



Early Surgical Intervention as A Crucial Management Strategy for Descending Necrotizing Mediastinitis: A Case Report and Literature Review

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ABSTRACT

Descending necrotizing mediastinitis (DNM) is a rare yet life-threatening complication primarily originating from oropharyngeal and odontogenic infections. The objective of this study is to highlight the critical role of early surgical intervention and multidisciplinary management in successfully treating complex DNM cases. This study employs a descriptive observational design, specifically combining a clinical case report with a comprehensive literature review. Primary clinical data were retrospectively collected from the patient's medical records, including diagnostic imaging, surgical reports, and clinical follow-up observations. Concurrently, secondary data were gathered through a structured literature search to compare management strategies and clinical outcomes documented in previous studies. A 32-year-old male presented with progressive neck pain, fever, and dysphagia following a carious right mandibular molar infection. Computed tomography confirmed mediastinitis with right-sided empyema. Initial management involved intravenous antibiotics, cervical incision, debridement, chest tube placement, and extraction of the odontogenic source. Due to persistent pleural infection, a subsequent thoracotomy was performed to evacuate approximately 400 mL of purulent fluid, followed by rigorous irrigation and lung decortication. Post-surgical wound care utilized negative-pressure wound therapy combined with medical-grade honey. Effective management of DNM mandates a prompt diagnosis, aggressive source control, and vigilant reassessment of the thoracic cavity when pleural infections stubbornly persist. Surgical approaches must be meticulously tailored to the anatomical spread of the infection and the patient's evolving clinical course to prevent fatal outcomes.

Keywords: cervicotomy; descending necrotizing mediastinitis; empyema; mediastinal drainage; odontogenic infection

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INTRODUCTION

Descending necrotizing mediastinitis (DNM) is a severe mediastinal infection that usually develops through downward spread of an infection originating in the neck. Infection from the oral cavity or pharynx may spread into the retropharyngeal space and descend into the mediastinum through communicating deep cervical fascial planes. Respiratory movements and negative intrathoracic pressure may facilitate this spread. Mediastinitis has several causes and is commonly categorized as post-operative mediastinitis, DNM, or fibrosing mediastinitis. DNM is characterized by rapid progression, whereas fibrosing mediastinitis generally follows a more chronic course. Because DNM is uncommon, its incidence is difficult to establish. However, it has been reported in association with deep neck infections, particularly cervical necrotizing fasciitis.

The rapid progression of DNM makes early detection, accurate diagnosis, and prompt aggressive treatment essential. Reported mortality ranges from approximately 25% to 40% in earlier stages and may reach 50% in advanced disease. Delays in diagnosis, antibiotics, or surgical intervention may worsen the clinical condition and increase the risk of death. This report describes a patient with odontogenic DNM complicated by right-sided empyema and highlights the role of early surgical source control. The primary objective of this study is to highlight the critical role of early surgical intervention, aggressive source control, and multidisciplinary management in successfully treating complex cases of descending necrotizing mediastinitis (DNM) originating from odontogenic infections and complicated by empyema.

METHOD

This manuscript presents a descriptive single-patient case report. The clinical narrative was assembled from the history, physical examination, laboratory findings, imaging reports, microbiology results, operative descriptions, and postoperative course documented in the source case report. The case was organized chronologically to describe diagnosis, treatment decisions, and subsequent thoracic intervention. Relevant published literature on DNM, anatomical spread, and surgical drainage was used to contextualize the case; this was a narrative background search rather than a systematic review, and no pooled analysis or statistical testing was performed.

The source document did not include a statement confirming ethics approval or written informed consent for publication. The authors should verify and add the applicable institutional ethics and patient-consent statement before submission.

