CASE REPORT
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Direct to the heart: ventricular injury due to percutaneous thoracic catheter

Directo al corazón: lesión ventricular por catéter torácico percutáneo

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ABSTRACT

We present the case of a male patient who was treated in the emergency department for left pleural effusion by means of a thoracic drain. After placement, immediate blood output was obtained. A chest CT scan was performed, as well as an echocardiogram which showed the position of the drainage tube in the left ventricle. Surgical intervention was performed to remove the catheter by left anterior thoracotomy with successful extraction.

Keywords: ventricular perforation, endopleural tube, percutaneous drainage, heart, complication.

RESUMEN

Presentamos el caso de un paciente masculino quien fue tratado en el departamento de urgencias por derrame pleural izquierdo mediante un drenaje torácico. Posterior a la colocación se obtuvo gasto hemático inmediato. Se realizó tomografía de tórax, así como ecocardiograma que evidenció posición de tubo de drenaje en ventrículo izquierdo. Se realizó intervención quirúrgica para el retiro de catéter mediante toracotomía anterior izquierda con extracción exitosa.

Palabras clave: *perforación ventricular, tubo endopleural, drenaje percutáneo, corazón, complicación.*

INTRODUCTION

Pleural effusion is a common complication, occurring in 41% of patients admitted to the intensive care unit and 21% of all hospitalizations.[1] Chest tube placement is a frequently performed procedure in the hospital setting, ranging from emergency situations to postoperative chest drains for elective surgery. Despite its numerous indications and patient benefits, chest tube placement is associated with various complications. These complications can be categorized into early (< 24 hours after placement), occurring in 3% of cases, and late (> 24 hours after placement), occurring in 8-10% of procedures. Organ-specific complications, including esophageal, gastric, intestinal, hepatic, splenic, and diaphragmatic injuries, have been reported. Pulmonary injury is the most frequent complication, and excessive suction can lead to pulmonary infarction. Another serious injury is cannulation of a pulmonary artery, which necessitates surgical repair of the injured vessel.[2]

Percutaneous pleural drainage is one of the most commonly performed procedures in the intensive care unit, ranking among the top three invasive procedures, alongside vascular catheterization and endotracheal intubation.[2] Thoracic ultrasound has emerged as a valuable adjunctive tool, enabling physicians to enhance the success rate of the procedure while minimizing complications.

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Minimally invasive percutaneous thoracic drainage systems have become an essential tool in in-hospital practice. The UNICO® catheter placement is a viable alternative for performing minimally invasive procedures, including thoracentesis, pneumothorax interventions, hemothorax management, and drainage of pleural effusions of neoplastic origin or other fluid collections. The UNICO® system (Redax S.p.A., Poggio Rusco, Italy) comprises a fenestrated polyurethane catheter nested within another catheter, an extension line, an adapter for connection to any chest drainage system, a collection bag, and a set of two syringes. Its innovative two-valve design enables the unidirectional flow of air and fluids out of the cavity, preventing re-entry. This design eliminates the need for the traditional three-way stopcock previously used during fluid evacuation. Notably, the UNICO® system facilitates a minimally invasive approach, allowing for easy bedside placement without requiring operating room positioning.

Filosso et al. presented preliminary results on the placement of small-caliber chest drainage in a specific population with malignant pleural effusion. The study analyzed the placement of UNICO® catheters in seven patients, all of whom had undergone previous thoracentesis for pleural effusion. The procedures were performed at the bedside, and no complications were reported following drain insertion. The median dwell time for the chest tube was 7.2 ± 2.7 days, ranging from 4 to 11 days. Radiographic evidence of lung re-expansion was observed in all patients. Notably, there were no instances of wound infection, displacement, or alteration of drainage. The unique design and characteristics of the UNICO® catheter makes it a safer option for this patient population.[1]

CASE DESCRIPTION

We report the case of a 76-year-old male patient with a 30-year history of type II diabetes and end-stage renal disease (KIDGO G5), managed with hemodialysis. His current presentation began with a generalized tonic-clonic seizure at home, following which he was admitted to a private institution and initiated on diphenylhydantoin. Subsequent to hospitalization, a thoracic computed tomography (CT) scan was performed, revealing radiographic findings consistent with pneumonia and left pleural effusion. The CT report noted a massive left pleural effusion and moderate pericardial effusion. Pulmonology service chose to place a UNICO® percutaneous drainage catheter. Immediately following catheter placement, the output was reported to be completely hemolytic. A follow-up chest CT scan revealed the presence of the catheter in the left ventricle *(Figure 1)*. Upon discovery of this complication, the patient was transferred to the general hospital for further management by the cardiothoracic surgery service.

