

THE MANAGEMENT OF CHYLOTHORAX

Onur GENÇ, M.D., Şaban SEBİT, M.D., B. Ali ÖZUSLU, M.D., S. Daniş KAMALI, M.D.

GATA, Departments of Thoracic Surgery, Ankara, Turkey
Gazi Medical Journal 7 : 49-53, 1996

SUMMARY : *The chylothorax is a serious and often life-threatening clinical entity. Optimal management of this problem has not been well defined to date.*

We have reviewed an experience about management of chylothorax at our department for a patient who has abounded chylothorax due to surgery.

The anatomy and physiology of thoracic duct are described and a plan for the effective management of chylothorax is presented.

Key Words : *Chylothorax, Management.*

INTRODUCTION

Chylothorax is the presence of lymphatic fluid in the pleural space resulting from a leak of the thoracic duct or one of its major divisions. This condition is being recognized more frequently, after both cardiac and general thoracic surgery (6).

The ideal treatment of chylothorax is not well established. Its etiologies are diverse and the type and timing of diagnostic and therapeutic procedures are different (3, 6).

Because of chylothorax is an unusual entity, personal experience, therefore is limited and the management strategy is not clear. Increased understanding of the physiology, pathogenesis, diagnosis and management of chylothorax have decreased the initial % 50 mortality to a mortality of % 10 in major medical centers (6).

We have reviewed an experience about management of chylothorax at our department for a patient

who has abounded chylothorax due to surgery. The anatomy, physiology and diseases of thoracic duct are described and a plan for the effective management of chylothorax is presented.

A rationale for the treatment of this difficult clinical problem is based on the anatomy and physiology of thoracic duct and needs exact knowledge about total parenteral nutrition (4, 6).

ANATOMY OF THE THORACIC DUCT

Embriologically the thoracic duct is the bilateral structure therefore, it may develop different anatomical patterns. Many minor variations occur in lymphatico-venous anastomosis. A rich collateral network exists, which may permit ligation of thoracic duct at any point in its course (6).

Most commonly, the duct originates from the cisterna chyli at the level of second vertebra in the midline (lymphatics from the lower limbs and pelvis and the bowel lacteal vessels drain into cisterna).

The duct enters the thorax through the aortic hiatus to the right of the midline and is covered by the aorta. In the lower thorax, it lies between the aorta and the azygos vein and is behind the esophagus and more superiorly behind the subclenus anterior muscle insertion and empties into the junction of the left intrenal jugular and subclavian veins (6).

The right lymphatic duct receives lymph from the right side of head and neck, the right arm and the right side of the chest and both lungs. The duct opens into the right jugulosubclavian angle; it may a single channel or its tributaries, are important collateral channels.

The thoracic duct has a muscular wall controlled by the autonomic nervous system, that contains multiple valves to prevent backflow (6).

PHYSIOLOGY OF THE THOROCIC DUCT

The forward or upward flow of chyle is maintained by several factors.

1- The inflow of the chyle into the lacteal system creates a vis a tergo which in turn is produced by the intake of food and liquid into the intestine and is augmented by intestinal movement.

2- The negative intrathoracic pressure on inspiration, and the resulting gradient between this negative pressure and positive intra abdominal pressure, helps the upward flow of chyle.

3- Muscular contraction of thoracic duct wall is probably the most important factor. Contraction of the duct wall occur every 10 to 25 cm H₂O and with obstruction may rise to 50 cm H₂O.

Simulation of distal cut end of vagus nerve causes contraction of the thoracic duct and acetylcholine given intravenously in to the duct causes contraction of duct muscle with reduction of flow (3, 6).

The flow of the chyle varies greatly with meals and is particularly increased when the fat content of the food is high. Volumes of up to 2500 ml. of chyle in 24 hours have been collected from the cannulated human thoracic duct. The flow rate may range from 14 to 110 ml. per hour. Aspiration of the chest may result in the loss of between 2 and 3 liters of chyle daily in presence of chylous fistula (6).

Water taken by the mouth can increase the flow of chyle by 20% but this does not occur with intravenous intake. Starvation reduces the flow to a mere trickle of clear lymph.

The rate of passage of ingested fat from the intestine to the systemic circulation is about 1.5 hours, with a peak absorption at 6 hours (3).

The composition and the charecteristics of the chyle were shown in table 1 (6).

