

CASE REPORT

An Iron Rod Impaling the Axilla with Major Vascular Injury: A Case Report

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Abstract

Background and Objective: Impalement injury is an uncommon cause of vascular trauma; however, such serious injuries are associated with a high mortality rate and need to be managed by a multidisciplinary medical team at tertiary trauma center. The reported literature is scarce and no available well-written guidelines so that the management plan should be individualized and tailored to the situation at hand. The objective of this case study is to update the management protocols to maximize the clinical outcome and minimize the fatality rate of such challenging life-threatening events.

Methods: It is a case report of a 31 year construction worker that sustained an impalement injury when he fell on an iron rod traversing his left axilla; he was transferred to our hospital with a 90 cm rod in situ. The patient was rapidly resuscitated and investigated preparing him for prompt surgical intervention; the metallic rod was extracted at the theater gently under direct vision with gushing out of blood due to the major vascular injury that was

immediately controlled, followed by proper washout and thorough debridement of all devitalized tissues. Then, exploration of the neurovascular bundle at the axilla showed an injury of the axillary vein for which primary repair was successfully performed, but fortunately the axillary artery and brachial plexus were intact.

Results: The patient had uneventful postoperative course with no complications and his limb was saved; he is being followed for 14 months up till now.

Conclusion: Major vascular injuries caused by impalement accidents are rare events; however, they are challenging and may be fatal. Our current conclusions and recommendations are deficient and we need more updated research work to improve the outcome and decrease the number of deaths. We can acknowledge the end points which include careful and rapid transportation of the patient to a tertiary trauma centre with the impaled objects in situ that should be extracted only at the theater, proper diagnosis, and prompt surgical intervention by a multidisciplinary team.

Key Words: *Axilla; Impalement injury; Iron rod; Infection; Major vascular; Multidisciplinary team*

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Introduction

Impaled objects are traumatic agents that have penetrated the human body and are still embedded; depending on the location of impalement and the size of the object, emergency medical response may be necessary. Impalements usually result from fall from a height, vehicle accidents or slip with strong external force thus causing special pattern of injuries that combine effects of both penetrating and blunt trauma resulting in crush injury, multiple organ damage and high risk of infection due to severe wound contamination [1-3].

Impalement injury is an uncommon cause of vascular trauma, the extremities being the most common anatomical site of involvement; however, such unique complex injuries are associated with a high mortality rate and need to be managed by a multidisciplinary medical team at tertiary trauma center. The reported literature is scarce and no available well-written guidelines so that the management plan should be individualized and tailored to the situation at hand. There are several challenges regarding the management of such injuries including pre-hospital care, transportation, and surgical management at hospital [4,5].

Patients and Methods

It is a case report of a 31-year male construction worker that sustained an impalement injury when he fell from a height on an iron rod traversing his left axilla, the rod was cut with minimal handling at the scene of the accident; he was transferred to our hospital with a 90 cm rod in situ (Figure 1). The patient was rapidly resuscitated and investigated with full trauma survey according to ATLS; he was fully conscious and hemodynamically stable, the left upper limb showed signs of venous congestion, but the arterial blood flow was fairly good with palpable distal pulses and no associated neurological deficits, and the patient did not have any other major injuries on CT. We prepared him for prompt surgical intervention after starting strong intravenous antibiotics and tetanus prophylaxis, the patient was placed supine on the operation table and there was no difficulty regarding the insertion of the endotracheal tube. The metallic rod was extracted

at the theater gently under direct vision using a fistulotomy type incision following the entry to exit wounds to lay open the wound tract, and this resulted in gushing out of blood due to the major vascular injury that was immediately controlled. This was followed by proper irrigation of the foreign body tract using saline containing Garamycin ampoules and thorough debridement of all devitalized tissues to prevent infection.



Figure 1) *The left axilla impaled by an iron rod.*

Then, exploration of the neurovascular bundle at the axilla showed a lacerated injury of the axillary vein for which primary repair was successfully performed and we did not need venous patch grafting, however the axillary artery and brachial plexus were fortunately intact. The patient had uneventful postoperative course without any complications, discharged to home after 5 days with continuing the broad spectrum antibiotics and the anticoagulant therapy (we started by LMWH then shifted to DOACs), and his limb was saved; he was followed at 1-month then at 3-month periods.

