

Acute Abdomen in the Emergency Department due to a Diaphragmatic Hernia with Gastric Strangulation and Perforation

Amanda K Young, MD*; David A Caro, MD

***Amanda K Young, MD**

Dept. of Emergency Medicine, University of Florida College of Medicine-Jacksonville, USA

Email: Amanda.Young@jax.ufl.edu

Abstract

A 65 year old woman presented to the emergency department with acute abdominal pain and rapid deterioration in the emergency department. She was found to have gastric strangulation and perforation due to diaphragmatic pathology. Clinical presentation features and epidemiology are discussed, along with suggested management of this rare combination of pathophysiology.

Keywords

diaphragmatic hernia; eventration; gastric; strangulation; perforation

Abbreviations

IV: intravenous; CT: computed tomography; GCS: Glasgow Coma Scale

Introduction

Diaphragmatic hernias occur most frequently in adults at the site of the esophageal hiatus, less frequently as a traumatic or iatrogenic lesion, and rarely through a previously undiagnosed congenital posterolateral (Bochdalek) or substernal (Morgagni) defect [1,2]. Studies have estimated the incidence of asymptomatic congenital hernias in the adult population from 1 in 2000-7000 to 6% [3,4]. Even more rarely, adults will present with symptomatic congenital diaphragmatic hernias [5]. One review of the literature noted that fewer than 100 cases of symptomatic Bochdalek hernias had been reported in adults as of 1994 [6]. Another noted that 5-25% of adult patients with congenital diaphragmatic hernia not diagnosed in the neonatal period will have chronic respiratory or gastrointestinal complaints [7,8]. Severe presentations of symptomatic congenital diaphragmatic hernias include incarcerated bowel and severe pulmonary disease [3,9-10]. However diaphragmatic hernia as a cause of intestinal obstruction and strangulation in adults is very rare.

Diaphragmatic eventration is also rare in adults [11,12], with one study estimating 37 patients out of 107,778 [13]. Eventration is a rare anomaly defined by a permanent elevation of a hemidiaphragm without defects caused by a disorder in which all or part of the diaphragm muscle is replaced by fibroelastic tissue [14-16].

Case Report

A 65 year-old African American woman presented to the Emergency Department with sudden onset of abdominal pain which began three hours prior to arrival, shortly after eating dinner. The patient

had no known medical history other than gastroesophageal reflux, and had no known history of significant trauma, though this history was not pursued in detail in the Emergency Department. She described the pain as severe and diffuse, but was worst in the suprapubic area. She described nausea and vomiting that was non-bloody and non-bilious. She had normal bowel movements with no reported diarrhea or constipation. She also reported feeling short of breath, but attributed this to the severity of her pain. Her review of systems was otherwise negative. On exam, she appeared to be uncomfortable and in moderate distress, but was awake and oriented. She was tachycardic to 150 beats per minute, tachypneic to 27 breaths per minute, and had an initial blood pressure of 74/56 mmHg. Her exam was significant for decreased breath sounds bilaterally at the bases, diffuse abdominal tenderness to palpation with voluntary guarding, a rectal temperature of 100.9 degrees Fahrenheit, guaiac negative stool, and cool distal extremities. 2 liters of normal saline were immediately bolused with improvement of systolic blood pressure to 90-100 mmHg. She was also given acetaminophen 1000 mg by mouth, ondansetron 4 mg IV, and morphine 6 mg IV. Initial results included an electrocardiogram with sinus tachycardia, a lactate of 9.6 mmol/L, and a chest X-ray with significant elevation of the left hemidiaphragm and rightward mediastinal shift (Figure 1), but no free air under the diaphragm. General surgery was immediately consulted regarding her concerning abdominal exam and unstable vital signs. A CT angiogram of the abdomen was ordered. The remainder of her labs results were significant for an elevated anion gap of 24 with a bicarbonate of 19 mmol/L, a potassium level of 2.8 mmol/L, a bandemia of 27% with a white blood cell count of 8.4 thou/mm³, and a lipase of 107 U/L. The rest of her labs, including liver function tests, coagulation studies, electrolytes, and a complete blood count were within normal limits. Approximately one hour and 20 minutes after the patient's arrival, shortly after general surgery's initial assessment, the patient was found unresponsive, with a GCS of 3 and a rightward deviated gaze. Blood glucose remained within normal limits. The patient was intubated with etomidate 20mg IV and rocuronium 100mg IV. Post-intubation the patient had worsening of her hypotension and was given more intravenous fluids. Her blood pressure did improve, however was persistently below normal. Because the patient was too unstable to transport to CT, a bedside ultrasound was performed and demonstrated a significant amount of free fluid in the abdomen. Despite continued intravenous fluids and two units of emergent packed red blood cells, the patient remained hypotensive and was rushed emergently to the operating room. During her first operation, she had an exploratory laparotomy which revealed the splenic flexure within the left thoracic cavity, a large superior and anterior defect or eventration of the diaphragm, and a perforated and ischemic greater curvature of the stomach. A partial gastrectomy was performed after reduction of the splenic flexure. The patient continued to have worsening acidosis, and the surgical team felt that damage control was the appropriate surgical approach. They therefore irrigated the abdomen copiously and then left the patient's abdomen open with a wound vacuum-assisted closure (VAC) in place. She was transferred to the surgical intensive care unit (ICU) for further stabilization. During her second operation, the surgeon noted high placement of the spleen and splenic flexure in the potential thoracic cavity, a possible hernia sac, and a loose and lax diaphragm without any defect noted at that time. While attempting to take the spleen down from its lateral attachment, significant bleeding was noted from the spleen, and so the surgeon elected to perform a splenectomy. The surgeon noted that mobilization of the splenic flexure via blunt dissection and electrocautery was very difficult due to the deep and superior location of the splenic flexure. The patient began to require increasing cardiorespiratory support, and as

