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A rare case of a transabdominal impalement after a fall from a ladder



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ABSTRACT

INTRODUCTION: Impalement injuries are caused by objects that penetrate and remain inside the human body. They are rare and often lead to complex surgical problems, demanding immediate measures and intensive care.

PRESENTATION OF CASE: We report a case of a 39 year old male who presented in our emergency department with a history of fall from a 3 m high ladder, landing on a wooden stick that penetrated the patient from his left lumbar region, leading to a *trans*-abdominal impalement injury.

DISCUSSION: Nowadays impalement injuries although rare, demonstrate a challenging presentation for emergency providers. Their complexity often raises concerns about the proper surgical approach and postoperative management. In many cases, they may cause severe morbidity or even be lethal.

CONCLUSION: The article describes a case of a transabdominal impalement injury and pinpoints the strategies followed regarding the prehospital care, as well as the intra- and postoperative management.

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1. Introduction

Impalement injuries are rare and are produced from objects that penetrate and remain impaled in the human body [1]. According to the existing literature, the management of these injuries is controversial, mainly because of the small number of cases and the challenging surgical approach. In this case report, we present the initial management, surgical approach and the post-operative care of a patient with an abdominal impalement caused due to a fall from a ladder on a wooden stick.

2. Presentation of case

A 39 year-old male fell from a 3 m high ladder and landed on a wooden stick (shown in Fig. 1). The stick penetrated the patient from his left lumbar region (shown in Fig. 2) and the tip of it was palpable in the right upper quadrant of the abdomen but there was no exit wound. (shown in Fig. 3). The ambulance arrived within 10 min from the event and within half an hour the patient was transferred to the hospital. No attempt to remove the stick at blind was made by the patient or rescuers at the site of the accident. On admission to the emergency department (ED) the patient was fully alert with a Glasgow Coma Score (G.C.S) of 15/15, a heart rate of 85 beats per minute (BPM) and a blood pressure of 150/80 mmHg. Immediate resuscitation protocol took place including the placement of

a central and two peripheral vein catheters, fluid administration, hematological and biochemical profile and catheterization of the bladder. His hemoglobin remained stable in consecutive measurements at a level of 14 g/dl and the white blood cell count (WBC) was $18,000 \times 10^3/\text{ml}$. No other abnormal values from the laboratory tests were noticed, while the urinalysis revealed no signs of hematuria. Regarding fluid management, 500 ml of 0.9% saline were given over 10–20 min to the patient and another 500 ml were administered until the performance of the Computed Tomography (CT). The patient was complaining of pain at his left lumbar region and his right hypochondriac region. On clinical examination he presented with remarkable sensitivity on palpation, while defense and rebound tenderness were noticed. There were no other findings from the rest of the physical examination.

Considering the stable condition of the patient and the high risk for concomitant injuries, the team proceeded with the performance of a computed tomography (CT) of the head, neck, thorax and abdomen. The CT of the abdomen revealed the penetrating foreign object, entering into the body from the left lumbar region and traversing through the whole abdomen, while its end could be seen subcutaneously, in the right quadrant of the abdomen. In addition, the stick was in contact with the left kidney and the posterior wall of the stomach (shown in Fig. 4).

The patient underwent an emergency laparotomy through midline and the abdominal cavity was thoroughly examined. The operating theatre time was approximately 90 min. The wooden stick impaled, was entering the abdomen through the posterior peritoneum right by the ligament of Treitz, traversing the posterior wall of the stomach (shown in Fig. 5), the tail of the pancreas and the

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Fig. 1. shows the penetrating wooden stick.

ligamentum teres hepatis. Its edge was found subcutaneously without exiting the abdomen. The spleen and the liver were not injured and there was a mild haemo-peritoneum. Careful examination of the left kidney revealed no injury as well.

The wooden stick was carefully removed by controlled pulling it out and its trajectory was thoroughly investigated for any concomitant injuries. The gastric perforation was sutured in two layers and a nasogastric tube was inserted by the anesthetist and left in place. In addition minor bleeding from the tail of pancreas was controlled and a drainage tube was placed there. Another drainage tube was also inserted below the posterior wall of the stomach where the major injury was. The entry wound was left open in order to avoid postoperative infection and broad spectrum antibiotics and tetanus vaccination were administered, while the patient was transferred to the Intensive Care Unit (ICU).

The next day, after patient's stabilization, he was transferred to the surgical ward. Analysis of the drainage tube fluid showed increased level of amylase during the 2nd postoperative day at a value of 1200 IU/ml. Eventually its level dropped to 50 IU/ml during the 6th postoperative day and consequently drainage tubes were removed. Drains were left until then in order to obtain daily samples of fluid and rule out pancreatic fistula formation. The patient had an uneventful recovery and remained afebrile with a mild leukocytosis, while the antibiotic administration was discontinued on the 7th postoperative day as there was a gut perforation. He was discharged home after 8 days in the hospital without any deficits.



Fig. 2. shows the penetrating stick entering the patient's left lumbar region.

