Review article
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Hand injuries sustained while contacting operating electric meat grinders (literature review illustrated with authors' clinical cases)

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Abstract

Introduction Upper limb injuries sustained by children and adults with electric meat grinders in motion are mutilating. These injuries may lead to physical disability and severe psychological consequences not only for the injured subjects, but also for their family members.

Aim Based on current medical literature, to analyze the issues of incidence, etiopathogenesis, clinical symptoms, surgical treatment, rehabilitation, prevention of injuries to the upper limbs sustained with electric meat grinders and to illustrate the material with authors' own clinical cases.

Material and methods The search for scientific publications was carried out in the electronic databases and libraries PubMed, eLibrary.ru, CyberLeninka. The search depth was 47 years. In total, 49 scientific articles were analyzed and studied: 9 domestic sources (18.36 %) and 40 foreign ones (81.64 %).

Results and discussion Epidemiological data show that the incidence of injuries sustained by individuals while contacting with electric meat grinders in motion is 1.4 % to 11.1 % of open injuries to the upper limbs,. The main cause of this type of injury in children is the lack of control by adults, and in adults it is failure to comply with safety measures. The main mechanisms of trauma are traction and rotation. The right hand is most often injured, namely its fingers II, III and IV. Injuries are characterized by traumatic amputations, ruptures and crushing of hand segments. The most important goals of surgical treatment is excision of non-viable tissue, arrest of bleeding, shaping stumps of finger phalanges and metacarpal bones and / or osteosynthesis of broken bones, suturing of vessels and nerves, the maximum possible closure of the soft tissue wound with preserved skin flaps. As preventive measures, it is proposed to inform the population on safety measures by operating electric meat grinders. There should be careful supervision by adults over young children if they are in places where food is prepared. Services of professional butchers are highly recommended.

Conclusion Based on data from 49 scientific articles, information was obtained on the frequency of occurrence, causes, mechanisms, clinical features, surgical treatment, rehabilitation and prevention of severe hand injuries sustained by individuals contacting with operation electric meat grinders.

Keywords: mutilating injuries, upper limb, electric meat grinder, literature review, own case series

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INTRODUCTION

Injuries to the upper limbs caused by contact with operating electric meat grinders are mutilating [1, 2]. These injuries may lead to disability due to the loss of fingers or the entire hand [3, 4]. The relevance of the problem is also due to the fact that mutilating hand injuries have extremely severe psychological consequences not only for the injured individual but also for his/her family members [5].

Purpose Based on current medical literature, to analyze the issues of incidence, etiopathogenesis, clinical symptoms, surgical treatment, rehabilitation, prevention of injuries to the upper limbs sustained while contacting with electric meat grinders and to illustrate the material with authors' own clinical cases.

MATERIALS AND METHODS

The search for publications on the problem of upper limb injuries caused by operating electric meat grinders was carried out in the electronic databases and libraries PubMed, eLibrary.ru, CyberLeninka. The search depth was 47 years.

The search for literature sources was conducted using the following keywords: crippling injuries of upper limbs, working electric meat grinders.

The study used the following criteria for inclusion of scientific publications in the literature review: systematic reviews devoted to open hand injuries, monocentric cohort studies and clinical cases describing the treatment tactics and treatment outcomes of patients who sustained upper limb injuries with working electric meat grinders. A total of 49 scientific articles were analyzed, reflecting the most pressing issues and aspects of the topic under study: 9 domestic literary sources (18.36 %) and 40 foreign ones (81.64 %).

RESULTS AND DISCUSSION

There are few scientific articles in current medical literature devoted to injuries to the upper limbs caused with electric meat grinders. Suffice it to say that a group of Uzbek authors in their scientific work published in 2017 reported that they were unable to find publications devoted to this topic in current scientific information search systems [6]. At the same time, there are a large number of reports in electronic media in various countries about cases of hand injuries sustained with electric meat grinders in children and adults. Thus, in 2013 alone, the Occupational Safety and Health Administration in the United States officially recorded more than 4,000 cases of this type of injury [7].

