Laparoscopic diagnosis and treatment of diaphragmatic Morgagni hernia
Case report and review of the literature

Ann. Ital. Chir., 2008; 79: 29-36

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Laparoscopic diagnosis and treatment of diaphragmatic Morgagni hernia. Case report and review of the literature.

BACKGROUND: *Morgagni's hernia is a rare and congenital type of diaphragmatic hernia. The majority of these are asymptomatic and diagnosed incidentally during evaluation or treatment for other conditions. When diagnosis is made surgery is mandatory. The Authors report the laparoscopic repair of small Morgagni hernia, followed by review of the literature.*
MATERIALS AND METHODS: *A case of 55-year-old woman complaining a sensation of tightness in her chest, but especially an oppressive epigastric pain with episodes of fainting fit and breathless is described. The definitive diagnosis was confirmed by laparoscopy. The hernia was repaired laparoscopically using a mesh fixed by hernia stapler after excision of the sac.*
RESULTS: *In the postoperative patients has presented an episode of heart condition due to pericarditis treated pharmacologically. The patient was discharged on the seventh postoperative day symptom-free.*
CONCLUSIONS: *Laparoscopic technique must be considered as a first line approach for the treatment of Morgagni hernia, easy and safe by carry out. We recommend do not excise hernia sac, even if small, and particular cure in the use of the mesh fixed by metal staples.*

KEY WORDS: Laparoscopic repair, Laparoscopy, Morgagni hernia.

Introduction

Congenital diaphragmatic hernia through the foramen of Morgagni is extremely rare representing, according to the world literature, approximately 1% to 6% of all surgically treated diaphragmatic hernias [1-9].
The retroxiphoid or retrosternal or subcostosternal herniation was first described by Giovanni Battista Morgagni in 1769 while performing a post-mortem examination on a patient who died of a head injury [10-12].
Embriologically, the diaphragm forms early in gestation (third week) and results from fusion of several component parts: septum transversum, pleuroperitoneal folds (their fusion separate the chest from the abdomen) and muscle fibres grow from the cervical myotomes with complete formation of diaphragm (ninth week) [1,2,13-20].

Pervenuto in Redazione Settembre 2006. Accettato per la pubblicazione Novembre 2006.
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Morgagni's hernia is caused by a congenital defect in the fusion of septum transversum of the diaphragm and the costal arches. Hernia results from this area of weakness in the retrosternal muscle when the small superior epigastric vessels pass from the thorax into the rectus sheath (otherwise filled with fat) [1-3,9-15,17,21-23].
It can occur on either side of the sternum but is usually situated in the right side (*Morgagni's hernia*), but also can be seen bilaterally (*Morgagni-Larrey's hernia*) and rarely on the left side (*Larrey's hernia*) [7]. Dominic John Larrey was the surgeon general of Napoleon who described approach to the pericardial cavity through an anterior diaphragmatic defect [13,24,25].
These types of hernias are generally asymptomatic conditions discovered incidentally in adult life during routine radiologic examination for unrelated problems [26-34]. Whereas upper abdominal pain, findings of intestinal obstructions or chest tightness are reported by symptomatic patients [1,2,15,20]. Children may also presents cough and respiratory distress syndrome [9,17,32].
When the diagnosis is established, surgical treatment is mandatory even in asymptomatic patients to avoid future complications (obstruction and intestinal incarceration) [1,5,31,34-36].

Conventional surgery require transthoracic or, more frequently, transabdominal approach [5,12,27,28]. The huge progress in minimally invasive techniques by new prosthetic materials development makes possible to perform Morgagni's hernia repair safely and easily by laparoscopic surgery [29,37-49].
We report the laparoscopic repair of small Morgagni hernia performed by placement of a mesh, which we believe particularly interesting for symptoms, the way of diagnosis and postoperativel course, followed by review of the literature.

