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Case report

Iatrogenic diaphragmatic hernia and intestinal obstruction following laparoscopic hepatectomy: A case report

Ercan KORKUT¹, Rifat PEKSÖZ^{2*}, Nurhak AKSUNGUR¹

¹Department of General Surgery, Atatürk University, Faculty of Medicine, Erzurum-Turkey

²Department of General Surgery, Malazgirt State Hospital, Muş-Turkey

Abstract

Diaphragmatic hernias may be either congenital or acquired. Acquired diaphragmatic hernias generally develop in association with blunt or penetrating thoraco-abdominal injuries. Iatrogenic diaphragmatic hernias are rare in the literature. Traumatic diaphragmatic ruptures are diagnosed during the imaging tests performed due to accompanying organ injuries or during surgery. However, acquired diaphragmatic hernias developing in the late postoperative period are uncommon, and the difficulties in diagnosis may result in increased mortality and morbidity. The use of electrocautery and other electric devices during the release of hepatic ligaments is thought to result in diaphragmatic hernias in the late period of diaphragmatic injuries that are missed during surgery.

We describe the diagnosis and the therapeutic course of a case undergoing laparoscopic right hepatectomy due to hepatic alveolar echinococcosis and taken for emergency surgery with diagnoses of diaphragmatic hernia and intestinal obstruction approximately 20 months subsequently in the light of the current literature.

Keywords

: diaphragmatic hernia, hepatectomy, diaphragmatic injury, intestinal obstruction

Highlights

- ✓ Minor traumas occurring in the diaphragm during surgery may gradually result in hernias.
- ✓ The post-hepatectomy DH is an exceedingly rare, but life-threatening condition.
- ✓ Delayed diagnosis and treatment may result in severe morbidity and mortality.

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*Corresponding author: Rifat PEKSÖZ, Department of General Surgery, Malazgirt State Hospital, Muş Turkey

E-mail: kemal_peksoz@hotmail.com

Introduction

The herniation of the abdominal organs into the thorax may be either congenital or acquired. The acquired diaphragmatic hernia (DH) occurs either as a result of the thoraco-abdominal blunt or penetrating injuries, or as iatrogenic injuries (1). Traumatic diaphragm ruptures are an uncommon but important condition that may result in increased mortality due to the difficulties in diagnosis (2). Diaphragmatic ruptures are rare, occurring in approximately 3% of all abdominal injuries. Motor vehicle accidents are responsible for 80-85% of such ruptures, and penetrating traumas for 10-15% of them (3).

Iatrogenic DH seen in the late period after surgery can be explained in terms of energy devices such as the electrocautery equipment causing unnoticed thermal diaphragm damage during the release of hepatic ligaments, intestinal loops replacing the resected right lobe after right hepatectomy, loss of right hepatic lobe support for the diaphragm, and the negative thoracic pressure during respiration. Following right hepatic resection, the liver covering the surface of the right diaphragm is replaced by the right colon and small bowel. DH development is a complication that may be rarely seen following liver resection (4).

The purpose of this study is to discuss the diagnosis and therapeutic course of a 28-year-old woman with a history of right laparoscopic hepatectomy due to alveolar echinococcosis approximately 20 months ago and subsequently referred to us due to DH, in a poor general condition and in septic shock, in the light of the current literature.

Case report

A 28-year-old woman with a history of right laparoscopic hepatectomy due to a hepatic alveolar cyst 20 months ago presented due to abdominal pain, nausea and vomiting, respiratory distress, and a generally poor condition persisting for the previous two days.

On examination, the patient's general condition was poor, and confusion was noticed. Defense and rebound were present in all abdominal quadrants at the physical examination. Respiratory sounds could not be determined in the right lung at auscultation. The vital signs were: blood pressure 90/60 mm/Hg, heart rate: 130/min, and SaO₂:80%. At the laboratory tests, WBC was 32.5000/mm³, Inr: 1.67, Na: 129 mmol/l, Cl: 97 mmol/l, albumin: 3.2 g/dl, and creatinine: 0.6 mg/dl.

An air fluid level compatible with the ileus was observed at the abdominal X-ray (Figure 1). The herniation of the intestinal loops in the right hemothorax was noticed

at the abdominal and thoracic CT (Figure 2). The patient was taken for emergency surgery with the diagnosis of right DH.

