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CASE REPORT

Percutaneous Embolization of a Chylous Leak from Thoracic Duct Injury in a Child

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Abstract Postoperative chylous leak may result from thoracic duct injury during surgical procedures in the chest or neck and can be successfully treated with percutaneous embolization. We report the case of a child with persistent chylothorax and chyloperitoneum following multivisceral transplantation, which was performed due to unresectable inflammatory myofibroblastic tumor of the retroperitoneum. Intranodal lymphangiography was used to demonstrate the site of chylous leak from the lower segment of the thoracic duct and the leak resolved within days following percutaneous embolization of the thoracic duct.

Keywords Chylothorax · Thoracic duct · Embolization · Transplantation

Introduction

Persistent postoperative chylous leak secondary to laceration of the thoracic duct can be challenging to manage with serious sequelae including loss of essential proteins, immunoglobulins, fat, vitamins and electrolytes. The condition is associated with high morbidity due to malnutrition, cachexia, pulmonary complications, immunosuppression, and sepsis [1]. Percutaneous thoracic duct embolization, guided by lymphangiographic localization of the leak, is a successful, minimally invasive alternative to open surgical ligation of the thoracic duct [2, 3]. While this approach is well described in adult patients, it is sparsely reported in the pediatric literature.

In this report, we present a child who developed persistent chylothorax and chyloperitoneum following multivisceral transplantation. The thoracic duct leak was localized using intranodal lymphangiography and was treated successfully with percutaneous embolization.

Case Report

Institutional review board approval was not required by our hospital for publishing a retrospective case report. In keeping with the ethical conduct of studies, the principles of the Declaration of Helsinki were followed.

A 9-year-old girl with a large unresectable inflammatory myofibroblastic tumor of the retroperitoneum (Fig. 1) underwent multivisceral transplantation. Transplantation of the distal esophagus, stomach, liver, pancreas, duodenum, small intestine, and spleen was successfully performed. The operation was technically challenging, with extensive resection of tumor that extended into the crura of the diaphragm and the thoracic cavity. Bilateral chest tube placement also was performed.

One week following transplantation, and following the removal of the right surgical chest tube, the patient developed a large right chylus pleural effusion. The high-volume effusion (approximately 2 liters/day, weight 25 kg) was drained with a pigtail catheter. Following 8 weeks of unsuccessful medical therapy (including diet modification), intranodal lymphangiography was performed with the aim

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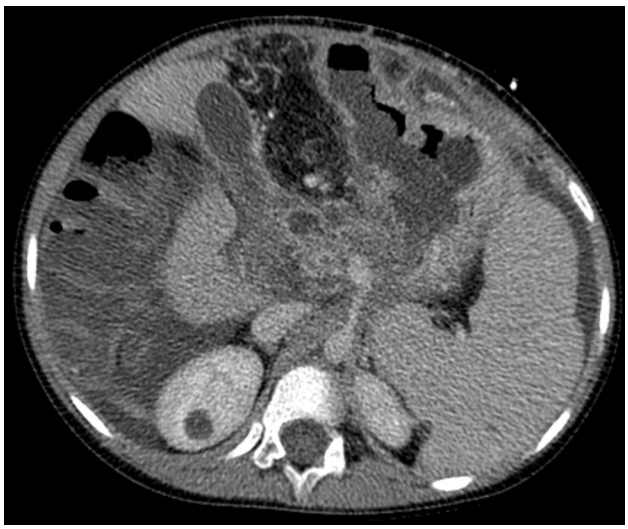

Fig. 1 Enhanced abdominal CT scan image demonstrating a large, tethering soft-tissue mass centered in the root of mesentery with encasement of the pancreas, aorta, celiac artery, and IVC. *Note* diffuse duodenal wall thickening, ascites, and a simple right renal cyst

of localizing the chylous leak and performing percutaneous embolization on postoperative day 55.

Intranodal lymphangiography was performed according to the standard technique [4]. A 23-gauge needle was inserted into a right femoral lymph node under sonographic guidance. Slow infusion of ethiodized contrast (Lipiodol Ultra-Fluid, Laboratoire Guerbet, France) under intermittent pulsed fluoroscopy demonstrated normal femoral, iliac, and lumbar lymphatic vessels. Contrast flowed through the cisterna chyli into the caudal aspect of the thoracic duct from which point contrast leaked freely into the right pleural cavity. The cisterna chyli was accessed percutaneously under fluoroscopic guidance with a 22-gauge Chiba needle. A 0.018-inch NiT-Vu microwire (AngioDynamics, Queensbury, NY) was advanced into the thoracic duct. Unfortunately, attempts to advance a 0.021 inch Renegade STC 18 microcatheter (Boston Scientific, Natick, MA) were unsuccessful and access was lost. Further attempts to cannulate the cisterna chyli and thoracic duct were unsuccessful. Despite needle manipulation of the cisterna chyli, no change in the volume of the pleural effusion was noted.

