Case Report

Laparoscopic Management of Acquired Diaphragmatic Hernia

Ajaz Ahmad Rather[1], Yaqoob Hassan[2], Sanan Ajaz Rather[3]

Diaphragm is a dome shaped Musculo-tendonous septum separating the thorax from abdomen. It develops from septum transversum, mesentery of forget, body wall, and pleuroperitoneal membrane. These four parts fuses and close the primitive communications between pleura and peritoneal cavities. Defect any were can lead to development of hernia. Diaphragmatic hernias can be congenital or acquired. Majority of congenital diaphragmatic hernia are antenatally diagnosed and repaired when haemodynamic and cardiorespiratory physiology is normalised 24hrs after birth. Some may present as acute respiratory distress postnatally and some may remain asymptomatic and diagnosed incidentally. Acquired diaphragmatic hernias are common among adult and the most common aetiology responsible is trauma including both blunt and penetrating one. Adults with diaphragmatic hernia may have varied presentation.They may present acutely, may have unexplained symptoms or may be discovered months to years after being evaluated for some disease or symptom. Due to the negative intra-thoracis pressure and depending upon the site of defects, intra-abdomen or retroperitoneal organs or tissue may prolapse inside the thorax. Surgical treatment of diaphragmatic hernia is mandatory to prevent potentially serious associated complication. Since the advent of minimal access surgery, laparoscopy has taken significant role compared to tradition laparotomy or thoracotomy approaches. We present the case series of two traumatic diaphragmatic hernia cases and the role of laparoscopy in the management. This case series and literature review highlights the unusual presentation of chronic post-traumatic diaphragmatic hernia and feasibility of primary laparoscopic repair.

[*J Indian Med Assoc* 2021; **119(4):** 55-8]

Key words **: Acquired Diaphragmatic Hernia, Laparoscopy, Congenital Diaphragmatic Hernia.**

Diaphragm is a musculo-tendinous partition separating the abdominal viscera from the chest. It has a powerful musculature that helps us in breathing. It develops from the fusion of septum transversum, mesentery of forget, body wall, and pleuroperitoneal membrane. Diaphragmatic hernias can be congenital or acquired. Congenital diaphragmatic hernia occurs due to the incomplete formation/muscularization in the development and allow abdominal viscera to fill the chest cavity. Prenatal ultrasonography is successful in diagnosis of congenital diaphragmatic hernia as early as 15 weeks gestation and earlier the diagnosis, worst the prognosis[1]. The prevalence of Congenital Diaphragmatic Hernia (CDH) is estimated at 3-3.6/10,000 live births[2] and with slightly higher male predominance[3]. Majority of patients present with severe respiratory distress in neonatal period and only 5-10% present after infancy with varied presentation. Only 1% of individuals are completely asymptomatic and the defect is discovered incidentally on imaging studies[4].

Acquired diaphragmatic hernia is common in adults and results from either blunt (35%) or penetrating trauma (65%)[5]. Blunt trauma produce rupture(due to rapid elevation of diaphragm) and radial tears of diaphragm whereas penetrating trauma produces small perforations. Traumatic diaphragmatic hernia and diaphragmatic injuries in general are difficult to diagnoseas up to 31% of patients may demonstrate no abdominal tenderness and 40% may have normal chest radiograph[6]. Because the penetrating injuries produces mall perforations, they remain salient and asymptomatic for months to years and may later on lead to diaphragmatic hernia possibly with incarceration or may be strangulation. The surgeon in general and accident emergency residents in particular should prompt appropriate investigations in patients with clear history of thoracoabdominal trauma and high clinical suspicion of traumatic diaphragmatic rupture.

Traumatic diaphragmatic hernia should always be repaired once diagnosed in order to decrease the morbidity and mortality associated with it. The traditional thoracotomy and laparotomy approaches have been taken over by laparoscopy since the advent of minimal

Editor's Comment :

- For diagnosing a diaphragmatic Hernia High index of suspicion is very important.
- We need not have much advanced investigations for diagnosis- a plain standing x-ray chest with both domes should be enough for diagnosis,augmented by CT scan.
- Diaphragmatic hernia can be managed easily by laparoscopic technique with excellent results.

