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Chylothorax in children, A retrospective study

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Abstract:

Background: The purpose of this study was to determine the incidence, risk factors, laboratory findings and outcomes of chylothorax in children.

Material and Methods : Nemazee hospital database (affiliated hospital to Shiraz University of Medical Sciences, Shiraz, Iran) were used to identify cases with chylothorax. Medical records including records of daily management were reviewed.

Results: From April 2004 to April 2009, there were 14 cases of chylothorax. Incidence of chylothorax was significantly higher with Balalock Taussig procedures. Nutritional management included low fat diet, enteral feedings enriched with medium-chain triglycerides, and parenteral nutrition. Five patients were treated with octreotide. Duration of hospitalization in these patients was 10±4 days that was significantly lower than others (28±5, p=0.003). One patient with post-operation pulmonary hypertension experienced sudden death 2 days after administration of octreotide.

Conclusion: Somatostatin analogs can be helpful in management of chylothorax and its use decreases hospital stay although there are not enough data regarding complications and mortality with this drug in children.

Keywords: chylothorax, infants, newborn, pleural effusion, somatostatin

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Introduction

Chylothorax is characterized by a turbid or usually milky white appearance of pleural fluid due to its high lipid content. The lipids in a chylothorax consist of triglycerides entering the pleural space as chyle, most commonly from disruption of the thoracic duct. Blockage of the thoracic duct or its lymphatic tributaries at some point along their course in the chest is the most common cause of chylothorax [1].

Chylothorax is a rare but potentially important complication of pediatric cardiac operations, with an incidence of near 1% [2]. Conservative therapy with the use of a low-

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fat diet containing medium-chain triglycerides or total parenteral nutrition, combined with pleural drainage, is often effective. Operation is advocated after 3 to 4 weeks of unsuccessful nonoperative treatment [3]. Different surgical methods have been described (e.g. ligation of the thoracic duct, pleuroperitoneal shunt, and pleurodesis), but the results are not always quite satisfactory [3-5].

In childhood, chylothorax is usually a postoperative complication caused by thrombosis of the left or right subclavian vein. It is rarely due to the malformation of the pulmonary or thoracic lymphatic system associated with dysmorphic syndromes [5-7]. In adults, common causes of chylothorax are thoracic or neck trauma or a malignancy at the upper thoracic aperture [8-10].

The definition of chyle in adults is well established in the literature. For children, no clear definition exists and very often-adult values are applied [8-11]. One reason for this is the small number of chylothoraces in this age group. Values derived from adult patients are not necessarily applicable to children.

In recent years, many advances in surgery for patients with congenital heart disease, including earlier intervention, have resulted in improvement of patients' survival. However, important morbidity continues to complicate the postoperative care of these patients. Chylous pleural effusion, or chylothorax, is usually an early postoperative complication [5,11, 12]. Patients usually remain asymptomatic until a large volume of chyle accumulates [2,13]. Therefore, fluid accumulations may remain unrecognized for some of time. Loss of this fluid by therapeutic drainage can lead to nutritional depletion, fluid and electrolyte loss, hypolipemia, and lymphocytopenia of T cells, which can contribute to immunodeficiency [14,15]. Previous studies of chylothorax in children have been limited to issues regarding conservative

versus surgical management and have not adequately addressed the risk factors for postoperative chylothorax and factors affecting the clinical course [2,5,12,16,17].

This study was performed to evaluate clinical presentation, laboratory findings, management strategy and outcome of patients with chylothorax and more specially after using somatostatins in these patients.

Methodology

In this study, the data of all patients with the diagnosis of chylothorax in Nemazee hospital database, affiliated hospital to Shiraz University of Medical Sciences, Shiraz, Iran were retrospectively analyzed from April 2004 to April 2009. There were 14 patients having this diagnosis.

The following parameters were recorded: triglyceride level, total cell number in blood, total cell number in pleural effusion, white blood cell count in blood, white blood cell count in pleural, content of lymphocytes in pleural effusion, and duration of pleural effusion after the initiation of therapy. Therapy consisted of a diet with a fat-free formula. Total parenteral nutrition (TPN) with total enteric rest was begun when the diet was unsuccessful (after 2 to 3 weeks); surgery was performed when TPN was not effective. The length of each therapeutic modality was recorded.

All data are expressed as mean \pm one standard deviation (SD); data were compared by Mann-Whitney test, and a P value 0.05 was considered statistically significant. SPSS version 15 statistical software was used for all statistical analyses

Results

There were 8 boys and 6 girls with the diagnosis of chylothorax. Their ages ranged from 1 month to 192 months (mean, 37 ± 12 months).

