ORIGINAL ARTICLE

Prevalence of household meat grinder-induced severe hand injuries: A retrospective clinical study

İbrahim Gökhan Duman, M.D.

Department of Orthopaedics and Traumatology, Mustafa Kemal University Faculty of Medicine, Hatay-*Türkiye*

ABSTRACT

BACKGROUND: The aim of the study was to evaluate patients with household meat grinder-related hand injuries who presented to our hospital between 2009 and 2020, investigate the causes of these injuries, and discuss prevention methods.

METHODS: Sixty-four patients injured by a meat grinder were retrospectively screened. The patients aged one to 18 years were evaluated in the pediatric group and those over 18 years were evaluated in the adult group. The relationships between age, gender, location of injury (right hand, left hand, wrist, and fingers), and amputation level were analyzed.

RESULTS: Twenty-two of the patients were children, of whom 13 were boys and nine were girls, with a mean age of 11 (range 1–18) years. There were 42 adult patients comprising 15 males and 27 females, and their mean age was 42 (range 19–74) years. In the pediatric group, the rate of amputations at the metacarpophalangeal (MP) and wrist joint levels were significantly higher compared to the adults ($p<0.005$). In the adult group, the rate of amputations at the third finger distal interphalangeal (DIP) joint was significantly higher compared to the pediatric group ($p=0.007$). There was no statistically significant difference between the pediatric and adult groups regarding the rate of amputations at the thumb and little finger levels.

CONCLUSION: There seems to be a lack of research to guide the development of strategies to prevent household meat grinder-related injuries, and this type of injury remains a national health problem. To prevent such injuries, occupational safety should be considered not only in workplaces but also at home, and information should be provided to raise the awareness of the society.

Keywords: Amputation; hand injuries; meat grinder.

INTRODUCTION

The hand has a unique and perfect structure and is perhaps one of the most important organs of human beings that have achieved the current level of industrial and cognitive development. This is also a reason why the hand is the most frequently used part of our body in daily life. Therefore, hand injuries are among the most injured parts of the human body, constituting one of the most common causes of emergency admissions.[1,2] Annually, more than 2.7 million hand and wrist injuries occur in the United States of America (USA) according to the National Emergency Service data.[3]

Hand injuries can have many causes, with one of the major causes being industrial activities.[1,2] More than 10,000 work-related finger amputations are reported annually in the USA. Similarly, in the USA, hand injuries are reported to be very common in working men under the age of 40 years.[1]

The consequences of especially severe traumas, those related to the use of electric saws, electric spiral machines and agricultural machinery, traffic accidents, explosions, and crush injuries can be very dramatic.[4–7] Other causes of hand injuries other than work accidents include non-occupational reasons, sports activities, wars, and accidents related to home and school activities.[8–10] The present study aimed to retrospectively evaluate patients presenting to our hospital with hand injuries caused by meat grinders and discuss possible prevention methods.

Cite this article as: Duman İG. Prevalence of household meat grinder-induced severe hand injuries: A retrospective clinical study. Ulus Travma Acil Cerrahi Derg 2022;28:1622-1626.

Address for correspondence: İbrahim Gökhan Duman, M.D.
Mustafa Kemal Üniversitesi Tıp Fakültesi, Ortopedi ve Travmatoloji Anabilim Dalı, Hatay, Türkiye
Tel: +90 326 - 229 10 00 E-mail: dumanigd@hotmail.com

Ulus Travma Acil Cerrahi Derg 2022;28(11):1622-1626 DOI: 10.14744/tjtes.2021.55866 Submitted: 07.04.2021 Revised: 15.09.2021 Accepted: 25.09.2021
OPEN ACCESS This is an open access article under the CC BY-NC license (http://creativecommons.org/licenses/by-nc/4.0/).

MATERIALS AND METHODS

Patients that presented to our hospital with hand trauma from 2009 to 2020 were retrospectively screened to test the hypothesis whether children would have more fingers and proximal amputations than adults. The study included 64 patients injured with a domestic meat grinder converted from the manual to industrial type with the addition of an electric motor (Fig. 1). Our study included patients whose conditions were too severe to undergo replantation. Cases with attempted replantation were not included in the sample. Injuries related to industrial meat grinders were also excluded from the study. The patients aged 1–18 years were evaluated in the pediatric group and those over 18 years were evaluated in the adult group. The patients were analyzed in terms of their age, gender, location of injury (right hand, left hand, wrist, and finger), and amputation level of the fingers, as well as the relationships between these data. Analyses were also undertaken in terms of the presence of multiple finger injuries in the same patient.

