Chylothorax: a complication after internal thoracic artery harvesting

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Chylothorax is a rare but serious complication of cardiac surgery. A 64-year-old man with three-vessel disease underwent coronary artery bypass grafting. Ten days later he developed left pleural effusion. An intercostal drain was inserted and 1600 ml of pale pink, milky fluid were obtained. The results of biochemical analysis were consistent with chyle. The diagnosis of a left chylothorax was made. Conservative treatment consisting of total parenteral nutrition and pleural drainage was successfully employed. In the literature we found 17 cases in which the development of chylothorax after a coronary revascularization procedure is described.

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Introduction

The accumulation of chyle within the pleural cavity (chylothorax), first reported by Blalock et al.[1] in 1936, is a well-recognized complication of thoracic surgery. Chylothorax occurs in 0.25 to 0.5% of the cardiac operations performed through thoracotomy incisions[2]. Such an event is an even more unusual complication after cardiac operations performed through median sternotomy and very few cases have been reported in the literature. Only 17 cases of such a complication after coronary artery bypass grafting (CABG) are described in the literature. In most of these cases left internal thoracic artery (LITA) harvesting had been performed. In the present case report, we describe the development of chylothorax 10 days after a CABG procedure.

Case report

A 64-year-old man with unstable angina was admitted to our institution. The patient's history included hypercholesterolemia, dislipidemia and chronic obstructive bronchopneumopathy. One year before admission, he experienced a non-Q wave anterolateral myocardial infarction. Coronary angiography revealed critical stenosis (90%) of the middle-third segment of the left anterior descending artery and a stenotic lesion (80%) of the first obtuse marginal artery. The right coronary artery presented a 75% stenotic lesion before the crux. The patient underwent a CABG procedure. Anesthetic venous access was achieved using a single right-sided internal jugular venous catheter. At surgery, the LITA was harvested according to the pedunculated technique including incision of the pleurae and excision of the thymus. Cardiopulmonary bypass was established using a single two-stage venous cannula and the arterial return was to the ascending aorta. Intermittent anterograde cold blood cardioplegia and moderate hypothermia (32°C) were employed. No tape was passed around the aorta, and the pulmonary artery was not dissected. The two saphenous veins were grafted to the posterior descending artery and obtuse marginal artery, and the left internal mammary artery was anastomosed to the left anterior descending artery. The early postoperative course was uneventful. The patient was discharged from the intensive care unit on the first postoperative day.

On the sixth postoperative day the patient presented an aseptic dehiscence of the inferior third of the sternal wound. One day later he developed progressive shortness of breath. A chest X-ray showed a pleural effusion occupying more than one third of the left hemithorax. An intercostal catheter drain was inserted and 1600 ml of a pale pink, milky flu-

id were obtained. Results of the biochemical analysis of the pleural liquid were consistent with sterile chyle (Table I). The patient was kept on a "nil by mouth" regimen and total parenteral nutrition was initiated. Parenteral nutrition consisted of essential amino acids (60 g/2000 ml/24 hours) and glucose (400 g/2000 ml/24 hours) for a total calorie intake of 1600 kcal. A left-sided pleural drain was kept in place and a closed-chest drainage system was set up. The total serum protein level was reduced (5.97 g/dl), but not significantly compared to the preoperative level (6.86 g/dl). Drainage of 600 ml of yellowish fluid per day persisted for the next 6 days and diminished progressively within the next 5 days. The patient was not feverish and felt well. By the eleventh day of parenteral nutrition, chylous drainage had completely stopped. The patient was placed on a normal diet and chylothorax did not recur; all drains were removed on the fourteenth day following the initiation of parenteral nutrition. The wound dehiscence was completely healed on the fifteenth postoperative day. Repeat chest X-ray was performed before discharge. There was no evidence of pleural effusion. The patient was discharged on the twenty-fifth postoperative day. Subsequent evaluation at 3 months of follow-up revealed that the patient's conditions were satisfactory and that there was no recurrence of chest pain. Chest X-ray did not reveal the presence of any pleural effusions.

Table I. Laboratory data of the drained pleural fluid and of serum.

Parameter	Drained pleural fluid	Serum
White blood cell (/mm^3)	3900	7900
Sodium (mEq/l)	146	146
Potassium (mEq/l)	4.6	4.4
Chloride (mEq/l)	112	114
Protein (g/dl)	3.6	6.86
Glucose (mg/dl)	174	105
Cholesterol (mg/dl)	64.7	206
Triglycerides (mg/dl)	815.6	131
Microbiology	No growth at 72 hours	

Discussion

The thoracic duct is the main collecting channel of the lymphatic vessels. It arises in the abdomen in front of the second or third lumbar vertebra and it runs through the aortic hiatus of the diaphragm proceeding upwards between the esophagus and the vertebrae. At the level of the fourth thoracic vertebra, it curves leftwards towards the transverse process of the seventh cervical vertebra. In that area it bends anteriorly and inferiorly to reach the left internal jugular-left subclavian vein junction where it drains.

