

Case Series

Thoraco-laparoscopic management of diaphragmatic hernia of adults: a case series

Siddharth S. Chauhan¹, Ajit Mishra², Sandeep Dave^{3*}, Jawwad Naqvi³,
Siddharth Tamaskar³, Vikram Sharma³, Nitin Niwas³

¹Department of Minimal Access Surgery, Ramkrishna Care Hospital, Raipur, Chhattisgarh, India

²Department of GI Surgery, Ramkrishna Care Hospital, Raipur, Chhattisgarh, India

³Department of General Surgery and Department of Minimal Access Surgery, Ramkrishna Care Hospital, Raipur, Chhattisgarh, India

Received: 04 March 2020

Revised: 03 April 2020

Accepted: 07 April 2020

*Correspondence:

Dr. Sandeep Dave,

E-mail: dr.siddharth.tamaskar@carehospitals.com

Copyright: © the author(s), publisher and licensee Medip Academy. This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT

Diaphragmatic hernia (DH) usually occurs in childhood; however, in adult it is uncommon. Most common aetiology of DH in adult is trauma while spontaneous DH is a rare entity accounting for <1%. The management is primarily surgical repair in the form of open or laparoscopic approach; the later has been associated with low morbidity, mortality and excellent long term outcomes with low rate of recurrence. In this case series, confirmation of the diagnosis was done by CT scan and by laparoscopy in all the patients; laparoscopic repair was performed in all the patients along with thoracoscopic aid in two cases. We found that minimal access techniques can be safely done in DH; in conditions when the herniated content are difficult to get reduced laparoscopically alone, a simultaneous thoracoscopy has helped in great deal in reducing the content and completing the procedure entirely by minimal access techniques. This gives all the advantages of minimally invasive approach like less postoperative pain, shorter hospital stay, quicker recovery and low recurrence rate; provided tissue repair is done in tension free manner by an experienced laparoscopic surgeon.

Keywords: CT scan chest and abdomen, Diaphragmatic hernia, Laparoscopy, Thoracoscopy

INTRODUCTION

The diaphragmatic hernia is a herniation of abdominal viscera within the pleural space through a diaphragmatic defect; it can be either acquired or congenital.¹ Acquired hernias are most commonly traumatic in origin and may be due to penetrating or blunt thoracoabdominal trauma. Rarely, spontaneous acquired hernia without any symptom may be occurred.² Spontaneous diaphragmatic hernia is an uncommon entity that accounts for <1% of diaphragmatic hernia ruptures.³ The clinical features depend on location of hernia, the organ herniated through it and timing of presentation. Diagnosis may be delayed by several months or even years. A sceptical approach,

combined with thorough history, physical examination and a correct interpretation of the chest x-ray, are very important in diagnosis. In situations of uncertain diagnosis a CT scan chest and abdomen can be of great help. The timing of operation usually is decided by the patient's symptoms. For patients who have incarcerated hernia, urgent repair is necessary. For those patients in whom the hernia is found incidentally, an elective repair can be performed. Amongst the various surgical approaches the minimally invasive technique (laparoscopic and thoracoscopic approach) gives safe, feasible, effective alternative along with it's all the advantages of being minimally invasive surgery.

CASE SERIES

In this case series we analyzed our prospectively maintained data base, viz., medical records, imaging studies and intraoperative video recordings of surgeries and presented this report.

We report five cases of non-traumatic DH managed over a period of two years at Ramkrishna care hospital, a tertiary care hospital in central India. All patients were

treated by minimal access surgical technique, viz., laparoscopy, thoracoscopy or both and were regularly followed-up. A thorough history and clinical examination of all the patients was done in follow-up to see sign of recurrence. Table 1 summarizes the demographic distribution, various symptoms, etiology and pre-operative investigation done in this case series.

Table 1: Patient demography, etiology and pre-operative investigation.

