

Penetrating abdomino-thoracic injury with an iron rod: An anaesthetic challenge

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ABSTRACT

Penetrating abdomino-thoracic injuries are potentially life-threatening due to the associated haemorrhagic shock and visceral injury. The management of these injuries poses specific challenges in pre-hospital care, transport, and management strategies. We report a 35-year-old male having impalement injury of the left thorax and left upper arm with a metallic rod used for construction of the house after a fall from height. One rod penetrated thorax from left shoulder and exit point was present just above the iliac crest and second rod was seen piercing left upper arm. Patient was successfully managed without any intraoperative, post-operative surgical complications, neurological damage or permanent injuries.

Key words: Abdomino-thoracic injury, anaesthetic management, impalement injuries thorax, penetrating injuries

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INTRODUCTION

Penetrating trauma to the torso can present a complex diagnostic and therapeutic challenge. Penetrating abdomino-thoracic injuries are potentially life-threatening due to the associated haemorrhagic shock and visceral injury.^[1,2] Thoracic penetrating injuries are rare, but severe due to risk of involvement of vital organs. Improper positioning of the patient may add complexity to anaesthetic and surgical management in such patients. The management of these injuries poses specific challenges in pre-hospital care, transport, and management strategies.^[3] Here, we report the successful anaesthetic management of penetrating abdomino-thoracic injury with an iron rod.

CASE REPORT

A 35-year-old male weighing 62 kg (as informed by patient) having penetrating injury of the left thorax and left upper arm with a metallic rod after a fall from height, was brought to emergency ward (EW). Patient was conscious, oriented, and was slightly dyspnoeic due to severe pain and had tachycardia (100 beats/min). One rod penetrated thorax from left shoulder and exit

point was present just above the iliac crest and second rod was seen piercing left upper arm [Figures 1 and 2]. In EW two wide bore intravenous cannulae were established, and samples were sent for haematological investigations and for cross-match of blood and blood products. Hetastarch 500 ml was transfused, and patient was assessed for another associated injury. Air-entry was decreased on the left side, and dull note on percussion of the abdomen was found. In EW, pain relief was achieved with the use of non-steroidal anti-inflammatory drugs (NSAIDS). Though the patient was haemodynamically stable, the surgeon suspected involvement of some major internal organ that could render patient unstable at any moment, so immediate surgery was planned. Patient was shifted to the operating room for exploration. All the monitoring devices were placed, including continuous electrocardiography, O₂ saturation and non-invasive blood pressure cuff.

Baseline arterial pressure, heart rate, respiratory rate and room air O₂ saturation were 100/60 mmHg, 110 beats/min, 20/min and 96%, respectively. Ultrasound performed on the operation table (OT) ruled out cardiac injury and thoracic rod was seen passing through the lower lobe of the left lung and

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Figure 1: Impalement injury with a metallic rod

piercing the diaphragm. Presence of free fluid in the abdominal cavity was also established.

After pre-oxygenation, general anaesthesia was induced with ketamine 2 mg/kg; injection suxamethonium 1.5 mg/kg was used to facilitate tracheal intubation. The rod was blocking access of anaesthesiologist's hand to airway on one side. Prior to administration of suxamethonium, priming with a small dose of vecuronium was performed to prevent fasciculations. The trachea was intubated using 39 French gauge left double lumen tube. Anaesthesia was further maintained using 33% O₂ in 66% N₂O and isoflurane. Injection vecuronium was administered to provide muscle relaxation. Injection fentanyl 1 µg/kg was used as intraoperative analgesia. After induction, temperature probe and end-tidal CO₂ monitors were attached, the radial artery was cannulated. Internal jugular vein cannulation was avoided due to thoracic injury, and right femoral vein was cannulated, and catheter was placed to monitor central venous pressure, and urinary bladder was catheterised. After induction of anaesthesia, rod present in the arm was pulled by an orthopaedic surgeon, after ruling out any vascular involvement. The patient was then positioned in right lateral position. Thoracotomy was performed, and rod was visualised passing through the left lung that was found lacerated and pierced the diaphragm. Another incision was made in the renal area, near the exit point. Rod was seen passing through the spleen and damaging the descending colon. The rod was gradually withdrawn under direct observation.

Surgical procedures performed included repairing of lung laceration, splenectomy, left phrenorrhaphy



Figure 2: Exit point

and resection anastomosis of the damaged colon. The surgery lasted for 5 h. Total blood loss was approximately 2000 ml, and four units of packed cells were administered. Intraoperative arterial blood gas analysis was within normal limits. Intercostal blocks were given for post-operative pain relief along with NSAIDs. Patient was shifted to intensive care unit for elective ventilation. The patient was successfully extubated next morning and was shifted to the ward after 48 h and discharged from the hospital after 8 days. No post-operative surgical complications, neurological damage or permanent injuries were noted.

