

# Morgagni's Hernia: Analysis of 21 Patients with Our Clinical Experience in Diagnosis and Treatment

Soykan Arikan<sup>1</sup> · Mehmet Baki Dogan<sup>1</sup> · Ahmet Kocakusak<sup>2</sup> · Feyzullah Ersoz<sup>1</sup> · Serkan Sari<sup>1</sup> · Yigit Duzkoynu<sup>1</sup> · Ali Emre Nayci<sup>1</sup> · Emre Ozoran<sup>1</sup> · Emine Tozan<sup>3</sup> · Turkan Dubus<sup>4</sup>

Received: 28 November 2015 / Accepted: 23 December 2016 / Published online: 6 January 2017  
© Association of Surgeons of India 2017

**Abstract** A Morgagni's hernia is a congenital defect found in the anterior aspect of the diaphragm between the costal and the sternal portions of this muscle. This defect is also referred to as the space of Larrey. It has been reported that 70% of patients with Morgagni's hernia are female, 90% of the hernias are right-sided, and 92% of the hernias have hernia sacs. This type of hernia is a rare clinical entity and accounts for 3% of all surgically treated diaphragmatic hernias. There are no large retrospective or prospective studies on this topic. This type of hernia is a rare type among adults without a well-described prevalence and without well-established definitive management strategies. There are also few clinical reports about this clinical entity and its surgical treatment. We treated 21 patients with Morgagni's hernia in a 12-year period, and we report our experience while discussing the surgical treatment of this disease. We performed a retrospective review of the 21 patients who were operated between 2003 and 2015. These patients had undergone surgical repair of Morgagni's hernia. For each subject, demographic data, symptoms of presentation, physical examination findings, preoperative imaging studies and diagnosis, and surgical procedures were documented. Location of the hernia sac and its contents,

postoperative complications, and duration of hospital stay were recorded and evaluated. Twelve patients were females and nine were males. The mean age of patients was 63.85 years. Dyspnea was the most prominent symptom in our patients. Morgagni's hernias were located on the right side in 19 patients and on the left side in 2 patients. Chest X-ray in 10 patients and abdominal computerized tomography in 17 patients were the major diagnostic tools. Four patients were operated as emergency while others underwent elective surgery (17 patients). Twelve patients were operated with laparoscopy and the remaining nine were operated with the conventional open abdominal technique. Hernia sacs were observed in all of the patients and removed except in four of them. The omentum and the transverse colon were the most commonly seen organs in hernia sacs. Hernia defects were repaired with primary sutures in four patients (all open cases) and primary closure supported with mesh in six patients (four laparoscopic, two open cases). In the remaining 11 patients, hernia defects were closed with synthetic meshes (eight laparoscopic, three open cases). Mean postoperative hospital stay was 9.8 days. No recurrence was observed in any patients. Only one of our patients died during follow-up. In Morgagni's hernias, surgical intervention is necessary as the hernia may cause complications such as strangulation of the colon or intestines. A laparoscopic approach has increased its popularity in recent years because of the well-known advantages of laparoscopy.

✉ Soykan Arikan  
soykanarikan@yahoo.com

<sup>1</sup> General Surgery Clinic, Istanbul Training and Research Hospital, Istanbul, Turkey

<sup>2</sup> General Surgery Clinic, Haseki Training and Research Hospital, Istanbul, Turkey

<sup>3</sup> Anesthesiology and Reanimation Clinic, Istanbul University School of Medicine, Istanbul, Turkey

<sup>4</sup> Thoracic Surgery Clinic, Istanbul Training and Research Hospital, Istanbul, Turkey

