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Treatment of Chylothorax

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Authors' contributions

This work was carried out in collaboration among all authors. Author ŞM performed the statistical analysis. Author BO designed the study, wrote the protocol and wrote the first draft of the manuscript. Authors ŞM, IAF and EL managed the analyses of the study. Authors BO and ŞM managed the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

The accumulation of lymphatic fluid absorbed in the lymphatic system in the intrapleural space is called chylothorax. Traumatic and nontraumatic causes are included in the etiology. Pleural fluid analysis obtained by thoracentesis has an important place in the diagnosis of chylothorax. A triglyceride> 110 mg / dL and cholesterol / triglyceride ratio <1 in pleural fluid is defined as chylothorax. Fluid drainage with a thoracic tube is usually the first treatment method. A high protein, low fat diet with medium chain fatty acids is recommended. If necessary, oral nutrition is stopped and supported with parenteral nutrition. If chylous drainage continues, somatostatin or octreotide therapy is given in the early period. If there is no response to conservative and medical treatment and if the drainage is not high, the alternative treatment methods is evaluated. Pleurodesis, pleuroperitoneal shunt, and embolization are alternative options. Surgical treatment begins with ductus ligation with video-assisted thoracoscopic surgery or thoracotomy. Transabdominal thoracic duct mass ligation is a treatment method in appropriate indication. Laparoscopic cisterna chile ligation is another surgical treatment method in cases where treatment is not successful. In this article, the treatment of chylothorax has been evaluated in the light of the literature.

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Keywords: Chylothorax; conservative; somatostatin; thoracic duct ligation; cisterna chile ligation.

1. INTRODUCTION

The accumulation of lymphatic fluid absorbed in the lymphatic system in the intrapleural space is called chylothorax. May be due to rupture of the thoracic ductus or its branches and leakage from pleural lymphatics and collaterals or it is possible with the transdiaphragmatic passage of chylous acid through the peritoneal cavity [1]. Chylous fluid in the pleural cavity was first described by Bartolet in 1633 and the first successful treatment (supradiaphragmatic duct ligation) was reported by Lampson in 1948 [2]. The major lymphatic drainage system in the body is the thoracic duct. While this duct carries liquid and digested fats into the systemic circulation, outside the vascular system it makes the proteins return to the blood again [3]. The lymph fluid in the duct is mostly from the intestines, in an amount originates in the lungs, liver, abdominal wall, and extremities [4]. Normally, 1500-2500 mL chylous fluid per day is drained into the venous system. The electrolyte content of this liquid is similar to the serum and its protein content is more than 3 g / dL [5]. Thoracic duct is variational in more than 50% of people. Anatomically, it arises from the cisterna chile, usually located in front of the L2 vertebral corpus (rarely between T10-L3). Then heads up from the right edge of the ascending aorta and enters the thorax through the aortic hiatus. Continues in the right hemithorax, medial to the vena azygos and behind the esophagus. At the level of the T5 or T6 vertebra, passes in front of the corpus to the left. It emerges from the posterior part of the thoracic outlet and arc 3-4 cm above the clavicle at the level of the C6 or C7 vertebral corpus. Pours into the systemic circulation at the junction of the left subcalian and left jugular vein (Fig. 1). Between the thoracic duct and intercostal veins collateral vessels are located [6,7]. In addition to electrolyte,fat,protein and vitamin loss in chylothorax,T cell loss is also seen.Post-lymphopenia infection and malnutrition are the main causes of death in chylothorax [8]. For all these reasons, chylothorax treatment is important and will be evaluated together with the literature.

