Comparison of Nail Bed Repair Versus Nail Trephination for Subungual Hematomas in Children

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Fifty-three fingers in 52 children were divided into 2 groups, operative and nonoperative, after fingernail crush injury. Criteria for inclusion into the study were an intact nail and nail margin with subungual hematoma and no previous nail abnormality. The length of the follow-up period averaged longer than 2 years for each group. Twenty-six fingers in 26 children were treated by nail removal, exploration, and repair of nail bed lacerations (operative group). Twenty-seven fingers in 26 children were treated by evacuation of hematoma by nail trephination without nail removal in 11 fingers and by observation in the other 16 fingers (nonoperative group). In the operative group, transient abnormalities (nail depression or hypertrophy), which resolved by 4 months, occurred in 3 patients. In the group treated by simple decompression, there were no complications except for 1 transient nail depression at 3 months. The average cost to the operative group was $1,263 compared with $283 to the trephination group. Although formal nail bed reconstruction has been advocated for hematomas larger than 25%, we found no notable difference in outcome between the 2 groups regardless of hematoma size, presence of fracture, injury mechanism, or age. Charges, however, were 4 times greater for the operative group. Based on the results of this study, we do not feel that nail removal and nail bed exploration is indicated or justified for children with subungual hematoma and an intact nail and nail margin. (J Hand Surg 1999;24A:1166–1170.

Key words: Subungual hematoma, nail, perionychium, fingernail.

The management of nail bed injuries is often a matter of opinion and personal preference.[1] Many investigators have advocated formal repair of the nail bed if greater than 25% of the nail contains hematoma, especially in the presence of fracture.[2–8] Others believe, however, that hematomas of moderate to large size may be adequately treated by trephination alone.[3,4,9,10] This is thought to avoid additional trauma to the nail bed and the potential to cause or increase nail deformity. Trephination alone is adequate to alleviate pain from the pressure of hematoma[9,10] and allow nail bed healing.[11]

The purpose of this study was to compare the outcome of nail removal and formal nail bed reconstruction to simple evacuation of the subungual hematoma via trephination after fingernail crush injury.

Materials and Methods

A sequential study was established to compare the findings of formal reconstruction of subungual hematomas involving greater than 25% of the nail bed to a more conservative approach of simple trephination. The operative group was gathered sequentially until 25 candidates were included for study and then the nonoperative group was enrolled for review. Cri-

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teria for inclusion in the study were an intact nail with subungual hematoma and no history of previous nail abnormality by the patient or parent.

Fifty-three patients met the criteria for inclusion in the study over a 2-year span. Twenty-six consecutive fingers were treated with formal nail bed repair and 27 were treated with simple nail trephination alone. All fingers were evaluated for a minimum of 4 months in the office with a subsequent telephone interview at the end of the follow-up period.

In the operative group, 16 patients were male and 10 were female; the average age was 8 years (age range, 8 months to 15 years). In the nonoperative group, 19 of the patients were male and 7 were female; the average age was 7 years (age range, 6 months to 20 years).

Formal operative care consisted of informed consent, intravenous or intramuscular sedation if desired by the parents or deemed necessary by the treating physician, and digital block in the emergency department's procedure room. The wounds were then prepared in a sterile manner with povidone-iodine scrub and paint, a finger tourniquet was applied, and the intact nail was elevated with a Freer elevator. Exploration (under loupe magnification), irrigation, and reapproximation of the lacerations (if present) were completed with 6–0 or 7–0 chromic suture. The nail was then cleansed of all remaining tissue, replaced with an evacuation portal, and held in place with several chromic sutures. A nonadherent material covered by sterile gauze and either a finger dressing or application of a club cast completed the treatment regimen. Routinely, cephalexin was given for 5 days as prophylaxis against infection. In-office follow-up examinations were done weekly for 4 weeks, then again at 4 months. Telephone interviews were conducted to reassess for the occurrence of nail abnormalities since the last clinic visit or resolution of nail abnormalities noted on their release from the office at 4 months. Patients were queried with regard to functional and/or cosmetic problems with the nail and any other concerns about the finger. The minimum follow-up period was 13 months for the telephone questioning. All patients were contacted for follow-up inquiries.

