

The way to a man's heart is through his stomach? A unique case report of transient constrictive pericarditis secondary to infarction of herniated omentum following bariatric surgery

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Background

Intrapericardial diaphragmatic hernias are a rare form of diaphragmatic hernia. The presentation is usually acute due to trauma or from iatrogenic causes. In some instances however, these patients can present years later. We describe an unusual case of transient constrictive pericarditis associated with herniation of omentum through a diaphragmatic hernia extending into the pericardial space, which infarcted following recent bariatric surgery. A multi-disciplinary approach was required with surgical correction of the diaphragmatic defect and removal of omentum from the pericardial space.

Case summary

A 38-year-old gentleman with a history of a remote abdominal stab wound and recent laparoscopic gastric sleeve procedure presented with sharp central chest pain radiating to the shoulder. Chest imaging [echocardiography, computed tomography (CT), and cardiac magnetic resonance imaging (MRI)] revealed the presence of an intrapericardial diaphragmatic hernia and herniation of devascularized omentum into the pericardial space. Surgery was undertaken to remove the pericardial omentum. Echocardiography and cardiac MRI revealed changes of pericardial constriction which resolved with anti-inflammatories.

Discussion

A multi-disciplinary approach was required in this case with surgical correction of the diaphragmatic defect and removal of omentum from the pericardial space. Multi-modal imaging proved essential in the diagnosis of this rare condition, aiding in timely diagnosis, ongoing management decisions, and for assessing therapeutic response.

Keywords

Pericardium • Intrapericardial diaphragmatic hernia • Transient constrictive pericarditis • Bariatric surgery
Multi-modal imaging • Case report

ESC Curriculum

2.1 Imaging modalities • 6.6 Pericardial disease

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Learning points

- Intrapericardial diaphragmatic hernia is a rare form of diaphragmatic hernia.
- Usually presents acutely from trauma or iatrogenic causes though it can also be congenital.
- Abdominal contents can herniate through the defect causing a wide range of symptoms.
- Multimodality imaging including echocardiography, CT, and cardiac MRI is essential in diagnosis and in guiding therapeutic course.
- Constrictive pericarditis improved following surgical removal of devascularized omentum, repair of the diaphragmatic defect, and treatment with anti-inflammatories.
- Imaging of the thoracoabdominal region can be useful in the pre-operative surgical assessment prior to bariatric surgery.

Introduction

Intrapericardial hernias are the rarest form of adult diaphragmatic hernia.¹ It is defined as a defect in the central portion of the diaphragm and can be associated with the herniation of abdominal contents into the pericardium. In contrast to the congenital diaphragmatic hernias (Bockdalek and Morgagni), non-congenital intrapericardial diaphragmatic hernias communicate directly with the pericardial space without a peritoneal sac and are almost always due to blunt trauma (most commonly motor vehicle accident).² Iatrogenic cases have also been reported following surgical procedures such as pericardial window formation and post oesophagectomy.^{3,4} Although the majority of case reports describe findings at the time of trauma, some have been discovered decades later.⁵ Herniation of abdominal contents into the pericardial space can cause varied symptoms including abdominal pain, bowel obstruction, chest pain, dyspnoea, tamponade, and even pericarditis. In this case report, we describe a patient presenting with pericarditis and transient constrictive changes following a recent gastric sleeve procedure. To our knowledge, this is the first case report describing transient constrictive pericarditis secondary to herniated devascularized omentum through an intrapericardial diaphragmatic hernia following a gastric sleeve procedure. We outline our approach to this complex patient in this case report.

Timeline

Background	Time points
Remote history of abdominal stab wound ~20 years prior	~20 years prior
PRESENTATION	
Laparoscopic gastric sleeve procedure for weight loss. Discharged home.	Day 0
Re-presents with pericardial chest pain, dyspnoea and low grade fevers	Day 5
INITIAL INVESTIGATIONS	
Echocardiography and CT imaging reveals intrapericardial diaphragmatic hernia with devascularized omentum in pericardial space	Day 5

