

Mechanism and epidemiology of paediatric finger injuries at Prince of Wales Hospital in Hong Kong

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ABSTRACT

Objectives: To determine the mechanism and epidemiology of paediatric finger injuries in Hong Kong during 2003-2005 and 2010-2012.

Design: Comparison of two case series.

Setting: University-affiliated teaching hospital, Hong Kong.

Patients: This was a retrospective study of two cohorts of children (age, 0 to 16 years) admitted to Prince of Wales Hospital with finger injuries during two 3-year periods. Comparisons were made between the two groups for age, involved finger(s), mechanism of injury, treatment, and outcome. Telephone interviews were conducted for parents of children who sustained a crushing injury of finger(s) by door.

Results: A total of 137 children (group A) were admitted from 1 January 2003 to 31 December 2005, and 109 children (group B) were admitted from 1 January 2010 to 31 December 2012. Overall, the mechanisms and epidemiology of paediatric finger injuries were similar between groups A and B. Most finger injuries occurred in children younger than 5 years (group A, 56%; group B, 76%) and in their home (group A, 67%; group B, 69%). The most common mechanism was crushing injury of finger by door (group A, 33%; group B, 41%) on the hinge side (group A, 63%; group B, 64%). The right hand was most commonly involved. The door was often closed by another child (group A, 37%; group B, 23%) and the injury often occurred in the presence of adults (group A, 60%; group B, 56%). Nailbed injury was the commonest type of injury (group A, 31%; group B,

39%). Fractures occurred in 24% and 23% in groups A and B, respectively. Traumatic finger amputation requiring replantation or revascularisation occurred in 12% and 10% in groups A and B, respectively.

Conclusions: Crushing injury of finger by door is the most common mechanism of injury among younger children and accounts for a large number of hospital admissions. Serious injuries, such as amputations leading to considerable morbidity, can result. Crushing injury of finger by door occurs even in the presence of adults. There has been no significant decrease in the number of crushing injuries of finger by door in the 5 years between the two studies despite easily available and affordable preventive measures. It is the authors' view that measures aimed at promoting public awareness and education, and safety precautions are needed.

Hong Kong Med J 2015;21:237-42

DOI: 10.12809/hkmj144344

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This paper was presented at the 27th Annual Congress of the Hong Kong Society for Surgery of the Hand, 15-16 March 2014, Hong Kong.

This article was published on 8 May 2015 at www.hkmj.org.

New knowledge added by this study

- Similar to other countries, crushing injury of finger by door was the most common cause of paediatric finger injuries in Hong Kong.
- Although many preventive measures are available and easily accessible at low cost, there were no significant differences in injury mechanism and epidemiology between 2003-2005 and 2010-2012.

Implications for clinical practice or policy

- Paediatric crushing injury of finger by door can occur even in the presence of adults. Reinforcement of public education on the use of safety measures, including door modification and precautions in the home, should be conducted to prevent such injuries.

Introduction

Injuries to the hand and fingers are extremely common in children, yet they can have a significant

impact on a child's growth and development. Fingers are used to explore surroundings and perform daily activities such as playing, eating, and homework.

香港威爾斯親王醫院中兒童手指受傷的原因和流行病學

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目的：找出2003-2005年以及2010-2012年期間香港兒童手指受傷的機制和流行病學。

設計：兩個病例系列的比較。

安排：香港一所大學附屬的教學醫院。

患者：回顧研究分別於兩個三年期的時間內因手指受傷往香港威爾斯親王醫院求診的兩組兒童患者（年齡介乎0至16歲）。比較兩組之間的年齡、涉及的手指、受傷原因、治療以及其結果。對於手指被門夾傷的病例，亦會用電話訪問傷者父母受傷的細節。

結果：本研究的兩個三年期分別為2003年1月1日至2005年12月31日以及2010年1月1日至2012年12月31日，於第一個三年期因手指受傷而入院的有137名兒童（甲組），而於第二個三年期因相同原因而入院的有109名兒童（乙組）。總體而言，兩組兒童手指受傷的原因及流行病學分佈相似。大部分病例發生在5歲以下的兒童身上（甲組56%，乙組76%），且在家中發生（甲組67%，乙組69%）。最常見的原因為手指被門夾傷（甲組33%，乙組41%），尤以鉸鏈位置附近為甚（甲組63%，乙組64%）。意外最常累及右手，通常是當另一名兒童把門關上時發生的（甲組37%，乙組23%）；而意外發生時通常有成年人在場（甲組60%，乙組56%）。甲床損傷最常見（甲組31%，乙組39%）。甲乙兩組的骨折率分別為24%和23%，而因受傷須截除手指以及再植或血運重建的比率分別為12%和10%。

