

ORIGINAL ARTICLE

The Profile of Diaphragmatic Hernias in three tertiary hospitals in South-East Nigeria: A 13-Year Review

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ABSTRACT

Background: The diaphragm is a fibro-muscular partition that separates the relatively low-pressure thoracic cavity from the relatively high-pressure abdominal cavity. This difference in pressure causes transmigration of abdominal contents into the thoracic cavity whenever there is a defect, often resulting in cardio-respiratory disturbances.

Objective: To describe the profile of diaphragmatic hernias managed in three tertiary hospitals in, South-East Nigeria and compare same with global outcomes.

Methodology: Retrospective study of patients with different types of diaphragmatic hernias managed in three centre over a 13-year period was done. Data on demography, types of hernias, mode of presentation, diagnostic methodology, treatment offered and prognosis including complications were obtained from Record Departments of each hospital.

Results: There were a total of 44 patients with male to female ratio of 9:2. The ages ranged from 21 days to 840 months. The profile of the hernias was congenital (n=8, 18.2%), acquired traumatic (n= 30, 68.2%) and acquired non-traumatic (n=6, 13.6%). Among the congenital types-four (50%) were central, three (37.5%) were posterior while one (12.5%) was anterior. In the acquired traumatic types, left side was dominant. In the hiatal hernia (acquired non-traumatic), types 1 has the highest occurrence followed by type IV. Associated injuries in traumatic diaphragmatic hernias were the determinants of morbidity.

Conclusion: Thoraco-abdominal hernias as described are not uncommon in our centre. Multidisciplinary approach and functional Intensive care unit (ICU) played significant role in the outcome of congenital diaphragmatic hernias.

Keywords: Profile, Diaphragm, Hernias, Enugu

INTRODUCTION

Congenital Diaphragmatic Hernia (CDH) is characterized by a defect in the diaphragm

leading to the protrusion of abdominal contents into the thoracic cavity affecting the normal development of the lungs. The

condition may present as an isolated lesion or as part of a syndrome. The incidence of CDH based on the available literature ranges from approximately 0.8–5 per 10,000 births and varies across the population.^{1,2,3,4} There is slightly higher male predominance and a lower risk of isolated CDH reported among African-Americans.^{5,7} In spite of the advances made in the medical and surgical management of CDH, the mortality and morbidity remain high.^{6,7,8} Infants with CDH also have a prolonged length of stay in the hospital requiring multi-disciplinary approach for their management and follow-up after hospital discharge.

Hiatal hernia refers to herniation of the contents of the abdominal cavity, most commonly the stomach, through the oesophageal hiatus of the diaphragm, into the mediastinum. The prevalence of hiatus hernia increases with age and body mass index.⁹ In the absence of symptoms, there is no indication to diagnose or treat hiatus hernia. Gastroesophageal reflux disease is the main clinical manifestation of hiatus hernia. Endoscopy, radiology with barium swallow, or high-resolution manometry can detect most cases of hiatus hernia. Surgical treatment of hiatus hernia, usually coupled with an anti-reflux procedure, can be complicated, making a critical risk-benefit assessment mandatory.¹⁰

Traumatic diaphragmatic hernia is one of the common complications of blunt and penetrating injuries. The anatomic location of diaphragmatic injuries appears to be more common on the left side because embryologically, it is weaker.¹¹ The liver offers some degree of protection to laceration of the diaphragm on the right side, however autopsy studies show equal affectation of the left and the right.¹² Bilateral injuries to the diaphragm reportedly occur in 2% of all patients sustaining diaphragmatic trauma.¹³ Tears in the central tendon of the diaphragm with

herniation of abdominal contents into the pericardium are uncommon. Indeed, it is the rarest form of traumatic diaphragmatic hernia in the adult. Only eight cases have been reported in the literature.^{14,15} This is because of the inter-cavity pressure difference. Disruption of the partition invariably leads to herniation of some of the intra-abdominal contents into the chest often resulting in both respiratory and hemodynamic compromise.