**Keywords** Diaphragm · Hernia · Morgagni · Larrey

## Introduction

A Morgagni's hernia is a congenital defect found in the anterior aspect of the diaphragm between the costal and the sternal

portions of this muscle. In 1796, Giovanni Batista Morgagni first described the substernal herniation of abdominal organs into the thoracic cavity, based on his observation at the post-mortem examination of a patient who died of head injury [1, 2]. This defect is also referred to as the space of Larrey, Napoleon Bonaparte's surgeon who described the retrosternal space as an avenue through which pericardial tamponade could be treated [3, 4]. There is still confusion about the description and naming of congenital diaphragmatic hernias in the literature. Morgagni, Larrey, Morgagni-Larrey, Retrocosto-xiphoid, diaphragmatic dome, posterolateral level, parasternal, retrochondrosternal, retrosternal, subcostal, substernal, and subcostosternal hernias are among names used in the literature [1, 3, 5–9]. There is also confusion about the sides of Morgagni's and Larrey's description. Dapri et al. describes Morgagni's hernia on the left side [5] while other authors describe Morgagni's hernia on the right and Larrey's hernia on the left side [3, 10]. Some authors accept both right and left sides for Morgagni's or Larrey's hernias [1, 6–8]. A diaphragmatic hernia may be located at the esophageal hiatus (sliding and paraesophageal hiatal hernias) or at posterolateral location on the diaphragm (Bochdalek's hernia) or at the parasternal region (Morgagni-Larrey). There are also traumatic hernias of the diaphragm which occurs after closed thoracoabdominal trauma or stab wounds of the thoracoabdominal region [11, 12]. There are no large retrospective or prospective studies on this topic. This type of hernia is a rare type among adults without a well-described prevalence and without well-established definitive management strategies [3]. There are also few clinical reports about this clinical entity and its surgical treatment. We treated 21 patients with Morgagni's hernia in a 12-year period, and we report our experience while discussing the surgical treatment of this disease.

## Material and Method

We performed a retrospective review of the 21 patients who were operated between 2003 and 2015. These patients had undergone surgical repair of Morgagni's hernia. For each subject, demographic data, symptoms of presentation, physical examination findings, preoperative imaging studies and diagnosis, and surgical procedures were documented. Location of the hernia sac and its contents, postoperative complications, and duration of hospital stay were recorded and evaluated (Table 1).

## Results

Twelve patients were females and nine were males. The mean age of patients was 63.85 years (minimum age 28, maximum

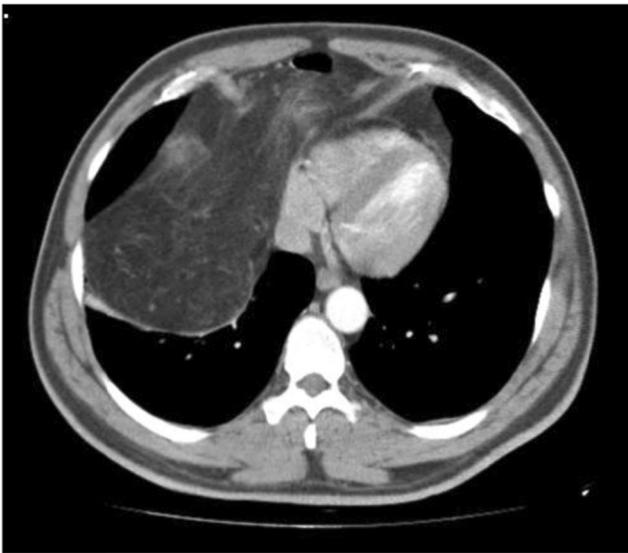
**Table 1** Comparison of laparoscopic and open procedures regarding demographic data, operation characteristics, and postoperative results

Operation procedure	Laparoscopic (12)	Open (9)
Age (year)	56.66 (28–75)	73.44 (57–81)
Sex	8 females, 4 males	4 females, 5 males
Hernia side	Left 1, right 11	Left 1, right 8
Emergency operation	0	4
Elective operation	12	5
Synchrone operation	2	1
Mesh	8	3
Suture	0	4
Suture + mesh	4	2
Hernia sac removed	8	9
Hernia sac remained	4	0
Complication	2	2 (1 died)
Exitus	0	1
Postoperative stay (day)	6.58	14.11

age 93). Dyspnea (13 patients), abdominal pain (6 patients), abdominal swelling and discomfort (3 patients), nausea and vomiting (2 patients), food intolerance (1 patient), and loss of gas and fecal discharge (2 patients) were the principle symptoms of the patients at admission. Fourteen patients had concomitant diseases with Morgagni's hernia (seven patients had chronic obstructive lung disease, four patients had hypertension, two patients had cholelithiasis, one patient had papillary thyroid cancer, one patient had benign prostate hyperplasia, one patient had coronary artery disease, and one patient had polyneuropathy at the lower extremity). Three patients had previous operations (two cholecystectomy, one inguinal hernia repair, one umbilical hernia repair, one transurethral resection of the prostate). Morgagni's hernias were located on the right side in 19 patients (Fig. 1) and on the left side in 2 patients.