Case no.	Age in years/sex	Symptoms	Etiology	Investigation
1.	25/female	Abdominal pain, obstipation	Post splenectomy	Chest x-ray, CT scan
2.	45/male	Recurrent vomiting	Unknown	Chest x-ray, CT scan
3.	66/female	Abdominal pain	Morgagni hernia	Chest x-ray, USG abdomen, CT scan
4.	70/male	Abdominal pain, vomiting	Morgagni hernia	Chest x-ray, CT scan
5.	29/male	Shortness of breath, chest heaviness	Diaphragmatic eventration	Chest x-ray, UGI endoscopy, CT scan

CT = computed tomography; USG = Ultrasonography; UGI = upper gastrointestinal

Case 1

A 25 year old girl presented with gradually increasing abdominal pain, distension and non-passage of stool and flatus since four days. She had undergone open splenectomy in the past. X-ray findings was suspicious of bowel loops in left thorax, she was further evaluated with CT thorax and abdomen which showed, left sided diaphragmatic hernia with obstructed splenic flexure of colon with proximal dilatation of the transverse colon, ascending colon and caecum. Laparoscopic hernia repair was planned.

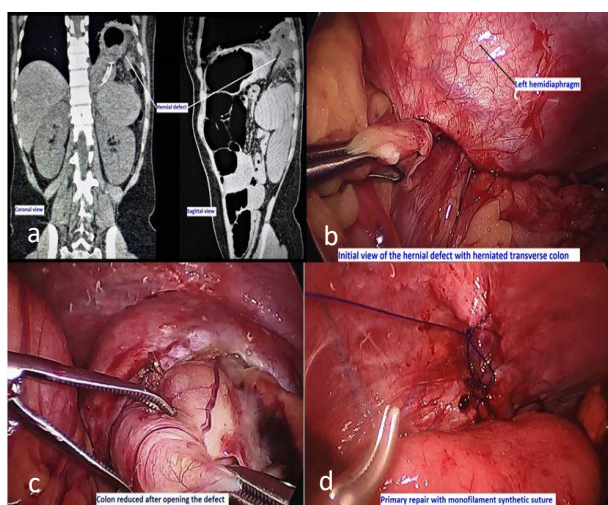


Figure 1: Case 1 (a) Hernial defect, (b) initial view of hernial defect with herniated transverse colon, (c) colon reduced after opening the defect and (d) primary repair with monofilament synthetic suture.

On laparoscopy there was left sided diaphragmatic hernia and content was transverse colon, small bowel and omentum. Contents were viable and were reduced. A primary tension free repair of the hernia defect of size three centimeters was done with prolene 1.0 suture. Left intercostal drain tube was placed which was removed on post-operative day two, patient was discharged on post-operative day four. Patient remained asymptomatic on follow-up visits.

Case 2

A 45 year old gentleman presented with recurrent episodes of vomiting along with abdominal pain and shortness of breath for 2 weeks. On clinical examination the air entry was found to be decreased in left hemithorax. The X-ray revealed bowel loop in the left thorax and on further evaluation with CT chest and abdomen it showed left sided diaphragmatic hernia with herniation of small bowel, colon and spleen into the left thoracic cavity. On laparoscopy the diaphragmatic hernia was noted with herniated small bowel, colon, omentum and spleen. The bowel content was reduced easily but spleen was not reduced due to dense adhesions of it to the thoracic wall, so a thoracoscopic approach was taken to reduce the adherent spleen. The diaphragmatic defect of size 10×8 cm was noted after achieving complete reduction and considering its large size with lax diaphragmatic muscle a mesh reinforcement was planned. A repair with prolene sutures and composite mesh was done. Intercostal drain tube was placed on the left side, which was removed at discharge on post-operative day seven. Patient is asymptomatic in the OPD follow-up.

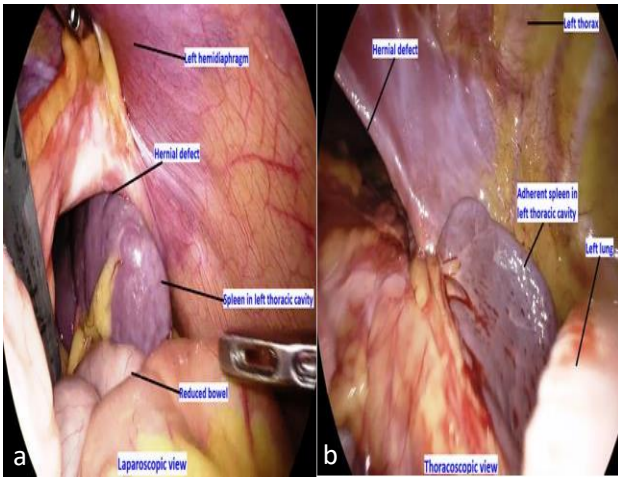


Figure 2: Case 2 (a) laparoscopic view and (b) thoracoscopic view.