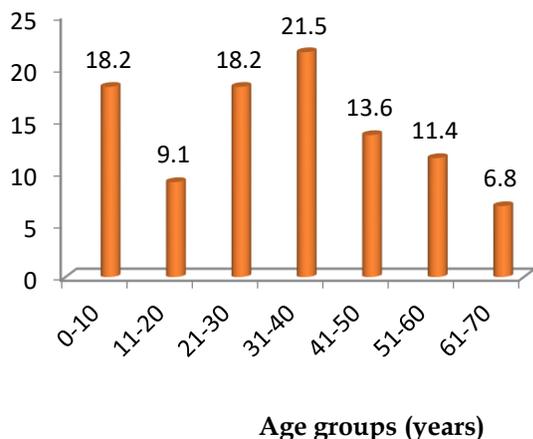
METHODOLOGY

We retrospectively reviewed the profile of diaphragmatic hernias from January 2007 to December 2019. Data were retrieved from the database domiciled at the department of hospital record of our respective hospitals. The data obtained were on demography, types of different diaphragmatic hernias, the sites, aetiology/predisposing factors, modes of presentation, and treatment methods (i.e. thoracotomy or laparotomy), as well as outcome. Others were associated injuries, complications of diaphragmatic hernias and postoperative complications. Data were analyzed using SPSS Statistics for Windows, Version 20.0, Armonk, NY: IBM Corp. released 2011. Rates and proportions were calculated with 95% confidence interval. The proportions were compared using Student's *t*-tests. Level of significance was set at $p \leq 0.05$.

RESULTS

There were a total of 44 patients with diaphragmatic hernia, 36 were males and 8 females with male to female ratio of 9:2. Their ages ranged from 21 days to 840 months. Figure 1 shows the distribution of the age ranges of patients. Here the highest age groups affected was 31-40 years. This was followed by 0-10 and 21-30 years, respectively. The least was 60-70 years.

Figure 1. Age range of patients (%)



Congenital hernias were 8(18.2%) while acquired traumatic diaphragmatic hernia was found in 30 (68.2%) patients. Of the eight that has CDH, 4 were central, 3 postero-lateral, and 1 anterior subclasses. Of the acquired traumatic DHs 20(66.7%) occurred in the left postero-lateral position, 7(23.3%) on the right postero-lateral position and 3(10%) bilateral.

In the acquired non-traumatic types, 6 (13.6%) were recorded. They were distributed as follows:

- Type I (sliding hernia) = 3(50%)
- Type II (rolling hernia) = 2(33.3%)
- Type III (combination of types I & II) = 0(0%)
- Type IV (herniation of other viscus or viscera other than stomach) = 1(16.7%)

Among the associated injuries fractured ribs, long bones and vascular injuries were the most common in sequential order (Table 1).

Two main approaches were used in the treatment of the hernias- thoracotomy (62.5%) and thoraco-laparotomy (32.5%). There was no documented approach via laparotomy alone.

Haemothorax/haemopneumothorax, recurrent chest infection and chronic empyema thoracis were the most common

complications in sequential order that were encountered in this review.

Table 1. Associated injuries for acquired traumatic hernias

	Associated Injuries	Freq	(%)
1	Rib fracture	8	21.1
2	Long bone fracture	7	18.4
3	Intra-abdominal viscera injuries	6	15.8
4	Vascular injuries	4	10.5
5	Pulmonary contusion	3	7.9
6	Pelvic fracture	3	7.9
7	Intracranial haematoma	2	5.3
8	Sternal fracture	2	5.3
9	Cardiac contusion	1	2.6
11	Pericardial tamponade	1	2.6
11	Spinal fracture	1	2.6
	Total	38	100.0