The patient underwent evaluation by the cardiology service, which included a 2D transthoracic echocardiogram with pulsed Doppler. The echocardiogram revealed left ventricular perforation by the endopleural probe through the lateral wall, with the probe tip extending into the left atrium. Additionally, the mitral valve was compromised by the pleural probe, resulting in moderate insufficiency. The left ventricular ejection fraction was reported as 39%. Global and segmental mobility were abnormal due to global hypokinesia. A severe global pericardial effusion was also noted, with a separation of 34 mm and an approximate volume of 900 ml, indicating tamponade *(Figure 2)*.

After evaluation by the cardiothoracic service, it was decided to perform surgery. A left anterior thoracotomy approach was performed due to the position of the catheter

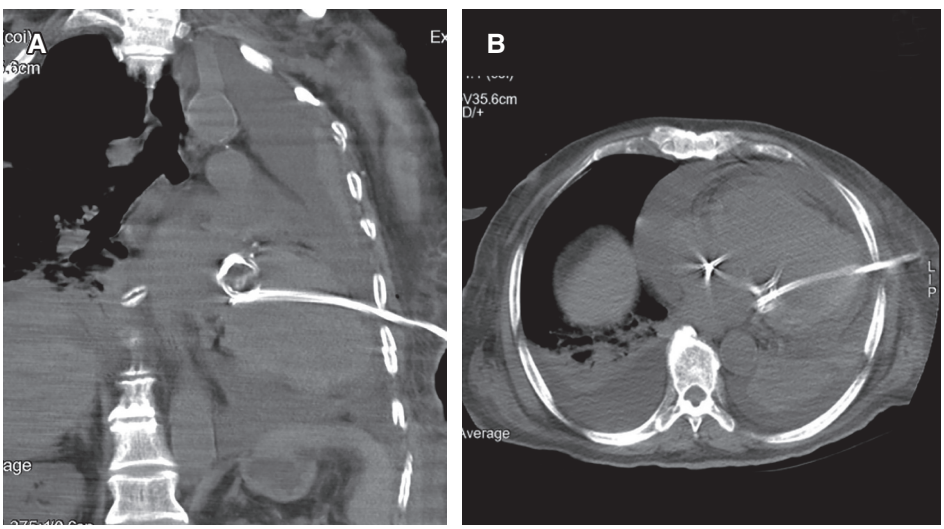

Figure 1:

Tomographic slices showing catheter in ventricular position. **A)** Coronal section. **B)** Cross section, showing the presence of intracardiac catheter.

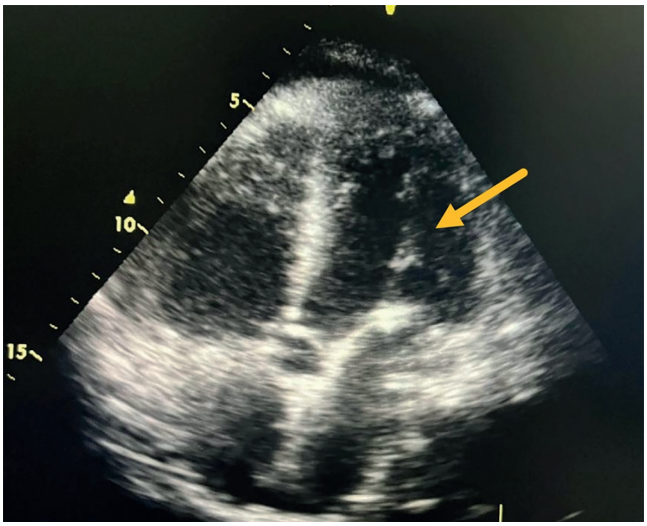

Figure 2: Echocardiogram with evidence of mitral valve lesion and pericardial effusion.