[1]MBBS, MS, FACS, FICS, FACRSI, FCLS, Professor and Head, Department of General and Minimal Invasive Surgery, SKIMS Medical College & Hospital, Srinagar 190012

[2]MBBS, MS, Registrar, Department of General and Minimal Access Surgery, SKIMS Medical College & Hospital 190012 and Corresponding Author

[3]MBBS Student, DAKKA National Medical College, Bangladesh, Dakka 1000

Received on : 22/02/2021
Accepted on : 07/04/2021

access surgery. We hereby present case series of two of our traumatic diaphragmatic hernia subjects and their laparoscopic management. Our case series high lights the unusual, delayed presentation, diagnosis and management of chronic traumatic diaphragmatic hernia in adults.

Case 1 :

50-year-old female, P2L2 without any underlying comorbidity, presented with one-day history of pain upper abdomen and multiple episodes of vomiting in our accident and Emergency Department. Patient was subjected to thorough physical and clinical examination which was unremarkable. Any past surgical and medical history was excluded. Baseline haematological and biochemical investigations including complete blood count, Kidney/Liver function test, serum electrolytes, radiography of chest and ultrasonography of abdomen was ordered. Except elevation in left hemi diaphragm in radiography of chest, rest of the investigations were grossly normal (Fig 1). In view of X-ray chest findings, history was again reviewed and patient recalled the event of significant blunt trauma left lower chest some 5 months back. Contrast enhanced computed tomography of chest and abdomen was ordered which revealed the left diaphragmatic hernia with herniation of stomach and spleen with collapse of ipsilateral lung and mild pleural effusion.

Patient was planned for laparoscopic repair of hernia under general anaesthesia. Pre-anaesthesia check-up made and patient was cleared for procedure. The procedure and associated complications explained to the patient and accompanied legal attendants in their own language and written informed consent was taken.

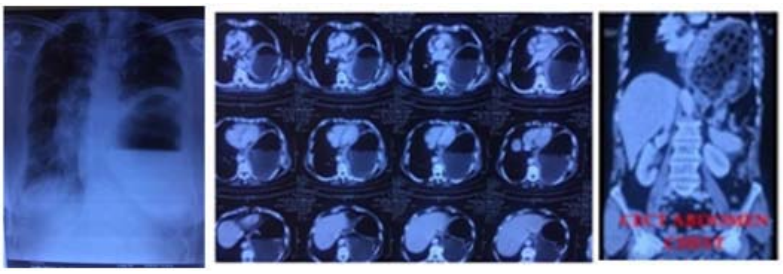

Fig 1 — Radiograph and CECT of Chest (Case 1)

Patient was given 1gm of intravenous ceftriaxone before the intubation in operating theatre (Fig 1).

Case 2 :

17-year-old female, unmarried, without any known medical comorbidity, presented with upper abdominal discomfort since last one year and also gave history of thoraco abdominal trauma some 4 years back. Since last one year patient was subjected to multiple ultrasonography abdomen focussing on hepatobiliary system and conservative treatment of gastritis was advised on each visit. Patient was thoroughly examined in our Outpatient Department, except some added sounds in left lower chest on auscultation, rest of the examination was unremarkable. Patient reported none of her past medical records of trauma. Radiography of chest was advised and patient was admitted in the ward for further evaluation. There was apparent elevation on plain chest radiography.

Contrast enhanced computed tomography of chest showed left diaphragmatic hernia with herniation of multiple small gut loops only (Fig 2). Patient was diagnosed as traumatic left diaphragmatic hernia and

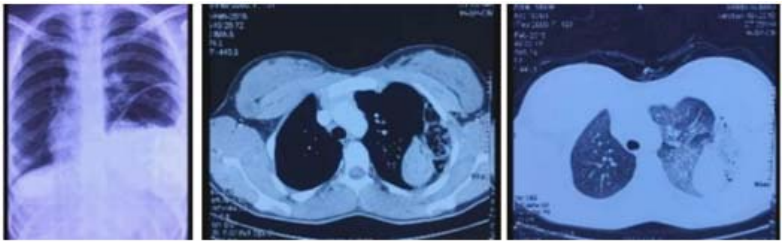

Fig 2 — Radiograph and CECT of Chest (Case 2)

planned for laparoscopic repair on rounds in the next list. Written informed consent taken and intravenous dose of 1gm of ceftriaxone was given before the procedure.

