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Meat Grinder–related Hand Injuries: A 50-year Systematic Review of Case Reports and Series

Abdullah M. Alhusain, MBBS*†
Sultan Alshaalan, MBBS‡
Jullanar Alkhunein, MBBS§
Abdulaziz Alghamdi, MBBS¶
Fatima Alhije, MBBS‖
Fay Alaowid, MBBS§
Abdulaziz K. Alhujayri, MBBS, SB-Plast*†

Background: Meat grinder–related hand injuries often result in severe tissue damage, including deep lacerations, avulsions, and amputations, leading to significant functional impairments. This systematic review examines injury characteristics, management approaches, and outcomes, based on published case reports and series.

Methods: A systematic review following PRISMA guidelines was conducted using MEDLINE, PubMed, Web of Science, and the Cochrane Library. English-language case reports and series from January 1975 to June 2024 were analyzed for demographics, injury patterns, treatments, and outcomes.

Results: Thirteen studies comprising 121 patients were included, with a slight female predominance (52.89%). Patient ages ranged from 1 to 42 years, and 21.48% presented with hands still entrapped. Fingers were the most frequently injured site (31.40%). Initial management involved debridement (12.39%) and amputations (9.09%). Microsurgical revascularization was attempted in 4.95% of cases. Follow-up data revealed sensory deficits in 57.14% and motor deficits in 46.42% of patients. Only 3 patients utilized prostheses.

Conclusions: Meat grinder–related hand injuries present significant management challenges, with low replantation rates and high rates of long-term functional deficits. Despite surgical interventions, persistent impairments remain common. Further research is necessary to refine treatment protocols and improve patient outcomes.
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INTRODUCTION

Upper extremity injuries are among the most frequently encountered presentations in emergency departments, accounting for approximately 10% of all traumas.[1] According to the Nationwide Emergency Department Sample, more than 2.7 million traumatic hand and wrist injuries are treated annually in emergency departments across the United States, with more than 10,000 work-related finger amputations reported each year, often attributed to industrial machinery.[2,3]

Among the broad spectrum of hand injuries, meat grinder–related injuries represent a significant concern within the occupational and medical health fields.[4,5] These incidents occur when an individual's hand becomes entangled with the moving parts of a meat grinder, leading to varying degrees of tissue loss. These injuries range from minor lacerations to severe avulsions, potentially leading to partial or complete finger amputation, extensive hand mutilation, and significant tissue and nerve damage.[6]

Meat grinders rank among the top 10 objects involved in hand amputations for both men and women, with a 90% amputation rate for patients presenting with such complaints in emergency departments.[7] Employees in commercial and manufacturing sectors are typically at higher risk of meat grinder–related injuries due to their frequent interaction with this machinery.[6–8] Other studies have also reported incidents occurring at home, particularly among the pediatric population.[9,10]

*From the *Division of Plastic Surgery, Department of Surgery, King Abdulaziz Medical City, Ministry of National Guard - Health Affairs, Riyadh, Saudi Arabia; †King Abdullah International Medical Research Center, Riyadh, Saudi Arabia; ‡Plastic and Reconstructive Surgery Department, King Khaled University Hospital; §College Of Medicine, King Saud bin Abdulaziz University for Health Sciences, Riyadh, Saudi Arabia; ¶College Of Medicine, King Saud bin Abdulaziz University for Health Sciences, Jeddah, Saudi Arabia; and ‖College Of Medicine, Imam Abdulrahman Bin Faisal University, Dammam, Saudi Arabia.*

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Hand and wrist injuries are the most expensive type of injury, surpassing the costs associated with knee injuries, lower limb fractures, and skull and brain trauma.[11] They often require invasive medical interventions and extended rehabilitation, with productivity losses surpassing direct healthcare costs.[12–14] The devastating impact of hand injuries caused by meat grinders underscores the need for comprehensive care and support. Effective prevention strategies and early intervention are crucial to mitigate the substantial costs and improve patient outcomes. This systematic review aims to evaluate the cases of meat grinder–related hand injuries published in the literature.

Takeaways

Question: This study assesses the prevalence and characteristics of hand injuries caused by meat grinders and identifies common treatment strategies, complications, and outcomes.

Findings: A systematic review of 13 studies involving 121 patients revealed that meat grinder–related hand injuries cause severe trauma, with many cases involving amputations. Most injuries affected the right hand, with fingers being the most frequently impacted. Debridement and amputation were the primary surgical interventions, whereas complications such as necrosis and infections occurred in some cases.

Meaning: Meat grinder–related hand injuries result in significant trauma, often requiring complex surgical intervention and rehabilitation, emphasizing the need for preventive measures.

