



Case report

Cardiac tamponade after robotic hiatal hernia repair from liver sling stitch: Case report of a rare complication and literature review

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ABSTRACT

Introduction and importance: Cardiac tamponade following hiatal hernia repair is a rare and potentially fatal complication most often associated with the use of mechanical fixation devices for hiatal mesh reinforcement. Only three cases have been reported with sutures alone, and none following robotic hiatal surgery.

Case presentation: A 54-year-old patient underwent elective robotic hiatal hernia repair with Toupet fundoplication during which a sling suture was placed to elevate the left lateral segment of liver. No mesh or mechanical fixation devices were used. Eight hours postoperatively, the patient developed hemodynamic instability. Cardiac tamponade was diagnosed on bedside echocardiogram and the patient underwent emergent pericardiocentesis with subsequent stabilization. The remainder of the postoperative course was notable for pericarditis which was treated with aspirin and colchicine.

Clinical discussion: While the use of suture-based liver retraction has the advantages of avoiding an additional port and potential collision between retractor holder and robot arms, it constitutes a novel risk factor for cardiac tamponade. Prompt diagnosis via bedside echocardiography is essential and may facilitate percutaneous rather than operative management.

Conclusion: Suture-based liver retraction in minimally invasive foregut surgery should be used judiciously until further data is available. Surgeons should maintain a high index of suspicion for tamponade in the setting of postoperative hypotension after its use.

1. Introduction

Cardiac tamponade is an extremely rare complication of hiatal hernia repair, and is almost always associated with fixation of mesh using tacks or other mechanical devices [1]. Additional risk factors include prior history of hiatal surgery and emergency surgery [2]. Acute pericardial hemorrhagic effusion leading to tamponade after hiatal surgery has a high mortality rate, ranging from 42 to 48 % in some series [1,3] reported up to 66 % [4]. Even with prompt recognition, most cases have required aggressive cardiac surgical management for hemorrhage control, with a minority responding to percutaneous methods alone [5].

Robotic hiatal hernia repair (rHH) with fundoplication is a safe operation even in reoperative fields [6]. The robotic platform offers superior optics and dexterity to laparoscopy, theoretically mitigating the risks of inaccurate placement of sutures or other fixatives near the hiatus. Mechanical liver retraction, while performed commonly in foregut

surgery and is generally safe, has been reported to be associated with parenchymal bleeding, liver congestion from compression, elevations in liver enzymes, and vascular injury to the liver [7]. These complications, albeit rare, have led to surgeons exploring alternative techniques for liver retraction and hiatal exposure. The technical ease of robotic intracorporeal suturing has also led to innovation in surgical exposure. Suture-based liver retraction is gaining favor for anatomically suitable cases, eliminating the need for an additional incision in the subxyphoid area which can be associated with pain and obviating potential collision of mechanical retractor holder with robot arms [7]. In this article we report a case of cardiac tamponade following rHH with Toupet fundoplication, which was attributed to the use of a liver sling stitch. The objective of this article is to raise awareness of the possibility of this complication even in the absence of mesh fixation devices, and facilitate early diagnosis for prompt life-saving intervention.

This article has been reported in line with the SCARE criteria [8].

Abbreviations: rHH, robotic hiatal hernia repair; GERD, gastroesophageal reflux disease; PPI, proton pump inhibitor; EKG, electrocardiography; CXR, chest radiograph; TTE, transthoracic echocardiography; IVC, inferior vena cava; ml, milliliter(s); POD, postoperative day.

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2. Case presentation

A 54-year-old patient with history of obesity (BMI 30.2 kg/m²), hypertension, hyperlipidemia, and GERD presented for surgical consultation with typical reflux symptoms refractory to PPI therapy. There was no pertinent toxic, psychosocial or family history. Pathologic reflux was confirmed on pH testing. Endoscopy demonstrated a Hill Grade 4 gastroesophageal flap valve and a 3 cm sliding hiatal hernia. The patient was not on anticoagulation or antiplatelet therapy. The patient had no history of prior foregut or cardiothoracic operations. The decision was made to proceed with rHH and Toupet fundoplication.

The patient was taken to the operating room electively by an experienced robotic surgeon with minimally-invasive and foregut expertise. Access was obtained using the Veress/Optiview technique. All robotic ports and an assistant port were placed under direct laparoscopic visualization. After docking the robot, the patient's anatomy appeared favorable for liver retraction using a sling stitch, which was created using a 0 Stratafix (Ethicon, USA) suture between the anterior crura and the anterior abdominal wall (Fig. 1). However, the patient had hepatosteatosis and, due to concern for laceration of fragile parenchyma, the stitch was removed. The left lobe of the liver was retracted with the fourth robotic arm when needed. Hernia reduction and mediastinal mobilization were uneventful. The hiatus was repaired with four interrupted posterior sutures; no anterior sutures were used. No mesh was required. A Toupet fundoplication was performed in the standard fashion and anchored to the posterior crura, with no anterior gastropexy stitches. There was no hemodynamic instability during the operation and estimated blood loss was 15 cc.

