Original Article

Traumatic diaphragmatic hernia in a tertiary hospital in Benin City, Nigeria

Raymond Atah Eghonghon , Oseyi Christopher Dawodu

Department of Surgery, University of Benin/University of Benin Teaching Hospital, PMB 1111, Benin City, Edo State, Nigeria.

Abstract

Background: Traumatic diaphragmatic injuries are not commonly encountered in trauma. They are a marker of severe injury worse still with blunt mechanisms. Computed tomography scan is the imaging modality of choice in stable patients and treatment involves simple or mesh repair.

Aim: The aim of this study was to determine the pattern of presentation of diaphragmatic injuries at the University of Benin Teaching Hospital (UBTH), Benin City.

Methods: The data of patients with traumatic diaphragmatic injuries between 1st January 2020 and 31st December 2024 was collected retrospectively from retrieved patient records and analysed and results are presented.

Results: Of the 1785 patients with thoraco-abdominal trauma, 8 (0.4%) of them had diaphragmatic injuries. Six patients (75%) were males, and the mean age was 34.5 years (SD + 14.6). Blunt and penetrating mechanisms were implicated in 4 patients (50%) each. The penetrating mechanism was from gunshot in 3 patients (37.5%). Five patients had left sided diaphragmatic injury, 2 patients had right sided diaphragmatic injuries and 1 patient had bilateral injuries. The diagnosis of diaphragmatic injury was made intra-operatively at laparotomy for peritonitis in 4 patients (50%). The surgical approach was a laparotomy in 7 patients (87.5%), while only 1 patient (12.5%) had a left thoracotomy. Overall mortality was 25% (2 patients).

Conclusion: Traumatic diaphragmatic injuries present a diagnostic challenge and require an index of suspicion for diagnosis. Missed injuries lead to delayed presentation with gut herniation into the chest causing increased morbidity and mortality.

Keywords: Thoraco-abdominal trauma, diaphragmatic injuries, mechanisms, outcome

Address for correspondence: Dr. Oseyi Christopher Dawodu, Department of Surgery, University of Benin/University of Benin Teaching Hospital, PMB 1111, Benin City, Edo State, Nigeria.
Email: oseyi.dawodu@uniben.edu, oseyid@yahoo.com
Phone: +2347060482007

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INTRODUCTION

The diaphragm is a dome-shaped musculo-tendinous structure that separates the chest and the abdominal cavities. It is the principal muscle of respiration, playing a more active role in inspiration.[1] Traumatic diaphragmatic injuries are seldom diagnosed and may occur following blunt or penetrating thoracic and abdominal trauma. Previous studies have shown that they account for 0.8 to 15% of thoraco-abdominal injuries, penetrating injuries accounting for most of them.[2-4] Diaphragmatic injuries commonly occur in the setting of polytrauma and are an indicator of severe injury. Diagnosis and management of traumatic diaphragmatic injuries pose a challenge to both trauma and thoracic surgeons. Diaphragmatic injuries require an index of suspicion for prompt diagnosis. Sometimes,

diagnosis may be missed in the acute presentation even with appropriate imaging, more so in penetrating mechanisms where the laceration is small and there is no immediate herniation. Delayed diagnosis is associated with increased morbidity and mortality.[5,6]

Chest radiograph is of value in the initial assessment, but Chest CT scan is more sensitive in the diagnosis of diaphragmatic injuries. The most common diagnostic sign seen on chest CT scan is the discontinuous diaphragm sign. Others include organ herniation, dependent viscera sign and collar sign.[7] Laparoscopy and video-assisted thoracoscopy are both diagnostic with high sensitivity and can facilitate the repair of the diaphragmatic injury. Traumatic diaphragmatic lacerations often require surgical repair. However, there is no consensus among trauma and thoracic surgeons on the most appropriate surgical approach or technique. A laparotomy is favoured by many trauma surgeons in the acute phase as it allows for associated abdominal injuries such as gastric and splenic injuries on the left and liver injuries on the right to be addressed.[3] Video assisted thoracoscopy or thoracotomy is the choice of approach by many thoracic surgeons in delayed presentation.[4]

Mortality from diaphragmatic injuries is often due to the other associated chest and abdominal injuries. Patients with isolated diaphragmatic injuries have better outcomes.[2]

This study aims to evaluate the prevalence, pattern of presentation, mode of diagnosis, and outcome in patients with diaphragmatic injury at the University of Benin Teaching Hospital.