Case 3

A 66 year old lady presented with chief complains of abdominal pain predominantly in the right hypochondrium and in epigastrium since four months. On investigating, the chest x-ray showed a radiopaque shadow in right lower chest and ultrasonography reported cholelithiasis. Further she underwent a CT chest and abdomen, which showed right side diaphragmatic hernia. Patient was planned for laparoscopic management of the hernia and a cholecystectomy, on laparoscopy a Morgagni hernia/right anterior parasternal diaphragmatic hernia with omentum as content was noted. She underwent laparoscopic cholecystectomy along with laparoscopic diaphragmatic hernia repair (hernia sac with content reduced) using synthetic prolene mesh, placed in retrorectus plane. During repair the right pleural cavity was opened accidentally and a right sided intercostal drainage tube was placed, which was removed later. Patient was discharged on postoperative day four, patient is asymptomatic in follow-up visits.

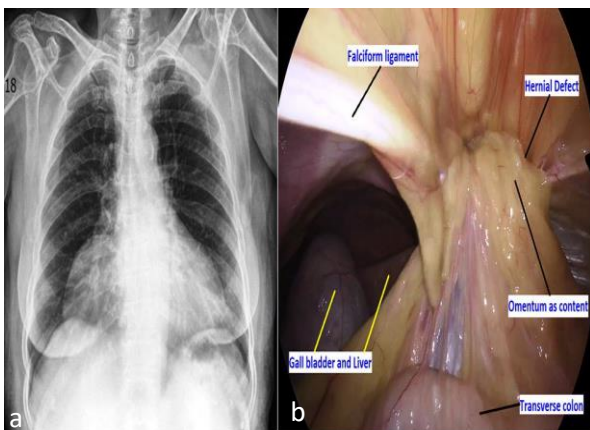


Figure 3: (a) Chest X-ray showing radiopaque shadow in right lower chest, (b) laparoscopic view of Morgagni hernia with content.

Case 4

A 70 year old gentleman presented with abdominal pain and intermittent vomiting since 20 days. On clinical examination there was decreased air entry in the right hemithorax. X-ray revealed bowel loops in the right thorax and on further evaluation with CT chest and abdomen right sided diaphragmatic hernia with herniation of stomach, first and second part of duodenum and transverse colon into the right thoracic cavity was found. On laparoscopy above findings were noted along with adherent omentum to the hernia sac, Laparoscopic reduction of the content was done, tension free closure of the defect was done after reducing the sac and utilizing it in closure of the defect in two layers with PDS and ethibond (J and J) sutures. An overlying composite mesh was placed and fixed. Right sided intercostal drain tube was placed which was removed in subsequent days, patient was discharged on post-operative day four. Patient is asymptomatic in follow up visits.

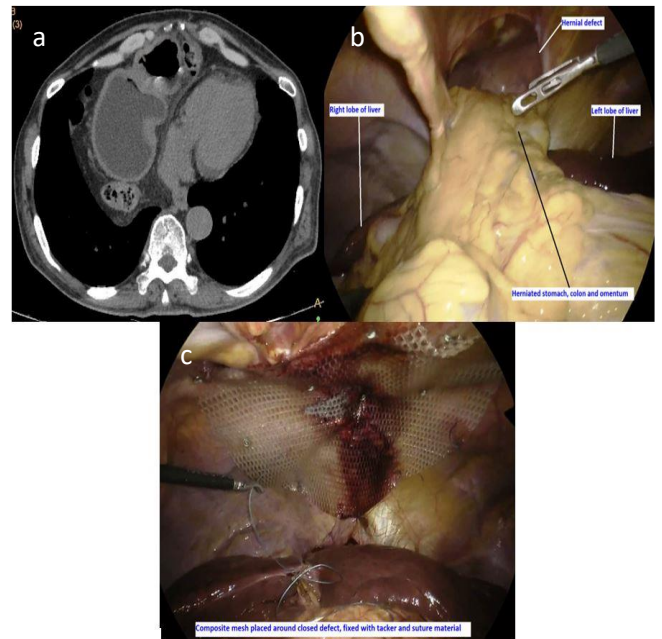


Figure 4: (a) CT scan transverse view showing herniated stomach and colon, (b) laparoscopic view of Morgagni hernia with content, (c) final view of repair, composite mesh fixation.

