Massive left hemothorax following left diaphragmatic and splenic rupture with visceral herniation: Case Report

Esubalew T. Mindaye (esubetad24@yahoo.com)
St Paul's Hospital Millennium Medical College
Abraham Zegeye
St Paul's Hospital Millennium Medical College
Tesfaye H. Tufa
St Paul's Hospital Millennium Medical College

Case report

Keywords: Massive hemothorax, diaphragmatic rupture, splenic rupture, case report

Posted Date: September 15th, 2020

DOI: https://doi.org/10.21203/rs.3.rs-76122/v1

Version of Record: A version of this preprint was published at International Journal of Surgery Case Reports on January 1st, 2021. See the published version at https://doi.org/10.1016/j.ijscr.2020.11.144.

Abstract

Background: Massive left hemothorax following left diaphragmatic and splenic rupture with visceral herniation is quite an uncommon life-threatening condition usually associated with blunt thoracoabdominal trauma. Mortality is generally associated with coexistent vascular and visceral injuries that could be rapidly fatal. Timely, and proper diagnosis is mandatory as survival depends on prompt diagnosis and treatment.

Case presentation: We describe a case of massive left hemothorax secondary to blunt thoracoabdominal injury with left diaphragmatic and splenic rupture, gastric, greater omentum and splenic herniation into the left thoracic cavity in a 32 years old male car driver after sustaining a road traffic accident and presented with shortness of breath and easy fatigability of 4 hours' duration. He also had non-expanding zone 3 retroperitoneal hematoma and left acetabular fracture. He was treated surgically and discharged home improved.

Discussion: Diaphragmatic ruptures following blunt injuries are generally larger leading to herniation of visceral organs into the thoracic cavity and the most common organ to herniate on the left side is the stomach followed by omentum and small intestine. Isolated diaphragmatic rupture is rare and associated injuries are the main cause of mortality with spleen being the most common involved organ. Splenic rupture is a very rare cause of hemothorax and isn't usually considered in the differential diagnosis, making proper information about the mechanism of injury vital.

Conclusion: Massive hemothorax following splenic and diaphragmatic rupture with visceral herniation resulting from either blunt or penetrating trauma is rare. Delayed or missed diagnosis is associated with higher morbidity and mortality. A high index of suspicion and the proper use of diagnostic studies are the most important factors in early and correct diagnosis.

Introduction

Diaphragmatic injuries can occur following blunt or penetrating trauma and iatrogenic causes often resulting in herniation of abdominal viscera into the thoracic cavity (1). Although the true incidence is difficult to ascertain due to missed and delayed diagnosis, it ranges from 1 to 7% of all patients with significant blunt trauma, and 10 to 15% with penetrating wounds, and this number is expected to increase due to the rise in the number of road traffic accidents annually (2). The commonest causes for blunt injury are high velocity road traffic accidents(RTAs) and for penetrating injuries are knife attacks and gunshot wounds (1). In blunt injuries following lateral trauma, the abrupt change in intra-abdominal pressure is thought to cause the majority of injuries (3). Diaphragmatic rupture is invariably a marker of serious trauma and isolated injury is rare. Associated injuries include intra-abdominal injuries, thoracic injuries, fractures of the ribs, pelvis and long bones, and head injuries. The spleen is the most commonly injured organ, due to its fragile nature and fixation by various ligaments, or the pulling effect of the stomach in blunt trauma (4–6)

Clinically, diaphragmatic injuries are divided into three phases as the initial or acute phase, latent phase, and obstructive phase (6, 7).A timely diagnosis in acute phase can be difficult since patients invariably have other distracting and possibly life-threatening injuries, and present with shock in 50–60% of the time (8). Physical findings can be either thoracic including, decreased breath sounds, fractured ribs, flail chest, and signs of haemothorax or pneumothorax, or abdominal including guarding, absence of bowel sounds, and abdominal swelling, depending on the extent of injuries (1).