repair of the diaphragmatic pathology was not emergent, further exploration was postponed. The patient's abdomen was again left open with a wound VAC in place and she was returned to the surgical ICU. During her third operation, a 5cm posterior defect of the diaphragm was ultimately noted and repaired without complication. The patient's abdomen was gradually closed after many washouts. She also ultimately required a left sided chest tube for thoracic contamination. She suffered post-operative complications including acute renal failure requiring hemodialysis, a tracheostomy for failure to wean from the ventilator, and sepsis due to ventilator associated pneumonia, intraabdominal abscesses, and bacteremia. The patient ultimately improved and was discharged no longer requiring hemodialysis or ventilator support, and had a Passy-Muir valve placed for her tracheostomy. She was able to tolerate oral feeds.

Discussion

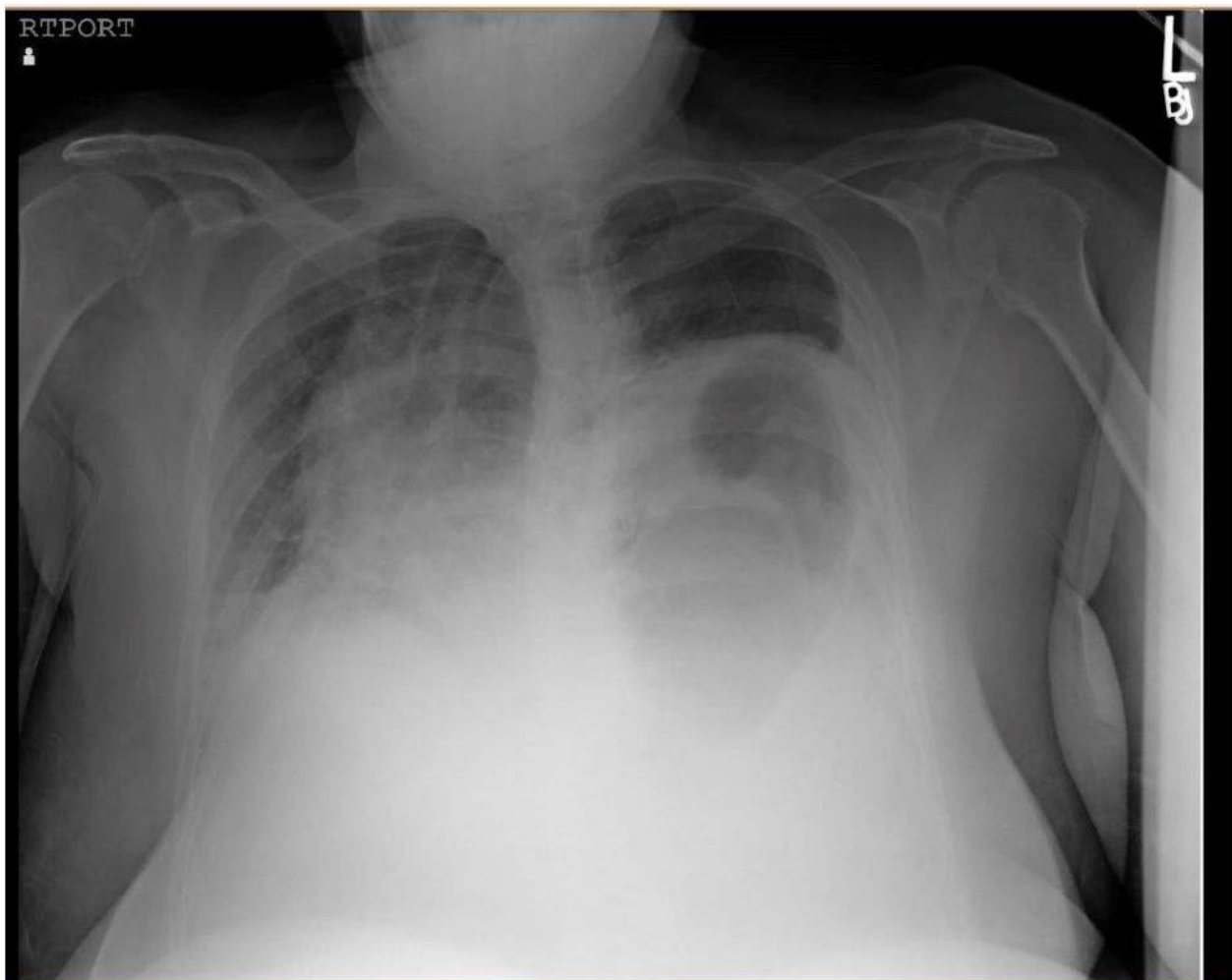
Non-hiatal diaphragmatic hernias are rare, but importantly can contain intraabdominal contents which can become strangulated and even incarcerated [17]. These incarcerations with strangulation can present acutely with both gastrointestinal and respiratory symptoms, as well as abnormalities on early imaging such as an elevated hemidiaphragm. Gastrointestinal incarceration associated with non-hiatal diaphragmatic hernias can be seen in pregnancy [18-24], post-surgically [1,25-30], following trauma [1,31-68], or spontaneously through a pre-existing defect such as an undiagnosed congenital hernia [5,9-10,36-39,69-96]. Less commonly reported is a non-hiatal diaphragmatic hernia with strangulation of abdominal contents and viscus perforation [1-2,19-20,53-68,79-96]. Still even fewer of these cases have involved gastric perforation [1,20,58-68,89-96]. A review of the literature in adults found 42 cases of perforation associated with non-hiatal diaphragmatic hernias, 25 of which were gastric.

