Ulutas Med J 2016;2(1):1-6
DOI: 10.5455/umj.20151214013947

REVIEW ARTICLE OPEN ACCESS

Descending Necrotizing Mediastinitis

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Abstract

Background: Mediastinitis is an infection of the mediastinal connective tissue and surrounding structures, the course of which can be serious and lethal. Descending necrotizing mediastinitis (DNM) is one of the most lethal forms of mediastinitis. It occurs as a result of a complication of cervical necrotizing fasciitis resulting from infections in the floor of the mouth or the cervical region and spreads to the mediastinum through the fascial planes without primary skin or muscle involvement.

Conclusion: Necrosis and tissue damage develops from the infection spreading from this region through the fascial and deep cervical planes. It can lead mortality, if not prevented at the early stage. When early diagnosis is delayed, surgical drainage and debridement may be required.

Keywords: Descending necrotizing mediastinitis, necrose, mediastinitis

Introduction

Mediastinitis is a lethal infection of the mediastinal connective tissue. It can be infectious or non-infectious and acute or chronic depending on the etiology. If it is not diagnosed and treated during the early stages, this infection is life threatening. A majority of acute mediastinitis cases develop secondary to esophageal perforation or previous mediastinal and cardiac operations. In its chronic form, this infection develops secondary to tuberculosis and bacterial and fungal infections like histoplasmosis or sarcoidosis (Table-1).

MTHFR has an important Descending necrotizing mediastinitis (DNM) occurs as a result of a complication of cervical necrotizing fasciitis resulting from infections in the floor of the mouth or in the cervical region spreading to the mediastinum through the fascial planes without primary skin or muscle involvement. Clinically, this infection is quite different from mediastinitis that develops after esophageal perforation or cardiac surgery. It is a rare infection, but the mortality rate is very high (15–50%). It is a clinical condition, the course of which still has a high mortality rate despite intensive treatments.

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Received: Nov 10, 2015 **Accepted**: Dec 14, 2015
Published: 30.03.2016

DNM, which is caused by necrotizing soft tissue infections (NSTI) in general, was first identified by Estrea *et al.* in 1983 (1). The most common causes of DNM are dental, retropharyngeal, peritonsillar, and odontogenic abscesses (2–5). In a wide series comprising DNM cases, it has been reported that the most common cause of DNM was of odontogenic origin (58%) (6).

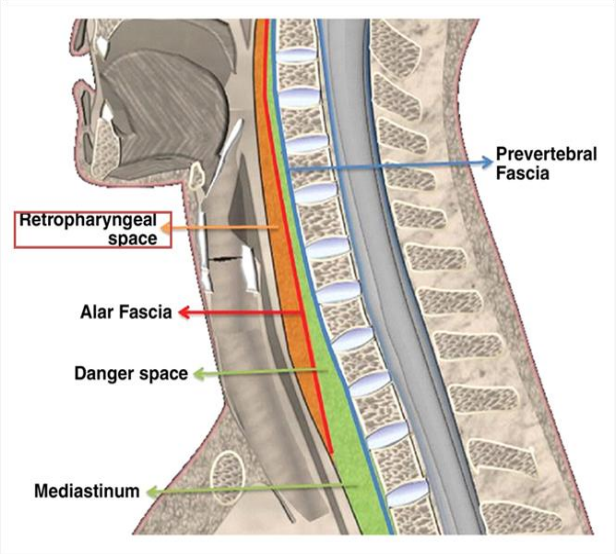
Table-1. Main cause of acute/chronic mediastinitis

Causes of Acute Mediastinitis	
Esophageal Perforation Iatrogenic Trauma (cutting/piercing) Abdominal trauma (with pressure) Boerhaave Corrosive burns Cancer Diverticulitis	After sternotomy Open heart surgery Thoracic surgery cases Retropharyngeal abscess After dental infections
Causes of Chronic Mediastinitis	
Infections Tuberculosis Histoplasmosis capsulatum Blastomycosis Amoebic abscess Hydatid cysts	Autoimmune diseases Behçet's disease Radiotherapy Drug Methysergide maleate

Anatomy

Primarily, the main fascial pathways in neck region should be studied to understand the spread of necrotizing soft tissue infections to mediastinal compartments. The infection spreads to the mediastinal compartment via three main fascial pathways (7). These are pretracheal (superficial) ending in the anterior mediastinum, latero pharyngeal (perivascular) ending in middle mediastinum, and retropharyngeal (prevertebral space) ending in the posterior mediastinum (8).