The relevance of the topic under discussion is evidenced by the fact that to date the incidence of upper limb injuries caused by electric meat grinders in the structure of open hand injuries is not reliably known. It can be judged from indirect data provided in publications. Thus, Russian authors inform readers that among 70 children with open fractures and wounds of the hand, 1.4 % of the injured were contacting with working electric meat grinders [8]. According to Greek authors, 7 % of children under four years of age sustained severe hand injuries while contacting with various machines and tools [9]. A group of Chinese surgeons reports that in 11.1 % of cases, purulent tenosynovitis of the hand and forearm in the patients they examined was caused by injuries sustained during careless handling of electric meat grinders [10].

Table 1 presents information about scientific publications in which the authors describe their experience in providing medical care to patients with upper limb injuries resulting from contact with working electric meat grinders.

Table 1

Scientific publications on injuries of the upper limbs in children and adults sustained while contacting with electric meat grinders

No	Authors and reference list number	Quantitative characteristics by patients' age			
		children		adults	
		Number of case	Mean age, months	Number of case	Mean age, years
1.	Al-Arabi et al. [11]	22	21		
2.	Ibrahim et al. [12]	1	24		
3.	Ezhov et al. [13]	1	33		
4.	Novruzov et al. [6]	13	29		
5.	Cardoso et al. [14]	20	–	5	–
6.	Kassa [2]	2	36	1	24
7.	Yaldiran et al. [15]	13	–	49	–
8.	Duman [16]	22	132	42	42
9.	Al-Hassani et al. [17]			1	23
10.	Brandner et al. [18]			3	37
11.	Gearing et al. [19]			2	35
12.	Green et al. [20]			1	45
13.	Kinoschito et al. [21]			1	39
14.	Lubis [22]			3	24
15.	Patial et al. [23]			2	25
16.	Maajiid et al. [24]			1	29
Total		94		111	

As follows from the information in the table, four articles are devoted to the description of injuries only among children [6, 12, 13, 21], four publications describe injuries in children and adults [2, 14, 15, 16] and eight scientific papers characterize limb wounds, treatment tactics and treatment outcomes in patients over 18 years of age [17–24]. In total, the authors of scientific articles describe clinical cases of 94 children of average age (39 ± 6) months and 111 adults of average age (32 ± 1.8) years.

The main cause of injuries to small children is their curiosity and interest when, without adult supervision, they put their fingers into the mouth of a working electric meat grinder [12, 18]. Teenagers, as a rule, injure their hands when they use their fingers instead of a special device (pusher) to push pieces of meat onto a rotating auger [15]. Injuries to adult patients are mainly associated with violations of safety precautions in the food industry and at home [7, 25, 26]. Thus, Iranian authors report 49 typical errors they have uncovered, caused by personal, managerial and organizational factors that can lead to severe injuries to the hands of the personnel working with electric meat grinders [27].

The right hand is mostly injured [17, 22, 28], since the right hand is dominant in most people and, therefore, involved in most functions [2, 29]. However, there are frequent cases when the left upper limb is also injured [30, 31].

All injured patients are delivered to medical institutions with their hands trapped in electric meat grinders [6]. The authors of almost all the scientific articles named in Table 1 provide illustrations of the patients before removing their injured hands from the electric meat grinders.

The first and most important stage of providing medical care to such patients is adequate pain relief, which allows not only to alleviate the suffering but also to begin the fastest possible removal of the hand from electrical devices [21]. Most authors use the experience of special services for these purposes, often calling them directly to the operating rooms. Thus, Al-Hassani et al. involved the regional civil defense service of Qatar removal [17]; Gearing et al. called the fire brigade

of the Australian city in which they worked [19]; Turkish doctors invited a rescue team with a special circular saw [12]; Indian surgeons used a welding machine to cut a meat grinder and to free a trapped hand [23]. Domestic surgeons involved specialists from the Ministry of Emergency Situations, who own special power equipment to free the hand of a girl, aged 2 years 9 months, trapped in an electric meat grinder [13]. While providing emergency medical care to 13 children with their hands trapped in electric meat grinders, a group of traumatologists from Uzbekistan used household electric saws of the "Bulgarian" type in 8 (61.5 %) cases, and a manual reverse (reverse unscrewing) technique with an adjustable wrench in 5 (38.5 %) cases [6]. Egyptian microsurgeons report a higher number of using the reverse unscrewing technique. Thus, Abdelmegeed et al. state that this technique was effective in 80 % (n = 4) of cases, and only one teenager required the use of a circular saw [32].