Diaphragmatic eventration is also rare in adults [11-12], one study noting approximately 1 in 3000 patients [13]. The etiology of diaphragmatic eventration may be congenital, traumatic, neurogenic (central or peripheral), atrophic, aplastic, hypoplastic, or infectious in nature [16,97-99]. In the pediatric population, patients typically present with respiratory distress or with recurrent respiratory infections, and also occasionally with gastrointestinal complaints such as regurgitation, failure to thrive, or feeding intolerance [99-101]. Adults are frequently asymptomatic if not diagnosed in childhood [11-13,103], and can present later in life with both respiratory and gastrointestinal complaints, as well as elevation of the affected hemidiaphragm on imaging studies [98,102]. These can be chronic symptoms that progress to an acute presentation, or sub acutely progressive symptoms [14,103-109]. Adults can also develop acquired eventration of the diaphragm, usually from trauma to the phrenic nerve [103-106]. Even more rarely, patients with diaphragmatic eventrations can have diaphragmatic hernias [17], intestinal obstruction due to the spontaneous rupture of a diaphragm eventration [110], or post-traumatic diaphragmatic tears associated with acquired eventration [111].

The patient in this case developed an acute abdomen from a gastric incarceration through a diaphragmatic defect with associated strangulation and perforation. The etiology of her diaphragmatic hernia and possible eventration are unclear. It is possible that she had a previously undiagnosed congenital diaphragmatic hernia, or that she had previously sustained a traumatic injury resulting in a diaphragmatic hernia. Given the posterior location of her diaphragmatic defect, it is certainly possible that this was a previously undiagnosed Bochdalek hernia. Regardless of the etiology, this case serves to

highlight the importance of maintaining a high index of suspicion of diaphragmatic pathology in patients who present with both gastrointestinal and respiratory symptoms as well as elevation of the diaphragm on chest X-Ray. These patients may have been previously asymptomatic, or may have had vague respiratory and/or gastrointestinal symptoms for years. In the case of gastrointestinal strangulation or perforation, these patients will present with new symptoms or acute worsening of their chronic symptoms. These patients will benefit from early imaging, including radiographs and computed tomography, if they are stable. Suspicion for diaphragmatic pathology should be increased if an elevated hemidiaphragm is noted on chest X-Ray. As unstable patients are not suitable to leave the emergency department for imaging, they will benefit from the use of bedside ultrasound. Bedside ultrasound is often more expeditious than other imaging modalities, and can potentially demonstrate evidence of life-threatening pathology such as the presence of free fluid as was the case with our patient. These patients require early surgical consultation as operative management is imperative and any delay in this increases the risk of further complications.

Figure



References

1. Christiansen LA, Blichert-Toft M, and Bertelsen S. Strangulated diaphragmatic hernia. *American Journal of Surgery* 1975;129(5):574-8.
2. Prieto Nieto I, Perez Robledo JP, Hardisson D, and Granado de la Fuente A. Bochdalek hernia in an adult. *Scandinavian Cardiovascular Journal* 1998;32(2):113-4.