The etiology of chylothorax after cardiac surgery is thought to involve disruption or dissection of the thoracic duct where it drains into the subclavian-jugular venous junction. Another possible cause of left chylothorax following the LITA harvesting procedure is the disruption of the collateral lymphatics, proximal to the jugular-subclavian venous junction, where they terminate in the azygos, brachiocephalic and intercostal veins. Other possible etiologies have been proposed such as increased superior vena cava pressure, due to the use of tapes or to venous thrombosis, during cardiopulmonary bypass, causing obstruction to the drainage of chyle and further inducing extravasation[3-5]. Pollard et al.[5] suggest that occlusion of the thoracic duct by thrombosis leads to a rise in pressure within the lymphatic system, and back-flow from this through ruptured lymphatic vessels is the pathophysiological basis of postoperative chylothorax. In the present case report, there was no evidence of venous thrombosis.

Seventeen cases of chylothorax after CABG were found in the literature (Table II)[6-21]. In 13 of them the LITA was harvested. In 2 other patients the right internal thoracic artery was harvested. We can hypothesize that lymphatic injury in patients undergoing LITA or right internal thoracic artery harvesting occurs at the time of dissection performed in order to maximize the conduit's length, near the proximal end of the pedicle. For this reason, it is recommendable that electrocautery dissection be avoided when the subclavian vessels are exposed, due to the fact that lymph contains less coagulable material than plasma (Table I) and as a consequence lymphatic leakage cannot be controlled by such a method.

The timing of the development of chylothorax after CABG is quite variable in the series reported in the literature and ranges from 2 to 90 days. However, in most of the reported cases, patients presented evident chylothorax within 2 weeks of surgery, confirming the close relationship between surgical dissection and this complication. In 3/17 cases, patients presented with associated chylopericardium, with chyle accumulation in the pericardial cavity, probably due to the disruption of the cardiac lymphatic channels in the pericardial reflections during surgery[20].

A variety of management regimens have been employed for the treatment of chylothorax. Initial therapy is conservative. Some authors prefer pleural drainage and substitution of dietary fat with medium-chain triglycerides to reduce its volume[9]. If voluminous drainage persists despite such therapy, they indicate total parenteral nutrition as a second therapeutic step in the management of this complication. Other authors successfully employed pleural drainage, and if necessary pericardial drainage[20] combined with total prolonged parenteral nutrition[21]. Such a therapeutic scheme applies the principles of minimizing chyle formation, preventing immune deficit and maintaining adequate drainage and nutrition. In our patient we successfully employed the

Table II. Chylothorax following a coronary artery bypass grafting procedure.

Author	Age (years)	Sex	Surgical procedure/LITA	Chyle location	Time interval between surgery and development of chylothorax (days)	Associated invasive treatment
Weber et al.[6], 1981	55	M	CABG/Yes	Mediastinum	2	Chest drainage
Kshettry and Rebello[7], 1982	51	M	CABG/No	Left thorax	30	Chest drainage
Di Lello et al.[8], 1987	53	M	CABG/Yes	Left thorax	9	Left thoracotomy
Zakhour et al.[9], 1988	73	M	CABG/Yes	Left thorax	90	Chest drainage
Zakhour et al.[9], 1988	59	M	CABG/No	Mediastinum	2	Chest drainage
Czarnecki et al.[10], 1988	61	F	CABG/Yes and RITA	Right thorax	42	Right thoracotomy
Chaiyaroj et al.[11], 1993	69	F	CABG/Yes	Left thorax	6	Left thoracotomy
Bogers et al.[12], 1993	NA	M	CABG/Yes	Left thorax	NA	Left thoracotomy
Wood and Ullyot[13], 1994	69	M	CABG/Yes	Left thorax	2	Left thoracotomy
Davies and Spyt[14], 1994	48	M	CABG/Yes	Left thorax	21	Left thoracotomy
Zaidenstein et al.[15], 1995	70	F	CABG/No	Left thorax	NA	Chest drainage
Yamaguchi et al.[16], 1996	64	M	CABG/Yes	Left thorax	2	Left thoracotomy
Priebe et al.[17], 1999	75	F	CABG/Yes	Left thorax	NA	Chest drainage
Perez et al.[18], 1999	68	M	CABG/Yes	Left thorax	10	Chest drainage
Venturini et al.[19], 1999	67	M	CABG/Yes and RITA	Left thorax	70	Left thoracotomy
Sharpe et al.[20], 1999	63	F	CABG/No	Mediastinum and left thorax	11	Chest and pericardial drainage
Pego-Fernandes et al.[21], 1999	38	M	CABG/Yes	Left thorax	90	Chest drainage
Brancaccio et al., 2000	64	M	CABG/Yes	Left thorax	7	Chest drainage

CABG = coronary artery bypass grafting; LITA = left internal mammary artery; NA = not available; RITA = right internal mammary artery.

same therapeutic protocol. It was not necessary to resort to a surgical approach. Such an approach should however be taken into consideration in case of loculation, incomplete drainage, or persistent loss of chyle. The problem of reoperation is that the source is not always easy to identify. Other authors report a very good outcome for the surgical approach in case of chylothorax[13,14]. The best surgical approach seems to be left thoracotomy or right thoracotomy in cases with left or right chest chylothorax respectively. Such an approach permits the surgeon to control and to find the leaking duct, which should be ligated. Pleurodesis should be induced to make the cure more certain[22].

In conclusion, on the basis of our experience and of the reported cases we recommend pleural and, eventually pericardial drainage, in combination with total parenteral nutrition as the therapeutic protocol of choice for patients with chylothorax. In cases with continuous loss of chyle, surgical exploration is required.

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