



LAPAROSCOPIC TENSION FREE, MESH REPAIR IN ADULT CASES OF DIAPHRAGMATIC DEFECTS: A SERIES OF FOUR CASES.

Surgery

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ABSTRACT

Introduction: Congenital diaphragmatic hernia is a rare entity even rarer in adults. Trauma is the most common cause of diaphragmatic hernia in adults. Here we are presenting four cases of different varieties of diaphragmatic hernia in adults. All four cases underwent to laparoscopic mesh hernia repair and shown excellent outcomes.

Methods: From March 2017 to September 2019, four cases (three females, one male adult cases) of diaphragmatic hernia were admitted to our department of surgical gastroenterology in tertiary care institute. Patient presented with respiratory and gastrointestinal symptoms. They were evaluated with Chest X-ray, CT scan chest and abdomen.

Case reports: Case 1 was a 47 year old female. She was present with complain of epigastric pain and diagnoses to have paraesophageal hernia. She underwent for laparoscopic mesh repair and Nissens Fundoplication. Case 2 and 3 were 60 years male and 44 years female respectively. Both diagnosed to have morgagni hernia. They underwent for laparoscopic reduction and mesh hernioplasty. Case 4 was a 45 year female. She came to us with complain of epigastric pain and diagnosed to have posterolateral diaphragmatic hernia which was laparoscopic mesh hernioplasty with Nissen's Fundoplication. The postoperative period of all four patients was uneventful, except one patient, devolved intrathoracic fluid collection that was successfully managed by radiological intervention.

Conclusion: Although the diaphragmatic hernia is a rare entity. However, high index suspicion leads to early diagnosis and management. The laparoscopic tension free hernia repair could be a best option for management of diaphragmatic hernia without losing the advantages of minimal invasive surgery and lesser recurrence rate.

KEYWORDS

Diaphragmatic Hernia, Morgagni Hernia, Laparoscopy

INTRODUCTION:

Congenital diaphragmatic hernia is extremely rare <1% in adults¹. Surgery is *the only available option for symptomatic patients*. It could perform by open and laparoscopic method. *Minimally invasive repair has shown is equal effectiveness* and keeping all benefits minimal invasive surgery². Here we *present* total 4 cases of diaphragmatic hernia in adult age groups. These cases presented with respiratory and gastrointestinal symptoms. All 4 *cases underwent for laparoscopic tension free, composite mesh repair*. They have *allowed oral sips on the first postoperative day*. All the *patients have advantage less postoperative pain, shorter hospital stay and early recovery*. They all doing well for the last 3 years of maximum OPD follow up and have not shown any recurrence

Case 1:

A 47 years old female without any co-morbidities or previous surgeries presented with intermittent low grade epigastric pain for 2 months. It was associated with dyspeptic symptoms and heart burn. No respiratory symptoms. Examination revealed an averagely build and nourished lady with no anemia, pedal edema and lymphadenopathy. Her chest and abdominal examinations were unremarkable. Her USG abdomen was normal. CECT (contrast enhanced CT scan) revealed a central defect in diaphragm, with protrusion of stomach through hernial defect (**Figure 1a, 1b**). Upper gastrointestinal endoscopy revealed a large hiatus hernia. Barium swallow revealed type III paraesophageal hernia and about > 5 cm stomach was protruding into the thoracic cavity. Because of her persistent symptoms, she planned for laparoscopic reduction of hernia and Nissen's fundoplication. Intra-operatively, fundus of stomach and omentum were contents. They could be reduced and there was a 5 x 5 cm defect in hiatus. Bilateral crura were approximated with interrupted prolene 2-0 sutures and the defect reinforced with composite mesh. A floppy Nissen's fundoplication created (**Figure 2a, 2b**). No esophageal injury or pleural breach occurred during surgery. Her post-operative course was uneventful. She allowed liquids from day 1 and patient discharged on 3rd postoperative day. Since then after 1 year of follow up she is doing

well and symptom free.

Case 2:

A 60 years old male, a retired teacher with no co-morbidities presented with mild pain in right upper abdomen since last 4 months. It was insidious onset, intermittent type, no radiation or referral. It was aggravated with food intake and relieved spontaneously. He also had history of associated shortness of breath for 2 weeks. Respiratory symptoms were insidious in onset, intermittent type and gradually progressive. He had multiple paroxysmal episodes of shortness of breath during nights, which was relieved by getting up, walking and lying down. He had no cough, chest pain, palpitation. He had no history of loss appetite or weight loss. On examination he was averagely build and well nourished. There was no pallor, icterus, cyanosis, clubbing or pedal edema or any lymphadenopathy. Chest examination revealed kyphoscoliosis and barrel shaped chest. There were decreased breath sounds on right lower chest. His electrocardiogram was normal. His blood parameters revealed normal results. His chest radiograph showed a radio-opaque shadow over right lower zone. He was further evaluation with CECT thorax which revealed a large rounded mass in right cardiophrenic angle below the tracheal bifurcation. It showed an oval mass of fat attenuation measuring 16x15cm in size. Which was containing transverse colon in anterior mediastinum suggestive of morgagni hernia? He underwent laparoscopic reduction of hernia contents and mesh hernioplasty. Intra operatively there was an 8 x 6 cm defect in left hemidiaphragm, with omentum and transverse colon as contents with flimsy adhesion between neck of sac and colon. Adhesiolysis done and contents were reduced and then defect was defined. Defect was covered with 20 x 15 cm (Parietex) composite mesh and fixed to parities with sutures at 4 angles and then with tackers. Post-operative course was uneventful. He was allowed orally liquids on day 1. On post-operative day 3 he had respiratory distress and there was decreased breath sound on right side of chest. He was evaluated with CECT thorax and it revealed a 12 x 9 x 7.6 cm collection, with air fluid level on CT scan in the antero-superior and anterior mediastinum along right heart border causing mild

atelectasis of anterior segment of right lung. It had required drainage. Its nature was serous and culture was sterile and discharged on post-operative day 12 in stable condition. Since last 1 year follow up, he is doing well with no shortness of breath.

Case 3:

A 44 years female presented with dyspnoea on exertion since last 3 years. It was mild and non-progressive. She didn't have orthopnoea. And also had no history of altered bowel or bladder habits. She had no history of loss of appetite or weight loss. She had history of migraine and had undergone laparoscopic cholecystectomy 5 years back and there was no intra operative injury or abnormal finding in either pre-operative investigation or intra-operative assessment. Examination revealed an averagely build and well nourished female. She was not paler or icteric. She had no pedal edema or cervical lymphadenopathy. Chest revealed decreased breath sound on right side as compared to left side. Abdominal examination was normal. Her chest radiography didn't reveal any significant findings. Her routine blood parameters within normal limits. CECT thorax and upper abdomen revealed a diaphragmatic hernia on anterior aspect of diaphragm with transverse colon as the content. She underwent laparoscopic reduction of hernia with mesh hernioplasty. A 3 x 4 cm defect was found in the anterior aspect of the diaphragm with omentum and transverse colon as contents of the hernia. Contents were reduced and sac excised. Defect was defined and approximated with prolene 1-0 extra corporeal sutures using suture passer. A 10 x 15 cm (Parietex®) composite mesh reinforced and fixed with tackers (Protac®) at the anterior margin. Inferior margin was fixed with Ethibond® 2-0 sutures (Figure 3a, 3b). Her post-operative course was uneventful and she was discharged on post-operative day 4. In last 2 year follow up, she is doing well and she

had no dyspnoea.

Case 4:

A 45 years old female with no medical co-morbidities presented with mild, intermittent epigastric pain since last 1 year. It aggravates after food intakes. It relieves after 1-2 hours and she had recurrent belching. He had no respiratory complaints and there was no loss of appetite or loss of weight. Examination revealed an averagely build female. She was not anemic and there was no icterus, pedal edema or cervical lymphadenopathy. Routine blood parameters were normal. Her chest and abdominal examinations were within normal limits. Her upper GI endoscopy revealed normal esophagus and superficial erosions in antrum of the stomach. Ultrasound abdomen was normal. Barium swallows revealed gastric volvulus (organoaxial). CECT abdomen showed a left sided diaphragmatic hernia. Its content were colon and omentum with gastric volvulus. There were no signs or symptoms of gastric ischemia. She underwent laparoscopic mesh repair with Nissen's Fundoplication. Intra-operatively there was a 4 x 3 cm defect in left side of diaphragm. Contents were stomach and omentum and both were viable. Esophagus was mobilized circumferentially. Crus was approximated using two prolene 2-0 interrupted sutures. Defect size reduced by using interrupted polene 2-0 sutures covered by using 15 x 15 cm Parietex® (composite) mesh encircling esophagus with an overlap of 3 cm on all sides of the defect. Mesh fixation was done using absorbable tackers. After fixation a 360 degree floppy Nissen's fundoplication was done using interrupted prolene 2-0 sutures. She fared well in post-operative period. She was discharged on post-operative day 4 in stable condition. After 3 years of follow up she is doing well (Table 1).

Table 1: Details Of All Patients Demography, Presentation, Surgical Management And Outcomes.