3. Mullins ME, Stein J, Saini SS, and Mueller PR. Prevalence of incidental Bochdalek's hernia in a large adult population. *Am J Roentgenol* 2001;177(2):363-6.
4. Killeen KL, Mirvis SE, and Shanmuganathan K. Helical CT of diaphragmatic rupture caused by blunt trauma. *Am J Roentgenol* 1999;173(6):1611-6.
5. Mathai AS, and Singh M. Peri-operative course of peritonitis following tube thoracostomy: A misdiagnosed case of congenital diaphragmatic hernia. *Anesthesia, Essays and Researches* 2011;5(1):92-94.
6. Salaçin S, Alper B, Cekin N, and Gülmen MK. Bochdalek hernia in adulthood: a review and an autopsy case report. *J ForsenicSci* 1994;39(4):1112-6.
7. De Lorimier Alfred A. Pediatric Surgery. In: Ashcraft Keith W, Holder Thomas M, editors. Diaphragmatic hernia. Second Edition. Philadelphia: WB Saunders Company; 1993. pp.204-17.
8. Hamid KS, Rai SS, and Rodriguez JA. Symptomatic Bochdalek hernia in an adult. *JLS* 2010;14(2):279-81.
9. Hung YH, Chien YH, Yan SL, and Chen MF. Adult Bochdalek hernia with bowel incarceration. *Journal of the Chinese Medical Association* 2008;71(10):528-31.
10. Owen ME, Rowley GC, Tighe MJ, and Wake PN. Delayed diagnosis of infarcted small bowel due to right-sided Bochdalek hernia. *Annals of the Royal College of Surgeons of England* 2007 Mar;89(2):W1-2.
11. Deslauriers J. Eventration of the diaphragm. *Chest Surgery Clinics of North America* 1998;8(2):315-30.
12. Gatzinsky P and Lepore V. Surgical treatment of a large eventration of the left diaphragm. *European Journal of Cardiothoracic Surgery* 1993;7(5):271-4.
13. Christensen P. Eventration of the diaphragm. *Thorax* 1959;14:311-19.
14. Nathani N and Iles PB. Acute respiratory failure with an abnormal chest radiograph. *Respiration* 2005;72(2):205-9.
15. Mouroux J, Venissac N, Leo F, Alifano M and Guillot F. Surgical treatment of diaphragmatic eventration using video-assisted thoracic surgery: a prospective study. *Annals of Thoracic Surgery* 2005;79(1):308-12.
16. Wayne ER, Campbell JB, Burrington JD, and Davis WS. Eventration of the diaphragm. *Journal of Pediatric Surgery* 1974;9(5):643-51.
17. Angelescu N, Jitea N, Bordea A, Voiculescu S, Vlădăreanu M, Mircea N, et al. High obstruction in strangulated diaphragmatic hernia. *Chirurgia (Bucur)* 1997;92(1):33-8.
18. Rajasingram D, Kakarla A, Jones A, and Ash A. Strangulated congenital diaphragmatic hernia with partial gastric necrosis: a rare cause of abdominal pain in pregnancy. *International Journal of Clinical Practice* 2007;61(9):1587-9.
19. Lampert M, Cinqualbre J, Tempe JE, Jaeger A, and Forster E. Congenital diaphragmatic hernia (Bochdalek hernia) well tolerated up to twenty-three, then strangulated and perforated at the seventh month of pregnancy (author's trasnl). *Ann Chir* 1981;35(3):247-252.
20. Yoshizu A and Kamiya K. Diaphragmatic hernia complicated with perforated stomach during pregnancy. *KyobuGeka* 2011;64(6):487-90.
21. Rifki Jai S, Bensardi F, Hizaz A, Chehab F, Khaiz D, and Bouzidi A. A late post-traumatic diaphragmatic hernia revealed during pregnancy by post-partum respiratory distress. *Archives of Gynecology and Obstetrics* 2007;276(3):295-8.
22. Barbetakis N, Efstathiou A, Vassiliadis M, Xenikakis T, and Fessatidis I. Bochdaleck's hernia complication pregnancy: case report. *World Journal of Gastroenterology* 2006; 12(15):2469-71.

