*Case Reports*

# Repair of Intrapericardial Diaphragmatic Hernia

## during Aortic Surgery in a 78-Year-Old Woman

**Konstantinos Spiliotopoulos, MD, PhD**
**Kim I. de la Cruz, MD**
**Georgios Gkotsis, MD**
**Ourania Preventza, MD**
**Joseph S. Coselli, MD**

*Intrapericardial diaphragmatic hernias are reported very rarely. Those of congenital origin are most often diagnosed in neonates, and those caused by indirect blunt trauma occur chiefly in adults. The latter type can be asymptomatic; however, the results of a computed tomographic scan can yield a definitive diagnosis. Once discovered, these hernias should be corrected to avoid severe sequelae such as bowel strangulation and necrosis, peritonitis, mediastinitis, and cardiac tamponade.*

*We report the case of a 78-year-old woman who presented for elective ascending aortic aneurysm repair. Computed tomographic angiograms incidentally revealed a large intrapericardial diaphragmatic hernia, which had probably developed years earlier, after a traffic accident. The patient underwent a median sternotomy and repair of the intrapericardial diaphragmatic hernia with use of a bovine pericardial patch, followed by ascending aortic and hemiarch repair, aortic valve repair, and aorto–right coronary artery bypass grafting. We discuss the details of these procedures and alternative treatment options. To our knowledge, this is the first report of concomitant aortic surgery and repair of a trauma-induced intrapericardial diaphragmatic hernia in an adult.* ***(Tex Heart Inst J 2017;44(2):150-2)***

***Key words:*** *Abnormalities, multiple; cardiac surgical procedures; diaphragm/injuries; hernia, diaphragmatic, traumatic/diagnosis/diagnostic imaging/pathology/surgery; incidental findings; pericardium/pathology; tomography, x-ray computed; treatment outcome; wounds, nonpenetrating*

***From:*** *Department of Cardiovascular Surgery (Drs. Coselli, de la Cruz, Preventza, and Spiliotopoulos), Texas Heart Institute; Department of Cardiovascular and Thoracic Surgery (Dr. Coselli), CHI St. Luke's Health–Baylor St. Luke's Medical Center; and Divisions of Cardiothoracic Surgery (Drs. Coselli, de la Cruz, Preventza, and Spiliotopoulos) and Vascular Surgery (Dr. Gkotsis), Michael E. DeBakey Department of Surgery, Baylor College of Medicine; Houston, Texas 77030*

***Address for reprints:*** *Konstantinos Spiliotopoulos, MD, Division of Cardiothoracic Surgery, Michael E. DeBakey Department of Surgery, Baylor College of Medicine, One Baylor Plaza, Houston, TX 77030*

***E-mail:*** *cvspiliotopoulos@hotmail.com*



Intrapericardial diaphragmatic hernias (IDHs), the rarest of the diaphragmatic defects, form between the peritoneal and pericardial cavities and typically do not have a hernia sac. They can have a congenital or traumatic cause and thus can be identified at any age. Congenital cases, which are usually diagnosed in neonates, are attributed to failed fusion of the retrosternal portion of the transverse septum of the central diaphragmatic tendon. In contrast, IDHs in adults are usually due to trauma. These sometimes-asymptomatic hernias might be discovered incidentally on a chest radiograph or chest computed tomogram (CT), or they might be found intraoperatively. The chief differential diagnosis is Morgagni hernia. We report the case of an elderly woman with a history of trauma who underwent repair of an incidentally discovered IDH in combination with aortic surgery.

## Case Report

A 78-year-old woman with a history of chronic arterial hypertension, hypercholesterolemia, obstructive sleep apnea, and congestive heart failure presented for evaluation of an ascending aortic aneurysm, which her primary care provider had discovered when she sought treatment for coughing, dyspnea, and malaise. She had been in a motor vehicle accident 13 years earlier and had sustained injuries to the chest (broken ribs), abdomen, and pelvis. Whether she had undergone a CT scan during that 5-day hospitalization was unknown.