Component	Amount (Per 100 ml)
Total fat	0.4-5 g
Total cholesterol	65-220 mg
Total protein	2.21-5.9 g
Albumin	1.2-4.1 g
Globulin	1.1-3.6 g
Fibrinogen	16-24 g
Sugar	48-200 g
Electrolytes	similar toplasma
AMOUNT	
Cellular elements	
Lymphocytes	400-6800 /mm ³
Erythrocytes	50-600 / mm ³
Antithrombin globulin	> 25 % plasma concentrate
Prothrombin	> 25 % plasma concentrate
Fibrinogen	> 25 % plasma concentrate
CHARECTERISTICS	
Milky appearance with creamy layer on standing : clears when fat is extracted by alkali and ether.	
Fat globüles stain with Sudan III	
Alkaline	
Oderless	
Sterile and bacteriostatic	
Specific gravity, 1.012-1.025	

Table 1 : The composition and the characteristics of chyle.

ETIOLOGY OF THE CHYLOTHORAX

1- Congenital Chylothorax : Chylothorax may be present after birth. Usually this condition is associated with birth trauma. A congenital fistula that becomes apparent once the infant is fed.

2- Traumatic Chylothorax : Penetrating or nonpenetrating injuries to the thorax may cause the rupture of thoracic duct. Injury at operation is common. Chylothorax has been reported following almost every known thoracic surgical procedures, including operations on the aorta, esophagus, heart, lungs and sympathetic nervous system. Before a chylothorax becomes overt, there is a latent interval of two to ten days. But some times weeks and months elapse between the time of injury the onset

of chylous pleural effusions. This is because, following rupture of the duct, chyle accumulates to the posterior mediastinum-the so called chyloma-and finally ruptures through the mediastinal pleura.

3- Neoplastic Chylothorax : Bening cystes and tumors arising in the thoracic duct may produce single or multiple cystlike space with chyle. The thoracic duct may be secondarily involved by lymphatic spread of abdominal and intrathoracic cancer. The importance of involvement of the duct by malignant disease is that some part of duct will occasionally leak chyle (3, 6).

DIAGNOSIS OF CHYLOTHORAX

Diagnosis depends on the recognition of the chyle once it has been aspirated from the chest. Chyle is a milky liquid and in traumatic chylothorax the chyle is frequently bloodstained at first and this may be misleading. On microscopic examination, the presence of fat globules which clear with alkali and ether or stain with Sudan III and chylomicrons are diagnostic. A low grade fever is usually present. Radiographically the opacity of a chylous effusion is not characteristic. A lymphangiogram may help the diagnose the site of chyle leakage (3, 8).

TREATMENT OF CHYLOTHORAX

The spontaneous closure of thoracic lymph fistula is quite unpredictable. The crucial decision in the management of such patient is how long to continue with a trial of conservative treatment. When such therapy is instituted, oral feeding is stopped, the stomach is kept empty with a nasogastric tube, and feeding is done intravenously only. Intravenous feeding replaces losses of fluid and electrolytes, along with plasma and lipids (8).

Treatment of chylothorax can be divided into three parts :

- 1- Conservative therapy
- 2- Surgical treatment
- 3- Radiotherapy

Drainage of chylothorax is better done by a continuous tube method than by a intermittent aspirations, for the lung it should be expanded completely to help to stop the leak (3).

The conservative treatment should be abandoned if there is a loss of chyle of more than 500 ml/day in an adult or more than 100 ml/day in a child longer than two or three weeks (7).

In unilateral chylothorax the chest should be opened on the side of effusion, when the effusion is bilateral the right side should be explored first. Surgical exploration usually is done only 2-3 weeks after of conservative therapy that has been not successful. The proteins and the other blood elements will be abnormal at this time and should be corrected to the greatest possible extent before operation (2).

To make it easy for the surgeon to find the leaking duct, the patient should be given 200-300 ml of milk and cream mixture by mouth 3-4 hours before the operation. It is the best to do a full posterolateral thoracotomy at the level of sixth or seventh interspace. As the milk and cream mixture has been absorbed and traveling upward in the duct by this time the leak in the duct is easily identified by the steady drip of milky fluid from the open end (6).

The best way to control leakage is to pick up the leaking end with a forceps and ligate it in the event of traumatic leak following a thoracic operation. The leak will be near the operation site rather than just above the diaphragm, and this is the area and the level to be explored (6).

