Case Report

Chylothorax after Off-pump Coronary Artery Bypass Graft Surgery: Management Strategy

Abstract

Chylothorax is a rare complication after cardiac surgery but is associated with morbidity and mortality. The most common cause of chylothorax is damage to or avulsion of thoracic duct by electrocautery during left internal thoracic artery harvesting for coronary artery bypass graft (CABG) surgery. We describe a case of chylothorax after off-pump CABG, which was successfully treated with thoracostomy tube drainage, withholding of oral intake, total parenteral nutrition and subcutaneous octreotide, a somatostatin analog, and chemical pleurodesis.

Keywords: *Chylothorax, octreotide, off-pump coronary artery bypass graft*

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Introduction

Chylothorax is a rare complication after cardiac surgery but is associated with morbidity and mortality.[1] The most common cause of chylothorax is damage to or avulsion of thoracic duct by electrocautery during left internal thoracic artery (LITA) harvesting for coronary artery bypass graft (CABG) surgery. We describe a case of chylothorax after off-pump CABG, which was successfully treated with thoracostomy tube drainage, withholding of oral intake, total parenteral nutrition (TPN) and subcutaneous octreotide, a somatostatin analog, and chemical pleurodesis.

Case Report

A 52-year-old man was admitted to our hospital with triple-vessel disease for CABG surgery. After midline sternotomy, the left pleura was incised and LITA was harvested using electrocautery. LITA was anastomosed to the left anterior descending artery; reversed saphenous vein graft was anastomosed to distal circumflex and acute marginal artery on a beating heart (off-pump CABG). He was successfully extubated after 6 h of surgery. The chest drains were removed on the 2nd postoperative day. The patient was shifted to ward on the 3rd postoperative day. However, on the 6th postoperative day, the patient became very dyspneic; X-ray chest and ultrasound scan revealed massive pleural effusion on the left side [Figure 1]. He was shifted to intensive care unit and a left pleural drain was inserted. Around 2400 ml of milky fluid was drained [Figure 2]. The fluid was analyzed in laboratory which showed triglyceride levels of 448 mg/dL, and cholesterol level was 84 mg/dL confirming the diagnosis of chylothorax. He was kept nothing by mouth; TPN with a low-fat diet rich in medium-chain fatty acids and calorie intake restricted to 1500 Kcal/day was administered. Subcutaneous octreotide (Sun Pharmaceutical, Ind.) 100 units three times a day was started. Over 4 days, the amount of drainage through chest tube reduced to 450 ml/day. On the 11th postoperative day, pleurodesis was done using 25 ml of 7.5% povidone-iodine (Win Medicare, India) diluted in 25 ml of saline 0.9% and 10 ml of 2% lignocaine (Neon Laboratories, India). Chest drain was left clamped and the patient's position rotated for 1 h after which the clamp was released and fluid allowed to drain out without negative suction application.[2] Chest drain was removed on the 14th postoperative day [Figure 3]. He was discharged on the 15th postoperative day. His follow-up X-ray after 1 month was clear.

Discussion

Lymphatic system was first described by Aristotle and the anatomist Herophilus and Erasistratus in 300 B.C. In 16th century, Vesalius named the thoracic duct as the

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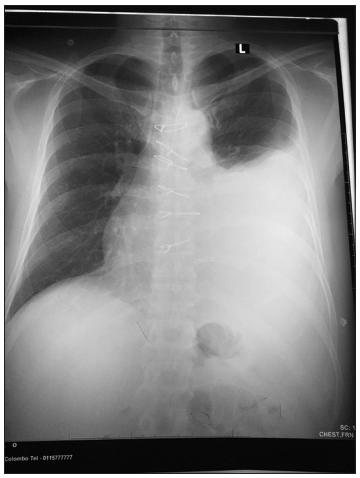