MATERIALS AND METHOD

The study was conducted in the Department of Surgery, University of Benin Teaching Hospital, Benin City, Edo State, South-South, Nigeria. Ethical approval for the study was obtained from the University of Benin Teaching Hospital Health Research and Ethics Committee (Protocol number: ADM/E 22/A/VOL.VII/148312103).

Data from the trauma registry on all patients with thoraco-abdominal injuries within a 5-year period, between January 1, 2020 and December 31, 2024 were reviewed. Records of patients who were managed for traumatic diaphragmatic injuries were identified and their case files retrieved. Relevant clinical information including socio-demographic data, mechanism of injury, associated injuries, interventions, and outcomes were entered into a predesigned structured proforma. The data was analyzed using Microsoft® Excel® for Microsoft 365 MSO version 16, manufactured by Microsoft Corporation, Redmond, Washington State, United States of America. The results are presented in prose, tables, and figures.

RESULTS

The data of 1785 patients who sustained thoraco-abdominal injuries during the 5 years period were analysed. Eight (0.4%) of the patients had a diagnosis of diaphragmatic injury. Six patients (75%) were males while 2 (25%) were females.

The ages of the patients ranged between 21 and 65 years with a mean age of 34.5 years (SD $\pm$ 14.6).

The mechanism of injury was blunt force to the thoraco-abdominal region in 4 patients (50%). Of the remaining 4 patients (50%) that had penetrating injuries, the majority, 3 patients (37.5%) were due to gunshot to the thoraco-abdominal region (Figure 1). One patient (12.5%) had a stab injury to the thoraco-abdominal region.

Left sided diaphragmatic injuries were more commonly encountered occurring in 5 (62.5%) of the patients while right sided injuries occurred in 2 patients (25%). One patient (12.5%) had bilateral diaphragmatic injury (Figure 2).

The duration from presentation to diagnosis ranged from 8 hours to 288 hours. Four patients (50%) had the diagnosis of diaphragmatic injury made intra-operatively during laparotomy for peritonitis. The diagnosis was made in 2 patients (25%) with a chest radiograph. Two patients (25%) had the diagnosis of diaphragmatic injury made with a chest CT scan after 11 days and 12 days on

admission respectively. The surgical approach was a laparotomy in 7 patients (87.5%) with repair of diaphragmatic laceration using nylon 2 interrupted stitches, while 1 patient (12.5%) had a left thoracotomy and repair of left sided 10cm diaphragmatic laceration with a polypropylene mesh (Figure 3).

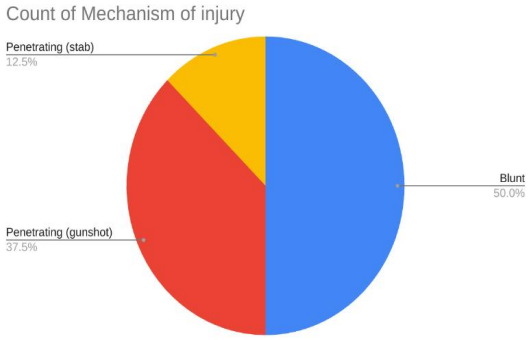

Figure 1: Pie chart showing the mechanisms of injury.

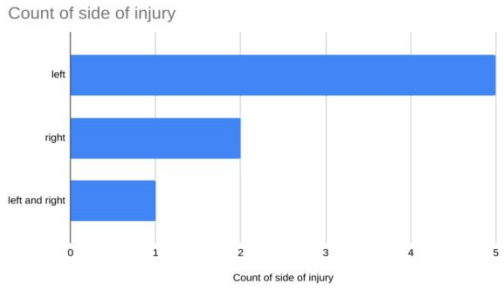

Figure 2: Bar chart showing the distribution of the location of the injuries.

