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CASE REPORT: CLINICAL CASE

Isolated Chylopericardium in an Infant With Hypoplastic Left Heart Syndrome

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ABSTRACT

Isolated chylopericardium is an exceedingly rare complication in any age group. Review of the limited published case series shows the most common cause of isolated chylopericardium to be cardiac surgery. We present a case of isolated chylopericardium after a bidirectional Glenn procedure in an infant with hypoplastic left heart syndrome. (**Level of Difficulty: Intermediate.**) (J Am Coll Cardiol Case Rep 2020;2:2115–9) © 2020 The Authors. Published by Elsevier on behalf of the American College of Cardiology Foundation. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/).

A 7-month-old female infant with a fetal diagnosis of hypoplastic left heart syndrome (HLHS) was born at full term to a 17-year-old primigravid mother. The child's past surgical history was significant for a Norwood procedure with Sano shunt placement at 4 days of life and the need for balloon angioplasty of the Sano shunt, right pulmonary artery, and coarctation of aorta at 2 months of age for persistent desaturation and oxygen dependency. At 6 months of age, she underwent a bidirectional Glenn procedure in addition to an atrial septectomy and bilateral pulmonary arterioplasties (as indicated in **Figure 1**).

LEARNING OBJECTIVES

- To recognize the need for a high degree of suspicion for CP following congenital heart surgery in children who have a persistent pericardial effusion and evidence of cardiopulmonary insufficiency.
- To consider early management of persistent post-operative CP after congenital heart surgery with surgical drainage for rapid resolution and decrease in length of stay.

Her post-operative course was complicated by a parainfluenza virus infection requiring noninvasive positive pressure ventilation and inhaled nitrous oxide support. On post-operative day (POD) 4, a transthoracic echocardiogram (TTE) revealed a trivial pericardial effusion. She recovered gradually and was started on her home formula of completely hydrolyzed protein.

Given her persistent supplemental oxygen dependency and respiratory distress, a repeat TTE was done on POD 28, and it showed a moderate-size pericardial effusion extending circumferentially. On physical examination, she was in mild to moderate respiratory distress with tachypnea and equal air entry in bilateral lung fields. No gallop, muffled heart sounds, or friction rub were auscultated. She received

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ABBREVIATIONS AND ACRONYMS

CP = chylopericardium

CT = computed tomography

HLHS = hypoplastic left heart syndrome

LET = left efferent lymphatic trunk

POD = post-operative day

RET = right efferent lymphatic trunk

TTE = transthoracic echocardiogram

prednisolone, furosemide, and ibuprofen out of concern for post-pericardiotomy syndrome. The electrocardiogram was significant for only sinus tachycardia and right ventricular hypertrophy.

Her oxygen requirement persisted; thus a repeat TTE (Figure 2) was completed on POD 43 and showed a moderate pericardial effusion with fibrous stranding, located predominantly in the posterior (1.4 cm) and apical (9 mm) regions. As seen in Figure 3, computed tomography (CT) of the chest depicted an enhancing pericardial effusion suggesting lipid-rich content. Hounsfield units for this effusion were +6 to −6. Hounsfield units quantify radiodensity on CT, and these values did not align with expected values of, for example, blood (+13 to +75). At this point, the decision was made to drain the pericardial fluid with pericardial window creation. Figure 4 indicates the pericardial effusion on transesophageal echocardiogram before the pericardial window creation.