Continued

Continued

Background	Time points
INITIAL MANAGEMENT	
Laparoscopic abdominal procedure performed to remove omentum from pericardial space.	Day 6
FURTHER INVESTIGATIONS	
Echocardiography and cardiac MRI suggestive of pericardial constriction	Days 12–14
FURTHER MANAGEMENT	
Commencement of anti-inflammatory drugs.	
Residual omentum removed through Video assisted thoroscopic surgery (VATS) procedure. Discharged 3 days post.	Day 13
Improvement in symptoms at initial clinic review. Resolution of symptoms at 3 month review	6 weeks post discharge and 3 months post discharge

Case presentation

A 38-year-old man presented to the emergency department with a 2-day history of central sharp chest pain radiating to the shoulder. This was associated with breathlessness, fever, and chills. The patient had undergone an elective laparoscopic sleeve gastrectomy for weight loss 5 days prior. He did not have abdominal pain, vomiting, or symptoms of bowel obstruction.

His medical history was significant for obesity, diet controlled type II diabetes mellitus, dyslipidaemia, obstructive sleep apnoea, non-alcoholic steatohepatitis, gout, and childhood asthma. He also reported a history of an upper abdominal stabbing in a knife fight 20 years prior. Further details of this injury were not available. There was no significant family history of cardiovascular disease.

On initial examination, he was tachycardic with a heart rate of 118 beats per minute. The blood pressure was 103/62 mmHg. The temperature was 37.9°C. Oxygen saturation was 95% on room air. There was no jugular venous distension. Heart sounds were dual but soft, and there were no murmurs or pericardial rub. Auscultation of the lung fields revealed reduced air entry and bilateral basal crepitations. The abdomen was soft and non-tender. There

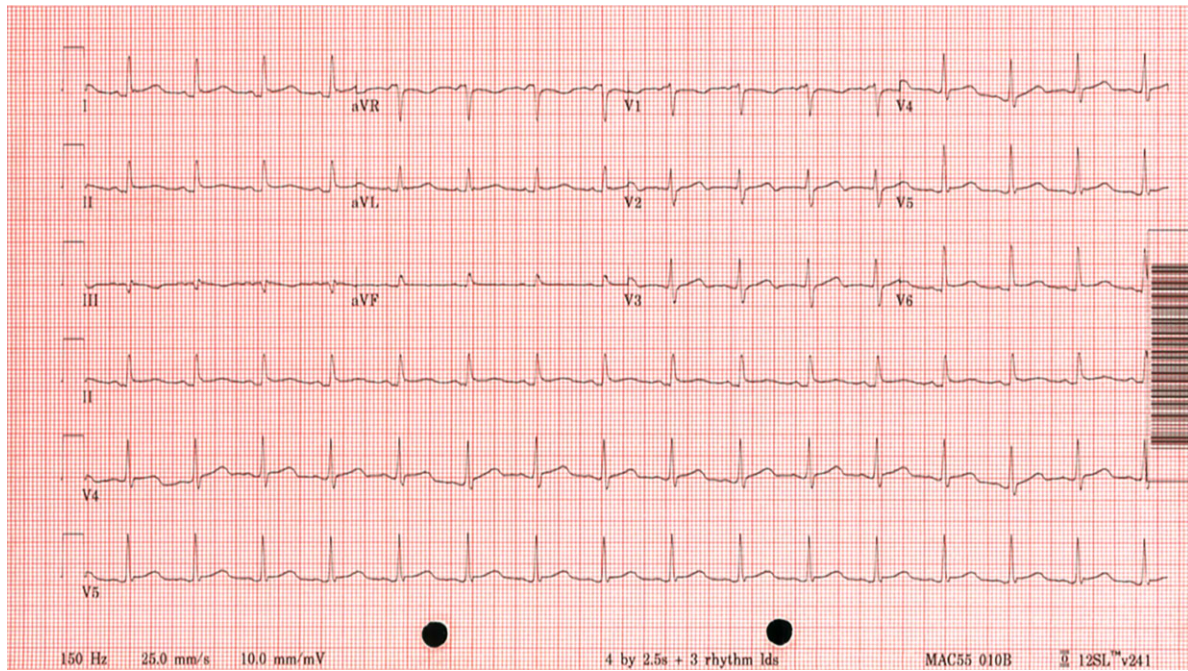


Figure 1 Electrocardiogram. Sinus tachycardia with PR segment depression and ST segment elevation in leads I, II, III, aVF, V5-6.