Three patients (37.5%) required mechanical ventilation in the intensive care unit in the early post-operative period on account of respiratory insufficiency. Of these 3 patients, 2 died after 2 days and 5 days of hospitalization respectively. Overall mortality was 25% (2 patients) and was related to the associated multiple injuries including chest and traumatic brain injuries and post-operative sepsis from gut perforation. Blunt thoraco-abdominal trauma was the mechanism of diaphragmatic injury in both patients.

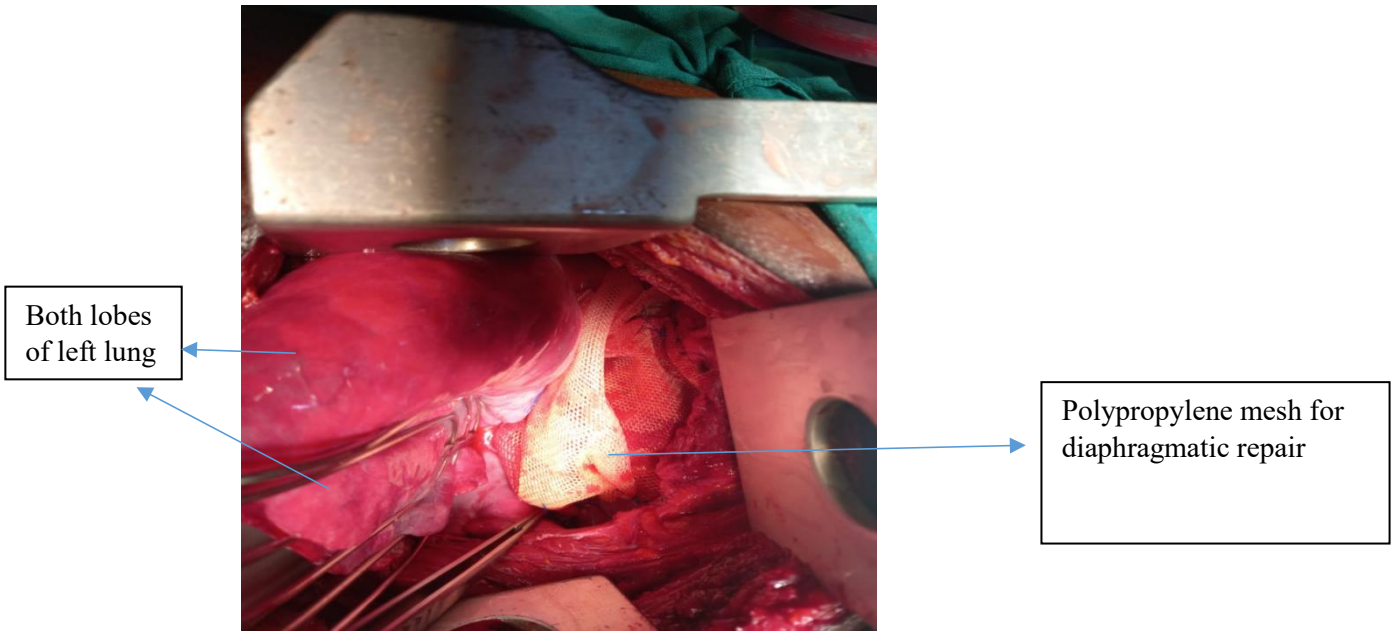

Figure 3: Left thoracotomy with repair of a 10cm diaphragmatic defect with a polypropylene mesh.

DISCUSSION

Diaphragmatic injuries are uncommon and were diagnosed in 0.4% of all patients who sustained thoraco-abdominal injuries from our review. The incidence of diaphragmatic injuries is difficult to determine but varies widely due to late presentation and high propensity for missed injuries. Thiam et al[2] and Bosanquet et al[8] reported an incidence of 0.2 to 15% among trauma patients. The low incidence of diaphragmatic injuries is accounted for by the protection offered by the rib cage. Majority of the patients were young (mean age 34.5 years), and male (75%) adults. This population represents the active population, who are considered to be adventurous and at risk of trauma. The findings are consistent with the studies by Gao et al[9] who reported a mean age of 32.4 years, as well as Shah et al[10] and Thiam, O., Konate, I., Gueye, M.L. et al[2] who both reported a male to female ratio of 4:1.

