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Surgical Management of Diaphragmatic Hernia and Eventration – a Single Centre Experience

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ABSTRACT

Background: Congenital diaphragmatic hernia is a muscular defect in diaphragm and adult presentation of the hernia is extremely rare. Diaphragmatic eventration is abnormal elevation of a portion or entire hemi-diaphragm. It is due to lack of muscle or nerve function. If left untreated, it can result in severe respiratory distress and death. Both entities can be congenital or acquired. Here we report our experience of in surgical management of diaphragmatic hernia and eventration.

Objectives: Observational study on surgical management of diaphragmatic hernia and eventration. **Materials and Methods:** Retrospective and Prospective analysis of 15 patients who presented with either diaphragmatic hernia or eventration for a period of 3 years from June 2019 to June 2022, at our institution.

Results: Total of 15 patients were included in the study, 7 had diaphragmatic hernia and 8 had diaphragmatic eventration. Average age of patients was 45.47 years, out of which 10 were male and 5 were female. All hernia was on left side except for one which was on right side and all eventration was on left side. All patient with diaphragmatic eventration had laparoscopic repair and all patients with diaphragmatic hernia underwent open repair. Average OT time for diaphragmatic hernia was 241.42 min and diaphragmatic eventration was 124.37 min. Average postoperative stay for diaphragmatic hernia was 10 days and eventration was 5 days. None of the eventration patient had any intraoperative or postoperative complications. 1 out of 7 diaphragmatic hernia patient had mortality and 1 had morbidity.

Conclusion: Our study dealt with the surgical management of diaphragmatic disorders. We observed that laparoscopic repair of eventration is a favourable option. Patient with diaphragmatic hernia, usually presented in emergency and was taken up for open laparotomy and thus was found to have more mortality and morbidity. Thus early detection of diaphragmatic disorders should be done. Study is limited.

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INTRODUCTION

Diaphragmatic hernia is protrusion of contents of abdomen into thoracic cavity due to defect in diaphragm. It is usually congenital presenting in childhood but rarely (5% – 10%) it can present in adulthood [1]. Less commonly it is acquired due to trauma. Congenital hernia is of two types: Bochdalek hernia – posterolateral defect and Morgagni hernia - parasternal. Bochdalek hernia is most common type [2]. It occurs due to the failure of closure of the posterolateral aspect of pleuroperitoneal membrane, which takes place between 8 and 10 weeks of gestation. As the left canal closes later than the right, it occurs on the left side in 85% of cases [3]. Diagnosis is usually

made by imaging modality with CT being the investigation of choice [4]. Treatment of hernia presenting as an acute setting requires appropriate resuscitation of the patient [5] followed by surgery. Usually open abdominal repair with primary anatomical closure with non-absorbable sutures [6]. If primary repair is not possible because of large size of defect then mesh repair is done [7].

Diaphragmatic eventration (DE) is the abnormal elevation of a portion or entire hemidiaphragm. It is caused either due to congenital structural defect of the diaphragm or as a result of phrenic nerve injury [8]. But the muscle retains its continuity and attachments to the costal margins without defects and there is no interruption between the pleural or peritoneal layers [9-12]. Innervation of the diaphragm is provided by the right and left phrenic nerves, which originate from cervical nerves C3–C5 and facilitate both sensory and motor function [13]. Impaired development or injury to this nerve can lead to diaphragmatic paralysis and eventration with diminished

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lung expansion [14]. It can affect one or both hemidiaphragm, but more commonly it is unilateral involving left hemidiaphragm [15]. It is usually asymptomatic and only supportive care is recommended. But may cause symptoms like progressive dyspnea and frequent respiratory infections and in such conditions surgery is indicated [16]. Surgical treatment for diaphragmatic eventration is plication. It involves creating pleats with U-stitches in the weakened hemidiaphragm and then anchored down. This results in a flattened and lowered hemidiaphragm allowing for increased intrathoracic volume and lung expansion [14]. It can be done either via open thoracotomy, video-assisted thoracoscopic surgery (VATS), laparoscopic transabdominal or robotic-assisted surgery. The benefits of endoscopic surgery are evident in the literature and include quicker recovery, smaller incision(s), decreased pain, and specific treatment of the exact problem [17]. It should be noted that surgical plication does not improve the function of the hemidiaphragm [18-20].

