



# **AETIOLOGY AND MANAGEMENT OF CHYLOTHORAX IN ADULTS**

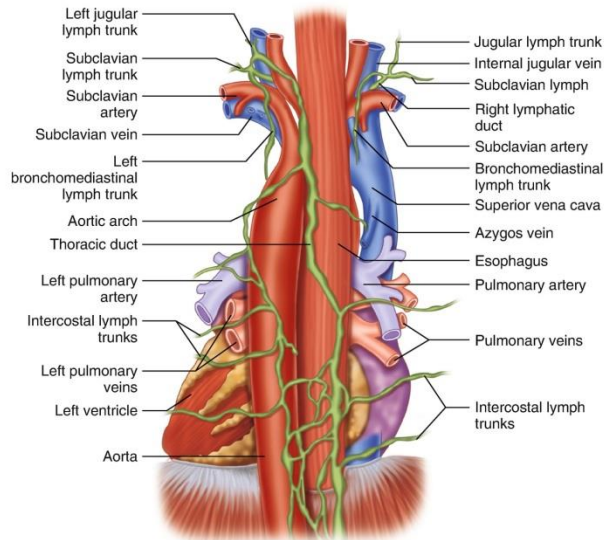
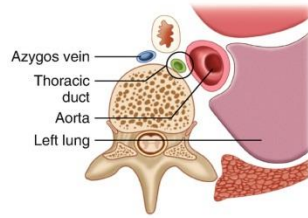
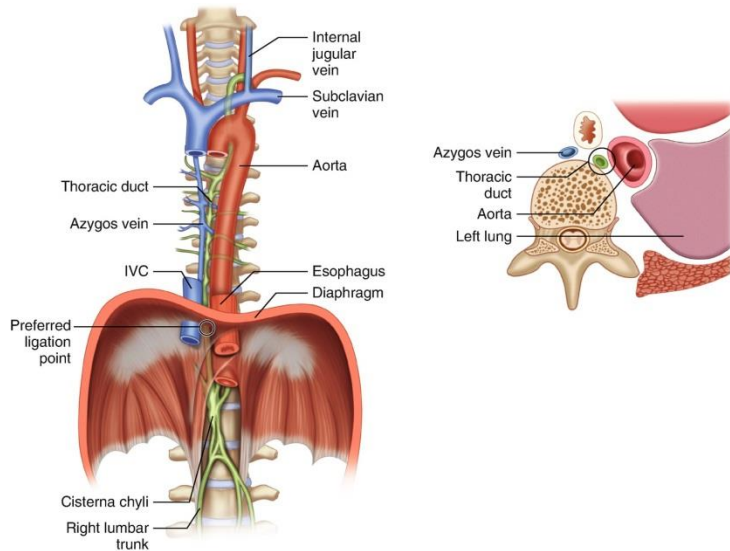
**Dr.Rami Kindi**

# INTRODUCTION

Chylothorax represents chyle in the pleural cavity. Chyle represents lymphatic fluid enriched with fat and its digestive products absorbed by the intestinal epithelium. **The abundant presence of chylomicron in the pleural fluid aspirate is diagnostic of chylothorax.**




# ANATOMY OF THE THORACIC LYMPHATIC SYSTEM



The thoracic duct has an approximate length of 36-45 cm and a diameter of 2-3 mm. It drains intestinal chyle to the bloodstream and the lymphatics of the body, except for the right side of the head and neck, right upper limb, right lung, right side of the heart and the convex surface of liver which in turn drain by the right lymphatic duct.



Significant variations to the above-described pattern can occur. Embryologically, the thoracic duct is a bilateral structure and hence many anatomical variations are possible. The pattern described above is true only in about 65% of the population .The thoracic duct **duplicates** or **triplicates** itself in more than 40% of the population .These branches may coalesce to form a plexus in the mid portion of the duct and end independently or as one duct . Infrequently, the upper portion of the thoracic duct divides into two branches that drain separately, one in the usual manner and the other reaching the right subclavian vein . This variation from the normal anatomical pattern explains the incidence of chyle leak despite care and attention the surgeon might have practised in identifying and protecting the main thoracic duct during an operation such as oesophagectomy.