Table 2. Complications of diaphragmatic hernias encountered in our review

	Complications	Freq	(%)
1	Haemothorax/haemopneumothorax	6	31.6
2	Recurrent chest infection	5	26.3
3	Chronic empyema thoracis	3	15.8
4	Lung collapse	2	10.5
5	Haemopericardium	1	5.3
6	Visceral incarceration		
7	Postprandial dyspnoea	1	5.3
8	Intestinal obstruction	1	5.3
	Total	2	10.5

Table 3. Postoperative complications

	Postoperative complications	Freq	(%)
1	Persistent pleural effusion	5	45.5
2	Prolonged mechanical ventilation	3	27.3
3	Wound infection	1	9.1
4	Reversible multi-organ failure	1	9.1
5	Pulmonary embolism	1	9.1
	Total	11	100.0

Persistent pleural effusion and prolonged ventilatory support were the most common postoperative complications (Table 2).

DISCUSSION

The pathophysiology of CDH is a combination of lung hypoplasia and immaturity associated with persistent pulmonary hypertension of newborn (PPHN) and cardiac dysfunction.^{17,18} In this study, all the 8 (18.2%) cases of CDH, presenting between 1 to 10 years of age occurred in isolation, non occurred alongside any syndromic diseases. All were diagnosed via chest x-ray, abdominal ultrasound and computerized tomography scan. Approach to surgery was through thoracotomy. Thirty percent of the cases needed ventilatory support in the ICU for a variable period of 2 to 5 days. Three deaths (16.7%) were recorded.

Hiatal hernia (HH) represents a relatively frequent condition in the general population. It is caused by increased intra-abdominal pressure, which leads to the protrusion of the stomach and other abdominal viscera into the mediastinum.^{19,20} Para-oesophageal hernias are less common (5-15% of all hiatus hernias).²¹ The defining characteristic of a para-oesophageal hernia is asymmetry, such that the herniated viscera which could be stomach, colon, spleen, pancreas, or small intestine, herniates adjacent to the native course of the oesophagus.²² In this review, 6 cases of hiatal hernia were recorded. Most of the patients presented with symptoms such as epigastric pain, chest pain, postprandial fullness, nausea and stretching. Oesophgo-gastro-duodenoscopy (OGD), chest x-ray, and computerized tomography scan (CT scan) of the chest were used in confirming clinical diagnosis in the study. Open thoracotomy was the approach to surgical intervention. Our institutions lacked equipment and expertise to treat via VATS

(video assisted thoracotomy surgery). In other studies, and according to the Society of American Gastrointestinal Endoscopic Surgeons (SAGE), laparoscopic surgery is currently the main stay of treatment of hiatal hernia.²³

A traumatic diaphragmatic rupture (TDR) can develop in cases of thoraco-abdominal injuries and in a very high percentage of cases it is associated with other organ injuries. In some cases, TDR itself can cause life-threatening complications, but generally the outcome of the injury with TDR depends on the severity of the lesions and complications of the associated organ(s) injuries.²⁴ Hospital mortality is 15% after blunt injuries and 4% after penetrating lesions.²⁵ In our review, TDR constituted 68.2% of all diaphragmatic hernias managed. In similar studies, eighty percent of TDRs were found on the left side and 20% on the right side among trauma patients.²⁶ It is bilateral in around 3% of the cases.²⁹ Blunt trauma constituted 70% of aetiology in this study while penetrating injury was 30%. In the work of Hanna et al. in 2008, there has currently been a slight change in the aetiology, as the causes of TDR are now more frequently due to penetrating trauma (63%) than blunt injuries (37%).²⁸ Proliferation of firearms and armed conflicts were attributed to this change