Materials and Methods

This is a Retrospective and Prospective observational study conducted between June 2019 to June 2022 at the Department of Surgical Gastroenterology, GMKMCH Salem. Total of 15 patients were included in the study. Inclusion criteria was, all patient who was diagnosed to have diaphragmatic hernia or eventration by imaging study – CT chest.

Operative Procedure:

Diaphragmatic Hernia:

Under GA in supine position, parts painted and draped. Midline laparotomy incision given and peritoneum entered. Further steps were done based on the intraoperative findings.

- 2 patients underwent only reduction of content and anatomical repair of hernia.
- 2 patient had reduction of content and right hemicolectomy and end ileostomy and distal mucous fistula with anatomical repair of hernia.
- One patient underwent laparotomy and reduction of hernia, segmental resection of transverse colon and jejunum. Diaphragmatic hernia repair with roux eny gastrojejunostomy, colocolic anastomosis and jejejunojejunostomy and feeding jejunostomy.

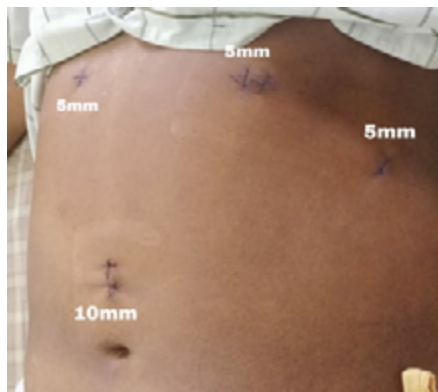
Then abdomen was closed and chest tube was placed in all patient on hernia side.

Diaphragmatic Eventration:

Under GA patient in Low lithotomy position, parts painted and draped. Pneumoperitoneum created by closed veress method.

Laparoscopic Ports Position.

10 mm optical port in supraumbilical region, a 5mm port in right midclavicular line, a 5mm port in left mid clavicualr line and a 5mm post in left anterior axillary line.



Plication of diaphragm was done from lateral edge to medial edge using intermittent No 1. Prolene intermittent sutures.

Additional procedure done in 2 patients

- 1 patient had underwent laparoscopic cholecystectomy for acute calculus cholecystitis
- 1 patient had underwent laparoscopic Gastropexy for Gastric volvulus repair.

Haemostasis achieved. Pneumoperitoneum was released. Ports closed.

Results

A total of 7 cases underwent Laparotomy and diaphragmatic hernia repair and 8 underwent laparoscopic diaphragmatic eventration repair. Characteristics are tabulated in **Table 1** and **Table 2**.

Total of 15 patients were included in the study. Age of the patients ranged from 22 years to 68 years (Average – 45.47 years) (**Figure 1**), out of which 7 had diaphragmatic hernia and 8 had diaphragmatic eventration. 10 were male and 5 were female (**Figure 2**). Out of 7 diaphragmatic hernia patients 6 were on left side and 1 patient was on right side (**Figure 3**). All diaphragmatic eventration was on left side.

All Diaphragmatic hernia presented as an acute emergency with either breathless or intestinal obstruction and was evaluated with CT chest and CECT abdomen and pelvis and was taken up for emergency surgery. Whereas patients with diaphragmatic eventration presented with complaints of cough and breathless, for which they were evaluated with CT chest and was stabilised and then surgery was done in an elective basis. All diaphragmatic hernia patients underwent open laparotomy and all diaphragmatic eventration underwent laparoscopic repair. One patient had associated acute calculus cholecystitis and one patient had gastric volvulus.

For laparoscopic repair of diaphragmatic eventration, average OT time was 127.5 min and ranging from 110 minutes to 160 minutes. 2 patients had associated other operation too, which increased the OT timings. 1 with associated laparoscopic cholecystectomy had OT time of 150 minute and other patient with associated gastropexy had OT time of 160 minutes and none required conversion to open. None of the diaphragmatic eventration patient had any intraoperative or postoperative complications or mortality

Average OT duration for Diaphragmatic hernia operation was 241.42 minutes and ranging from 160 – 310 minutes). 1 out of 7 diaphragmatic hernia patient had mortality and 1 patient had prolonged ventilation.