Morgagni's hernia was diagnosed incidentally in one patient after falling from a wall while examining for trauma. Hernia defect was diagnosed and treated in three other patients while examining for bowel obstruction (Fig. 2) and acute abdomen in one patient. The remaining patients were diagnosed while they were examined for their complaints. Chest X-ray in 10 patients and abdominal computerized tomography in 17 patients were the major diagnostic tools. All but one of the patients had abnormal chest radiographies, ranging from slight densities to gross pathologic appearance of the right cardiophrenic angle.

Twenty patients were diagnosed preoperatively and one patient perioperatively. Four patients were operated in emergency while others underwent elective surgery (17 patients). Twelve patients were operated with laparoscopy and the remaining nine were operated with the conventional open abdominal technique (four of them were emergency cases).



**Fig. 1** A preoperative CT image of a right-sided hernia

Hernia sacs were observed in all of the patients and removed except in four of them. Inside the hernia sac was the omentum in 17 patients, transverse colon in 16 patients, stomach in 4 patients, small intestines in 3 patients, and cecum in 1 patient (Fig. 3).

Mean postoperative hospital stay was 6.58 days (1–14 days) for laparoscopically operated patients, 14.11 days for those operated using the open technique (3–42 days), 21.5 days (5–42 days) for emergency patients, and 7.05 days (1–16 days) for elective patients. 9.8 (1–42) days was the overall average.

Thorax tube drainage was performed in three patients, cholecystectomy in one patient, umbilical hernia repair in one patient, and bilateral total thyroidectomy in one patient (due

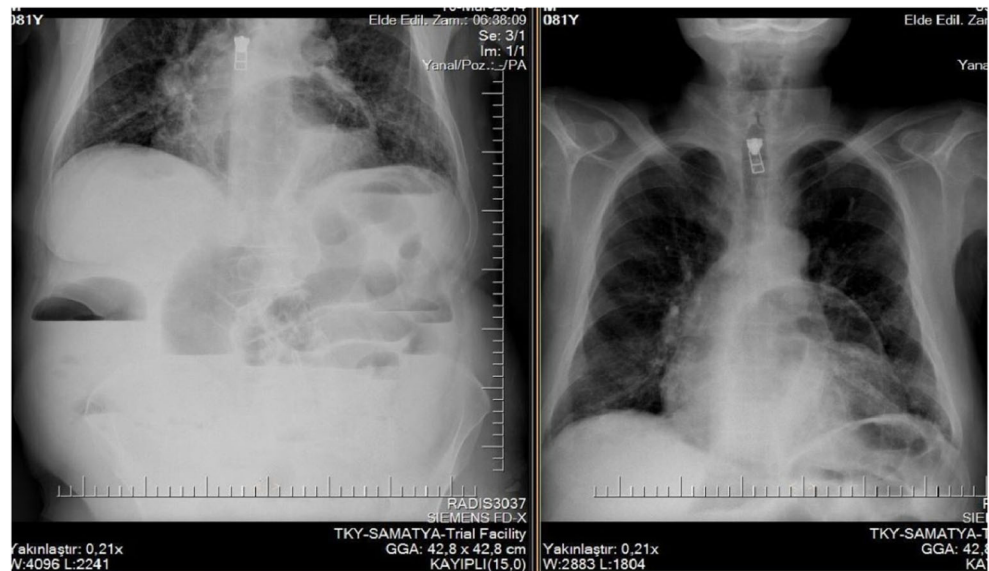
to thyroid malignancy) during the same session with Morgagni's hernia repair. The size of diaphragmatic defects in recorded patients varied between 5 and 10 cm at the largest dimension. Hernia defects were repaired with primary sutures in four patients (all open cases) and primary closure supported with mesh (four polypropylene, two dual mesh) in six patients (four laparoscopic, two open cases). In the remaining 11 patients, hernia defects were closed with synthetic meshes (three polypropylene, seven dual, one PTFE mesh) (eight laparoscopic, three open cases).