23. Craddock DR and Hall JI. Strangulated diaphragmatic hernia complicating pregnancy. *Br J Surg* 1968;55(7):559-60.
24. Goldstein AI, Gazzaniga AB, Ackerman ES, Rajcher WJ, Kent DR, and Campbell R. Strangulated diaphragmatic hernia in pregnancy presenting as an empyema. *The Journal of Reproductive Medicine* 1972;9(3):135-9.
25. Arsalane A, Herman D, and Bazelly B. Left strangulated diaphragmatic hernia: an unusual complication of gastric bypass. *Rev Pneumol Clin.* 2005;61(6):374-7.
26. Axon PR, Whatling PJ, Dwerryhouse S, and Forrester-Wood CP. Strangulated iatrogenic diaphragmatic hernia: a late diagnosed complication. *Eur J Cardiothoracic Surg* 1995;9(11):664-6.
27. Narayanan S, Sanders RL, Herlitz G, Langenfeld J, and August DA. Treatment of diaphragmatic hernia occurring after transhiatal esophagectomy. *Annals of Surgical Oncology* 2015;22(11):3681-6.
28. Jadowiec CC and Sakorafas LU. Delayed presentation of traumatic right-sided diaphragmatic hernia after abdominoplasty. *Case Reports in Surgery* 2014;2014:949531. doi: 10.1155/2014/949531. Epub 2014 May 8.
29. Rustagi T. Intestinal obstruction from diaphragmatic hernia following colonoscopy. *The American Journal of the Medical Sciences* 2011;341(5):423-5.
30. Dukhno O, Peiser J, Levy I, and Ovnat A. Iatrogenic diaphragmatic hernia due to laparoscopic gastric banding. *Surg Obes Relat Dis* 2006;2(1):61-3.
31. Hassine E, Racil H, Marniche K, Bousnina S, Ben Mustapha MA, Maalej M, et al. Intrathoracic strangulated diaphragmatic hernia. A diagnostic trap to avoid. *Rev Mal Respir* 2003;20(5):767-71.
32. Lerner CA, Dang H, and Kutilek R. Strangulated traumatic diaphragmatic hernia simulating a subphrenic abscess. *The Journal of Emergency Medicine* 1997;15(6):849-53.
33. Morjaria R, Al-Gailani H, Afzal S, Sabir S, and Salman S. Twenty-seven year old man presenting with a strangulated diaphragmatic hernia eight years after the initial injury. *BMJ Case Reports* 2010;2010. pii: bcr09.2009.2288. doi: 10.1136/bcr.09.2009.2288. Epub 2010 Mar 4.
34. Schiano di Visconte M, Picciano P, and Munegato G. Acute abdomen due to a right-sided strangulated traumatic diaphragmatic hernia. Case report. *Minerva Chir* 2006;61(5):451-4.
35. Sodhi SS, Zech LA Jr, Batura V, and Kulasekhar S. Diaphragmatic hernia with strangulated loop of bowel presenting after colonoscopy: case report. *International Archives of Medicine* 2009;2(1):38
36. Boshier LH, Fishman L, Webb WR, and Old L. Strangulated diaphragmatic hernia with gangrene and perforation of the stomach. *Dis Chest* 1960;37:504-12.
37. Hoffman, E. Strangulated diaphragmatic hernia. *Thorax* 1968;23(5):541-9.
38. Sugg WL, Roper CL, and Carlsson E. Incarcerated Bochdalek hernias in the adult. *Annals of Surgery* 1964;160:847-51.
39. Tauro LF, Rao BSS, Hegde BR, Peter AI, and Gulvadi RK. Obstructed/strangulated diaphragmatic hernia: A rare cause of acute intestinal obstruction in adults. *Indian Journal of Thoracic and Cardiovascular Surgery* 2006;22(4):233-5.
40. Ueno K, Murota Y, Takeda M, Katayama A, and Tanaka K. Delayed traumatic diaphragmatic hernia with strangulated stomach; report of a case. *Kyobu Geka* 2008;61(5):423-6.
41. Chen K, Hsiao C, and Yang M. Late gastric incarceration 20 years after penetrating chest trauma. *The Thoracic and Cardiovascular Surgeon* 2012 Dec;60 Suppl 2:e13-5. doi: 10.1055/s-0031-1295582. Epub 2012 Jan 3.

