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Case Report

Hand Injuries Due to Top Loader Automatic Washing Machine: Experience from Oman with Three Case Reports and Literature Review

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Abstract

Washing machines are common in most households and crucial for laundry management. However, they are associated with risks, especially in children. In this report, we present three cases of severe hand injuries in pediatric patients that resulted from attempts to unload laundry while the washing machine was still spinning. Fortunately, in all three cases, the injured hands were successfully treated with revascularization of the affected parts. Compared to revision amputation or other reconstructive techniques, finger replantation and revascularization offer the most favorable outcomes. Several preventive strategies, such as more parental supervision and thorough appliance safety training, can reduce the likelihood of such injuries. Increasing awareness and promoting safe practices can drastically reduce the frequency of potentially fatal accidents.

Keywords: Hand Injuries, Washing machine, Revascularization.

Introduction

Injuries from washing machines are a serious problem, particularly for young children. In the United States, 19,109 injuries related to washing machines were reported between 1993 and 2000. An estimated 11,000 or more children in the United States are injured by washing machines each year, according to the National Electronic Injury Surveillance System (NEISS) of the Consumer Product Safety Commission (CPSC) [1]. In the past, injuries from earlier washing machine generations—especially those with manually operated rollers—have generally involved soft tissue and skin damage and have been less severe. With these older models, fractures were uncommon [2] However, more serious injuries surfaced as electrically powered washing machines increased, especially in the 1930s when wringer machines were widely used [3]. Successful interventions highlight the importance of treating hand trauma with advanced surgical techniques and timely medical attention [4]. Various studies have shown the positive outcomes of digital replantation and revascularization procedures in trauma centers due to specialized microsurgical expertise [5]. In addition, putting safety procedures into place and distributing educational materials about possible risks to both adult and pediatric audiences can be crucial in reducing these traumatic events.

Case Presentation 1

A 12-year-old boy tried to remove a piece of cloth from a spinning washing machine and seriously injured his right index finger. Examination of the finger revealed significant soft tissue damage, severe twisting, and an ischemic appearance. A significant portion of the dorsal skin was degloved and there was a circumferential wound at the level of the proximal phalanx. The ischemia time

was four hours (Figure 2). The radiographs showed a diaphyseal fracture in the proximal phalanx, however, there was no damage to the metacarpophalangeal joint.

Figure 1: Wringer washing machine.

Figure 2.1: Twisted and Ischemic Right index finger

Figure 2.2: X-rays showing the fracture of proximal phalanx.

Figure 2.3: Post revascularization and K wire fixation of the index finger

After the initial management, the patient was shifted to the operating room so that the finger could be salvaged through revascularization. The intraoperative findings confirmed a twisted, ischemic digit with intact flexor tendons, both digital arteries were avulsed, while the extensor tendon and both digital nerves were intact. After all wounds were thoroughly debrided, a single axial 1mm K-wire was used to stabilize the skeleton. Under a microscope, 10-0 nylon sutures were used to repair the radial digital artery.

Despite extensive degloving of the dorsal skin, the two dorsal veins were identified and successfully repaired, leading to improved finger perfusion. The hand was immobilized in a splint and the patient was admitted to our hospital for close inpatient observation for 5 days. The postoperative period was uneventful and the patient was discharged after 5 days. The patient had good Vascularity and gained adequate function of the finger in the follow-up period.

Case Presentation 2

A 54-year-old man was trying to get a piece of cloth out of a spinning washing machine when he suffered a severe twisting injury to his right index finger. He arrived at the hospital seven hours after the injury. On physical examination, the finger presented with a double-level crush injury, appearing deformed, twisted, and congested, with no detectable circulation.

X-rays showed a fracture of the middle phalanx that was fragmented into several pieces (as depicted in Figure 3.2). Subsequently, the patient was moved to the operating room for an immediate vascular intervention. Intraoperative findings included a severe crush injury with circumferential lacerations in the middle and proximal phalanges and the finger twisted around the intact flexor tendons. Both digital nerves were avulsed with the distal stumps absent, and both the radial and ulnar digital arteries were cut. The middle phalanx head (P2) had a bicondylar fracture with comminution.

Figure 3.1: Injured Index finger with absent distal vascularity.

Figure 3.2: X-ray showing comminuted fracture of the middle phalanx.

The ulnar digital artery was repaired under a microscope with 10-0 nylon sutures. Two veins were also successfully repaired: a dorsal vein and a volar vein. Due to the severe comminution and bicondylar split of the fracture, fixation was not performed; instead, the fragments were reduced, and the hand was immobilized in a cast. Following the procedure, the color of the finger improved, and normal perfusion was restored. The patient's postoperative period was uneventful. The patient was kept under observation for seven days in the hospital (Figure 3.3). At follow-up, all wounds healed, and the fracture alignment was deemed acceptable.

Figure 3.3: case 2 post-op 7 days

Case Presentation 3

A 15-year-old girl sustained an injury to her right index finger while attempting to retrieve clothes from a spinning- washing machine. She presented to the hospital four hours after the injury. On examination, the finger was nearly amputated, with a circumferential wound at the base of the proximal phalanx. The finger was congested with no circulation and hanging by flexor tendons. The radiographs indicated a displaced fracture at the base of the proximal phalanx, coupled with epiphyseal damage. Subsequently, the patient was then shifted to the operating room for exploration and revascularization. Intraoperatively, both digital nerves were avulsed, and both digital arteries were completely severed. Digital structures were repaired under a microscope using standard microsurgical techniques.