Case 5

A 29 year old gentleman presented with chief complains of chest heaviness, shortness of breath and gradually developing difficulty in swallowing over a period of six months. The chest x-ray showed elevated left dome of diaphragm into the left hemithorax along with mediastinal shift to the right hemithorax. On further evaluation an upper GI endoscopy was done which was within normal limits and a CT chest and abdomen showed eventration of left hemidiaphragm with stomach and bowel segments in the left thorax with significant right mediastinal shift. On laparoscopy the left

hemidiaphragm was thinned out with visible splaying of the diaphragmatic muscle fibers and was lying high up in the left thoracic cavity along with abdominal contents. A laparoscopic reduction of abdominal contents was done, the plication of the left hemidiaphragm could not be achieved laparoscopically so, it was done thoracoscopically with interrupted prolene sutures after reducing the contents. An ICD was placed in left side. On post-operative day two a left sided pneumothorax was detected on x-ray chest, which was managed conservatively by another ICD insertion. Chest tubes were removed after one week and patient was discharged. Later patient developed recurrence of the symptoms and was found to have recurrence. He was advised re-exploration but patient denied and is now lost to follow-up.

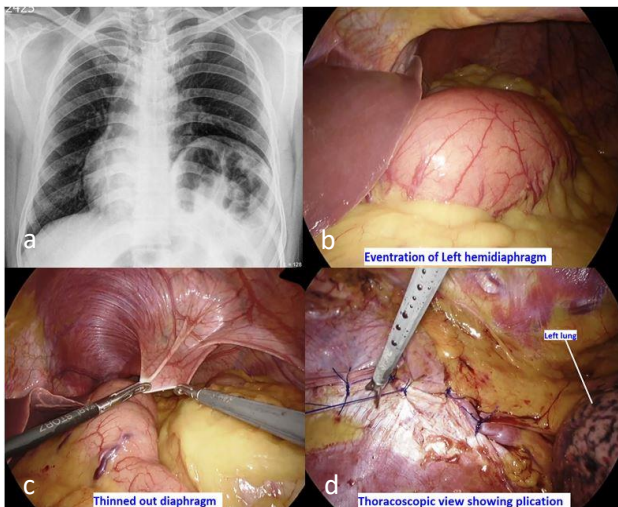


Figure 5: Case 5 (a) X ray of chest, (b) eventration of left hemidiaphragm, (c) thinned out diaphragm and (d) thoracoscopic view showing plication.

Laparoscopic repair was performed in all the patients along with thoracoscopic aid in two cases. The mean age was 47 years (range, 25-70 years). Three male and two female patients had spontaneous diaphragmatic hernia in this case series. The main presenting complain in almost all the patients was abdominal pain while patient with diaphragmatic eventration had chest symptoms. The etiology was defined in four cases and it was unknown in one patient. All patients underwent preliminary investigation of x-ray chest and subsequently confirmation was done by CT scan and laparoscopically. Left sided hernia had transverse colon, stomach, small bowel, omentum and spleen as content while right sided hernia was mainly containing omentum, stomach and transverse colon.

Two cases required thoracoscopic intervention because of the dense adhesions of the abdominal content to the inner chest wall. These adhesions were released thoracoscopically. In all the repairs the approximation was achieved with no tissue tension except in one case of diaphragmatic eventration which eventually lead into recurrence. Tissue approximation was done using prolene suture or ethibond suture (J and J) material along with mesh reinforcement done in three cases, viz., composite mesh in two case and prolene mesh in one case in retrorectus plane. The Summary of intraoperative findings and post-operative complications are in Table 2. The mean hospital stay postoperatively was 5.2 days (range, 4-7 days). All the patient were asymptomatic in immediate and early post-operative period except one patient who had recurrence of symptoms which was detected at one month follow-up. Patient was advised re-exploration but, patient denied admission and is lost to follow-up.

Table 2: Intraoperative finding and complications.