42. Wani AM, Al Qurashi T, Rehman SA, Al Harbi ZS, Sabbag AR, and Al Ahdal M. Massive haematemesis due to strangulated gangrenous gastric herniation as the delayed presentation of post-traumatic diaphragmatic rupture. *BMJ Case Reports* 2010 Sep 7;2010. pii: bcr0420102874. doi: 10.1136/bcr.04.2010.2874.
43. Kafih M and Boufettal R. A late post-traumatic diaphragmatic hernia revealed by a tension fecopneumothorax (a case report). *Rev PneumolClin* 2009;65(1):23-6.
44. Chen CW, Chang WC, Hsu CC, Yu CY, and Chen CY. Small bowel strangulation caused by delayed penetrating diaphragmatic hernia. *The New Zealand Medical Journal* 2006 Dec 15;119(1247):U2362.
45. Abboud B, Jaoude JB, Riachi M, Sleilaty G, and Tabet G. Intrathoracic transverse colon and small bowel infarction in a patient with traumatic diaphragmatic hernia. Case report and review of the literature. *J Med Liban* 2004;52(3):168-70.
46. Chanson C, Hahnloser D, Nassiopoulos K, and Petropoulos P. Gastric and omental incarceration through an occult traumatic diaphragmatic hernia in a scuba diver. *The Journal of Trauma* 2002;52(1):146-8.
47. Kingsnorth AN and Gunning AJ. An unusual complication of traumatic diaphragmatic hernia. *Thorax* 1979;34(1):125-6.
48. Mansour KA. Strangulated traumatic diaphragmatic hernia: A case report. *Am Surg* 1974;40(7):431-3.
49. Aktan K. Stomach gangrene caused by strangulation of a traumatic diaphragmatic hernia and its treatment. *Turk Tip CemiyMecm* 1962;28:472-8.
50. Behrend A, Kravitz CH, and Tonse MH. Direct diaphragmatic hernia with gangrene of the stomach caused by vomiting. Report of a case. *IntSurg* 1966;45(2):128-31.
51. Braslow L, Bishop CO, and Burch BT. Strangulated diaphragmatic hernia complicated by gangrene of the stomach. *West J Surg Obstet Gynecol* 1960;68:120-2.
52. Moos DJ. Traumatic diaphragmatic hernia with strangulation and gangrene of the stomach. *Minn Med* 1956;39(12):795-9.
53. Purdy MR. Large-bowel obstruction as a result of traumatic diaphragmatic hernia. *South African Medical Journal* 2007;97(3):180-2.
54. Ramdass MJ, Kamal S, Paice A, and Andrews B. Traumatic diaphragmatic herniation presenting as a delayed tension faecopneumothorax. *Emergency Medicine Journal* 2006 Oct;23(10):e54.
55. Seelig MH, Klingler PJ, and Schönleben K. Tension fecopneumothorax due to colonic perforation in a diaphragmatic hernia. *Chest* 1999;115(1):288-91.
56. Popentiu AI, Weber-Lauer C, Nieman C, Kauvar DS, and Sabau D. Late presentation of a shrapnel wound-induced traumatic intra-thoracic abdominal evisceration, as colon perforation with left faecopneumothorax. *Chirurgia* 2010;105(2):253-6.
57. Reddy SA, Vemuru R, Padmanabhan K, and Steinheber FU. Colopleural fistula presenting as tension pneumothorax in strangulated diaphragmatic hernia. Report of a case. *Diseases of the Colon and Rectum* 1989;32(2):165-7.
58. Mattila S, Järvinen A, Mattila T, and Ketonen P. Traumatic diaphragmatic hernia. Report of 50 cases. *ActaChirScand* 1977;143(5):313-8.
59. Windsor R. Strangulated diaphragmatic hernia with perforation of the stomach: a case report. *N Z Med J* 1963;62:425-8.
60. Johnston JH Jr and Twente GE. Perforated gastric ulcer in acute diaphragmatic hernia; case report. *Surgery* 1952;31(5):742-5.

61. Joynt GH. Strangulated diaphragmatic hernia with gangrene and perforation of the stomach. *Surgery* 1956;40(4):696-701.
62. Rafael AA, Rodrigues P, Carmo LD, Nascimento C, Machado J, and Fonseca JR. Late traumatic diaphragmatic hernia complicated by intrathoracic perforation and haemorrhagic gastric cyst: a rare combination. *Acta Med Port* 2005;18(4):295-301.
63. Boyce SH, Corfield AR, McGuffie AC, Stevenson J, and Rawlings D. Spontaneous tension pneumopericardium. *European Journal of Emergency Medicine* 2004;11(3):181-4.
64. Leoncini G, Iurilli L, Lupi P, and Catrambone U. Intrathoracic perforation of the gastric fundus as a late complication of an unknown post-traumatic rupture of the diaphragm. *G Chir* 1998;19(5):235-8.
65. Schwab RJ and Jarvik JG. Tension pneumothorax secondary to gastropleural fistula in a traumatic diaphragmatic hernia. *Chest* 1991;99(1):247-9.
66. Anderson EA Jr, Allen B, McCoy-Sibley R, Teal JS, and Lowery RC Jr. Computed tomography of strangulated gastric hernia complicated by perforation and pneumothorax. *J Natl Med Assoc* 1987;79(7):767-9.
67. Onakpoya U, Ogunrombi A, Adenekan A, and Akerele W. Strangulated tension viscerothorax with gangrene of the stomach in missed traumatic diaphragmatic rupture. *ISRN Surg* 2011;2011:458390. doi: 10.5402/2011/458390. Epub 2011 Jun 22.
68. Abboud B, Tabet G, BouJaoude J, and Sleilaty G. Gastric incarceration and perforation following posttraumatic diaphragmatic hernia: case report and review of the literature. *J Med Libani* 2007;55(2):104-7.
69. Kanazawa A, Yoshioka Y, Inoi O, Murase J, and Kinoshita, H. Acute respiratory failure caused by an incarcerated right-sided adult Bochdalek hernia: report of a case. *Surgery Today* 2002;32:812-5.
70. Kashima T, Inoue K, Kume M, Takaba T, and Makita T. A case of intrathoracic colon perforation due to adult Bochdalek hernia. *The Japanese Journal of Thoracic Surgery* 1993;46(9):819-22.
71. Mar Fan MJ, Coulson ML, and Siu SK. Adult incarcerated right-sided Bochdalek hernia. *The Australian and New Zealand Journal of Surgery* 1999;69:239-41.
72. Perch P, Houck WV, and DeAnada A Jr. Symptomatic Bochdalek hernia in an octogenarian. *Annals of Thoracic Surgery* 2002;73(4):1288-9.
73. Vega MT, Maldonado RH, Vega GT, Vega AT, Liévano EA, and Velázquez PM. Late-onset congenital diaphragmatic hernia: A case report. *International Journal of Surgery Case Reports* 2013;4(11):952-4.
74. Wenzel-Smith G. Posterolateral diaphragmatic hernia with small-bowel incarceration in an adult. *South African Journal of Surgery* 2013;51(2):73-4.
75. Kocakusak A, Arikian S, Senturk O, and Yucel AF. Bochdalek's hernia in an adult with colon necrosis. *Hernia* 2005;9(3):284-7.
76. Barut I, Tarhan OR, Cerci C, Akdeniz Y, and Bulbul M. Intestinal obstruction caused by a strangulated Morgagni hernia in an adult patient. *Journal of Thoracic Imaging* 2005;20(3):220-2.
77. Niwa T, Nakamura A, Kato T, Kutsuna T, Tonegawa K, Kawai A, et al. An adult case of Bochdalek hernia complicated with hemothorax 2003;70(6):644-6.
78. Tiberio G, Ortiz H, Coscoyuela R, Hernández R, and Jiménez C. Bochdalek hernia with gastric incarceration and volvulus. *Rev ClinEsp* 1992;190(7):357-8.
79. Koh H, Sivarajah S, Anderson D, and Wilson C. Incarcerated diaphragmatic hernia as a cause of acute abdomen. *Journal of Surgical Case Reports* 2012 Oct 1;2012(10):4. doi: 10.1093/jscr/2012.10.4.

