hematoma with nail bed laceration or phalanx fracture [13]. Weir added that trephining a hematoma in the presence of a fracture can increase infection's risk and potential nail deformities [5]. Furthermore, Hawken and Giladi stated that nail removal can result in nail deformity and iatrogenic complications [16]. On the other side, Weir and

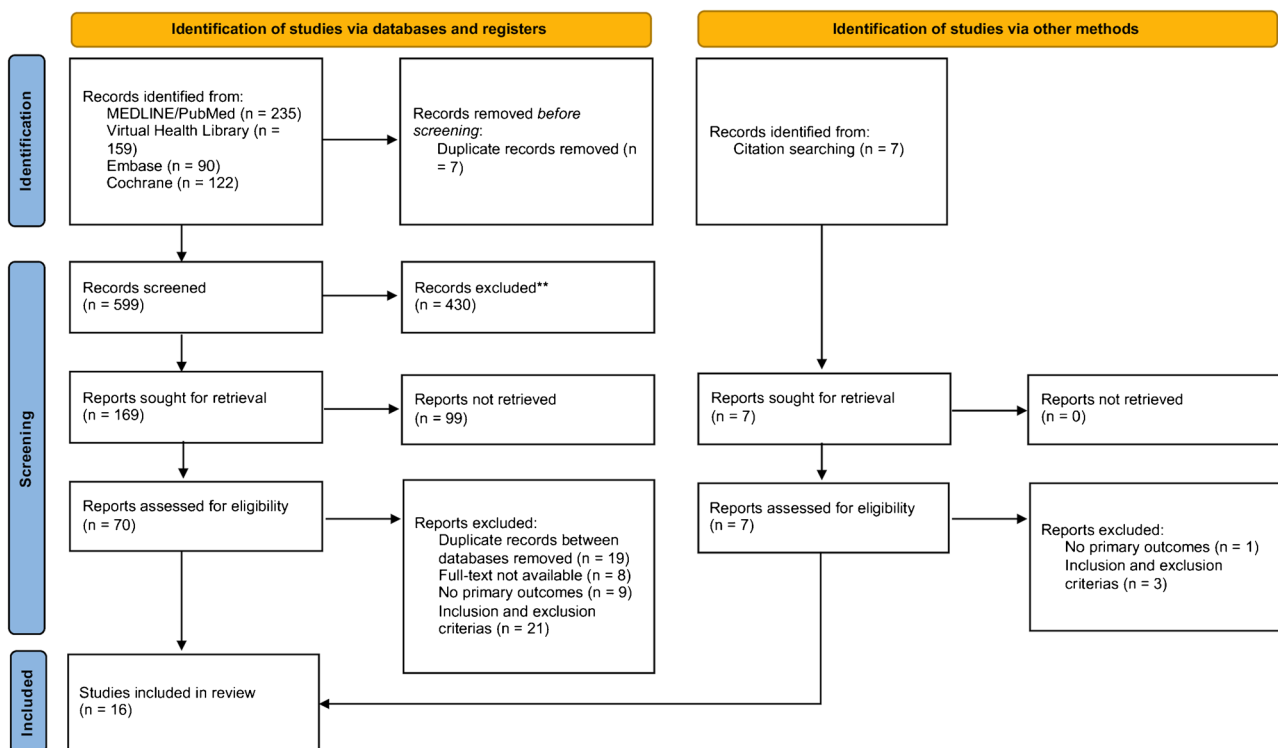
Venkatesh et al. cited articles which showed no difference in cosmetic outcomes and complications when comparing nail removal and trephination [5, 17].

On the other side, subungual hematomas also can be relieved by simple trephination, yielding good pain relief and satisfactory nail plate regeneration. Besides the same results, many authors showed that isolated trephination has much lower costs [4, 5, 7, 13, 16, 18].

Moreover, some authors stated that small and painless hematomas are often left to reabsorb without treatment, knowing that it is incorporated into the nail and progressively migrates to the free edge of the nail plate [6, 10, 13–15]. Vergara-Amador et al. agreed and demonstrated that this approach is also valid for children [18].

Mignemi et al. emphasized the paucity of high-quality data at the moment of their study and affirmed that further research on nail complex trauma was needed to determine the best treatment [3]. Weir added that more studies are necessary to define the most effective trephination methods [5].

The results of each article included in the systematic review are listed in Table 1.