METHODOLOGY

This systematic review aimed to gather and evaluate the key characteristics of meat grinder–related hand injury case reports and series published in the literature. The review follows guidelines from the PROSPERO-registered protocol (registration number: CRD42024553666).

INCLUSION AND EXCLUSION CRITERIA

We included studies evaluating hand injuries caused by meat grinders published in English from January 1975 to June 2024. Eligible designs were case reports and case series. Studies that did not specifically focus on meat grinder–related hand injuries, non-English publications, nonhuman research, and studies published before January 1975 were excluded.

SEARCH STRATEGY

A comprehensive literature search was conducted in MEDLINE, PubMed, Web of Science, and the Cochrane Library. The search terms included combinations of keywords such as

- "hand injury*" OR "hand trauma" OR "hand damage"
- "meat grinder*" OR "meat mincer" OR "meat grinding machine"
- "traumatic injury*" OR "crush injury*" OR "laceration*" OR "amputation*"
- "treatment outcome*" OR "surgical treatment" OR "recovery" OR "rehabilitation"
- "prevention and control" OR "safety measure*" OR "preventive measure*" OR "safety protocol*"

These terms were combined using Boolean operators (AND, OR) to create a comprehensive and systematic search strategy. The searches were limited to English-language articles published between January 1975 and June 2024. To ensure comprehensive coverage, reference lists of relevant articles were also manually searched.

During the identification phase, a total of 530 records were retrieved across the databases: 88 from MEDLINE, 63 from PubMed, 321 from Web of Science, 8 from the Cochrane Library, and 50 from Wiley Online Library. After removing duplicates, 412 unique records were screened by title and abstract.

STUDY SELECTION AND DATA EXTRACTION

Two independent reviewers screened the 412 records by title and abstract, followed by full-text reviews for 18 articles, applying the inclusion and exclusion criteria. Pilot testing of the study selection process was conducted to ensure consistency. Out of the 18 full-text articles reviewed, 5 were excluded due to study design, leaving 13 articles for inclusion in the final review.[15] Discrepancies during the selection process were resolved through discussion or seeking input from a third reviewer. Data extraction was performed using a standardized and pilot-tested form, capturing details on study characteristics, population demographics, injury mechanisms, clinical findings, treatment methods, outcomes, and preventive measures. Data extraction was conducted independently by 2 reviewers, with any discrepancies resolved through discussion or consultation with a third reviewer. The detailed process of identification, screening, and inclusion of studies is visually summarized in the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) flow chart (Fig. 1).

RISK-OF-BIAS ASSESSMENT

The risk of bias was assessed using the Newcastle-Ottawa scale for observational cohort studies and the Critical Appraisal Skills Programmed checklists for case series and case reports. The Newcastle-Ottawa scale evaluated selection, comparability, and outcomes, whereas the Critical Appraisal Skills Programmed checklists assessed the clarity of aims, appropriateness of methodology, definition of cases, data collection methods, analysis, conclusions, context within existing knowledge, ethical approval, and declaration of competing interests. Any discrepancies in the risk-of-bias assessment were resolved through consensus. Comprehensive details of the risk-of-bias assessment process and results are included in the appendix.

