REVIEW

Clinical presentation and operative repair of hernia of Morgagni

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A 77 year old woman who presented with an incarcerated hernia of Morgagni was successfully treated without complications. A Medline search (1996 to date) along with cross referencing was done to quantify the number of acute presentations in adults compared to children. Different investigating modalities—for example, lateral chest and abdominal radiography, contrast studies or, in difficult cases, computed tomography or magnetic resonance imaging—can be used to diagnose hernia of Morgagni. The favoured method of repair—laparotomy or laparoscopy—is also discussed. A total of 47 case reports on children and 93 case reports on adults were found. Fourteen percent of children (seven out of 47) presented acutely compared with 12% of adults (12 out of 93). Repair at laparotomy was the method of choice but if uncertain, laparoscopy would be a useful diagnostic tool before attempted repair. Laparoscopic repair was favoured in adults especially in non-acute cases.

showed mild diverticular disease. She took aspirin for her previous stroke and lansoprazole for gastritis and severe reflux oesophagitis. She had no family history of bowel malignancy.

On examination, she was dehydrated but stable. Her abdomen was distended with two tender tympanic masses on the right side. Abdominal radiography showed dilated loops of large bowel, measuring about 18 cm in diameter. She was operated on with a presumptive diagnosis of caecal volvulus.

At operation, an incarcerated knuckle of the transverse colon was found in the hernia of foramen of Morgagni. It was easily reduced and repaired without a mesh. She recovered uneventfully.

METHODS

A Medline search (1996 to date) along with cross referencing was done to quantify the number of acute presentation in adults compared to children. Patients were subdivided into acute, subacute, chronic, or asymptomatic presentations. Acute presentations were those where patients presented with less than a week of symptoms, subacute where patients presented up to six months, and chronic presenters had symptoms for more than six months. We excluded any case reports that had no clear description of surgical repair. Case reports in a foreign language are briefly mentioned and included in the references. The approach for repair was laparotomy, thoracotomy, laparoscopy, or other (as stated in tables 1 and 2).

The results of the Medline search are shown in tables 1 and 2.

LITERATURE REVIEW

Hernia of Morgagni was first described by Giovanni Battista Morgagni, an Italian anatomist and pathologist in 1769, while performing a postmortem examination on a patient who died of a head injury.³ Hernia of Morgagni is located just posterolateral to the sternum. It has also been called retrosternal, parasternal, substernal, and subcostosternal. It is caused by a congenital defect in the fusion of septum transverses of the diaphragm and the costal arches. This weakness in the diaphragm later would be stretched by rapid rise in intraperitoneal pressure, giving rise to a hernia. Lev-Chelouche *et al* mentioned that it is for this reason that hernia of Morgagni is usually not discovered in children.⁴ It can occur on either side of the sternum through a muscle-free triangular space called the Larrey space, although it is more common on the right. In rare cases, the hernia can be bilateral.

Hernia of Morgagni is the most rare of the four types of congenital diaphragmatic hernia (2%–3% of all cases).^{1,2} In adults, it commonly presents with non-specific symptoms—for example, excess flatulence and indigestion. In severe cases, it might present with symptoms of bowel obstruction or strangulation. In children, the majority present with repeated chest infection; rarely it might present in the neonatal period as acute respiratory distress syndrome. More than half are detected when patients are being investigated for unrelated problems. It is diagnosed with a lateral chest radiograph and confirmed with a barium enema or computed tomogram. Reports in the literature describe repair by the transabdominal or trans-thoracic approach with or without a mesh. In recent years there has been a trend towards repair by laparoscopy.

CASE REPORT

A 77 year old Jehovah's Witness presented to the accident and emergency department with a 10 day history of worsening abdominal pain, distension, vomiting, and constipation. She had presented to casualty six weeks previously with abdominal pain only and was presumed to have constipation and was treated accordingly.