結論：手指被門夾傷常見於幼童，並造成大量入院個案，這種意外可導致高發病率及嚴重後果，例如截除手指。即使有成年人在場，手指被門夾傷也可能發生。儘管可以透過簡單而又便宜的預防措施來避免手指被門夾傷，但本研究發現縱使兩段研究期相隔五年，同類的意外並沒有明顯減少。筆者認為必須採取適當的防範措施，並提高公眾意識、加強公眾教育來避免同類意外發生。

Restricting children from these activities due to injuries can have immediate short- and long-term detrimental effects on the function of the hand, psychological wellbeing, and quality of life of the children. A 10-year review on the psychological impact on children and adolescents with finger or hand injuries noted that "Hand injuries are common and loss of a dominant hand or opposition is most important [sic]. Self-esteem and skill are associated

with hand sensation, appearance, and functions."¹

Studies by Al-Anazi² and Doraiswamy³ have identified crushing injury of finger(s) by door as the main cause of finger injuries in children. However, there has been no local study to identify the main cause of finger injuries in Hong Kong. In 2007, Lau and Ho presented data on the epidemiology of childhood finger injuries (unpublished data; Lau M, Ho PC. 20th Annual Congress of the Hong Kong Society for Surgery of the Hand, Hong Kong, 2007) that supported the findings in other cities. Similar to Al-Anazi² and Doraiswamy,³ Lau and Ho found that crushing injury of finger by door was the most common cause of paediatric finger injuries from 2003 to 2005, and recommended various preventive measures.

The present study aimed to compare the previous set of data from 2003 to 2005 reported by Lau and Ho with more recent data obtained from 2010 to 2012. By comparing the epidemiology and mechanisms of finger injuries among local Hong Kong children, we aimed to determine whether there have been any significant changes over the past 5 years.

Methods

Data of patients admitted to Prince of Wales Hospital from 1 January 2003 to 31 December 2005 (group A) and from 1 January 2010 to 31 December 2012 (group B) were retrieved using the Clinical Data Analysis and Reporting System (CDARS) of the Hospital Authority's Clinical Management System. Children aged 0 to 16 years, and with at least one of the International Classification of Diseases, 9th Revision, Clinical Modification (ICD-9-CM) codes listed in the Box among the top three diagnoses were included in the analysis.

Discharge summaries of all patients were reviewed to identify the mechanisms of finger injuries. For children in whom the mechanism was not immediately discernable from the discharge summary, further clarifications were obtained by telephone interviews with the child's parents, which were conducted in 2006 for group A and in 2013 for group B. For children in whom crushing injury of finger(s) were due to closing doors, additional data were collected by telephone interviews with their parents using a specifically designed questionnaire (Fig 1).

Results

Group A consisted of 140 children who presented with finger injury to Prince of Wales Hospital from 1 January 2003 to 31 December 2005. Three children from this group were excluded due to coding error. Group B comprised 109 children who presented from 1 January 2010 to 31 December 2012. No

BOX. CDARS case finding list of Prince of Wales Hospital

ICD-9-CM code: 2014 ICD-9-CM diagnosis

816: Fracture of one or more phalanges of hand

817: Multiple fractures of hand bones

883: Open wound of finger(s)

885: Traumatic amputation of thumb (complete) [partial]

886: Traumatic amputation of other finger(s) (complete) [partial]

923.3: Contusion of finger

927.3: Crushing injury of finger(s)

Abbreviations: CDARS = Clinical Data Analysis and Reporting System; ICD-9-CM = International Classification of Diseases, 9th Revision, Clinical Modification

Crushing injury of the finger and Questionnaire

1. Site of injury:



2. Place of injury:

- ☐ Home ☐ School ☐ Car ☐ Others ☐ Unknown

3. Locations of doors causing finger injuries (home):

- ☐ Front door ☐ Bedroom ☐ Kitchen ☐ Toilet ☐ Others ☐ Unknown

4. Side of door:

- ☐ Hinge ☐ Lock ☐ Middle of a double door ☐ Unknown

5. Who closed the door?

- ☐ Self ☐ Child ☐ Adult ☐ Spontaneous ☐ Unknown

6. Presence of adult:

- ☐ Yes ☐ No

7. Outcome - Level of satisfaction (0-10):

a. Pain

Please circle the number which best describes your current level of pain

0 1 2 3 4 5 6 7 8 9 10
No pain Worst possible pain

b. Daily activity

Please circle the number which best describes your current level of activity

0 1 2 3 4 5 6 7 8 9 10
Severely affecting daily activities No problem

c. Cosmesis

Please circle the number which best describes your current level of cosmesis

0 1 2 3 4 5 6 7 8 9 10
Poor cosmesis No cosmetic problem

FIG 1. Questionnaire on crushing injury of finger by door

children from this group were excluded.