# BIOCHEMISTRY OF CHYLE

Component	Concentration (per 100 ml)
Total fat	0.4—6 g
Total cholesterol	65—220 mg
Total protein	2.21—6 g
Albumin	1.2—4.1 g
Globulin	1.1—3.6 g
Fibrinogen	16—24 g
Sugar	48—200 g
Electrolytes	Similar to plasma
<b>Cellular elements</b>	
Lymphocytes	400—6800 per ml
Erythrocytes	50—600 per ml
Antithrombin globulin	25% of plasma level
Prothrombin	25% of plasma level
Fibrinogen	25% of plasma level




# MECHANISM OF CHYLOTHORAX

- Trauma to the thoracic duct is the commonest mechanism of chylothorax (Thoracic Surgery, Cardiac Surgery)
- Central venous catheterisation (Thrombosis )
- Often, a **latency period of 2—7 days** exists between the time of injury and clinical evidence of chylothorax if the injury is not a major one. This is because lymph accumulates in the posterior mediastinum until the mediastinal pleura ruptures, **usually on the right side at the base of the inferior pulmonary ligament.**
- Mediastinal lymphadenopathy
- Rare mechanisms leading to chylothorax (hepatic chylothorax, Down's and Noonan's syndrome, Yellow-nail syndrome )



# EFFECT OF CHYLOTHORAX

- Loss of chyle and lymph into pleural space can lead to drastic consequences because of the loss of essential **proteins**, **immunoglobulins**, **fat**, **vitamins**, **electrolytes**, and **water**.
  - Large chylothoraces commonly lead to **hypovolaemia** due to the large volume loss. Decompensation occurs depends on the amount, rate, and duration of chyle loss.
  - **Hyponatraemia**, **acidosis**, and **hypocalcaemia** are the most commonly recognised phenomena.
  - Continued loss of proteins, **immunoglobulins**, and **T-lymphocytes** into the pleural space leads to immunosuppression .Furthermore, **B-lymphocyte**-mediated immune functions are impaired by prolonged chyle drainage .
  - Infection of a chylothorax itself is very uncommon because chyle is inherently bacteriostatic.
  - The bioavailability of certain drugs could be severely impaired causing subtherapeutic **digoxin** , **amiodarone** and **cyclosporine** levels in the serum of patients.
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# AETIOLOGICAL CLASSIFICATION OF CHYLOTHORAX

## Modified DeMeester Classification of Chylothorax

### ○ Traumatic :

1. Blunt
2. Penetrating
3. Surgical :
  - A. Cervical :
    - Excision of lymph nodes
    - Radical neck dissection
  - B. Thoracic :
    - Ligation of patent ductus arteriosus
    - Surgery for coarctation of aorta/aortic aneurysm
    - Post-esophagectomy
    - Surgery for mediastinal tumours
    - Post-pneumonectomy

### c. Abdominal :

- Post-sympathectomy
- Radical lymph node dissection

### D. Diagnostic procedures :

- Lumbar arteriography
- Subclavian vein catheterisation

### ○ Congenital :

1. Atresia of thoracic duct
2. Birth trauma
3. Pleural thoracic duct fistula

### ○ Neoplasms

### ○ Miscellaneous






# CLINICAL FEATURES OF CHYLOTHORAX


- Clinical features are typical of any pleural effusion. **Dyspnoea, cough, and chest discomfort** are the main symptoms.
- Pleuritic **chest pain and fever are uncommon** because chyle is not irritating to the pleural surface.
- The course of the thoracic duct explains why injury to the duct above the level of the fifth thoracic vertebra usually produces left-sided chylothorax and injury below that level, a right-sided chylothorax .
- Half of all chylothoraces are right-sided, one-third is left-sided, and the remainder are bilateral .