Clinical presentation

Nine patients (64%) developed chylothorax after cardiac surgery. From the remaining five patients, one had congenital chylothorax, one developed chylothorax due to lymphangiectasia, the third one had Down's syndrome, one had chylothorax after insertion of chest tube for management of pneumothorax, and one patient had surgery for tracheoesophageal fistula. All of the other patients in surgical group had operation for congenital heart diseases, 6 patients had modified Balalock-Taussig shunt, one had chylothorax after total correction of endocardial cushion defect and one case had chylothorax after total-cavo-pulmonary connection (TCPC) due to high pulmonary pressure (Mean pulmonary artery pressure=30 mmHg) and one developed chylothorax after Glenn shunt with mean pulmonary pressure of 8 mmHg.

Laboratory Findings

Analysis of pleural effusion is shown in Table 1. Laboratory finding of serum at admission and at the discharge time is shown in Table 2.

Table 1. Plural effusion analysis.

	Mean ± SD
Triglyceride (mg/dL)	358 ± 426
Total white blood cell count (mm ³)	2993 ± 4.5 x 10 ³
Polymorphonuclear cell (%)	44 ± 34
Lymphocytes	49% ± 35
Red blood cell count (mm ³)	7368 ± 1.2 x 10 ⁴
Total protein (g/L)	5.7 ± 3.54
Sugar (mg/L)	111 ± 51
Lactate dehydrogenase (U/L)	796 ± 817

Management

Three patients needed surgical ligation of thoracic duct after 2 weeks of unsuccessful conservative therapy and 2 weeks usage of total

Table 2. Serum analysis at admission and at the time of discharge from hospital (Mean ± SD).

	At admission	At the time of discharge
Total white blood cell count (cells/mm ³)	1.25 x 10 ⁴ ± 6.53 x 10 ³	1.22 x 10 ⁴ ± 7.08 x 10 ³
Polymorphonuclear cell count	43 ± 15 %	55 ± 27 %
Lymphocytes count	48 ± 12 %	45 ± 27 %
Total protein (g/dL)	5.5 ± 1.38	4.8 ± 1.25
Albumin(g/dL)	3.48 ± 0.78	4.11 ± 2.18

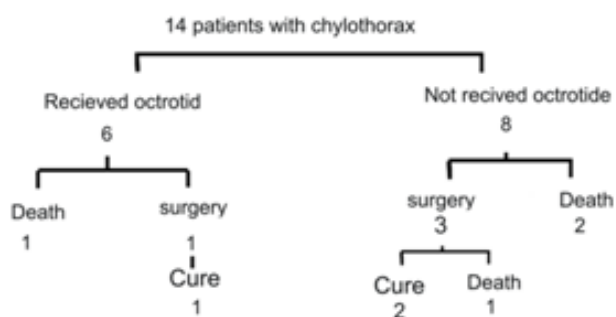
parenteral nutrition. Two patients showed some improvement and were discharged after 5 days and the other one expired one-week after surgery.

Mean duration of hospitalization was 15.3 ± 10.22 days, maximum being 35 days, and minimum was 7 days. Three patients needed chest tube for drainage of chylous effusion and in the others repeated plural tap was sufficient. For five patients, octerotide (somatostatin analogous) was started (dosage= 2 mcg / kg / h) which they received continually and the dosage was adjusted for evidence of response. It was continued intramuscularly twice per day for one month and was gradually tapered off. One patient had sudden cardiac death 2 days after starting the octreotide. Duration of admission in these patients was 10 ± 4 days which was significantly lower than the others 28 ± 5, P=0.003. Comparison between patients who received somatostatin and others is shown in Table 3.

Four patients died during the hospital course, one with congenital chylothorax, one with lymphangiectasia, the patient with TCPC and another with endocardial cushion defect (Figure1).

Table 3. Comparison between patient who received somatostatin and others

	Received somatostatin	Others	P value
Number of cases	6	8	
Mortality	1	3	0.046
Need for surgery	1	4	0.041
Duration of admission	10 ± 4	28 ± 5	0.003



Discussion

Clinical presentation

Chylothorax is an important complication of cardiovascular operations for congenital heart disease. A conservative treatment strategy is currently usually recommended for most of the patients in order to avoid operation [3]. However, patients may present with massive lymph drainage, which will induce critical losses of fluid, lymphocytes, proteins, coagulation factors, and antibodies, thus increasing morbidity and mortality [2]. This is particularly true in small babies, for whom early operation is advocated [4]. In the present study, there was a statistically significant reduction in duration of hospitalization in pediatric patients who received somatostatin. Somatostatin can reduce gastric, pancreatic, and intestinal secretions [18]. Somatostatin can also cause a decrease hepatic venous pressure gradient and a mild but sustained decrease of splanchnic blood flow without influencing systemic hemodynamic [18-