DISCUSSION

Penetrating injury of abdomen and thorax has been reported in the literature from time to time. Various authors have reported penetration of a number of objects such as glass, knife, wooden blocks, blades, etc. We encountered penetration of two metallic rods, one penetrating abdomen and thorax and another traversing axilla. Incidence of metallic rod penetration reported in the literature is rare. Such impalement injury is an acute emergency.^[2,4] The anaesthetic management of these types of injuries is challenging because of urgency for the surgery and associated haemodynamic instability.^[3]

Resuscitation and close monitoring prior to and during surgery are vital with anticipation of major organ and vascular injuries compromising the normal physiology of respiration and circulation. Hypovolemia should be corrected in the EW.^[2,3] Progressive dyspnoea can be the most important symptom in patients with penetrating chest injury. Such patients can be managed

with implantable cardioverter-defibrillator insertion to relieve haemopneumothorax.^[3]

The immediate management of thoracic trauma should follow standard advanced trauma life support guidelines.^[5]

Trauma with impalement can be categorised as those with: (A) Cardiovascular injury, (B) injury of hollow organs, (C) injury of parenchymatous organs and (D) combined injuries.

Group A patients have the worst prognosis and death may result within 30 min of the accident. Injuries of groups B and C variety have a good chance of a positive outcome if patients can be treated at a tertiary trauma centre with the capability of rapid diagnosis. To assess the complexity of trauma-induced injuries, a computed tomography scan should be performed in addition to chest radiography and abdominal ultrasound.^[6,7]

The impaling objects should be left *in situ* at the site of the primary accident. Removal should be performed only at a tertiary centre utilising a multimodality surgical approach under the guidance of specialised surgeons. Removal should only be attempted on OT under anaesthesia when arrangement to explore the patient is complete because the foreign body *in situ* may generate a plugging effect on the injured vessels or structure, thus preventing major bleeding.^[3,4,8]

With the foreign body in place, it is always easier to physically visualise the traversed organs, thus preventing missing of any organ injury during surgery.^[4]

In our patient, rod penetrating the arm was removed after induction. Any penetrating injury of this area is likely to damage neurovascular bundle, but no neurovascular injury was encountered in our patient. Second rod impaling abdomen and thorax was removed after assessment of tract following thoracotomy and simultaneous laparotomy.

Positioning problem during induction of anaesthesia is the common problem faced by anaesthesiologist in these patients.^[3,9,10] Many alternative techniques of positioning have been reported in the literature. Few authors reported arranging two parallel tables and positioning patient in such a way that the projecting rod takes the space between the two.^[3,11] Few were

intubated^[3] in the lateral position, and some managed to hang the torso of patient partially out of the table, with manual support.^[9] In our patient, we did not encounter much difficulty in maintaining the position since the second rod was lying below the shoulder.

Induction of anaesthesia may lead to a dramatic loss of blood pressure and care should be taken with the choice of induction agent.^[2] Ketamine is an ideal induction agent and fentanyl an ideal analgesic agent in states of hypovolemia.^[2,5] When thoracotomy is planned, it is better to administer one lung ventilation as in the present case. These patients need 100% O₂ delivery to the tissues until haemoglobin can be replaced.^[2,7]

Fluid should be replaced appropriately, and the excessive transfusion should be avoided prior to haemorrhage control.^[2] Adequate amount of blood and blood products should be arranged prior to operating these patients. In our patient, blood loss was approximately around 2000 ml, which was adequately replaced. The use of adrenaline or inotropes is contra indicated in the presence of hypovolemia. Inotropes may be required after control of haemorrhage.^[2] Left sided thoracic injury could have injured heart, which can lead to devastating complications, but our patient was fortunate enough that rod just passed touching the heart causing no damage to this vital organ.

Pain from thoracotomy is generally very severe because of associated muscle destruction, cutting of the parietal pleura and rib resection or retraction which may directly damage the intercostal nerves. Pain relief can be provided in the form of systemic analgesia, intrathecal or epidural opioids, intercostal and paravertebral nerve block.^[5] Because of urgency of surgery, epidural analgesia could not be provided in our patient and was managed with systemic analgesia and intercostal nerve blocks.

CONCLUSION

Penetrating abdomino-thoracic injuries demand immediate life-saving measures, appropriate resuscitative care, urgent shifting of patient to tertiary care centre, prompt diagnosis and immediate surgical intervention by multi-disciplinary team of abdominal, vascular, and cardiothoracic surgeons. Early intervention can improve the patient outcome and minimise mortality.

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