# INVESTIGATIONS

- Chest roentgenography with lateral views as well as decubitus views may be helpful in determining the size and location of the chylothorax.
  - CT is useful when chylothorax is associated with trauma, or where an underlying tumour is suspected.
  - Bipedal lymphangiography has been recommended to identify the cause and detect the site and size of the leak.
  - A fat meal mixed with methylene blue leads to bluish-green discolouration of the pleural fluid in chylothorax, thereby helping at times to localise the leak.
  - Lipoprotein analysis of pleural fluid will confirm the presence of chylomicrons.
  - Pleural fluid triglyceride levels  $>110$  mg/dl, presence of chylomicrons, low cholesterol level, and elevated lymphocyte count are diagnostic of a chylothorax.
  - When the triglyceride level is between 55 and 110 mg/dl, a lipoprotein analysis is indicated to detect chylomicrons. Other criteria for chylothorax include a pleural fluid to serum triglyceride ratio  $>1$ , and a pleural fluid to serum cholesterol ratio  $<1$ .
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# PSEUDOCHYLOTHORAX VERSUS CHYLOTHORAX

- Pseudochylothorax, also known as chyliform pleural effusion or **cholesterol pleural effusion**, is the term applied to pleural fluid that mimics true chylous pleural effusion in appearance but lacks the biochemical criteria for chylothorax.
  - Pseudochylothorax is more likely to result from long-standing pleural effusion.
  - High cholesterol levels are typical of a pseudochylous pleural effusion. Cholesterol levels are generally >200 mg/dl and may even exceed 1000 mg/dl .
  - Tuberculosis pleural effusions account for approximately 54% of all cases.
  - Pseudochylous pleural effusions are usually sterile and require no treatment, unless they are large and cause progressive respiratory symptoms.
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# MANAGEMENT OF CHYLOTHORAX

- Conservative strategy :
  1. Nil by mouth
  2. Medium-chain triglycerides by mouth
  3. Total parenteral nutrition
  4. Drainage of chylothorax :
    - Thoracentesis
    - Intercostal tube drainage
  5. Ensuring complete lung expansion
  6. Somatostatin or octreotide infusions
- Operative strategy
  1. Direct ligation of thoracic duct
  2. Mass ligation of supradiaphragmatic thoracic duct
  3. Pleuroperitoneal shunting
  4. Pleurectomy
  5. Pleurodesis — glue or talc
- Radiotherapy to a total dose of 2000 rads

