

## Emergency Transport, Diagnosis and Resuscitation of Penetrating Injury Caused by Iron Rod: A Case Report

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### ABSTRACT

Foreign bodies with their long edges that penetrate the body are potentially life-threatening, owing to the resulting hemorrhagic shock and visceral damage. In an under-resourced environment, the outcome after major impalement injury can be improved by (a) rapid transport with the impaled object in situ (b) quick assessment and resuscitation in the emergency room (c) transport to operating room for definitive care. We report here the successful management of penetrating long iron rod injury from the perineum to the loin of pediatric patient, including transport from rural to tertiary hospital, diagnosis and, resuscitation.

### Keywords

Fall injury, iron rod, penetrating injury, perineal impalement injury, prehospital care

### INTRODUCTION

Penetrating injuries presenting in emergency includes gunshot injury, stab injury, shrapnel wounds and impalement of objects. Abdomino-perineal impalement injury caused by long construction iron rod in children are rare in emergency rooms. These type of injury have a significant death and morbidity rate due to the risk of hemorrhagic shock and visceral injuries.<sup>1</sup> We report a pediatric case in which family members cut the penetrated construction iron rod from base and transported the child a considerable distance from a rural village to a tertiary care hospital, showing the necessity of comprehensive pre-hospital treatment in poor nations.

### CASE PRESENTATION

On 23 December 2020, at approximately 19.00 PM in the remote valley of Surkhet, Nepal, a 13-year-old boy, while playing hide and seek in the terrace, unknowingly fell from 2 storey building and got penetrated by 2x2 cm wide iron rod kept vertically as incomplete pillar for constructing home. According to the family members, some sound of fall was noticed followed by missing of the child. Approximately after



Fig 1. Impalement injury caused by iron rod  
 Figure 2a, 2b. Computed tomography images in supine and left lateral position

10 minutes they discovered him hanging vertically on an iron rod. Child was unconscious for about 10 minutes at that time. The iron rod pierced his perineum vertically and exited through his right loin with minimal bleeding seen. Family members feared that removing the iron rod from the body might worsen the injury, so they removed the base of the iron rod with an electric metal cutter, with four people stabilizing him at the head, torso, and limbs. The patient was conscious, stable and silent during the whole procedure. After cutting the iron rod, patient was carefully lied down and initially kept in his home for some time.

The boy was subsequently taken by autorickshaw to a hospital in Surkhet district. While evaluating over there, he was found hemodynamically stable, awake, alert, and conscious. IV fluids, Tetanus toxoid, Inj. Ceftriaxone, Inj. Metronidazole, and analgesics were used to treat him. Patient was then referred to our center due to the lack of vascular and pediatric surgeons and the likelihood of needing that expertise. For that reason, the patient was first driven by ambulance from Surkhet to Nepalgunj airport (126 km, 3.5–4 hours), then flown from Nepalgunj to Kathmandu (512 km, 1 hour), and finally driven by ambulance from Kathmandu airport to our institute (7km, 20 min). The patient was not accompanied by medical personnel during the journey. Four family members hold the patient from different site during the travel. Patient reached to our center remarkably unharmed after 18 hours of injury. At the time of presentation, child was lying in lateral position with slight flexion of hip and knee joint and was in pain (Figure 1). He looked pale and dehydrated. The entry and exit wound were about 2.5 cm in diameter. Both the wound openings were sealed by the iron rod. Around 16 cm of iron rod had invaded out from the body in left loin region, approximately 18 cm of rod was in the body

and around 54 cm was below the entry wound. In emergency room, patient was triaged to critical red area. Application of rigid spinal board was done. Patient was evaluated using advance trauma life support guideline. Patient airway, breathing was normal. He was dehydrated, and pale. His heart rate was 140 bpm, and blood pressure 120/80, normal urine output, with apparently intact distal neuro-vasculature. Due to risk of movement of iron rod and further injury, unnecessary interventions and investigations were postponed. Patient was resuscitated with IV fluids, Analgesia, Inj. Tazobactam-piperacillin, Inj. Metronidazole, Tetanus Immunoglobulin. Contrast enhanced CT scan of abdomen and pelvis showed injury over urogenital diaphragm penetrating iliopsoas muscle and sparing of other major vessels, visceral organs, bones (Figure 2). Prioritization for emergency operation and immobilization of the patient while transferring was done. Upon discharge from emergency his heart rate dropped to 120 bpm, and blood pressure was 120/80mmhg. In operation theatre, patient was carefully transferred along with rigid spinal board to operating table. Patient got intubated with Flexometallic tube in the same lateral position.