The retropharyngeal space is the main pathway for oropharyngeal infections to reach the mediastinum.



Retropharyngeal Pathway

The infection spreads to the posterior mediastinum via this pathway. This region is a limited space above the hyoid bone and extends up to the T1 vertebra. The cervical prevertebral space has two compartments. The retropharyngeal region in the anterior compartment is the most common dissemination pathway of DNM (7-10).

The posterior compartment is known as the danger space. Following rupture of the alar fascia due to an abscess in retropharyngeal region, the infection spreads to the posterior mediastinal region after reaching the danger space. Since this region extends from the skull base to coccyx, transdiaphragmatic dissemination of the infection has been shown (8).

The pretracheal pathway is the most superficial of the cervical fascial pathways. It is limited to the anterior trachea and thyroid cartilage (6) and is the main pathway for spread of thyroid-related infections to the mediastinum. Parietal pleura constitute the inferior part of this region in the pericardium and carina.

The lateropharyngeal pathway is the main pathway followed for draining necrotizing soft tissue infections from the head and neck region to the middle mediastinum. This region consists of the internal jugular veins, carotid arteries, and vagus nerves. Arterial hemorrhage may develop because of perivascular dissemination.

Epidemiology and Risk Factors

DNM is commonly observed during odontogenic infections of the second and third molar teeth (Ludwig's angina) and spreads to mediastinum due to negative thoracic pressure along the cervical fascia in the lateropharyngeal region. On the other hand, DNM may further develop due to infections originating from the teeth, parotid glands, and tonsils and otitis, mastoiditis, or epiglottitis rarely occur. Diabetes, advanced age, obesity, peripheral vascular disease, cancer, immunodeficiency, hypoalbuminemia, chronic renal failure, corticosteroid use, and malnutrition are risk factors for DNM (8-11).

Microbiology

Generally, aerobic and anaerobic micro-organisms co-exist (Table 2) and are the most commonly observed causative organisms in one of the three cases. The most commonly detected aerobes are *Streptococ pyogenes*, *Staphylococcus. aureus*, *Escherichia coli*, and *Pseudomonas aeruginosa* as well as anaerob such as *Bacteroides fragilis* and *Clostridium* species (12).

Diagnosis

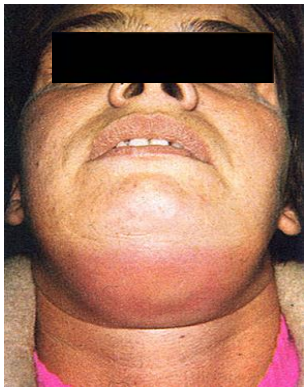
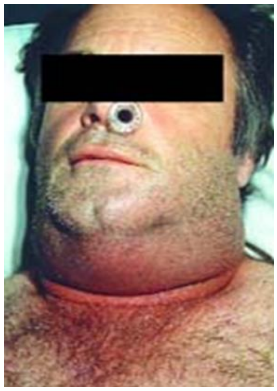
Early diagnosis of mediastinitis is difficult due to uncertain symptoms. History and physical examinations are important for diagnosis. The most important step in the diagnosis of the disease is to consider NSTI. Deep cervical infections with the abovementioned predisposing factors in the patient's history should indicate necrotizing fasciitis. Estrera *et al*. reported the diagnostic criteria, which includes severe oropharyngeal infection residuals, characteristic radiologic findings, necrotizing mediastinitis infection during surgery, and a relationship between DNM and the oropharyngeal process (1-10).

