



Impalement Chest Injury: A Narrow Miss of Vital Structures.

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Abstract

Impalement injuries to the chest mostly result from high energy injury from a sharp protruding object. They are most often fatal, but cases of many survivors have been recorded, just as the index case being reported. The patient sustained injury as a passenger in a truck which lost control, and a sharp stationary wood by the road side got stuck onto his chest. He presented to the hospital 5 hours after the injury. He was then taken to theatre where the impaled object was removed successfully aided by a thoracotomy for proximal vascular control under general anaesthesia. Surprisingly, no major intrathoracic injury was seen. The patient recovered fully without any disability.

Keywords: Impalement injury, Chest, Thoracotomy, Vascular Control.

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Introduction

Thoracic impalement injuries are horrifying injuries that result from high kinetic impact with immobile protruding object that are able to transfix the thorax. They are common among the military but rare among civilians. These injuries are often as a result of blunt or penetrating trauma sustained during road traffic accidents, crash or fall in a construction site, and aircraft accidents. Most of the reported thoracic impalement injuries are as a result of road traffic accidents¹.

It comes with several multiple life-threatening complications, with most victims dying before making it to the hospital. Apart from the impalement of the thorax, other thoracic complications that can result from road traffic accidents include rib fracture and laceration of the thoracic organs. These injuries are often very fatal and to increase the chance of the victim's survival, there should be a prompt and adequate surgical intervention with strict adherence to the protocols and management of trauma. We present a case of a 32-year-old man who had impalement injury to the chest from a motor vehicular accident, which narrowly missed vital organs in the chest.

Case Report

A 32-year-old man was brought into the Accident and Emergency centre of our institution after a motor vehicular

accident about 4 hours prior to presentation. He was sitting next to the driver of a truck when the truck veered off the road while trying to avoid an oncoming vehicle. The truck hit a makeshift kiosk made of wood by the road side. A log of wood with a pointed end from the kiosk penetrated anterior-posteriorly from the upper part of the thorax on the left and exited below the tip of the left scapula at the back (Fig 1). He also sustained minor injuries on the left side of the head and proximal part of the upper limb with associated minimal bleeding. There was no loss of consciousness or inability to move any limb, and no bleeding from any craniofacial orifice (Figure 1).

The patient was brought into the emergency room of our hospital with the log of wood in situ. The piece of wood measured 1.5m in length with thickness of about 10cm anteriorly, tapering to about 3cm wide posteriorly. It penetrated through the left side of the chest superiorly into the back with blood smear around it. There was no sign of active bleeding, neurological deficit, seizure or dizziness and he was haemodynamically stable. He was mildly tachypnoic, with a respiratory rate of 24 cycles per minute (cpm) and a pulse rate of 72 beats per minute (bpm). The blood pressure was 120/70mmHg. Intravenous access was secured and the patient was transferred to theatre in the sitting position after the necessary work up. No radiological image was done as positioning of patient for any image acquisition was



Fig 1: Log of wood traversing the chest anteriorly and exiting below the scapula posteriorly



Fig. 2 Positioning on table before draping.



Figure 3: Log of wood after



Fig 4: After extraction of wood and wound apposition after closing thoracotomy extraction wound and dressed.



technically difficult for the radiographers without manipulating the log of wood.

The team immediately planned and prepared for the surgery with sufficient blood back up as necessary. Putting the patient under general anaesthesia was challenging. The patient had to be pre-oxygenated, induced and paralyzed in sitting position with support. He was then rapidly but carefully put in supine position at the edge of the table to allow the pointed exit end of the wood some

space posteriorly. He was quickly intubated with single lumen endotracheal tube.

Under general anaesthesia, the length of the wood was reduced by cutting the proximal and distal end to allow for easy positioning of the patient without posing a threat to the managing team and minimal manipulation of the log and for safety of the patient. He was positioned in the right lateral decubitus position [left side up] (Fig 2, skin prepared and draped.

Patient had left posterolateral thoracotomy done to ensure haemostasis, by achieving proximal control of possible arterial injury, and to assess extent of intrathoracic injury for repair. The intraoperative findings were: soft tissue chest wall injury along the trajectory of the wood, narrowly missing the left upper lobe of the lung in the process. Most of the thoracic organs were found intact with minor bruise lesion to the wall of the left subclavian artery and vein. No haemothorax was detected. Proximal control of left subclavian artery was then secured from the root origin on the arch of aorta. The wood was successfully removed by carefully pulling it bit by bit by an assistant in one piece under direct vision (Fig 3). No major bleeding was noted as the major vessels were intact.

The entry and exit wound sites were copiously irrigated with saline. Devitalized soft tissues were debrided and wound edges were loosely apposed with interrupted stitches, leaving adequate space for wound drainage (Fig.4). The lungs were fully expanded on table with no evidence of air leak or bleeding. The chest was subsequently closed in layers with a chest tube left in-situ. After the patient recovered fully from anesthesia, he was transferred to the ICU for close monitoring. His immediate condition post-surgery was satisfactory. He was discharged after 5 days and followed up in clinic for about 3 months. He has recovered fully without any disability.