She had no previous bowel surgery. A barium enema six years before this admission (1996)

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Table 1 Case reports on children

Author	No of cases	Presentation (No of cases)	Type of operation (No of cases)
Fotter <i>et al</i> , 1992 ²¹	1	Subacute	Laparotomy
Sinclair and Klein, 1993 ²²	1	Acute	Laparotomy
Bentley and Lister, 1965 ¹⁶	3	Acute (1) Subacute (2)	Thoracotomy (1) Laparotomy (2)
Sarihan <i>et al</i> , 1996 ²³	2	Chronic (2)	Laparotomy (2)
Machmouchi <i>et al</i> , 2000 ²⁴	9	Chronic (4) Acute (2) Asymptomatic (3)	Laparotomy (9)
Soylu <i>et al</i> , 2000 ²⁵	7	Chronic (7)	Laparotomy (7)
Nursal <i>et al</i> , 2000 ²⁶	1	Subacute	Laparotomy
Singh <i>et al</i> , 2001 ²⁷	2	Acute (2)	Laparotomy (2)
Parmar <i>et al</i> , 2001 ²⁸	1	Chronic	Laparotomy
Lima <i>et al</i> , 2001 ²⁹	2	Subacute (2)	Laparoscopy (2)
Al-Salem <i>et al</i> , 2002 ⁶	15	Subacute (13) Acute (1) Asymptomatic (1)	Laparotomy (14) Thoracotomy (1)
Ponsky <i>et al</i> , 2002 ³⁰	2	Asymptomatic (2)	Laparoscopy (2)
Kulaylat <i>et al</i> , 2003 ³¹	1	Chronic	Transthoracic

Total cases in children = 47. Presentation: chronic, 15; subacute, 19; acute, 7; asymptomatic, 6. Repair: laparotomy, 40; laparoscopy, 4; thoracotomy, 3.

Like the first patient described,³ the majority of hernias of Morgagni are diagnosed late because patients can be asymptomatic or present with non-specific respiratory and gastrointestinal symptoms and signs.⁵ Before presenting with acute intestinal obstruction, our patient had been seen for the last three years for symptoms of indigestion and bloating. She may have developed an uncomplicated hernia of Morgagni then or in the interim and this was therefore missed on barium enema at that time. Diagnosis can be difficult and a missed diagnosis can lead to life threatening complications such as obstruction or strangulation.¹ In our literature review, hernia of Morgagni presents itself more acutely (seven cases, 14%) and subacutely in children (19 cases, 40%). In recent years there has been a rise in the number of cases reported, with an approximate total of 200 cases in the last 10 years.⁴⁻⁷² This may be due to greater awareness of its diagnosis and because of early treatment to prevent any complications. However, hernia of Morgagni may be more frequent than the literature suggests since most cases are asymptomatic.

Diagnosis is confirmed by plain chest radiographs and contrast films. Hernia of Morgagni usually presents with recurrent chest infections in children (55%) and lateral chest radiographs are usually always conclusive.⁶ Screening may apply to children with increased risk associated anomalies and familial forms of congenital diaphragmatic hernias (from 34% to 50%).⁷ Patients with Down's syndrome (five cases) have increased risk of hernia of Morgagni.⁸ Obese patients may develop it later in life and sometimes it may follow trauma.

Depending on the contents of the hernia—omentum, stomach, small intestine, or liver—it can appear differently on chest radiography and the diagnosis can be missed. For example, if omentum is present in the sac, a solid paracardiac shadow will appear on the chest radiograph. Differential diagnosis would be an intrathoracic tumour, atelectasis, pneumonia, or pericardial cyst. This might affect the decision to operate and the type of operation carried out—that is, the transabdominal or transthoracic approach. Contrast examination—for example, barium enemas carried out for