A plain chest radiograph is accessible, highly useful imaging modality in patients suspected with diaphragmatic injury, to show a nasogastric tube within the chest, hepatic displacement into the right hemithorax, or herniated bowel loops within the chest, with or without focal constriction of the viscus at the herniation site known as a “collar sign”.Other suggestive signs include irregularity of the diaphragmatic outline and mediastinal shift (1, 6). Chest X-ray can be normal or non-specific in 20–50% of all patients with diaphragmatic injuries (9). In hemodynamically stable patients conventional CT (sensitivity of 14%-61% and specificity of 76%-99%) or Helical CT (sensitivity of 71% and specificity of 100%) can be used to diagnose diaphragmatic injury (10). Diagnostic laparoscopy remains an excellent tool for the detection of haemoperitoneum, solid organ damage and diaphragmatic lacerations (11) and thoracoscopy has diagnostic accuracy 98%-100% to diaphragmatic injuries (8). The diagnosis may be even unsuspected and found only on laparotomy in up to 50% of blunt ruptures(12).

Management is primarily according to ATLS(Advanced Trauma Life Support) guidelines and, most morbidity and mortality is due to associated injuries(1). Once the patient is stabilized thorough evaluation for further obvious and occult injuries should be done during a secondary survey. At laparotomy, regardless as to whether the diagnosis is suspected or confirmed pre-operatively, full evaluation of both diaphragms should be undertaken. All herniated viscera must be carefully reduced and relocated to its original position, and the pleural cavity should be drained (1). Devitalized diaphragmatic tissue needs to be carefully debrided and closed using a horizontal mattress with preferably nonabsorbable sutures(1, 13). Diaphragmatic repair can be done through thoracotomy alone, however, relocation of abdominal viscera can be quite challenging (8), and laparoscopic repair is the other alternative (1).

Case Presentation

A 32 years old male car driver presented with shortness of breath and easy fatigability of 4 hours’ duration associated with left side abdominal & hip pain after being involved in front collision of two automobile cars. He was hit by the front door of his car to his left side of the chest, abdomen and pelvic area. For these complaints, he was taken to a nearby primary hospital within 1hour of the trauma where a chest tube was inserted to his left chest, and upon insertion about 1500 cc of frank blood was drained for which he was referred to our tertiary center, Saint Paul’s Hospital Millennium Medical College(SPHMMC), with an impression of massive left hemothorax. After 2hrs of travel upon arrival to our Emergency surgical department his chest tube has drained extra 1200 cc blood and was acutely sick looking with difficulty of breathing and deranged vital signs (PR = 130beats/min, feeble, RR = 36breath/min, BP = 70/40mmhg). He was assessed according to ATLS protocol and resuscitation continued. With 15 liters of

face mask oxygen, his saturation of oxygen was 85% and he had paperwhite pale conjunctiva, absent air entry on the left posterior lower 2/3 lung field but no evidence of rib fracture. His abdomen was full with active bowel sound and there was slight tenderness on the left upper quadrant and pelvic area. He also had marked tenderness upon moving his left hip joint with limited range of motion. Upon catheterization, his urine was clear but only 20 cc. Other organ system examination was unremarkable.

Focus abdominal ultrasound for trauma(FAST) was unremarkable and his hemoglobin(Hg) was 7 gm/dl, and with continued resuscitation with crystalloids and whole blood till achieving targeted systolic blood pressure of 90mmhg Supine Chest X-ray was taken(Fig. 1) showing irregular left diaphragmatic outline, collapsed left lung, marked mediastinal shift to the right and soft tissue opacity containing visceral gas in the thorax with no evidence of rib fracture.