Discussion

Thoracic traumatic injuries can result in major life-threatening complications. Management of these patients can be very complex, with several challenges arising right from the point of the accident. The approach to management usually depends on the mechanism and severity of the injury^{2,3}.

The protruding part of the impaled object is best left in its place with minimal manipulation of the object and the patient⁴. Premature removal or tampering with the foreign object can result in fatal episode of hemorrhage which can be difficult to control and could severely damage the surrounding tissue. The impaling object would have punctured several organs in the region and compressed the vascular organs in the area, exerting a tamponading effect that prevent bleeding⁵. Therefore, it is best to remove the object under direct vision and careful assessment of the tissues surrounding the foreign body². In our case, we were unable to carry out any preoperative radiographical images due to the extreme technical difficulty of positioning the patient for the acquisition of images without manipulating the object. The object transfixied the patient with long length seen at both the entry and exit point (Fig1). Hence the decision to proceed to surgery.

The length of the object can be reduced for easy transport of the patient to the health care facility. Prompt transfer to the hospital is critical to increase the chances survival of the patient, as delays could worsen the situation⁶.

There are varying approaches of accessing the impaling object. The surgeon will determine the best possible incision for the patient to access the object. When the patient is not haemodynamically stable, sternotomy or thoracotomy is usually the best procedure that provides a direct view for repair of damaged structures^{7,8}. For this surgery, due to the trajectory of the object in the chest, thoracotomy had to be done to identify and assess possible intrathoracic injury that will require attention and to secure proximal control of vessels that are likely to be injured. But luckily for our index patient, the intrathoracic organs were spared and the wood was not visible from the intra pleural view. The left subclavian artery was then isolated at its origin in anticipation of any bleeding after the extraction of the wood.

However, for haemodynamically stable patients, thoracoscopy could be a possible alternative to view the intra pleural space⁵. This offers an advantage of assessing intrathoracic organ involvement via a minimal invasive approach limiting further trauma of surgery^{5,9}.

Radiological projections from different angles can provide information about the severity of the damage and condition of the vital organs around the area¹⁰, but when radiological examination is not possible, because of the interfering impladed object, it can be excluded. However, in haemodynamically unstable patients, little time should be wasted for radiological and laboratory investigations. CT Angiography, chest x-ray, ultrasound are some of the radiological examination that can be used to assess the patients^{5,9}. This may help occasionally in preparing for expectations at surgery. It should be noted however, that large object in the thorax could present as a major artifact on the result thereby affecting the correct interpretation⁵. Hence, the best assessment is still intraoperative findings. In the principles of management of impalement injuries, priority should be given to control of major bleeding (haemostasis) and thereafter repair of damaged tissues after dislodgement of the object. This is aimed at achieving haemodynamic stability and good oxygenation^{11,12}. The impaling object must only be removed when the extent of injury to the organs has been examined and haemostasis achieved or plans already put in place to achieve successful haemostasis such as securing proximal control where necessary¹.

Where the impaling object misses the vital organs, the patient has a better chance of survival. However, if it is suspected that a vital structure is involved, and haemostasis will be difficult to achieve, the surgical team may need to prepare for a cardiopulmonary bypass^{1,12}.

The chance of infection from the open wound is high as the area contains organic materials, soil debris, necrotic tissues and clothes. The area around the wound must be copiously irrigated. Necrotic and devitalized tissues and foreign materials should be debrided. Provision must be made for drainage at the site of the wound through a drain or partial closure to monitor the possibility of infection¹¹. It is advisable to give tetanus vaccine and

combination of antibiotics. Common infection includes bronchopneumonia, empyema thoracis, and osteomyelitis. The area of the chest where the impalement occurs is usually a major factor that determines the chance of survival. Most victims that survive usually have the impalement to the right side of the chest. Impalement to the left side can be challenging because of the presence of vital organ such as heart¹³. When the impalement happens to the left thorax the chances of survival is usually increased if the object misses a vital organ. In the case of our patient, the impaling object misses the vital organs and great vessels. The object lodged between muscles of the chest wall, entering just above the midpoint of the left clavicle and exiting just below the inferior angle of the left scapula. It spared major neuro-vascular structures around the region, mainly the left subclavian artery, carotid artery and the brachial plexus.

This case has shown that there could be an impalement chest injury transfixing the chest wall through and through without vital organ injury. It also reiterated the fact that preoperative radiological investigation is not always necessary, based on the circumstances of presentation, for a successful outcome in the management of impalement chest injury.

Also, thoracotomy may be needed for the sole purpose of achieving proximal vascular control to prevent catastrophic haemorrhage. The chance of survival is high for injuries to the right or when the object misses vital organs. Early intervention, age of the patient and proper management of the trauma are other factors that increase the chances of survival.

Conclusion

Impalement injuries are often fatal, but many survivors have been documented. The factors that usually contribute to such survival are; the trajectory of the impaling object missing vital organs, prompt transportation of the victim to a standard facility where they can be attended to with the impaling object left in place, availability of material resources and skilled personnel to provide professional surgical and medical care at the center without any delay. Other associated injuries must also be given adequate attention and prevent complications from the seemingly minor injuries. This will ensure complete recovery and return to general well-being of the victims.

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