Methods

A 55-year-old woman patient (165 cm, 85 Kg) presented to our Department of General Surgery with symptoms developed 6 months before the admission complaining a sensation of tightness in her chest, but especially an oppressive epigastric pain with episodes of fainting fit and breathless. She denied cough, focal weakness, nausea, vomiting or palpitations with these episodes. Her bowel habits were not varied.
Physical examination of the chest and abdomen revealed no additional findings. Routine laboratory analyses were normal.
An electrocardiogram and echocardiogram revealed no cardiac disease.
Chest-X-ray, contrast examination and ultrasound scan emphasized no abnormalities.
A chest CT scan was also carried out and showed a small mass (2 cm) in lower anterior mediastinum in retroxiphoid area of meaning uncertain.
Laparoscopic exploration was therefore performed. The patient was placed in a supine position with thighs open and under general anesthesia. A pneumoperitoneum was created using a Veress needle introduced in the left upper abdominal quadrant. The abdomen was insufflated with CO2 until an intraabdominal pressure of 14 mmHg was obtained. A 5-mm 30 angle laparoscope was introduced into the abdomen just above the umbilicus.
Careful examination of upper abdomen revealed the presence of a small defect (2 x 2 cm) of the retroxiphoid part of the diaphragm to the right of the round ligament, and therefore hernia of Morgagni was detected (Fig. 1).
This small hernial defect could be visualized and treated more easily with laparoscopy than by laparotomy or thoracotomy.
Under visual control two more trocar of 5 mm were inserted in the right mid-abdomen and left mid-abdomen. The hernial sac with properitoneal fat was removed without complications and especially the pleura and pericardium remained intact. The peritoneum was mobilized for several centimetres along the entire circumference of the defect with exposition of the surrounding fascia. Diaphragmatic defect was covered with a 5 x 5 cm polypropylene mesh tailored to the appropriate shape and fixed by a 5 mm Ethicon hernia stapler over the defect. The peritoneal edges were successfully approximated with staples thereby obtaining a complete peritonealization of the mesh.

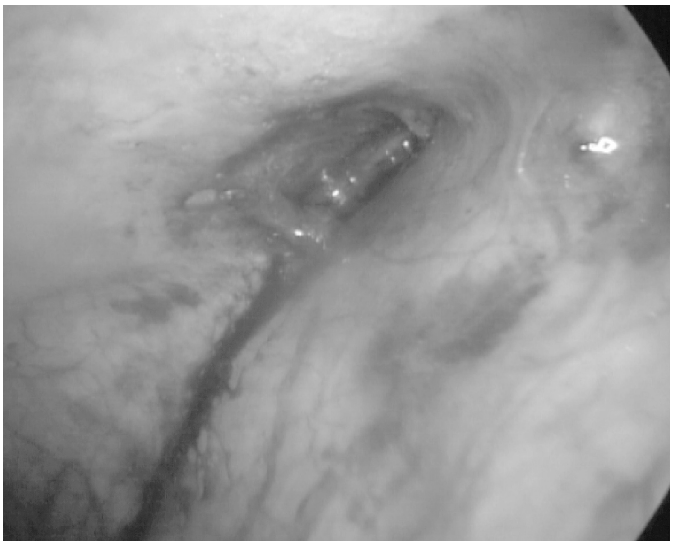

Fig. 1: Laparoscopic view showing a small retroxiphoid defect in the right side of the diaphragm.

The postoperative course was uneventful but after 36 hours the patient presented an episode of heart condition due to pericarditis, which was treated pharmacologically. The patient was discharged on the seventh postoperative day completely symptom-free.
In the follow-up of 1, 2, 3, 6, 12 months the patient had no symptom and a controlled CT at the 18th postoperative month showed no evidence of recurrence.

Discussion

Hernia of Morgagni is a rare and congenital type of diaphragmatic hernia first described by Giovanni Battista Morgagni in 1769 [10,11]. Incidence of congenital diaphragmatic defects occurring in one in every 2100 pregnancies and one in every 4800 live-born infants, and approximately 2% - 4% of these are Morgagni-type hernias [1-9].
Morgagni hernia occur in the retroxiphoid region through an area of relative weakness (muscle-free triangle also called Lerrey's space) in the anterior diaphragmatic fibres.
It is located anteriomedially on either side and is caused by a failure of fusion between the costal and the sternal parts of diaphragm [9,21-23].
Although embryonic disorder of diaphragmatic differential is believed to be the main etiological factor of Morgagni hernia, other acquired conditions such as trauma, severe efforts, pregnancy, obesity (all of which increased intraabdominal pressure) and connective-tis-

sue diseases, are predisposing factors contributing to the growth of the hernia. For this reason hernia of Morgagni is usually not discovered in children but later in life [1-3,9,14-19,27,50,51].

Sometime it is associated with other congenital abnomalies such as Turner syndrome, Prader-Willi syndrome, omphalocele, congenital heat disease, Down syndrome, mental ritardation, etc [5,12,22,52,53].

About 90% of Morgagni hernias are located on the right side, 2% are located on the left side and 8% are bilateral. The rare incidence of left sided diaphragmatic hernia can be explained by the formation of a barrier on the sternocostal trigon by the pericardial sac [1,5,15,24].