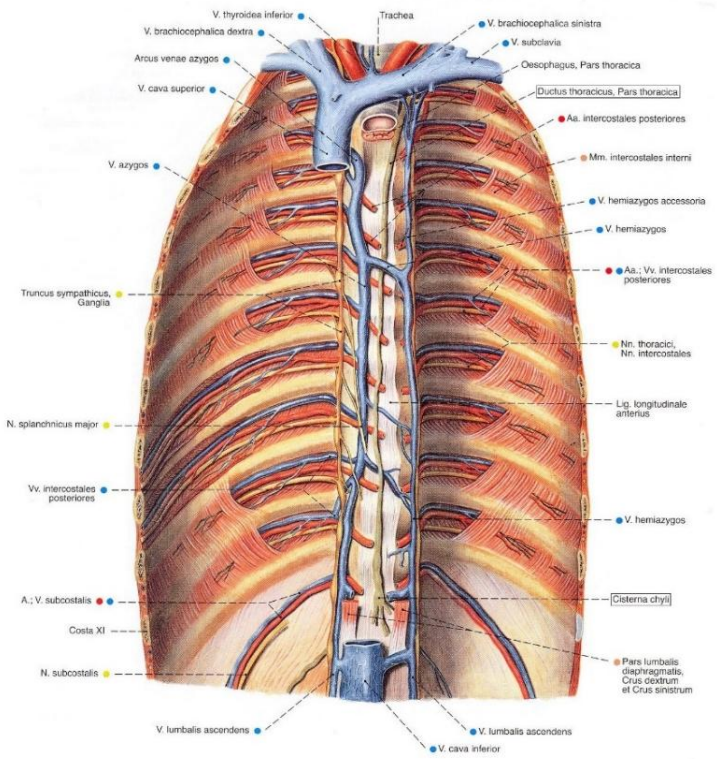

Fig. 1. Anatomical view of cisterna chile and ductus thoracicus in mediastinum Sobotta, Atlas der Anatomie (Elsevier-Urban & Fischer) Editor: F. Paulsen, J. Waschke / S.Tuna Karahan 2019

1.1 Etiology Diagnosis and Clinical Charactesistics of Chylothorax

1.1.1 Etiology

Any interruption, occlusion, or dysfunction in the flow of chylous fluid in the thoracic duct causes chylothorax. In general, chylothorax has a non-traumatic and traumatic etiology (iatrogenic, blunt trauma or penetrating injury). Malignancy is the main cause of non-traumatic chylothorax and thoracic surgery commonly cause of traumatic chylothorax [9,10]. The ratios of chylothorax are traumatic 50%, non-traumatic 44% and idiopathic 6% [10].

Traumatic causes: Esophagectomy and congenital heart disease surgical treatments are the most common causes of surgical traumatic chylothorax [11]. Medical and surgical interventions applied to lungs, trachea, mediastinum, cardiovascular, aorta, neck,esophagus,diaphragm, stomach and vertebral bodies traumatic chylothorax causes [12,13]. Increased intra-thoracic or intraabdominal pressure, blunt trauma, give birth, stretching, sneezing, vomiting, seat belts and thoracolumbosacral orthosis are among the causes of non-surgical traumatic chylothorax [14,15].

Non-traumatic causes: Lymphoproliferative malignancies (mostly lymphoma 61%), hematologic and solid tumors, which constitute 17-46% of all cases, are among the causes of nontraumatic chylothorax [16-19]. Lymphatic diseases such as lymphangioleiomyomatosis, pulmonary lymphangioctasis and lymphangiomas It is associated with nontraumatic chylothorax [20]. Lymphangiomas; may present as mediastinal, pulmonary, or chest wall lesions and cause chylous effusion [21]. Gorham-Stout syndrome; It is a disease characterized by bone involvement. when spread chylothorax may develop in 17% of cases, most commonly in thoracic duct obstruction [22,23]. Liver cirrhosis, nephrotic syndrome, congestive heart failure, infections, surgery, malignancy, ascites fluid similar to pleural fluid characteristics were reported in patients with lymphatic disorders and postoperative scarring. It has been stated that this situation occurs with the transdiaphragmatic migration of abdominal fluid into the thoracic cavity [21,24-27]. Chylous pleural effusion cases have been reported in approximately 3% of sarcoidosis cases [28,29]. Mycobacteria (most common Tuberculosis), It has been reported that hepatitis A, paragonimiasis and paracoccidioidomycosis infections cause chylothorax [30-33].

Other causes: Chylothorax may occur due to thoracic duct damage following subclavian vein catheterization and venous thrombosis after central venous catheterization [34]. Congenital chylothorax occurs due to congenital malformations [35]. Chylothorax has also been described as an early and late complication of radiotherapy [36].

