Successful management of right-sided diaphragmatic injury via video-assisted thoracoscopic surgery

Kun Woo Kim¹, Byungchul Yu²

Received April 14, 2020

Revised June 8, 2020

Accepted June 9, 2020

¹Department of Thoracic Surgery, ²Department of Trauma Surgery, Gachon University Gil Medical Center, Incheon, Korea

Correspondence to

Byungchul Yu
Department of Traumatology, Gachon University, 21 Namdong-daero 774beon-gil, Namdong-gu, Incheon 21565, Korea
Tel: +82-32-460-3010
Fax: +82-32-460-3247
E-mail: kane2123@gilhospital.com

Blunt traumatic right-sided diaphragmatic injury is difficult to diagnose owing to accompanying injuries. Most guidelines recommend laparotomy for the treatment of diaphragmatic injury; however, in cases of right-sided diaphragmatic hernia, using a thoracic approach has some advantages. Herein, we present our experience in managing a case with right-sided diaphragmatic injury via video-assisted thoracoscopic surgery.

Key Words: Trauma, Injury, Diaphragm

Introduction

Traumatic right-sided diaphragmatic hernia is a rare condition, with challenging diagnosis in some cases. Traditionally, diaphragmatic hernia is treated via direct repair using thoracotomy or laparotomy (1). Recently, the development of minimally invasive surgery has led to the introduction of thoracoscopic or laparoscopic repair for diaphragmatic injury. Herein, we report a case of right-sided diaphragmatic injury that was successfully repaired via video-assisted thoracoscopic surgery (VATS).

Case presentation

A 23-year-old man visited the trauma center after being involved in a traffic accident with complaints of chest pain and right ankle pain. His initial vital signs were stable, with no abnormal laboratory findings except for elevated

levels of liver enzymes. Radiologic examination revealed minimal hemothorax and right hemidiaphragm elevation as well as bimalleolar fracture in the right ankle (Fig. 1). The presence of hump and band signs led to the suspicion of right-sided diaphragmatic injury (Fig. 2). Owing to this suspicion and because we wanted to perform a planned operation, such as VATS, the patient was admitted to the general ward for observation. The next day, he developed dyspnea, and liver enzyme levels were further elevated. Therefore, we decided to immediately perform VATS (Video 1). We observed bloody effusion (300 ml) and right-sided anterior diaphragmatic rupture (10-cm in length) along with superficial laceration on the exposed liver portion. Bleeding within the liver was controlled via electrocautery and use of hemostatic materials. The ruptured diaphragm was successfully repaired via VATS, and the patient was discharged on postoperative day 12 without any complications.

Fig. 1. (A) Right-sided diaphragm elevation and minimal hemothorax upon chest AP. (B) Bimalleolar fracture of right ankle.

Fig. 2. Chest computed tomography showing the “hump” (A, star) and “band” (B, arrow) signs.

Operative Technique

Operation was performed under general anesthesia, and a double-lumen endotracheal tube was inserted. The patient was placed in the left lateral decubitus position, and a 5-mm, 30° videoscope was inserted via a 5-mm thoracoport. Initially, two additional ports were inserted (Fig. 3). After identifying the liver and diaphragm injuries, an additional port was inserted to retract the liver. Bleeding within the liver was controlled and then the diaphragm was repaired using interrupted horizontal mattress pledgeted

nonabsorbable polypropylene sutures. We used pledgeted (polytetrafluoroethylene) sutures to prevent possible tissue tearing or damage.

Discussion

Blunt traumatic diaphragmatic injury (TDI) involves the left diaphragm (56%-86%) in the majority of cases and the right diaphragm only rarely (1). Blunt TDI generally occurs during high-energy impact trauma; therefore, TDI

Fig. 3. Port insertion site and utilization of VATS operation.

diagnosis may be missed because of other severe injuries accompanying the TDI in patients with blunt trauma. However, multidetector computed tomography (MDCT) has a diagnostic accuracy of 95%, particularly when there is accompanying herniation (1). There are several MDCT findings, such as collar sign, hump sign, band sign, and dependent viscera sign, indicative of TDI (2).

In general, laparotomy is advantageous in blunt TDI because associated abdominal injury can be verified, and reduction of herniated organs is easy with laparotomy. However, in cases of right-sided TDI, the liver is more likely to be injured, and adhesions may form between the margins of the ruptured diaphragm and the liver. The repair of right-sided injury is technically difficult via laparotomy, which requires mobilization of the friable liver. Therefore, open thoracotomy is considered a convenient

approach for repair if there is no associated bowel injury (3). In addition, a minimally invasive technique, such as VATS, could be more advantageous for the treatment of right-sided TDI.

Conflict of interest

No potential conflict of interest relevant to this article was reported.

Supplementary material

Supplementary data including one video can be found with this article online at www.traumaimpro.org.

Video 1. We used various hemostatic materials to stop bleeding due to liver injury. After attaining hemostasis, we repaired the injured diaphragm using interrupted horizontal mattress pledgeted non-absorbable polypropylene sutures. In this case, we used a knot pusher to throw extracorporeal knots to the diaphragm. At the end of the operation, we inserted a chest tube into the right-sided thoracic cavity.

References

1. Hanna WC, Ferri LE. Acute traumatic diaphragmatic injury. *Thorac Surg Clin.* 2009;19(4):485-9.
2. Bocchini G, Guida F, Sica G, Codella U, Scaglione M. Diaphragmatic injuries after blunt trauma: are they still a challenge? *Emerg Radiol.* 2012;19(3):225-35.
3. Joshi M, Dhua A. Right hemi-diaphragmatic rupture: an injury missed or masked? *APSP J Case Rep.* 2015; 6(2):18-21.