Procedure Details :

The procedure was performed in supine position under general anaesthesia using three ports and 30-degree camera. Operating surgeon, assistant and scrub nurse on right side, monitor on left head end and operating table in left up and reverse Trendelenburg's position. Nasogastric tube was put in by anaesthesiologist. Pneumoperitoneum created via Veress needle and primary port made above umbilicus. Diagnostic laparoscopy was done and diagnosis of diaphragmatic hernia confirmed. Rest of the two ports were created under direct vision one on either side of primary port. Whole of stomach, spleen and part of omentum had herniated in Case 1 and multiple loops of small intestine in Case 2. However, no signs of incarceration, obstruction or strangulation were noted. There were no apparent ischaemic changes of bowel or other hernial content, however, there was significant collapse of left lung in Case 2. The hernia contents were reduced using atraumatic laparoscopic graspers and defects measured as 6x6 Cms in Case 1 and 5x6 Cms in Case 2. Multiple small adhesions in Case 1 were meticulously dissected using Harmonic Scalpel and free edges of hernia defect were demarcated. Spleen was pulled down gradually with steady traction, chest cavity visualised and fluid aspirated.

The defects were closed in two layers, first layer by

barbed suture (STRATAFIX) and second layer interrupted 1-0 polypropylene. 26F tube drain placed in left pleural cavity in both the cases. Another tube drain was placed in left sub-phrenic space in case-1. After final laparoscopic look, pneumoperitoneum was deflated,working ports were removed under vision followed by primaryport. 10mmport closed with 2-0 Vicryl and both the patient extubated uneventfully and shifted to high dependency unit of our surgical ward. Both the patients were monitored critically during first 24hrs of postoperative period. Oral liquids started in 48hrs in Case 1 and after 24 hrs in Case 2. The chest tube drains were removed 36hrs after operation and normal check-radiograph of chest. Post-operative antibiotics continued for 48 hrs. Case 1 discharged on 5th post-operative day and Case 2 on 4th day and were attached to our out-patient department for follow up. Both the patients are doing well as of nowin the past $3^{1/2}$ years follow-up period (Figs 3,4,5).

