



# Trapped diaphragmatic hernia with necrosis of the gastric wall – Case Report and literature review

Julia Siek<sup>1,A-D</sup> , Michał Borys<sup>2,E-F</sup> 

<sup>1</sup> Student Research Group / Second Department of Anaesthesiology and Intensive Therapy, Medical University, Lublin, Poland

<sup>2</sup> Second Department of Anaesthesiology and Intensive Therapy, Medical University, Lublin, Poland

A – Research concept and design, B – Collection and/or assembly of data, C – Data analysis and interpretation, D – Writing the article, E – Critical revision of the article, F – Final approval of the article

Siek J, Borys M. Trapped diaphragmatic hernia with necrosis of the gastric wall – Case Report and literature review. J Pre Clin Clin Res. 2023; 17(1): 16–18. doi: 10.26444/jpccr/161337

## Abstract

A diaphragmatic hernia can be defined as the collapsing of the contents of the abdominal cavity into the thorax as a result of a diaphragmatic defect. Most often it is congenital, but can also be acquired. Congenital hernia is a foetal defect that is most often diagnosed before birth by ultrasound or in newborns, and forms during intrauterine growth. The cause of congenital hernia is the abnormal development of tissues and the walls of body cavities. On the other hand, an acquired diaphragmatic hernia occurs after a blunt or penetrating injury in which the diaphragm ruptures and is accompanied by a hernia of the abdominal contents. Acquired diaphragmatic hernia may appear spontaneously or as a result of iatrogenic causes. Acquired diaphragmatic hernia is quite rare, but is very dangerous, causing entrapment and suffocation, and can be associated with high mortality.

## Key words

diaphragmatic hernia, laparoscopic surgery, necrosis of the stomach wall

## INTRODUCTION

A diaphragmatic hernia refers to the movement of the viscera from the abdomen to the chest through an opening (gate) in a torn diaphragm. It can be acquired or congenital. Congenital diaphragmatic hernia is a rare defect which, in adults, occurs with the frequency of 0.17–6% [1]. Diaphragm rupture is a rare consequence of trauma, and occurs in approximately 5% of severe closed thoraco-abdominal injuries [1–4]. Diagnosis is often made too late. Patients may remain asymptomatic for several years after the injury, until complications occur [1]. In the event of a traumatic diaphragm rupture, surgery should be performed, especially in symptomatic patients [1, 5]; however, the risk of mortality is high. Over the last decades, the standard procedure has been the primary repair of sutures or covering the defect with a synthetic mesh [1]. Recently, biological meshes are thought to be effective in repairing diaphragmatic defects. They cause the closure of the diaphragm defect, reduce the inflammatory response and reduce the formation of adhesions [1, 6]. Traditional methods of treating diaphragm rupture include laparotomy or thoracotomy [1]. Recently, laparoscopic methods of hernia repair [1, 7] have also been very popular. An untreated hernia has a high mortality rate of 32% [8, 9]. There can be numerous complications, including intra-abdominal organ dysfunction, strangulated intestine, and lung disease. The presented article presents the clinical case of a patient with a trapped diaphragmatic hernia and necrosis of the gastric wall, and discusses diagnostic problems and treatment based on a review of the literature.

## CASE REPORT

A 60-year-old patient was admitted to the University Hospital in Lublin, Poland, for surgical treatment of a trapped diaphragmatic hernia with necrosis of the stomach wall. The patient was admitted to the ward in a serious condition. Total gastrectomy with gastrointestinal disconnection was performed on the day of admission. The patient was transferred from the secondary hospital, where had spent two weeks from the first diagnosis of an incarcerated hernia, but without any attempt at surgical treatment of diaphragmatic hernia. However, the diagnosis was confirmed in computed tomography (CT) scans on the third day after admission.