Pleuroperitoneal shunting has been used in the treatment of chylothorax especially in neonatal chylothorax and adult cases of traumatic and malignant etiology (5, 7).

It has been reported that the radiotherapy was successful in the treatment of chylothorax in case of mediastinal lymphoma or carcinoma. The irradiation of pleural lymphatic with 2000 rad would be helpful in many cases (6).

A plan is shown for management of chylothorax in table-2 (6).

CASE REPORT

The patient 21 years old man, presented at the time of admission with a complaint of dyspnea. He had a past medical history notable for antituberculous therapy for 14 months. Chest x-rays and computed tomography showed a thickened parietal pleura (Fig. 1).

The patient underwent decortication with a right posterolateral thoracotomy. After the operation the pathology about pleural pieces and the lymph nodes were reported as chronic pleuritis and tuberculous lymphadenitis.

The second day postoperatively, a chylous drain

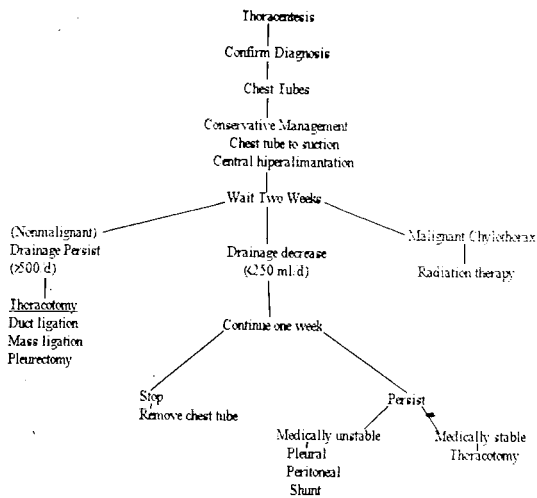


Table 2 : The Management of Chylothorax.

nage from the chest tube was noted. He was placed on a low-fat diet. Chylous drainage persisted at a rate of 800-1200 ml daily (Fig. 2).

On the postoperative day 10, the nutritional assessment revealed a 6 kg. weight loss since admission and hypoalbuminemia was present.

On the postoperative day 12, drainage continued. A left subclavian catheter was placed and total parenteral nutrition was initiated. The oral feeding was stopped.

The milky appearance of chylous liquid disappeared but the chest tube drainage continued seriously at a high level averaging 1000 to 1500 ml/day for two months. He could not be reoperated due to his previous decortication.

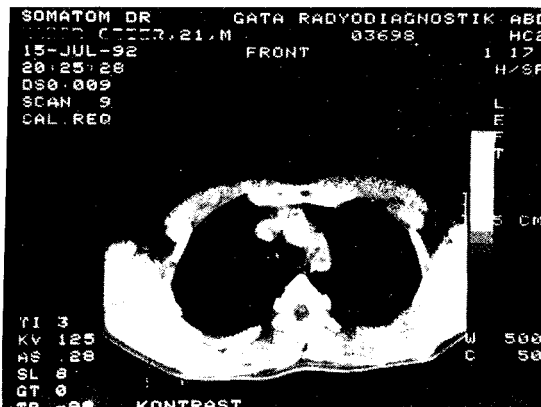


Fig - 1 : The thickened pleura on CT.

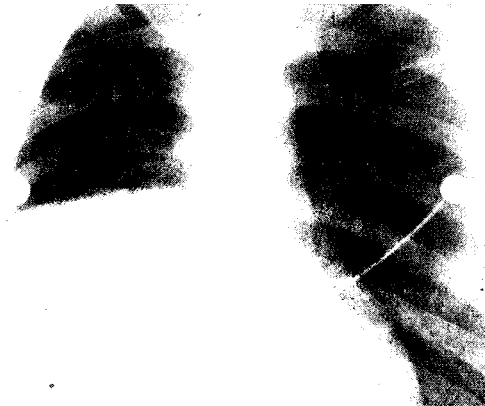


Fig - 2 : The persistent chylothorax in the 2nd operative day.

Two months after this procedure, because the volume of drainage was substantial, a deep X-ray therapy was applied to the right hemithorax at the level of the sixth and seventh vertebrae as 2400 rad for three days.

A week after X-ray therapy, he had no further drainage (Fig. 3). The chest tube was removed and oral feeding was initiated.