1.2 Clinical Charactesistics

Similar to normal pleural effusion, dyspnea, chest pain and cough are seen in chylothorax. It is seen in 50% on the right, 33.3% on the left and 16.66% on both sides. If there is damage in the proximal part of the T5 vertebra, effusion is seen on the left side, if there is damage in the distal on the right [37]. Clinical symptoms depend on the amount of chylous fluid lost. When the pleural space is filled with fluid, respiratory distress may ocur and hypovolemia may occur due to rapid fluid loss. Malnutrition may occur due to the loss of protein, fat and vitamins. Electrolyte loss causes hyponatremia and hypocalcemia [38]. Loss of immunoglobulin, T lymphocyte and protein causes immunosuppression and the patient becomes susceptible to opportunistic infections but the chylous fluid (bacteriostatic) infection does not occur immediately [39,40]. Malignancy and bilateral chylothorax have the worst prognosis [41].

1.3 Diagnosis

Pleural fluid analysis obtained by thoracentesis has important place in the diagnosis of chylothorax. If the triglyceride is> 110 mg / dL in the pleural fluid, this fluid is 99% chylous fluid. Chylothorax criterion is that the pleural fluid cholesterol / triglyceride ratio is <1. Even if the liquid appearance is milky white, if this ratio is >1 called pseudochylothorax. Microscopic observation of the fat globules with Sudan III stain is the definitive diagnosis of chylothorax [42].

Chest radiography does not give detailed information about the etiology of chylothorax. Trauma areas in the lymphatic system, mediastinal lymph nodes, tumoral lesions can be detected in thorax CT. Lymphangiography, lymphoscintigraphy and MRI are other diagnostic methods. Lymphangiography, It is one of the

main methods of imaging lymphatic vessels and lymph nodes [43]. Lymphoscintigraphy is the method in which technetium-99 albumin solution is applied subcutaneously, is carried through the lymphatic system [44]. Then, areas of leakage causing chylothorax are visualized with CT or SPECT (single-photon emission computer tomography). Chylous fluid leaks and some lymph node diseases can be detected in noncontrasted MR lymphangiography [45].

2. TREATMENT OF CHYLOTHORAX

In a chylothorax patient, first drainage is required by evaluating the amount of fluid on chest radiography.Tube thoracostomy should be performed in cases where pleural fluid increases on radiography or when respiratory symptoms ocur (Fig. 2).

2.1 Tube Thoracostomy and Drainage

Traditionally, pleural effusion can be followed if it is minimal and drainage is not required. In chylous pleural effusion, there is a possibility of stopping the fluid leakage with both the re-expansion of the lung and the compression effect. In a period of 1 month, the daily drainage amount without additional surgery indicates improvement up to 10 mL / kg, and more than 10 mL / kg indicates insufficiency [46]. If drainage continues despite conservative treatment, surgical treatment is required (1100 mL / 24h, 1000 mL / day for 5 days, or 2000 mL / day) [47,48].

2.2 Medical and Conservative Treatment

Long chain triglycerides absorbed from the intestine but the absorption of medium chain triglycerides occurs through the portal system [49]. Therefore, directly absorbed from the portal system medium-chain fatty acids (8-12 carbon) diet is preferred. A high protein low fat diet (<10 g fat / day) is recommended in chylothorax. Oral nutrition should be provided as much as possible [49]. If there is no decrease in the amount of pleural drainage despite diet, oral nutrition is stopped and parenteral nutrition (TPN) is started [45]. Conservative treatment is considered successful if chylous drainage with TPN is <500 mL / day without oral nutrition [50]. The fat-free diet is another option, but it is difficult to implement, involves the concern of causing fatty acid deficiency, and it may be necessary to give supplementary therapy with fat again [49].

Somatotatin analogues are currently used as medical therapy in patients who do not result in conservative treatment. These drugs reduce intestinal blood flow, by reducing chylomicron synthesis, oil they become effective by reducing the absorption.

Somatostatin is used at a dose of 250 µ / h IV in adults and 3.5-7 µg / kg / h in children and Octreotide is 100 µg / day 2-3 times SC in adults and 10-40 µg / kg / day SC in children.

