

Case report

SURGICAL MANAGEMENT OF AN ABDOMINAL IMPALEMENT INJURY: A CASE REPORT

Manejo quirúrgico de una lesión por empalamiento abdominal: reporte de caso

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ABSTRACT

Impalement injuries are a complex and rare type of penetrating abdominal trauma that happens when an object such as a post or a pole penetrates a person injuring several organs, making it a life-threatening situation in which time and correct management play an important part in the survival of the patient. A 37-year-old man suffered abdominal impalement injury with a metal signal post, penetrating the left flank of the abdomen. On examination, there is a hypoventilated left hemithorax with intercostal retractions, increased heart rate, weak distal pulses, delayed capillary refill, and pale skin. A 1-meter-long metal post (approximately 7cm diameter) penetrates the left flank with the entry in the posterior lumbar region. Abdominal viscera, omentum, intestinal content, and ischemic loops of the small intestine are visible. An exploratory laparotomy was performed; left hemicolectomy, end colostomy and Hartmann procedure, resection of the affected jejunum, and end-to-end anastomosis were performed. On the ninth postoperative day, an abdominal tomography was performed due to the presence of fever peaks, which reported thrombosis of the left renal artery and emphysematous pyelonephritis, with the presence of a left pararenal collection. A simple left nephrectomy was performed. Postoperative surveillance was satisfactory during the following 5 days. The patient was discharged. An impaled injury is a complex lesion that needs special attention from the medical field for correct management. Although there is some literature about it, we encourage more research to be done about impalement injuries.

Keywords: Impalement, Case report, Abdominal trauma, Penetrating abdominal trauma, Renal trauma.

1. Introduction

Impalement injury is a specific type of trauma defined as a penetrating wound caused by an object with a blunt tip and is mostly related to falls, sexual activity, and slipping with a strong external force. (Oya, et al., 2013). It creates a complex surgical problem in which one or multiple regions of the body are transfixated by a rigid object of variable size. Such injuries combine aspects of both blunt and penetrating trauma, resulting in considerable tissue destruction by transmitted energy as well as actual organ penetration. (Horowitz, et al., 1985).

These injuries may be classified into two levels, according to the injury mechanism. Type I impalement involves the decelerating human body falling on a stationary object, while a type II impalement involves a mobile object piercing through the stationary human body. (Udo, et al., 2017). Both are often associated with vascular and visceral damage entailing significant morbidity and mortality. The management of these injuries involves specific challenges in pre-hospital care, transport, and appropriate surgical strategies in the operating theatre. (Moncure, et al., 2009).

There is no strict specific protocol to approach an impalement injury, due to the variability and complexity of each case (Ugoletti, et al., 2019). Impaled objects may be large, heavy, or fixed to a landmark, requiring special equipment by emergency medical personnel for the transportation of the patient. Surgeons must analyze the object's complexity, the potential visceral and surrounding damage, and determine how to safely remove it, focusing on vital and primordial organs. Kinetics must be taken into account due to the high energy impact of the event, causing secondary injuries in regions unrelated to the impaled object. This becomes a true surgical challenge even for the most experienced surgeons.

We report a case of an abdominally impaled patient involved in a rollover-type automobile, the emergency room management, and the surgical approach. Important complications were raised

during the postoperative follow-up that were adequately managed with surgical reintervention. The present case report adheres to the CARE checklist. (Gagnier, et al., 2013)

2. Case report

A 37-year-old man with no significant medical history was admitted after being involved in a rollover-type automobile accident. The patient suffered a frontal impact against the windshield through which he was projected towards a retaining wall, suffering impalement with a metal post, penetrating the left flank of the abdomen. He was transferred by paramedics to the emergency room. Upon admission, the patient has a patent airway, respiratory rate 30 rpm, heart rate 125 bpm, lethargic, assessed at 13 points on the Glasgow Coma Scale, temperature 35.1°C, blood pressure 60/40 mmHg, MAP 50 mmHg (Hemorrhagic shock grade III). On examination, there is a cylindrical neck with a central trachea, hypoventilated left hemithorax with intercostal retractions, increased frequency heart sounds without audible murmurs, weak distal pulses, delayed capillary refill, and pale skin. A 1-meter-long metal post (approximately 7cm diameter) penetrates the left flank with the entry in the posterior lumbar region. Abdominal viscera, omentum, intestinal content, and ischemic loops of the small intestine are visible [Figure 1].

Figure 1.