Table 2 Case reports on adults

Author	No of cases	Presentation (No of cases)	Type of operation (No of cases)
Chin and Duchesne, 1955 ¹⁴	27	Asymptomatic (22) Chronic (5)	Laparotomy (3) Thoracotomy (3) Not repaired (21)
Rossi and Weiss, 1967 ³²	1	Acute	Thoracotomy
Shackelford <i>et al</i> , 1971 ³³	1	Chronic	Laparotomy
Catalona <i>et al</i> , 1972 ⁹	1	Subacute	Thoracotomy
Missen, 1973 ³⁴	1	Chronic	Laparotomy
Paris <i>et al</i> , 1973 ¹³	9	Asymptomatic (2) Subacute (7)	Thoracotomy (2) Laparotomy (4) Preperitoneal subxiphoid route (1) Not repaired (2)
Dawson and Jansing, 1977 ³⁵	3	Asymptomatic (1) Subacute (2)	Laparotomy (3)
Gray, 1981 ³⁶	1	Acute	Laparotomy
Ramos <i>et al</i> , 1982 ³⁷	1	Acute	Laparotomy
Fagelman and Caridi, 1984 ¹⁰	1	Asymptomatic	Thoracotomy
Sortey <i>et al</i> , 1990 ³⁸	1	Chronic	Laparotomy
Kuster <i>et al</i> , 1992 ¹⁷	1	Chronic	Laparoscopy
Rau <i>et al</i> , 1994 ¹⁸	1	Acute	Laparoscopy
Newman <i>et al</i> , 1995 ³⁹	3	Acute (1) Chronic (1) Asymptomatic (1)	Laparoscopy (3)
Smith and Ghani, 1995 ⁴⁰	1	Subacute	Laparoscopy
Huntington, 1996 ²⁰	1	Asymptomatic	Laparoscopy
Fernandez and Oteyza, 1996 ⁴¹	1	Acute	Laparoscopy
Orita <i>et al</i> , 1997 ⁴²	1	Subacute	Laparoscopy
Hussong <i>et al</i> , 1997 ⁴³	1	Asymptomatic	Video-assisted thoracic surgical repair
Nguyen <i>et al</i> , 1998 ⁴⁴	1	Subacute	Laparoscopy
Del Castillo <i>et al</i> , 1998 ⁴⁵	1	Subacute	Laparoscopy
Bortul <i>et al</i> , 1998 ⁴⁶	1	Subacute	Laparoscopy
Larosa <i>et al</i> , 1999 ⁴⁷	1	Acute	Laparoscopy
Ramachandran and Vijay, 1999 ¹⁹	1	Acute	Laparoscopy
Contini <i>et al</i> , 1999 ⁴⁸	1	Subacute	Laparoscopy
Lev-Chelouche <i>et al</i> , 1999 ⁴	2	Acute (1) Subacute (1)	Thoracotomy (1) Laparotomy (1)
Masahiro <i>et al</i> , 2000 ⁴⁹	1	Acute	Laparotomy
Ackroyd and Watson, 2000 ⁵⁰	1	Chronic	Laparoscopy
Meredith <i>et al</i> , 2000 ⁵¹	2	Subacute (2)	Thoracotomy (1)
Agrinasi <i>et al</i> , 2000 ⁵²	1	Chronic	Laparotomy (1) Laparoscopy
Jani, 2001 ⁵³	1	Acute	Laparotomy
Machtelinckx <i>et al</i> , 2001 ⁵⁴	1	Acute	Attempted laparoscopic repair Laparotomy
Ngaage <i>et al</i> , 2001 ⁵⁵	1	Subacute	Laparotomy
Kilic <i>et al</i> , 2001 ¹⁵	16	Asymptomatic (2) Subacute (14)	Thoracotomy (16)
Ipek <i>et al</i> , 2002 ⁵⁶	3	Asymptomatic (2) Subacute (1)	Laparoscopy (3)
White <i>et al</i> , 2002 ⁵⁷	1	Chronic	Laparoscopy

Total cases in adults = 93. Presentation: chronic, 13; subacute, 35; acute, 12; asymptomatic, 33. Repair: laparotomy, 21; laparoscopy, 21; thoracotomy, 26; other, 2; not repaired, 23.

gastrointestinal symptoms can also be absolutely normal.⁹ Computed tomography can be considered to be an accurate, non-invasive method of diagnosing hernia of Morgagni. It can help establish a diagnosis if, as in some cases, the hernia

sac is empty or contains omentum or part of the liver. But as described by Fagelman *et al* the computed tomogram did not confirm the diagnosis after the chest radiograph as the presence of gas within the lesion was variable: the bowel was sliding in and out of the defect.¹⁰ This might make diagnosis difficult or confusing. Other investigations such as magnetic resonance imaging (MRI) and radionuclide liver scan may help with diagnosis but the cost is difficult to justify. In our review, there were 3 cases that were diagnosed with MRI. Collie *et al* demonstrated with MRI a herniation of liver through hernia of Morgagni on a patient who presented with increasing shortness of breath and exertional angina.¹¹

In our opinion, we feel a simple chest radiograph is most likely to reveal an asymptomatic hernia of Morgagni when done for unrelated problems. However, if suspected clinically, computed tomography would be the preferred imaging modality to confirm the diagnosis in adults and children. Another option, a less expensive one, would be a barium enema for adults. When investigations are non-diagnostic, confirmation by laparoscopy may be needed. Follow up after operative repair can be done with a chest radiograph at three months and one year.