(Figure 3A). The catheter was located in the anterior axillary line, at the level of the intercostal space, visualizing a catheter with a pulsatile trajectory. An incision was made at the level of the sixth intercostal space. Dissection by planes was performed. Pericardium was opened and serohematic liquid was obtained. We visualized a single 12 FR catheter in the lateral wall of the left ventricle at 1cm from the anterior descending artery, without active bleeding *(Figure 3B)*. For catheter removal, two 4-0 polypropylene stitches were placed with 20 × 10 mm Bard® PTFE Felt Pledget Teflon patches. Two mattress stitches with patches were placed around the puncture site. The first stitch *(Figure 4A)* was adjusted prior to placement of the contralateral patch. Once adequate adjustment of both stitches with patch is verified *(Figure 4B)*, the caterpillar is removed while sutures are kept under tension and knots are tied. Adequate hemostasis of the perforation site is observed, adequate closure *(Figure 4C)*. Cardiopulmonary bypass was not required. Subsequently, a Coseal® type surgical sealant was placed. Pericardium is closed and then drains are placed. Conventional plane closure was performed.

After surgery, the patient was transferred to the intensive care unit of the hospital for hospitalization. Transthoracic echocardiographic tracing is performed, showing pericardial effusion with posterior predominance, with 16 mm leaflet separation. Left ventricular ejection fraction of 56% is reported. With preserved mobility. During the stay in the intensive care unit, he was kept under mechanical ventilation, presented with upper gastrointestinal tract bleeding, refractory atrial fibrillation and vasopressor support. He died three days after surgery due to pneumonia and septic shock in intensive care.

COMMENT

Injuries to the left ventricle following chest tube placement are rare, but their occurrence can be lethal. Complications as common as infection, bleeding, and even life-threatening injury to adjacent organs can occur.

Pleural drain placement procedures are the most common procedures performed at the patient's bedside, in the emergency department and even in intensive care. It is important to remember that, despite being a common procedure, it is necessary to follow a process of preparation of the patient, the area where the procedure will be performed and the equipment to be used.[3]

Several cases of ventricular injury due to chest drain placement have been described in the literature. The case reported by Haron H, et al.,[4] involves a patient where the patient suffered ventricular injury with catheter mobility during systole and diastole. A 20 fr chest tube with a sharp metal-tipped trocar was placed. The repair was performed with double sutures. In this case the patient was young with no comorbidities, the treatment was successful and the patient was discharged from the hospital. In the report of Goltz JP, et al.[5] where the lesion involved the anterolateral wall of the left ventricle, crossing the ventricle through the mitral valve, to the left atrium and into the contralateral lung. The tube used in this case was Pleuracan® (B. Braun, Melsungen, Alemania). A left anterolateral thoracotomy was performed, not specifying the approach. Although the patient was older (ninth decade of life), he was successfully discharged from the hospital. Kim D, et al.,[6] reported a case where a Prime-S® (Sungwon Medical, Cheongju, Corea) catheter was used, which does not contain a metallic trocar. In this case a lesion was reported in the left ventricle, crossing the aortic valve, with the tip located in the ascending aorta. In this case, open mini-thoracotomy was performed, the catheter was removed, but the myocardium was not repaired. Hospital evolution was hindered by pneumonia and prolonged mechanical ventilation. The patient died. Ahn S, et al.,[7] reported a right ventricular injury, with injury to the hepatic vein via the inferior vena cava. In this case a Thal-Quick® (Cook Medical, Bloomington, USA) chest tube was used. This type of catheter consists of an introducer needle. The resolution of this case was performed by interventionism, where an Amplatzer® (Abbott Medical, Nathan Lane North Plymouth, MN, USA) device was used as a vascular plug.