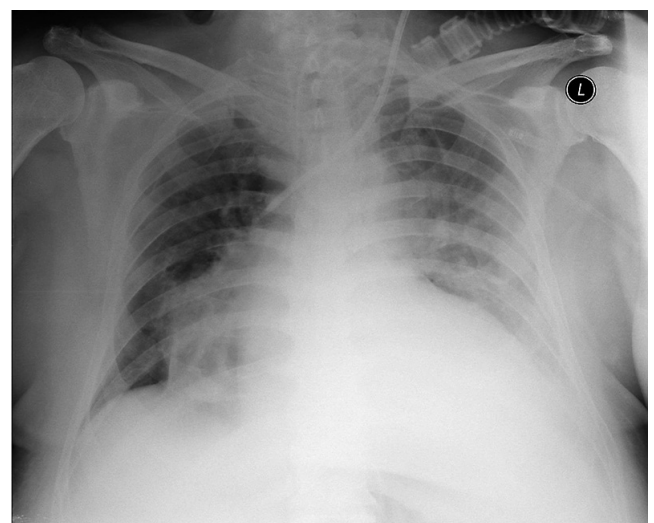
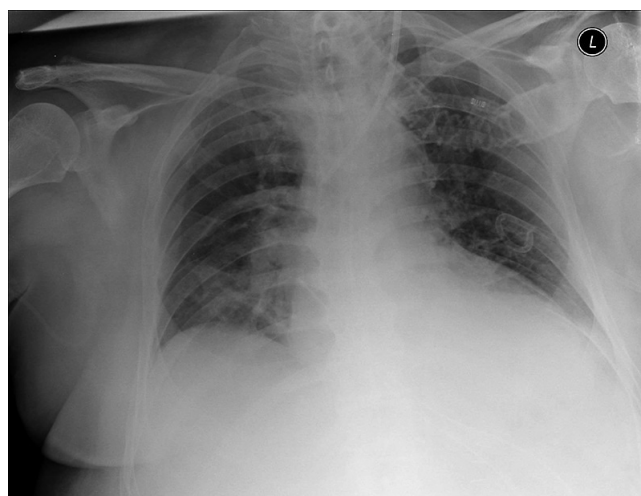


Figure 1. Lung X-ray the day before surgery

✉ Address for correspondence: Julia Siek, Student Research Group of The Second Department of Anaesthesiology and Intensive Therapy, Medical University, Staszica 16, 20-081 Lublin, Poland  
E-mail: siekjj@gmail.com



**Figure 2.** Lung X-ray taken immediately after surgery

After surgery, the patient was under the influence of analgesedation, mechanically ventilated by tracheostomy in the Synchronized Intermittent Mandatory Ventilation, Pressure Regulated Volume Control (PRVC-SIMV) mode with Fraction of Inspired Oxygen (FiO<sub>2</sub>) 0.45, Positive End-Expiratory Pressure (PEEP) 5 cm H<sub>2</sub>O, 20 breaths per minute. Due to the large amount of fluid, the left pleural cavity was drained. The circulatory system required a large dose of norepinephrine and additional fluid therapy. The patient required continuous renal replacement therapy. Parenteral nutrition through jejunostomy was introduced.

In the following days, the patient's condition was still severe. Periodically, atrial fibrillation (AF) was observed. This arrhythmia was treated pharmacologically with amiodarone and phenazoline. Moreover, electrical cardioversion was performed several times. During the first days following the gastrectomy, the patient was conscious and able to answer questions from the medical staff. The infusion of sedatives and catecholamines was reduced and finally stopped. The patient breathed spontaneously through a tracheostomy tube, periodically supported by a ventilator in pressure support mode.

On day six of the hospital stay, the patient's condition deteriorated dramatically. Hyperthermia, AF, and a drop in systemic blood pressure was observed. The patient required mechanical ventilation in SIMV mode with sedatives, and circulation supported with norepinephrine under haemodynamic monitoring. The patient's condition systematically deteriorated over the next days. Oliguria, abdominal bloating was observed, as well as generalized oedema, despite renal replacement therapy. Subsequent surgical consultations were inconclusive. The patient died on day nine following the surgery.