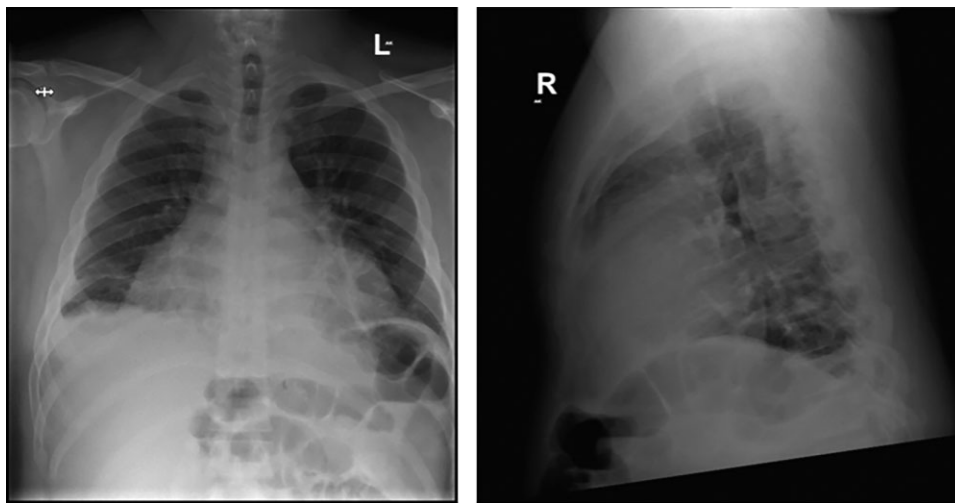


Figure 2 CXR (Anteroposterior [AP] and lateral views). A widened cardiothoracic ratio, bibasilar atelectasis, and a small right pleural effusion.

were no signs of abdominal distension or bowel obstruction. There was no evidence of infection associated with his recent surgical wounds. No old scars were noted on the abdominal wall. There was no peripheral oedema.

The initial electrocardiogram (ECG) showed ST segment elevation in the inferolateral leads and PR segment depression, suggestive of pericarditis (Figure 1). The chest X-ray (CXR) (Figure 2) showed a widened cardiothoracic ratio with bibasilar atelectasis and a small right-sided pleural effusion. Previous chest imaging was not available for comparison.

Laboratory testing showed a leucocytosis with a white cell count (WCC) of $25.8 \times 10^9/L$. Inflammatory markers were elevated with a C-reactive protein (CRP) of 409 mg/L. Renal function was normal. No troponin was requested. Serial blood cultures were negative.

A transthoracic echocardiogram was performed. This showed a large amount of echogenic material in the pericardial space. There was also evidence of interventricular dependence and constrictive physiology (Figure 3A and 3B).

A computed tomography pulmonary angiogram was performed (Figure 4) at presentation. It excluded a pulmonary embolism