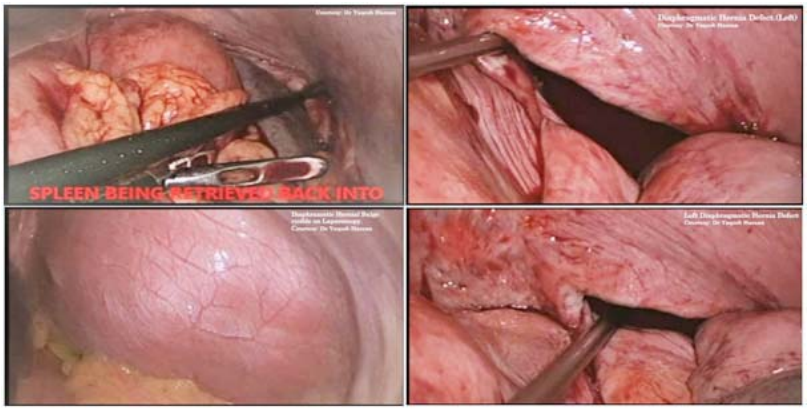

Fig 3 — Intra-operative Photographs of Case 1

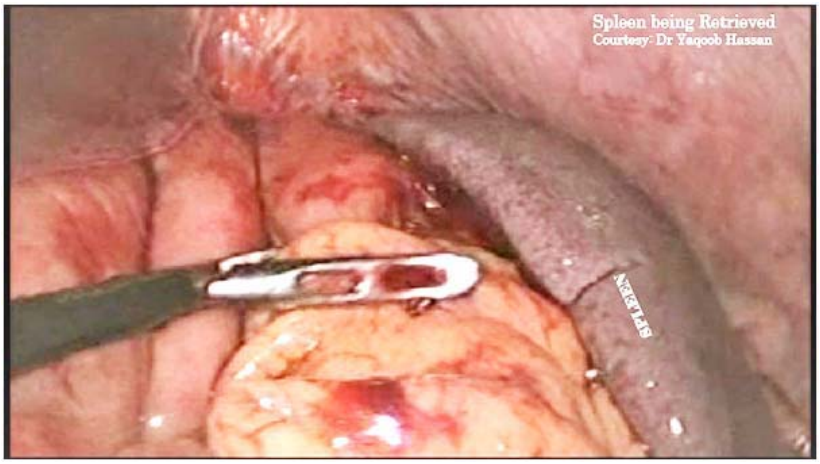

Fig 4 — Intra-operative photograph of spleen retrieval of Case 1

Fig 5 — Intra-operative photographs of Case 2

Discussion

Trauma including blunt and penetrating to the upper abdomen can both results in diaphragmatic rupture/ hernia with penetrating trauma being the leading case accounting for 65% cases[5]. Approximately 0.8 to 3% patient of thoracoabdominal trauma are associated with diaphragmatic rupture[7,8].This loss of integrity may cause the abdominal organs to shift upwards into the thoracis due to the pressure difference between the two cavities and presenting as diaphragmatic hernia. Left hemidiaphragm injuries are diagnosed more commonly than right in blunt trauma, likely as a result of force-distribution protection afforded by extensive solid parenchymal mass of liver[9]. The patients of diaphragmatic hernia may be diagnosed immediately after trauma or some cases may remain asymptomatic and diagnosed during evaluation for various symptoms. Patients of acquired diaphragmatic hernia can have respiratory symptoms like shortness of breath or chest pain, abdominal symptoms like recurrent pain abdomen, post-prandial fullness or may have obstructive symptoms[10] and some can have cardiac symptoms[11].

In order to prevent the occurrence of serious complications, the surgical management of diaphragmatic hernia is mandatory once the diagnosis is made. Therapy entails either primary repair with permanent non-absorbable sutures or prosthesis in case of large defects which would require undue tension in muscular edges if repaired primarily. Chinnusamy Palanivelu *et al* and Yoshihiro Kitano *et al*. in their respective studies on diaphragmatic hernias, have recommended use of meshes in defects exceeding 20 to 30 cm[12,13].

Approaches of diaphragmatic repair in a haemodynamically stable patients include tradition ones (laparotomy or thoracotomy) and newer minimal access approaches (laparoscopy or thoracoscopy). Both the laparoscopic and thoracoscopic repair of adult diaphragmatic hernia, have been reported in the literature[14]. Thoracoscopy have advantages in cases with dense adhesions between hernial contents and lung. Laparoscopic diaphragmatic

hernia repair is increasingly reported to be an acceptable, safe with minimal morbidity and postoperative pain and performed in times comparable to those required for open surgical repair[15] besides having excellent visualization of repair and good clinical outcome.

Conclusion :

Traumatic diaphragmatic hernia may remain asymptomatic or may present with unexplained and unrelated symptoms. The diagnosis requires high clinical suspicious and patient should be advised prompt radiological investigation. Tradition approaches of thoracotomy or laparotomy have been superseded by minimal access approaches of laparoscopy or thoracoscopy. Laparoscopy is an attractive, safe, and efficient approach for repair of haemodynamically stable and chronic traumatic diaphragmatic hernia.

Conflict of Interest : None.

Ethical Issue : None.

Financial Interest : Authors have no financial or competitive intensions.