The need for surgery depends on presentation. Although the majority of these hernias are asymptomatic, repair is recommended to avoid future complications. Operation is indicated when the colon is in the sac, as there is a high risk of obstruction. If the hernia is small or if it contains omentum only, operation is indicated when symptoms are recurrent and bothersome. Treatment options include transabdominal or transthoracic repair.¹²

The transabdominal approach was favoured when the diagnosis was certain as it allows easier reduction of the hernia, especially for bilateral hernias. Furthermore, abdominal viscera within the hernia can be easily pulled down to their normal location in the abdomen. The sac can then be withdrawn and resected along the margins of the defect if need be. In our patient, we left the sac and part of the omentum in situ, closed the defect with interrupted, nylon sutures and reinforced it with a polypropylene mesh. Paris *et al* suggested a preperitoneal subxiphoid approach because it allows freeing of the pleural adhesions to the sac by an extrapleuroperitoneal route.¹³ This avoids the large incision of a laparotomy.

Chin *et al* advise a transthoracic approach as it provides a wide exposure and easy repair of the hernia sac.¹⁴ This is also advocated by Kilic *et al* who performed thorcotomies on 16 patients, all with uneventful recoveries and no recurrence of symptoms.¹⁵ However, Bentley and Lister describe a patient who had to undergo a second operation for intestinal obstruction after the initial thoracic procedure failed to diagnose bilateral hernia of Morgagni.¹⁶ Thorcotomy was indicated when the diagnosis was uncertain.

The first laparoscopic repair was reported by Kuster *et al* in 1992.¹⁷ Since then, there have been 25 cases reported: 21 adults (22%) and four children (8%). Laparoscopy is an excellent way to confirm diagnosis and to repair non-complicated hernia of Morgagni. The hernia sac can be easily viewed through the laparoscope. The hernia contents can then be easily reduced once the peritoneum at the perimeter of the defect is incised. The sac is usually not removed and the defect is closed with silk sutures and reinforced with a mesh stapled onto the diaphragm. Other advantages of laparoscopic repair are reduction in trauma, a faster recovery and faster return to normal diet and activity.¹⁸ It is also a safe and useful procedure to perform on children, especially when computed tomography is non-diagnostic. Table 3 highlights the complications that were encountered with each approach.

Things to consider during the operation are whether to remove the sac and whether to use a mesh. Almost 90% of

Table 3 Complications and failures

Approach	No of cases	Complications (No of cases)	Failure
Laparotomy	61	Pleural effusion ⁵³ (1) Wound infection ⁵⁵ (1) Atelectasia ¹⁶ (2) Deep vein thrombosis ⁵⁴ (1) Pulmonary embolism ⁵⁵ (1)	Partial reduction only possible due to intrathoracic adhesions. Right thoracotomy carried out ³⁸
Laparoscopy	25	None	Failure to reduce contents: progressed to open surgery ⁵⁴
Thoracotomy	30	Pneumonia + sepsis ⁴ (1)	Bowel obstruction: emergency laparotomy. Death via aspiration ¹⁶

cases of hernia of Morgagni have a sac. In our view, in more than half of the cases reported, the sac was not removed. As described in Kuster *et al* it was recommended not to remove the sac as this may result in massive pneumomediastinum with potential respiratory and circulatory complications.¹⁷ Rau *et al* had a different approach and removed the sac to avoid leaving a loculated space-occupying lesion in the chest that might result in recurrence or cyst formation.¹⁸ However there is no available literature to demonstrate the reasons for either procedure. Ramachandran *et al* left the sac alone and repeat computed tomography a month later showed almost complete disappearance of the sac.¹⁹ We feel that removing the sac would depend on the skill of the surgeon and the presentation of the patient. The use of a prosthetic mesh is becoming more popular. If the defect is small, it can be easily sutured as done in our patient. A mesh overlapping the edges of the defect can be easily manipulated with laparoscopic instruments and it provides a good tension-free repair.²⁰ No recurrence or complications have been seen with using a mesh.

CONCLUSION

Hernia of Morgagni is rare in both adults and children. In our literature review, acute presentation occurred more frequently in children. This may be because more cases are being detected due to greater awareness. Most asymptomatic cases were found in adults by chest radiography for unrelated problems. Diagnosis can be confirmed with contrast studies or laparoscopy. In adults presenting more acutely, the transabdominal approach would be the first line method of repair, reducing the hernia, leaving the sac alone, and using a prosthetic mesh. In non-acute cases, laparoscopic repair would be the first choice in children and adults as well being a useful diagnostic tool.