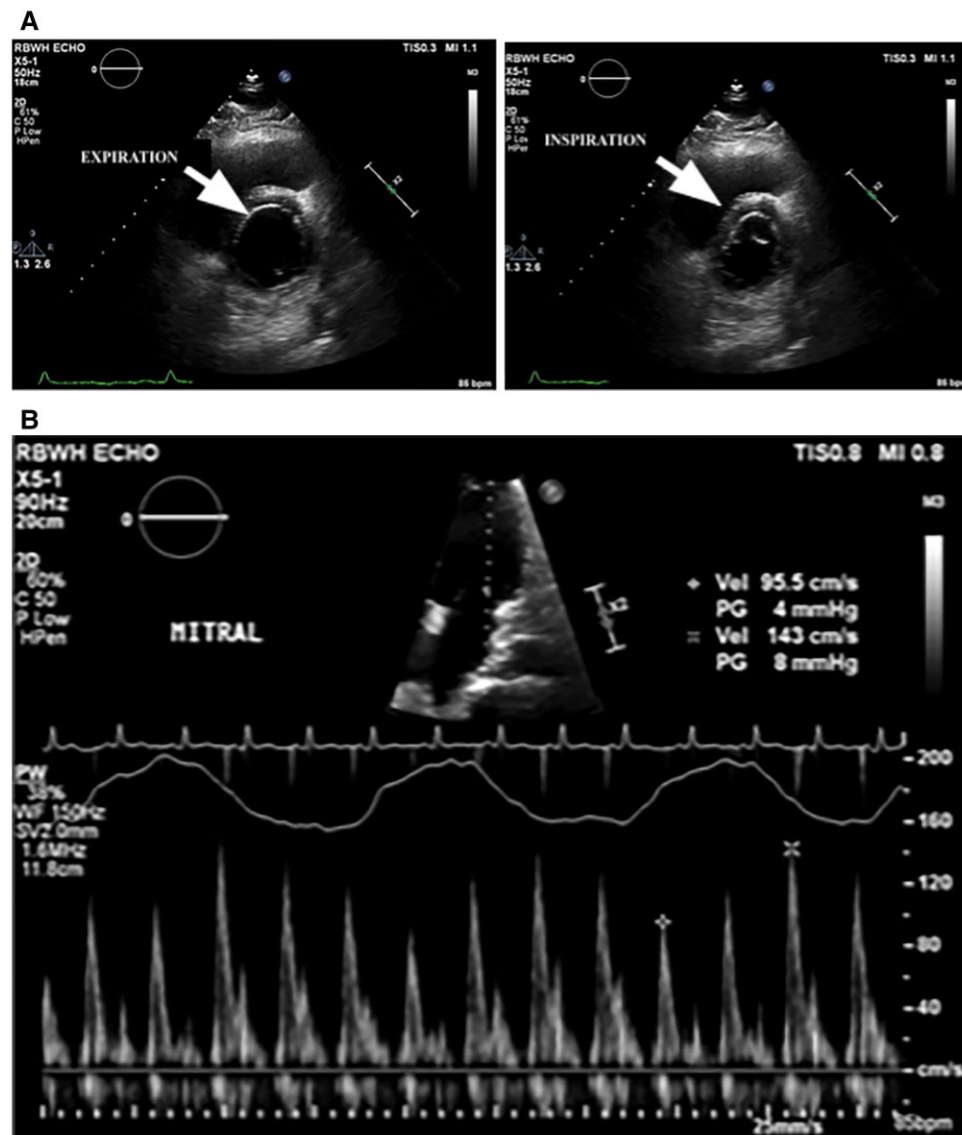


Figure 3 Transthoracic echocardiogram. Large amount of echogenic material visualized in pericardial space. (A). Ventricular interdependence and (B). respirophasic mitral inflow velocity.

however revealed a 9 mm defect along the central tendon of the diaphragm. A large amount of herniated omental fat was visualized in the pericardial space. There was evidence of fat stranding suggestive of inflammation and necrosis.

Cardiac magnetic resonance imaging (MRI) was also performed later in the hospital stay (Figure 5). This showed increased signal intensity of the pericardium on post Gadolinium delayed enhancement imaging and fat suppressed T2-weighted imaging. This was thought to be consistent with active inflammation. There was mild septal shift during inspiration suggestive of ventricular interdependence and constrictive physiology (see Supplementary material online, Video S1).

The patient was empirically treated with broad spectrum antibiotics (piperacillin/tazobactam 4.5 g QID) though infectious pericarditis was considered a less likely diagnosis. There was no infectious prodrome on history.

Abdominal laparoscopy was performed the day after presentation in consultation with the general surgical team. It was considered a reasonable initial approach rather than proceeding directly to laparotomy. Laparoscopy confirmed the presence of herniated omentum in the pericardial space, through a diaphragmatic defect (see Figure 6 and see Supplementary material online, Video S2). The pericardial omentum was retrieved and the pericardial and diaphragmatic defects were closed. Biomesch was used for closure of the diaphragmatic defect. Histology of the retrieved pericardial omental fat showed fat necrosis, haemorrhage, and fibrosis.

Almost 2 weeks after presentation a video-assisted thoracoscopic surgery was performed to retrieve residual necrotic omentum, which had become densely adherent to the right atrium. An echocardiogram performed the next day showed evidence of mild constrictive physiology. This suggests that both mechanical factors and



Figure 4 Computed tomography images of chest (coronal, axial, and sagittal). There is a large amount of omental fat present within the pericardial cavity with fat stranding. A communication between the pericardium and abdominal cavity can be seen with a defect in the diaphragm (white arrow).