Injuries caused by percutaneous catheters or chest tubes are rare. The prevalence of these injuries depends on the preparation and careful technique of the physician performing the procedure. Injuries that are usually significant and life-threatening involve injuries to the lungs, cardiac structures, neighboring organs such as the liver, diaphragm, stomach or spleen.[5]

Since Beck, in 1926, described the physiology of the cardiac buffering triad, the diagnosis of cardiac injury has evolved. Ventricular lesions represent a challenge. Repair

can be complicated by tachycardia due to bleeding. It is suggested that 2-0, 3-0 or 4-0 polypropylene sutures be used for ventricular repairs. The sutures should contain folding. In lesions proximal to the coronary arteries, mattress sutures are used to ensure hemostasis.[8] In our case, mattress stitches were performed during the approach in order to achieve hemostasis. In our reported case no coronary artery injury was involved.

The repair of ventricular lesions depends on the rapid identification of the lesion and the appropriate protocol. The success of the treatment is determined from the transfer of the patient to an adequate hospital, access to necessary resources, such as blood bank, supplies, operating room and prepared equipment. Coordination between the surgical and resuscitation teams is a key point for success.[9] The cardiothoracic surgeon is a fundamental part in these cases. The preparation and experience is fundamental in this case to achieve a surgical plan that will be successful.

CONCLUSIONS

Ventricular injury following chest tube insertion is rare but lethal when it occurs. Although it is a procedure that is performed numerous times in hospitals, it usually has a minimal percentage of minor complications. Even in inexperienced hands the occurrence of these injuries is extremely rare. The presentation of this case highlights the

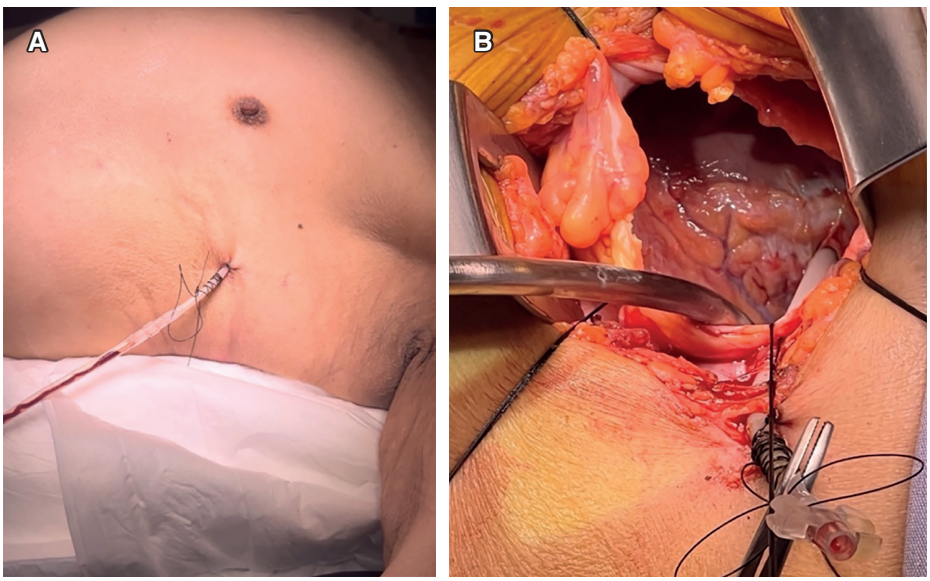

Figure 3:

A) Catheter with pulsatile trajectory.
B) Catheter in ventricular position.