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REFERENCES

- Harrington SW. Clinical manifestations and surgical treatment of congenital types of diaphragmatic hernia. *Rev Gastroenterol* 1951;**18**:243.
- Comer TP, Clagett OT. Surgical treatment of hernia of the foramen of Morgagni. *J Thorac Cardiovasc Surg* 1966;**52**:461-8.
- Morgagni GB. *The seats and causes of diseases investigated by anatomy*. London: Millar and Cadell, 1769;3:205.
- Lev-Chelouche D, Ravid A, Michowitz M, *et al*. Morgagni hernia: unique presentations in elderly patients. *J Clin Gastroenterol* 1999;**28**:81-2.

- 5 Lin ST, Moss DM, Henderson SO. A case of Morgagni hernia presenting as pneumonia. *J Emerg Med* 1997;15:297-301.
- 6 Al-Salem AH, Nawaz A, Matta H, et al. Herniation through the foramen of Morgagni: early diagnosis and treatment. *Pediatr Surg Int* 2002;18:93-7.
- 7 Hitch DC, Carson JA, Smith EI, et al. Familial congenital diaphragmatic hernia is an autosomal recessive variant. *J Pediatr Surg* 1989;24:860-4.
- 8 Berman L, Stringer D, Ein SH, et al. The late presenting pediatric Morgagni hernia: a benign condition. *J Pediatr Surg* 1989;24:970-2.
- 9 Catalona WJ, Crowder LW, Chretien PB, et al. Occurrence of hernia of Morgagni with filial cervical lung hernia: a hereditary defect of the cervical mesenchyme? *Chest* 1972;62:340-2.
- 10 Fogelman D, Caridi JG. CT diagnosis of hernia of Morgagni. *Gastrointest Radiol* 1984;9:153-5.
- 11 Collie DA, Turnbull CM, Shaw TR, et al. Case report: MRI appearances of left sided Morgagni hernia containing liver. *Br J Radiol* 1996;69:278-80.
- 12 Comer TP, Clagett OT. Surgical treatment of hernia of the foramen of Morgagni. *J Thorac Cardiovasc Surg* 1996;52:461-8.
- 13 Paris F, Tarazona V, Casillas M, et al. Hernia of Morgagni. *Thorax* 1973;28:631-6.
- 14 Chin EF, Duchesne ER. The parasternal defect. *Thorax* 1955;10:214-19.
- 15 Kilic D, Nadir A, Doner E, et al. Transthoracic approach in surgical management of Morgagni hernia. *Eur J Cardiothorac Surg* 2001;20:1016-9.
- 16 Bentley G, Lister J. Retrosternal hernia. *Surgery* 1965;57:567-75.
- 17 Kuster GG, Kline LE, Garzo G. Diaphragmatic hernia through the foramen of Morgagni: laparoscopic repair case report. *J Laparoendoscopic Surg* 1992;2:93-100.
- 18 Rau HG, Schardey HM, Lange V. Laparoscopic repair of a Morgagni hernia. *Surg Endosc* 1994;8:1439-42.
- 19 Ramachandran CS, Vijay A. Laparoscopic transabdominal repair of hernia of Morgagni-Larrey: brief clinical reports. *Surg Laparosc Endosc* 1999;9:358-65.
- 20 Huntington TR. Laparoscopic transabdominal preperitoneal repair of a hernia of Morgagni. *J Laparoendoscopic Surg* 1996;6:131-3.
- 21 Fother R, Schimpi G, Sorantin E, et al. Delayed presentation of congenital diaphragmatic hernia. *Pediatr Radiol* 1992;22:187-91.
- 22 Sinclair L, Klein BL. Congenital diaphragmatic hernia—Morgagni type. *J Emerg Med* 1993;11:163-5.
- 23 Sarihan H, Imamoglu M, Abes M, et al. Pediatric Morgagni hernia. Report of 2 cases. *J Cardiovasc Surg* 1996;37:195-7.
- 24 Machmouchi M, Jaber N, Naamani J. Morgagni hernia in children. Nine cases and a review of the literature. *Ann Saudi Med* 2000;20:63-5.
- 25 Soyulu H, Koltuksuz U, Sarihan H, et al. Morgagni hernia: an unexpected cause of respiratory complaints and a chest mass. *Pediatr Pulmonol* 2000;30:429-33.
- 26 Nursal TZ, Atli M, Kaynaroglu V. Morgagni hernia in a patient with Morquio syndrome. *Hernia* 2000;4:37-9.