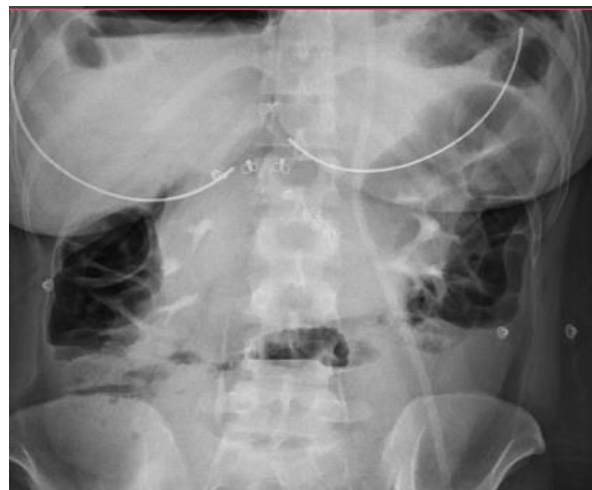


Figure 1. Intensive gas shades at the abdominal x-ray/

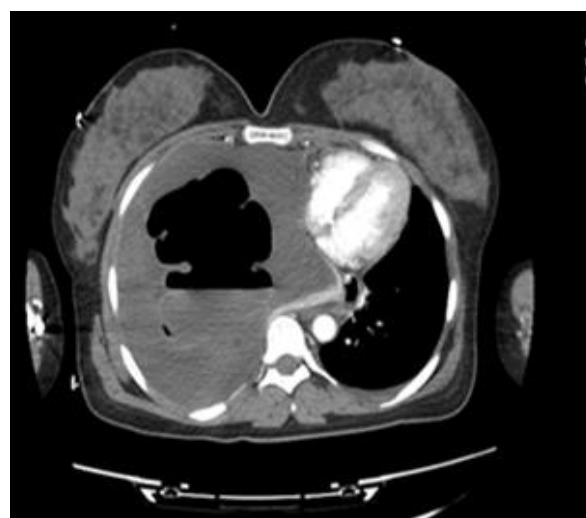


Figure 2. The herniation of the intestinal loops to the thorax at the axial CT

The abdomen was penetrated into with a median incision above and below the umbilicus. The exploration revealed that the small and the large bowel segments had entered the thorax through an approximately 10-cm defect toward the middle posterior in the right diaphragm (Figure 3). The elimination of the pulmonary pressure and an improvement in the vital signs was achieved with the reduction of the herniated organs. An approximately 20-cm small bowel segment and 30-cm transverse colon segment were observed to be necrotized (Figure 4).

Small bowel and colonic resection and side-to-side small bowel and large bowel anastomosis were performed. The primary repair of the diaphragmatic defect was performed at the chest surgery clinic, and a tube was inserted in the right thorax. Following surgery, the patient was taken to the intensive care unit under intubation. She was disconnected from the ventilator on the 1st

postoperative day, and the vital signs and the laboratory values were stable on day 2, in which she was discharged from the intensive care unit. The patient started fluid feeding with the removal of the nasogastric tube on day 3. The P-A X-ray was normal and the chest tube was therefore removed (Figure 5). The patient was discharged in a healthy condition on postoperative day 10.

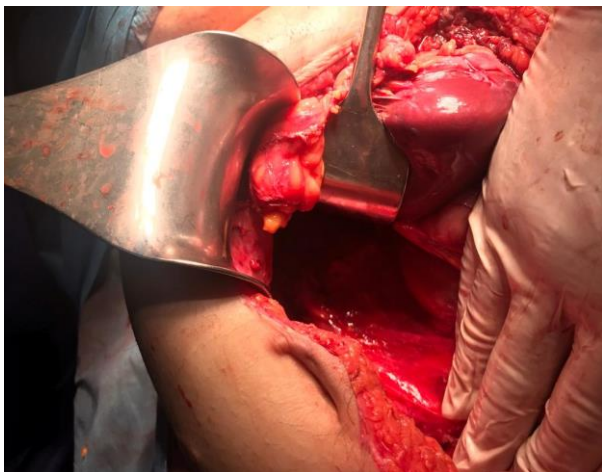


Figure 3. Diaphragmatic hernia

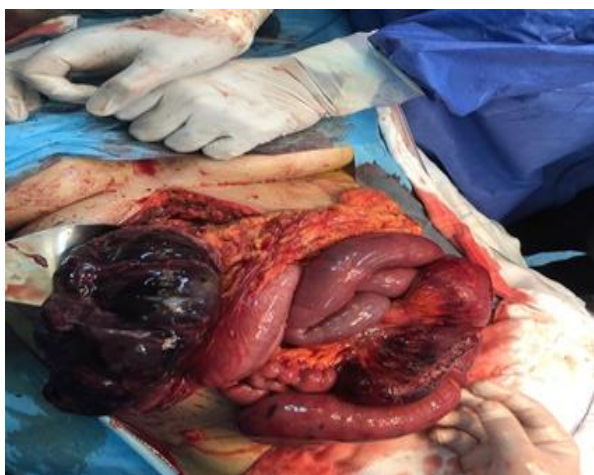


Figure 4. Necrotized small and large bowel



Figure 5. Postoperative control thoracic x-ray

Discussions

Alveolar echinococcosis is a malignant disease caused by *Echinococcus multilocularis* and it commonly involves the liver (5). The surgical resection, particularly in the early stages of the disease, is the only potentially curative technique for *E. alveolaris* (6).