Approximately 5 h post-procedure, the patient developed oliguria and hypotension refractory to crystalloid resuscitation. Laboratory and EKG assessment was unremarkable; there was no significant change in hemoglobin concentration from preoperative values. Portable CXR revealed mild pulmonary edema and a cardiomeastinal silhouette at the upper limit of normal (Fig. 2). Bedside TTE revealed a moderate echogenic pericardial effusion with right atrial and ventricular free wall flattening and a dilated IVC consistent with tamponade physiology (Fig. 3). The patient was taken emergently for fluoroscopy-guided pericardiocentesis with drainage of 200 ml of bloody fluid. A pericardial drain was left in place to gravity drainage. The patient's hemodynamics rapidly improved following the procedure.

Over two days, the volume of drain output tapered. A follow-up TTE revealed trace residual pericardial effusion, and the pericardial drain was removed on POD3. The patient was discharged on POD5 and re-presented on POD9 complaining of chest pain and low-grade fevers, and a diagnosis of pericarditis was made. The patient was started on aspirin and colchicine with improvement in symptoms. Repeat TTE

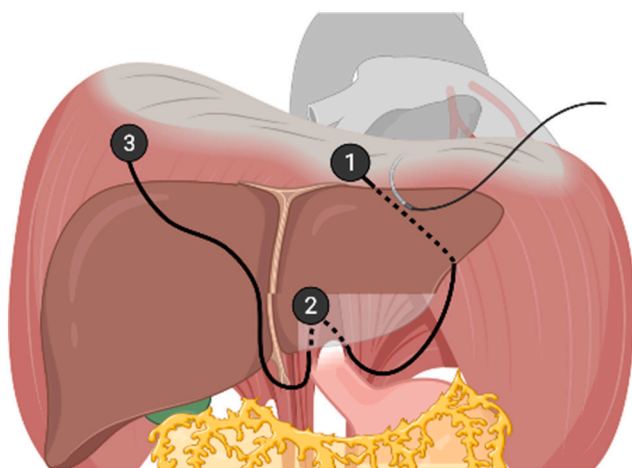


Fig. 1. Liver sling stitch schematic.

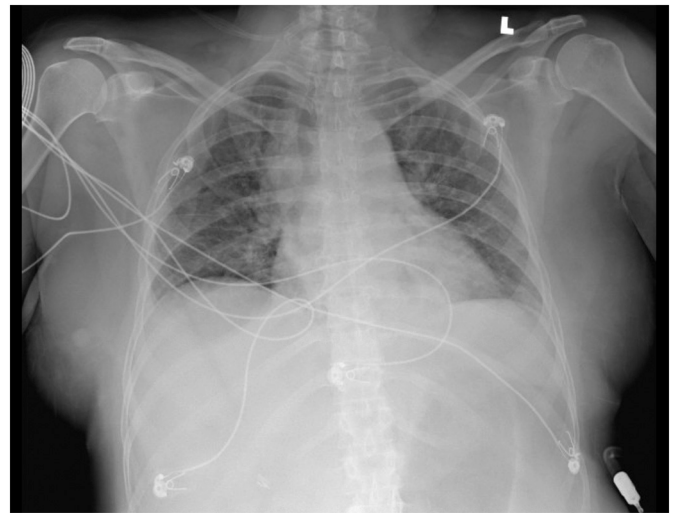


Fig. 2. Portable anterior-posterior chest radiograph demonstrating borderline enlargement of the cardiac silhouette.

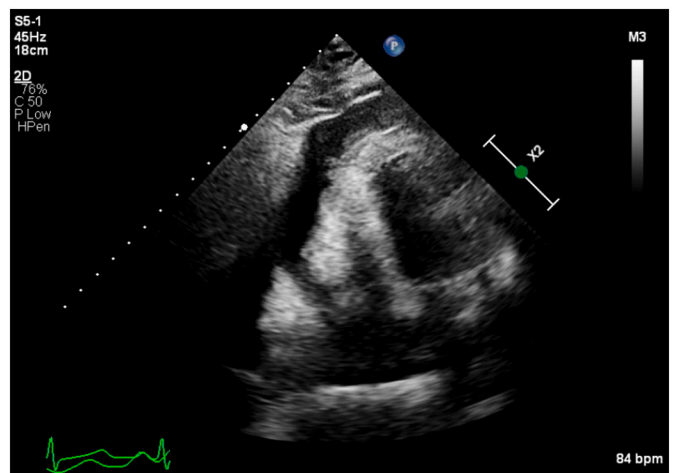


Fig. 3. Apical 4-chamber view demonstrating effusion with right atrial and ventricular collapse.

showed stable size of trace effusion, and the patient was discharged on hospital day 3.