Eleven fingers in the nonoperative group had decompression of the hematoma via needle or electrocautery units; 16 patients and/or parents refused evacuation of the hematomas. All fingers were covered with a nonadherent dressing, gauze, and a finger splint if fracture of the tuft was present. Antibiotic prophylaxis was prescribed for 3 days to all the patients. Follow-up evaluation in this group consisted of 4 weekly visits, with a final follow-up visit at 4 months. Telephone interviews were conducted for the final follow-up inquiries. No patients were lost to follow-up monitoring.

The relative charge for the 2 groups was determined by averaging 5 representative charts from each group and assessing the hospital charges recorded for each patient. These included emergency department consultations, radiology film and reading fees, equipment and materials charges, and orthopedic consultations and treatment charges, both in the emergency department and the office.

Results

Operative Group

In the operative group, the length of the follow-up period averaged 28 months (range, 15–36 months). Sixteen of the patients were male and 10 were female. The average age was 8 years (age range, 8 months to 15 years).The dominant hand was injured in 14 patients (54%). Dominance could not be determined in 4 patients (18%) due to their young age. The right hand was injured in 20 patients (77%). The finger that was injured most frequently was the long finger (9 cases; 35%), followed by the index and small fingers (6 each), the ring finger (3), and the thumb (2). Most patients sought treatment within 6 hours of injury (22 of 26 patients), but 2 delayed presentation for 48 hours until there was an increase in discomfort. Blunt injury occurred in 25 fingers, with the predominant object being the doorjamb of a car (31%) or house (27%).

Seventy-seven percent of cases had subungual hematomas greater than 75% of the nail surface, and all but one were greater than 25%. Twenty-one of the 26 fingers (85%) were found to have lacerations of the nail bed on fingernail removal. In 5 patients, no laceration was found. Subungual hematomas were greater than 75% of the nail bed in 2 of these 5 patients, 25% to 50% in 2, and less than 25% in 1. Fifty-two percent of the lacerations were in the proximal third, and all but one of these were of the complex/stellate type. All lacerations in the distal two thirds (10 cases) were transverse and simple. Tuft fractures occurred in 12 patients; none of these were displaced or intra-articular. Eleven were associated with a laceration. Ten fractures were found in fingers with hematoma greater than 75%; 1 fracture was found in each group with 25% to 50% and 50% to 75% hematoma.

All patients underwent irrigation, debridement, digital block, repair, and coverage with their native nail and a nonadherent dressing. Twenty-five percent of the patients received intramuscular sedation and 60% were placed into a splint or club cast after nail bed repair for further protection. Antibiotic prophylaxis was administered to 24 of the patients (92%), with 70% obtaining a prescription for 5 days' coverage. Three patients each received 3 and 7 days' coverage.

Complications occurred in 4 of the 26 fingers; these were transient in 3. Two fingernails had transverse depression of the nail identified at the repair site (at 4 months) and 1 fingernail had a hypertrophic region at the site of repair identified at 2 months, which resolved by 4 months. All deformities had resolved by the time of the final follow-up evaluation. The remaining complication is a nonstructural, cosmetic abnormality consisting of transverse white lines (leukonychia) in a 12-year-old boy. It was felt to be of no significance by either the patient or his parents. There were no infections.

The charges for patients treated by formal repair ranged from $1,100.58 to 1,537.53, an average charge of $1,263.