Authors have access to the data and a role in writing this manuscript

References

1 Hackam DJ, Grikscheit R, Wang K, Jefferey S — Upperman, and Henri R. Ford Paediatric Surgery,Schwartz's Principles of Surgery, F. Charles Brunicardi, et al. 10e,2015 Chapter 39. McGraw-Hill,

2 Shanmugam H, Brunelli L, Botto LD, Krikov S, Feldkamp ML — Epidemiology and prognosis of congenital diaphragmatic hernia: a population-based cohort study in Utah. *Birth Defects Res* 2017; **109:** 1451-9. doi: 10.1002/bdr2.1106. Epub 2017 Sep 19.

3 Yang W, Carmichael SL, Harris JA, Shaw GM — Epidemiologic characteristics of congenital diaphragmatic hernia among 2.5 million California births, 1989-1997. *Birth Defects Res A Clin Mol Teratol* 2006; **76(3):** 170-4. doi: 10.1002/bdra.20230.

4 Bag³aj M, Dorobisz U — Late-presenting congenital diaphragmatic hernia in children: a literature review. *Pediatr Radiol* 2005; **35:** 478-88. doi: 10.1007/s00247-004-1389-z.Epub 2005 Mar 19.

5 Kaiser JR, Rosenfeld CR — A population-based study of congenital diaphragmatic hernia: impact of associated anomalies and preoperative blood gases on survival. *J Pediatr Surg* 1999; **34(8):** 1196-202. doi: 10.1016/s0022-3468(99)90151-3.

6 Leppäniemi, Ari MD; Haapiainen, Reijo MD Occult Diaphragmatic Injuries Caused by Stab Wounds, The Journal of Trauma: Injury, Infection, and Critical Care: October 2003 - Volume 55 - Issue 4 - p 646-650

7 Pancholi CK, Hombalkar NN, Dalvi SB, Gurav PD — Left Sided Hydro-pneumothorax in a Operated Case of Left Diaphragmatic Hernia Repair: A Diagnostic Dilemma. *J Clin Diagn Res* 2015; **9(4):** PD03-4. doi: 10.7860/JCDR/2015/11879.5759.Epub 2015 Apr 1.

8 Kozak O, Mentes O, Harlak A, Yigit T, Kilbas Z, AslanI, Akin M, Bozlar U — Late presentation of blunt right diaphragmatic rupture (hepatic hernia). *Am J Emerg Medicine* 2008; **26(5):** 638.e3-5. doi: 10.1016/j.ajem.2007.10.032.

9 Pachter HL, Wilson CT, Frangos SG —Traumatic injuries to the diaphragm.Fisher's Mastery of surgery. Josef E. Fischer et al. 7th ed. Wolter Kluwers, [2019] Page 2467-91.

10 Testini M, Girardi A, Isernia RM, De Palma A, Catalano G, Pezzolla A, *et al* — Emergency surgery due to diaphragmatic hernia: case series and review. *World journal of emergency surgery : WJES* 2019; **14:** 28.

11 TibrewalaNS,Pai PM, Congenital malformations in the newborn period. *Indian Pediatrics* 1974; **11(6):** 403-7.

12 Palanivelu C, Rangarajan M, Rajapandian S, Amar V, Parthasarathi R — Laparoscopic repair of adult diaphragmatic hernias and eventration with primary sutured closure and prosthetic reinforcement: a retrospective study. *Surg Endosc* 2009; **23(5):** 978-85. doi: 10.1007/s00464-008-0294-1. Epub 2009 Mar 14.

13 Kitano Y, Lally KP, Lally PA — Late-presenting congenital diaphragmatic hernia. *J Pediatr Surg* 2005; **40(12):** 1839-43. doi: 10.1016/j.jpedsurg.2005.08.023.

14 B Sutedja ,YMuliani Laparoscopic repair of Bochdolek Hernia in an adult Woman. *Asian J of Endosc Surg* 2015; **8:** 354-6. doi: 10.1111/ases.12179.

15 Thoman DS, Hui T, Phillips EH — Laparoscopic diaphragmatic hernia repair. *Surg Endosc* 2002; **16(9):** 1345-9. doi: 10.1007/s00464-001-8162-2.Epub 2002 May 3.

"Life is like a game of cards. The hand you are dealt is determinism; the way you play it is free will."

— Jawaharlal Nehru