The same manual reverse technique was effective in freeing the trapped hands of two children and one adult reparted by Kassa BG [2]. It was used in a single case and then described in a scientific article by Green et al. [20]. Indonesian surgeons successfully used manual reverse method with an adjustable wrench on three female meat-processing workers aged 23, 24, and 25 [22]. An unusual method of freeing a hand trapped in an electric meat grinder was used by Indian doctors who delivered a 29-year-old man from the hospital to a nearby auto repair shop, where auto mechanics were able to remove the injured hand from the electric meat grinder. The decision was made after a medical consultation and preliminary agreement with the auto repair shop workers. Patient's transportation and the process of cutting the electric meat grinder was carried out under adequate anesthetic support and medical supervision [6, 24].

After the injured limbs are removed from the electric meat grinders, the severity of the injuries should be assessed [33]. Based on the design and operating principle of the electric meat grinders, it becomes clear that the main mechanisms that injure the hand are traction/rotation and grinding/crushing [1, 25, 34]. Sharma et al. call such a combined impact of traumatic forces on the upper limb "unique mechanism" [36]. Multidirectional and at the same time coordinated actions of damaging forces lead to severe multiple contusions, crushing, smashing and ruptures of the skin, muscles, ligaments, tendons, vessels and nerves of the limb trapped in the meat grinder, open multi-level fractures of the phalanges of the fingers, metacarpal bones, wrist bones, and in some cases, the distal metaphysis of the forearm bones [23, 34].

Matveev et al. in a scientific article devoted to open wounds of the hand cite more than 30 existing and used in clinical practice classifications of these types of injuries [37]. In domestic traumatology, the most used classification is that of Gromov et al., according to which the injuries resulting from the action of working electric meat grinders should be classified as group V, traumatic amputations (complete and incomplete), avulsions and crushing of fingers and other segments of the hand [38].

The stages of surgical treatment of the injured include arrest of bleeding, excision of non-viable tissue, wound sanitation, formation of stumps of the phalanges of the fingers and metacarpal bones and/or osteosynthesis of broken bones, suturing of vessels and nerves, maximum possible "closure" of the soft tissue wound with intact or minimally injured simple or combined skin flaps [33, 35]. Surgical treatment of the wound should be carried out sparingly in order to preserve the maximum possible volume of the anatomical structures of the hand [13, 39]. Impaired blood circulation and innervation, development of inflammation are the main causes of necrosis of those anatomical structures of the hand that surgeons try to preserve during primary surgical treatment of wounds [14]. Immediately after the formation of stumps, all injured patients are prescribed a course of antibacterial therapy. As medications, cephalosporins of the 1st–3rd generations (ceftriaxone, cefazolin, cefuroxime,

etc.) are used in age-related dosages [8]. In cases of particularly severe injuries to the upper limb, patients are prescribed antimicrobial and antiprotozoal drugs. Thus, Navruzov et al. gave preference to metronidazole, administered intravenously by drip for 6–7 days [6].

Being in contact with rotating electrical equipment, including meat grinders, the phalanges of the fingers and metacarpal bones are the most frequently affected anatomical structures of the hand [19, 40, 41, 42]. Analysis of literature sources shows that amputations at the level of the phalanges of the fingers or disarticulations at the level of the interphalangeal, metacarpophalangeal joints and proximally are performed frequently involving the 2nd, 3rd and 4th digits [12, 17] (Fig. 1). The 5th digit in combination with the listed fingers is less affected [2, 13].