The potential risk factors for DH during the hepatic resection in alveolar echinococcosis and tumors of the liver include diaphragm invasion, resection, and opening. Tabrizian et al. reported that DH developed in half of the patients with tumors greater than 10 cm (4). The size of the hepatic resection was the most important risk factor for DH formation in our patient. No visible DH occurred during the laparoscopic hepatectomy in other studies (7, 8). The right-side DH may be a surgical complication following hepatectomy (9). Laparoscopic hepatectomy, a less invasive technique, was performed in our case.

Dissection at the side of the diaphragm and the use of electrocautery can lead to the damage of the diaphragm during surgery. The use of ultrasonic energy devices in particular can result in the development of a weak point in the diaphragm (10). Thermal devices may also have caused damage to the diaphragm in our case. Surgeons must therefore use thermal and ultrasonic dissector devices with great care during laparoscopy (11). A diathermy injury may not be observed during surgery, and such a defect begins to grow due to the difference in abdominal and thoracic pressure (12).

Ruptures may be seen anywhere in the diaphragm. A left-side posterolateral location is reported 3-5 times more commonly than the right side following blunt traumas in particular (13). This has been shown to be due to the liver exhibiting a more protective effect than the stomach and the colon (14). A less common right-side DH was present in our case.

Our study of the literature has revealed few patients with DH following hepatectomy. The mean time for DH formation after hepatectomy was 19 months. The most common symptoms of patients at presentation are abdominal pain in 50% of the cases and respiratory symptoms in 14% of the cases, while 10% of cases are asymptomatic. The most commonly herniated organ is the colon, in 42% of the cases. The reported elective surgery rate is 47% of all cases, with an emergency surgery rate of 43% (15). In our case, DH developed 20 months after hepatectomy, and our patient presented under emergency conditions with abdominal pain and respiratory symptoms. The herniated tissues were the colon and the small bowel. All these findings were compatible with those of the previous literature.

Abdominal and thoracic approach techniques are used in diaphragm repair. Non-mesh abdominal DH repair is the most widely used technique in the literature, in 71% of the cases (15). In agreement with the literature, primary diaphragm repair with non-absorbable sutures without the use of mesh was performed in our case.

The best diagnostic imaging technique for DH is computerized tomography (CT). The sensitivity is high, but its specificity for the right diaphragm is only 50% (16). We also used CT for the diagnosis of our patient.

The laparoscopic approach is more suitable, especially in left DH, and it determines a shorter hospital stay. However, since the liver represents an obstacle in laparoscopic surgery, and open surgery is more appropriate than laparoscopic surgery, open surgery is performed in a high proportion of cases of right DH and these are not suitable for laparoscopic repair. Nevertheless, laparoscopic repair can be attempted in small, non-emergency, elective hernias. Laparoscopic surgery has also been reported to be successful in previous studies (17). Laparoscopic surgery was not done directly in our case, since the vital signs were unstable and because the patient experienced difficulty in breathing.

Morbidity and mortality of 66-80% have been reported in patients with complications of strangulation and perforation following herniation (18). Due to a multidisciplinary approach, our patient in septic shock and a poor general condition was subsequently discharged in a healthy condition.

Conclusions

Thermal devices must be used with great care during the hepatic mobilization, and patients must be monitored in terms of unnoticed diaphragmatic damage in the postoperative period. Minor traumas occurring in the diaphragm during surgery may gradually result in hernias. The post-hepatectomy DH is an exceedingly rare, but life-threatening condition. DH should be suspected in patients presenting to the emergency department with difficulty in breathing, intestinal obstruction and a history of hepatectomy. Delayed diagnosis and treatment may result in severe morbidity and mortality.

Conflict of interest disclosure

There are no known conflicts of interest in the publication of this article. The manuscript was read and approved by all authors.

Compliance with ethical standards

Any aspect of the work covered in this manuscript has been conducted with the ethical approval of all relevant bodies and that such approvals are acknowledged within the manuscript.