In both groups, crushing injury of finger by door was the most common cause of injury—45 (33%) in group A and 45 (41%) in group B—followed by sports injury, cut, and slip and fall (Table 1). Among children with crushing injury of finger by

door, younger children were the most commonly injured (Fig 2a). The male-to-female ratio was 1:1.25 in group A and 1.37:1 in group B.

In the telephone interviews conducted with the parents of the 45 children who had crushing injury of finger by door, parents of two children in group A and six children in group B could not be contacted. Overall, all the parameters measured were similar between the periods 2003-2005 and 2010-2012. In both groups, most of the fingers involved were from the right hand, with the middle, ring, and little fingers being more commonly affected than the other fingers (Fig 2b).

Most of the injuries occurred at home—29 (67%) in group A and 27 (69%) in group B. At home, fingers were most frequently crushed at the hinge side of the door—27 (63%) in group A and 25 (64%) in group B—followed by the lock side and the middle

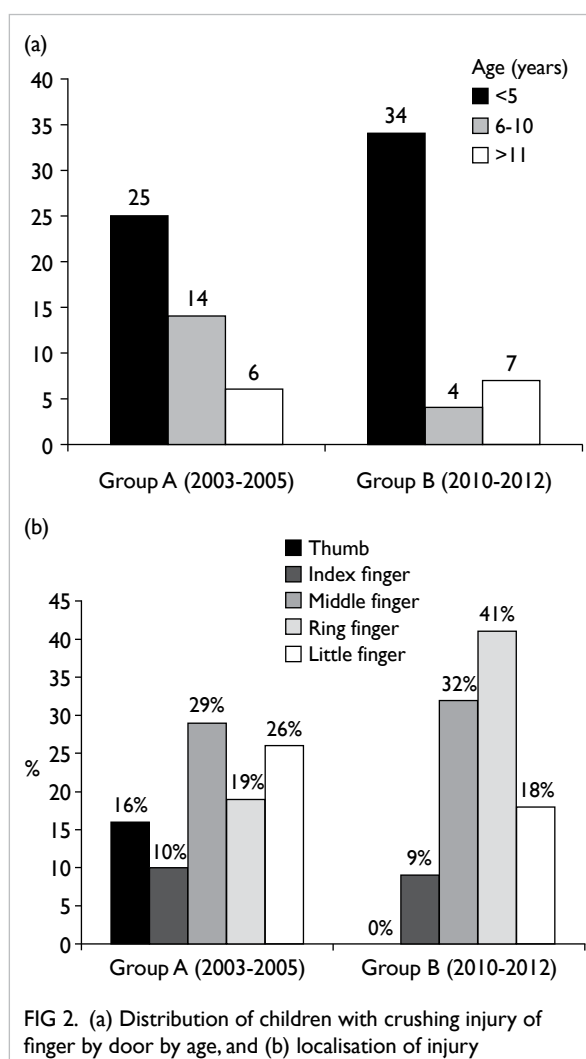
TABLE 1. Mechanism of injury

Mechanism of injury	No. (%) of patients*	
	Group A (2003-2005) [n=137]	Group B (2010-2012) [n=109]
Crush (door)	45 (33)	45 (41)
Sports injury	34 (25)	18 (17)
Cut	21 (15)	15 (14)
Slip and fall	14 (10)	9 (8)
Others	10 (7)	12 (11)
Crush (others)	12 (9)	5 (5)
Unknown	1 (1)	5 (5)

* Because of rounding, not all percentages total 100

TABLE 2. Telephone interviews of parents of children who had crushing injury of finger by door