3. Discussion

In this case, we highlight a novel presentation of cardiac tamponade following rHH with fundoplication in the absence of all previously described risk factors for this rare complication. This was classified as a Clavien-Dindo IVa event. The most likely etiology for hemorrhagic effusion in this patient is the placement of a liver sling stitch.

A PubMed database search of the MeSH terms pericardial effusion or pericardial tamponade and hiatal hernia returned 28 articles of which 14 were contextually appropriate. The most recent applicable review was performed by Kockerling et al. [1], who identified 25 reported cases of post-hiataloplasty cardiac complications of which 92 % were attributable to tacks. Only three cases were attributable to sutures used to pexy the fundoplication to crura.

Acute tamponade following hiataloplasty with fixation has been linked to a variety of anatomic injuries, including stapling of the epicardium [3], laceration of a coronary vein [9], tacking of the posterior descending artery [10], and a tack impaling the right ventricle [11]. Since the patient in our case was managed nonoperatively, there was no

confirmation of the location of injury. However, the spontaneous resolution of hemopericardium makes trauma to the heart itself or any major epicardial vasculature unlikely.

Though rare, cardiac tamponade requires prompt diagnosis to prevent hemodynamic collapse. In the Kockerling series [1], 12 (48 %) of the cases were fatal despite cardiac surgical intervention, which is almost always indicated [2]. Only one prior case has been successfully managed with percutaneous drainage alone [5]. In the present case, the patient was initially assessed by a non-surgical rapid response team who recommended CT scan to rule out abdominal hemorrhage. Bedside echocardiography was initiated by the surgical team on their arrival leading to the diagnosis; indeed, CT scan in this situation may have had catastrophic consequences as previously reported [12].

The subacute development of symptomatic pericarditis in this patient may have been prevented by prophylaxis with colchicine [13]. In one prior case of tamponade following hiatal hernia repair, colchicine therapy was initiated before index discharge with successful primary prevention [5]. However, given the hemorrhagic nature of this patient's effusion, the risks of up-front nonsteroidal anti-inflammatory therapy may have been viewed as prohibitive.

The liver sling stitch was devised to replace fixed mechanical liver retraction in anatomically favorable cases. Conventional liver retractors are associated with pain and scarring from additional incisions, radiographic liver injury, and postoperative transaminitis which is usually self-limited [7,14–16]. There are reports of lobar necrosis [17] and cardiac injury [18] due to mechanical retractors, but these are exceedingly rare and none have been reported to be fatal. Suture-based liver retraction methods, in contrast, have been explored primarily in the bariatric and single incision laparoscopic surgical literature [7,19]. They generally have been found to be both safe and effective, with the primary complications being minor liver parenchymal bleeding which can be controlled intraoperatively [7,8]. While suture-based retraction methods offer some advantages over mechanical retractors, this case highlights a novel potential shortcoming of this technique that warrants further scrutiny. When used judiciously, it may be more appropriate to use a 2–0 suture with a small needle and a very shallow bite rather than a 0 suture (used here) anteriorly at the right crus since the thickness of the diaphragm in this location is about 1.5 mm (ref [4]).

4. Conclusion

Mechanical liver retraction is widely used with few serious reported complications, but comes at the cost of additional incisions, pain, and potential collision of retractor holder with robot arms. In comparison, suture-based retraction holds promise, but this case illustrates a potential caution to its widespread use. Cardiac tamponade is an exceedingly rare complication of hiatal hernia repair. However, as demonstrated here, even temporary suture placement anterior to the hiatus may result in supradiaphragmatic injury with hemodynamically significant consequences. Bedside echocardiography is the most rapid method of identifying tamponade and should be performed in all cases of undifferentiated hypotension following hiatal surgery. When tamponade is diagnosed early, percutaneous drainage may be lifesaving and enable patients to avoid emergent cardiac surgery with its attendant morbidities. Consideration should be given to colchicine for pericarditis prophylaxis with careful assessment of the patient's individual risk profile for rebleeding.

Consent

Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

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CRediT authorship contribution statement

Benjamin Wadowski: conceptualised, wrote the manuscript and reviewed the literature. Tanuja Damani: supervised, reviewed the literature, and edited the manuscript.

Research registration (for case reports detailing a new surgical technique or new equipment/technology): N/A.

Declaration of competing interest

None.

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