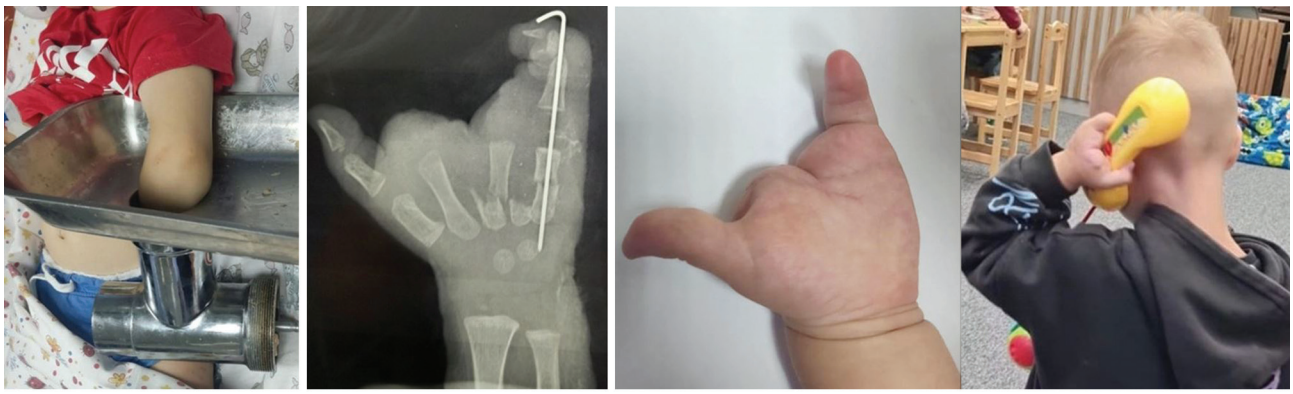

Fig. 1 A crippling injury to the left upper limb in a 1.5-year-old child: *a* the child's left hand is in an electric meat grinder; *b* an X-ray of the left hand, direct view; *c* the child's left hand one year after the injury (authors' case, August 2022)

Duman, based on the experience of treating 22 children and 42 adults with open hand injuries resulting from patients' contact with electric meat grinders, reports that in the children's the incidence of disarticulations at the level of the metacarpophalangeal and wrist joints is statistically significantly higher compared to the group of adult patients [16] (Fig. 2). However, there are also cases of "high" amputation among adult patients. Thus, Patial et al. describe a clinical case of a 22-year-old man who underwent emergency disarticulation at the level of the wrist joint. He sustained a hand injury while grinding meat in an electric meat grinder. The authors of the article particularly emphasized the fact that after the hand wound had healed, the patient refused a hand prosthesis [23].

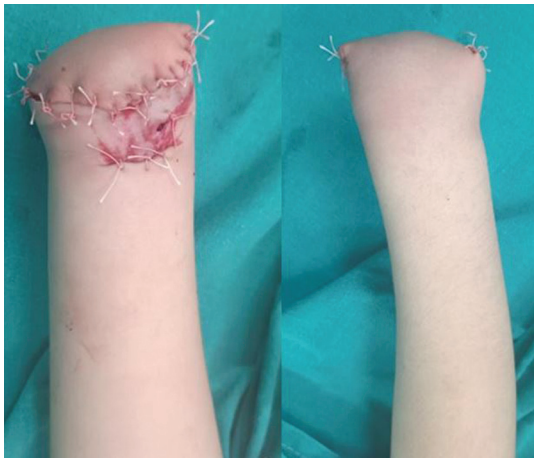

Fig. 2 Stump of the right forearm formed in a four-year-old child after a crippling injury resulting from trapping the hand in a working electric meat grinder (authors' case, September 2023)

F. del Pinal formulated a goal, which, in his opinion, should be sought when providing assistance to patients injured by an electric meat grinder. He named it "acceptable hand". The author describes "a hand with three fingers, one of which is the first, the fingers are of almost normal length and retain almost normal sensitivity." But the author does not report anything about the patients' requirements for the functional state of the hand with amputated fingers [43]. However, most authors dealing with the problem of hand injuries attach primary importance to the residual functional state

of the injured limb [44, 45]. According to Chinese surgeons, Tsai et al., to achieve a satisfactory functional state of the injured limb in pediatric patients, it is necessary to use aggressive treatment methods, including early reconstruction and rehabilitation [46]. Sozbilen et al. are convinced that the final treatment results in children with hand injuries are better than in adults with similar severe injuries [47].

In some countries, mainly in the Muslim world, upper limb injuries resulting from contact with working electric meat grinders have been and are currently considered a national health problem [16, 48]. According to Yildiran et al., this is due to centuries-old traditions of sacrificing domestic animals during holidays, and it is on these days that the incidence of various limb injuries, including those caused by working electric meat grinders, increases [15].