## DISCUSSION

The cause of the patient's death was most likely the diaphragmatic hernia, and more specifically its incarceration. The most important factor affecting the patient's prognosis was the delay between the diagnosis of the hernia incarceration and the surgery. On day six following the gastrectomy, the signs and symptoms of mediastinitis were observed, which eventually caused multi-organ failure. However, the

patient had many comorbidities that could potentially have weakened the body.

Acquired diaphragmatic hernia as a result of diaphragm trauma may appear in areas of potential weakness along the embryonic points of anastomosis [1, 10]. Diaphragm rupture is a rare consequence of trauma occurring in approximately 5% of severe closed thoracoabdominal injuries [1]. It is believed that this may be due to the sudden increase in the peritoneal pressure gradient as a result of the trauma [1, 10]. Many factors may result from iatrogenic causes, depending on the type of surgery, patient factors, and the technique used to close the diaphragm [11]. Acquired diaphragmatic hernia and diaphragm rupture more often appear on the left side of this muscle [10], probably due to the size of the liver under which the right part of the diaphragm is hidden [10, 12]. Right-sided ruptures and hernias are very rare and are often associated with higher mortality and morbidity [10–11]. The content of the abdominal cavity that can pass through the diaphragm varies, but documented cases include hernias of the stomach, small intestine, mesentery, spleen and pancreas [10, 13]. Most cases of acquired diaphragmatic hernia are the result of blunt trauma penetrating the chest or abdomen [10]. A thorough history of the injury should be additionally supported by imaging studies to determine the extent of the injury, which may then show the presence of the acquired diaphragmatic hernia [10].

It is very important to consider the patient's prior surgical history when making a diagnosis, as this may be the cause of acquired diaphragmatic hernia. The presence of an acquired diaphragmatic hernia can manifest itself in different ways. Patients may experience respiratory and abdominal symptoms, and in rare cases also cardiac symptoms [10, 14]. The effect of pressing the abdominal contents against the chest can cause shortness of breath and chest pain. Abdominal symptoms cannot be ruled out, including recurrent abdominal pain, feeling of fullness after a meal, vomiting and obstructive gastrointestinal symptoms [1, 10]. In some random cases, the diaphragmatic hernia may remain asymptomatic and can only be detected by imaging tests [10]. During physical examination in the presence of a diaphragmatic hernia, breathing sounds may be suppressed in the lower thoracic region, with intestinal sounds being heard [10, 15]. However, it is quite common that diagnosis is delayed, for example, there is the history of a patient who, six years after an accident, discovered that he had his stomach in his chest [16, 17, 18].

**Diagnosis.** Diaphragmatic hernias may be asymptomatic [19]; therefore, diagnosis is often significantly delayed [16]. The diagnosis of traumatic diaphragmatic hernia in the immediate post-traumatic period is difficult due to accompanying injuries and the fact that some radiological features suggesting a hernia may mimic chest injuries [16]. Hernias may be present months or even years after apparent recovery from a traumatic incident [16]. There are cases of asymptomatic patients in whom their hernias have been detected in imaging tests [16]. It is possible that many patients with undiagnosed traumatic diaphragmatic hernia remain asymptomatic and only those with symptoms are hospitalized [16]. Few patients are asymptomatic [16]. Most have symptoms that vary with the organ in the chest [16], which may include classic intestinal obstruction with abdominal pain and distension, vomiting and fluid in the upper abdomen,

and / or chest pain with vomiting and dyspnoea [16]. The differential diagnosis includes cholecystitis, pancreatitis, peptic ulcer exacerbation, myocardial infarction, pneumonia, or even pneumothorax [16]. Physical symptoms are of little help unless an initial diagnosis has been made, a hernia is suspected, and usually only in retrospect should the signs and physical findings be related [16].