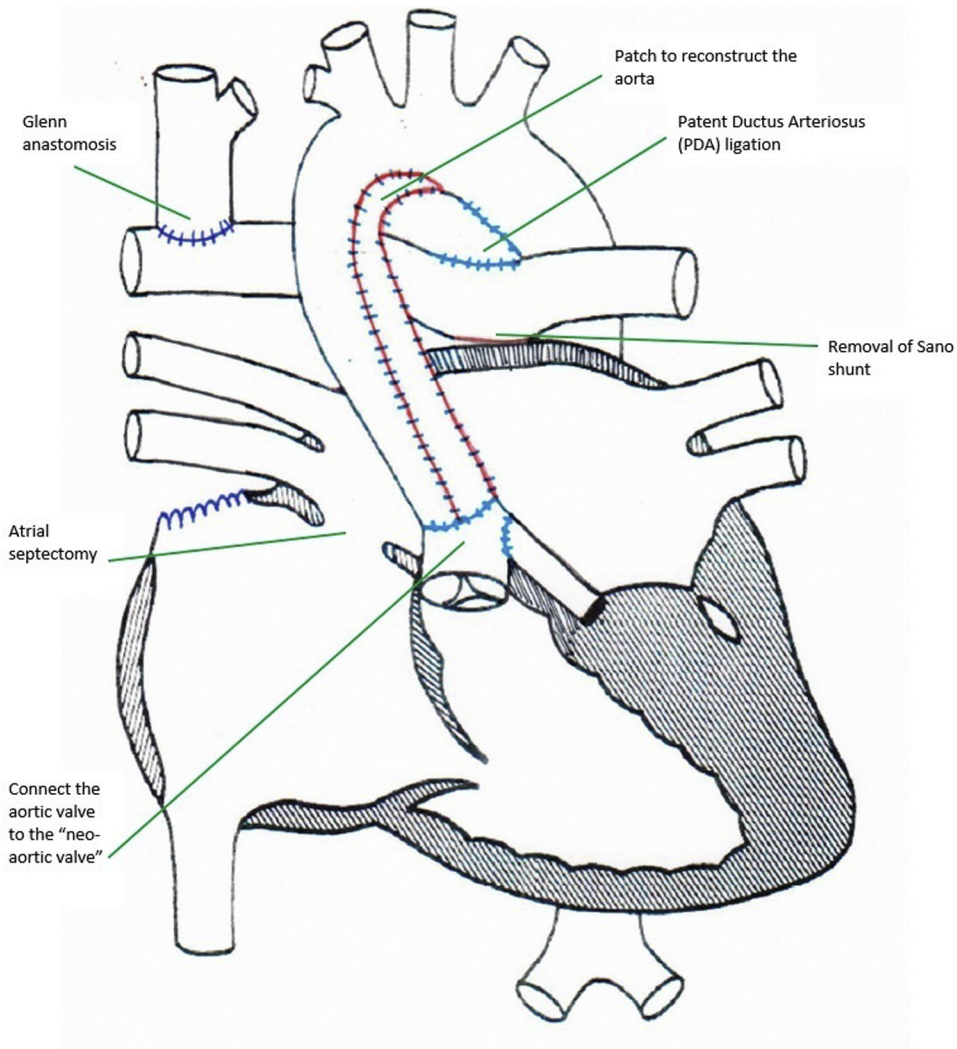
PAST MEDICAL HISTORY

Her past medical history included HLHS.

DIFFERENTIAL DIAGNOSIS

The differential diagnosis included post-pericardiotomy syndrome, pericardial effusion, hemopericardium, chylopericardium (CP), and cardiac tamponade.

FIGURE 1 Patient's Anatomy After Glenn Shunt Placement



Hypoplastic Left Heart s/p Bidirectional Glenn

INVESTIGATIONS

Milky pink pericardial fluid was aspirated; studies demonstrated a positive chylomicron screen and a triglyceride level of 660 mg/dl. Total pericardial nucleated cells were 16,330/μl with the differential showing 100% lymphocytes. The concurrent serum triglyceride level was 72 mg/dl.

MANAGEMENT

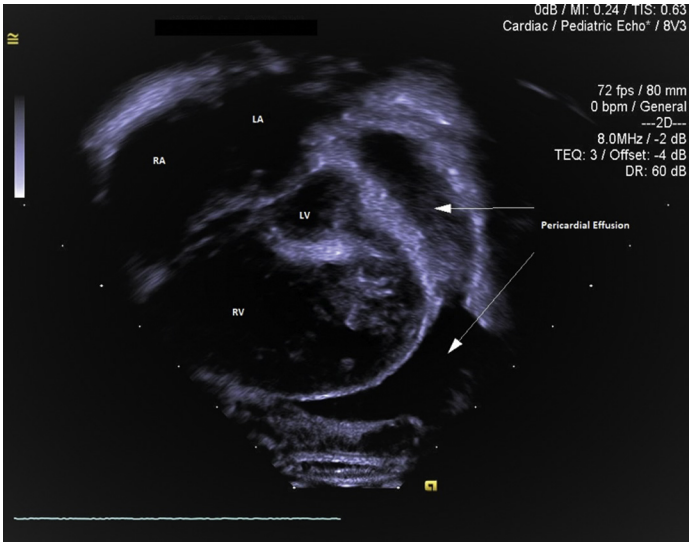
Because of her prolonged hospitalization and persistent oxygen dependency, the decision was taken to drain the pericardial effusion surgically over a trial of a low-fat diet. As determined during the cardiothoracic surgery evaluation, the effusion was not accessible by a percutaneous route. She underwent pericardial window creation with drain placement that drained copious, milky, loculated fluid inferior to the heart. She was kept nil per os and supported with total parenteral nutrition soon after pericardial window creation. The drain was removed after 2 days. She was placed on a low-fat enteral formula subsequently.