Statistical Analysis

Data obtained were analyzed using the Statistical Package for the Social Sciences v. 18 and presented as numbers and percentages. The Chi-square and Fisher's exact tests were used to compare the rates between the two groups, where appropriate. The statistical significance level was accepted as 0.05.

RESULTS

The data related to the patients' age, gender, location of injury (right hand, left hand, wrist, and fingers), and amputation level distal interphalangeal (DIP), proximal interphalangeal (PIP) and metacarpophalangeal (MP) joints, and wrist are given in Tables 1–4.

In total, 36 (56.3%) of the patients were female and 28 (43.8%) were male. Twenty-two (34.4%) patients were in the pediatric group (median: 11 [min: 1-max: 18] years), and 13 of these patients were boys and nine were girls. The number of adult patients was 42 (65.6%) (median age: 42 [min: 19-max: 74] years), and this group consisted of 15 men and 27 women.

In the pediatric group, the right side was affected in 13 patients and the left side in nine, while in the adult group, the right side was affected in 23 patients and the left side in 19. There was no significant difference between the pediatric and adult groups in terms of gender and affected side.

Figure 1. (a, b) Household meat grinder converted from the industrial type with the addition of an electric motor.

Table 1. Distribution of amputation levels (MP, DIP, and PIP) in the pediatric and adult groups

	Pediatric (n=22, 34.4%)	Adult (n=42, 65.6%)	p
Amputations at the level of the MP joint	21	5	0.016
Amputations distal to the MP joint	28	62	
	12 DIP-16 PIP	49 DIP-13 PIP	0.037
Amputations at the wrist level	4	0	0.012

DIP: Distal interphalangeal; PIP: Proximal interphalangeal; MP: Metacarpophalangeal.

Table 2. Data on the amputation of fingers at the MP and DIP levels

Amputation level	Pediatric	Adult	p
First MP joint	2	0	1.115
Second MP joint	5	1	0.016
Third MP joint	7	1	0.005
Fourth MP joint	5	2	0.042
Fifth MP joint	2	1	1.100
Third DIP joint	3	20	0.007

DIP: Distal interphalangeal; MP: Metacarpophalangeal.

Table 4. Data on multiple finger injuries in the same patient

		Frequency	Valid percent	Cumulative percent
Valid	.00	4	6.3	6.3
	1.00	29	45.3	51.6
	2.00	15	23.4	75.0
	3.00	9	14.1	89.1
	4.00	5	7.8	96.9
	5.00	2	3.1	100.0
	Total	64	100.0	

Table 3. Distribution of age, gender, and affected side in pediatric and adult groups

	Pediatric n=22 (34.4%), median age: 11 (min: 1-max: 18) years	Adult n=42 (65.6%), median age: 42 (min: 19-max: 74) years	p
Gender, male/female	13/9	15/27	0.073
Affected side, right/left	13/9	23/19	0.740

In the pediatric group, the rate of amputations at the MP and wrist joint level was significantly higher compared to the adults (p<0.005) (Fig. 2). In the adult group, the rate of amputations at the third finger DIP joint was significantly higher compared to the pediatric group (p=0.007) (Fig. 3). There was no statistically significant difference between the pedi-

Figure 2. Meat grinder injury in three children. **(a)** MP joint, **(b)** wrist, and **(c)** hand in meat grinder.

Figure 3. Meat-grinder injury in an adult.

atric and adult groups regarding the rate of amputations of the thumb and little fingers.

While 29 patients had only one finger trauma, 31 patients had more than one finger trauma. There were two finger traumas in 15 patients, three finger traumas in nine, four finger traumas in five, and five finger traumas in two.

DISCUSSION

As a result of this study, it was seen that the main cause of hand injuries was meat grinders that were originally manual but converted to home use with the addition of an electric motor. In terms of the amputation level, it was mostly at the level of the MP joint in the pediatric group and fingertip level in adults. All of these patients had been injured with a converted household meat grinder when preparing traditional food stuffed meatballs, kaytaz borek (savory pastry with ground meat), oruk (ground meat and bulgur balls), etc., in their homes in villages or during tomato paste making at home, which is also common in the region.

