Journal of Integrative Pediatric Healthcare

Research Article

"Crushed Finger" Injuries in the Infant and the Child: A Preliminary Study of 35 Cases

This article was published in the following Scient Open Access Journal:
Journal of Integrative Pediatric Healthcare
Received December 01, 2017; **Accepted** January 06, 2018; **Published** January 12, 2018

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Abstract

Background: Crushed finger injuries represent the most frequent Paediatric hand surgical emergency. There are many kinds of injuries, from simple pulp or nail wound to fingertip amputation all the way to the complex fracture of the distal phalanx. Their initial treatment needed meticulous care and often appeal to microvascular reconstruction. The purpose of this study is to assess our management in the context of nonexistent microsurgery.

Methods: It's a preliminary prospective study managed from April 2010 to April 2015 about all infants and child presenting crushed finger of which a surgical initial treatment is immediately performed in our Paediatrics Surgery Department. A systematic clinical complete examination makes analysis of different structures of injured finger and establishes a gravity score for fingertip amputations using the common classification in 4 areas. The aesthetic and functional criteria base on scar and nail quality outcome and postoperative use of the finger are registered for comparison.

Results: We have treated 19 males and 16 females with a mean age of 2 years for extremes of 11months and 7years. The right hand dominance was found in 27 cases with 32 door's crush injuries versus 3 falls of blunt object on the hand. All the children were outpatients who went under local anesthesia surgery with a digital or wrist tourniquet. We registered seven simples sutures of pulp wounds, eleven pulp reconstructions using "V-Y" advancement flap, one rectangle flap, distraction system, five pulp replantations, six distal replantations with distal interphalangeal joint fused, four amputations' terminalisations and two finger shortenings with primary skin closure. We noticed parietal suppuration with favorable evolution in 2 cases and distal necrosis of finger in 3 cases.

Conclusion: Authors report satisfactory results despite the lack of microsurgery.

Keywords: Crush finger, Paediatric hand, Reconstruction, Lack of microsurgery

Introduction

Crushed finger injuries represent the most frequent Paediatric hand surgical emergency [1]. Mechanism is often a direct impact resulting in trapped finger when the hand is caught between the door and the door's surround as the door closes. The "smashed fingertip in door" often present distal vascular stripping of the finger with a risk of partial or complete fingertip necrosis [2,3]. There are many kinds of injuries, from simple pulp or nail wound to fingertip amputation all the way to the complex fracture of distal phalanx. Their initial treatment needed meticulous care and often appeal to microvascular reconstruction. The purpose of this study is to assess our management in the context of nonexistent microsurgery.

Methods

It is a preliminary prospective study managed from April 2010 to April 2015 about all infants and child presenting crushed finger of which a surgical initial treatment is immediately performed in our Paediatrics Surgery Department.

A systematic clinical complete examination makes analysis of different structures of the injured finger and establishes a gravity score for fingertip amputations using the Allen's common classification in 4 areas (Figure 1). The classification is based on level of injury: type1 injuries involve only the pulp; type2 involve the pulp and nail bed; type 3 injuries include partial loss of the distal phalanx; type4 injuries are proximal to

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the lunula. All the children were out patients, treated under local anesthesia with bleeding controlled using a tourniquet made from surgical glove and place on the injured finger or wrist. An axial bone pinning using a 20G needle was performed in every case of reconstructed amputation with the aim of fixing the distal segment to the bone.

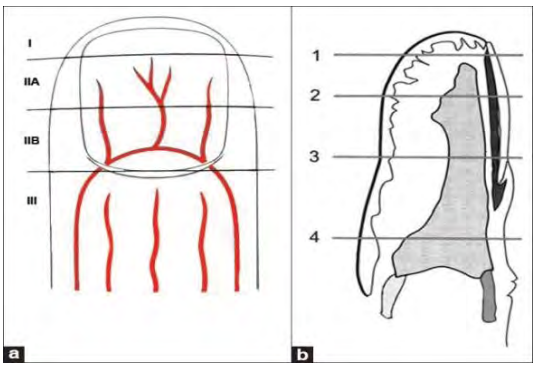

Figure 1: ALLEN's fingertip amputation classification.

The aesthetic and functional criteria base on scar and nail quality outcome, adverse event such as infection or structures necrosis and postoperative use of finger are registered for comparison.

Results

The data registered showed 19 males versus 16 females with a mean age of 2 years for extremes of 11 months and 7 years. The right hand dominance was found in 27 cases with 32 houses' doors crush injuries versus 3 falls of blunt object on the hand.

The distal amputations were registered on Allen's type II in 11 cases, type III in 8 cases while other phalangeal injuries were an open fracture associated with Proximal Phalanx Joint (PPJ) dislocation and two amputations over the second phalange (Figure 2). We performed simple suture of pulp wound in seven cases, 11 pulp reconstructions using Atasoy's "V-Y" advancement flap on long fingers, a rectangle advancement flap on thumb, one Suzuki's distraction system for an interphalangeal proximal joint open fracture on ring, six distal replantations with distal interphalangeal joint fused, five pulp replantations and four amputations' terminalisations (Figures 3-6).

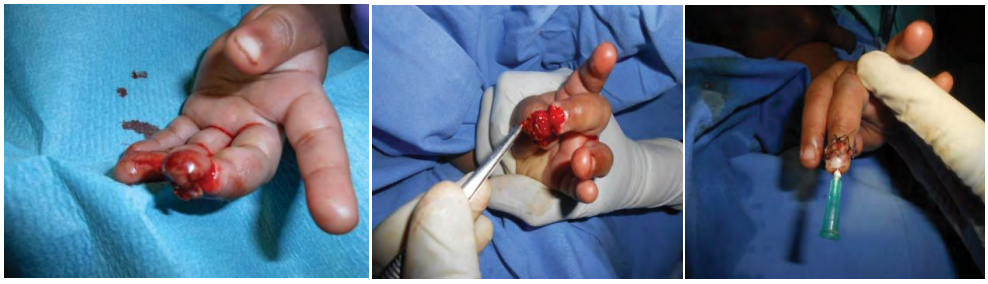

Figure 2: Allen type III crush finger-dorsal view-treatment.

