after surgery, its efficacy is yet to be proven. Differences in outcome may be related to different dosing. The dose remains empirical but we recommend approximately 3–5 $\mu g \cdot kg^{-1} \cdot h^{-1}$ intravenously for up to 3–5 days. Causes of venous obstruction should be sought and relieved.

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Octreotide and Low-Fat Breast Milk in Postoperative Chylothorax

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Chylothorax is a rare complication following cavo-pulmonary connection and can lead to significant morbidity in infants and young children. We report here the case of a 3-month-old infant who underwent bilateral cavo-pulmonary connections, and developed severe chylothorax refractory to the usual conservative and surgical treatments. His chylothorax resolved after using a combination of parenteral octreotide (Sandostatin, Novartis Pharmaceuticals, East Hanover, NJ) and low-fat breast milk.

(Ann Thorac Surg 2004;77:2215–7)

CASE REPORTS

Chylothorax occurs in 0.9% to 1.5% of pediatric patients following cardiac surgery [1, 2]. It leads to fluid and electrolyte disturbances, protein-calorie malnutrition, coagulopathy, and increased susceptibility to infections [1]. Conservative management includes pleural drainage for greater than or equal to 2 to 3 weeks combined with either enteral low-fat formula, or enteric rest with total parenteral nutrition (TPN). Surgery is advocated if conservative therapy, which is not always effective and may add to the morbidity, fails.

A 3-month-old male infant was diagnosed at birth with complex cyanotic congenital heart disease consisting of: hypoplastic left ventricle and left atrioventricular valve, double outlet right ventricle, D-malposed great arteries, pulmonary obstruction, and left superior vena cava to the coronary sinus. A central aorto-pulmonary shunt was placed at 5 days of age, followed by bilateral cavo-pulmonary connections at 3 months of age, keeping the shunt patent due to desaturation. At postoperative day (POD) 6 and shortly after starting enteral feeds with breast milk (BM), he developed severe respiratory distress and was diagnosed with bilateral chylothoraces. Chest tubes were placed, and enteric rest and TPN were started (Fig 1). Catheterization done on POD 18 showed ventricular end-diastolic pressure of 5 mm Hg, mean venous pressure within the cavo-pulmonary connections of 8 mm Hg, pulmonary-to-systemic flow ratio of 2, and no anatomic obstruction. He underwent surgical ligation

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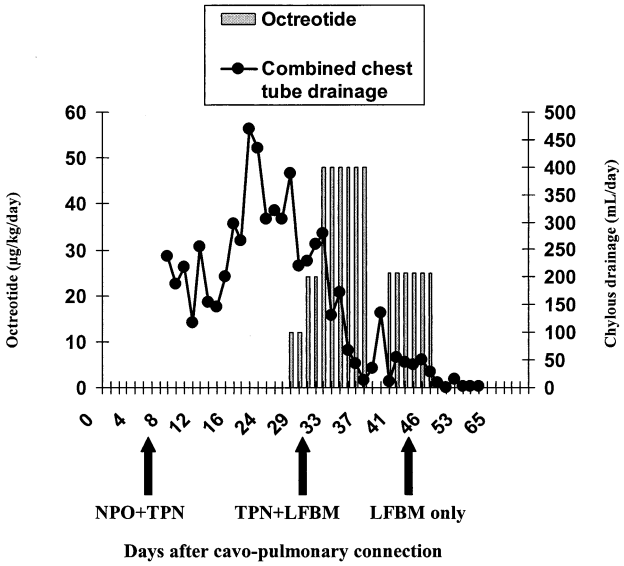