Hernia may contain transverse colon, omentum, liver and rarely stomach, small bowel or jejunum [21,33,40,48].

Diagnosis can be difficult when there is intermittent incarceration and especially if contents of the hernia is either omentum or only properitoneal fat [5,35,55].

The majority of Morgagni hernias are diagnosed in adult life because patients can be asymptomatic and present with incidental findings during evaluation or treatment for other conditions. Some other patients present with non-specific respiratory and gastrointestinal symptoms and signs [9,28-30,34].

Symptoms, if present, including usually upper abdominal pain, intestinal obstruction, epigastric discomfort and bloating (especially if the hernia contains hollow viscera) or chest tightness [9]. Wong et al. [32] describes a case report of patient with dyspnea, dry cough, fever, tachypnea and tachycardia. Soylu et al. [28] reports a case of children with respiratory symptoms, including cough and respiratory distress. Small intestinal obstruction and intermittent gastric volvulus are relatively rare, whereas palpitations and cardiac symptoms may occasionally occur [5,21].

The possibility of discover such defects may depend on how they present clinically in the patient.

In more than 70% of cases Morgagni hernias are asymptomatic and diagnosis is made by incidental radiological investigations [34]. In symptomatic patients with intestinal obstruction because of strangulation of viscera, associated chest pain and dyspnea may be send towards diagnosis [5,24,25].

But Morgagni hernias are usually diagnosed on routine chest radiography [30,36].

Generally, a mass containing solid areas of fluid levels in the right substernal cardiophrenic angle often is showed by anterior-posterior and especially lateral chest X-rays. The lateral radiograph reveals that the hernia is located anteriorly [8,9].

However, if the contents of the hernia is either omentum or only properitoneal fat and when herniation is intermittent, the radiograph may be normal and therefore diagnosis can be difficult [5,35,55].

When the diagnosis become difficult of doubtful, confirmation of suspicious radiologic findings may be made with gastrointestinal contrast studies, ultrasound, computed tomography (CT), magnetic resonance imaging (MRI) and radionucleotide liver scan [12,39].

Contrast examination (barium enema or barium meal study) can be carried out when the hernia contents hollow viscera and therefore to confirm the diagnosis of herniated colon, small bowel or stomach [14,16].

Computer tomography (CT) can be considered to be an accurate non invasive method of diagnosing hernia of Morgagni especially when the hernia sac is empty or contain, as in our case, only properitoneal fat. Moreover with CT scan is possible the differential diagnosis that includes a pleuropericardial cyst, pleural mesothelioma, pericardial fat pad, mediastinal lipoma, tumor or cyst of the diaphragm, thymoma, atelectasis and other intrathoracic or mediastinal anterior masses [5,56].

Magnetic resonance imaging (MRI) for differential diagnosis and radionucleotide liver scan to detect intrathoracic liver herniation, are other investigations that can be useful for diagnosis of Morgagni hernia but cost-benefit analysis do not justify their costant employment [21,57,58].

When all those investigations are non-diagnostic, laparoscopic exploration may help, as in our case, to make the diagnosis or to allow her confirmation [25,55,5].

Although the majority of these hernias are asymptomatic, whenever a diagnosis is established, surgery is recommended both in children and in adult patients to avoid future complications (incarceration and strangulation of the herniated abdominal organs, besides to pathological sequelae because of occupation and compression of the intrathoracic structures by intraperitoneal organs) [60-62].

The conventional surgical approach for Morgagni hernia require thoracotomy [27,38,39,41,44,63] or, more frequently, laparotomy [1,28,37,48,62]. But these procedures are usually associated with along postoperative recovery and high morbidity [1]. The open transthoracic approach is carried out by some surgeons in recurrences or when other intrathoracic lesions are suspected and particularly when the diagnosis is uncertain. Thoracic route may be useful which facilitates the release of pericardial adhesions [45,54,58].

Transabdominal repair of Morgagni hernia has been used by numerous authors with favourable results. An abdominal approach may be preferred when the diagnosis is certain especially in case of bilateral and complicated hernia sac with intraabdominal adhesions particularly when the patient has symptoms suggesting intestinal strangulation [5,12,24].

Conventional open repair includes hernia reduction, resection of the hernia sac, whenever possible, followed by closure of the diaphragmatic defect [35].

When it isn't possible to close the too large defect by sutures, a tension-free repair with a mesh-prosthesis is preferred [9,21,30]. It is important to cover the prosthesis by peritoneum, omentum or liver (when possible) to prevent adhesions between the mesh and other intraabdominal organs [26,34,49,59].