80. Sakai T, Ogura Y, Yamada Y, Kodama H, Kimura D, Hatanaka R, et al. Elderly Bochdalek hernia found out by intestinal obstruction. *The Japanese Journal of Thoracic Surgery* 2013;66(12):1074-8.
81. Sinha M, Gibbons P, Kennedy SC, and Matthews HR. Colopleural fistula due to strangulated Bochdalek hernia in an adult. *Thorax* 1989;44(9):762-3.
82. Spence PA, Cohen Z, and Salerno TA. Strangulated diaphragmatic hernia in a patient with osteogenesis imperfecta. *Canadian Medical Association Journal* 1984;131(11):1369-70.
83. Offman RP and Spencer RM. Incarcerated diaphragmatic hernia with bowel perforation presenting as a tension pneumothorax. *Western Journal of Emergency Medicine* 2014;15(2):142-4.
84. Esmer D, Alvarez-Tostado J, Alfaro A, Carmona R, and Salas M. Thoracoscopic and laparoscopic repair of complicated Bochdalek hernia in adult. *Hernia* 2008;12(3):307-9.
85. Kumar A, Maheshwari V, Ramakrishnan TS, and Sahu S. Caecal perforation with faecal peritonitis – unusual presentation of Bochdalek hernia in an adult: a case report and review of the literature. *World Journal of Emergency Surgery* 2009 May 6;4:16. doi: 10.1186/1749-7922-4-16.
86. Sarris M, Georgoulis J, Gatos M, and Dariotis A. A case of strangulated congenital diaphragmatic hernia with necrosis and rupture of the colon and herniation into a left hemithorax in an adult (author's transl). *Sem Hop* 1980;56(1-2):43-5.
87. Guven H, Malazgirt Z, Dervisoglu A, Danaci M, and Ozkan K. Morgani hernia: rare presentations in elderly patients. *ActaChirBelg* 2002;102(4):266-9.
88. Granier V, Coche E, Hantson P, Thoma M. Intrathoracic caecal perforation presenting as dyspnea. *Case Reports in Medicine* 2010;2010:296730. doi: 10.1155/2010/296730. Epub 2011 Jan 20.
89. Ghanem AN, Chankun TS, and Brooks PL. Total gastric gangrene complicating adult Bochdalek hernia. *Br J Surg* 1987;74(9):779.
90. Maa J, Lubbock C, Harrison M, and Corvera C. Perforated ulcer mimicking a spontaneous pneumothorax in a patient with congenital diaphragmatic hernia. *Am Surg* 2009;75(4):354-6.
91. Hofmann S, Kümmel A, Hoffmann W, Barth T, Henne-Bruns D, and Weber T. Intrathoracic gastric perforation due to central diaphragmatic hernia – rare cause of tension pneumothorax and septic shock. *ZentralblChir* 2013;138(3):348-50.
92. Faizah MZ, Sharifah MI, Johoruddin K, and Juliana AL. Adult Bochdalek hernia complicated with perforated gastric ulcer: preoperative diagnosis with multiplanar CT. *Medical Journal of Malaysia* 2011;66(4):367-8.
93. Pancholi CK, Hombalkar NN, Dalvi SB, and Guray PD. Left sided hydro-pneumothorax in an operated case of left diaphragmatic hernia repair: a diagnostic dilemma. *Journal of Clinical and Diagnostic Research* 2015;9(4):PD03-4. doi: 10.7860/JCDR/2015/11879.5759. Epub 2015 Apr
94. Chui PP and Tan CT. Sudden death due to incarcerated Bochdalek hernia in an adult. *Annals of the Academy of Medicine, Singapore* 1993;22(1):57-60.
95. Karanikas ID, Dendrinos SS, Liakakos TD, and Koufopoulos IP. Complications of congenital posterolateral diaphragmatic hernia in the adult. Report of two cases and literature review. *The Journal of Cardiovascular Surgery* 1994;35(6):555-8.
96. Radley SB and Goldsmith HP. A case of diaphragmatic hernia of congenital origin with perforation of stomach. *British Medical Journal* 1949;2(4623):366.
97. Shah-Mirany J, Schmitz GL, and Watson RR. Eventration of the diaphragm. Physiologic and surgical significance. *Archives of Surgery* 1968;96(5):844-50.