Fig 1. Total chest tube chylous drainage in relation to the doses of octreotide used. The arrows *indicate the time when each of the feeding methods was started. (*LFBM = *low-fat breast milk;* NPO = *nothing by mouth;* TPN = *total parenteral nutrition.)*

of his shunt and mechanical pleurodesis of both pleural spaces, but continued to have chylous drainage, resulting in weight loss (from 5.9 kg before surgery to 4.1 kg) (Fig 2), hyponatremia, hypoproteinemia, and several episodes of bacterial and fungal infections. He required multiple infusions of albumin and immunoglobulins, replacement of fluid losses, as well as multiple courses of antibiotics and antifungals. Intolerance to enteral Portagen (Mead-Johnson, Evansville, IN) precluded its use. On POD 28, octreotide (Sandostatin, Novartis Pharmaceuticals, East Hanover, NJ), a somatostatin synthetic analogue, was started at infusion rate of 0.5 $\mu g \cdot kg^{-1} \cdot h^{-1}$, increasing to 1 then 2 $\mu g \cdot kg^{-1} \cdot h^{-1}$ over 4 days. At 2 $\mu g \cdot kg^{-1} \cdot h^{-1}$, the chylous drainage decreased from 270 mL/d to 30 mL/d over 4 days (Fig 1). By POD 37, the pleural drainage decreased to 2 to 11 mL/d, steady weight gain was achieved, and serum albumin and globulin were normalized (Fig 2). Five days after starting octreotide, enteral feeding was started using low-fat BM, prepared by fat removal following centrifugation. It was supplemented with medium-chain fatty acids, complex sugars, and protein. The pleural drainage increased dramatically on POD 37 when octreotide was interrupted transiently, where it was restarted at 20 μg/kg per day intravenously in three divided doses, decreasing the drainage (Fig 1). Octreotide was finally discontinued on POD 49, and the chest tubes were removed. No side effects were encountered during the use of octreotide.

The patient was discharged on POD 67, and regular breast feeding was resumed two weeks later, without recurrence of the chylothorax.

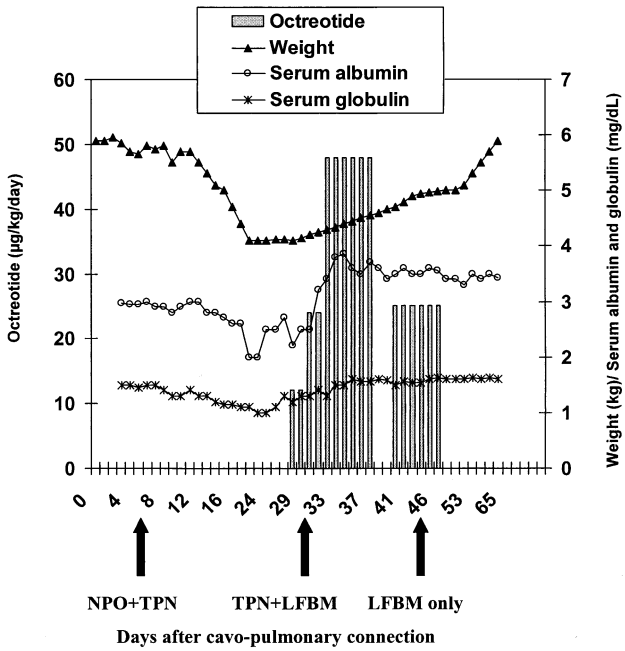

Fig 2. Trends of weight, serum albumin, and globulin in relation to the doses of octreotide used and the type of feeding. The arrows *indicate the time when each of the feeding methods was started. (*LFBM = *low-fat breast milk;* NPO = *nothing by mouth;* TPN = *total parenteral nutrition.)*

Comment

Chylothorax can occur after cavo-pulmonary connection secondary to central venous hypertension, venous thrombosis, or direct trauma to the lymphatic vessels or the thoracic duct [1, 3]. Chyle is formed from lymphatic fluid enriched with fat secreted by intestinal cells [4], and is transported through the thoracic duct into the venous circulation. Surgical treatment is advocated after either excessive ($>$ 10 mL/kg/d or $>$ 100 mL/yr of age), or prolonged ($>$ 3 to 4 weeks) drainage [1, 3, 4]. Surgical options include pleurodesis, ligation of the thoracic duct and adjacent lymphatic vessels, or pleuro-peritoneal shunts [4]. Somatostatin has been recently used in 3 case reports in the treatment of postoperative and traumatic chylothorax [5–7]. The mechanism of action is not exactly known, but is thought to be through the inhibition of pituitary and gastrointestinal hormone release and the reduction in gastrointestinal blood flow and hepatic venous pressure. Portagen and other low-fat and medium-chain triglyceride (MCT) -enriched formulas have been used to feed infants with chylothorax [2]. Contrary to the long-chain triglycerides, MCT is transported directly into the portal system, bypassing the lymphatic pathways and thus diminishing lymph flow through the thoracic duct [2]. Analysis of the prepared BM showed only 0.02% of fat, compared to 3.5% in the regular human milk, and 3.1% in Portagen. The fat content in Portagen is 85% MCT, and 15% corn oil (which is composed of unsaturated and long-chain fatty acids). Thus, low-fat BM could be used as an alternate to Portagen and other similar formulas. Octreotide can minimize the complications of postoperative chylothorax in infants, and low-fat BM can be used as another mode of enteral nutritional support.