From: Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *BMJ* 2021;372:n71. doi: 10.1136/bmj.n71. For more information, visit: <http://www.prisma-statement.org/>

Fig. 1 PRISMA 2020 flow diagram

Table 1 Studies and the conclusions of the original and cited authors

Chosen treatment	Cited author
Small and painless hematoma: no intervention	Roser and Gellman [13]; Dumontier et al. [14]; Seaberg et al. [15, 18]; Brown, Dautel, VanBeek, Lórea [18]
In the absence of significant fingertip injuries: trephination	Chakravarthy et al., Alwis [19]; Batrick et al. [5]; Hawken and Giladi [16]
< 50%*: trephination	Brown, Dautel, Lórea, VanBeek [18]; Seaberg et al. [15, 18]
Regardless the size of hematoma or the presence of fracture with intact nail plate: trephination	Seaberg et al., Meek and White [3, 7, 10]; Roser and Gellman [3, 10]
Regardless the size of the subungual hematoma with intact nail plate: trephination	Seaberg et al. [11, 14]; Roser and Gellman [14], Hamel [20]
≥ 25%*: nail removal**	Brown and Borschel [10]; Gellman, Simon and Wolgin [3, 7]; Hart and Kleinert, Roser and Gellman [6]
> 50%*: nail removal**	Simon and Wolgin [11]; Schraga [6]; Salazard et al., Gellman [5]
> 50%* associated with a fracture of the distal phalanx: nail removal**	Zook et al., VanBeek et al. [15]; Simon et al. [14]
> 50%* or > 25%* in the presence of a fracture: nail removal**	Zook and Doermann, Zook, Matthews, Melone and Grad, Russell and Casas, Zacher [4]; Simon and Wolgin [4, 17]
All cases of subungual hematoma: nail removal**	Simon and Wolgin [13]
Hematomas associated with nail margin damage or distal phalanx fracture: nail removal**	Batrack et al. [4, 17]; Chakravarthy et al. [19]; Patel [17]; Hart and Kleinert, Roser and Gellman [6]; Mignemi et al. [3]
Nail plate intact and a not significantly displaced fracture: not necessary nail removal**	Brown, Seaberg et al., Meek and White, Dean et al., Batrick et al. [4]; Fieg [10]; Hart and Kleinert [6]; Roser and Gellman [4, 6]

*Size of the subungual hematoma

**Nail removal for nail matrix repair with subsequent replacement of the nail plate

Reference number = original author

Discussion

Fingernails are an aesthetic and functional unit of the human hand and when a person sustains an injury to the nail bed, especially to the germinative zone, dystrophic nail growth can be a result [21]. One of the main goals of surgical treatment of a nail complex lesion is to avoid nail dystrophy and preserve functionality [9]. The absence of a fingernail or the existence of a dystrophic nail is commonly not accepted by the patient, as long as the psychological damage can be massive, especially when caused by a work-related accident [21]. Therefore, proper management requires extensive knowledge of motor and neurovascular anatomy.

Nail complex injuries are usually defined as subungual hematoma, simple or complex lacerations and avulsions or crush injuries [4]. The main injury mechanism to the nail complex in children is door crushing, the right hand is most often affected, and the fingertip is the most injured site [5].

Many surgical techniques and other methods have been described for the reconstruction of the fingertip, but there are disagreements about when to operate and which technique is the best. When planning treatment, the doctors should obtain a focused history and physical examination to decide which is the most appropriate intervention for each individual. The characteristics of the injury and psychosocial factors such as occupation, hobbies, cultural norms, socioeconomic status, secondary motive, and clinician bias must be considered [11].

Furthermore, the knowledge and experience of the attending clinician can also direct the treatment decisions [22].

Based on the available literature, we noted that the majority of the studies said that, whenever possible, simple nail trephination must be chosen, considering mainly the low costs and good aesthetic results. Other positive outcomes such as a good pain relief and a low infection rate were also cited. Besides that, trephination had the same functional and sensitivity recovery than nail removal. According to some authors, this procedure is often viable when the hematoma covers up to 50% of the nail. However, when the hematoma covers more than 50% of the nail bed or there is associated distal phalanx fracture, most authors defended nail removal. On the other hand, small and painless hematomas, without complicated signals, should be left the reabsorb spontaneously and no intervention is needed.

Conclusion

Most treatment decisions are made based on surgeons' experience and preferences, resulting in a significant bias of many studies. Until then, there was no consensus regarding the treatment of trauma to nail complex, which obscured the conduct of doctors and justified the importance of studying this issue. We found that different techniques can be chosen for nail complex injury management, depending

on the trauma mechanism, injured site, and nail complex commitment.

The importance of this review was to determine more accurate recommendations regarding the possible treatment for subungual hematoma. In this sense, nail trephination alone is recommended whenever possible and nail removal is better when there is fracture or hematoma covers greater than 50%. In addition, small non-painful bruises do not require intervention, as knowing that it is incorporated into the nail and progressively migrates to the free edge of the nail plate.

Finally, as many treatments are available to treat the same injury, with very similar results, it is important to assess the cost–benefit of each, in terms of public health.

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Declarations

Statement of human and animals rights This article does not contain any studies with human or animal subjects.

Informed consent The authors declare that the work described does not involve patients or volunteers.

Conflict of interest Jefferson Braga Silva, Alice Scalzilli Becker, Bruna Leiria Meréje Leal, Catarina Vellinho Busnello, Elisa Hartmann Kist, and Natália Dias Koff declare no competing interests.

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