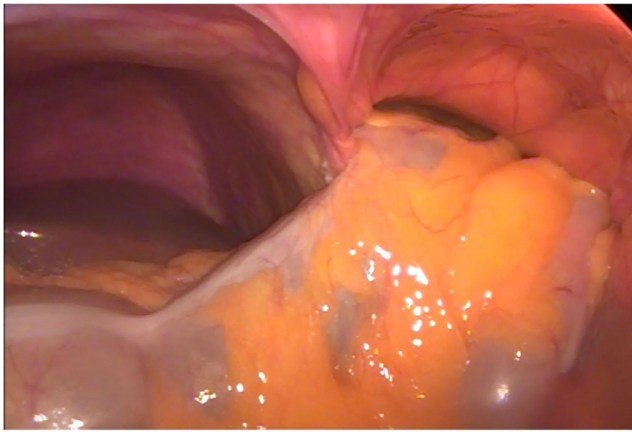
Meshes were fixed to the diaphragm with metallic and absorbable tacking devices (in laparoscopic cases) (Fig. 4) and nonabsorbent sutures (in open and laparoscopic cases).

All patients received antibiotic prophylaxis with a first generation cephalosporine and antibiotic treatment was continued in five patients. Postoperative analgesic treatment was administered. Additionally, treatment for coexisting diseases of the patients was administered postoperatively.

One patient was reoperated 9 days later due to bowel obstruction and abdominal eventration. Fluid retention was observed 2 months later in one patient whose hernia sac had not been removed during the operation. Four months later, she had fluid retention in the pericardial cavity and was followed conservatively. Nine months later, she was operated because of aortic aneurism. She had also suffered from chest pain postoperatively and was referred to the algology outpatient clinic (no recurrence was observed in the postoperative second month and second year with chest radiogram and CT scans). Atelectasia was observed in one patient on the postoperative second day and was treated. One patient presented to the emergency clinic on the postoperative 13th day with an exacerbation of chronic obstructive pulmonary disease (COPD) and died 1 week later (postoperative 20th day) due to COPD

**Fig. 2** Chest X-ray image showing bowel obstruction in a left-sided hernia





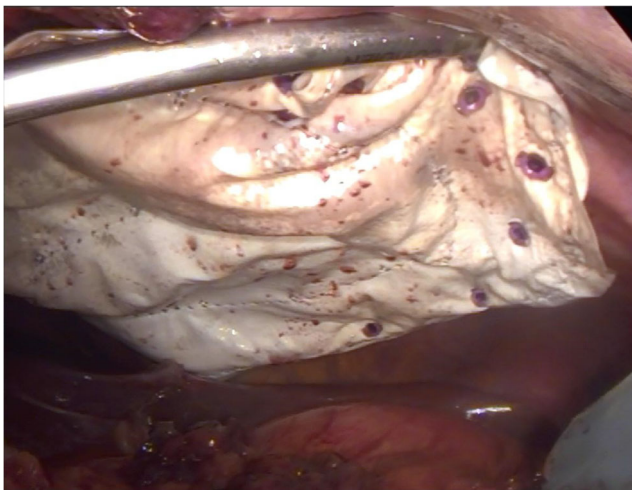
**Fig. 3** Herniation of the transverse colon into the Morgagni's hernia sac

complications. No recurrence was observed in any patients in the examination of readmission records for control, between postoperative periods ranging from 2 months to 3 years.

## Discussion

It has been reported that 70% of patients with Morgagni's hernia are female, 90% of the hernias are right-sided, and 92% of the hernias have hernia sacs. This type of hernia is a rare clinical entity and accounts for 3% of all surgically treated diaphragmatic hernias [13]. Approximately 10% of all patients with congenital diaphragmatic hernias have chromosomal abnormalities [6, 14]. Although majority of the Morgagni's hernias are located on the right side [13], only left-sided cases were also reported [15]. Except two patients, our cases also had defects on the right side.