As a preventive measure, it is necessary to inform better the population about the importance of safety measures when working with electric meat grinders and to illustrate the consequences of injuries, no matter how shocking they may be for the population [2, 19, 23]. Stronger supervision of young children by adults in places where food is prepared [9, 49] and the invitation of professional butchers at public holidays are also effective ways to prevent hand injuries caused by electric meat grinders [15].

CONCLUSION

In pursuit of the goal set in this study, we analyzed 49 current scientific publications covering the issues of incidence, etiopathogenesis, clinical symptoms, surgical treatment, rehabilitation and prevention of hand injuries sustained by contact with operating electric meat grinders. In the structure of open injuries of the upper limbs, these injuries accounts for 1.4 to 11.1 % of cases. The 2nd, 3rd and 4th digits of the right hand are mainly injured. The most important stages of surgical treatment are arrest of bleeding, excision of non-viable tissues, formation of stumps of the phalanges of the fingers and metacarpal bones and/or osteosynthesis of broken bones, suturing of vessels and nerves, the maximum possible closure of the soft tissue wound with the available skin flaps. As preventive measures, it is proposed to inform the population about safety precautions when operating electric meat grinders, good supervision of young children by adults in places where food is prepared, and invitation of professional butchers.

Conflict of interests *The authors declare that they have no conflict of interest regarding the study presented.*

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REFERENCES

1. Ahmad RS, Heng PRW. Crush Injuries of the Hand Part I: History, Mechanism and Pathomechanics [Internet]. In: Salgado AA. (ed.) *Essentials of Hand Surgery*. 2018. doi: 10.5772/intechopen.76658.
2. Kassa BG. Meat grinder Hand injuries: serial cases. *MOJ Clin Med Case Rep*. 2017;6(6):135-137. doi: 10.15406/mojcr.2017.06.00179.
3. Koryukov AA. Hand defects in children. Part I: etiology, clinical and radiological features and pathophysiological disorders. *Bulletin of St. Petersburg University*. 2010;(2):99-111. (In Russ.).
4. Shengxiang W. Clinical comprehend of hand injury caused by meat grinder with microsurgery techniques. *China Modern Medicine*. 2011;1:1-6.
5. Thirkannad SM. Mutilating Hand Injuries in Children. *Hand Clin*. 2016;32(4):477-489. doi: 10.1016/j.hcl.2016.07.007.
6. Navruzov SY, Nizov ON, Musaev TS, et al. Treatment issues of hand and fingers opened injuries in children at tractional-crushing injuries by electric meat-chopper. *Bulletin of emergency medicine*. 2017;X(1):23-28. (In Russ.).
7. United States. Occupational Safety and Health Administration, issuing body. *Preventing Cuts and Amputations from Food Slicers and Meat Grinders*. Occupational Safety and Health Administration, U.S. Department of Labor, 2015. Available from: https://www.osha.gov/Publications/OSHA3794.pdf. Accessed Aug 11, 2024.
8. Gordienko II, Tsap NA, Sosnovskikh AK, Borisov SA. Treatment of open injuries of the hand in children. *Medical Bulletin of the North Caucasus*. 2018;13(3):482-485. doi: 10.14300/mnnc.2018.1308.
9. Panagopoulou P, Antonopoulos CN, Iakovakis I, et al. Traumatic hand amputations among children in Greece: epidemiology and prevention potential. *Inj Prev*. 2012;18(5):309-314. doi: 10.1136/injuryprev-2011-040121.