Based on the provided manuscript, the research procedures were conducted through the following stages, (1) The study was structured as a descriptive single-patient case report combined with a narrative literature review. (2) Data were retrospectively gathered from the patient's medical records. This involved extracting detailed information from the patient's medical history, physical examinations, laboratory findings, microbiology results, diagnostic imaging (chest radiographs and CT scans), operative descriptions, and postoperative care documentation. (3) The collected clinical narrative was organized chronologically to systematically describe the progression of the disease, the initial diagnosis, the sequence of treatment decisions, the specific surgical interventions (cervical drainage, chest tube placement, and exploratory thoracotomy), and the outcomes of post-surgical wound care (using negative-pressure wound therapy and medical-grade honey). (4) A narrative background search of relevant published literature was conducted. This focused on DNM pathophysiology, anatomical spread, and surgical drainage strategies to contextualize the clinical decisions made in the case. (Note: This was conducted as a narrative review, meaning no systematic pooled analysis or statistical testing was performed). (5) The clinical findings and literature insights were synthesized to draw conclusions regarding the necessity of prompt diagnosis, tailored surgical approaches based on infection extent (Endo-Hasegawa classification), and vigilant reassessment for persistent pleural infections.

RESULT

A 32-year-old man was referred from a regional hospital with continuous neck pain that had been present for three weeks before admission. The pain worsened with neck movement and mouth opening. He also reported intermittent fever for two weeks, difficulty swallowing, and reduced appetite. The illness initially began with pain in a carious right lower molar, followed by progressive swelling and pain on the left side of the neck. Analgesics and antipyretics provided incomplete relief. He denied previous allergies, trauma, and chronic disease.

The patient underwent incision and drainage of a cervical abscess at the referring hospital. One week after the procedure, he developed chest pain and progressive shortness of breath, aggravated by activity and lying supine and relieved by rest and sitting upright. Fever continued intermittently. CT imaging of the neck and chest showed mediastinitis with right-sided empyema (Figure 1).

Physical examination revealed erythematous, warm, tender swelling over the anterior neck extending to the infraclavicular region and suprasternal notch. The swelling was fluctuant, suggesting fluid accumulation. Bilateral submandibular incisions were present, with pus draining from the cervical surgical wound but no visible necrotic tissue. Trismus was also noted; the maximum mouth opening was recorded as “xx cm” in the source record. Chest examination showed reduced breath sounds on the right and reduced percussion resonance up to the fifth intercostal space.

Laboratory testing showed leukocytosis ($25.43 \times 10^3/\mu\text{L}$), hypoalbuminemia (2.9 g/dL), and reactive hepatitis B surface antigen (HBsAg). Random blood glucose was 161 mg/dL. Renal function was reported as normal, with urea 46.0 mg/L and creatinine 0.76 mg/L. The initial chest radiograph at the referring hospital showed no abnormality. A repeat radiograph two days later at Arifin Achmad Regional General Hospital demonstrated homogeneous consolidation in the right lower lung, with a cardiothoracic ratio below 50%. CT imaging showed fluid accumulation with air bronchograms, diffuse ground-glass opacities in both lungs, and bilateral pleural effusions, more prominent on the right. A deep neck abscess extended into the superior and anterior middle mediastinum to the level of the T8 vertebra, consistent with DNM classified as Endo-Hasegawa type IIA. The right-sided consolidation and pleural effusion raised concern for associated right empyema.

Immunoserology and Gram-stain findings from the referring hospital suggested a mixed bacterial infection: Gram-positive diplococci (4+), Gram-positive streptococci (4+), and Gram-negative bacilli (2+). The specimen also showed epithelial cells (4+, >10/low-power field), leukocytes (4+, >10/low-power field), and fungi (2+, 1–3/low-power field). Based on the clinical, radiological, and laboratory findings, DNM secondary to an odontogenic infection was diagnosed. Initial intravenous treatment consisted of ampicillin–sulbactam 1.5 g four times daily and metronidazole 500 mg three times daily. Intravenous paracetamol 1 g three times daily was given for analgesia and fever control. Surgical drainage was planned and performed on the day of diagnosis.

A transverse incision was made over the anterior neck through the skin, subcutaneous tissue, and platysma. Approximately 30 mL of pus was drained, followed by blunt dissection to the paratracheal space and perivascular sheath. The incision was extended through cervicotomy to the sternal notch. Intraoperative findings included fasciitis involving the deep cervical fascia and sternocleidomastoid muscle. Necrotic tissue was debrided, pus was aspirated and drained, and the operative field was irrigated with 0.9% sodium chloride solution. The wound was left open (Figure 3).