Morgagni's hernias have hernia sacs and classically hernia sacs are removed surgically. There are different points of view



**Fig. 4** A view of dual mesh attached to the diaphragm with absorbable tacks

about performing this procedure in the literature. Some authors leave the hernia sac, mentioning that they did not see any complications because of the remaining sac [9, 16, 17]. In some other reports, sacs are removed with good results [18–20]. In our study, hernia sacs were not removed in four patients. One of them was the patient with postoperative complications which could not be definitely attributed to the residual hernia sac except for fluid retention in the remaining sac. In the early follow-up period, fluid retention was observed in the remaining sac. Later, she was operated because of aortic aneurysm and inguinal hernia. Although observed 4 months after the operation, the finding that could be linked with the Morgagni's hernia operation was the pericardial effusion, which might be secondary to an aneurysm of the ascending aorta. The postoperative pain that we observed in this patient might have been due to the tacker used for mesh fixation in the Morgagni's hernia operation.

Some authors recommend not to remove the hernia sac as this may cause massive pneumomediastinum with potential respiratory and circulatory complications [21]. In one review, it was documented that sacs were removed in 100% of the thoracic approaches and 82% of the open abdominal technique but only 31% of the laparoscopic abdominal operations [3]. Much experience is needed in laparoscopic cases for the resection of the hernia sac and the closure of the hernia gap. Except for four, we resected the hernia sac in our laparoscopic cases. We closed the hernia gap with sutures and used mesh (three polypropylene, one dual mesh) in four of the laparoscopic cases, and we used mostly helical tacks for mesh fixation.

In our opinion, removing the hernia sac safely in Morgagni's hernia does not pose a significant challenge for an experienced surgeon, even in laparoscopic operations. This procedure did not cause any complications in our series. However, if the surgeon has any doubts about whether the sac must be removed or not, they should not hesitate to let it remain at its location as the results are also good [16, 17].

The defect can be repaired with primary suturing, with prosthetic meshes or both. Dual prosthetic mesh was the preferred type in our patients, but there is no consensus about the type of the mesh used for this procedure, and we did not see any advantage or disadvantage of any mesh type in this limited patient group. Theoretically, dual meshes have the advantage of avoiding abdominal adhesions but polypropylene meshes are cheaper than the other types. Thus, for the upper abdominal region, prospective studies are needed to show the most suitable and appropriate mesh type. Mesh should close the entire hernia defect with 3–5 cm of overlap in all sides as safety margin [5, 22]. Meshes can be fixed to the diaphragm with simple sutures. In laparoscopy, helical clips are also used for fixation of the mesh. Some authors advise not to use helical clips for mesh fixation because of potential trauma to the pericardium [7]. Near the pericardial region, these clips may

damage the heart and the pericardium resulting in cardiac tamponade. Thus, it is better to use primary sutures to avoid this complication when working close to the pericardium [5, 23].

There is no consensus in the literature about the necessity of closing the hernia gap. Some authors recommend the closure of the defect [8, 9, 16] while others consider this optional [5]. Although we closed the hernia gaps in 10 cases, we did not see any harmful or beneficial effects of this procedure in our cases. Prospective randomized studies are necessary to evaluate the risks and benefits of this approach in this disorder.

Although it is a congenital disease, many Morgagni's hernias are seen in the elderly people. It is hypothesized that increased abdominal pressure is the reason for clinical appearance of hernia in the elderly people. Lev-Chelouche et al. point that for this reason, Morgagni's hernia is usually not identified in children [24]. Trauma, obesity, and pregnancy are the most common causes of herniation of abdominal content in adult patients [25, 26].

Most of our patients were admitted to the hospital with dyspnea and abdominal pain. Obstructive symptoms must alert surgeons, as seen in our patients; they can be a sign of strangulation besides the obstruction of hollow viscera.