After adequate resuscitation and getting informed written consent, with diagnostic impression of hemorrhagic shock secondary to massive left hemothorax secondary to blunt thoracoabdominal injury with left diaphragmatic rupture and suspected left hip bone fracture he was operated through midline laparotomy. The intraoperative finding was about 12 cm x 10 cm left diaphragmatic rupture through which the stomach, greater omentum and spleen has herniated into the left thoracic cavity (Fig. 2). There was 150 cc hemoperitoneum in the general peritoneal cavity and 1000 cc clotted blood in the left thoracic cavity. The tight diaphragmatic defect was released and herniated viscera was relocated into the peritoneal cavity. Up on replacement of the spleen in to the peritoneal cavity, grade four splenic injury was identified on the diaphragmatic surface extending to the hilum (Fig. 3) with active bleeding for which splenectomy was done. There was non-pulsatile, non-expanding zone three retroperitoneal hematoma but other visceral organs looked normal. The hemoperitoneum and clotted hemothorax was sucked out, the left diaphragmatic defect closed using interrupted horizontal mattress with silk, peritoneal cavity lavaged with warm saline and abdominal wound closed in layers. Postoperatively he was transferred to intensive care unit (ICU) where resuscitation continued while being on mechanical ventilatory support. He was transfused with a total of 6 units of whole blood and both adrenalin drip and crystalloid resuscitation continued until the mean arterial pressure (MAP) raises to 70 mmhg. On the second operative day, he was able to gain consciousness and weaned from the mechanical ventilator. On the 4th post-operative day, pelvic CT scan was done (Fig. 4) and showed left acetabular anterior and posterior column fracture for which skeletal traction was applied until he recovers for operative fixation. On his 10th postoperative day he was taken to the operating theater and, Open reduction and internal fixation was done(Fig. 5). Subsequently, he improved well and discharged home on his 10th postoperative day (Fig. 5 and Fig. 6).

Discussion

Normal intra-abdominal pressure varies from + 2 to + 10 cm H2O during inspiration and the pressure gradient across the diaphragm reaches100 cm H2O during the Valsalva's maneuver, and this pressure gradient is thought to exist at the moment of injury, thus contributing to both the initial injury, and can lead to the herniation of abdominal contents through a diaphragmatic injury (1, 14). The most commonly herniated organs on the left side are the stomach (80%), omentum, small intestine, colon, and spleen (15,

16). Diaphragmatic ruptures following blunt injuries are generally more extensive than those caused by penetrating trauma, measuring 5–15 cm, and are typically radial (1). These look to be the mechanism of injury to our patient and the herniated organs were stomach, greater omentum and spleen. Although spleen is the most commonly involved organ in such trauma massive hemothorax leading to circulatory collapse are rarely reported in literature. Since splenic rupture is a very rare cause of hemothorax it isn't usually considered in the differential diagnosis, delaying early proper surgical intervention making proper information about the mechanism of injury vital. In polytrauma patients with diaphragmatic rupture like ours' patient survival depends on the severity of associated injuries, timely correct diagnosis and early intervention. In this regard our patient has suffered from ongoing bleeding during transportation till getting definitive surgical intervention which has increased his morbidity during recovery.

Upon subsequent post-operative follow-up for the last 6 months, he has marked Clinical improvement with physiotherapy and is happy with his treatment.

Conclusion

Although diaphragmatic rupture is rare it signifies underlying serious injuries which are highly fatal with delayed intervention. A high index of suspicion with detailed information about the mechanism of injury and proper use of diagnostic studies are the most important factors in early and correct diagnosis. Although massive hemothorax following splenic rupture is extremely rare condition delayed or missed diagnosis is associated with higher morbidity and mortality making its consideration into the differential diagnosis crucial.

List Of Abbreviations

ATLS- Advanced Trauma Life Support

Cm H2O- centimeter of water

CT - computerized tomography

FAST- Focused abdominal ultrasound for trauma

MAP - Mean arterial pressure

RTA –Road Traffic accident

SPHMMC - Saint Paul's Hospital Millennium Medical College

Declarations

Ethics approval and consent to participate: Clearance was obtained from the Institutional Research and Ethics Review Committee (IRB) of SPHMMC for the publication of the case report

Consent to publish: informed consent was obtained from the patient for publication of this case report and accompanying images

Availability of data and materials

All data related to the outcome are included in the manuscript.