DISCUSSION

An isolated CP is a rare occurrence in pediatrics. A literature review done by Yu et al. (1) looking at all case reports (adult and pediatric) of primary or idiopathic CP from January 1950 to December 2015 noted that idiopathic cases accounted for about 35% of all the reported cases. The most common cause of CP in pediatrics is a complication of congenital heart surgery. The incidence of isolated CP in children remains unknown apart from a few published reports from single-center studies. Reports published from single centers of CP following cardiac operations have noted an incidence of 0.12% to 0.22% (2,3), representing 0.0004% to 0.15% of the complications of cardiac surgery (4). Most cases were treated with pericardiocentesis or a low-fat or medium-chain triglyceride diet. Treatment of prolonged drainage with pericardial-peritoneal shunting has been suggested as well (5).

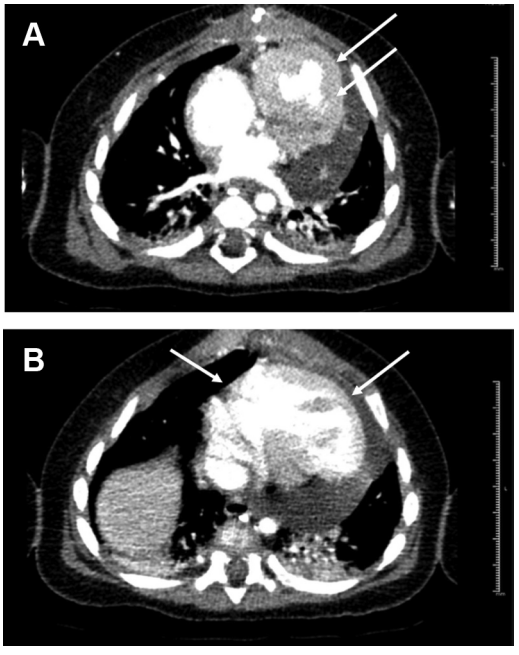
There is a double layer of lymphatic networks that drain pericardial surfaces. The anterior surface drains into pericardial fat and areolar tissue lymphatics, whereas the posterior surface drains into the lymphatics of the reflected mediastinal pleura (6). Any impairment of this drainage during surgery in this region can lead to the formation of a CP. Among intrathoracic tributaries of the thoracic duct, about 9% of them arise from the heart. Major tributaries are the right and left efferent lymphatic trunks (RET and

FIGURE 2 Transthoracic Echocardiogram Demonstrating Moderate Pericardial Effusion in 4-Chamber View



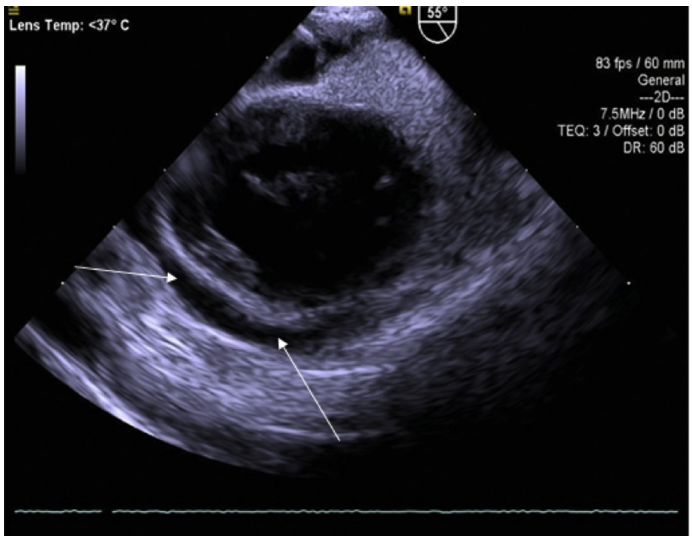
LA = left atrium; LV = left ventricle; RA = right atrium; RV = right ventricle.

FIGURE 3 Axial Computed Tomography Showing Pericardial Fluid



(A and B) Chest slices demonstrating enhancing pericardial fluid **(arrows)**.

FIGURE 4 Transesophageal Echocardiogram With Pericardial Effusion



Pericardial effusion **(arrows)**.

LET, respectively) (7). The LET arises from the left ventricle and ascends behind the main pulmonary artery to drain into the thoracic duct after joining the right paratracheal lymph nodes. The RET, conversely, arises from the right ventricle and travels between the ascending aorta and the main pulmonary artery, then left of the thymus gland to drain into the thoracic duct. Because of this anatomic course of RET, surgery manipulating major vessels has the potential to injure the RET inadvertently and contribute to the development of CP (7). Published reports also note post-operative leaks in thymic lymphatic tissue that are associated with CP (3). This observation also explains the higher incidence of CP in children compared with adults because children have thymic tissue rich in lymphatics.

There are 2 classes of clinical presentations described. Some patients present asymptomatically wherein the intrapericardial drain begins to drain chylous fluid during the post-operative period. The second and more common presentation consists of signs of tamponade in the few weeks after surgery; initially, these cases can be more difficult to differentiate from post-pericardiotomy syndrome (2). The review by Yu et al. (1) noted that the asymptomatic presentation accounts for close to 40% of all cases, and the most common symptoms at presentation have been dyspnea (44%) and cough (11%).