A week later, repeat intranodal lymphangiography, re-demonstrated the leak from the caudal aspect of the thoracic duct. Percutaneous access into the thoracic duct via the anterior abdominal wall at the level of L1 vertebra was achieved under fluoroscopic guidance using a 21-gauge Chiba needle. The position of the needle tip was confirmed by injection of a small amount of contrast (Optiray 320, Mallinckrodt, Hazelwood, MO). The needle was removed over a 0.018-inch V-18 control microwire (Boston Scientific). A 0.021-inch Prowler Plus Select microcatheter

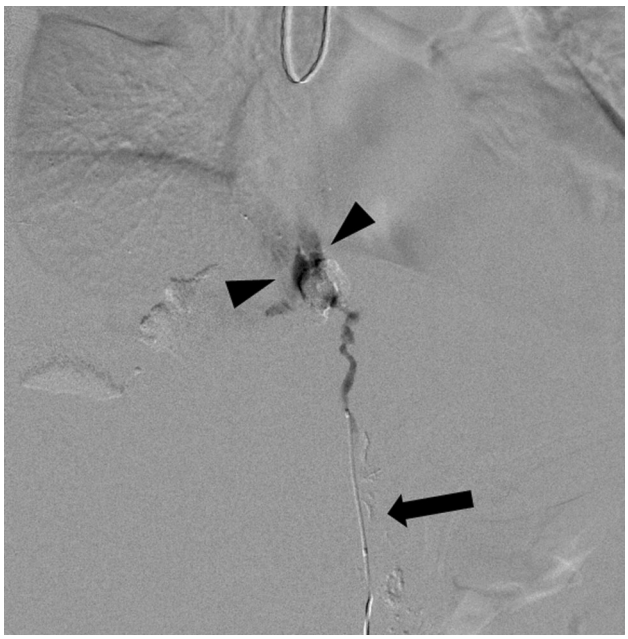

Fig. 2 Digital subtraction lymphangiography. The microcatheter was introduced into the cisterna chyli (*arrow*) then to the thoracic duct. *Note* truncation of the thoracic duct and leak into the right pleural space (*arrowheads*)

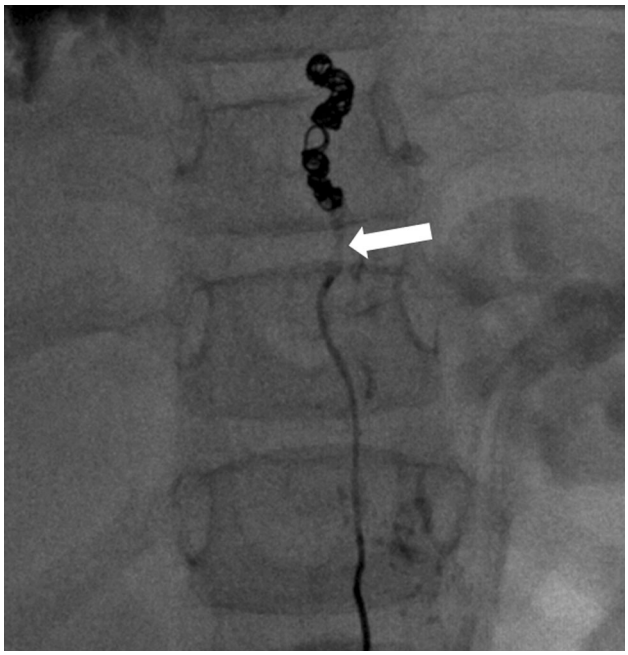

Fig. 3 Embolization of the thoracic duct below the level of leak with coils and glue (*arrow*)

(DePuy, Warsaw, IN) was advanced over the wire. A contrast study confirmed the position of the tip of the catheter just caudal to the level of leak (Fig. 2). The thoracic duct below the level of the leak at the level of T10

vertebra was embolized under fluoroscopic guidance using 3–4 mm, 018 Interlock fibered helical 2D and VortX Diamond coils (Boston Scientific) buttressed by a small amount of 50 % n-butyl cyanoacrylate glue (Trufill, Cordis Endovascular, Miami Lakes, FL; Fig. 3). The microcatheter was immediately removed. The patient tolerated the procedure without complications and the chylous leak gradually resolved; the chest tubes were removed 2 weeks following the procedure. Serial chest radiographs, up to 4 months following the procedure, showed no evidence of effusion.

Discussion

The incidence of chylothorax in children undergoing cardiothoracic surgery is low [5]. Whereas trauma to the thoracic ducts is typically a complication of thoracic surgical procedures, the occurrence of chylothorax also has been reported following abdominal operations [6]. Conservative management of chylothorax is the preferred initial therapy, with modified diet (low-fat, medium-chain triglycerides, parenteral nutrition, and supplemental elements), drainage of effusions and administration of octreotide [7] forming the mainstay of traditional treatment. Surgical interventions include thoracic duct ligation, mechanical pleurodesis, and application of fibrin glue. Surgical thoracic duct ligation has a success rate of up to 70 % in children refractory to medical therapy [8]. Percutaneous, minimally invasive thoracic duct embolization has been used to obliterate the thoracic duct with successful outcome in more than two-thirds of adult patients with posttraumatic chylothorax, including patients with failed surgical thoracic duct ligations [9]. Percutaneous thoracic duct embolization requires localization of the site of the chylous leak with lymphangiography, which can be particularly challenging in children [3]. Intranodal lymphangiography provides a simple and safe alternative to the conventional pedal lymphangiography [4].

Although increasingly well-described in adults [10], the published experience in embolization of the thoracic duct for persistent postoperative chylothorax in children is limited. As demonstrated in this case report, percutaneous embolization of the thoracic duct guided by intranodal lymphangiography could potentially offer a safe, minimally invasive therapy in children, obviating the need for tedious pedal lymphangiography and, importantly, avoiding the risks associated with surgical reintervention.

Conclusions

Successful intranodal lymphangiography and percutaneous thoracic duct embolization for iatrogenic thoracic duct injury may be performed safely in children. With adequate institutional experience, this minimally invasive technique could be considered as the first line of treatment.

Conflict of interest Aisling L. Snow, Wibke Uller, Heung Bae Kim, and Ahmad I. Alomari certify that there is no actual or potential conflict of interest in relation to this article.

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