The herniated organs in our study are consistent with the literature: the omentum and transverse colon were the organs mostly herniated in our series [1, 13, 25, 27]. Chest X-ray and CT scans are the tools that are helpful in the diagnosis of Morgagni's hernias. When they are used together, accuracy of the diagnosis is up to 80–90%. Another diagnostic technique is magnetic resonance imaging (MRI) [1, 5, 7, 28]. Respiratory functions must be determined preoperatively, especially in patients with respiratory problems [5]. In the follow-up period, chest X-ray and abdominal CT scans where necessary are useful tools.

Morgagni's hernia is mostly treated with surgical intervention; however, successful nonoperative management of this disease has also been described [29]. There are different surgical approaches for the treatment of this hernia. Laparotomy, thoracotomy, laparoscopic repair, and thoracoscopic repair are the methods described in the literature. Abdominal approaches allow for easier reduction of hernia contents, evaluation of contralateral diaphragm, and concomitant evaluation and repair of intra-abdominal pathologies. The primary advantage of the thoracic approach is easier dissection of the hernia sac from the mediastinal and pleural structures [3].

Although thoracotomy is the most widely used method in the world [3], since the first laparoscopic approach was reported in 1992 [21], surgeons have increasingly been using this technique.

According to our study, once diaphragmatic hernia is diagnosed, surgical intervention is necessary as the hernia may cause complications such as strangulation of the colon or intestines. To avoid these complications, some patients can be

operated in emergency conditions. Operations can be performed with an open or laparoscopic technique. Our cases were operated with open technique which can have some advantages in emergency conditions, especially if there is necrosis and necessity of organ resection [30] and if the surgeon does not have sufficient experience for the laparoscopic approach. Currently, the laparoscopic approach is usually preferred because of its well-known advantages like short postoperative stay, better cosmetic results, and postoperative comfort. It is for sure that if there is any necrosis in any organ strangulated in a hernia sac, it must be removed from the organism without any contamination. We did not have any necrosis in our patients. One important think which must be kept in mind is that usage of a mesh could be harmful if bacterial contamination due to perforation of a herniated hollow viscus was accompanying.

Our first laparoscopic case was in 2007. After that date, there were four cases because of emergency condition, where the open approach was preferred in three cases by the surgeon. We also prefer mostly the laparoscopic approach for elective conditions (3/12).

Our postoperative stay was longer than expected which was due to some complications which we experienced in some patients and due to some diseases like heart failure and chronic obstructive lung disease besides Morgagni hernia. Clinicians' obsession because of observing this entity very rarely might also have caused a minor effect on long postoperative stay.

Except for the thoracic approach, examples of all surgical interventions were present in our cases. But the laparoscopic approach has increased its popularity in recent years because of its known advantages in the literature, as previously mentioned [5–8].

#### Compliance with Ethical Standards

**Conflict of Interest** The authors declare that they have no conflict of interest.

#### References

1. Minneci PC, Deans KJ, Kim P, Mathisen DJ (2004) Foramen of Morgagni's hernia: changes in diagnosis and treatment. *Ann Thorac Surg* 77:1956–1959
2. Morgagni GB (1769) The seats and causes of diseases investigated by anatomy, vol 3. Millar and Cadell, London, pp 205
3. Horton JD, Hofmann LJ, Hets SP (2008) Presentation and management of Morgagni's hernias in adults: a review of 298 cases. *Surg Endosc* 22:1413–1420
4. Comer TP, Schmalhorst WR, Arbegast NR (1973) Foramen of Morgagni's hernia diagnosed by liver scan. *Chest* 63:1036–1038
5. Dapri G, Himpens J, Hainaux B, Roman A, Stevens E, Capelluto E, Germay D, Cadiere GB (2007) Surgical technique and