CP has been observed to have a higher association with particular surgical procedures, namely cavopulmonary anastomosis (because of exposure of the lymphatic system to the high venous pressure system), atrioventricular canal defect, and tetralogy of Fallot (2,3,8). The development of a CP is also associated with Down, Noonan, and Turner syndromes. Increased lymphatic permeability secondary to congenital lymphatic dysplasia is the most likely risk factor for CP in these children (3).

The diagnosis of CP is primarily based on the hematologic and chemical analysis of pericardial fluid. Lymphocytic predominance in the drainage fluid and high triglyceride content when compared with the serum are diagnostic for CP. Defining CP with an absolute triglyceride level may lead to false negative results because these children are either nil per os or on a restricted-fat diet for the conservative management of their CP and can have a low overall serum triglyceride level that translates to a low level in the pericardial fluid.

Conservative management of CP includes ruling out other reversible causes (e.g., jugular venous thrombosis), draining the chylous fluid, limiting total fluid intake, and instituting a low-fat diet with medium-chain triglycerides. Patients with refractory cases may require complete cessation of an enteral diet and support with parenteral nutrition until the drainage resolves. Use of somatostatin analogue infusion, intended to limit splanchnic blood flow, is also recommended to decrease overall lymphatic flow. Patients with persistent high chylous output may benefit from surgical intervention in the form of a thoracic duct ligation or chemical or surgical pleurodesis. A review by Yu et al. (1), looking at total of 104 adult cases, reported that in a majority (71%) of patients, the conservative approach was unsuccessful, and surgical interventions were needed, including pericardial window creation, thoracic duct ligation, thoracic duct embolization, and pericardioperitoneal shunt. We have not come across studies looking at a comparison of percutaneous versus surgical drainage of pericardial effusion, but a single-center retrospective study in adults showed no difference in mortality between the 2 techniques but a higher recurrence rate with percutaneous drainage (9).

FOLLOW-UP

By 3 days after pericardial window surgery, she was transitioned to room air with no distress. She remained hemodynamically stable and was discharged home on POD 7. No reaccumulation of pericardial effusion was noted on outpatient follow-up

visits with pediatric cardiology in her hometown 2 weeks after the discharge.

CONCLUSIONS

CP is an exceedingly rare occurrence in the pediatric patients, with a post-cardiac surgery complication representing the most common cause. It is even less common in children without any known syndromes or chromosomal abnormalities. We report this rare case where not only did CP develop in the patient after a bidirectional Glenn procedure, but also the diagnosis was suggested retrospectively on the basis of echogenicity of the fluid detected on imaging, including CT and TTE. CP is particularly dangerous because it can lead to tamponade physiology if left untreated. This rare condition is difficult to treat with conservative measures, as reported by Yu et al. (1) from their extensive review; therefore, early surgical interventions should be considered.

AUTHOR DISCLOSURES

The authors have reported that they have no relationships relevant to the contents of this paper to disclose.

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REFERENCES

1. Yu X, Jia N, Ye S, Zhou M, Liu D. Primary chylopericardium: a case report and literature review. Exp Ther Med 2018;15:419–25.

2. Campbell RM, Benson LN, Williams WW, Adatia I. Chylopericardium after cardiac operations in children. Ann Thorac Surg 2001;72:193–6.

3. Kan CD, Wang JN, Wu JM, Yang YJ. Isolated chylopericardium after intrapericardial procedures: possible role of inadvertent right efferent lymphatic trunk injury. Tex Heart Inst J 2007;34:82.

4. Pitol R, Pederiva JR, Pasin F, Vitola D. Isolated chylopericardium after cardiac surgery. Arq Bras Cardiol 2004;82:384–6.

5. Chan BB, Murphy MC, Rodgers BM. Management of chylopericardium. J Pediatr Surg 1990;25:1185–9.

6. Eliskova M, Eliska O, Miller AJ. The lymphatic drainage of the parietal pericardium in man. Lymphology 1995;28:208–17.

7. Riquet M, Barthes FLP, Souilamas R, Hidden G. Thoracic duct tributaries from intrathoracic organs. Ann Thorac Surg 2002;73:892–8.

8. Densupsoontorn N, Jirapinyo P, Wongarn R, et al. Management of chylothorax and chylopericardium in pediatric patients: experiences at Siriraj Hospital. Bangkok. Asia Pac J Clin Nutr 2005;14:182.

9. Saltzman AJ, Paz YE, Rene AG, et al. Comparison of surgical pericardial drainage with percutaneous catheter drainage for pericardial effusion. J Invasive Cardiol 2012;24:590.

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