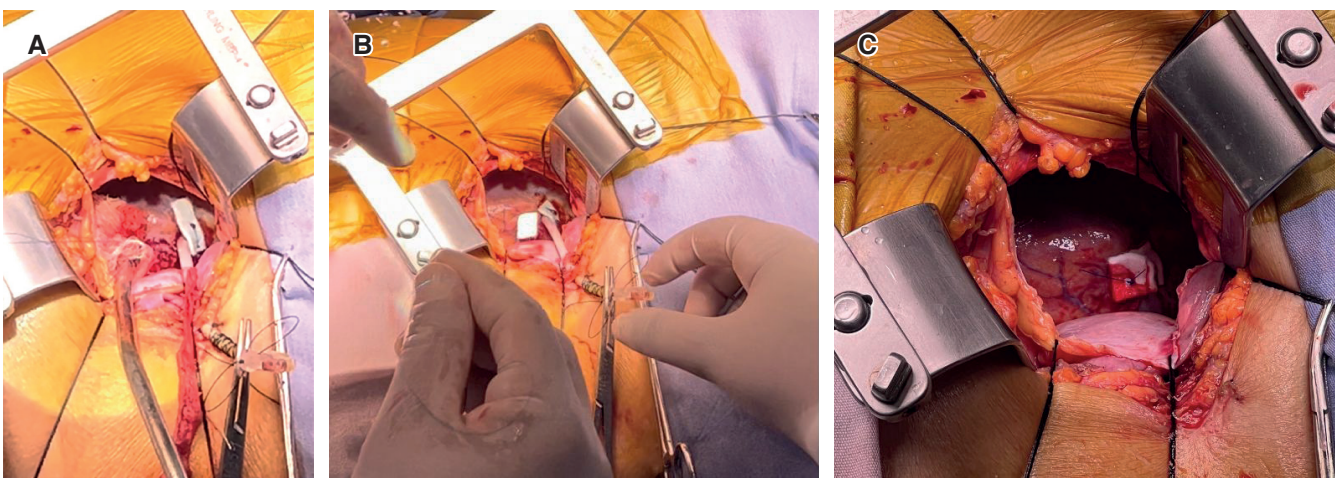

Figure 4: A) First mattress point with pledgeted. **B)** Second contralateral mattress point. **C)** Verification of hemostasis following mattress point adjustment.

importance of knowing the proper technique for chest tube insertion, as well as the identification of the classic safety points. This report serves as a reminder to trainee physicians of the critical importance of theoretical knowledge and fundamental skills in clinical practice.

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REFERENCES

1. Vetrugno L, Guadagnin GM, Orso D, Boero E, Bignami E, Bove T. An easier and safe affair, pleural drainage with ultrasound in critical patient: a technical note. Crit Ultrasound J. 2018;10(1):18. doi: 10.1186/s13089-018-0098-z.
2. Kwiatt M, Tarbox A, Seamon MJ, et al. Thoracostomy tubes: a comprehensive review of complications and related topics. Int J Crit Illn Inj Sci. 2014;4(2):143-155. doi: 10.4103/2229-5151.134182.
3. Filosso PL, Sandri A, Felletti G, Ruffini E, Lausi PO, Oliaro A. Preliminary results of a new small-bore percutaneous pleural catheter used for treatment of malignant pleural effusions in ECOG PS 3-4 patients. Eur J Surg Oncol. 2011;37(12):1093-1098. doi: 10.1016/j.ejso.2011.09.037.
4. Haron H, Rashid NA, Dimon MZ, et al. Chest tube injury to left ventricle: complication or negligence? Ann Thorac Surg. 2010;90(1):308-309. doi: 10.1016/j.athoracsur.2010.01.075.
5. Goltz JP, Gorski A, Böhler J, Kickuth R, Hahn D, Ritter CO. Iatrogenic perforation of the left heart during placement of a chest drain. Diagn Interv Radiol. 2011;17(3):229-231. doi: 10.4261/1305-3825.DIR.3131-09.0.
6. Kim D, Lim SH, Seo PW. Iatrogenic Perforation of the Left Ventricle during Insertion of a Chest Drain. Korean J Thorac Cardiovasc Surg. 2013;46(3):223-225. doi: 10.5090/kjtcs.2013.46.3.223.
7. Ahn S, Moon MH, Park CB, Suh JH. A chest tube misplaced in the heart? Eur J Cardiothorac Surg. 2018;53(5):1091-1092. doi: 10.1093/ejcts/ezx412.
8. Hromalik LR Jr, Wall MJ Jr, Mattox KL, Tsai PI. Penetrating cardiac injury: a narrative review. Mediastinum. 2023;7:15. doi: 10.21037/med-22-18.
9. Ball CG, Lee A, Kaminsky M, Hameed SM. Technical considerations in the management of penetrating cardiac injury. Can J Surg. 2022;65(5):E580-E592. doi: 10.1503/cjs.008521.