CASE REPORTS

This case report was written in compliance with the regulations of the Human Investigation Committee at Yale University School of Medicine. Data regarding the patient's clinical status were collected by chart review. The patient's confidentiality was maintained during data collection and manuscript preparation.

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Diagnosis and Management of Aortoesophageal Fistula Caused by a Foreign Body

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Aortoesophageal fistula is a rare cause of gastrointestinal hemorrhage often resulting in mortality. A case of aortoesophageal fistula caused by a swallowed fish bone leading to respiratory arrest is reported. The clinical presentation was unusual. The successful treatment required the use of hypothermic circulatory arrest.

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Aortoesophageal fistula is a rare complication of foreign body ingestion. The typical presentation of aortoesophageal fistula is chest pain, swallowing pain, sentinel hematemesis, and massive upper gastrointestinal hemorrhage. Unfortunately, despite advanced therapeutic interventions mortality from aortoesophageal fistula remains high.

We present the case of a previously healthy 57-year-old woman urgently referred to a district hospital with central chest pain after swallowing a fish bone. The clinical examination, blood tests, electrocardiogram, and chest roentgenogram were unremarkable. The patient's symptoms settled, and she was sent home. A week later she represented to the same hospital because of worsening chest pain that radiated to the jaw.

Clinical examination remained unremarkable, but blood tests showed a white blood cell count of 16.29 and C-reactive protein of 103. Chest roentgenogram showed a line of gas tracking up the right heart border to the neck. A diagnosis of esophageal perforation leading to mediastinitis and pneumomediastinum was made.

The patient was initially managed with broad-spectrum antibiotics and analgesia, but she deteriorated and suddenly had a respiratory arrest. She was resuscitated, but attempted endotracheal intubation proved difficult. Bronchoscopy showed a narrowing of the trachea beyond the endotracheal tube. At this stage it was thought that a localized perforation of the esophagus had caused a superior mediastinal abscess resulting in compression of the trachea. A computed tomographic scan was performed and she was urgently transferred to the specialist center.

A pre-contrast computed tomorgraphic scan (Fig 1) showed a gas-filled collection around the esophagus in the superior mediastinum, leading to significant tracheal narrowing. In retrospect there was radiologic intravenous contrast in the abscess cavity (Fig 2); however, because she remained hemodynamically stable, aortic involvement was not anticipated.

A standard right posterolateral thoracotomy operation was performed to gain access to the superior mediastinum and the esophagus. The aim was to drain the abscess and decompress the airway and then manage the esophageal perforation. After incision of the thickened mediastinal pleura, frank pus was drained followed rapidly by arterial blood at high pressure. The thoracotomy was extended anteriorly, the pericardium was opened, and the patient was placed on cardiopulmonary bypass through the ascending aorta and the right atrium. The systemic temperature was lowered to 18°C for hypothermic circulatory arrest. The esophagus was mobilized above and below the abscess and was lifted away from the aorta. This exposed a 1-cm necrotic defect in the distal aortic arch, just distal to the origin of the left subclavian artery. After debridement, the 3×2 cm aortic defect was closed with an aortic homograft patch sewn in place with continuous 3-0 polypropylene. No other foreign material was used. After rewarming, cardiopulmonary bypass was recommenced with rewarming. There was no difficulty in separating from perfusion. Esophagectomy was then carried out, stapling the esophagus at the thoracic inlet and at the hiatus.

The patient was admitted to the intensive care unit where she gradually improved. Three days later she returned to the operating room for a formation of end cervical esophagostomy and insertion of a needle cathe-

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