- 27 Singh S, Bhende MS, Kinnane JM. Delayed presentations of congenital diaphragmatic hernia. *Pediatric Emerg Care* 2001;17:269-71.
- 28 Parmar RC, Tullu MS, Bavdekar SB, et al. Morgagni hernia with Down syndrome: a rare association-case report and review of literature. *J Postgrad Med* 2001;47:188-90.
- 29 Lima M, Lauro V, Domini M, et al. Laparoscopic surgery of diaphragmatic disease in children: our experience with five cases. *Eur J Pediatr Surg* 2001;11:377-81.
- 30 Ponsky TA, Lukish JR, Nobuhara K, et al. Laparoscopy is useful in the diagnosis and management of foramen of Morgagni hernia in children. *Surg Laparosc Endosc* 2002;12:375-7.
- 31 Kulaylat N, Narchi H. A six-year old boy with regurgitation of fluids from nose and mouth. *International Pediatrics* 2003;18:33-5.
- 32 Rossi G, Weiss M. Herniation and strangulated incarceration of small intestines in the foramen of Morgagni. *Journal of Mount Sinai Hospital* 1967;34:38-9.
- 33 Shackelford RT, Hunt EO. Hernia of Morgagni: concurrent presence of peritoneal and pleural sacs through same diaphragmatic defect. *South Med J* 1971;64:634-5.
- 34 Missen AJB. Foramen of Morgagni hernia. *Proc R Soc Med* 1973;66:654-6.
- 35 Dawson RE, Jansing CW. Case report: foramen of Morgagni hernias. *Journal of the Kentucky Medical Association* 1997;75:325-7.
- 36 Gray FJ. Strangulated hernia of the foramen of Morgagni: introducing a principle for the reduction of obstructed intraabdominal hernias. *Aust N Z Surg* 1981;51:314-17.
- 37 Ramos JM, Burke DA, Veitch PS. Hernia of Morgagni in patients on continuous ambulatory peritoneal dialysis. *Lancet* 1982;i:161-2.
- 38 Sortey DD, Mehta MM, Jain PK, et al. Congenital hernia through the foramen of Morgagni. *J Postgrad Med* 1990;36:109-11.
- 39 Newman L, Eubanks S, McFarland Bridges W, et al. Laparoscopic diagnosis and treatment of Morgagni hernia. *Surg Laparosc Endosc* 1995;5:27-31.
- 40 Smith J, Ghani A. Morgagni hernia: incidental repair during laparoscopic cholecystectomy. *J Laparosc Surg* 1995;5:123-5.
- 41 Fernandez JM, Oteyza PD. Brief case report: laparoscopic repair of hernia of foramen of Morgagni: a new case report. *J Laparoendosc Surg* 1996;6:61-4.
- 42 Orita M, Okino M, Yamashita K, et al. Laparoscopic repair of a diaphragmatic hernia through the foramen of Morgagni. *Surg Endosc* 1997;11:668-70.
- 43 Hussong RL Jr, Landreneau RJ, Cole FH Jr. Diagnosis and repair of a Morgagni hernia with video-assisted thoracic surgery. *Ann Thoracic Surg* 1997;63:1474-5.
- 44 Nguyen T, Eubanks PJ, Klein SR. The laparoscopic approach for repair of Morgagni hernias. *Journal of the Society of Laparoendoscopic Surgeons* 1998;2:85-8.
- 45 Del Castillo D, Sanchez J, Hernandez M, et al. Case report: Morgagni's hernia resolved by laparoscopic surgery. *Journal of Laparoendoscopic and Advanced Surgical Techniques. Part A* 1998;8:105-9.
- 46 Bortul M, Calligaris L, Gheller P. Laparoscopic repair of a Morgagni-Larrey hernia. *Journal of Laparoendoscopic and Advanced Surgical Techniques. Part A* 1998;8:309-13.
- 47 Larosa DV, Esham RH, Morgan SL, et al. Diaphragmatic hernia of Morgagni. *South Med J* 1999;92:409-11.
- 48 Contini S, Dalla VR, Bonati L, et al. Laparoscopic repair of a Morgagni hernia: report of a case and review of the literature. *Journal of Laparoendosc and Advanced Surgical Techniques. Part A* 1999;9:93-9.
- 49 Masahiro H, Yasuo N, Yoshihiro Y, et al. A case of idiopathic perforation of the sigmoid colon with Morgagni's hernia. *Jpn J Gastroenterol Surg* 2000;33:240-4.