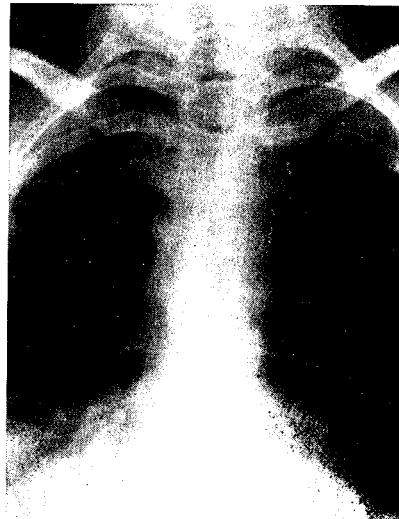


Fig - 3 : The PA radiogram of the patient after the X-ray therapy.

DISCUSSION

In the past, the chylothorax is an uncommon problem, but with the increased incidence of chest trauma and surgical procedures performed through the pleural space on mediastinal structures, chylothorax occurs more frequently (3).

With the introduction of the thoracic duct ligation by Lampson in 1948, the mortality rate from the chylothorax decreased from 50 to 16.5 per cent. Today, the crucial decision in the management of these patients is when to advocate surgical intervention (3).

Once the diagnosis of chylothorax is established, a course of therapy should be chosen which will avoid the serious metabolic and immunologic sequela widely known to this disease and a nutritional support should be begun early. Non operative measures are then instituted such as thoracentesis and/or tube thoracostomy (4, 6).

It is important to maintain the lung fully expanded, as this will prevent the formation both of loculated fluid collections and of a fibrothorax. Nutritional replacement can be managed best with intravenous hyperalimentation, because any oral feeding will increase the out put of fistula. There is no uniformity of opinion regarding the length of time that conservative treatment should be given while hoping for the fistula to seal. The recommended period of 14 days as the maximum time for conservative management appears to be appropriate. More prolonged conservative management is indicated in some circumstances for contraindicate thoracotomy (3). In our case the operation is contraindicated because of previous decortication of patients.

The radiation therapy is recommended for the patients if the underlying condition is malignancy. Generally, radiation therapy to the amount of 2000 rad controls most cases of this variety of chylothoraces (6).

On the contrary, in our case we applied a conservative therapy consist of tube thoracostomy and parenteral hyperalimentation for two months then the radyotherapy is administered. The irradiation successfully controlled the chlous leakage.

We believe that, this is the first case in the literature, in which the use of radiotherapy has been described in traumatic chylothorax.

Correspondence to : Dr.Onur GENÇ
GATA
Göğüs Cerrahisi Anabilim Dalı
Etilik
06018 ANKARA - TÜRKİYE
Phone : 312 - 325 12 11

REFERENCES

1. Adler RH, Levinsky L : Persistent Chylothorax. Treatment by Tale Pleurodesis. *J Thorac Cardiovasc Surg* 1978; 76 : 859-864.
2. Bolger C, Walsh TN, Tamer WA, Keeling TJ : Chylothorax after Esophagectomy. *Br J Surg* 1991; 78 : 587-588.
3. DeMeester TR, Lafontaine E : Chylothorax Eds P : 369-72, Sabiston, C D, Spencer F C, Gibbon's Surgery of the Chest 4 th ed. WB Saunders Comp 1983.
4. Jensen L G, et al : Dietary Modification of Chyle Composition in Chylothorax. *Gastroenterology* 1989; 97 : 761-765.
5. Kitchen ND, Hocken DB, Grenhalgh RM, Kaplan DK : Use of Denver Pleuroperitoneal Shunt in Treatment of Chylothorax Secondary to Filariasis. *Thorax* 1991; 46 : 144-145.
6. Miller IJ : Chylothorax Eds, P : 714-720, Shields W T General Thoracic Surgery 4th Ed. Williams-Wilkins Comp 1994.
7. Sade R M, Wiles HB, Charleston SC : Pleuroperitoneal Shunt for persistant Pleural Drainage after Fontan Procedure. *J Thorac Cardiovasc Surg* 1990; 100 : 621-623.
8. Wilson WJ, Kron LI, Rheuban KS, Rodgers BM : Chylothorax an Assesment of Current Surgical Management. *J Thorac Cardiovasc Surg* 1985; 89 : 221-227.