The finger's perfusion improved after the procedure and the color returned to pink. The hand was immobilized in a splint and hospitalized for 7 days for close observation. The patient was discharged after 7 days and followed in clinic. He showed good healing and acceptable range of motion in the follow-up period

Discussion

Washing machines have the potential to cause severe upper-limb injuries, particularly when hands or fingers are caught in clothing while the machine is still spinning [6]. The growing usage of these devices in Oman, a wealthy nation in the Gulf Cooperation Council, has been linked to an increase in hand injuries, frequently involving the pediatric population. In Oman, washing machine-related digit injuries accounted for approximately 0.46% of all hand emergencies, with 108 cases being reported between January 2015 and June 2019. The primary factors contributing to these injuries include inadequate safety measures and a lack of adult supervision [7]. All reported cases involved automatic top-loading washing machines, whereas injuries from front-loading machines remain rare. This is likely because front loaders are more expensive and less commonly used, and they also use 40-60% less water and 30-50% less energy, potentially leading to fewer and less severe injuries (Figure 5).

Figure 4.1: Circumferential laceration with ischemic finger

Figure 4.2: X-ray Showing displaced fracture base of proximal phalanx

Figure 4.3: Post revascularization of the finger

Figure 5

According to Yang and Jeong (2019), these pediatric hand injuries can have serious repercussions, including persistent discomfort, long-term functional disability, and major psychological effects on the afflicted individuals and their families. In two cases, the injuries resulted from insufficient parental supervision, while the third involved an adult male who was unfamiliar with the machine. The severity of injuries caused by washing machines can range from simple lacerations and closed fractures to more serious crushing injuries often involving ischemic digits. These injuries typically present with crush avulsion, and twisting due to the spinning drum, which are often accompanied by fractures. Owing to the nature of these avulsions and twisting injuries, replantation and revascularization procedures can be particularly challenging [8].

To lower the frequency of these injuries, public education is essential, and washing machine design must include improved safety features. Injuries have become more frequent and severe as washing machine technology has advanced to incorporate increasingly intricate features and stages. Automatic/semi-top loading, automatic front loading, and twin-tub/semi-automatic loading are the three main categories into which modern washing machines fall. Due to their accessibility and affordability, top-loading machines are the most popular, but because of their inadequate safety features, they are also linked to the highest injury rate.

Despite advancements in safety mechanisms leading to a decline in injuries, we are still a long way from completely eradicating them [9]. Surprisingly, some modern machines have been linked to more severe injuries, such as avulsion amputations, burns, and even fatalities. Injuries typically occur when the hands become entangled with the laundry during the washing or drying phases. Injuries related to the dryer phase are often more severe, especially at higher speeds, because the long delay before the drum comes to a complete stop can tempt users to unload the machine prematurely [10]. Reinforcing safety measures is essential to prevent such injuries. Newer machines are equipped with safety locks that keep the door closed during operation as well as warning stickers with diagrams indicating potential hazards. Another effective safety feature is that the sensor detects even slight openings in the lid and automatically halts the machine. For optimal safety, two systems should be integrated into washing machines: one to keep the lid locked during operation, and another to pause the machine if the lid is inadvertently opened. Public health education also plays a vital role in preventing these injuries, which can be promoted through various channels, such as social media, awareness campaigns, and school outreach programs.

S. S. Suresh reported three cases of upper limb injuries caused by washing machines, all involving pediatric patients. Unlike more severe cases, these injuries primarily involve closed fractures rather than ischemia or open wounds. Suresh highlighted the potential of washing machines to cause serious soft tissue injuries, such as compartment syndrome, which can lead to vascular compromise. He emphasized the need for further safety improvements to mitigate these risks [11].

Wolfers, Geraghty, Montorfano, et al described the case of an adult female who sustained a mangled upper extremity after placing her arm in a running washing machine. They presented a case of serious upper extremity injury that required extensive reconstructive procedures to save a limb with minimum loss of function effectively. They concluded the need for an expert microvascular reconstructive team to get good outcomes for severe hand injuries [12].

Zhang Y. described the case of an adult patient who sustained a partial amputation of a single digit from a washing machine injury. The finger was successfully revascularized and salvaged. Zhang concluded that owing to avulsion, rotational stress, and contusion of skin and muscles, injuries such as fractures and degloving can occur. They also suggested that the safety features of washing machines should be enhanced to prevent such injuries [13]

Kwan, Saw, and Sara reported on four pediatric washing machine injuries in Malaysia. Two cases involved partial finger amputations, whereas the other two involved closed-bone injuries. All injuries occurred during the spinning phase of the machine operation. They concluded that the safety features, particularly during the spinning phase, should be improved. Additionally, operating instructions and safety precautions should be displayed in multiple languages, and parents should be educated on the risks they pose to their children [14].

Conclusion

Washing machine injuries can be devastating, although their severity can vary. Children are particularly at risk, largely due to

inadequate supervision. Every effort should be made to replant the injured parts as this approach offers the best cosmetic and functional results compared to revision amputation or other reconstructive techniques. Several preventive measures can help reduce the occurrence of these injuries, including parental education, appropriate supervision, strategic placement of washing machines in homes, and unplugging machines when not in use. In addition, the integration of a special trigger system that detects unintentional opening of the lid, together with clearly displayed safety instructions in multiple languages, can significantly reduce the risk of injuries caused by the washing machine.

Declaration

While preparing this work, the authors used Paperpal.Ai to check the grammar and improve the text of the article. After using this tool/service, the authors reviewed and edited the content as needed and took full responsibility for the publication's content.

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