10. Wang H, Xia F, Xing DM, et al. Effects of vacuum sealing drainage technique in acute and chronic suppurative tenosynovitis of hand. *Zhonghua Wai Ke Za Zhi*. 2017;55(5):384-388. (In Chin.) doi: 10.3760/cma.j.issn.0529-5815.2017.05.015.
11. Al-Arabi KM, Sabet NA. Severe mincer injuries of the hand in children in Saudi Arabia. *J Hand Surg Br*. 1984;9(3):249-250. doi: 10.1016/0266-7681(84)90034-2.
12. Ibrahim HS, Ilker E, Taskoparan H. Meat grinder hand injury; case report. *Int J Surg Case Rep*. 2022;91:106768. doi: 10.1016/j.ijscr.2022.106768.
13. Ezhov AA, Dovgal DA. A clinical case of posttraumatic recovery of functional capability of the hand in a child. *Polytrauma*. 2016;(3):68-78. (In Russ.).
14. Cardoso E, Husain MT, Kumar P, et al. Mutilating meat mincer injuries of the hand. *Injury*. 1990;21(2):113-114. doi: 10.1016/0020-1383(90)90068-6.
15. Yidiran G, Selimoglu M, Karamese M, et al. A periodical increase in hand injures: The sacrifice feast. *Hand Microsurg*. 2015;4(2):28-31. doi: 10.5455/handmicrosurg.176227.
16. Duman İG. Prevalence of household meat grinder-induced severe hand injuries: A retrospective clinical study. *Ulus Travma Acil Cerrahi Derg*. 2022;28(11):1622-1626. doi: 10.14744/tjtes.2021.55866.
17. Al-Hassani A, Wahlen BM, Ayasa MAM, et al. Meat grinder injury of the arm: how to extract an arm safe, fast and pain free: case report and literature review. *J Surg Case Rep*. 2022;2022(2):rjac001. doi: 10.1093/jscr/rjac001.
18. Brandner M, Bunkis J, Trengove-Jones G. Meat grinder injuries to the upper extremity. *Ann Plast Surg*. 1985;14(5):454-457. doi: 10.1097/00000637-198505000-00009.
19. Gearing PF, Goldie S, Barton R, Ramakrishnan A. Handy extrication methods for meat grinder injuries: a case series. *ANZ J Surg*. 2023;93(3):743-745. doi: 10.1111/ans.17959.
20. Green DP, Terry GC, Whittemore AK. Extrication of the hand from a meat grinder. *J Trauma*. 1975;15(1):32-35. doi: 10.1097/00005373-197501000-00005.
21. Kinoshita H, Sato N, Mimura S, et al. Anesthetic induction and endotracheal intubation in the sitting position due to the fixed forearm caught by a meat grinder. *Braz J Anesthesiol*. 2023;73(2):227-229. doi: 10.1016/j.bjane.2021.07.030.
22. Lubis NR. Meat grinder injury to the hand: serial cases. J Indonesian Orthop. 2012;40(3):29-34.
23. Patial T, Mittal RK, Garg R, Shah S, Kaur A. Grinder Injury of the Hand: A Rare but Devastating Occupational Hazard. *Surg J (N Y)*. 2021;7(4):e297-e300. doi: 10.1055/s-0041-1735902.
24. Maajid S, Lal T, Bhat TA, et al. Salvaging an entrapped hand unusual injury, unusual management. *MOJ Orthop Rheumatol*. 2017;7(6):11-12. doi: 10.15406/mojor.2017.07.00293.
25. Kringstad O, Dahlin LB, Rosberg HE. Hand injuries in an older population - a retrospective cohort study from a single hand surgery centre. *BMC Musculoskelet Disord*. 2019;20(1):245. doi: 10.1186/s12891-019-2617-x.
26. Smith GS, Wellman HM, Sorock GS, et al. Injuries at work in the US adult population: contributions to the total injury burden. *Am J Public Health*. 2005;95(7):1213-1219. doi: 10.2105/AJPH.2004.049338.
27. Mohammadian M, Choobineh AR, Nave ARM. Human errors identification in operation grinder using TAFEL technique. *J Occup Health and Epidemiol*. 2012;1(3):171-181. doi: 10.18869/acadpub.johe.1.3.171.
28. Bhatti DS, Ain NU, Fatima M. Occupational Hand-Related Injuries at a Major Tertiary Care Burn and Reconstructive Center in Pakistan. *Cureus*. 2020;12(9):e10444. doi: 10.7759/cureus.10444.
29. Abebe MW. Common causes and types of hand injuries and their pattern of occurrence in Yekatit 12 Hospital, Addis Ababa, Ethiopia. *Pan Afr Med J*. 2019;33:142. doi: 10.11604/pamj.2019.33.142.18390.