Approach to management was the deployment of ATLS protocol in acute cases especially in the presence of associated injuries. Clinical and investigative methodologies were employed in the diagnosis of chronic cases. Surgical approach in both acute and chronic cases was thoracotomy and exploration of the peritoneal cavity via the diaphragm when the need arose. As reported in different studies, the approach depended on the haemodynamic stability of the patients, and the preference and skills of the attending surgeon.²⁹ There is

no superiority of one cavity approach over the other in haemodynamically stable patients, but the associated injuries may require a specific approach. In the work of Gracilene *et al.* their approach was laparotomy (94%) and thoracotomy (6%).^{15, 27} Our approach was slightly at variance with the above in that thoracotomy was the most frequent approach (62.5%). According to Chughtai *et al.*, the causes of death in blunt diaphragmatic injuries were: head injury (25.0%), intra-abdominal bleeding (23.3%), pelvic hemorrhage (18.3%); and the most frequently associated injuries found were liver (64%), spleen (53%), small bowel and the mesentery (46%), rib fracture (76%) and pulmonary contusion (63%)³⁰. In this review, many associated injuries were also encountered as seen in table 1.

CONCLUSION

Traumatic diaphragmatic hernias were predominant and concomitant intra-thoracic injuries as well as associated extra-thoracic injuries accounted for the morbidity and mortality observed. The outcome of management was relatively good. In particular, availability of intensive care unit played key roles in the overall good outcomes of congenital diaphragmatic hernias (CDH). However, absence of expertise and equipment in minimal access technique adversely affected the outcome in some patients.

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REFERENCES

1. Pantelis D, Burger C, Hirner A, Wolff M. Indirekte traumatische Zwerchfellruptur – Unfallmechanismus und Diagnostik. *Chirurg* 2005;77(4):360-366.
2. Colvin J, Bower C, Dickson JE, Sokol J. Outcome of Congenital Diaphragmatic Hernia, a population-based study in Western Australia. *Pediatrics* 2005; 116(3):356-363.
3. Gallot D, Boda C, Ughetto S, Perthas I, Roben-Ghansia E, Francannet C, *et al.* Prenatal detection and outcome of Congenital Diaphragmatic Hernia: A French registry based study. *Ultrasound Obstetrics Gynaecology* 2007; 29(3):276-283.
4. Yang W, Carmidrel SL, Harris JA, Shaw GM. Epidemiologic characteristics of Congenital Diaphragmatic among 25 million Californian births, 1087-1997. *Birth defects Res A Clin Mol Teratol* 2007;76(3):170-174.
5. McGiven MR, Best KE, Rankin J, Wellesley D, Greenlees R, Addor MC, *et al.* Epidemiology of Congenital Diaphragmatic Hernia in Europe: a register based study. *Arch Dis Child Fetal Neonatal Education* 2015;100(2):137-144.
6. Fennant PW, Samarasetera SD, Pless-Mullooli T, Rankin J. Sex differences in the prevalence of congenital anomalies: a population based study. *Birth Defects Res A Clin Mol Teratol* 2011;9(10):894-901.
7. Browlee EM, Howalson AG, Davis CF, Sabharwal AJ. The hidden mortality of congenital diaphragmatic hernia: a 20-year review. *J Pediatr Surg* 2009;44(2):317-320.
8. Mah Vk, Zamakhshary W, Mah DY, Camera B, Bass J, Bohn D, *et al.* Absolute versus relative improvements in Congenital Diaphragmatic Hernia survival: What happened to hidden mortality. *J pediatric Surg* 2009;44(3):877-882.
9. Stege G, Fenton A, Jaffray B, Nilhilism in 1909: the true mortality of congenital diaphragmatic hernia. *Pediatrics* 2003; 112(3):530-535.
10. Anyanwu CH, Umeh BU, Swarup AS. Management of traumatic rupture of the diaphragm. *Br J Surg* 1987;4(3): 181-183. Doi : 10.1002/bjs.18007-40308.