Age/sex	Content of hernia	Size of defect (cm)	Repair	Thoracoscopy	Complications
25 year/female	Transverse colon, omentum, small bowel	3×2	Prolene suture	No	None
45 year/male	Colon, omentum, splenic flexure, spleen, small bowel	10×8	Ethibond (J and J) suture, composite mesh	Yes	None
66 year/female	Omentum	4×3	Prolene mesh	No	None
70 year/male	Stomach, D1 and D2, transverse colon, omentum	6×5	Prolene suture, ethibond (J and J) suture, composite mesh	No	None
29 year/male	Stomach, spleen, splenic flexure, colon, omentum	12×10	Prolene suture plication	Yes	Recurrence

D1 = first part of duodenum; D2 = second part of duodenum

DISCUSSION

Diaphragmatic hernia in adults can be congenital or acquired type (traumatic). Congenital diaphragmatic hernia is uncommon in adults, it occurs from incomplete fusion of the posterolateral foramina of the diaphragm leading to Bochdalek hernia or at anterior midline through the sternocostal region of diaphragm leading to Morgagni hernia. Spontaneous diaphragmatic hernia is one of the rarest thoracoabdominal emergencies, with 28 detailed reports published in world literature (1956-2009).⁴⁻⁸ In this case series three left sided and two right sided diaphragmatic hernias were found.

The pressure gradient between the thoracic and abdominal cavities, which may reach up to 100 mmHg during respiration, is the most effective factor contributing to herniation of abdominal contents to the thoracic cavity.⁹ They are most commonly found at the oesophageal hiatus or at the points of failure of embryonic fusion of diaphragm. The latter are usually subcostal (foramen of Morgagni, Larrey's spaces) or posterior (pleuroperitoneal or foramen of Bochdalek) in origin.¹⁰ A 'spontaneous' rupture implies absence of trauma, but there is always the possibility that a diaphragmatic defect arose from some forgotten trauma in the past or has a structural origin.¹¹

Diaphragmatic hernia is often asymptomatic or produces only mild symptoms; however, it may lead to serious complications associated with considerable morbidity and possible fatality, such as intestinal occlusion by incarceration and perforation of the bowel into the thorax, pancreatitis owing to strangled pancreas, rupture of spleen owing to splenic commitment, pneumothorax, superior vena cava syndrome and cardiac arrest.¹² The characteristic clinical features of a diaphragmatic hernia are thoracic and abdominal pain, dyspnoea, nausea and vomiting.¹³ Clinically, diaphragmatic rupture has 3 phases according to the interval between injury and diagnosis: the initial or acute phase, the interval phase and the obstructive or late phase. In the acute phase, which continues for 2 weeks, clinical signs of diaphragmatic rupture may be obscured by the associated injuries.¹⁴ Classically reported symptoms, such as abdominal pain, shortness of breath, and chest pain, can often be overlooked.¹⁵ The interval phase may be relatively asymptomatic and diaphragmatic rupture may be discovered only by incidental radiography. Finally, during the phase of obstruction and strangulation, most patients have acute symptoms secondary to acute respiratory or bowel obstruction problems. Also, patients most commonly have an acute abdomen secondary to incarceration and strangulation.¹⁴⁻¹⁶ In this series the predominant symptoms in patients were abdominal pain followed by vomiting.

In a study by Losanoff et al, spontaneous rupture of the diaphragm was seen on the left more often (68%). In the same study, the most commonly herniated organs were

the stomach (43%), colon (29%) and omentum (29%), whereas the most common symptoms were abdominal or thoraco-abdominal pain, nausea, vomiting, and dyspnoea.¹⁷ The most common reasons for diaphragmatic ruptures were coughing (32%), physical exercise (21%), and vaginal child birth (14%).¹⁷ In this series most common organ herniation seen is small bowel loop, transverse colon with omentum in case of Morgagni hernia whereas it was small bowel loops, transverse colon in left sided hernia. Differential diagnosis includes, giant hiatal hernias, congenital diaphragmatic hernias, pulmonary sequestration, neoplasia, phrenic nerve palsy, atelectasis, sub-pulmonic effusion, sub-pulmonic abscess and eventration of the diaphragm.¹⁸

Single or serial plain chest radiographs with a high index of suspicion are diagnostic in most cases of diaphragmatic rupture.¹⁹ On the chest x-ray radiography, degradation of the integrity of the diaphragm, visualisation of bowel haustras and gas shadows which may occur within the thorax, visualisation of the diaphragm above the normal anatomical position, mediastinal shift, atelectasis, pulmonary mass appearance, pleural effusion, pneumothorax, and hydropneumothorax can be observed. The computed tomography of the thorax is the second imaging modality of choice in these patients and the sensitivity varies between 71% and 90%.^{19,20} In this series chest x-ray and CT scan chest and abdomen was done prior, in all the cases.