Nonoperative Group

In the nonoperative group, the length of the follow-up period averaged 24 months (range, 13–37 months). The average age was 7 years (age range, 6 months to 20 years). Nineteen patients were male and 7 were female. Of the 27 fingers with subungual hematomas treated nonoperatively, 63% (17 of 27) were in the left hand. Dominance was 45% in the right hand and 37% in the left hand. Dominance could not be identified in 5 patients due to their young age. The most frequently injured finger was the long finger (41%), followed by the ring finger (18%), the small finger and the thumb (15% each), and finally the index finger (11%). The time to treatment was less than 6 hours in 18 patients (67%); 3 patients delayed treatment for more than 48 hours. The mechanism of injury was attributed to a door crush in 74% of cases; all other injuries were the result of a blunt blow (brick, weight, bike chain, stroller wheels, etc).

Hematoma size was more evenly distributed in this group of patients, with 33% having hematomas of greater than 75% involvement of the nail bed, 19% with 50% to 75% involvement, and 30% with 25% to 50% involvement; less than 25% of the fingers had subungual hematoma involvement. Tuft fractures were present in 11 of the 26 (41%) patients. Four fractures occurred in fingers with hematomas of 25% to 50% and 50% to 75%.Two fractures were found in fingers with more than 75% hematoma and 1 was found in the smallest hematoma group. No fractures were intra-articular or displaced.

Nail trephination was consented to by 11 patients. The other 16 patients preferred to be observed. Subjectively, all those in the trephination group reported a rapid decrease in pain following decompression. All fingers were dressed with a nonadherent gauze and sterile dry dressing. Thirty-seven percent of patients had an aluminum splint placed (all but 1 of the fingers with a distal phalanx fracture). Twenty percent were told to use soaks with dilute povidone-iodine solution. Antibiotics were prescribed for all; only 45% filled their prescriptions.

There was only one transient complication noted at the 4-month follow-up evaluation: a depression in the nail that was only a few millimeters from the nail tip, which had resolved by the final follow-up telephone call (at 24 months). This patient underwent trephination for a large (>75%) subungual hematoma without a fracture of the distal phalanx. There were no infections.

The cost of patients treated via trephination ranged from $265 to $297.95, an average charge of $283.

Discussion

Nails improve hand function, enhancing our ability to grasp tiny objects and increasing tactile sensation, and play an important part in regulation of the peripheral circulation of the finger tip.[6,12,13] It is imperative, therefore, that all physicians have the knowledge to evaluate and care for nail bed injuries.[9] Nail bed injuries occur due to a variety of mechanisms, the most common being a crush in a doorjamb of any type, as well as other associated blunt crushing injuries. The majority of injuries occur in children and adolescents, with the long finger being the most commonly involved. Nearly 50% of the injuries are associated with a tuft fracture. Simple lacerations in the middle or distal third of the nail bed (distal to the lunula) are the highest in frequency.[7,14,15] Crush injury to the fingertip results in a compression of the nail bed between the nail and underlying bone, often creating a straight, stellate, or tearing laceration of the nail bed. Rarely, when a sharp object is involved, amputation of the fingertip (partial or complete) may occur.

The anatomy and physiology of the perionychium has been well described.[7] The nail bed (matrix) is the tissue located under the nail; it allows for nail growth and migration. The matrix has multiple longitudinal fibers that anchor the dermis to the periosteum of the distal phalanx.[9] It was believed at one time that all nail growth begins in the root (germinal matrix or lunula) and the more superficial cells become cornified and slide more distally with little contribution from the sterile matrix.[12] It is now known, however, that the entire nail bed is active in the generation and migration of the nail.[16,17] Longitudinal growth of the nail requires between 70 and 160 days.[3,10–12,16] Baden[11] believes that after an injury, approximately 3 weeks is necessary until growth begins again, accounting for the hypertrophy (and/or a trailing depression) present within the elongating nail. The regeneration then progresses at an increased rate for the next 2 months, with total time to healing being 4 months.