S.no	Age/Sex	Presentation	Diagnosis	Surgery	Morbidity	Followupduration
1	47/F	Dyspepsia and epigastric pain	Paraesophageal hernia	Laparoscopic Nissen's fundoplication	No	1year
2	60/M	Abdominalpain and shortness of breath	Paraesophageal hernia	Laparoscopic reduction and mesh hernioplasty	Intrathoracic collection	1year
3	44/F	Shortness of breath	Paraesophageal hernia	Laparoscopic reduction and mesh hernioplasty	No	2years
4	45/F	Epigastricpain	Paraesophageal hernia	Laparoscopic mesh hernioplasty with Nissen'sfundoplication	No	3years

DISCUSSION:

Diaphragmatic hernias are usually diagnosed in childhood and rarely in adults. This is due to developmental defect in muscular diaphragm. They are of different types i.e. Bochdalek hernia (posterolateral), Morgagni hernia (parasternal), and peritoneal-pericardial hernia.³ Bochdalek hernia is most common among them and it was described by Bochdalek in 1848. Bochdalek type hernias occur at 8-10 weeks of gestation due to failure of closure of the posterolateral aspect of the pleuroperitoneal canal. left sided hernias are more common than right side as left side pleuroperitoneal canal closes later.⁴

Bochdalek hernia is seen in 1/ 2,200 births. In 5–10% it remains undetected till adult hood. Morgagni hernias are also rare incidence and it accounts for 2-5% of all congenital diaphragmatic defects.⁵ these are discovered in older children or adults as an incidental findings or symptoms like intestinal obstruction. Recurrent chest infections, respiratory distress.⁶ Congenital diaphragmatic hernias can be associated with other anomalies i.e neural tube defects, congenital heart defects, intestinal malrotation, chromosomal abnormalities (trisomy of chromosome 13, 18, 21) and pectus excavatum.⁷

Diaphragmatic hernias presents differently in different age groups. Chest pain, difficulty in breathing, abdominal pain, intestinal obstruction is frequent symptoms. They may remain asymptomatic especially in right sided hernias where liver used to plug the hernia site. Horton et al. reviewed 298 cases of adult morgagni hernias and shown that average age at presentation is 53 years and most common in females. It is mostly seen on right side. Asymptomatic cases constitute 28% and most common symptom is pain.⁸ Loong et al reviewed 140 case reports of Morgagni hernia (children-47, adults-93) and shown that acute and subacute presentations are more common in children than adults. Various solid organs i.e liver, spleen and hollow organs like stomach, small bowel, transverse colon can herniated. Lung hypoplasia, malrotation of midgut, and cardiac defects are associated with bochdalek hernias and these hernias are rare in adults. Hypoplasia of the right lobe of liver may be observed in morgagni's hernia.

Sometimes strangulation of hernia contents can occur. CECT is the preferred modality of investigation to make the diagnosis and to identify the hernia contents.⁹ There is risk of intestinal obstruction, strangulation so these hernias should be repaired when diagnosed. Mostly abdominal route is preferred. Laparoscopic repair of diaphragmatic hernia was first reported by campos and sipes et al.¹⁰

Minimally invasive methods are in vogue and gained popularity due to less pain, decreased hospital stay and better cosmesis.¹¹ Primary closure of defect with interrupted non-absorbable suture is preferred and in case of defects > 20-30 cm mesh is used.^{12,13} Paraesophageal hernias constitute 5% of all adult hiatus hernias where there is a defect in esophageal hiatus. It is due to weakness in phrenoesophageal membrane and increased intra-abdominal pressure. They have risk of strangulation which warrants prompt surgical repair. Laparoscopic repair is preferred in these cases. We have also included a case of type III paraesophageal hernia that was managed with laparoscopic reduction and nissen's fundoplication. There are multiple retrospective series of laparoscopic repair of these hernias with recurrence rate 0.5-9.3% requiring surgical management is less compared to radiological recurrence which is observed in 3.6-65.7%. In our patient after 1 year of follow up she is doing well with no dyspeptic symptoms and tolerating full oral diet.¹⁴ Recurrence rate following repair of these hernias is low despite of different method of access i.e laparotomy, thoracotomy, laparoscopy, and thoracoscopy. Horton et al also demonstrated that thoracoscopic approach and laparoscopic approach leads to less morbidity as compared to thoracotomy or laparotomy and similar results are being demonstrated by loong et al.¹⁵

Young et al did a retrospective review of morgagni hernia and compared laparoscopic repair with open repair. Out of 43 cases; 62.8% underwent laparotomy, laparoscopic (23.3%), and in 14% thoracotomy was performed. Laparoscopic approach had shorter hospital stay (p-value=0.0024) whereas complication rate were comparable.¹⁶ There are few case reports and series of laparoscopic repair of diaphragmatic hernia described (Table 2).

