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CASE REPORT

Treatment of Thoracic Duct Injury Using a Combination of Percutaneous and Artificial Hematoma Techniques

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Abstract

Here, we report a successful case of a 22-year-old male patient with percutaneous closure of the thoracic duct (TD) using percutaneous techniques guided by computed tomography combined with nodal lymphography and embolization. The therapy was successful, with complete cessation of thoracic drainage. Chylothorax embolization is described as a minimally invasive technique that includes percutaneous transabdominal catheterization of the cisterna chyli and embolization of the TD at the point of leakage. The main advantages of these minimally invasive techniques are the use of only local anesthesia, low morbidity and mortality rates, fast response as well as the use of lymphography to identify points of leakage and anomalies in the branches of the thoracic duct. The success rate of TD embolization is over 70% of patients without appreciable morbidity or mortality. Here, we report a successful case of a 22-year-old male patient with percutaneous closure of the thoracic duct (TD) using percutaneous techniques guided by computed tomography combined with nodal lymphography and autologous clot embolization. The therapy was successful, with complete cessation of thoracic drainage.

Key Words: *Thoracic duct; Chylothorax; Percutaneous techniques; Embolization; Surgical ligation; Computed tomography*

Introduction

The thoracic duct (TD) arises from the cisterna chyli (CC) in the upper abdomen and drains lymph through multiple branches to the left jugular or subclavian veins [1-3]. Chylothorax is characterized by the presence of chyle in the pleural space. It is classified, in accordance with etiological factors into congenital, traumatic, neoplastic, and miscellaneous. Trauma is the most common cause and is often iatrogenic (stemming from a surgical procedure) [4]. Esophagectomy is perhaps the most common iatrogenic cause of chylothorax, with an incidence of 4% [4].

Low chylothorax output (<500 mL/day) is generally treated conservatively (drainage), whereas cases of high volume (1000 mL/day) are traditionally treated with thoracic duct ligation [5]. However, percutaneous closure of the thoracic duct (PCTD) has emerged as a minimally invasive procedure with

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better clinical outcomes and lower morbidity than conservative management or surgical intervention [6-9]. The original PCTD, by Constantin Cope in 1999, involves bilateral lymphangiography followed by transabdominal catheterization of the CC or TD. After catheterization, the TD is occluded below the point of chyle leakage or TD abnormality with embolization to stop the leak [6]. Coils and/or N-butyl cyanoacrylate (N-BCA) glue may be used as an embolizing material [6-8,10].

Although rare in incidence, the general approach to chylothorax varies and there are no studies that give a clear answer to questions regarding how best to treat chylothorax. Here, we report a successful case of PCTD using percutaneous techniques guided by computed tomography (CT) combined with nodal lymphography (NL) and embolization, which was obtained ethics committee approval.

Presentation of Case

A 22-year-old male patient presented for to aortic surgical correction at our Institute. The patient had systemic arterial hypertension secondary to coarctation of the aorta (CoA) and ascending aortic aneurysm diagnosed the previous year. Aortic root reconstruction was performed with biological aortic valve prostheses and the CoA was repaired by a bypass between the ascending thoracic aorta and descending thoracic aorta. On the ninth postoperative day, the patient presented with fever and shortness of breath chest imaging was done, which showed a moderate pleural leak on the right side. Thoracentesis and chest drainage were performed, with the removal of 2,700 mL of fluid with pus. After the procedure, the patient exhibited excessive drainage of serous fluid, reaching 4,550 ml/24 h. Analysis of the pleural fluid revealed triglycerides >110 mg/dL and cholesterol >200 mg/dL. A low-fat diet was initiated as the management strategy and fluid drainage was maintained at 500 to 700 mL/day.

One month after thoracentesis, NL revealed leakage of contrast in a branch that composed the plexiform TD, located adjacent to the anastomosis of the aortic bypass (Figure 1). As the TD was plexiform, direct catheterization of thin branches for percutaneous transabdominal intervention was unsuccessful. The decision was made to perform embolization following direct percutaneous puncture of the duct lesion using the posterior transpulmonary route. Guided by CT, the active region of leakage was embolized with cyanoacrylate, associated with lipoid, with the aid of a 22-gauge needle.

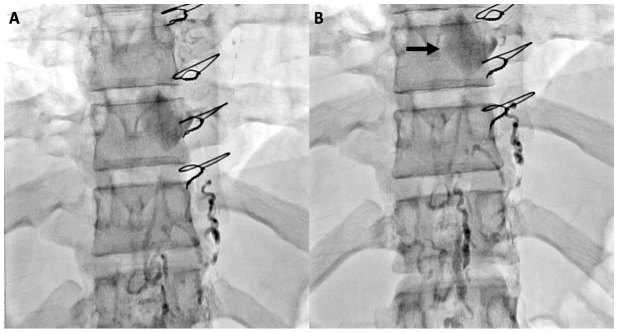

Figure 1) *Nodal lymphography after coarctation of the aortic and ascending aortic aneurysm. (A) Plexiform thoracic duct. (B) Leakage of contrast in plexiform thoracic duct (arrow).*

To cause a compressive effect that could reduce the lymphatic pressure of the plexiform thoracic duct and avoid recanalization of the fistula, a hematoma was induced. At the same surgical time of embolization, the topography adjacent to the CC was reached through the percutaneous route and right paravertebral access. The needle was positioned in the retrocrural region posterolateral to the right abdominal aorta. 40 mL of autologous blood were administered, followed by 10 mL of absolute alcohol and iodinated contrast, forming a stable hematoma, close to fluid leakage. Alcohol was used to cause a local inflammatory process and make the blood clot more stable, promoting a greater amount of time of compressive effect. The final volume of 10 mL of absolute alcohol associated with iodinated contrast (9:1 alcohol/iodinated contrast ratio) was the lower amount needed to involve all the blood clot (Figure 2). This procedure was performed

Figure 2) *Computed axial tomography during percutaneous technique on the thoracic duct. (A) Direct percutaneous puncture of the duct lesion using the right posterior transpulmonary route. (B) Right paravertebral access with the needle positioned in the retrocrural region to form an artificial hematoma. (C) Computed tomography after artificial hematoma (arrow).*

with local anesthesia and anesthetic support.