Hand injuries in our patients were in the form of a single or multiple levels of severely comminuted fractures requiring amputation. Thirkannad reported that while finger rupture among children usually occurred due to traumas caused by a door, window, or a heavy object, which allowed for the replantation of this part, our patients' digits were completely and severely fragmented due to the injury mechanism.[11] In another study, Cardoso et al.[12] evaluated 25 patients (20 children) with meat grinder-related injuries and reported that replantation failed in most digits. Similarly, our patients had injuries that were not suitable for replantation. In a study by Shah et al.[13] evaluating 818,688 hand injuries in patients under the age of 18 years between 1990 and 2009 in the USA, none of the patients had an injury caused by a meat grinder. Pomares et al.[14] conducted a 10-year retrospective study covering the years from 2004 to 2013 and reported meat grinder injuries in only 0.4% of 1715 traumatic amputations. Shields et al.[15] examined non-occupational hand injuries caused by a table saw and stated that children constituted 8.1% of their sample and only 3.2% of the adults were women. In contrast, in our study, 43.8% of the sample were children and 64% of the adults were women. This may be related to traditional food making. In addition, Shields et al. reported that 7.2% of children required finger amputations, of which 33% were at the fingertip level, 28% were partial amputations, and 39% were complete amputations. In our study, amputations among the children were most common at the second, third and fourth MP joints, and four patients were amputated from the wrist. We attributed this more proximal level of amputation (MP joint and wrist) among children to their hands being small and entering the grinding chamber completely. Similarly, the significantly higher rate of long finger amputation at the DIP level in adults compared to children may be related to their ability to reflexively pull their hands faster.

A review of the literature shows that there have been suggestions to develop technologies to stop the saw as soon as the saw blade comes into contact with skin to prevent related accidents.[16,17] In this context, we consider that structural or technological modifications can be made to increase the safety of meat grinders. Özgenel et al.[18] examined serious hand injuries due to tractors in children, but we consider that other severe hand injuries due to meat grinder were overlooked.

In a previous study conducted in Turkey, Işık et al.[19] retrospectively examined 25 patients injured by a threshing machine and reported that 24 of the patients were male, and 60% were under the age of 15 years. In our study, 36 patients were female and 28 were male, and 34.4% of the patients were under 18 years. Işık et al.[19] also emphasized that in regions where the agricultural sector was developed, families mostly engaged in agriculture, and therefore children in schools should be informed by healthcare workers about agricultural accidents and prevention methods. Similarly, we consider that it is important to conduct education and social awareness studies concerning serious injuries due to meat grinder use.

Conclusion

We determined that there was a lack of studies to guide developing countries to prevent household meat grinder-related injuries, and this type of injury remains a health problem of developing countries. To prevent such injuries, occupational safety should be considered not only in workplaces but also in homes, and information should be provided to raise the awareness of the society.

Ethics Committee Approval: This study was approved by the Hatay Mustafa Kemal University Non-interventional Clin-

ical Research Ethics Committee (Date: 11.03.2021, Decision No: 04/26).

Peer-review: Internally peer-reviewed.

Conflict of Interest: None declared.

REFERENCES

1. Kim YH, Choi JH, Chung YK, Kim SW, Kim J. Epidemiologic study of hand and upper extremity injuries by power tools. Arch Plast Surg 2019;46:63–8. [CrossRef]
2. Sozbilen MC, Dastan AE, Gunay H, Kucuk L. A prospective study of angle grinder injuries in the hand sand forearms during a one-year period. Hand Surg Rehabil 2018;37:300–4. [CrossRef]
3. Frank M, Lange J, Napp M, Hecht J, Ekkernkamp A, Hinz P. Accidental circular saw hand injuries: Trauma mechanisms, injury patterns, and accident insurance. Forensic Sci Int 2010;198:74–8. [CrossRef]
4. Ootes D, Lambers KT, Ring DC. The epidemiology of upper extremity injuries presenting to the emergency department in the United States. HAND 2012;7:18–22. [CrossRef]
5. Sritharen Y, Hernandez MC, Zielinski MD, Aho JM. Weekend woodsmen: Overview and comparison of injury patterns associated with power saw and axe utilization in the United States. Am J Emerg Med 2018;36:846–50. [CrossRef]
6. Durusoy R, Davas A, Kayalar M, Bal E, Aksu F, Ada S. What kinds of hand injuries are more likely to result in amputation? An analysis of 6549 hand injuries. J Hand Surg Eur 2011;36:383–91. [CrossRef]
7. Żyluk A, Chrapusta A, Jabłecki J, Romanowski L, Mazurek T. Three-year (2014–2016) activity report of the replantation service for amputated hands in Poland. Pol Przegl Chir 2018;90:10–6. [CrossRef]
8. Aksan AD, Durusoy R, Ada S, Kayalar M, Aksu F, Bal E. Epidemiology of injuries treated at a hand and microsurgery hospital. Acta Orthop Traumatol Turc 2010;44:352–60. [CrossRef]
9. Nauta J, Jespersen E, Verhagen E, van Mechelen W, Wedderkopp N. Upper extremity injuries in Danish children aged 6-12, mechanisms, and risk factors. Scand J Med Sci Sports 2017;27:93–8. [CrossRef]
10. Conn JM, Annest JL, Ryan GW, Budnitz DS. Non-work-related finger amputations in the United States, 2001-2002. Ann Emerg Med 2005;45:630–5. [CrossRef]
11. Thirkannad SM. Mutilating hand injuries in children. Hand Clin 2016;32:477–89. [CrossRef]
12. Cardoso E, Husain MT, Kumar P, Hawary B, Hassanain J. Mutilating meat mincer injuries of the hand. Injury 1990;21:113–4. [CrossRef]
13. Shah SS, Rochette LM, Smith GA. Epidemiology of pediatric hand injuries presenting to United States emergency departments, 1990 to 2009. J Trauma Acute Care Surg 2012;72:1688–94. [CrossRef]
14. Pomares G, Coudane H, Dapa F, Dautel G. Epidemiology of traumatic upper limb amputations. Orthop Traumatol Surg Res 2018;104:273–6.
15. Shields BJ, Wilkins JR, Smith GA. Nonoccupational table saw-related injuries treated in US emergency departments, 1990–2007. J Trauma 201;71:1902–7. [CrossRef]
16. Smith SE, Kendrick I, Huntsman T. Table saw injuries: Are our safety features really keeping us safe? Hand 2018;13:181–3. [CrossRef]
17. Chung KC, Shauver MJ. Table saw injuries: Epidemiology and a proposal for preventive measures. Plast Reconstr Surg 2013;132:777e–83. [CrossRef]
18. Özgenel GY, Akın S, Özbek S, Kahveci R, Özcan M. Severe hand injuries in children related to farm tractors: A report of 70 cases. Ulus Travma Acil Cerrahi Derg 2008;14:299–302.
19. Işık D, Ceylan MF, Tekin H, Karadaş S, Güner S, Canbaz Y. Upper extremity injuries due to threshing machine. Ulus Travma Acil Cerrahi Derg 2012;18:55–60. [CrossRef]