Diaphragmatic rupture leads to a challenging situation requiring surgical repair.²¹ The diaphragm is in a constant state of movement during respiration. Therefore, diaphragmatic ruptures almost never heal without repair.²² Surgery is indicated for symptomatic as well as asymptomatic patients who are fit for surgery. It can be done by laparotomy, thoracotomy, thoracoscopy, or laparoscopy.²³ In patients with diaphragmatic hernia, surgical repair should not be delayed as any delay might cause complications such as volvulus formation, incarceration, strangulation, haemorrhage, and even perforation of a hollow visceral organ.²⁴ The management of diaphragmatic hernia consists of reducing the herniated organs to the abdominal cavity and repairing the diaphragmatic defect either by open surgical methods (thoracotomy, laparotomy, or both) or by minimal access surgery.²⁴ With the advent of minimal access techniques, the open surgical repair for this hernia has decreased. The results of thoracoscopy and laparoscopy in such cases have been found to be comparable. Laparoscopic repair helps in delineating clear anatomy, working space, early recovery, and return to home and work.²³ Laparoscopic diaphragmatic hernia repair is increasingly reported to be an acceptable and safe alternative to open surgical repair.²⁵ In this series three patients were operated on emergency basis, who presented with sudden onset of symptoms (two left sided hernia cases and one right sided hernia case) while two cases were operated after optimizing the patient (electively).

The surgical approach is determined by the location and duration of the diaphragmatic rupture and whether intra-abdominal organs have herniated into thoracic cavity. The transthoracic approach is the most appropriate way of removing adhesions in the absence of any abdominal pathology or in delayed cases. The defect may be repaired primarily or by using prosthetic mesh.²⁶ The diaphragmatic defect should be repaired using interrupted nonabsorbable polypropylene sutures after reduction of the herniated abdominal organs.²⁷ In this series two patients undergone primary repair of the defect and three patients had mesh reinforcement required. Also, a laparoscopic repair was achieved in all the patients along with the need of thoracoscopic aid in two cases to release the densely adherent herniated abdominal content from the thoracic cavity wall.

CONCLUSION

Spontaneous diaphragmatic hernia is an uncommon entity but a life-threatening condition and needs a high index of suspicion in patient having abdominal pain and dyspnea. Early diagnosis is of paramount importance. Surgery is indicated for all patients who are diagnosed with this condition. The timing of operation is dictated by the patient's condition. Emergency surgery is required if patient is having obstructed hernia while elective repair is performed for patients without having symptoms and signs of obstruction. The repair can be done by primary tissue approximation using suture material with or without a prosthetic mesh for reinforcement. We found that minimal access techniques can be safely done in diaphragmatic hernia; in conditions when the herniated content are difficult to get reduced laparoscopically alone, a simultaneous thoracoscopy has helped in great deal in reducing the content and completing the procedure entirely by minimal access techniques. This gives all the advantages of minimally invasive approach like improved operative visualization, less postoperative pain, quicker recovery, shorter hospital stay, low recurrence rate and this also leads to decrease in cost of hospital stay; provided tissue repair is done in tension free manner by an experienced laparoscopic surgeon.