Octreotide therapy was initiated, and the low-fat diet was maintained. Thoracic drainage ceased and the drainage device was removed three days after NL. The patient was discharged in November with a good respiratory pattern, no limb edema and no signs of pleural leakage on the radiography (Figure 3).

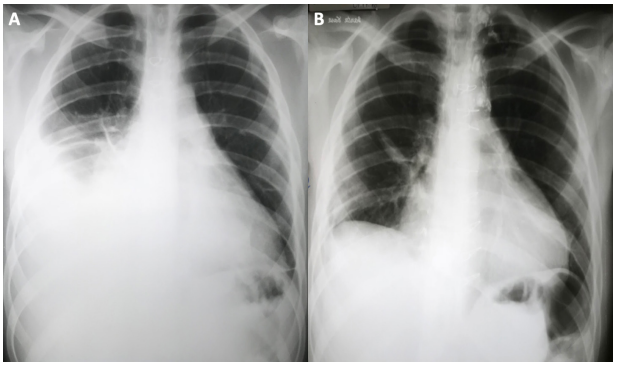

Figure 3) *Chest radiography in posteroanterior view before and after percutaneous embolization of the thoracic duct. (A) Image shows moderate pleural leakage on the rightside view, after surgical procedure of correction of coarctation of the aorta correction and aneurysm of the ascending aorta and before percutaneous embolization of the thoracic duct. (B) Image one week after percutaneous embolization of the thoracic duct, with improvement in pleural leakage.*

Discussion

Chylothorax is characterized by the presence of chyle in the pleural space. Loss of chyle and lymph into pleural space can lead to variable consequences because of the loss of essential molecules such as proteins, immunoglobulins, fat, vitamins, electrolytes, and water [11]. In the early stages, patients are usually able to compensate, but if left untreated, chylothorax promotes hydroelectrolytic disorders, hypoproteinemia and immunosuppression [12,13].

Low-output chylothorax (about 500 mL/day) is traditionally treated conservatively, with pleural drainage, a low/medium-fat diet or total parenteral nutrition, with or without octreotide therapy [14]. With failed conservative management for chyle leakage, surgical intervention protocols have been advocated [15]. This case revealed an unsuccessful conservative treatment that required a CT guided plexiform TD embolization. In complicated or no obvious trauma cases, imaging techniques such as CT, magnetic resonance or bipedal lymphangiography of the thorax may be required.

Chylothorax embolization is described as a minimally invasive, three-step process consisting of bilateral lymphangiography followed by percutaneous transabdominal catheterization of the CC and embolization of the TD at the point of leakage or occlusion using coils and/or glue [6-8]. In this case report, the conventional Cope technique was enhanced in an attempt to cause a compressive effect and allow for faster recovery, by accelerating the inflammatory process. Then, it was planned a technique based on hydraulic mechanisms that influence mechanical forces and flow mechanisms on vessel occlusion. Moreover, injection of absolute alcohol into the TD assists with occlusion of the point of chyle leakage. This technique has already been reported in portal vein embolization through inflammatory pathological and imaging findings [16]. In addition to the reduced time to recover, in this study, we used NL, a technique that improved imaging guidance during TD embolization and demonstrated reduction of the procedure time [17,18].

The American College of Radiology recommends lymphangiography and TD embolization as a treatment for chylothorax [19]. The main advantages of these minimally invasive techniques are the use of only local anesthesia, low morbidity and mortality rates and fast response as well as the use of lymphography to identify points of leakage and anomalies in the branches of the thoracic duct [7]. A recent meta-analysis of lymphatic interventions found that the success rate of thoracic duct embolization approached 80% with a major complication rate of 2.4% [20]. The success rate is directly related to the ability to catheterize the CC or TD [9]. The use of an embolic liquid may influence too. Studies have shown that the use of embolic liquid with coils has a high success rate of embolization (91% of effectiveness) compared to the use of coil only (84% effectiveness) [8]. In addition, the ability to visualize the cisterna CC/TD, operator experience, patient's clinical condition at the start of treatment and the patient's variations in TD anatomy may affect the success of catheterization [8,21]. In some cases, percutaneous transabdominal catheterization of the TD followed by embolization is technically impeded due to anatomic anomalies, such as the duct being completely plexiform, which is a rare finding described in 1% of cases [22]. In this reported case, although plexiform anatomy, the patient was discharged without signs and symptoms related to chylothorax. In such difficult cases, one option is direct puncture at the extravasation point, with the drainage of lymphatic fluid followed by sclerotherapy/embolization [23].

Cases with modifications in the material and protocol of the TD embolization have shown success [24-27]. Technical adjustments to meet individual requirements are important as long as they do not miss the basic principles of the technique. Moreover, to publishing the modifications increased clinical application and innovation [21].

In the present case report, we describe the direct

puncture of the point of chylous leakage followed by embolization, together with measures that certified the effectiveness of treatment, such as mechanical compression of the CC by a modified hematoma (autologous clot and absolute alcohol), a low-fat diet and octreotide therapy. This case report demonstrates a procedure that has not previously been described as a minimally invasive technique for chylothorax. The therapy was successful, with the complete cessation of thoracic drainage on the fifth day after surgery.

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