



REVIEW ARTICLE

IMPALEMENT INJURY TO BIG TOE: A CASE REPORT WITH REVIEW OF LITERATURE

*¹Bhat A Tanveer, ²Wani Y Nahida, ¹Mir Ishaq and ¹Wani A Hafiz

¹Department of Plastic and Reconstructive Surgery, SKIMS, Soura, Srinagar, India

²Department of Radiation Oncology, Govt. Medical College, Srinagar, India

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ABSTRACT

Introduction: Impalement injuries are one of the rare presentations in the emergency department and present complex surgical challenges in management. Prompt transfer to tertiary center, pre-operative planning, and multispecialty involvement is crucial in the management of such cases. **Case Report:** We report a case of 40-year-old male who sustained impalement injury to big toe while digging a well with an iron rod which fell into the well from the ground. After quick assessment of vital parameters and ruling out major organ injury, wound extent was examined. The rod was successfully removed under direct vision. The patient recuperated without sequelae. **Conclusion:** One should not get distracted by the appearance of the impalement injuries. After initial resuscitation, full trauma evaluation should be carried out before attending to local injury. Minimal manipulation, extraction of impaled object in operation theatre under direct vision, wound debridement and administration of antibiotics to prevent wound infection are pearls of the management of impalement injury.

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INTRODUCTION

Impalement injuries are one of the severe types of injuries combining effects of both penetrating and blunt trauma leading to crush injury, wound contamination, and multi-organ damage (Ketterhagen, 1983; Horowitz, 1985; Oya, 2013; Shikata, 2001 and Naito, 2008). These types of injuries are usually a result of fall from height, vehicular accidents, and slip with strong external force (Ketterhagen, 1983; Oya, 2013 and Naito, 2008). These injuries are uncommon (Ketterhagen, 1983; Horowitz, 1985; Shikata, 2001; Naito, 2008 and Bajaj, 1989), and review of literature reveals only occasional case reports. Management of such injuries demands specific pre-hospital care, transportation, minimal handling, prevention of infection, anticipating the potential intraoperative complications and managing them effectively with appropriate surgical specialties (Ketterhagen, 1983; Horowitz, 1985; Shikata, 2001; Naito, 2008; Kelly, 1995). We report successful management of impalement injury to big toe with review of literature.

Case Report

An 40-year-old male sustained a impalement injury to his right big toe while digging a well with a iron rod which fell into the well from a height of around 60 feet. The man managed to come out of the well of his own and reached the hospital with the rod in the big toe.

On presentation, he was conscious, well oriented, and hemodynamically stable (GCS-E4M6V5). The patient did not have any other major injury except abrasions over left forearm, elbow, and left lower back. Entry wound of the rod was through the anterior aspect of the right big toe, with an exit through posterior aspect of the big toe (Fig. 1 and 2). The big toe was cyanosed and edematous. No attempts were made to remove the rod in the procedure room. Plain X-rays confirmed trajectory of rod (Fig. 3 and 4). The patient was taken in the operation theatre. Local anaesthesia given. The exit wound of the rod was extended and soft tissue dissection was carried out to make the rod free from the adjacent neurovascular structures. We found that rod had penetrated extensor hallucis tendon, the proximal phalanx bone and the flexor hallucis longus tendon. We checked for any breach in vessel lumen and inspected nerves carefully by exploring them proximally and distally. Neurovascular structures were found to be intact. Once we were sure of integrity of neurovascular structures, the protruding part of the rod was gently pulled anteriorly along its length through wound track. Wash with copious amount of normal saline was given. Fracture was reduced and fixed with two k-wires followed by repair of the tendons. However one K wire was removed immediately after the cyanosis of the big toe worsened. After removal of second K wire the cyanosis improved. Wounds were closed primarily. Iron rod was 3cms in breadth and 2 meters long. Broad spectrum antibiotics were administered along with booster dose of tetanus and anti-tetanus serum.