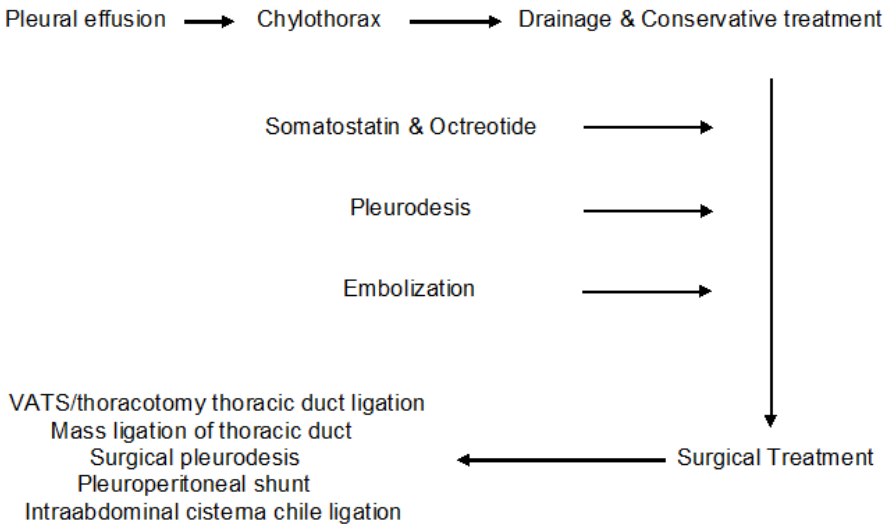

Fig. 2. Treatment of chylothorax

These drugs are recommended to be administered in the early period without disturbing the metabolic balance. However, it may have side effects such as diarrhea, temporary liver damage, malabsorption, nausea, gas in the digestive system, hypoglycemia, and constipation. In general, in conservative treatment, if the drainage amount is not <500 mL / day at the end of the 1-month follow-up period, if drainage cannot be provided, if the lung cannot be expanded, interventional treatment steps are started [51-53].

2.3 Alternative Treatment

Apart from conservative and surgical treatments available in alternative methods in chylothorax.

2.3.1 Pleurodesis

It has been reported that thoracoscopic asbestos-free sterile talc pleuridesia at a dose range of 4-8 g in cases with recurrent chylothorax complication of lymphoma has achieved 100% success [54].

In a meta-analysis evaluating iodopovidone pleurodesis, the average success rate 88.7% has been found. It has been reported that tube or thoracoscopic application does not affect the success [55].

Silver nitrate, iodopovidone, tetracycline and derivatives, various such as bleomycin, mitomycin-C, Corynebacterium parvum agents have been tried for chemical pleurodesis [56]. In addition, the application of 100 mL of 50% glucose and 20 mL of 1% lidocaine has been reported to be successful for pleuridesis [57].

In a meta-analysis in which a total of 1168 patients were evaluated success rates 93% for talc, 86% for minocycline, 76% for Corynebacterium parvum, 72% for doxycycline, tetracyclines 67% for bleomycin and 54% for bleomycin. Talk is the most effective and It was concluded that it was the least costly agent [58]. OK-432 (picibanil) are recommended for pleuridesis [59].

2.3.2 Embolization

Percutaneous transabdominal catheterization following lymphangiography, and proximal embolization of leakage or occlusion of the thoracic ductus. Embolization is commonly done with coils and n-butyl cyanoacrylate (n-BCA) [60]. A case of embolization with Lipiodol and n-BCA has been reported with combined MRI and fluoroscopy [61].

2.4 Surgical Treatment

The first step of surgical treatment in chylothorax is usually the application of tube thoracostomy. Drainage is usually almost always used to re-dilate the lung and take advantage of compression effects. After drainage with tube thoracostomy and if there is no response to conservative treatments, surgical procedures are initiated. In addition, surgical pleuridesis method such as pleurectomy or laser ablation is also applied. In resistant chylothorax cases, in order to prevent chylous fluid loss and return it to the circulation; cases of pleuroperitoneal shunt allowing passage of chylous fluid in the pleural space to the abdomen have been reported [62].