ORİJİNAL ÇALIŞMA - *ÖZ*

Ev tipi kıyma makinesine bağlı şiddetli el yaralanmalarının prevalansı: Geriye dönük bir çalışma

Dr. İbrahim Gökhan Duman

Mustafa Kemal Üniversitesi Tıp Fakültesi, Ortopedi ve Travmatoloji Anabilim Dalı, Hatay

AMAÇ: Bu çalışmanın amacı, 2009–2020 yılları arasında hastanemize başvuran ev tipi kıyma makinesine bağlı el yaralanması bulunan hastaları değerlendirmek, nedenlerini araştırmak ve korunma yollarını tartışmaktır.

GEREÇ VE YÖNTEM: Kıyma makinesi sebebiyle yaralanan 64 hasta geçmişe yönelik olarak tarandı. Hastalardan 1–18 yaş aralığında olanlar çocuk grubuna alınırken, 18 yaş üstü hastalar erişkin grupta değerlendirildi. Hastaların yaşları, cinsiyetleri, sağ el, sol el, el bileği, hangi parmak, parmakların yaralanma seviyeleri arasındaki ilişkiler analiz edildi.

BULGULAR: Hastaların 22'si çocuk, bunların da 13'ü erkek 9'u kadın ve yaş ortalamaları 11 (dağılım 1–18 yaş) idi. Hastaların 42'si erişkin, bunların da 15'i erkek 27'si kadın ve yaş ortalamaları 42 (dağılım19–74 yaş) idi. Çocuk grupta 2. parmak metakarpofalangeal (MP) eklemde anlamlı fark bulundu (p=0.016). Çocuk grupta 3. parmak MP eklemde ileri derecede anlamlı fark bulundu (p=0.005). Çocuk grupta 4. parmak MP eklemde anlamlı fark bulundu (p=0.042). Çocuk grupta el bilek seviyesinde anlamlı fark bulundu (p=0.012). Erişkin grupta sadece 3. parmak distal interfalangeal (DIP) eklemde ileri derecede anlamlı fark bulundu (p=0.007). Birinci ve 5. parmaklarda çocuk ve erişkin yaş grupları arasında anlamlı fark saptanmadı.

TARTIŞMA: Bu tip yaralanmaları önlemek için gerekli çalışmaların yapılmadığı ve ulusal bir sorun olduğu görülmüştür. Ayrıca bu tip yaralanmaları önlemek için iş güvenliği sadece iş yerlerinde değil evler içinde düşünülmeli ve aynı zamanda toplumu bilinçlendirme amacıyla eğitim çalışmaları yapılmalıdır.

Anahtar sözcükler: Ampütasyon; el yaralanmaları; kıyma makinesi.

Ulus Travma Acil Cerrahi Derg 2022;28(11):1622-1626 doi: 10.14744/tjtes.2021.55866