	No. (%) of patients	
	Group A (2003-2005) [n=43]	Group B (2010-2012) [n=39]
Place of injury		
Home	29 (67)	27 (69)
School	6 (14)	5 (13)
Car	2 (5)	0 (0)
Others	6 (14)	7 (18)
Location of door at home		
Front door	8 (19)	6 (15)
Bedroom	7 (16)	12 (31)
Kitchen	4 (9)	0 (0)
Toilet/bathroom	5 (12)	10 (26)
Others	5 (12)	2 (5)
Unknown	14 (33)	9 (23)
Side of door		
Hinge side	27 (63)	25 (64)
Lock side	14 (33)	9 (23)
Middle of a double door	1 (2)	0 (0)
Unknown	1 (2)	5 (13)
Who closed the door		
Self	8 (19)	9 (23)
Another child	16 (37)	9 (23)
Adult	9 (21)	11 (28)
Spontaneous	9 (21)	5 (13)
Unknown	1 (2)	5 (13)
Presence of adult		
Yes	26 (60)	22 (56)
No	17 (40)	17 (44)



of a double door. The doors were frequently closed by another child—16 (37%) in group A and 9 (23%) in group B and, in more than half of the cases, occurred even in the presence of adults—26 (60%) in group A and 22 (56%) in group B (Table 2).

The types of injury and their relative frequencies were compared between the groups (Table 3). Among the more common injuries were: nailbed injury—22 (31%) in group A and 22 (39%) in group B; fracture—17 (24%) in group A and 13 (23%) in group B; and laceration—17 (24%) in group A and 11 (20%) in group B. Most of the children in both group A (31 [72%]) and group B (30 [77%]) required operation. Among the 31 operations in group A, 21 (68%) were performed under general anaesthesia. By contrast, only 12 (40%) of the 30 operations in group B involved general anaesthesia.

Clinical outcomes were assessed when the telephone interviews were conducted, ie, in 2006 for group A and in 2013 for group B. Most children had a good recovery following treatment. Overall, 42 (98%) of children in group A and 37 (94%) of children in group B reported no pain. Only minor cosmetic problems prevailed in most children, with 34 (79%) in group A and 35 (89%) in group B rating their current level of cosmesis over 7 out of 10 (score 10 = no cosmetic problem). The injuries had minimal adverse effects for most children, with 42 (98%) in

TABLE 3. Types of injury, surgical intervention, and mode of anaesthesia of children having crushing injury of finger by door

	No. (%) of patients	
	Group A (2003-2005)	Group B (2010-2012)
Type of injury*		
Nailbed injury	22 (31)	22 (39)
Fracture	17 (24)	13 (23)
Laceration	17 (24)	11 (20)
Amputation	5 (7)	4 (7)
Contusion	5 (7)	3 (5)
Subungual haematoma	3 (4)	3 (5)
Tendon cut	1 (1)	0
Total	70 (100)	56 (100)
Surgical intervention		
Yes	31 (72)	30 (77)
No	12 (28)	9 (23)
Total	43 (100)	39 (100)
Mode of anaesthesia		
Local anaesthesia	10 (32)	18 (60)
General anaesthesia	21 (68)	12 (40)
Total	31 (100)	30 (100)