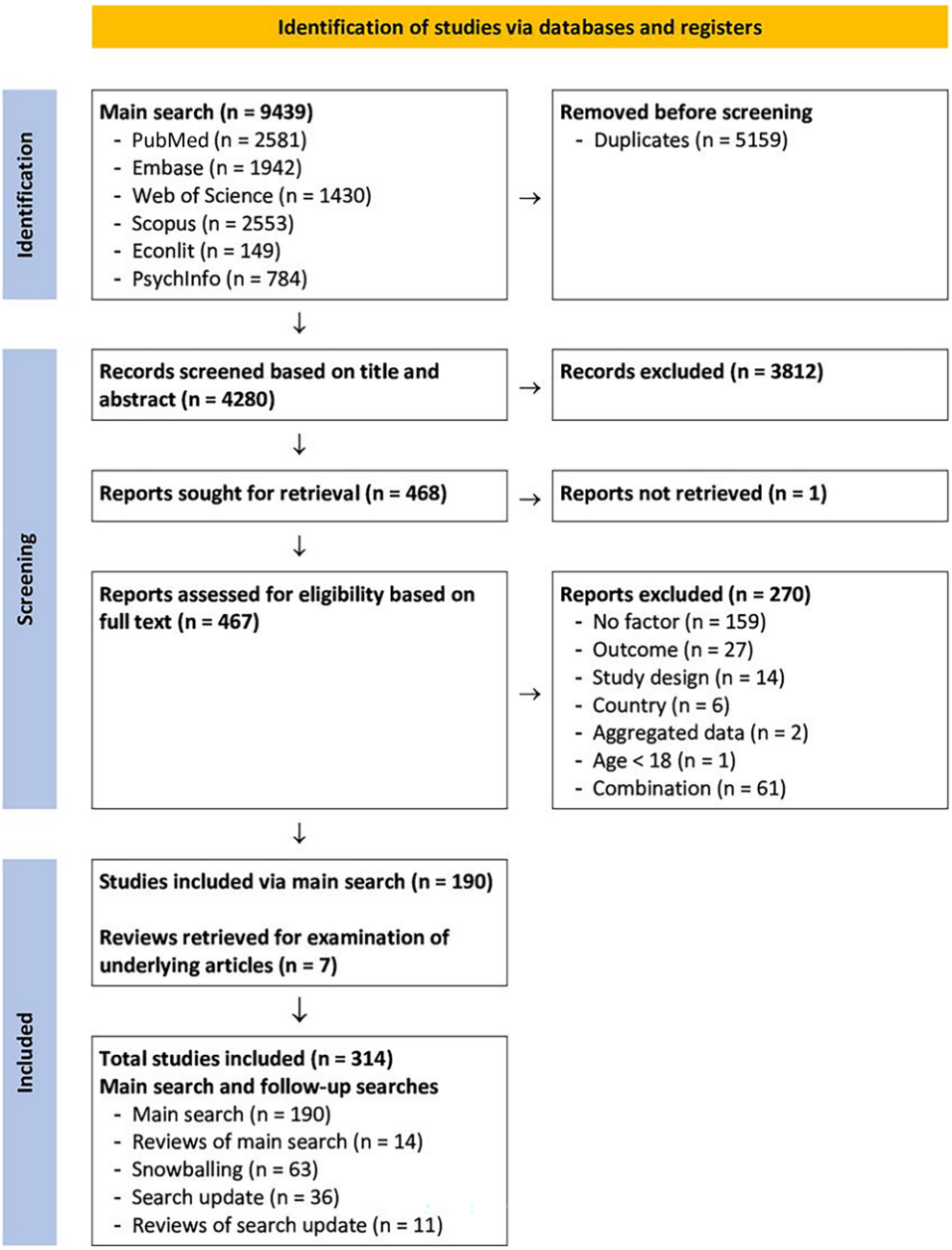

Fig. 1. PRISMA 2020 flow diagram for new systematic reviews, which included searches of databases and registers only.

STATISTICAL DATA ANALYSIS

Data from included sources were presented as frequencies, percentages, means, and ranges. When applicable, the sum of the frequencies from the solitary studies was analyzed using JMP Pro software version 15 (IMP Statistical Discovery LLC, Cary, NC) and presented as frequencies and percentages.

REPORTING

The review adhered to PRISMA guidelines. Findings are presented using flow charts and data extraction tables to enhance clarity and transparency. Ethical considerations were followed per institutional guidelines, and no ethical approval was required as the study involved secondary data analysis.

RESULTS

Search Results and Study Selection

An initial database search using the keywords yielded 530 results. After the titles, abstracts, and full-text screening, 13 studies were eligible for inclusion in this systematic review[5,6,16] (Abdelmegeed et al, 2022) (Fig. 1, PRISMA).

Table 1. Characteristics of the Included Patients and Studies

Author, Year	Country	Type of Study	No. Patients	Sex, n (%)	Age, y
Cardoso et al, 1990[17]	Saudi Arabia	Case series	25	Male: 15 (60.00); female: 10 (40.00)	NR
Abdelmegeed et al, 2022[18]	Egypt	Case series	3	Male: 2 (66.66); female: 1 (33.33)	Range: 3–8
Hassan Salad Ibrahim et al, 2022[19]	Somalia	Case report	1	Male: 1 (100.00)	2
Berhe Gebreslassie Kassa, 2017[20]	Ethiopia	Case series	3	Male: 2 (66.66); female: 1 (33.33)	Range: 2–24
Deepak Hongaiah et al, 2019[21]	India	Case series	12	Male: 3 (25.00); female: 9 (75.00)	Range: 20–30
Gearing et al, 2023[22]	Australia	Case series	2	Female: 2 (100.00)	Range: 25–46
Lubis, 2012[16]	Indonesia	Case series	3	Female: 3 (100.00)	Range: 23–24
Al-Hassani et al, 2022[23]	Qatar	Case report	1	Male: 1 (100.00)	23
Duman, 2022[24]	Turkey	Case series	64	Male: 28 (43.75); female: 36 (56.25)	Pediatric age group: mean: 11 and range: 1–18; adult age group: mean: 42 andrange: 19–74
Patial et al, 2021[5]	India	Case series	2	Male: 2 (100.00)	22–29
Brandner et al, 1985[6]	The United States	Case series	3	Male: 1 (33.33); female: 2 (66.66)	17–39
Green et al, 1975[15]	The United States	Case report	1	Male: 1 (100.00)	17
Buncke et al, 2003[25]	The United States	Case series	1	NR	6
Total	—	—	121	Male: 56 (46.28); female: 64 (52.89)	—

NR, not reported.