Figure 3: "Y-V" advancement flap or Atasoy procedure.

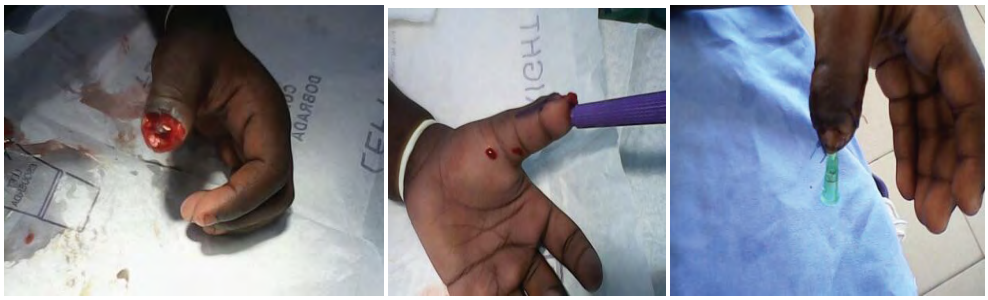

Figure 4: Moberg procedure on crush Thumb.

Figure 5: Suzuki modified technique - X-ray before operation - treatment result.

Figure 6: amputation's terminalisation.

Table: recapitulative table of different methods used.

Type 1: Pulp wound Pulp uncomplete amputation	• simple suture • simple suture replantation	**7cases → Good outcome**
Type 2: Complete pulp amputation 3 : Distal phalanx amputation	• V - to – Y pulp reconsruction • simple suture replantation	**11cases → Good outcome** **8cases → 2 distal necrosis**
Thumb type 4 : complete pulp amputation Proximal to lunula	• Moberg rectangle flap reconstruction	**1case → Good outcome**
Proximal Interphalangeal Joint complex fracture	• Suzuki 's distraction system	**1case → Good outcome**

Figure 7: distal necrosis after replantation.

We noticed two complete distal necrosis of finger and one partial necrosis after replantation (Table). The partial necrosis had needed directed wound healing while the two others required amputation's terminalisation (Figure 7).

The results assessment based on defined criteria has been expressed of good opinion in 25 cases for instance, 71.4% of cases with a flat scar well-located nail and normal functional use of the finger. The judgment was medium in 3 cases with partial functional finger without nail and second-rate for 2 children on whom shortening finger was performed at the level of second phalanx.

Discussion

House doors crushed finger injuries represent the first hand emergency in the child. Our study notes 32 cases out of 35 children especially infants around 2years.

In Marseille it was found 3 out of 4cases about 81 hand traumas in the young child. The study of 241cases in Nantes discovered a frequency of child's hand injury from 3years old to 5years old [1,4].

Our work showed causes which were exclusively represented by house doors responsible of clipping mechanism on the finger. Other aetiologies were characterized by mechanism of leaned impact against the hand. The causes mentioned in literature apart from houses' doors were cars' doors, windows, cupboards, bicycles' chains and folding chairs [5].

Lesions of the distal phalanx which constituted more than half of our cases were predominated on types 2 and 3 fingertip injuries referring to topographic classification. All the structures in the finger were involved from nail or nail bed to bone phalanx all the way to pulp injuries. Those finger lesions, by their own issues in treatment, represent a broad spectrum of surgical emergency conditions with various technical options of healing: bone covering, pulp reconstruction, revascularization using central artery or dorsal vein [6].

Surgery has consisted in wound closing or pulp reconstruction using "V-Y" flap in more than half of cases and rectangle flap on thumb in one case. There are various types of flap reconstruction and choosing the appropriate one depends on the extent and configuration of distal tissue loss. The good result of the V-Y advancement random flap especially for long fingers was confirmed by most of authors. Both two flaps seemed to us simple and accessible in our context [7].

We registered 3 cases of necrosis after 5 distal replantations

for finger amputation while pulp replantation in 2 cases had favourable result. There was no attempt to microsurgical revascularization because of a lack of instruments in contrast to our satisfactory results in 71% of cases. The pulp vascular anatomy permits very distal replantations until type 2 topography under microscopes sutures. The difficulty of those replantations in children remains on vein repair almost impossible in type 2 and 3 topography of injuries as we have no dorsal vein. However simple repositioning for distal amputation can give satisfactory results if the child is less than three or four years old and the amputated segment of good quality. It's a very simple method but distal necrosis, infection risk, bandage duration and parents' worry constitute limiting factors of its indications [8-11].

The treatment of child's phalanx fractures is often orthopedic but, in the case of bone instability or join fracture anatomical reduction is followed by surgical pinning [12]. The distraction system we realized for a 30-month-old infant was performed on a type III epiphyseal fracture at the root of the second phalanx with open proximall interphalangeal joint dislocation.

Conclusion

Crushed finger injuries constitute the leading surgical emergency of the child's hand. It is often resulting in crushed fingertips smashed into house doors with distal phalanx vascular stripping risk. Lesions can be simple or complex needing special care and most of the times appeal to microvascular reconstruction. However simple method of distal replantation and local fingers' flaps reconstruction can be highly satisfactory in early childhood in a context of nonexistent microsurgery.

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