Average duration of postoperative hospital stay following diaphragmatic eventration repair was 5 days and ranged from 3 days to 8 days and diaphragmatic hernia was 10 days and ranged from 9 to 15 days.

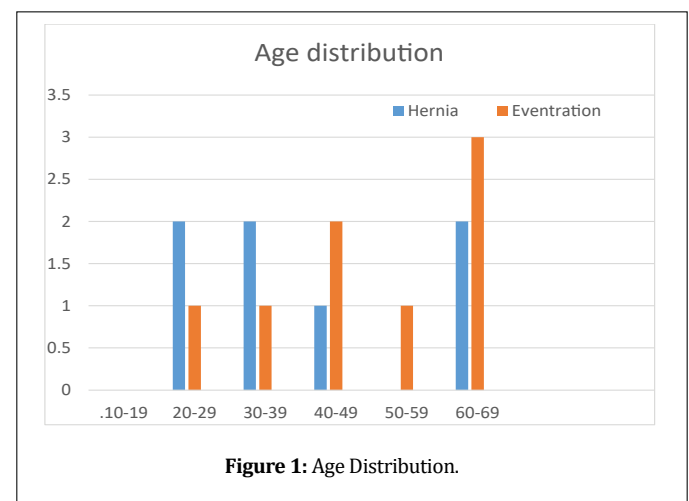


Table 1: Patient Characteristics and Data – Diaphragmatic Hernia.

Sl. No.	Age (year)	Sex	Side	Diagnosis	Procedure	OT time (min)	Post op stay (days)	Complication
1	68	M	Left	Transverse colon and small bowel - with impending colonic obstruction	Laparotomy and reduction of content, segmental resection of transverse colon and jejunum. Diaphragmatic hernia repair with roux en y GJ, colocolic anastomosis and JJ and FJ	300	10	Nil
2	26	F	Left	Transverse colon with subacute intestinal obstruction	Laparotomy and hernia reduction with anatomical closure	180	9	Nil
3	26	M	Left	Transverse colon	Laparotomy and reduction content and right hemicolectomy with end ileostomy with anatomical repair of hernia	270	-	Death
4	39	M	Left	Transverse colon with right sided obstructed inguinal hernia	Laparotomy and reduction of content with right hemicolectomy and end ileostomy and distal mucous fistula with anatomical repair of diaphragmatic hernia	300	10	Nil
5	60	F	Right	Transverse colon and gastrocolic omentum as content	Laparotomy and reduction of content with anatomical repair of hernia	170	9	Nil
6	35	F	Left	Transverse colon and small bowel - with impending colonic obstruction	Laparotomy and reduction of content, segmental resection of transverse colon and jejunum. Diaphragmatic hernia repair	310	15	Prolonged ventilation with URTI
7	46	M	Left	Transverse colon with subacute intestinal obstruction	Laparotomy and hernia reduction with anatomical closure	160	9	Nil
Avg	42.85					241.42	10	

Table 2: Patient Characteristics and data – Diaphragmatic eventration.

Sl. No	Age (Years)	Sex	Diagnosis	Associated condition	OT time (min)	Conversion to open	Post op stay (days)	Complication
1	57	M	Left Side Diaphragmatic Eventration	Nil	110	No	4	Nil
2	47	M	Left Side Diaphragmatic Eventration	Acute calculus cholecystitis	150	No	6	Nil
3	60	F	Left Side Diaphragmatic Eventration	Nil	120	No	3	Nil
4	66	M	Left Side Diaphragmatic Eventration	Nil	115	No	5	Nil
5	60	M	Left Side Diaphragmatic Eventration	Gastric Volvulus	160	No	8	Nil
6	22	M	Left Side Diaphragmatic Eventration	Nil	110	No	5	Nil
7	36	M	Left Side Diaphragmatic Eventration	Nil	110	No	4	Nil
8	41	F	Left Side Diaphragmatic Eventration	Nil	120	No	5	Nil
Avg	48.62				124.37		5	