Study Characteristics

The total number of patients included in this systematic review was 121 (range: 1–64). Female patients were slightly higher in number than male patients, with 64 (52.89%) being women. The United States contributed 3 studies (23.07%), the highest among the included studies. The ages of the included patients ranged from 1 to 42 years (Table 1).

Clinical Presentations

Twenty-six (21.48%) patients arrived at the hospital with their hands still attached to the meat grinders. The majority of the injuries involved the right hand (n = 78, 64.46%), and fingers were the most frequently injured part (38 patients, 31.40%), followed by wrist injuries (13 patients, 10.74%).[7] Complete amputations were reported in 14 cases (11.57%), and crush injuries in 13 cases (10.74%) (Table 2).

Surgical Management and Complications

Surgical management and its details have been reported for 23 (19.00%) patients. The rest of the patients had no reported details regarding their management (n = 98, 81.00%). The most frequently reported surgical procedure was debridement of dead tissue, performed in 15 (12.39%) patients. Amputation was necessary in 11 (9.09%) patients. Microsurgical revascularization was attempted in 6 (4.95%) patients. Surgical complications included necrosis in 4 (3.30%) cases and infection in 2 (1.65%) cases.[20] Out of the 6 microscopic revascularization attempts, 4 (66.66%) cases had successful outcomes, whereas the other 2 (33.33%) did not report the outcomes (Table 3).

Follow-up and Prognosis

Follow-up information was available for 28 (23.14%) patients, with the follow-up period ranging from 5 to 90 days. Of the patients who underwent amputation, only 3 (10.71%) were reported to be using prosthetic hands. At the final follow-up, sensory dysfunction was noted in 16 (57.14%) patients, motor dysfunction in 13 (46.42%), tender scars in 12 (42.85%), and joint stiffness or contracture in 10 (35.71%) patients (Table 4).

DISCUSSION

This systematic review included 13 case reports and series (Fig. 1, PRISMA), evaluating a total of 121 patients with mutilating hand injuries caused by meat grinders. The patients' ages ranged from 1 to 42 years, with a notable prevalence among women, who represented 52.89% of the cases. Injuries from meat grinders are common home accidents, often resulting from misuse or mishaps with the operating machinery. Despite the widespread use of this appliance and the low incidence of reported injuries, it has the potential to cause serious upper limb trauma. A recent study conducted at an emergency clinic found that meat grinders were responsible for 7 (0.4%) incidences of traumatic upper limb amputation.[26] Furthermore, children frequently sustain hand injuries as a result of their innate curiosity. Incidence peaks at ages 1–4 and 15–19, with men being more affected.[27]

A large portion of patients present to the emergency department with their hands firmly entrapped in the meat grinder.[22,16] Notably, this review reports an entrapment rate of 21.48% (n = 26). The predominance of right-hand injuries (64.46%) can be attributed to the fact

Table 2. Clinical Presentations of the Included Patients

Author, Year	The Grinder Machine Was Still Attached to the Hand on Presentation	Hand Laterality, n (%)			Level of Injury, n (%)			No. Injured Fingers, if Any	Type of Injury in Fingers, Metacarpals, or Wrists, n (%)		
		Right	Left	Bilateral	Fingers	Metacarpals	Wrist		Amputation	Laceration	Crush
Cardoso et al, 1990[17]	7 (28.00%)	19 (76.00)	6 (24.00)	0	NR	NR	NR	89	NR	NR	NR
Abdelmegeed et al, 2022	3 (100.00%)	2 (66.66)	1 (33.33)	0	1 (33.33)	0	2 (66.66)	3	0	0	3 (100.00)
Hassan Salad Ibrahim et al, 2022	1 (100.00%)	1 (100.00)	0	0	1 (100.00)	1 (100.00)	0	3	0	1 (100.00)	1 (100.00)
Berhe Gebreslassie Kassa, 2017	3 (100.00%)	3 (100.00)	0	0	3 (100.00)	0	0	Range: 4–5 fingers	0	3 (100.00)	3 (100.00)
Deepak Hongaiah et al, 2019	NR	9 (75.00)	3 (25.00)	0	12 (100.00)	0	0	Range: 1–4 fingers	7 (58.30)	5 (41.70)	NR
Gearing et al, 2023[22]	2 (100.00%)	2 (100.00)	0	0	2 (100.00)	1 (50.00)	0	8	1 (50.00)	0	1 (50.00)
Lubis, 2012[16]	3 (100.00%)	1 (33.33)	2 (66.66)	0	3 (100.00)	1 (33.33)	0	8	2 (66.66)	1 (33.33)	
Al-Hassani et al, 2022[23]	1 (100.00%)	1 (100.00)	0	0	1 (100.00)	1 (100.00)	1 (100.00)	3	1 (100.00)	1 (100.00)	1 (100.00)
Duman, 2022[24]	NR	36 (56.25)	28 (43.75)	0	NR	NR	4 (6.25)	116	NR	NR	NR
Patial et al, 2021[5]	2 (100.00%)	1 (50.00)	1 (50.00)	0	0	0	2 (100.00)	10	0	0	2 (100.00)
Brandner et al, 1985[6]	2 (66.66%)	1 (33.33)	NR	0	2 (66.66)	1 (33.33)	0	12	1 (33.33)	0	2 (66.66)
Green et al, 1975[15]	1 (100.00%)	1 (100.00)	0	0	0	0	1 (100.00)	5	1 (100.00)	0	0
Buncke et al, 2003[25]	1 (100.00%)	1 (100.00)	0	0	0	0	1 (100.00)	5	1 (100.00)	0	0
Total	26 (21.48%)	78 (64.46)	41 (33.88)	0	38 (31.40)	8 (6.61)	13 (10.74)	259	14 (11.57)	11 (9.09)	13 (10.74)