Table 2: Few case series showing laparoscopic repair of diaphragmatic hernias.

Authors	Year	Types of hernia	Number of patients	Mesh/suture repair	Complications	Recurrence	Follow up
D. S. Thoman et al.	2002	BH-8, Traumatic hernia-11	19	Mesh-9, suture-10	Enterotomy-2 Conversion-1	0	2-42 Months
Ipek T et al.	2002	MH	3	Mesh-3	No major morbidity	0	41 Months
Percivale A et al.	2005	MH	3	Mesh-3	No major morbidity	0	23 Months
Atul Wadhwa et al.	2005	BH-3, Traumatic hernia-3	6	Mesh-6	No major morbidity	0	2.9 years
E Durak et al.	2007	MH	5	Mesh-4, Suture-1	No major morbidity	0	-
C Palanivelu et al.	2009	BH- 12, MH-3, eventration-3, traumatic hernia-3	21	Mesh-18, suture-3	Complications-19% Mortality-4.5%	1	10 Months
Junya Oguma et al.	2016	BH	2	Mesh-2	No major morbidity or mortality	0	6-7 Months
Sanjay Kumar Saroj et al.	2016	BH-4, Eventration-9	13	Mesh-4, suture-9	No major morbidity or mortality	0	2 Years
Soykan Arıkan et al.	2018	MH	21(lap-12, open-17)	Mesh-15, Suture-6	No major morbidity	0	-

BH (Bochdalek hernia), **MH** (Morgagni hernia)

Here we have reported 1 case of type III paraesophageal hernia, 2 cases of morgagni hernia and 1 case of posteriolateral diaphragmatic hernia where the repair done laparoscopically. In all three diaphragmatic hernias, mesh was placed to reinforce the defect. All patients experienced less pain and were discharged early except in one patient; who had respiratory distress in post-operative period and there was fluid collection at the hernia site. It warranted drainage and patient recovered well.

CONCLUSION:

Diaphragmatic hernia is an uncommon entity. It is difficult to diagnose until patients developed respiratory and gastroenterology related symptoms. However, a high index of suspicion in patient having alarming is important for early diagnosis. Since tension free approximation of tissue *has been* always not possible. That why a collagen layer (composite mesh needs) reinforcement possibly a better option for tension free repair. Minimal invasive method of surgery also is capable to keeping all the advantages of minimally invasive surgery like decrease in postoperative pain, shorter hospital stay, and early recovery. *Ultimately, results in decreasing the recurrence rate.*

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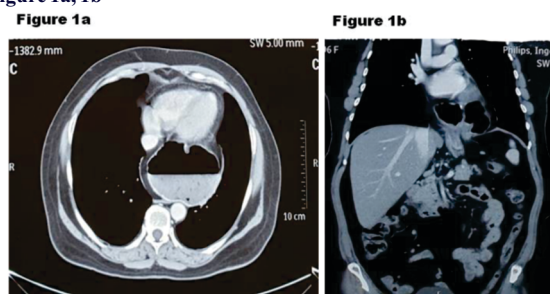
Figure 1a, 1b

Figure 1a 1b: Case 1, (1a) CT scan transverse view showing herniated stomach (1b) CT scan coronal view showing herniation of viscera inside the thoracic cavity.

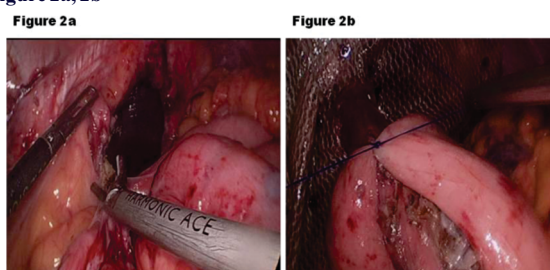
Figure 2a, 2b

Figure 2a 2b: Case 1, (2a) laparoscopic view of hiatus hernia after reduction of contents (2b) fixation of composite mesh to covered the defect with Nissen's Fundoplication.

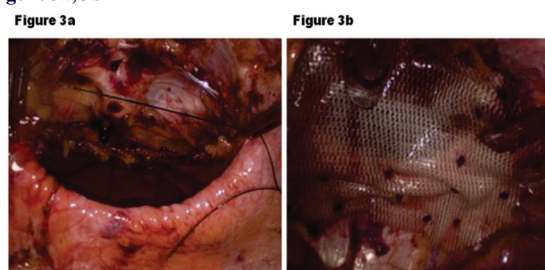
Figure 3a, 3b

Figure 3a 3b: Case 3, (3a) Laparoscopic view of Morgagni hernia after reduction of contents, (3b) final view of repair, composite mesh fixation.

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