**Treatment.** Treatment of an acutely acquired diaphragmatic hernia requires appropriate resuscitation of the patient [20]. The procedure after this is surgical. Usually, the procedure is performed with an open abdominal approach, and repair is performed through the primary closure [10, 21]. In cases where primary closure with non-absorbable sutures is not possible due to the size of the defect, mesh repair may be an alternative [1, 10]. If diagnosis is delayed, the thoracic approach is usually preferred to reduce visceropleural adhesions and visceral perforation in the thorax [9]. Occasionally, in some delayed cases, the use of a combined thoraco-abdominal approach may be appropriate. A laparoscopic approach may be feasible and may be a repair option, depending on experience [10, 20].

The treatment of diaphragmatic hernia is surgical and usually involves flap closure of the diaphragm using an open or endoscopic method (access can be through the abdomen or through the chest), or combined techniques [22]. Laparoscopic treatment has many advantages, the most important of all is certainly less invasiveness during the procedure, but it is also worth paying attention to aesthetic issues. After laparoscopic surgery, the postoperative scar will be much smaller than after the classic opening of the abdominal integuments. Published studies show that laparoscopic procedures are safe and cause relatively few complications. In a published series of clinical cases [22], none of the four patients involved had postoperative complications [22]. Laparoscopic surgery was a complete success in all cases [22]. In only one case it was necessary to add mini-thoracotomy in the laparoscopic access (hybrid technique) in order to reduce the content [22]. The defect was corrected with a polypropylene suture and reinforced with a mesh [22]. The laparoscopic procedure was performed under general anesthesia with endotracheal intubation [22]. During the procedure, the patients were placed four ports [22] which were placed on the right side with a slightly raised top of the head at an angle of about 20–30° [22]. The defects were closed with a polypropylene suture. Closed cavities were reinforced with mesh [22]. All patients received injected painkillers for the first 24 hours after the procedure, and then received painkillers as needed [22]. Postoperative pain was assessed using the VAS (Visual Analog Scale) [22].

## SUMMARY

Most acquired diaphragmatic hernias are caused by injuries. Occasionally, a hernia may be asymptomatic and diagnosis is therefore often delayed. It is best to additionally carry out imaging studies that will visually show the extent of the injury. The only treatment for hernia is surgery. If surgical treatment is not performed, complications must be expected, including rupture of the diaphragm, acute obstructive symptoms, entrapment of the diaphragm, respiratory failure, cardiac tamponade, asphyxiation and, consequently, death.