- complications during laparoscopic repair of diaphragmatic hernias. *Hernia* 11:179–183
6. Arraez-Aybar LA, Gonzalez-Gomez CC, Torres-Garcia AJ (2009) Morgagni's-Larrey parasternal diaphragmatic hernia in the adult. *Rev Esp Enferm Dig* 101:357–366
  7. Durak E, Gur S, Cokmez A, Atahan K, Zahts E, Tarcan E (2007) Laparoscopic repair of Morgagni's hernia. *Hernia* 11:265–270
  8. Iso Y, Sawada T, Rokkaku K, Furihata T, Shimada M, Kita J, Kubota K (2006) A case of symptomatic Morgagni's hernia and a review of Morgagni's hernia in Japan (263 reported cases). *Hernia* 10:521–524
  9. Loong TPF, Kocher HM (2005) Clinical presentation and operative repair of hernia of Morgagni. *Postgrad Med J* 81:41–44
  10. Thomas DS, Hui T, Phillips EH (2002) Laparoscopic diaphragmatic hernia repair. *Surg Endosc* 16:1345–1349
  11. Crandall M, Popowich D, Shapiro M, West M (2007) Posttraumatic hernias: historical overview and review of the literature. *Am Surg* 73(9):845–850
  12. Hanna WC, Ferri LE (2009) Acute traumatic diaphragmatic injury. *Thorac Surg Clin* 19(4):485–489
  13. Comer TP, Clagel OT (1966) Surgical treatment of hernia of the foramen Morgagni. *J Thorac Cardiovasc Surg* 52:461–468
  14. Pober BR (2007) Overview of epidemiology, genetics, birth defects, and chromosomal abnormalities associated with CDH. *Am J Med Genet C Semin Med Genet* 145C(2):158–171
  15. Abraham V, Myla Y, Verghese S, Chandran BS (2012) Morgagni-Larrey hernia—a review of 20 cases. *Indian J Surg* 74(5):391–395
  16. Anqrisani L, Lorenzo M, Santoro T, Sodano A, Tesauro B (2000) Hernia of foramen of Morgagni in adult: case report of laparoscopic repair. *JSLs* 4:177–181
  17. Chang TH (2004) Laparoscopic treatment of Morgagni-Larrey hernia. *W V Med J* 100:14–17
  18. Fernandez-Cebrian JM, Perez de Otezia J (1996) Laparoscopic repair of foramen of Morgagni a new case report. *J Laparoendosc Surg* 6(1):61–64
  19. Rau HG, Scardey HM, Lange V (1994) Laparoscopic repair of a Morgagni hernia. *Surg Endosc* 8:1439–1442
  20. Ridai M, Boubia S, Kafih M, Zerouali ON (2002) Larrey or Morgagni hernias treated by laparoscopy. *Presse Med* 31:1364–1365
  21. Kuster GG, Kline LE, Garzo G (1992) Diaphragmatic hernia through the foramen of Morgagni: laparoscopic repair case report. *J Laparoendosc Surg* 2:93–100
  22. Le Blanc KA (2004) Laparoscopic incisional and ventral hernia repair: complications—how to avoid and handle. *Hernia* 8:323–331
  23. Kempainen E, Kiviluoto T (2000) Fatal cardiac tamponade after emergency tension-free repair of large paraesophageal hernia. *Surg Endosc* 14:593
  24. Leu-Chelauche D, Ravid A, Michowitz M et al (1999) Morgagni hernia: unique presentations in elderly patients. *J Clin Gastroenterol* 28:81–82
  25. Minecci P, Deans K, Kim P, Mathisen D (2004) Foramen of Morgagni hernia: changes in diagnosis and treatment. *Ann Thorac Surg* 77:1956–1959
  26. Ipek T, Altinli E, Yuceyar S, Erturk S, Eyuboglu E, Akcal T (2002) Laparoscopic repair of a Morgagni Larey hernia; report of three cases. *Surg Today* 32(10):902–905
  27. Marin-Blasquez AA, Candel MF, Parra PA, Mendez M, Rodenas J, Rojas MJ, Carrion F, Madriqal M (2004) Morgagni hernia: repair with a mesh using laparoscopic surgery. *Hernia* 8:70–72
  28. Tyrel D, Mohamed F, Paulides C, Kutalek S, Mulhern C, Nunes LW (2001) Half-fourier acquisition single-shot turbo spin echo imaging in the diagnosis of Morgagni hernia. *J Magn Reson Imaging* 14: 653–657
  29. Hunter WR (1959) Herniation through the foramen of Morgagni. *Br J Surg* 47:22–27
  30. Arora S, Haji A, Ng P (2008) Adult Morgagni hernia: the need for clinical awareness, early diagnosis and prompt surgical interventions. *Ann R Coll Surg Engl* 90:694–695