If scar is present due to inappropriate alignment of laceration edges, nail deformities are likely to occur. If the dorsal portion of the nail bed is damaged, a dull streak may occur. Splits or absence of the nail may occur due to scarring in the ventral nail (germinal matrix) and nonadherence may result if the sterile matrix is damaged.[7,9,13,16] Because of these potential cosmetic and functional abnormalities, it is believed that accurate reapproximation of nail bed lacerations is absolutely necessary.[12,16,18]

A simplified classification system was introduced by Ashbell et al[12] to include subungual hematoma, simple lacerations, stellate lacerations, severe crush, and avulsion. Hematoma formation occurs due to the disruption of the highly vascular nail bed. Chudnofsky and Sebastian[9] recommend decompression of the fingertips with an intact nail only for relief of pain using either a needle, a heated paperclip, or a battery-powered microcautery unit. Hematomas greater than 25% have been previously regarded as needing formal reconstruction.[3–7] More recently, conflicting recommendations concerning the size of the subungual hematomas requiring exploration have come to light in the emergency medicine literature.[9,10,19]

Simon and Wolgin[19] demonstrated the presence of lacerations in need of repair (>3.0 mm in size) in 60% of patients with more than 50% of the nail involved by subungual hematoma. This percentage increased to nearly 95% in the presence of fracture of the distal phalanx, perhaps the result of the interconnection of the matrix with the periosteum of the distal phalanx. These investigators concluded that fingernails with hematomas greater than 50% and/or a fracture (regardless of hematoma size) should have the nail removed and the nail bed explored for possible repair. There was no follow-up evaluation in this study, however, nor was a control group established for comparison.

A report by Seaberg et al[10] addressing injury in both children and adults questioned the need for the removal of any nail if it was still intact without disruption of the nail or nail border. Forty-seven hematomas in 45 consecutive patients (aged 3–60 years) with previously normal nails were prospectively evaluated. No prophylactic antibiotics were given. Regardless of hematoma size (55% with >50% involvement) or presence of a fracture (30%), all patients were treated with simple trephination and monitored for 10 months. There were no complications in this study. It was suggested that radiographs may not be necessary for this group of injuries. Chudnofsky and Sebastian[9] agreed with simple trephination in these patients but withheld advocating the elimination of radiographs, as proper bony alignment and stability are crucial for normal finger growth, particularly in children.

Our patient population was nearly identical to those of previous studies[7,10,14,15,20] with regard to finger injured, hematoma size and distribution, presence of fracture, and mechanism of injury. Our results are identical to those of Seaberg et al[10] and include a population of patients with isolated nail bed injuries and intact nail and nail margins. Despite the presence of fractures in our nonoperative group and a presumed 95% probability of matrix laceration,[19] no nail abnormalities occurred. In the group in which formal reconstruction of the matrix was completed, the only long-term abnormality found was residual horizontal white markings (leukonychia) of no structural or functional consequence. Therefore, either method of treatment seems equally efficacious.

When one looks at the charges of each method of treatment, however, they are markedly different. Those patients treated by either trephination or observation had an average charge of $283 compared with the $1,263 cost incurred by the operative group. Obviously, a significant savings would be realized with no significant difference in outcome of all patients fitting our criteria were treated by simple trephination alone. We recognize that with disruption of the nail or nail fold, or with displaced fracture fragments, the majority of studies recommend nail removal and primary repair of the laceration. Zook et al[8] have shown that lacerations managed in this way have an excellent prognosis.

In this study none of the distal phalanx fractures were displaced and none entered into the distal interphalangeal joint. There were no cosmetic or functional deficits noted at the final follow-up examination. There were no infectious in either group. In patients with an intact nail and nail margin with a subungual hematoma but no fingertip deformity, radiographs may not be needed, which would provide an additional cost savings at our institution of nearly $75 per case.

No important differences were found between these 2 groups regardless of hematoma size, presence of fracture, injury mechanism, or age of the patient. Cost, however, was 4 times greater for the operative group. Based on the results of this study, we do not feel that nail removal and nail bed exploration are warranted or justified in children with subungual hematoma and an intact nail and nail margin.

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