11. Nwafor IA, Eze JC, Aminu MB. Traumatic Diaphragmatic Rupture Through the Central Tendon with Herniation of the Stomach and Coils of Small Bowel into the Pericardial Cavity. *Nig J Med* 2011;20(2): 490-493.
12. Johnson Cd, Ellois H, Acquired hernias of the diaphragm. *Postgraduate Medical Journal* 1988; 64:317-321.
13. Andrus CH, Morton JH. Rupture of the diaphragm after blunt trauma. *Am J Surg* 1970; 119:686-693. DOI: 10.1016/0002-9610(70)90240-0
14. Hanna WC, Ferri LE, Fata P, Razek T, Mulder D. The current status of traumatic diaphragmatic injury: lessons learned from 105 patients over 13 years. *Ann Thorac Surg* 2008; 85:1044-1048. DOI: 10.1016/j.athoracsur.2007.10.084.
15. Gracilene PS; Daniele CC, Antonio JMC. Thoracotomy compared laparotomy in the traumatic diaphragmatic hernias: Systematic review and proportional metanalysis. *Act Cir Bras* 2018; 33(3):49-68.
16. Mihos P, Potaris K, Gakidis J, Paraskevopoulos J, Varvatsoulis P, Goujoutas B, et al. Traumatic rupture of the diaphragm: experience with 65 patients. *Injury* 2003;34(3):169-172.
17. George DK, Cooney IP, Chiu BK, Thurlbeck WM. Hypoplasia and immaturity of the terminal lung unit(acinus) in congenital diaphragmatic hernia. *Am Rev Respir Dis* 1987;136(4):947-950.
18. Dihore JW, Fauze DO, Slavin R, Wilsom JM. Experimental fetal tracheal ligation and congenital diaphragmatic hernia: a pulmonary vascular morphometric analysis. *J Pediatric Surg* 1995;30(7):917-923.
19. Oleynikov D, Jolley JM. Paraesophageal hernia. *Surg Clin North Am* 2015; 95:555-565.
20. Kohn GP, Price RR, DeMeester SR, Zehetner J, Muensterer OJ, Awad Z, et al. Guidelines for the management of hiatal hernia. *Surg Endosc* 2013; 27:4409-4442
21. Andolfi C, Jalilvand A, Plana A, Fisichella PM. Surgical Treatment of Paraesophageal Hernias: A Review. *J Laparoendosc Adv Surg Tech A* 2016; 26:778-783.
22. Roman S, Kahrilas PJ. The diagnosis and management of hiatus hernia. *BMJ* 2014; 349:g6154.
23. Zaman JA, Lidor AO. The Optimal Approach to Symptomatic Paraesophageal Hernia Repair: Important Technical Considerations. *Curr Gastroenterol Rep* 2016; 18:53.
24. Silva GP, Cataneo DC, Cataneo AJ. Thoracotomy compared to laparotomy in traumatic diaphragmatic hernia: Systematic review and proportional metanalysis. *Acta Cir Bras* 2018;33(1):49-66.
25. Ties JS, Peschman JR, Moreno A, Mathiason MA, Kallis KJ, Martin RF, et al. Evolution in the management of traumatic diaphragmatic injuries: A multicenter review. *J Trauma Acute Care Surg* 2014; 76:1024.
26. Lim BL, Teo LT, Chiu MT, Asinas-Tan ML, Seow E. Traumatic diaphragmatic injuries: a retrospective review of a 12-year experience at a tertiary trauma centre. *Singapore Med J* 2017; 58:595-600.
27. Zarour AM, El-Menyar A, Al-Thani H, Scalea TM, Chiu WC. Presentations and outcomes in patients with traumatic diaphragmatic injury: A 15-year experience. *J Trauma Acute Care Surg* 2013; 74:1392-1398.
28. Hanna WC, Ferri LE, Fata P, Razek T, Mulder D. The current status of traumatic diaphragmatic injury: lessons learned from 105 patients over 13 years. *Ann Thorac Surg* 2008; 85:1044-1048.
29. Furak J, Athanassiadi K. Diaphragm and transdiaphragmatic injuries. *J Thorac Dis* 2019;11(12):152-157.
30. Chughtai T, Ali S, Sharkey P, Lins M, Rizoli S. Update on managing diaphragmatic rupture in blunt trauma: a review of 208 consecutive cases. *Can J Surg* 2009; 52(3):177-181.