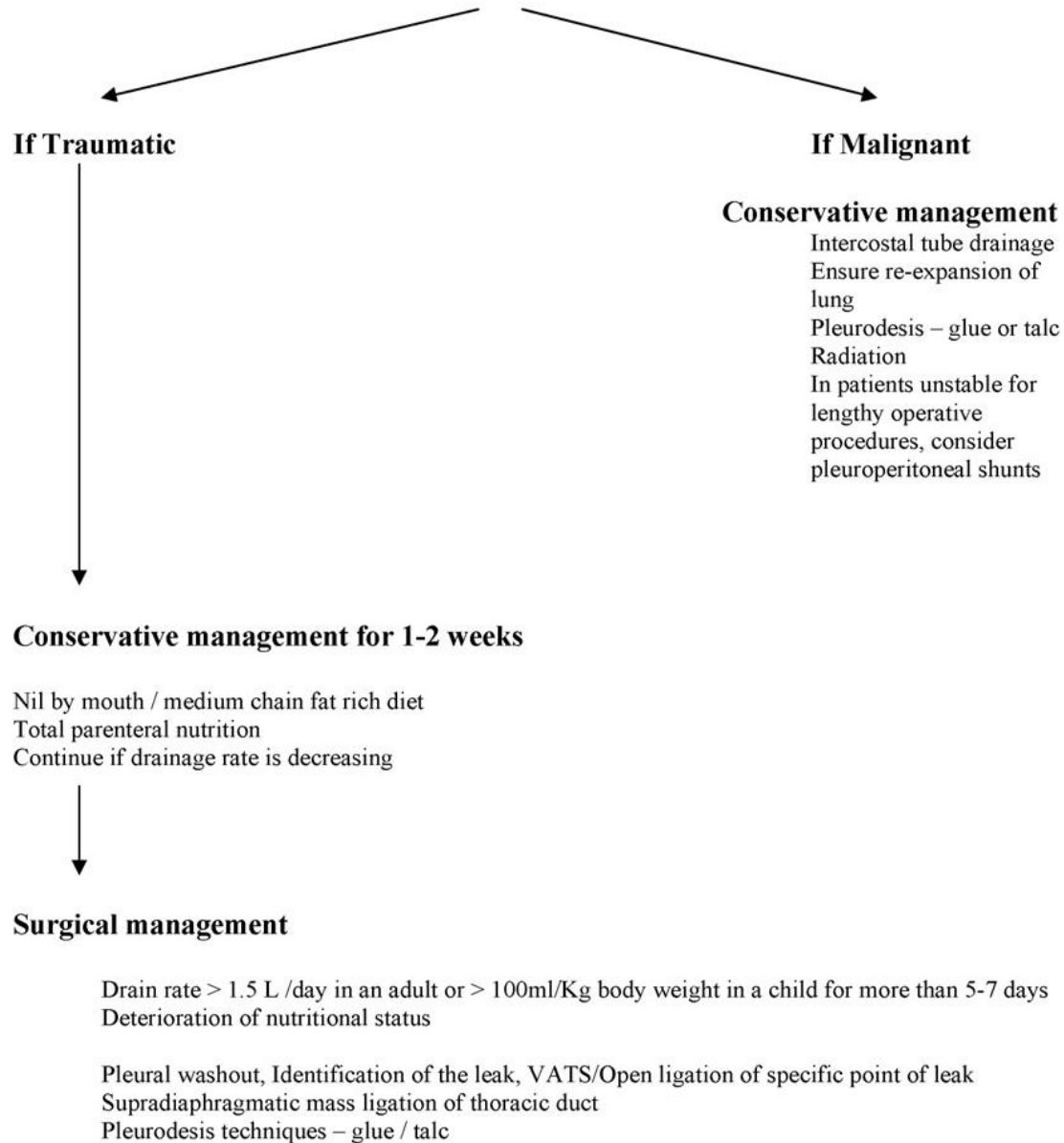


- Many advocate conservative management for a maximum of 2 weeks in the absence of a strong indication for surgery .
- Aggressive surgical therapy is recommended for posttraumatic or post-surgical chylothorax to decrease mortality.
- Surgical intervention offers better results than conservative management when :
  1. daily chyle leak exceeds 1.5 l in an adult or >100 ml/kg body weight per day in a child.
  2. Chyle drainage rate is more than 1 l/day for a period more than 5 days .
- How to find the site of leak ?
  1. Lymphangiography.
  2. Subcutaneous injection of 1% Evans blue dye in the thigh.
  3. Methylene blue added to a fat source.