## REFERENCES

- Testini M, Girardi A, Isernia RM, et al. Emergency surgery due to diaphragmatic hernia: case series and review. *World J Emerg Surg.* 2017;12:23. doi:10.1186/s13017-017-0134-5
- Pancholi CK, Hombalkar NN, Dalvi SB, et al. Left sided hydro-pneumothorax in a operated case of left diaphragmatic hernia repair: a diagnostic dilemma. *J Clin Diagn Res.* 2015;9(4):PD03–4. doi: 10.7860/JCDR/2015/11879.5759
- Turmak M, Deniz MA, Özmen CA, et al. Evaluation of the multi-slice computed tomography outcomes in diaphragmatic injuries related to penetrating and blunt trauma. *Clin Imaging.* 2018;47:65–73. doi: 10.1016/j.clinimag.2017.08.010
- Petrone P, Asensio JA, Marini CP. Diaphragmatic injuries and post-traumatic diaphragmatic hernias. *Curr Probl Surg.* 2017;54(1):11–32. doi: 10.1067/j.cpsurg.2016.11.001
- Campos Costa F, Cardoso V, Monteiro AM, et al. Laparoscopic Repair of an Acute Traumatic Diaphragmatic Hernia: Clinical Case. *Cureus.* 2020;12(10):e11082. doi:10.7759/cureus.11082
- Antoniu SA, Rudolph P, Granderath FA, et al. The Use of Biological Meshes in Diaphragmatic Defects An Evidence-Based Review of the Literature. *Front Surg.* 2015;2:56. doi:10.3389/fsurg.2015.00056
- Pahwa HS, Kumar A, Agarwal P, et al. Current trends in laparoscopic groin hernia repair: A review. *World J Clin Cases.* 2015;3(9):789–92. doi:10.12998/wjcc.v3.i9.789
- Hail K, Sididris N, Khelifi L, et al. Bochdalek's Hernia in Adults (Kidney in the thorax): About a clinical case. *IOSR-JDMS;*2020;40–43. doi: 10.9790/0853-1903134043
- Gooszen JAH, Slaman AE, van Dieren S, et al. Incidence and Treatment of Symptomatic Diaphragmatic Hernia After Esophagectomy for Cancer. *Ann Thorac Surg.* 2018;106(1):199–206 doi:10.1016/j.athoracsur.2018.02.034
- Spellar K, Lotfollahzadeh Gupta N. Diaphragmatic Hernia, Treasure Island (FL), 2022.
- Cortes M, Tapuria N, Khorsandi SE, et al. Diaphragmatic hernia after liver transplantation in children: case series and review of the literature. *Liver Transpl.* 2014;20(12):1429–35. doi:10.1002/lt.23977
- Lodhia JV, Appiah S, Tcherveniakov P, et al. Diaphragmatic hernia masquerading as a pulmonary metastasis. *Ann R Coll Surg Engl.* 2015;97(2):e27–9. doi:10.1308/003588414X14055925060758
- Lu J, Wang B, Che X, et al. Delayed traumatic diaphragmatic hernia: A case-series report and literature review. *Medicine (Baltimore).* 2016;95(32):e4362. doi:10.1097/MD.0000000000004362
- Krawiec K, Szczyzny M, Kadej A, et al. Hiatal hernia as a rare cause of cardiac complications—case based review of the literature. *Ann Agric Environ Med.* 2021;28(1):20–26. doi:10.26444/aaem/133583
- Panda A, Kumar A, Gamanagatti S, et al. Traumatic diaphragmatic injury: a review of CT signs and the difference between blunt and penetrating injury. *Diagn Interv Radiol.* 2014;20(2):121–8. doi: 10.5152/dir.2013.13248
- Zhao L, Han Z, Liu H, et al. Delayed traumatic diaphragmatic rupture: diagnosis and surgical treatment. *J Thorac Dis.* 2019;11(7):2774–2777. doi:10.21037/jtd.2019.07.14
- Siegal S, R, Dolan J, P, Hunter J, G. Modern diagnosis and treatment of hiatal hernias. *Langenbecks Arch Surg.* 2017;402(8):1145–1151 doi: 10.1007/s00423-017-1606-5
- Shakil A, Aparicio K, Barta E, et al. Inguinal Hernias: Diagnosis and Management. *Am Fam Physician.*2020;102(8):487–492.
- Perrone G, Giuffrida M, Annicchiarico A, et al. Complicated Diaphragmatic Hernia in Emergency Surgery: Systematic Review of the Literature. *World J Surg.* 2020;44(12):4012–4031. doi:10.1007/s00268-020-05733-6
- Katukuri GR, Madireddi J, Agarwal S, et al. Delayed Diagnosis of Left-Sided Diaphragmatic Hernia in an Elderly Adult with no History of Trauma. *J Clin Diagn Res.* 2016;10(4):PD04–5. doi:10.7860/JCDR/2016/17506.7544
- Minguez Ruiz G, García Florez LJ, Arias Pacheco R D, et al. Post-nephrectomy diaphragmatic hernia. Increase suspicion and decrease morbi-mortality: two cases report. *J Surg Case Rep.* 2018;2018(8):rjy224. doi:10.1093/jscr/rjy224
- Kumar A, Karn R, Khanal B, et al. Laparoscopic approach for diaphragmatic hernia repair in adult: our experience of four cases. *J Surg Case Rep.* 2020;2020(6):rjaa178. doi:10.1093/jscr/rjaa178