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: Not required

REFERENCES

- de Meijer VE, Vles WJ, Kats E, den Hoed PT. Iatrogenic diaphragmatic hernia complicating nephrectomy: Top-down or bottom-up? *Hernia*. 2008;12:655-8.
- Gupta S, Bali RK, Das K, Sisodia A, Dewan RK, Singla R. Rare presentation of spontaneous acquired diaphragmatic hernia. *Indian J Chest Dis Allied Sci*. 2011;53:117-9.
- Gupta V, Singhal R, Ansari MZ. Spontaneous rupture of the diaphragm. *Eur J Emerg Med*. 2005;12:43-4.
- Losanoff JE, Richman BW, Jones JW. Transdiaphragmatic intercostal hernia: review of the world literature. *J Trauma*. 2001;51:1218-9.
- Stoica SC, Craig SR, Soon SY, Walker WS. Spontaneous rupture of the right hemidiaphragm after video-assisted lung volume reduction operation. *Ann Thorac Surg*. 2002;74:929-31.
- Hamoudi D, Bouderkha MA, Benissa N, Harti A. Diaphragmatic rupture during labor. *Int J Obstet Anesth*. 2004;13:284-6.
- Kara E, Kaya Y, Zeybek R, Coskun T, Yavuz C. A case of a diaphragmatic rupture complicated with lacerations of stomach and spleen caused by a violent cough presenting with mediastinal shift. *Ann Acad Med Singapore*. 2004;33:649-50.
- Hillenbrand A, Henne-Bruns D, Wurl P. Cough induced rib fracture, rupture of the diaphragm and abdominal herniation. *World J Emerg Surg*. 2006;1:34.
- İçme F, Vural S, Tanrıverdi F, Balkan E, Kozacı N, Kurtoglu GÇ. Spontaneous diaphragmatic hernia: A case report. *Eurasian J Emerg Med*. 2014;13:209-11.
- Poe RH, Schowengerdt CG. Two cases of atraumatic herniation of the liver. *Am Rev Respir Dis*. 1972;105:959-63.
- Jha P, Hutchinson S, Spychal B, Lee CY. Respiratory distress after heavy lifting. *J Royal Soc Med*. 2004;97:290-1.
- Brindley GV. Complications of diaphragmatic hernia. *Arch Surg*. 1960;81:582-90.
- Akbar A, Parikh DH, Alton H, Clarke JR, Weller PH, Green SH. Spontaneous rupture of the diaphragm. *Arch Dis Child*. 1999;81:341-2.
- Clarke DL, Greatorex B, Oosthuizen GV, Muckart DJ. The spectrum of diaphragmatic injury in a busy metropolitan surgical service. *Injury*. 2009;40:932-7.
- Athanassiadi K, Kalavrouziotis G, Athanassiou M, Vernikos P, Skekas G, Poultisidi A, et al. Blunt diaphragmatic rupture. *Eur J Cardiothorac Surg*. 1999;15:469-74.
- Meyers BF, McCabe CJ. Traumatic diaphragmatic hernia. Occult marker of serious injury. *Ann Surg*. 1993;218:783-90.
- Losanoff JE, Edelman DA, Salwen WA, Basson MD. Spontaneous rupture of the diaphragm: case report and comprehensive review of the world literature. *J Thorac Cardiovasc Surg*. 2010;139:127-8.
- Oh KS, Newman B, Bender TM, Bowen A. Radiologic evaluation of the diaphragm. *Radiol Clin North Am*. 1988;26:355-64.
- Matsevych OY. Blunt diaphragmatic rupture: four years' experience. *Hernia*. 2008;12:73-8.
- Iochum S, Ludig T, Walter F, Sebbag H, Grosdidier G, Blum AG. Imaging of diaphragmatic injury: a diagnostic challenge? *Radiographics*. 2002;22:103-18.

21. Hacıbrahimoglu G, Solak O, Olcmen A, Bedirhan MA, Solmazer N, Gurses A. Management of traumatic diaphragmatic rupture. *Surg Today.* 2004;34:111-4.
22. Rubikas R. Diaphragmatic injuries. *Eur J Cardiothorac Surg.* 2001;20:53-7.
23. Saroj SK, Kumar S, Afaque Y, Bhartia AK, Bhartia VK. Laparoscopic repair of congenital diaphragmatic hernia in adults. *Minimal Invas Surg.* 2016; 2016:1-5.
24. Gupta S, Bali RK, Das K, Sisodia A, Dewan RK, Singla R. Rare presentation of spontaneous acquired diaphragmatic hernia. *Indian J Chest Dis Allied Sci.* 2011;53:117-9.
25. Thoman DS, Hui T, Phillips EH. Laparoscopic diaphragmatic hernia repair. *Surg Endosc.* 2002;16:1345-9.
26. Liman ŞT, Topçu S. Diyafram rüptürleri. *TTD Toraks Cerrahisi Bülteni.* 2010;1:87-95.
27. Peer SM, Devaraddeppa PM, Buggi S. Traumatic diaphragmatic hernia-our experience. *Int J Surg.* 2009;7:547-9.

Cite this article as: Chauhan SS, Mishra A, Dave S, Naqvi J, Tamaskar S, Sharma V, et al. Thoraco-laparoscopic management of diaphragmatic hernia of adults: a case series. *Int Surg J* 2020;7:1627-33.