98. Donzeau-Gouge GP, Personne C, Lechien J, Colchen A, Leroy M, Seigneur F, et al. Diaphragmatic eventration in adults. Apropos of twenty cases. *Sem Hop* 1982;58(36):2065-8.
99. Bishop HC, and Koop CE. Acquired eventration of the diaphragm in infancy. *Pediatrics* 1958;22(6):1088-96.
100. Tsugawa C, Kimura K, Nishijima E, Muraji T, and Yamaguchi M. Diaphragmatic eventration in infants and children: is conservative treatment justified. *Journal of Pediatric Surgery* 1997;32(11):1643-4.
101. Yazici M, Karaca I, Arikan A, Erikçi V, Etensel B, Temir G, et al. Congenital eventration of the diaphragm in children: 25 years' experience in three pediatric surgery centers. *European Journal of Pediatric Surgery* 2003;13(5):298-301.
102. Thomas TV. Congenital eventration of the diaphragm. *Annals of Thoracic Surgery* 1970;10(2):180-92.
103. Mantoo SK and Mak K. Congenital diaphragmatic eventration in an adult: a diagnostic dilemma. *Singapore Medical Journal* 2007 May;48(5):e136-7
104. Como JJ, Cohen-Kashi KJ, and Alhindawi R. Posttraumatic diaphragmatic eventration. *The Journal of Trauma* 2004;56(5):1149-51.
105. Di Giorgio A, Cardini CL, Sammartino P, Sibio S, and Naticchioni E. Dual-layer sandwich mesh repair in the treatment of major diaphragmatic eventration in an adult. *The Journal of Thoracic and Cardiovascular Surgery* 2006;132:187-9.
106. Moore CM, Mander BJ, and Raja MA. A case of congenital eventration of the diaphragm mimicking traumatic diaphragmatic rupture. *Injury* 2001;32(6):508-9.
107. Gupta V, Gupta P, and Chandra A. Diaphragmatic eventration complicated by gastric volvulus with perforation. *South African Journal of Surgery* 2012;50(3):90-1.
108. Moon SW, Wang YP, Kim YW, Shim SB, and Jin W. Thoracoscopic plications of diaphragmatic eventration using endostaplers. *The Annals of Thoracic Surgery* 2000;70(1):299-300.
109. Watanabe S, Shimokawa S, Fukueda M, Kinjyo T, and Taira A. Large eventration of diaphragm in an elderly patient treated with emergency plication. *Annals of Thoracic Surgery* 1998;65(6):1776-7.
110. Mitchell TE, Ridley PD, and Forrester-Wood CP. Spontaneous rupture of a congenital diaphragmatic eventration. *European Journal of Cardio-Thoracic Surgery* 1994;8(5):281-2.
111. Holgersen LO, Schnauffer L. Hernia and eventration of the diaphragm secondary to blunt trauma. *Journal of Pediatric Surgery* 1973;8(3):433-4.

Manuscript Information: Received: July 18, 2016; Accepted: October 13, 2016; Published: October 15, 2016

Authors Information: Amanda K. Young, MD*; David A. Caro, MD

Dept. of Emergency Medicine, University of Florida College of Medicine-Jacksonville, USA

Citation: Young AK, Caro DA. Acute abdomen in the emergency department due to a diaphragmatic hernia with gastric strangulation and perforation. *Open J Clin Med Case Rep*. 2016; 1172

Copy right statement: Content published in the journal follows Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>). © Young AK 2016

Journal: Open Journal of Clinical and Medical Case Reports is an international, open access, peer reviewed Journal focusing exclusively on case reports covering all areas of clinical & medical sciences.

Visit the journal website at www.jclinmedcasereports.com