Both blunt and penetrating mechanisms occurred with equal frequency, 4 patients each (50%). Injuries from firearms were the most implicated penetrating mechanism accounting for 3 (37.5%) of the cases, while only 1 (12.5%) patient had a stab injury to the thoraco-abdominal region. DeBarros and Martin[3], Bosanquet et al.[8] and Hanna et al.[11] reported a preponderance of penetrating mechanisms amongst patients with diaphragmatic injuries. Shinjo et al[12] reported that penetrating trauma accounted for only 29.8% of diaphragmatic injuries. Penetrating injuries are associated with smaller diaphragmatic lacerations which may lead to delayed herniation of abdominal viscera into the chest with the risk of missed diagnosis. A high index of suspicion is thus required in making a diagnosis.

Diaphragmatic injuries occurred more commonly on the left, 5 (62.5%) of the patients. Two patients (25%) had a right sided diaphragmatic injury and one patient (12.5%) had bilateral diaphragmatic injuries. This finding is consistent with the findings from other related literature.[2,4,13] Right sided diaphragmatic injuries are infrequently encountered due to the protection offered by the right lobe of the liver. Furthermore, right sided injuries are more likely to be missed during the evaluation of the injured patient as herniation of gut into the chest is infrequent on the right.

The diagnosis of diaphragmatic injury was made intraoperatively during emergency laparotomy for peritonitis in 4 patients (50%). Two patients (25%) had chest radiographic findings of distortion of the left diaphragmatic contour while another 2 patients (25%) had delayed diagnosis following a chest CT scan on the 11th and 12th day on admission respectively. Signs of diaphragmatic injury on a plain radiograph of the chest include elevation of the hemidiaphragm, distortion of the diaphragmatic outline and blunting of the costophrenic sulcus. These are indirect signs of diaphragmatic injury with prohibitively low sensitivity and specificity. The only direct sign of diaphragmatic injury is gut herniation into the chest. Computed tomography scan is the imaging modality of choice in the assessment of thoraco-abdominal trauma including diaphragmatic injuries with an acceptable sensitivity and specificity.[14] Seven patients (87.5%) had laparotomy and repair of the diaphragmatic lacerations using nylon 2 interrupted suturing while 1 patient (12.5%) had a left thoracotomy with repair of a 10cm diaphragmatic defect with a polypropylene mesh (Figure 3). There is no consensus amongst surgeons on the most appropriate access route for repair of diaphragmatic injuries. Whereas trauma surgeons favour a laparotomy in acute presentations as it allows access to address other intra-abdominal injuries, thoracic surgeons lean towards thoracotomy particularly in delayed presentations.[15] Minimal access procedures such as laparoscopy and video assisted thoracoscopy are useful in stable patients without associated visceral injuries.[16]

Three patients (37.5%) required mechanical ventilation in the intensive care unit post-operatively due to respiratory insufficiency from chest complications. Two of the patients (66.7%) admitted to the intensive care unit died in the early post-operative period hence an overall mortality rate of 25%. Mortality was

associated with multiple injuries in the chest and abdomen and blunt trauma accounted for the diaphragmatic injury in both patients. Dwivedi et al [4], Gao et al[9] and Shah et al[10] reported similar mortality rates ranging from 4.3 to 37%.

Being a retrospective study, the absence of real-time data collection and the need to rely on retrieved patient records was a limitation.

CONCLUSION

Traumatic diaphragmatic hernias though uncommon can be life threatening. Diagnosis is a challenge to the surgeon and requires a high index of suspicion to prevent missed injuries. Laparotomy in acute presentations allows the surgeon to handle other associated abdominal injuries. Mortality is related mainly to the presence of associated injuries.

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Conflict of interest:

There are no conflicts of interest.

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