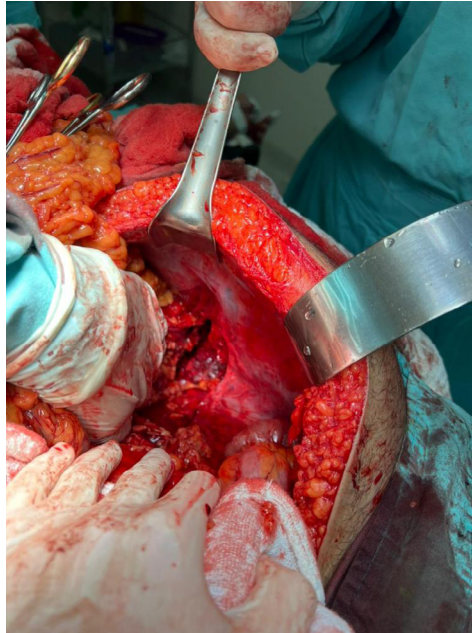
Metal post penetrates the left flank with the entry in the posterior lumbar region. Abdominal viscera, omentum, intestinal content, and ischemic loops of the small intestine are visible.



The airway is secured, the patient is intubated with an 8 Fr endotracheal tube, and two peripheral lines are obtained. The metal post is removed under direct vision by the surgical team, due to difficulty in transferring the patient. Without evidence of active bleeding upon removal, the wound is packaged with sterile compresses moistened with a physiological solution. The patient is taken to the operating room (OR) for emergency intervention [Figure 2].

Figure 2.

The metal post is removed under direct vision by the surgical team, due to difficulty in transferring the patient, without evidence of active bleeding upon removal.

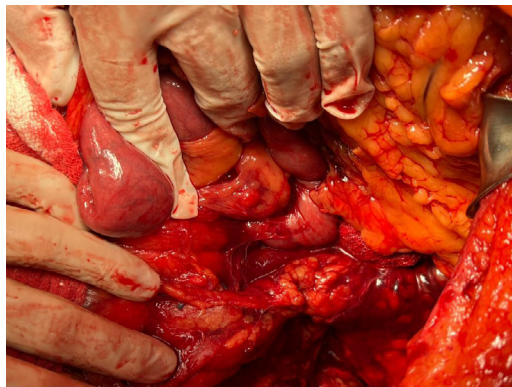


Laboratories are reported with a hemoglobin of 13 g/dL, leukocytes of 17 Ku/L, platelets 223.00 Ku/L, glucose 207 mg/dL, urea 7 mg/dL, and creatinine 1.3 mg/dL, DHL 328 IU/L, CPK 130.2 IU/L, and an arterial blood gas with decompensated metabolic acidosis. A jugular central venous catheter was placed, and a left chest tube was placed with an output of approximately 250 ccs of blood content.

An exploratory laparotomy was performed, showing avulsion of the left colon, a grade 4 lesion of the small intestine 50 cm from the angle of Treitz, and loss of tissue continuity in the retroperitoneum with a dislocated left kidney with a grade 1 lesion. Left hemicolectomy, end colostomy and Hartmann procedure, resection of the affected jejunum, and end-to-end anastomosis were performed **[Figure 3]**.

Figure 3.

Surgery findings: avulsion of the left colon, a grade 4 lesion of the small intestine 50 cm from the angle of Treitz, and loss of tissue continuity in the retroperitoneum with a dislocated left kidney with a grade 1 lesion.



Cavity lavage is performed, and Blake 19 Fr type drainage is placed along with the left paracolic slide. The defect is closed using peritoneum and mesocolon due to the size of the defect which makes it impossible to achieve closure of the penetrating defect in its entirety. Abdominal packing was performed with subsequent closure of the aponeurosis is performed at the level of the penetrating defect in the posterior region and the anterior wall of the abdomen. Total bleeding of 1,800cc, with 10 globular packages, 6 plasma packages, and 1 apheresis administered during the 6 hours of surgical time.

The patient was transferred to the intensive care unit with mechanical ventilation and with a requirement for amines. The patient underwent a second look and unpacking 24 hours after the first procedure, with the placement of the VAC system, which was replaced 72 hours later. The patient was extubated on the seventh day of stay in intensive care where he completed 24 hours of satisfactory ventilatory monitoring. The left endopleural tube was removed. On the ninth postoperative day, an abdominal tomography was performed due to the presence of fever peaks, which reported thrombosis of the left renal artery and emphysematous pyelonephritis, with the presence of a left pararenal collection. The surgical team performed a simple left nephrectomy [FIGURE 4]. Postoperative surveillance was satisfactory during the following 5 days. The patient was discharged.

Figure 4.

The surgical team performed a simple left nephrectomy due to thrombosis of the left renal artery and emphysematous pyelonephritis, with the presence of a left pararenal collection.



3. Discussion

It is important to discuss impalement injuries due to the lack of specific management protocols and the wide range of injury variability. The high kinetical force elevates de risk of added injuries, apart from those structures directly perforated or lacerated. Surgeons must use clinical reasoning skills in a setting of uncertainty, to counter the increased mortality and morbidity of these injuries. (Horowitz, et al., 1985; Quiroga-Garza, et al., 2020; Moncure, et al., 2009).