2.4.1 Video-Assisted Thoracoscopic Surgery (VATS) and thoracotomy

In cases where the chylothorax is unilateral, ligation is planned from the same side, and in cases where it is bilateral, ligation from the right hemithorax is planned. Olive oil or cream is used to locate the chylous liquid (orally 1 hour before the operation or with nasogastric catheter during the operation) [45].

If the operation is to be performed with VATS, the thorax is entered with two ports from the middle axillary line 6th intercostal space and posterior 5th or 6th intercostal space. Chylous fluid is drained and explored from the inferior pulmonary ligament to the proximal. With exploration, the localization where chylous fluid is seen is sutured [63].

If the operation is to be performed by thoracotomy, the thorax is entered with a posterolateral incision through the 7th or 8th intercostal space. When chylous fluid is detected, it is sutured with non-absorbable thread. If the leak point cannot be determined, the hiatus aorta is explored. From here, the place where the duct enters the thorax is determined and and ductus is sutured. Apart from this method, in the prone position, the periosteum of the right 8th rib is scraped off and the posterior mediastinum is reached. The ductus, which is on the midline of the azygos vein, is ligated [63].

Thoracic ductus ligation is 90% successful when applied just above the right hemidiaphragm [64].

If the chylous leak is in the neck area proximally the ductus is ligated in the area known the Poirier's triangle (between aortic arch, internalcarotid and vertebral column) [65].

2.4.2 Transabdominal thoracic duct mass ligation

After completion of the transthoracic esophagectomy, the right diaphragmatic crus is dissected before retracting the stomach into the transhiatal thorax. Then the paravertebral pleura on the right side of the aorta is cut and the tissue is circulated around the front of the spine with forceps. The tissue containing the thoracic duct, the right thoracic splanchnic nerve and the azygos vein is connected by a nonabsorbable thread. The stomach is now pulled into the thorax and an end-to-end esophagogastrostomy is performed [66]. In this method, case of thoracic duct mass ligation has been reported during esophagectomy to prevent chylothorax.

2.4.3 Intraabdominal cisterna chile ligation

Laparoscopically, 5 ports are entered into the abdomen, the liver is withdrawn, the gastrohepatic ligament is cut and the stomach is pulled to the left. The right flank of the aorta is exposed at the celiac level and the fatty tissue between the aorta and the right crus is clipped. The inferior vena cava is dissected from the right tubercle, then the cisterna chile is determined by pulling the inferior vena cava laterally. All fatty tissue is bound between the right crus and inferior vena cava [67]. A number of cases have been reported in which laparoscopic cisterna chile ligation was performed using this method.

3. CONCLUSIONS

Chylothorax is a disease that difficult to treat and requires multidisciplinary approach. It is among the undesirable complications after thoracic surgery. A triglyceride value above 110 mg / dL in pleural fluid analysis obtained by thoracentesis is the accepted method for diagnosis. Cholesterol / triglyceride ratio less than 1 is used in the differential diagnosis. Methods such as thorax CT, MRI, SPECT, FDG-PET, lymphangiography, lymphoscintigraphy are used to determine the etiology. According to the amount of pleural fluid, firstly drained for re-expansion of the lung. A low-fat, high-protein diet is recommended. If the drainage continues; oral nutrition is stopped and TPN support provided. Somatostatin and octeotide are among the conservative treatments. Pleurodesis can be used for visceroparietal agglutination. Embolization is among the other alternative options. As a surgical treatment; VATS or thoracotomy ductus ligation, intraabdominal ductus or cisterna chile ligation can be performed. Surgical pleurodesis, pleuroperitoneal shunt, transabdominal thoracic duct mass ligation are among other alternatid surgical options in appropriate indications. Chylothorax is a fatal disease due to the contents of loss fluid. There are many options from minimally invasive to invasive treatments. It must be treated for stop the loss of fluid contents

CONSENT AND ETHICAL APPROVAL

All quotations and pictures are referenced. The article is a literature analysis and does not include the experiences of the authors.

COMPETING INTERESTS

All authors declared that there is no conflict of interest.

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