Chest radiography and echocardiography were performed. The echocardiogram showed mild aortic valvular insufficiency and a left ventricular ejection fraction of 0.65. A CT angiogram showed ectasia of the aortic root at the sinus of Valsalva (dimensions, 4 × 3.7 cm), as well as aneurysms of the ascending thoracic aorta (diameter, 6.5 cm) and proximal transverse aortic arch (dimensions, 4.9 × 4.3 cm). The CT angiogram also showed a large anterior diaphragmatic hernia at midline (diameter, 3.6 cm within the neck), with protrusion of the left lobe of the liver, multiple loops of nondilated large and small bowels, and mesentery fat into the pericardial sac, anterior to the right ventricle (Fig. 1). A coronary angiogram showed 70% stenosis of the right coronary artery, and a carotid duplex ultrasonogram showed no stenosis.

The patient underwent elective surgery through a median sternotomy. When access to the pericardial cavity was attained, the diaphragmatic/pericardial circular defect (diameter, approximately 4 cm) and intrapericardially herniated abdominal viscera were immediately visible. The visceral content was reduced back inside the abdominal cavity, and the hernia was repaired successfully with use of a bovine pericardial patch and 2-0 Prolene sutures placed circumferentially. The cardiac operation then proceeded as planned: the patient's ascending aorta and proximal transverse aortic arch were resectioned and replaced by using a hemiarch approach with a beveled graft. The aortic valve was repaired by means of triple commissural plication and annuloplasty, and a reversed autogenous saphenous vein graft was grafted to the right coronary artery. The patient recovered uneventfully and was discharged from the hospital.

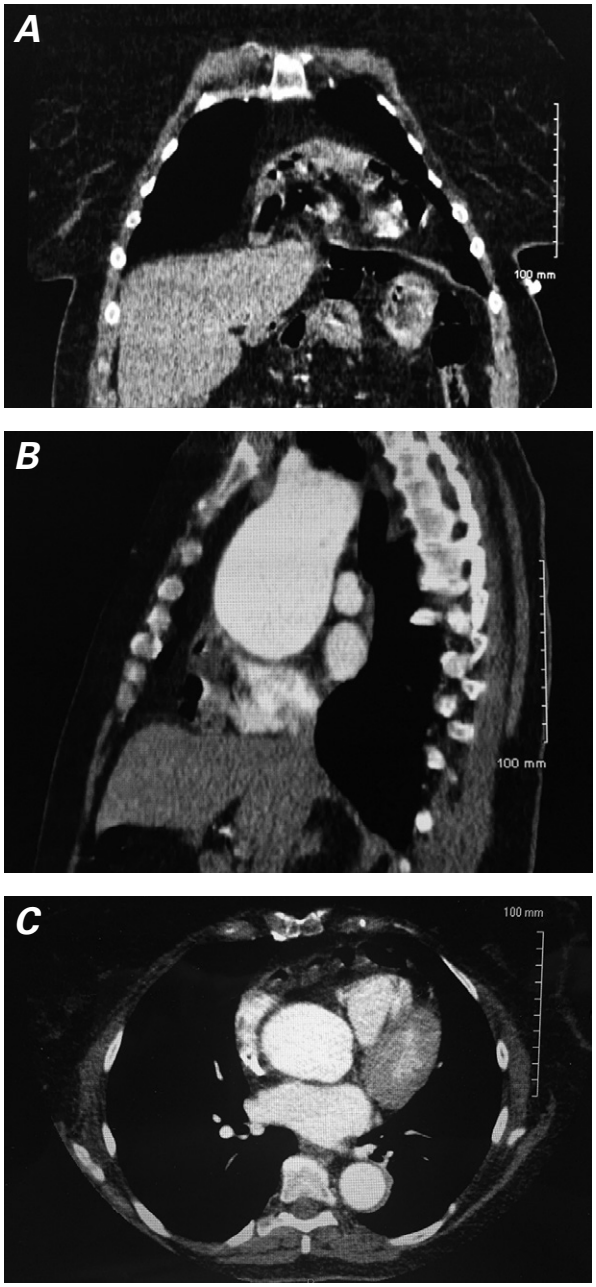


***Fig. 1*** *Preoperative chest computed tomographic angiograms in **A**) coronal, **B**) sagittal, and **C**) axial views show intrapericardial herniation of the abdominal viscera around the heart.*