Beta-hemolytic oral streptococcus
Prevotella
Peptostreptococcus
Fusobacterium
Veillonella
Actinomyces
Bacteroides
Staphylococcus
Alpha-hemolytic streptococcus
Klebsiella
Porphyromonas
Viridans streptococci
Serratia
Enterobacter
Neisseria
Pseudomonas aeruginosa
Escherichia coli

Table-2. The most commonly isolated micro-organisms from patients with descending necrotizing mediastinitis

Clinics

Symptoms generally manifest during the first 48 h. Mediastinal involvement is typically observed between 12 h and 2 weeks. Retrosternal pain, swelling, redness, rigidity in the neck and anterior thoracic wall (Figure 1 and 2), sepsis symptoms such as shivering and fever, cough, and dyspnea are observed. Dysphagia may develop. Pleural fluid and tamponade may develop because of pleural and/or pericardial involvement. In leukocytosis and sepsis, elevation in the platelet count is observed during the early stage, and if disseminated, intravascular coagulation occurs during later, with a decrease in the platelet count (Figures 1 and 2).

Figures 1 & 2. Retrosternal pain, swelling, redness, rigidity in the neck and anterior thoracic wall.

Radiology

Radiologically, the main finding is mediastinal extension. Estrea *et al.* summarized the radiological findings in mediastinitis, which include widening with or without air-fluid level in the retropharyngeal region (Picture 3), mediastinal emphysema (Picture 4), widening of the cervical lordosis, deviation of the tracheal air colon towards the front, pneumothorax due to pleural involvement, and hydropneumothorax.

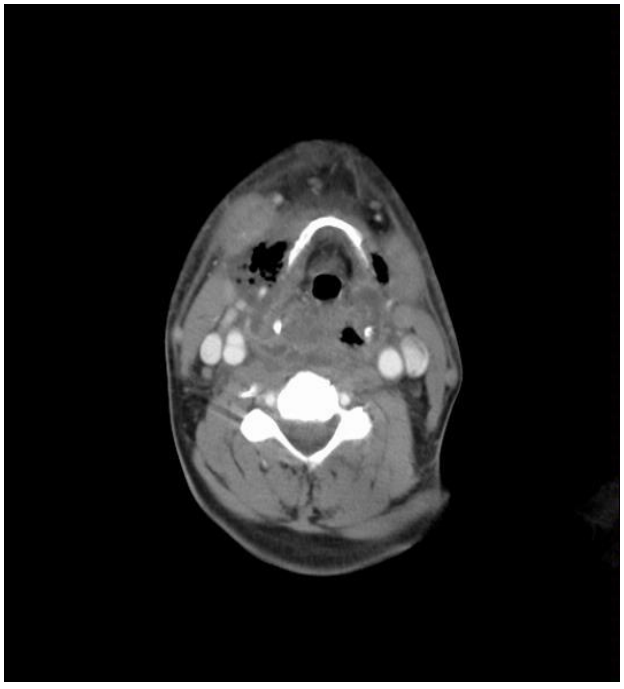


Figure-3. Widening in the retropharyngeal region and diffuse air densities.

Computerized tomography (CT) findings include mediastinal air sacs, localized mediastinal fluid collection or abscess collection, decrease in the normal adipose tissue and soft tissue infiltration, no lymphadenopathy, internal jugular vein thrombosis, and carotid pseudoaneurysm (Figure 3 and 4) (13-14).

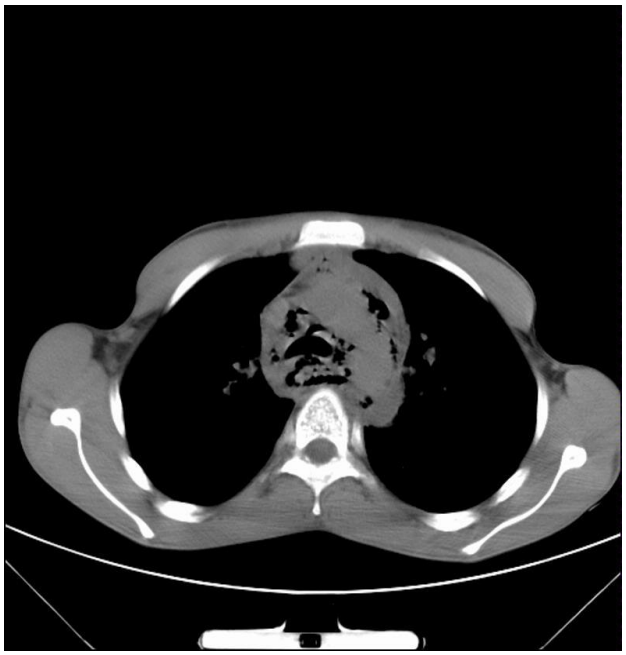


Figure-4. Mediastinal widening and mediastinal emphysema.