The optimal treatment must be technically feasible for the standard surgeon, have a high long-term success and minimal morbidity.

In this optics laparoscopic surgery for the treatment of Morgagni hernia can be easily and safely carried out by minimally invasive techniques [25,55,60]. The first laparoscopic repair is described by Kuster et al. [47] in 1992. Since then, the number of case reports has continued to grow, demonstrating that the laparoscopic approach is an exellent way to confirm diagnosis and to repair non-complicated hernia of Morgagni, more and more favourite by many authors [15,30]. Laparoscopy is also a safe and useful procedure to perform on children especially when CT is non-diagnostic [4,7,29,41,64,65].

Our review of the literature from 1992 revealed 40 cases of laparoscopic Morgagni hernia repair about which 33 adults and 7 children treated with several techniques. There are conflicting opinions in the laparoscopic literature about the possibility to excise the hernia sac or to leave it in place, and on the modality of hernial defect closure. This is so far a debating argoment (Table I).

TABLE I - *Repair of Morgagni hernia by laparoscopic surgery*

Author	No of cases	Age (year) *(month)	Sex	Size(cm)	Contents of hernia	Removal of sac	Mesh	Complications
Kuster et al., 1992 (47)	1	67	Woman	NA	NA	No	Primary cosure	No
Rau et al., 1994(9)	1	42	Man	6	Omentum	Yes	Mesh with staples	No
Newman et al., 1995 (40)	3	- 57 - 22 - 70	Woman Woman Woman	- NS - NS - 10 x 15	-Transverse colon, omentum - Left liver - NS	- Yes - NS - NS	- Primary closure - Primary closure - Primary closure	No
Smith and Ghani, 1995 (31)	1	NA	NA	NA	NA	No	Primary closure	No
Huntington, 1996 (26)	1	75	Man	4 x 9	Omentum	No	Mesh with staples	No
Fernandez-Cebrian, 1996 (60)	1	50	Woman	10 x 15	Colon, omentum, round ligament	Yes	Primary closure	No
Vanclooster et al., 1997 (34)	1	72	Woman	10 x 4	Transverse colon	No	Mesh with stitchs	No
Orita et al., 1997 (55)	1	78	Woman	2 x 3,5	Omentum	No	Primary closure + Mesh with staples	No
Del Castillo et al., 1998 (35)	1	50	Woman	12 x 15	Transverse colon, omentum	No	Mesh with staples	No
Nguyen et al., 1998 (66)	1	NA	NA	5 x 6	Transverse colon	Yes	Mesh with staples	No
Bortul et al., 1998 (59)	1	61	Man	6 x 10	Transverse colon, omentum	No	Mesh with staples	Atrial fibrillation
Ramachandran et al.,1999 (49)	1	58	Woman	8 x 5	Transverse colon, omentum	No	Mesh with staples	No
LaRosa et al., 1999 (48)	1	NA	NA	NS	Stomach	NS	NS	NS
Contini et al., 1999 (46)	1	85	Woman	NS	Transverse colon	No	Primary closure	No
Filipi et al., 2000 (67)	1	52	Woman	NA	NA	No	Mesh	No

Ackroyd and Watson, 2000 (68)	1	NA	NA	4 x 10	Transverse colon	Yes	Primary closure	No
Angrisani et al., 2000 (69)	1	69	Woman	NS	Transverse colon	No	Primary closure	No
Lima et al., 2000 (7)	1	3	Girl	10 x 5	Transverse colon	No	Primary closure	No
La Greca et al., 2001 (70)	1	NA	NA	9 x 5	Transverse colon	No	Primary closure	No
Dalvi et al., 2001 (71)	1	35	Man	5	Transverse colon, falciform ligament	Yes	Mesh	No
Ipek et al., 2002 (8)	3	- 62 - 58 - 34	Woman Woman Woman	- 4 x 4 - 8 x 8 - 6 x 6	- Omentum - Omentum - transverse colon	- No - No - Yes	- Mesh with staples - Mesh with staples - Mesh with staples	No
White et al., 2002 (30)	1	85	Woman	10 x 15	Transverse colon, omentum	No	Mesh with staples	No
Ridai et al., 2002 (53)	2	- 17 - 19	Man Woman	NS	- Transverse colon - Omentum	- Yes - No	- Primary closure - Primary closure	No
De Vogelaere et al., 2002 (29)	1	5	Boy	10 x 5	Transverse colon	No	Primary closure	No
Cokmez and Durak, 2003 (33)	1	65	Woman	8	Transverse colon, omentum, jejunum	No	Primary closure	No
De Vogelaere, 2003 (6)	1	8*	Boy	NS	Transverse colon, left liver	No	Primary closure	No
Azzie et al., 2003 (4)	4	- 11* - 14* - 14* - 36*	NS	NS	- Omentum - Omentum - Omentum - Transverse colon, left liver	- Yes - Yes - Yes - No	- Primary closure - Primary closure - Primary closure - Primary closure	No No No - Left subcostal port site hernia
Chang, 2004 (25)	2	- 40 - 22	Woman Man	NS	- Transverse colon, omentum - Transverse colon, omentum	- No - No	- Primary closure - Primary closure	No
Tarim et al., 004 (15)	1	50	Woman	10 x 15	Colon, omentum, round ligament	Yes	Primary closure	No
Marin-Blazquez et al., 2004 (21)	2	- 12 - 56	Woman Woman	6 x 7 6 x 8	- Transverse colon, omentum - Transverse colon, omentum	- No - No	- Mesh with staples - Mesh with staples	No