**Step 1. Pleurocentesis – Early confirmation of diagnosis**

**Step 2. Investigations to confirm aetiology**



# TECHNIQUES OF LIGATION OF THE THORACIC DUCT

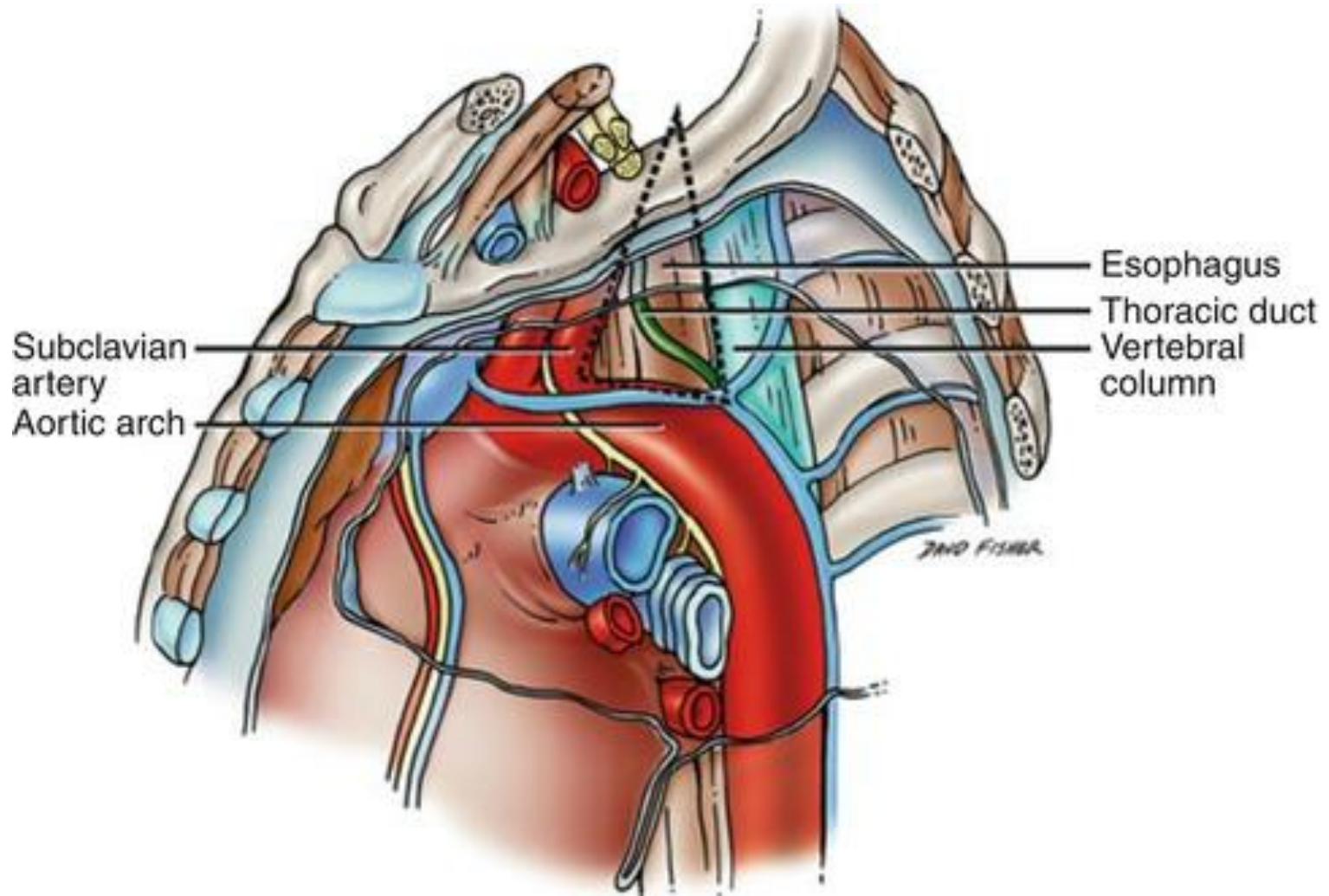
- Basically, if the chyle leak can be identified, direct ligation with nonabsorbable suture should be performed on either side of the leak.
  - If the site of leak is not identifiable easily, extensive dissection to find this is strongly discouraged to minimise trauma and further leaks.
  - Mass ligation of all tissue between the aorta, spine, oesophagus and pericardium is performed above the diaphragmatic hiatus via the right pleural space.
  - The surgical intervention of choice in thoracic duct injury is thoracic, abdominal or cervical ligation of the thoracic duct .
  - When the thoracic duct is unidentifiable, talc pleurodesis could be tried. This traditional technique has a success rate of 95% and negligible morbidity .
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- When the chylothorax is complicated, loculated, or the site of chyle leak cannot be established, pleural decortication and surgical pleurodesis may be indicated.
- If the leak is in the upper thorax or neck, ligation of the thoracic duct is performed in the Poirier's triangle, located between the internal carotid artery, arch of aorta, and vertebral column .
- Therapy using externalised pleuroperitoneal shunting in chylothorax after surgical correction of congenital heart disease is considered safe, effective, and minimally invasive .
- Though attempts have been successfully made by interventional radiologists to cannulate and embolise the leaking thoracic duct, success has been limited and the procedure not reproducible at many centres.





# POIRIER'S TRIANGLE



# PROGNOSIS OF CHYLOTHORAX

- In the past, the mortality due to chylothorax was in excess of 50% . Currently, the morbidity and mortality have improved due to the more aggressive management strategies adopted. Introduction of aggressive therapeutic measures to reverse the adverse effects of chyle loss has led to the lowering of mortality rates for post-traumatic chylothorax . Malignant chylothorax, chronic debilitating chylothorax and bilateral chylothoraces have worse prognosis .



THANK YOU