Competing interest

All authors declare that they have no competing interest.

Funding: None

Author's contribution

EM: Participated in the surgery, conceived and conducted the study, did literature search, AZ: Participated in the surgery, Overall supervision of the manuscript and critical revision of the manuscript, TT: Overall supervision of the manuscript and critical revision of the manuscript

All authors have read and approved the manuscript.

Acknowledgment: We want to thank our patient for consenting to the publication of the article.

References

1. Bosanquet D, Farboud A, Luckraz H. A review diaphragmatic injury. Respir Med CME [Internet]. 2009 [cited 2020 Sep 2];2(1):1–6. Available from: https://linkinghub.elsevier.com/retrieve/pii/S1755001709000037
2. Scharff JR, Naunheim KS. Traumatic diaphragmatic injuries. Thorac Surg Clin. 2007;17(1):81–5.
3. Sangster G, Ventura VP, Carbo A, Gates T, Garayburu J, D'Agostino H. Diaphragmatic rupture: a frequently missed injury in blunt thoracoabdominal trauma patients. Emerg Radiol. 2007;13(5):225–30.
4. Freixinet J, Segur J, Mestres C, Mateu M, Gimferrer J, Catalán M, et al. Traumatic injuries of the diaphragm. Experience in 33 cases. Thorac Cardiovasc Surg. 1987;35(04):215–8.
5. Nursal T, Ugurlu M, Kologlu M, Hamaloglu E. Traumatic diaphragmatic hernias: a report of 26 cases. Hernia. 2001;5(1):25–9.
6. Shah R, Sabanathan S, Mearns AJ, Choudhury AK. Traumatic rupture of diaphragm. Ann Thorac Surg. 1995;60(5):1444–9.
7. Lee W, Chen R, Fang JF, Wang C, Chen H-Y, Chen S-C, et al. Rupture of the diaphragm after blunt trauma. Eur J Surg Acta Chir. 1994;160(9):479–83.
8. Petrone P, Leppäniemi A, Inaba K, Søreide K, Asensio JA. Diaphragmatic injuries: challenges in the diagnosis and management. Trauma. 2007;9(4):227–36.

9. Arsensio J. Injury to the diaphragm. Trauma. 2000;
10. Iochum S, Ludig T, Walter F, Sebbag H, Grosdidier G, Blum AG. Imaging of diaphragmatic injury: a diagnostic challenge? Radiographics. 2002;22(suppl_1):S103–16.
11. İçme F, Balkan E, Becel S, Kavaklı HŞ, Yüzbaşıoğlu Y, Şener A. Thoracic and cardiovascular surgery. 1994;
12. Lindsey I, Woods SD, Nottle PD. Laparoscopic management of blunt diaphragmatic injury. Aust N Z J Surg. 1997;67(9):619–21.
13. Ueno K, Murota Y, Takeda M, Katayama A, Tanaka K. Delayed traumatic diaphragmatic hernia with strangulated stomach; report of a case. Kyobu Geka. 2008;61(5):423–6.
14. McElwee T, Myers R, Pennell T. Diaphragmatic rupture from blunt trauma. Am Surg. 1984;50(3):143.
15. Sánchez-Lozada R, Ortiz-González J, Chavaje GRV. Estrangulación gástrica secundaria a hernia diafragmática traumática. Presentación de un caso. Rev Med Hosp Gen Mex. 2001;64(3):162–6.
16. Ganie FA, Lone H, Lone GN, Wani ML, Ganie SA, Wani N, et al. Delayed Presentation of Traumatic Diaphragmatic Hernia: a Diagnosis of Suspicion with Increased Morbidity and Mortality. Trauma Mon [Internet]. 2013 May 26 [cited 2020 Sep 2];18(1):12–6. Available from: http://traumamon.com/en/articles/56788.html

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- CARE checklist the mothorax.docx
- CARE checklist the mothorax.docx
- CARE checklist the mothorax.docx