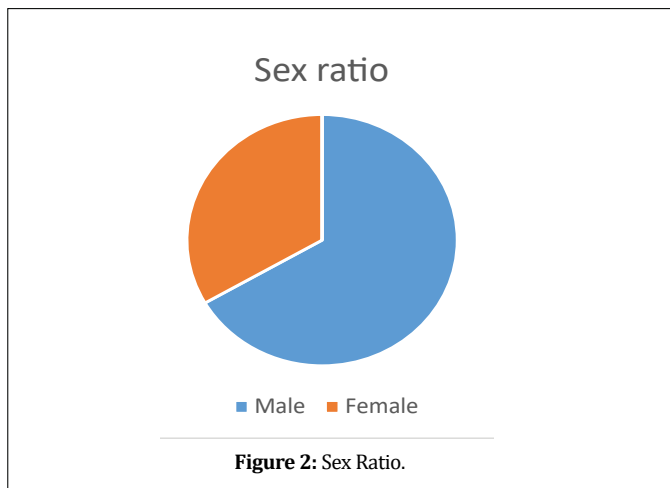


Figure 2: Sex Ratio.

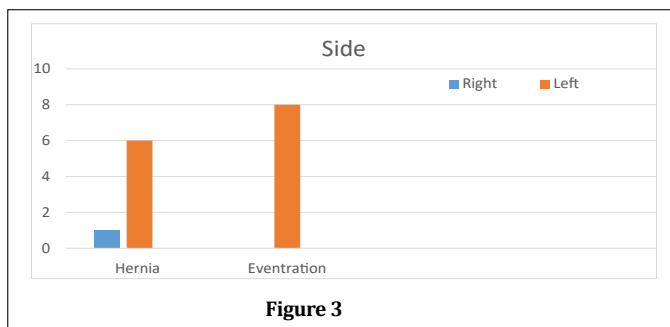


Figure 3

Discussion

Congenital diaphragmatic hernia presents present as cyanosis and respiratory distress in paediatric age group whereas in adults it presents with chest pain, difficulty in breathing, abdominal pain, and sometimes intestinal obstruction [21]. Some may remain asymptomatic due to the occlusion of diaphragmatic defect by the intra-abdominal viscous [22]. Congenital hernia is a rare hernia in adults and it can have various organ as it content like stomach, ileum, colon, and Spleen, liver and kidney may also herniate along with the bowel loops. Delay in diagnosis can lead to strangulation and death [23].

Diaphragmatic plication is an acceptable treatment for diaphragmatic paralysis [24]. It reduces the paradoxical movement of diaphragm by making it stiff and thus helping with efficient ventilation. Minimally invasive surgery for management of diaphragm eventration advantageous over open surgery including small incisions, decreased pain and quick recovery time [25]. In our study average age of patients was 45.47 years which was consistent with Groth *et al.*, [26] in which mean age of patients was 58.1 years and Palanivelu *et al.*, [27] where mean age was 42.5 years. Our study included 7 patients with diaphragmatic hernia and 8 patients with diaphragmatic eventration, with all on left side except for one which was on right side which was similar to Palanivelu *et al.*, [27] where Left-sided lesions were more common than right. All patient had underwent preoperative work up with CT chest. Average OT for laparoscopic eventration repair was 127 minutes (Range 110 to 160 min) and none had conversion to open which was consistent with the study done by Wang *et al.*, [27] where mean operation time was 125 minutes (range, 120 to 135 min). None of the patients who underwent eventration repair had intraoperative or postoperative complications and their average duration of stay was 5 days whereas 1 patients following laparotomy repair of diaphragmatic hernia had mortality and 1 had morbidity.

Conclusion

Our study dealt with the surgical management of diaphragmatic disorders. We observed that laparoscopic repair of eventration is a favourable option. Patient with diaphragmatic hernia, usually presented in emergency and was taken up for open laparotomy and thus was found to have more mortality and morbidity. Thus early detection of diaphragmatic disorders should be done. Study is limited.

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