References

1. Crandall M, Popowich D, Shapiro M, West M. Posttraumatic hernias: historical overview and review of the literature. *Am Surg.* 2007; 73(9): 845-50. PMID:17939410
2. Morgan B, Watcyn-Jones T, Garner J. Traumatic diaphragmatic injury. *J R Army Med Corps.* 2010; 156(3): 139-44. PMID: 20919612, DOI: 10.1136/jramc-156-03-02
3. Meteroglu F, Eren TŞ. Traumatic Diaphragmatic Ruptures. *Toraks Cerrahisi Bülteni* 2013; 4(4): 259-65. DOI:10.5152/tcb.2013.39.
4. Tabrizian P, Jibara G, Shrager B, Elsabbagh AM, Roayaie S, Schwartz ME. Diaphragmatic hernia after hepatic resection: case series at a single Western institution. *J Gastrointest Surg.* 2012; 16(10): 1910-14. PMID:22851338, DOI:10.1007/s11605-012-1982-7
5. Miman Ö, Sü Yazar S. Alveolar Echinococcosis in Turkey: in the light of the Literature. *Turkish Journal of Parasitology* 2012; 36: 116-20. DOI :10.5152/tpd.2012.28
6. Emre A, Ozden I, Bilge O, Arici C, Alper A, Okten A, et al. Alveolar echinococcosis in Turkey: experience from an endemic region. *Dig Surg.* 2003; 20(4): 301-5.
7. Lim C, Compagnon P, Sebah M, Salloum C, Calderaro J, Luciani A, et al. Hepatectomy for hepatocellular carcinoma larger than 10 cm: preoperative risk stratification to prevent futile surgery. *HPB (Oxford).* 2015; 17: 611-623. PMID:25980326, DOI:10.1111/hpb.12416
8. Memeo R, de'Angelis N, Compagnon P, Salloum C, Cherqui D, Laurent A, Azoulay D. Laparoscopic vs. open liver resection for hepatocellular carcinoma of cirrhotic liver: a case-control study. *World J Surg.* 2014; 38: 2919-2926. PMID:24912628, DOI:10.1007/s00268-014-2659-z
9. Sugita M, Nagahori K, Kudo T, Yamanaka K, Obi Y, Shizawa R, Yoshimoto N, Shimada H. Diaphragmatic hernia resulting from injury during microwave-assisted laparoscopic hepatectomy. *Surg Endosc.* 2003; 17: 1849-1850. PMID:14959733, DOI:10.1007/s00464-002-4554-1

10. Suh Y, Lee JH, Jeon H, Kim D, Kim W. Late onset iatrogenic diaphragmatic hernia after laparoscopy-assisted total gastrectomy for gastric cancer. *J Gastric Canc.* 2012; 12(1): 49–52. PMID: 22500265, DOI :10.5230/jgc.2012.12.1.49
11. De Meijer VE, Vles WJ, Kats E, den Hoed PT: iatrogenic diaphragmatic hernia complicating nephrectomy: top-down or bottom-up? *Hernia.* 2008; 12: 655–658. DOI :10.1007/s10029-008-0377-x
12. Soufi M, Meillat H, Yves-Patrice Le Treut. Right diaphragmatic iatrogenic hernia after laparoscopic fenestration of a liver cyst: report of a case and review of the literature, *World J Emerg Surg.* 2013; 8: 2. PMID: 23286877, DOI: 10.1186/1749-7922-8-2
13. Shah RSS, Mearns AJ, Choudhury AK. Traumatic rupture of diaphragm. *Ann Thorac Surg.* 1995; 60: 1444-9. PMID: 8526655; DOI: 10.1016/0003-4975(95)00629-Y
14. Lu J, wang B, Che X, Li X, Qu G, He S, Fan L. Delayed traumatic diaphragmatic hernia: A caseseries report and literature review. *Medicine.* 2016; 95(32): e4362 PMID:27512848. PMC: 4985303, DOI: 10.1097/MD.0000000000004362.
15. Francesco Esposito, Chetana Lim, Chady Salloum, Michael Osseis, Eylon Lahat, Philippe Compagnon, and Daniel Azoulay. Diaphragmatic hernia following liver resection: case series and review of the literature. *Ann Hepatobiliary Pancreat Surg.* 2017; 21: 114-121. PMID: 28989997, DOI : 10.14701/ahbps.2017.21.3.114
16. Peer SM, Devaraddeppa PM, Buggi S. Traumatic diaphragmatic hernia our experience. *Int J Surg.* 2009; 7: 547–549. PMID: 19778644, DOI: 10.1016/j.ijssu.2009.09.003
17. Rossetti G, Bruscianno L, Maffettone V, Napolitano V, Sciaudone G, Del Genio G, Russo G, Del Genio A. Giant right post-traumatic hernia: laparoscopic repair without mesh. *Chir Ital.* 2005; 57: 243–246. PMID:15916154
18. Goh BK, Wong AS, -ray K-H, Hoe MN. Delayed presentation of a patient with a ruptured diaphragm complicated by gastric incarceration and perforation after apparently minor blunt trauma. *CJEM.* 2004; 6(4): 277-80. PMID:17382006