NR, not reported.

Table 3. Surgical Management and Complications of the Included Patients

Author, Year	Surgical Management, n (%)								Surgical Complications, n (%)	
	Amputation	Debridement	Microscopic Revascularization	Tendon Repair	Nerve Repair	Skin Graft	K-wire Fixation and Splinting	Others	Necrosis	Infection
Cardoso et al, 1990[17]	NR	NR	2 (8.00)	NR	NR	2 (8.00)	NR	25 (28.08) fingers were viable, and 64 (71.91) fingers were unsalvageable	NR	NR
Abdelmegeed et al, 2022	2 (66.66)	3 (100.00)	1 (33.33)	1 (33.33)	1 (33.33)	0	0	—	0	0
Hassan Salad Ibrahim et al, 2022	0	1 (100.00)	0	1 (100.00)	0	0	1 (100.00)	—	0	0
Berhe Gebreslassie Kassa, 2017	2 (66.66)	3 (100.00)	0	0	0	0	2 (66.66)	—	2 (66.66)	2 (66.66)
Deepak Hongaiah et al, 2019	NR	NR	NR	1 (8.30)	NR	NR	NR	—	NR	NR
Gearing et al, 2023[22]	2 (100.00)	1 (50.00)	1 (50.00)	0	1 (50.00)	0	0	—	2 (100.00)	0
Lubis, 2012[16]	2 (66.66)	1 (33.33)	1 (33.33)	1 (33.33)	0	1 (33.33)	1 (33.33)	—	0	0
Al-Hassani et al, 2022[23]	1 (100.00)	1 (100.00)	0	1 (100)	0	0	1 (100.00)	Carpal tunnel release	0	0
Duman, 2022[24]	NR	NR	NR	NR	NR	NR	NR	—	NR	NR
Patial et al, 2021[5]	2 (100.00)	1 (50.00)	0	0	0	0	0	—	0	0
Brandner et al, 1985[6]	2 (66.66)	2 (66.66)	1 (33.33)	1 (33.33)	1 (33.33)	0	1 (33.33)	—	0	0
Green et al, 1975[15]	1 (100.00)	1 (100.00)	0	0	0	0	0		0	0
Buncke et al, 2003[25]	1 (100.00)	1 (100.00)	NR	NR	NR	NR	NR	Great toe-to-thumb transplant	0	0
Total	11 (9.09)	15 (12.39)	6 (4.95)	6 (4.95)	3 (2.47)	3 (2.47)	6 (4.95)	—	4 (3.30)	2 (1.65)

NR, not reported.