* More than one injury might be reported for a child

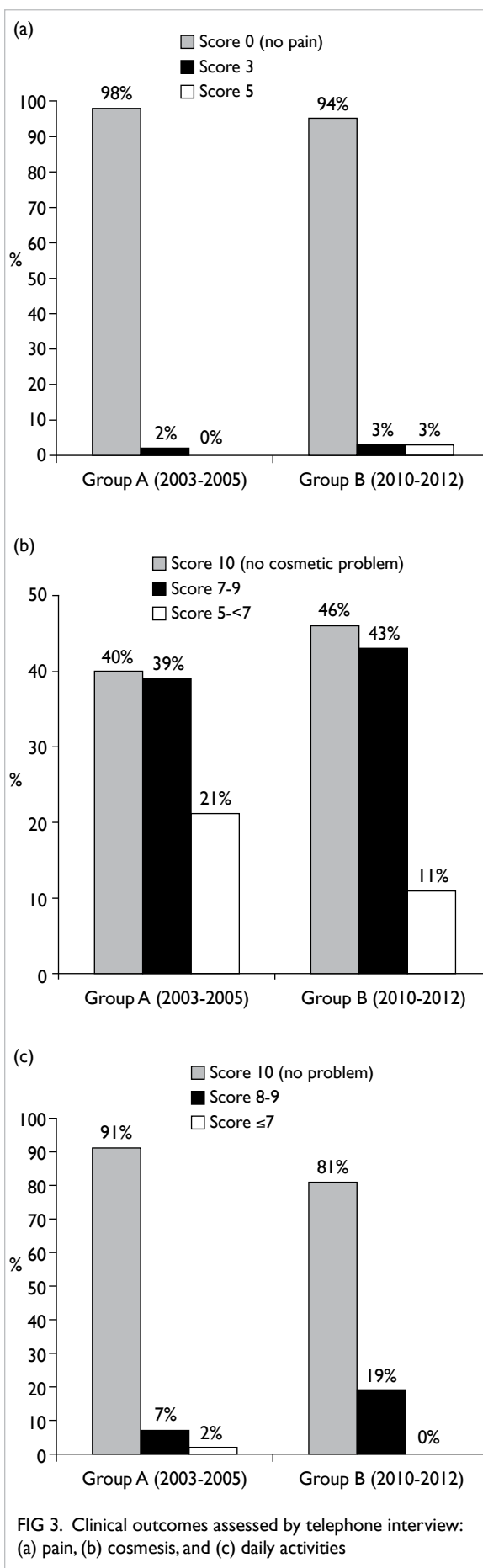


FIG 3. Clinical outcomes assessed by telephone interview: (a) pain, (b) cosmesis, and (c) daily activities

group A and 39 (100%) in group B rated their daily activities with a score over 8 (score 10 = no problem) [Fig 3].

However, five (12%) children in group A and four (10%) children in group B had crushing injury of finger by door resulting in finger amputation. Altogether seven children in groups A and B received replantation or revascularisation, one child underwent open reduction and fixation only, and one had a failed replantation due to failure to locate the arteries intra-operatively.

In group A, one child developed thrombosis following replantation of the right ring finger, requiring a subsequent revascularisation procedure 3 days later. This was complicated by hooknail deformity 1 year post-replantation and was subsequently treated by further reconstructive procedures. The levels of satisfaction in terms of appearance and daily function at final follow-up were rated 5 and 3 (out of 10, with 10 means no cosmetic problem and no problem in daily activities), respectively.

Discussion

Crushing injury of finger by door is common. The true incidence of this type of injury is likely to be higher, as our data were limited to public hospitals so relied on the correct entry of ICD-9-CM codes into the CDARS. Data from the accident and emergency department and private practitioners were not analysed. Furthermore, many minor injuries might have been managed at home and not reported.

Crushing injury of finger by door is not just a local problem. Studies from Saudi Arabia and Glasgow showed that this type of injury accounted for most childhood fingertip injuries in these areas.^{2,3} These injuries consistently occurred at home, with the involved finger being frequently crushed at the hinge side of doors. Younger children were mostly affected. The similarity in epidemiology between the overseas data and our local data can help with recommendations for suitable door safety devices.

In this study, we identified that crushing injury by door was the major cause of paediatric finger injuries leading to hospital admission in both 2003-2005 and 2010-2012. Although most children were satisfied with the level of pain, cosmesis, and daily function of the injured digit at their final follow-up after treatment, serious injuries involving fractures and amputations occurred in a minority of patients. In addition to the surgical intervention and long-term hospitalisation required, these injuries could further lead to detrimental effects on the children's growth and development.

Our study showed the presence of adults did

not reduce the rate of these accidents, since most occurred even in the presence of an adult. This highlights the need for other preventative measures.

Many types of safety devices are easily available and affordable in Hong Kong. As the hinge side of doors is the most common side for fingers to be crushed, finger guard devices can be installed to prevent fingers being trapped in the opposing surfaces. Triangular-shaped rubbers, plastic or wooden stoppers can be inserted at the bottom of a door to prevent spontaneous closure. Magnets applied to the back of a door and its opposing wall surface present another equally effective and simple method of preventing unintended door closures. Dampers can be set up to reduce the speed of closing doors, thereby decreasing the force exerted on trapped fingers. The use of automatic doors should be avoided.

Yet, despite the easy availability and accessibility of these safety devices, there has been no significant change or improvement in terms of incidence and morbidity of children with crushing injury of fingers by door admitted to Prince of Wales Hospital in the 5-year period between 2003-2005 and 2010-2012. Thus, we should promote public awareness about this type of injury and provide more educational programmes on safety precautions in order to reduce the incidence of crushing injury of finger by door.

Conclusions

Crushing injury of finger by door accounts for the most common cause of paediatric finger injury requiring hospitalisation in Hong Kong. These injuries frequently result in hospital admission and surgical intervention, with considerable morbidity and high treatment cost. Crushing injury of finger by door occurs even in the presence of adults. Despite the easily available and affordable preventative measures in Hong Kong, our comparison revealed no significant difference in the incidence, nature, and severity of these domestic injuries between the years 2003-2005 and 2010-2012. Thus, it is our view that more effort should be invested into raising public awareness and education about these preventable injuries and to promote prevention measures.

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