20]. These could be helpful in an attempt to decrease chyle production, as reported by Ulibarry and associates [21] in an adult patient. In our study, we obtained a similar result in an infant, in whom the introduction of somatostatin resulted in decreased duration of the patients' hospitalization. One of our patients that had operation for correction of endocardial cushion defect and had high pulmonary artery pressure postoperatively had sudden cardiac death 2 days after starting of somatostatin. Larger controlled studies are required to confirm these observations and the effects of somatostatin treatment on morbidity and mortality. No hypoglycemia or hyperglycemia, conduction abnormalities and arrhythmia detected during hospital stay. All of patients tolerated the intramuscular course but pain at injection site was major complication

Laboratory Finding

Although limited data exist, measurement of the pleural fluid triglyceride content may assist in the diagnosis of a suspected chylothorax. A pleural fluid triglyceride concentration greater than 110 mg/dL supports the diagnosis; a level less than 50 mg/dL excludes a chylothorax with reasonable likelihood, and an intermediate level between 50 and 110 mg/dL should be followed by lipoprotein analysis of the pleural fluid. Detection of chylomicrons in the pleural fluid by lipoprotein analysis confirms the presence of a chylothorax [8]. In our patients, the diagnosis of chylothorax was confirmed by pleural effusion with a triglyceride level > 50 mg/dL and a cell count >1,000 cells/mm³ with a predominance of lymphocytes.

In the literature, it is reported that chylothorax usually occurs in newborns and children as a complication of thoracic and cardiac surgery [6]. This was also the case in 9 out of 14 of our patients. Two patients had congenital chylothorax, probably because of birth trauma or as a complication of lymphatic malformation. This form of chylothorax is rarely described in the literature [11,23,24]. Chylothorax is also

described in children with trisomy 21 and Noonan's syndrome; in both instances, vascular and lymphatic malformations are found [7]. Only one patient in our series had trisomy 21 and chylothorax. In older children and adults, nontraumatic chylothoraces caused by an obstruction of the thoracic duct secondary to fibrosis or tumors are described [10].

After cardiac surgery, especially in newborns, oral feeding is often delayed, but small amount of formula feeding is usually sufficient to allow the diagnosis of chylothorax. Without oral fat intake, the distinction between chylous and nonchylous effusion is difficult or even impossible to determine. Staats et al. [8] and others [9] also noted that a milky appearance of the fluid, first described by Wallis and Schölberg [24] in 1911, can be helpful in diagnosis.

Management

Usually, initial therapy for postoperative chylothorax has been pleural space drainage, use of medium chain triglyceride (MCT) formula, fat-free oral alimentation, or enteric rest with TPN [5]. In all of our patients, a fat-free formula consisting of proteins and starch was given, and diet prepared by MCT (sunflower oil by nutritionist). If effusion did not abate after 2 to 3 weeks, TPN was started together with total enteric rest (in 2 patients). Repeated plural tap was done in the patients twice per week and if the amount of collection was massive chest, tube was inserted.

Surgery is not usually recommended as initial therapy. Some authors [25] recommend surgery if effusion persists for more than 2 weeks; others [25,26] regard an amount > 100 mL per year of age in children as an indication for surgery. Most authors, however, recommend an extended period of conservative management and do not proceed to surgical treatment until more than 4 weeks of pleural effusion [27,28]. Operative procedures include pleurodesis: the ligation of the main duct with adjacent leaking lymphatics (26,28). Usually, the decision to perform surgery

is delayed, mainly with the intention of preventing an additional thoracotomy. A possible solution to this problem was suggested by Murphy et al [26], as early as 8 days after diagnosis, they inserted a pleuroperitoneal shunt with good results in 75% of the patients. Especially in patients with chylothorax after thoracic procedures, pleuroperitoneal shunts were successful; less so in patients with caval thrombosis or high right atrial pressures. An advantage of this procedure is that it only requires the insertion of a pleural catheter. If successful, this technique avoids long parenteral nutrition and hospitalization time.

From the small series of patients with chylothorax reported in the literature It is not clear how often nonoperative management is successful. In our series, surgical interventions were performed very later and less than other reports. This is in contrast to the report by Milsom et al. [29,30] who performed a surgical procedure in 19 of 20 patients with chylothorax. Consequences of late surgical interventions are very prolong hospitalization and imminent nutritional and infectious complications [30]. Opinions and recommendations about the length of conservative management vary considerably and depend on the experience of the surgical team in performing a certain procedure. Advocates of operative interventions before 3 weeks have reported disappointing results when compared with conservative management.

In conclusion, early diagnosis of chylothorax, low fat diet prepared by MCT oil and administration of somatostatin analogs can be helpful in management of chylothorax, and can decrease hospital stay although there is not enough data regarding complications and mortality with this drug.

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