Table 4. Follow-up and Prognosis of the Included Patients

Author, Year	Follow-up Duration, d	No. Patients With Follow-up, n (%)	Use of Prosthetic Hand in the Case of Amputation, n (%)	Clinical Outcome in the Last Follow-up in the Case of Nonamputation, n (%)						
				Healed Amputation Site	Motor Dysfunction	Sensory Dysfunction	Tender Scar	Delayed Healing	Deformity	Joint Stiffness/ Contracture
Cardoso et al, 1990[17]	Mean: 9.1 (average: 5–52)	NR	NR	NR	The 25 digits that survived showed an overall functional impairment of 15%–20%	The 25 digits that survived showed an overall functional impairment of 15%–20%	0	0	0	0
Abdelmegeed et al, 2022	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Hassan Salad Ibrahim et al, 2022	14	1 (100.00)	0	0	0	0	0	0	0	0
Berhe Gebreslassie Kassa, 2017	Mean: 14.6 (range 9–21)	3 (100.00)	NR	2 (66.66)	2 (66.66)	2 (66.66)	0	0	0	0
Deepak Hongaiah et al, 2019	NR	12 (100.00)	0	0	0	3 (25.00)	12 (100.00)	2 (16.70)	0	10 (83.30)
Gearing et al, 2023[22]	90	2 (100.00)	1 (50.00)	2 (100.00)	2 (100.00)	2 (100.00)	0	0	2 (100.00)	0
Lubis, 2012[16]	Range: 3–70	3 (100.00)	0	2 (66.66)	2 (66.66)	2 (66.66)	0	0	0	0
Al-Hassani et al, 2022[23]	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Duman, 2022[24]	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Patial et al, 2021[5]	NR	2 (100.00)	1 (50.00)	2 (100.00)	2 (100.00)	2 (100.00)	0	0	0	0
Brandner et al, 1985[6]	NR	3 (100.00)	0	3 (100.00)	3 (100.00)	3 (100.00)	0	0	0	0
Green et al, 1975[15]	NR	1 (100.00)	1 (100.00)	1 (100.00)	1 (100.00)	1 (100.00)	0	1 (100.00)	0	0
Buncke et al, 2003[25]	NR	1 (100.00)	0	1 (100.00)	1 (100.00)	1 (100.00)	0	0	0	0
Total	—	28 (23.14)	3 (10.71)	13 (46.42)	13 (46.42)	16 (57.14)	12 (42.85)	3 (10.71)	2 (7.14)	10 (35.71)

NR, not reported.

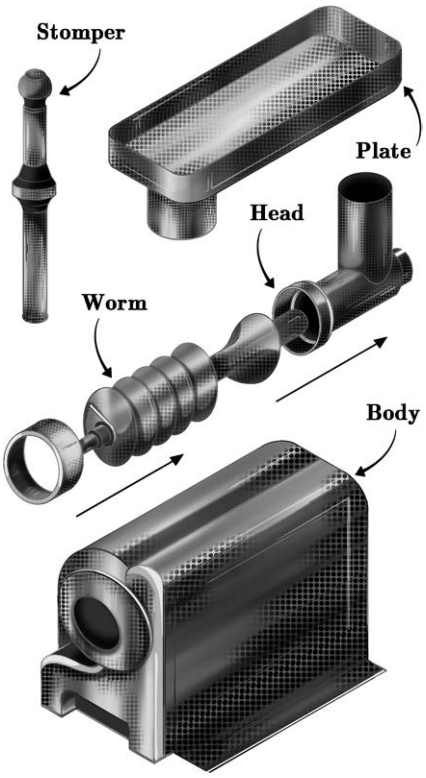

Fig. 2. Diagrammatic representation of a commercial meat grinder.

that many of these injuries occur in the dominant hand, often leading to significant disability.[6,22] The fingers were the most frequently reported site of injury, accounting for 31.40%. Similarly, a study of 64 patients with household meat grinder injuries reported that fingers were the most affected site and accounted for the majority of amputations.[24]

Patients entangled in meat grinder machines are usually found in a flexed position, their arms lodged within. As a result, establishing anesthesia with early limb extraction is the primary concern. An initial attempt to extract the damaged limb from the meat grinder can be made by reversing the "worm" mechanism, rotating the handle counterclockwise, or making cuts with an angle grinder, as shown in the structure in Figure 2.[15] If this is not possible, patients must be transported to the operating theater immediately to begin the extraction of the ischemic limb (Fig. 3).[22,23,15] Amputated body parts should be assessed immediately to ensure that replantation can be attempted. They serve as essential tissue for reconstruction but must be handled appropriately, wrapped in saline-moistened gauze, and cooled promptly.[28,29]

Debridement was one of the most prevalent initial treatments for meat grinder hand injuries (12.39%), followed by surgical amputation (9.09%) as shown in Table 3. It involves removing damaged tissue while preserving functional structures. After debridement, fracture management is an important step in salvageable hand injuries to prevent complications, with 4.95% of patients undergoing

Fig. 3. Demonstrating a case reported by the author of the article. A 28-year-old man, medically free, with a case of right-hand entrapment in a meat grinder, sustaining a degloving injury of the palmar skin with multiple deep wounds over the fingers. He underwent right-hand wound exploration, right index, middle, ring, and little finger digital nerve repair, and tendon repair. The patient underwent closed reduction and internal fixation with K-wires for middle and ring finger phalangeal fractures.