Results

It is a case study of a 31-year male patient that was impaled at construction site by an iron rod penetrating his left axilla; the pre-hospital care and transportation were properly done taking into account the importance of minimal manipulation of the impaling object to avoid bleeding and further injuries. The patient presented to us with a 90 cm iron rod in situ (Figure 2), clinically his left limb was congested, but not ischemic with intact distal pulses and no signs of associated nerve injuries; prompt surgical intervention by a multispecialty surgical

team after rapid resuscitation and investigations was performed; selective imaging was done to know the trajectory of the impaling object. The metallic rod was extracted under direct vision at the theater and we primarily repaired the axillary vein injury, properly irrigated the wound track, making thorough debridement of all nonviable tissues, and all of this done under strong broad spectrum antibiotic coverage (Imipenem 0.5 gm IV/8 h, Linezolid 600 mg IV/12 h, and Metronidazole 500 mg IV/8 h) to minimize the risk of infection in such heavily contaminated complex injuries. The patient stayed at hospital for 5 days with uneventful postoperative course; the follow up duplex showed fully compressible axillary vein with good flow and he was followed at 1-month then at 3-month periods for a mean follow-up period of 14 months. His limb was saved with good functional outcome and he had no complications.



Figure 2) *The patient on the operation table.*

Discussion

Review of literature reveals only occasional case reports of impalement injuries for example, two cases were reported, the first is thigh impalement by a tree branch and the second one is thoracoabdominal impalement due to vehicle accident [1]. A case of trunk impalement by an iron rod [4], and a series of four cases were published with recommending the individualized management in every case [6]. Another series of also four cases was reported, three of them were impalement of extremities and the last

one was thoracoabdominal injury [7].

The location of impalement, the size of the object, and the mechanism of trauma determine the pre-operative management plan and the clinical outcome. When we compare thoracoabdominal to limb impalement, the former is rarer, but more fatal than the latter due to the possibility of injury of vital organs as the heart, lung, liver, or major blood vessels with life threatening hemorrhage that is difficult to control so that such serious impalement injuries demand priority and emergent resuscitation and surgical intervention. In extremity impalement, the neurovascular bundle should be carefully examined to decrease the incidence of limb loss [3,5-7].

Our protocols and recommendations of management of impalement injuries are deficient and we don't have well written guidelines so every case is managed individually. In our case study, we try to stress the challenges and revise the principles of management of such rare life-threatening injuries. Impalement injuries are unique complex injuries that are associated with high morbidity and mortality, and there are several challenges concerning the management of such injuries including pre-hospital care, transportation and surgical management at hospital, and this actually happened in this study. The pre-hospital care and transportation are crucial; deliverance from the impaling object needs experience and should be done by cutting the object carefully to a manageable size with minimal manipulation and stabilized in place to facilitate transportation and never try removal of the impaled object at the scene of the accident or in the ED, as this may result in uncontrolled hemorrhage due to loss of the tamponade effect and may also cause further injuries [8].

Regarding the hospital management, the impaled patient should be transferred to a tertiary trauma center where a multidisciplinary medical team is available; all usual trauma management protocols with principles of basic life support (ATLS) should be followed. After emergent resuscitation and ruling out vital organ damage, the impalement site, in our case it was the left axilla and left upper limb, should be examined properly to determine the injury

pattern and prepare a pre-operative plan. There is a uniform agreement on prompt surgical exploration of hemodynamically unstable patients, in spite of initial resuscitation and not wasting time for further investigations; whereas in stable patients we can proceed to selective and emergent imaging studies to know the extent of injury and trajectory of the impaling object. The patient position on the operation table and anesthesia is also another challenge as sometimes the dimensions and trajectory of the impaled object make it difficult to manage, and as we mentioned before the impaled object should be extracted at the theater under direct vision either using the fistulotomy incision technique, connecting the entry and exit points to lay open the tract of the impaling object, or not doing so and in this case we introduce a catheter and irrigate it thoroughly [1,4,5,7,9].

Infection is a big threat in impalement injuries due to severe contamination, and we revise the principles to prevent its occurrence starting by early administration of broad spectrum antibiotics covering both aerobic and anaerobic species together with tetanus immunization. Wound care is of paramount importance and should be performed by proper saline irrigation of the wound tract, removal

of foreign bodies, and thorough debridement of all devitalized tissues. Regular patient follow-up is essential to diagnose infection early and we should be careful of the possibility of developing serious infections due to unusual organisms found in the soil or having fungal infection that needs appropriate treatment [1,3,4].

Conclusion

Major vascular injuries caused by impalement accidents are rare events; however they are challenging and may be fatal. Our current conclusions and recommendations are deficient and we need more updated research work to improve the outcome and decrease the number of deaths. Taking lessons from our case study, we can acknowledge the end points which include careful and rapid transportation of the patient to a tertiary trauma centre with minimal manipulation and the impaled objects in situ that should be extracted only at the theater, proper diagnosis and preoperative planning, and prompt surgical intervention by a multidisciplinary team. Also, proper wound care is essential to prevent infections which are challenging in impalement injuries.

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