After induction, patient was kept in supine position with support for back with roll cotton and cloth. Lower midline incision was given. A thorough search was made from entry to exist wound. No obvious injury to viscera was found except some lacerations on spleen. Then iron rod was pulled down through the perineum carefully under direct vision. Patient had iron rod 2x2 cm thickness passing though the perineal body with penetration of urogenital diaphragm passing though the iliopsoas muscle till the lower border of kidney and exit wound 2x2 cm in the left lumbar region. There was no injury to the rectum, urinary bladder, small and large bowel,

major vessels, diaphragm, chest and spine. After removal of the iron rod, intrabdominal examination was repeated for any missing injury to any visceral organs. As there were no other injuries, patient was successfully weaned after 3 hours 45 min from the time patient was anesthetized. Peri-operative period went uneventful as drain was removed on fourth POD and feeding was started on third POD. On regular follow for a month no neurological deficit was found except some tingling sensation on feet for two weeks.

## DISCUSSION

Impalement injuries are the result of the penetration into the body of elongated, typically fixed objects.<sup>2</sup> An impact between the human body and the object such as seen in cases of road traffic accidents or accidental fall from height is the usually encountered mechanism.<sup>3</sup> There was a similar accident in the index scenario.

For the survival of these patients, pre-hospital treatment is very crucial. Care must be taken not to remove the penetrating object while the patient is being transferred to the nearest hospital. A tamponade impact on the organs into which it has penetrated can be caused by the impaling object, thus preventing bleeding following trauma.<sup>4</sup> Emphasis is put on the significance of six hour intervention, especially for improving sepsis and wound recovery.<sup>5</sup>

As a rule, in a safe setting such as in the operation theatre, the impaling object must be removed under direct vision. In addition, it is often easier to physically visualize the organs through which it has traversed with the foreign body in place, thereby avoiding any organ damage during surgery from being missed. There are a few exceptional cases in which the impaling object is immediately removed, such as if the patient requires cardio-pulmonary resuscitation and the object interferes with it or whether the impaling object is in the airway of the patient.<sup>3</sup> Shortening of the object may however be attempted to facilitate transport. The impaling object must be secured so as to prevent any movement in relation to the body of the patient. This is to prevent further soft-tissue damage and bleeding. In the index case, the relatives did not make any attempt to remove the impaling object thus helped in limiting further injuries.

Vaslef et al outlined three principles of impalement injury prevention, particularly relevant in underdeveloped countries.<sup>6</sup>

1. The pre-hospital providers should leave the impaled object in situ to provide a possible

tamponade effect and permit the focus on rapid transport as the goal.

2. The patient should be rapidly stabilized and transported, preferably to a trauma center and
3. The patient should be rapidly assessed and resuscitated in the emergency department, avoiding any unnecessary tests that delay care, and then transported to the operating room for definitive care.

Unfortunately, pre-hospital facilities with well-equipped resources like ambulances, stretcher trolley with trained paramedics are not yet developed in most of the resource-constrained countries. In context of Nepal there are no modern trauma centers. Our case alarms the need of coordinated pre-hospital treatment policy, trained manpower and resources who can help transport the victim from the site of incident to primary care center and further during inter-hospital transport.

## CONCLUSION

Penetrating abdominal injuries demand immediate life-saving measures, appropriate resuscitative care, urgent shifting/transport of patient to tertiary care center, prompt diagnosis and immediate surgical intervention. Strengthening of pre-hospital care can improve the patient outcome and minimize mortality.

## CONSENT

Written informed consent was obtained from the patient's parents for publication of this case report and any accompanying images.

## CONFLICT OF INTEREST

None declared.

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