Kirschner wire fixation and splinting to support recovery.[30] In this review, only 4.95% of patients received revascularization via arterial and venous anastomosis, followed by tendon and nerve repair attempted in 4.95% of cases. Skin grafts were used in 2.47% of patients, and in the context of reconstructive surgery for hand injuries, especially in children, during an emergency operation, skin grafting is considered if primary closure cannot be achieved.[25] Studies indicate that meat grinder–related hand injuries have the lowest rate of reimplantation survival due to the extensive nature of these injuries.[7,17,24] In cases of severe tissue loss, amputation is the standard treatment.[6,9]

Surgical complications that may arise following the postoperative period can include stiffness, contracture, necrosis, infection, delayed healing, scar tenderness, and sensory or motor dysfunction. However, they can be classified into short-term and long-term complications, which can be monitored during the follow-up period.[31] As demonstrated in Table 3, infection was observed in 1.6% of cases and is commonly associated with extensive soft tissue damage. Necrosis was seen in 3.30% of patients in this review.

The long-term follow-up results revealed a significant deficit in both sensory and motor function, with overall poor functional outcomes. Nearly half of the patients who were following up reported sensory and/or motor dysfunction. These unfavorable results are directly related to the extensive nature of the finger injuries.[17] Such severe injuries may also limit the use of prostheses after amputation. In this review, only 3 patients reported using a prosthesis.[32]

Hand injuries impose a significant burden on both healthcare systems and affected individuals. These injuries often result in varying degrees of lasting disability, hindering patients from resuming their former jobs.[33] The age group mostly impacted by these productivity costs ranges from 20 to 64, with an estimated cost of $192 million attributed to missed work in the Netherlands.[11] In addition to direct financial implications, amputations and severe hand injuries greatly diminish quality of life. Many affected workers report adverse impact on their daily activities, sports participation, and housework.[34] Furthermore, these injuries can contribute to anxiety and depression stemming from functional impairment and altered body image.[35]

The present systematic review has several limitations. First, only 13 case reports and series were included due to the underreporting of meat grinder injuries in the existing literature. A larger dataset is needed to provide a more comprehensive assessment. Second, the analysis was impacted by the large number of missing variables throughout the reported studies, which affected the analysis and potentially led to a skewed overall picture. Third, the heterogeneity of the included articles is one of the noted limitations in this study. The majority of the articles did not report case-by-case surgical management and follow-up findings. Instead, they reported their findings out of the total. This fact limited our ability to obtain accurate data on the management and follow-up. The existence of such gaps proves that further dedicated studies are needed to demonstrate a more general coherent picture of the more significant impact of meat grinders on the overall burden of hand and upper extremity injuries. Future studies should present detailed information on the management plan, number of attempted procedures, and follow-up findings for each included case.

CONCLUSIONS

In conclusion, this systematic review underscores the severe and often debilitating nature of meat grinder–related hand injuries, which pose significant risks in both occupational and domestic settings. The findings reveal a concerning prevalence of these injuries, particularly among women and younger populations, highlighting the urgent need for enhanced safety measures and preventive strategies. The extensive tissue damage resulting from such incidents frequently necessitates invasive surgical interventions. Despite surgical efforts, many patients experience minimal recovery from sensory and motor deficits, which can severely impact their ability to return to previous occupations and engage in daily activities. In addition, the critical gap in the existing literature emphasizes the necessity for more comprehensive research to better understand the full scope of meat grinder–related injuries and their management and outcomes. Future studies should focus on establishing standardized reporting protocols and investigating the effectiveness of preventive measures, including user training and mechanical safety enhancements.

Abdullah M. Alhusain, MBBS
Division of Plastic Surgery, Department of Surgery
Ministry of National Guard - Health Affairs
22490 Riyadh 11426, Saudi Arabia; and
King Abdullah International Medical Research Center
Riyadh 11481, Saudi Arabia
E-mail: alhusainab@mngha.med.sa

DISCLOSURE

The authors have no financial interest to declare in relation to the content of this article.

REFERENCES

1. 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.
2. Wenzinger E, Rivera-Barrios A, Gonzalez G, et al. Trends in upper extremity injuries presenting to US emergency departments. *Hand*. 2019;14:408–412.
3. Kim YH, Choi JH, Chung YK, et al. Epidemiologic study of hand and upper extremity injuries by power tools. *Arch Plast Surg*. 2019;46:63–68.
4. Occupational Safety and Health Administration, Labor Department. Preventing cuts and amputations from food slicers and meat grinders. 2015. Available at https://www.govinfo.gov/app/details/GOVPUB-L35-PURL-gpo154447. Accessed June 11, 2024.
5. Patial T, Mittal RK, Garg R, et al. Grinder injury of the hand: a rare but devastating occupational hazard. *Surg J*. 2021;7:e297–e300.
6. Brandner M, Bunkis J, Trengove-Jones G. Meat grinder injuries to the upper extremity. *Ann Plast Surg*. 1985;14:454–457.
7. Durusoy R, Davas A, Kayalar M, et al. What kinds of hand injuries are more likely to result in amputation? An analysis of 6549 hand injuries. *J Hand Surg Eur Vol*. 2011;36:383–391.