Time is a critical element in these cases. Basic trauma care, cinematics of the accident, and identification of the possible involved structures must be performed in the pre-hospital attention by emergency personnel and communicated to the emergency room. (Horowitz, et al., 1985). The patient must be screened for lesions that can affect the ABCs (Airway, Breathing, Circulation). Injuries must

be treated promptly to correct hemodynamical instability. Extended-FAST (Focused Assessment with Sonography in Trauma) may aid in identifying abdominal and cardiac injuries. (Ugoletti, et al., 2019)

Whenever the clinical conditions allow it, and the hemodynamics are stable, imaging studies will add valuable data to the patient evaluation. (Biffi & Leppaniemi, 2015) (Ugoletti, et al., 2019). In these types of patients, it is important to identify the region of the body that was affected; in the thoracoabdominal region, a chest and abdominal x-rays would help to determine the trajectory of the object, and a focused abdominal sonographic examination for trauma (FAST) would reveal the presence of blood in the thoracic or abdominal cavity. Depending on the result of these studies, laparoscopy or a thoracoscopy would be performed. On the contrary, if the trauma happens on the back or flank, it is preferred to perform a CT scanning to have a better evaluation of the retroperitoneal organs. (Biffi & Leppaniemi, 2015)

Surgical objectives include the removal of the object, when possible, and repair of damaged structures. Removal should be performed in the OR, however, the lack of specialized equipment to cut or decrease the size of the objects protruding from the patient may lead to the need for removal, which is a high-risk practice. Removal may release pressure caused by the object, and increase bleeding, with fast deterioration of the patient. There should always be a multidisciplinary team to assess and treat the case. (Sankpal, et al., 2020)

The second-look surgery was performed to control bleeding caused by coagulopathy and massive blood transfusion. It also aids in the early identification of missed injuries. This type of surgery is useful in damage-control cases, controlling critical injuries and allowing time to stabilize the patient. (REFs)

The febrile syndrome is a common complication in the postoperative period of trauma patients. (Despaigne, et al., 2013). In the first two postoperative days, the patient may develop a fever due to tissue damage. Nonetheless, clinicians should rule out other causes such as pulmonary atelectasis, surgical site infection, catheter infection, urinary tract infection, and anastomotic leak, among other causes. (Pile, 2006)

Drains aid to avoid collections, and identifying leakage. Closed drains are recommended over open ones to avoid atmospheric contamination, especially with active drainage (negative pressure). (Durai & Ng, 2009) It is recommended to remove the drain 48 hours after the output has ceased and confirm the resolution of the collection with cross-sectional imaging. (Soop, et al., 2017)

This case has relevant points to review. It is important to always be on the lookout for complications, either from the impalement or from the surgery itself. In this case, it is unknown if the renal artery thrombosis was caused because of the kidney luxation or the procedure and manipulation of the abdominal cavity. Nonetheless, it is crucial for future cases of impalement that the surgeon responsible for performing the exploratory laparotomy is well trained and capable of recognizing all the injured structures to minimize the probabilities of complications.

Although the patient survived and there were no major complications involved, there is still room for improvement in the management of an impaled patient. In our case, we did not have a standardized protocol to remove the metal post correctly; it was taken out with direct vision and could have possibly injured an organ on its way out.

4. Conclusions

An impaled injury is a complex lesion that needs special attention from the medical field for correct management. Although there is some literature about it, we encourage more research to be done about impalement injuries.

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RESUMEN

Las lesiones por empalamiento son un tipo de traumatismo abdominal penetrante complejo y raro de que se produce cuando un objeto, como un poste o una vara, penetra a una persona lesionando varios órganos, lo que la convierte en una situación potencialmente mortal en la que el tiempo y el manejo correcto juegan un papel importante en la supervivencia del paciente. Un hombre de 37 años sufrió una herida por empalamiento abdominal con un poste de señales de metal, penetrando el flanco izquierdo del abdomen. A la exploración física, hay un hemitórax izquierdo hipoventilado con retracciones intercostales, aumento de la frecuencia cardíaca, pulsos distales débiles, relleno capilar retrasado y piel pálida. Un poste metálico de 1 metro de largo (aproximadamente 7 cm de diámetro) penetra el flanco izquierdo con entrada en la región lumbar posterior. Son visibles las vísceras abdominales, el epiplón, el contenido intestinal y las asas isquémicas del intestino delgado. Se realizó una laparotomía exploradora; Se realizó hemicolectomía izquierda, colostomía terminal y procedimiento de Hartmann, resección del yeyuno afectado y anastomosis terminoterminal. Al noveno día postoperatorio se realiza tomografía abdominal por presencia de picos febriles, que reporta trombosis de arteria renal izquierda y pielonefritis enfisematosa, con presencia de colección pararenal izquierda. Se realizó nefrectomía izquierda simple. La vigilancia postoperatoria fue satisfactoria durante los siguientes 5 días. El paciente fue dado de alta. Una lesión por empalamineto es una lesión compleja que necesita una atención especial desde el ámbito médico para su correcto manejo. Aunque existe cierta literatura al respecto, alentamos a que se realicen más investigaciones sobre estas lesiones.

Palabras clave: Empalamiento, Reporte de caso, Trauma abdominal, Trauma abdominal penetrante, Trauma renal