30. 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(1-3):74-78. doi: 10.1016/j.forsciint.2010.01.003.
31. Hey HW, Seet CM. Hand injuries seen at an emergency department in Singapore. *Eur J Emerg Med*. 2010;17(6):343-345. doi: 10.1097/MEJ.0b013e32833777c4.
32. Abdelmegeed AG, Saied S, Hifny MA. Meat grinder hand injury in children: A report of 5 cases. *Ann Chir Plast Esthet*. 2023;68(3):275-278. doi: 10.1016/j.anplas.2022.12.001.
33. Georgescu AV, Battiston B. Mangled upper extremity: Our strategy of reconstruction and clinical results. *Injury*. 2021;52(12):3588-3604. doi: 10.1016/j.injury.2021.04.004.
34. Nizov ON, Minaev TR, Yuldashev AA, et al. Choice of the treatment's tactics for avulsional and crashed injuries of the hand and fingers. *Bulletin of emergency medicine*. 2013;(2):10-15. (In Russ.).
35. Minaev TR, Yuldashev AA, Nizov ON, et al. Combined skin drafting at scalping defect of I-V fingers. *Bulletin of emergency medicine*. 2017;10(1):62-68. (In Russ.).
36. Sharma A, Sankhe M. A Proposed Classification for Sugarcane Crusher Injuries of the Hand and Its Correlation with Patient Rated Outcome Scores at 6 Months. *J Hand Surg Asian Pac Vol*. 2022;27(2):267-275. doi: 10.1142/S2424835522500382.
37. Matveev RP, Petrushin AL. Problems of classification and terminology of open hand injuries (review). *Traumatology and orthopedics of Russia*. 2011;17(2):191-198. (In Russ.) doi: 10.21823/2311-2905-2011-0-2-191-198.
38. Gromov MV, Lazarev AA, Korshunov VF. To the question of the classification of open injuries of the hand. *Orthopedics and traumatology*. 1977;(6):84-85. (In Russ.).
39. Miranda BH, Spilsbury ZP, Rosala-Hallas A, Cerovac S. Hand trauma: A prospective observational study reporting diagnostic concordance in emergency hand trauma which supports centralised service improvements. *J Plast Reconstr Aesthet Surg*. 2016;69(10):1397-402. doi: 10.1016/j.bjps.2016.06.030.
40. Shevtsov VI, Shabalin DA, Popova LA, Danilkin MYu. The ways of the hand first finger and ray formation using the technique of controlled transosseous osteosynthesis worked out at RISC «RTO». *Genij Ortopedii*. 2009;(2):17-21. (In Russ.).
41. Abu-Sittah GS, El Khatib AM, Dibo SA. Thermal injury to the hand: review of the literature. *Ann Burns Fire Disasters*. 2011; 24(4):175-185.
42. Harris C, Madonic D, Hartka TR. Lawn mower injuries presenting to the emergency department: 2005 to 2015. *Am J Emerg Med*. 2018;36(9):1565-1569. doi: 10.1016/j.ajem.2018.01.031.
43. del Piñal F. Severe mutilating injuries to the hand: guidelines for organizing the chaos. *J Plast Reconstr Aesthet Surg*. 2007;60(7):816-827. doi: 10.1016/j.bjps.2007.02.019.

44. Gordon AM, Malik AT, Goyal KS. Trends of hand injuries presenting to US emergency departments: A 10-year national analysis. *Am J Emerg Med*. 2021;50:466-471. doi: 10.1016/j.ajem.2021.08.059.
45. Neumeister MW, Brown RE. Mutilating hand injuries: principles and management. *Hand Clin*. 2003;19(1):1-15, v. doi: 10.1016/s0749-0712(02)00141-5.
46. Tsai YJ, Carvajal CF, Flores NM, et al. Reconstruction of pediatric hand injuries caused by automatic cup-sealing machines in Taiwan. *J Int Med Res*. 2019;47(11):5855-5866. doi: 10.1177/0300060519874540.
47. Sozbilen MC, Dastan AE, Gunay H, Kucuk L. One-year prospective analysis of hand and forearm injuries in children. *J Pediatr Orthop B*. 2021;30(4):364-370. doi: 10.1097/BPB.0000000000000802.
48. Hagie FE. Meat grinder accidents in children. *J Indiana State Med Assoc*. 1949;42:234.
49. 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(6):1688-1694. doi: 10.1097/TA.0b013e31824a4c5b.

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