8. Boyle D, Parker D, Larson C, et al. Nature, incidence, and cause of work-related amputations in Minnesota. *Am J Ind Med.* 2000;37:542–550.
9. Abdelmegeed AG, Saied S, Hifny MA. Meat grinder hand injury in children: a report of 5 cases. *Ann Chir Plast Esthet.* 2023;68:275–278.
10. Yildiran G, Selimoglu M, Karamese M, et al. A periodical increase in hand injuries: the sacrifice feast. *Hand Microsurg.* 2015;4:28.
11. De Putter CE, Selles RW, Polinder S, et al. Economic impact of hand and wrist injuries: health-care costs and productivity costs in a population-based study. *J Bone Joint Surg Am.* 2012;94:e56.
12. O'sullivan ME, Colville J. The economic impact of hand injuries. *J Hand Surg.* 1993;18:395–398.
13. Michaels AJ, Michaels CE, Smith JS, et al. Outcome from injury: general health, work status, and satisfaction 12 months after trauma. *J Trauma.* 2000;48:841–848; discussion 848.
14. Rosberg HE, Carlsson KS, Dahlin LB. Prospective study of patients with injuries to the hand and forearm: costs, function, and general health. *Scand J Plast Reconstr Surg Hand Surg.* 2005;39:360–369.
15. Green DP, Terry GC, Whittemore AK. Extrication of the hand from a meat grinder. *J Trauma.* 1975;15:32–35.
16. Lubis NR. Meat grinder injury to the hand: serial cases. *J Indonesian Orthop.* 2012;40:90615.
17. Cardoso E, Husain MT, Kumar P, et al. Mutilating meat mincer injuries of the hand. *Injury.* 1990;21:113–114.
18. Abdelmegeed AG, Saied S, Hifny MA. Meat grinder hand injury in children: a report of 5 cases. *Ann Chir Plast Esthet.* 2023;68:275–278.
19. Ibrahim HS, Ilker E, Taskoparan H. Meat grinder hand injury; case report. *Int J Surg Case Rep.* 2022;91:106768.
20. Kassa BG. Meat grinder hand injuries: serial cases. *MOJ Clin Med Case Rep.* 2017;6:135–137.
21. Hongaiah D, Kumar D, Kumar SV. Mixer grinder finger tip injuries and treatment outcome in a rural based tertiary center: a retrospective study. *Int Surg J.* 2019;6:2458–2463.
22. Gearing PF, Goldie S, Barton R, et al. Handy extrication methods for meat grinder injuries: a case series. *ANZ J Surg.* 2023;93:743–745.
23. Al-Hassani A, Wahlen BM, Ayasa MA, 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:rjac001.
24. Duman IG. Prevalence of household meat grinder-induced severe hand injuries: a retrospective clinical study. *Ulus Travma Acil Cerrahi Derg.* 2022;28:1622–1626.
25. Buncke GM, Buntic RF, Romeo O. Pediatric mutilating hand injuries. *Hand Clin.* 2003;19:121–131.
26. Pomares G, Coudane H, Dap F, et al. Epidemiology of traumatic upper limb amputations. *Orthop Traumatol Surg Res.* 2018;104:273–276.
27. Thirkannad SM. Mutilating hand injuries in children. *Hand Clin.* 2016;32:477–489.
28. Hegge T, Neumeister MW. Mutilated hand injuries. *Clin Plast Surg.* 2011;38:543–550.
29. Wilhelmi BJ, Lee WA, Pagensteert GI, et al. Replantation in the mutilated hand. *Hand Clin.* 2003;19:89–120.
30. Freeland AE, Lineaweaver WC, Lindley SG. Fracture fixation in the mutilated hand. *Hand Clin.* 2003;19:51–61.
31. Neumeister M, Hegge T, Amalfi A, et al. The reconstruction of the mutilated hand. *Semin Plast Surg.* 2010;24:077–102.
32. Salminger S, Roche AD, Sturma A, et al. Hand transplantation versus hand prosthetics: pros and cons. *Curr Surg Rep.* 2016;4:1–7.
33. Hung LK, Ho KK, Leung PC. Impairment of hand function and loss of earning capacity after occupational hand injury: prospective cohort study. *Hong Kong Med J.* 1999;5:245–250.
34. Boyle D, Larson C, Parker D, et al. Medical, personal, and occupational outcomes for work-related amputations in Minnesota. *Am J Ind Med.* 2000;37:551–557.
35. Grob M, Papadopulos NA, Zimmermann A, et al. The psychological impact of severe hand injury. *J Hand Surg Eur Vol.* 2008;33:358–362.