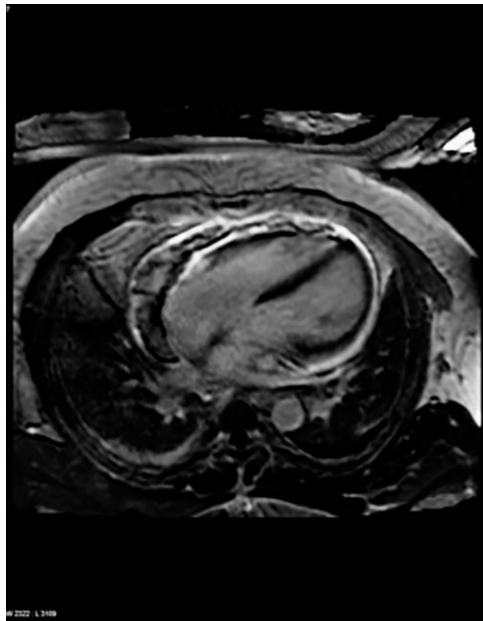


Figure 5 Cardiac magnetic resonance imaging. Increased signal intensity of pericardium on Late gadolinium enhancement (LGE) and fat suppressed T2 weighted imaging suggestive of active inflammation from devascularized omental fat.

inflammation were contributing to the constrictive picture. The patient was discharged home 3 days post procedure with minimal residual chest pain. His inflammatory markers had improved. He was prescribed a three month course of colchicine and ibuprofen, to prevent progression to chronic constrictive pericarditis.

At the three month follow-up, the patient remained asymptomatic and echocardiography showed improvement in the constrictive physiology (no tethering, septal bounce, or mitral inflow variation). Inflammatory markers including WCC and CRP also improved.

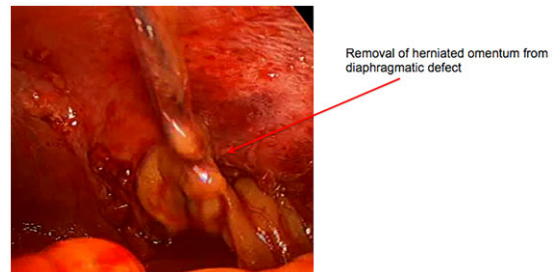


Figure 6 Abdominal laparoscopy. Removal of herniated omentum through the diaphragmatic defect.

The bariatric surgeon was consulted about the initial laparoscopic gastric sleeve procedure. They noted the diaphragmatic defect during the procedure. It was anatomically distant from the operative field and was clearly unrelated to that particular surgical intervention. The surgeon noted a tongue of omentum extending through the diaphragmatic hernia. It was not apparent that this defect extended through to the pericardium. Detachment of the tongue of omentum at the diaphragmatic border disrupted omental blood supply rendering it ischaemic and necrotic. It is hypothesized this precipitated an inflammatory response in the pericardium.

Discussion

Our literature review suggests the initial diagnosis of an intrapericardial diaphragmatic hernia can be delayed due to more apparent traumatic injuries.⁶ Symptoms may include chest or abdominal pain, dyspnoea, or vomiting. Herniation of transverse colon, stomach, jejunum, the left lobe of the liver and spleen have all been reported in a case series review by Meng *et al.*⁷ Omentum alone was reported in only four cases in this review. Frank cardiac tamponade has been reported in three cases.^{8–10} Pericarditis has been reported twice, one soon after the initial trauma and the second 4 years post.^{11,12}

Bowel sounds heard in the chest cavity, reduced breath sounds or muffled heart sounds may point to the diagnosis. Chest X-ray often provides clues to diagnosis. Prior to computed tomography (CT) scanning the diagnosis was often not made until the time of operation.²

Imaging is crucial in diagnosing patients with constrictive pericardial complications. Echocardiography features include respiration-related ventricular septal shift, preserved or increased medial e' velocity with reduced lateral e' velocity (the so-called annulus reversus), respiration related variation in mitral inflow velocity, and hepatic vein expiratory diastolic flow reversal.¹³