*Corresponding author: Bhat A Tanveer

¹Department of Plastic and Reconstructive Surgery, SKIMS, Soura, Srinagar, India



Figure 1. Photos showing impalement injury with a big iron rod in right big toe



Figure 2. Showing the injured big toe with entry and exit wounds after removal of iron rod



Figure 3. Showing k wire insitu with repair of the wound



Figure 4. Showing x rays of foot with oblique fracture of proximal phalynx of big toe before and after k wire fixation

Wound check was clean and suture lines were dry on the 1st and 2nd post-operative day. The patient was discharged on the 2nd day postoperatively.

DISCUSSION

Impalement injuries are relatively rare (Ketterhagen, 1983; Horowitz, 1985; Shikata, 2001; Naito, 2008; Bajaj, 1989). Ketterhagen and Wassermann (Ketterhagen, 1983) described two cases, one thigh impalement by tree branch and the other thoracoabdominal impalement in vehicular accident. Horowitz *et al.* (1985), presented successful management of trunk impalement by iron rod. Bajaj *et al.* (Bajaj, 1989), presented a series of four cases stressing the need to individualize management in every case. Kelly *et al.* (Kelly, 1995), studied a series of impalement injuries, three involving extremities and one of thoracoabdominal injury. Since then, many authors have reported individual experiences in the form of case reports discussing principles of management. Impalement injury combines the effects of both penetrating as well as blunt trauma (Ketterhagen, 1983; Horowitz, 1985; Oya, 2013; Shikata, 2007; Naito, 2008). It causes crush injury, wound contamination, underlying organ injury, as well as neurovascular damage (Oya, 2013). This type of injury usually results due to fall from height or vehicular accidents (Ketterhagen, 1983; Oya, 2013; Naito, 2008). In our case, it was caused due to fall of iron rod from a height of around 60 feet on the right big toe of a man who was digging a well. In impalement injury, the degree of damage depends on the organs involved. Higher mortality rates are usually seen in thoracoabdominal injuries due to the involvement of vital organs such as heart, lungs, or major blood vessels (Shikata, 2001; Naito, 2008; Bajaj, 1989; Kelly, 1995). In extremity involvement, complications are usually restricted to particular limb and are nonfatal (Bajaj *et al.*, 1989 and Kelly *et al.*, 1997). Complex impalements are injuries where impaling object traps the patient and interferes with transport. Removal of impaling object should never be attempted outside operation theater (Ketterhagen, 1983; Horowitz, 1985; Oya, 2013; Shikata, 2001; Naito, 2008; Bajaj, 1989 and Kelly *et al.*, 1995) as it may aggravate hemorrhage due to loss of tamponade effect. On arrival at tertiary centre, initial assessment of such injuries should be on the principles of basic life support (Ketterhagen, 1983; Horowitz, 1985 and Kelly, 1995).

After initial resuscitation and ruling out vital organ damage, impalement site should be examined to know the extent of damage. In stable patients, it is prudent to proceed with selective radiological investigations to know the extent of injury and trajectory of impaling object (Horowitz, 1985). According to Bajaj *et al.* (Bajaj, 1989), it is not necessary to lay open the tract taken by impaling object in every case; irrigating the wound with normal saline by introducing a catheter in the tract is sufficient. The wound should be thoroughly debrided to remove all devitalized tissue and optimum wash with normal saline should be given (Ketterhagen *et al.*, 1983; Horowitz *et al.*, 1985; Naito *et al.*, 2008 and Kelly, 1995). This is a very important measure to prevent wound infection. Early administration of broad-spectrum antibiotics covering both aerobic and anaerobic organisms is also essential (Ketterhagen, 1983; Horowitz, 1985 and Naito, 2008). Most of the times impalement injuries are field injuries and impaling objects are metal rods (iron) with soil contamination like our case; tetanus immunization should also be carried out as per guidelines (<https://www.cdc.gov/disasters/disease/tetanus.html>) based on patient's immunization status. Regular follow-up is needed to detect postoperative infections. Horowitz *et al.* (1985). Cautioned against the development of infections by unusual pathogens found in soil. In our patient, operative wound healed by primary intention and patient was asymptomatic at 5-month follow-up.

Conclusion

Impalement injuries require multidisciplinary approach. The management of each case has to be individualized. Extensive wound exposure, extraction under direct vision, adequate debridement, and antibiotic coverage are pearls of management.

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