NA= not available NS= not stated

When the sac is small, it is usual procedure to excise it completely [9,60]. Many other authors advocate leaving it in situ particularly in large hernias because of the risk of pericardial and pleural injury that may result from extensive dissection in the mediastinum [21,30,47,55].

In our review, in more than half of the cases reported, the sac is not removed. However, there is no available literature to indicate whether this influences recurrence or cyst formation. Ramachandran et al. [49] left the sac in situ and repeat CT a month later showed almost complete disappearance of residual cavity.

The repair of the herniated orifice may be performed

using various procedures (Table I). Small defects can be sutured laparoscopically. Orita et al. [55] closed a 2 x 3,5 cm defect with interrupted sutures and reinforced the repair with mesh.
Following the spread of a "tension-free technique" in inguinal hernia repair and thanks to the introduction of new prosthetic materials and the simplicity of using a stapler, the repair of Morgagni hernia could be also performed by mesh [72,73].
In our review of literature about half of the cases reported in adult patients, laparoscopic repair of Morgagni hernia has performed with a mesh secured by staples. Whereas using of a synthetic mesh prosthesis in children has not been reported [29].
The fixing of the mesh with metal staples further facilitates the laparoscopic procedure and obviates the need for the laborious technique of direct suturing reported by other authors [25,30,34,40,60,63,74].
In the current case, after complete excision of the sac with properitoneale fat, polypropylene mesh fixed by staples was used in accordance with technique of laparoscopic inguinal hernia repair.

Conclusions

Hernia of Morgagni is a rare condition in both adults and children. Laparoscopic technique is easy and safe in the diagnosis and treatment especially when hernia is small, permitting an excellent view of the surgical field, the reduction of trauma, a faster recovery and a faster return to normal diet and activity.
In order to prevent the complications, although rare, we recommend to not excise the hernia sac even if small, and moreover particular care and thoughtfulness in the use of the mesh fixed by metal staples to avoid pericardial and pleural injury with respiratory and circulatory complications.

Riassunto

L'ernia di Morgagni è una rara e congenita forma di ernia diaframmatica. La maggioranza di tali ernie sono asintomatiche e diagnosticate incidentalmente in corso di esami o trattamenti per altre patologie. Stabilita la diagnosi l'intervento chirurgico è mandatario. Gli Autori riportano la riparazione per via laparoscopica di una piccola ernia di Morgagni, seguita da una revisione della letteratura. Viene descritto il caso di una donna di 55 anni con una sintomatologia caratterizzata da tensione toracica ma soprattutto dolore epigastrico oppressivo ed episodi lipotimici. L'approccio laparoscopico ha permesso la conferma della diagnosi e la riparazione dell'ernia con posizionamento di mesh dopo aver resecato il sacco erniario. Nel decorso post-operatorio la paziente ha presentato un episodio di aritmia dovuto a pericardite trattata farmacologicamente. La paziente è stata dimessa in VII giornata post-operatoria chirurgicamente guarita. La via laparoscopica può essere considerata la prima linea di approccio per il trattamento dell'ernia di Morgagni, facile e sicura da eseguire. Noi raccomandiamo, come la maggior parte degli Autori, di non asportare il sacco erniario, anche se piccolo, e prestare particolare cura nel posizionamento della rete e nell'utilizzo di clips per la fissazione.

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