Acutely an abdominal approach is employed to remove the contents from the pericardium and close the defect. In delayed presentations however, a thoracic approach is often required due to adhesions in the pericardium as in our case.^{5,8}

In this patient we suspect the remote abdominal stab wound to the upper abdomen lacerated the diaphragm and pericardium causing an abnormal communication. Myocardial injury, pericardial tamponade or visceral laceration at the time of the assault would have prompted earlier detection. The lack of these potentially life-threatening injuries partly explains the 20-year delay in the diagnosis of the intrapericardial diaphragmatic hernia in our patient.

We hypothesize that an inflammatory pericarditis was precipitated by manipulation of omentum during the sleeve gastrectomy procedure and disruption of omental blood supply.

In retrospect, the diaphragmatic defect was not properly dealt with. However, in clinical practice incidental hernias are often best managed after weight loss is achieved.¹⁴ Chest imaging (even CXR) pre bariatric surgery would have been informative in this case. It would have revealed an abnormal cardiac silhouette and triggered further investigations including echocardiography and CT. This would have changed the surgical approach. This case certainly highlights the importance of a comprehensive pre-operative assessment. Chest imaging post bariatric surgery also would have been useful to further define the diaphragmatic defect seen intraoperatively. However, the patient re-presented to hospital within 5 days and prior to the scheduled post-operative follow-up.

Our patient demonstrated constrictive pericardial complications on echocardiography and cardiac MRI. Untreated pericardial constriction can lead to chronic constrictive pericarditis which carries a poor prognosis. Surgical correction with pericardiectomy provides symptomatic benefit and can improve survival.¹⁵

More novel approaches include the use of myocardial strain imaging. A study by Kusunose et al.¹⁶ showed a distinctive regional pattern of strain in patients with constrictive pericarditis. They found lower regional longitudinal systolic strain ratios (lateral/medial), with preserved medial strain and reduced lateral strain. Strain improved post pericardiectomy. Strain was more robust than annular velocities in differentiating between patients with constriction, those with restrictive cardiomyopathy and normal subjects. Unfortunately, strain was not performed for our patient due to limited technical capabilities at the time.

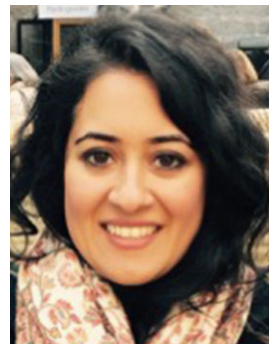
Cardiac MRI offers further diagnostic insights in defining cardiac anatomy and in tissue characterization of the pericardium. It can identify increased ventricular interdependence and respirophasic flow across the atrioventricular valves. Inflammation can be identified with delayed gadolinium enhancement, which if present, can predict

response to anti-inflammatories.¹⁵ This proved to be the case in our patient. Appropriate therapy with anti-inflammatories improved symptoms and constrictive changes on echocardiography. This may have prevented an unnecessary surgical referral for pericardiectomy (with its associated morbidity and mortality) should he have had progressive and symptomatic constriction.

Conclusions

A case of transient constrictive pericarditis associated with a remote traumatic intrapericardial diaphragmatic hernia has been presented. This case provides important learning points including the consideration of a broad differential diagnosis. It highlights the usefulness of imaging modalities in pericardial disease. Echocardiography, CT and cardiac MRI proved imperative in the diagnosis and management of our patient, and in assessing treatment response. Constrictive changes resolved following surgical removal of devascularized omentum from the pericardial space and treatment with anti-inflammatories. This case also highlights the importance of a comprehensive pre-operative assessment prior to bariatric surgery.

Lead author biography



Dr Suhasini Singh completed her medical degree at the University of Melbourne, Australia in 2011. She is currently undertaking advanced training in Cardiology at the Royal Brisbane and Women's hospital in Brisbane, Australia.

Supplementary material

Supplementary material is available at *European Heart Journal – Case Reports* online.

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Consent: The author/s confirm that consent for submission and publications of this case report including image(s) and associated text has been obtained from the patient in line with COPE guidance.

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