- 50 Ackroyd R, Watson DL. Laparoscopic repair of a hernia of Morgagni using a suture technique. *J Coll Surg Edinb* 2000;45:400-2.
- 51 Meredith K, Allen J, Richardson D, et al. Foramen of Morgagni hernia: surgical consideration. *Journal of the Kentucky Medical Association* 2000;98:286-8.
- 52 Angrinasi L, Lorenzo M, Santoro T, et al. Hernia of foramen of Morgagni in adult: case report of laparoscopic repair. *Journal of the Society of Laparoendoscopic Surgeons* 2000;4:177-81.
- 53 Jani PG. Morgagni hernia: case report. *East Afr Med J* 2001;78:559-60.
- 54 Machtelinckx C, Man RD, Coster MD, et al. Acute torsion and necrosis of the greater omentum herniated into a foramen of Morgagni. *Abdom Imaging* 2001;26:83-5.
- 55 Ngaage DL, Young RA, Cowen ME. An unusual combination of diaphragmatic hernias in a patient presenting with the clinical features of restrictive pulmonary disease: report of a case. *Surgery Today* 2001;31:1079-81.
- 56 Ipek T, Altinli E, Yuceyar S, et al. Laparoscopic repair of a Morgagni-Larrey hernia: report of 3 cases. *Surgery Today* 2002;32:902-5.
- 57 White DC, McMahon R, Wright T, et al. Laparoscopic repair of a Morgagni hernia presenting with syncope in an 85-year-old woman: case report and update of the literature. *Journal of Laparoscopic and Advanced Surgical Techniques. Part A* 2002;12:161-5.
- 58 Ketonen P, Mattila SP, Mattila T, et al. Surgical treatment of hernia through the foramen of Morgagni. *Acta Chirurgica Scandinavica* 1975;141:633-6.
- 59 Pissas A, Fourquet JP, Bodin JP, et al. Strangulated retrocostoxiphoid hernia. Review of the published literature and report of 2 cases. *Journal de Chirurgie* 1980;117:175-82.
- 60 Goebel N. Fat herniation through the diaphragm. *Journal Suisse de Medecine* 1985;115:1191-6.
- 61 Fiane AE, Nazir M, Saebo A, et al. Morgagni hernia. *Tidsskr Nor Laegeforen* 1990;110:1832-3.
- 62 Vietri F, Illuminati G, Guglielmi R, et al. Morgagni-Larrey hernia: 2 clinical cases. *Giornale di Chirurgia* 1991;12:449-52.
- 63 Daou R, Serhal S, Jureidini F, et al. Retro-costoxiphoid hernia in adults. Apropos of 3 cases. *Chirurgie* 1992;118:59-62.
- 64 Arzillo G, Aiello D, Priano G, et al. Morgagni diaphragmatic hernia. Personal case series. *Minerva Chirurgica* 1994;49:1145-51.
- 65 Caraco C, Candela G, Pezzullo L, et al. Morgagni hernia: surgical treatment with Marlex. A case report. *Minerva Chirurgica* 1997;52:107-11.
- 66 Carcoforo P, Di Marco L, Schettino AM, et al. Intestinal occlusion secondary to Morgagni-Larrey's herniation in an adult. Case report and analysis of the literature. *Annali Italiani di Chirurgia* 1998;69:97-100.
- 67 Iriki A, et al. Hernia of foramen of Morgagni—3 cases. *Journal of the Japanese Association for Thoracic Surgery* 1998;36:141-6.
- 68 Noya G, et al. Hernia of Morgagni as a cause of intestinal occlusion. Comments on 2 clinical cases. *Minerva Chirurgica* 1998;43:1639-42.
- 69 Guven H, Malazgit Z, Dervisoglu A, et al. Morgagni hernia: rare presentations in elderly patients. *Acta Chirurgica Belgica* 2002;102:266-9.
- 70 Guven H, Malazgit Z, Dervisoglu A, et al. Morgagni hernia: rare presentations in elderly patients. *Acta Chir Belg* 2002;102:266-9.
- 71 Ridai M, et al. Morgagni hernia treated by laparoscopy. *Presse Med* 2002;31:1364-5.
- 72 Ellyson JH, Parks SN. Hernia of Morgagni in a trauma patient. *J Trauma* 1986;26:569-70.