## Discussion

The chief cause of intrapericardial diaphragmatic hernias in adults is indirect blunt trauma, such as deceleration injuries, severe blows to the chest or abdomen, or severe falls.[1] Comparatively few IDHs result from a penetrating trauma; patients who sustain a pericardial diaphragm laceration (for example, from a stab or gunshot wound) typically also have a cardiac injury and therefore a high mortality rate. In addition, many abdominal stab wounds that involve the pericardium are extraperitoneal.

The force of blunt abdominal trauma is transmitted through the viscera to the diaphragm. Hernias occur more frequently in the left diaphragm, because the left-sided organs (stomach, spleen, and left kidney) afford less protection than do the organs on the right (liver and right kidney).[2] Intrapericardial diaphragmatic hernias are rare because the heart absorbs the additional force, and the pericardial diaphragm is strong.[3,4]

Congenital IDHs are attributed to coexisting pericardial and diaphragmatic defects. These defects make up a class of upper celosomias, which include a spectrum of anomalies that result from improper development of the cephalic fold somatopleure. Congenital IDHs are highly symptomatic very early in life, so they are most often detected in neonates and infants.[5]

The pathophysiology of IDHs, regardless of their cause, involves free transmission of negative pleural pressure to the peritoneum, which considerably increases the gradient during vigorous respiratory effort, causing further herniation. This prevents large diaphragmatic tears from healing and causes further stretching of the defect and the pericardial sac. The omentum is usually among the hernia contents. The transverse colon and stomach protrude less frequently than does the omentum, and the jejunum, left lobe of the liver, and spleen protrude least often. The pericardial diaphragm is a single, tightly fused layer, so lacerations typically involve its full thickness and result in a sacless herniation; adhesions form in most chronic cases.[3]

Intrapericardial diaphragmatic hernias might be overlooked when more obvious injuries take priority during the initial hospitalization of trauma patients.[6] Symptoms of IDH include chest or abdominal pain, fatigue, dyspnea, cyanosis, vomiting with or without distention, and weight loss. Palpitations and worsening dyspnea can suggest cardiac tamponade.[7] When an IDH is missed during the initial diagnosis, patients can subsequently

have a relatively stable hernia with intermittent symptoms. Useful diagnostic clues on physical examination include bowel sounds in the chest, decreased breath sounds, muffled heart tones, and an absent point of maximal impulse. When chest radiographs are not diagnostic upon clinical suspicion of an IDH, a CT scan of the chest and abdomen can yield a definitive diagnosis.[8]

The transabdominal approach is often thought to be best for repairing an IDH, except when heart surgery will also be performed, as in the case of our patient. Transabdominal access enables direct exposure and thorough examination of the abdominal viscera, whereas the transthoracic approach involves cardiac displacement and incision of the lateral pericardium and hemidiaphragm.[1] Repair in chronic cases usually necessitates the use of a prosthetic patch (such as bovine pericardium, GORE-TEX, or polypropylene mesh) because of the fixed circumference of the defect. Conversely, acute cases are repaired primarily with nonabsorbable sutures. Because of the severe and possibly fatal sequelae of IDH, such as strangulated or incarcerated intestine, bowel obstruction, and necrosis, correction should be performed upon diagnosis.

The main differential diagnosis is Morgagni hernia (alternatively called anterior parasternal or subcostosternal diaphragmatic hernia), which also affects the anterior mediastinum but without pericardial involvement. We found 4 reports of heart surgery combined with Morgagni hernia repair in adults[9-12]; however, to our knowledge, ours is the first report to describe concomitant aortic surgery and repair of a trauma-induced IDH in an adult.

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