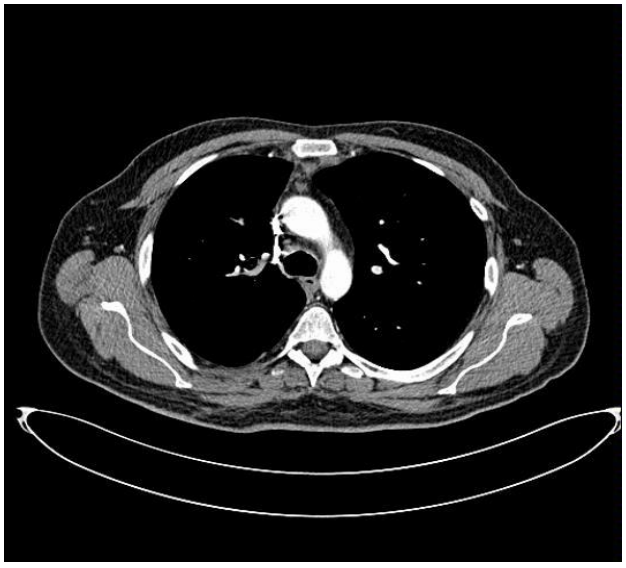
Treatment

The main treatment principle in DNM is suitable antibiotic use and surgical drainage. Antibiotic treatment is not effective without surgical drainage and debridement. The necrotic tissues should be debridged and the mediastinal and pleural regions should be irrigated.

The level and method of surgical drainage depends on the infection site. Here, the fourth thoracic vertebra was an important location. If it is above this level, anterior cervical mediastinotomy and placing a soft drain are beneficial; however, in infections below this level, the visceral compartment should be drained as well. Drainage to the pleural

space is performed by opening the mediastinal pleura. This can be performed by thoracotomy or video-assisted thoracic surgery (VATS) (Picture 5). If the infection includes bilateral thoracic cavities, bilateral VATS or unilateral posterior thoracotomy and exploration with contralateral VATS or "Clamshell" procedure can be performed for bilateral exploration. The subxiphoid trans thoracic approach may be performed concomitantly with the transcervical approach in anterior mediastinal collections (3).

Median sternotomy for drainage is not recommended because of the development of DNM posteriorly and difficulty in accessing the site and also the risk of osteomyelitis. The "Clamshell" incision (bilateral thoracotomy and median sternotomy) allows good exploration; however, it is a highly invasive method. With the Clamshell, the bilateral thorax can be reached in one session; however, it is a risky procedure for critical patients (Figure 5).



Picture-5: Postoperative CT image (VATS)

Hyperbaric Oxygen Therapy

Hyperbaric oxygen therapy can be initiated after the patient is stabilized and is performed in repeated sessions. The main purpose of this therapy is to prevent infections from spreading by increasing the oxygen perfusion to tissues and also to accelerate healing (15).

Prognosis

The mortality rate was approximately 50% before antibiotic treatment (16). The most common cause of mortality is late diagnosis and insufficient drainage (17). Death may occur due to fulminant sepsis, bleeding, aspiration, metastatic cranial infection, emphysema and purulent pericarditis, and tamponade.

Conclusion

Descending necrotizing mediastinitis (DNM) is one of the most lethal forms of mediastinitis. It occurs as a result of a complication of cervical necrotizing fasciitis resulting from infections in the floor of the mouth or the cervical region and spreads to the mediastinum through the fascial planes without primary skin or muscle involvement. Necrosis and tissue damage develops from the infection spreading from this region through the fascial and deep cervical planes. It can lead mortality, if not prevented at the early stage. When early diagnosis is delayed, surgical drainage and debridement may be required.

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How to cite?

Ulusan A, Koc I. Review: Descending Necrotizing Mediastinitis. Ulutas Med J. 2016;2(1):1-6.

DOI: dx.doi.org/10.5455/umj.20151214013947