3. Discussion

Echempati et al. trying to categorize the impalement injuries classified them into two subtypes [2]. According to them, Type 1 injuries occur when the human body strikes an immobile object [2]. These injuries are usually seen in industrial and car accidents when passengers are ejected from their automobiles. On the other hand, Type 2 injuries occur when a moving object collides with an immobile person [2]. In a review of the literatures from 1980-to year 2000 Gölder SK et al. pointed out motorbike and car accidents as the commonest cause of impalement injuries with penetration of the abdominal cavity [3]. They stated as well that another quite common cause of this type of injuries involves sexual activity or abuse [3]. Nevertheless, no case of transabdominal impalement as a result of a fall from a ladder has been reported.

The most important rule in the prehospital management is not to remove the impaled object [3,4,9]. An assumption of the tamponade effect of an impaling arrow on the surrounding blood vessels was already made by Bill JH back in 1862 [11]. This approach is



Fig. 3. shows the tip of the stick found subcutaneously with no visible exit wound.



Fig. 4. axial image that shows the object impaled traversing the tail of the pancreas as revealed by the CT.

necessary because major blood vessels, which are tamponaded by the impaled object, could have been damaged. As a consequence, uncontrolled removal could lead to a catastrophic bleeding especially when it is done outside the hospital setting [4]. However, there is a uniform agreement that the impaling object can be shortened in order to help transport or positioning of the patient on the operating Table [1,4,5]. Management protocols for impalement injuries vary according to organ system involved and according to the needs of each individual patient but the principle is essentially the same. Nevertheless, major goals in resuscitation are optimizing tissue oxygen delivery, control of bleeding and repletion of the intravascular volume, as well as avoiding over-hydration [10].

Impalement injuries traversing the abdomen and injuring multiple organs have a high rate of morbidity and mortality. Hemodynamic stability of the patient does not eliminate the risk of a severe vascular injury due to the tamponade effect of the impaling object. Provided the patient's condition is stable a computed tomography (CT) scan should be performed. This can help in assessing the trajectory of the impaling object and defining any other concomitant injuries. In a situation when patient is unstable, time consuming investigations should be avoided and an emergency exploratory laparotomy and extraction of the impaled object are recommended.

The surgical approach of impalement injuries could be controversial. When the impaling object causes a through-and-through injury, and its course is subcutaneous some surgeons recommend

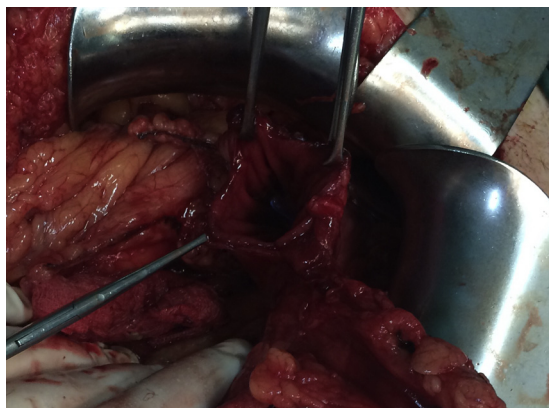


Fig. 5. intraoperative picture of the injury at the posterior wall of the stomach.

a fistulotomy-like incision between the entrance and exit sites [6]. When only an entrance wound exists, a traditional midline laparotomy incision may be appropriate [6]. In all cases the removal of the foreign object has to be followed by thorough hemostasis and control of abdominal organs.

To avoid postoperative infections both the entry and the exit wound should be left open to heal by second intention, while the wound should be carefully debrided daily. Broad spectrum antibiotics and tetanus vaccination should be administered [3,7,8]. The duration of the antibiotic prophylaxis could be questionable. According to the existing literature, there is enough evidence to support a Level I recommendation that prophylactic antibiotics should only be administered for 24 h in the presence of abdominal trauma [12,13–15]. In addition, there is no evidence to support the extension of antibiotic prophylaxis beyond the 24 postoperative hours [12,13–15].

Finally another aspect that should be taken seriously into account is the psychological status of patients that survive these kinds of injuries. They are often diagnosed with post-traumatic stress and need psychological assistance [7].

4. Conclusion

Abdominal impalement injuries are rare conditions and their morbidity and mortality rate depends on the structure damaged. This case reports an impalement injury and pinpoints the timely execution of proper management protocols, especially resuscitation and *peri*-operative treatment. In our case, although a sizeable object traversed the abdominal cavity, no life-threatening injuries were present.

4.1. Methods

The work has been reported in line with the CARE criteria [16].

Conflicts of interest

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Ethical approval

None.

Consent

Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

Authors contributions

Angelopoulos Stamatios: Figures, Mantzoros Ioannis: Discussion, Kyziridis Dimitrios: Abstract, Fontalis Andreas: Presentation of case, Parpoudi Stella: Conclusion, Konstandaras Dimitrios: References, Tsalis Constantinos: Introduction.

Guarantor

Mantzoros Ioannis.

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