Figure 1: X-ray shows massive left pleural effusion day 5

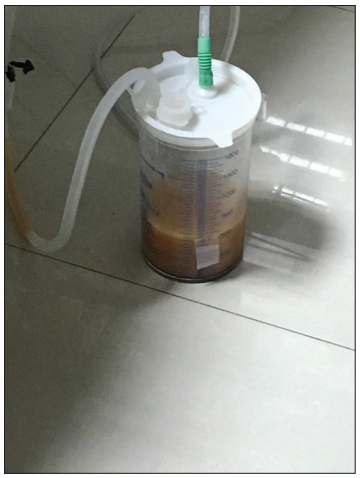

Figure 2: X-ray shows milky white color fluid in drainage bottle

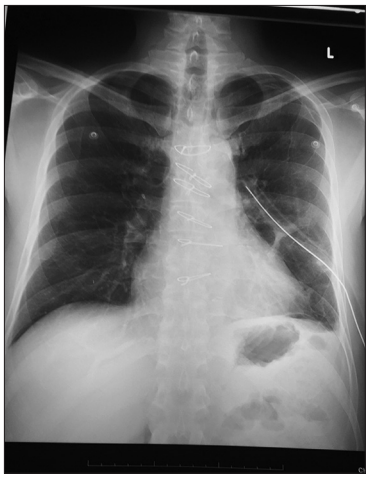

Figure 3: X-ray revealed complete resolution of pleural effusion day 14

vena alba thoracis, because it contained milky white fluid. Longelot in 1663 first described a traumatic chylothorax. Chylothorax as a possible complication of surgery was first described by Blalock in 1936.[3] Later on, injuries to the thoracic duct and its tributaries resulting in chylothorax have been described after almost any thoracic, mediastinal, cardiac, and neck surgery.[4] Although chylothorax after myocardial revascularization procedure is rare, it does occur particularly when LITA is harvested. The thoracic duct is the larger of the two lymph ducts of the lymphatic system. It is also known as left lymphatic duct, alimentary duct, chyliferous duct, and Van Hoorne's canal. The other duct is the right lymphatic duct. It carries chyle, a liquid containing both lymph and emulsified fats rather than pure lymph. In adults, it is typically 38–45 cm in length and has an average diameter of about 5 mm. The vessel usually starts from the level of the 12th thoracic vertebra (T12) and extends to the root of the neck. It drains into the systemic (blood) circulation at the angle of left subclavian and internal jugular veins as a single trunk at the commencement of the brachiocephalic vein. It collects most lymph in the body other than from the right thorax, arm, head, and neck which are drained by the right lymphatic duct. In adults, the thoracic duct transports up to 4 L of lymph per day. When the thoracic duct is blocked or damaged, a large amount of lymph can quickly accumulate in the pleural cavity leading to chylothorax. In our case, it is probably because of disruption or dissection of thoracic duct where it drains into subclavian-jugular venous junction. In majority of the patient, it is a small branch avulsion instead of complete transection of the thoracic duct when surgeon attempts to harvest maximum length of LITA. The use of electrocautery during LITA harvesting appears to be chief destructive mechanism. The abnormalities of lymphatic collateral circulation may be possible cause of chylothorax.[5]

Chylothorax is diagnosed and differentiated from other forms of effusion (pseudochylothorax) on the basis of chemical analysis of the pleural fluid aspirate in a laboratory. A characteristic finding is the presence of chylomicron particles about 0.5–1.0 mm in size, made up of proteins and lipids (long-chain triglycerides) that are absorbed and transported directly through the lymphatic pathways.[6]

Chylothorax is present in 99% of patients when triglyceride content is >110 mg/dL and a cholesterol content <200 mg/dL, whereas a triglyceride concentration <50 mg/dL almost rules out chylothorax. Pseudochylothorax, which is also milky, is characterized by a cholesterol concentration of >200 mg/dL and lower triglyceride content (<110 mg/dL) (cholesterol: triglyceride ratio >1). Most cases of chylothorax are exudative (high protein and low lactate dehydrogenase), but in about 25% of cases, it can be transudate. Transudative effusions indicate hepatic (portal hypertension and cirrhosis) or cardiac etiology.[7]

About 50% of patients with untreated chylothorax die from the resulting complications.[7] If chylothorax occurs postoperatively, 30-day mortality goes up five-fold.[8]

The octreotide is an octapeptide that resembles natural somatostatin pharmacologically. It was first synthesized

in 1979 by chemist Wilfred Bauer. Exact mechanism of the action of octreotide in chylothorax is uncertain. It is proposed that it causes mild vasoconstriction of splanchnic vessels including hepatic venous flow. This leads to the reduction of gastric, pancreatic, and intestinal secretions as well as intestinal absorption. These mechanisms collectively reduce the flow of chyle. Animal studies have shown that it is effective in treating thoracic duct injury by reducing chyle drainage and allowing early fistula closure.[9,10] Surgical intervention has been suggested in adults if daily loss of chyle over a 5-day period exceeds 1000 ml/day.[11]

Ligation of the thoracic duct for chylothorax is carried out surgically. The main difficulty in surgical intervention is identifying the thoracic duct or the leak. This becomes easier if cream is administered intraoperative through Ryle's tube. If duct is still not identifiable, mass ligation of tissues in the presumed course of the thoracic duct can be tried.[12]

Lymphangiography provides considerable diagnostic information and should be carried out before any therapeutic measures.[13] Methylene blue should not be used as it can stain the surrounding tissues and can make finding the leak extremely difficult.[11]

Minimally invasive techniques such as video-assisted thoracoscopic surgery are successful in clipping thoracic duct and application of fibrin glue.[14] Pleuroperitoneal shunt should be reserved if there are excessive chylus leaks of 1–2 weeks' duration with >1000 ml/day.[15] Percutaneous embolization of thoracic duct can even lead to healing in patients who have been unsuccessfully treated with surgery.[16]

In congenital heart disease, procedures predisposing to increased systemic venous pressure have the risk of postoperative chylothorax, particularly bidirectional cavopulmonary shunt operation, Fontan-type procedures, and right ventricular failure after repair of tetralogy of Fallot. In addition, some closed heart procedures such as Blalock-Taussig shunt, repair of aortic coarctation, and ligation of persistent ductus arteriosus may case chylothorax. Unilateral as well as bilateral chylothorax has been reported after central venous cannulations through neck vessels.[17]

Once the diagnosis is established by biochemical analysis of pleural fluid, the first step should be to drain the fluid to improve lung mechanics. The patient should be kept nil by mouth and observe daily for total amount of drainage. Pleurodesis or surgical intervention should be kept in mind as an important alternative for leakage of high volume or long duration. Ligation of thoracic duct should be considered when persistent leakage rates are more than 1000 ml/day over 5 days of strict starvation, when chyle leakage lasts longer than 2 weeks, or when nutritional or metabolic complications are feared.

In conclusion, we describe a case of postoperative chylothorax following off-pump CABG procedure. Chylothorax probably occurred as a result of damage due to electrocautery while harvesting LITA. Cornerstone of treatment in high-volume symptomatic chylothorax is continuous drainage to allow the lung to re-expand and optimize lung function. Adequate fluid and electrolyte replacement with appropriate parenteral nutrition and withholding patient's oral intake, subcutaneous octreotide, and pleurodesis are keys to fasten the proess of healing and successful recovery.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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