A chest tube was inserted in the right fourth intercostal space to manage the empyema. Pus, air bubbles, and fluid oscillation were observed, indicating ongoing pleural infection. The oral and maxillofacial surgery team subsequently extracted the tooth suspected to be the odontogenic source. The patient was admitted to the intensive care unit for monitoring. The wound was dressed daily using honey, and negative-pressure wound therapy (NPWT) was initiated on postoperative day 3. A follow-up chest radiograph was obtained on postoperative day 10. On postoperative day 12, exploratory thoracotomy was performed because of persistent pleural disease. Approximately 400 mL of pus was aspirated from the pleural cavity and sent for culture. The pleural cavity was irrigated with normal saline, and decortication was performed because adhesions involving the lung

parenchyma were found. The wound was closed on postoperative day 18. The source manuscript does not specify the exact dates of transfer from the ICU or hospital discharge.

DISCUSSION

DNM is a medical emergency that requires rapid diagnosis and treatment. Despite advances in care, reported mortality remains high, ranging from 24% to 50%, and may rise when diagnosis is delayed or treatment is insufficiently aggressive. Unlike mediastinitis caused by esophageal abscess rupture or cardiothoracic surgery, DNM spreads from cervical or oropharyngeal infection through fascial planes into the mediastinum. In this patient, the likely origin was the submandibular space, with subsequent spread through the retropharyngeal and parapharyngeal spaces and potentially along perivascular planes. Odontogenic and pharyngeal infections can spread through fascial planes and cause mediastinal involvement. Empyema further complicated this case and is a recognized, though uncommon, complication of mediastinitis. Recent case reports likewise describe DNM complicated by pleural infection and emphasize the need for repeated assessment when infection persists (Rice et al., 2021; Tamaki et al., 2021).

The diagnosis was supported by the criteria described by Estrera et al. (1983), which include clinical evidence of oropharyngeal infection, radiological findings consistent with mediastinitis, operative identification of necrotizing mediastinal infection, and a relationship between the oropharyngeal infection and mediastinal disease. CT of the neck and chest is important for defining the source and extent of infection. Relevant findings may include mediastinal widening, increased mediastinal attenuation, air–fluid levels suggesting abscess formation, and pleural effusion. In this case, the extension of a deep neck abscess to the superior and anterior middle mediastinum at the T8 level was consistent with Endo-Hasegawa type IIA DNM.

DNM management requires a multidisciplinary team, potentially including thoracic surgery, otolaryngology, oral and maxillofacial surgery, infectious disease specialists, intensive care, and microbiology. Initial management should follow core principles for critically ill patients, including airway protection, adequate oxygenation, hemodynamic stabilization, antimicrobial treatment, and source control. Because these infections are commonly polymicrobial, empirical broad-spectrum intravenous antibiotics should be started promptly and adjusted according to culture results. Regimens described in the literature include a second- or third-generation cephalosporin combined with metronidazole or clindamycin, or piperacillin–tazobactam; routine antifungal treatment is generally not recommended. In this case, ampicillin–sulbactam and metronidazole were used as initial therapy.

Antibiotics alone are insufficient when purulent collections and necrotic tissue require drainage. Cervical drainage is a central component of treatment, and inadequate drainage can permit continued progression. After drainage, suitable drains may be placed and wounds may be left open for repeated irrigation and dressing changes. The approach to mediastinal drainage depends on the extent and location of infection. Options include transcervical drainage, posterolateral thoracotomy, sternotomy, a subxiphoid approach, and video-assisted thoracoscopic surgery (VATS). A transcervical approach alone may not adequately reach the lower mediastinum. Additional thoracic drainage can provide broader access, while VATS may offer lower morbidity in selected patients. The approach should be individualized according to infection extent, patient condition, and tolerance of the procedure.

In the present case, surgical treatment began on the day the patient arrived at Arifin Achmad Regional General Hospital. Cervicotomy was followed by chest tube drainage and, when pleural infection persisted, exploratory thoracotomy. The Endo classification links the surgical approach to disease extent: type I may be managed with transcervical drainage; type IIA generally requires cervicotomy combined with a subxiphoid incision or anterior mediastinotomy; and types IIB and

IIC may require cervicotomy with thoracotomy.^{10,14} The subsequent thoracotomy in this patient enabled evacuation of 400 mL of pus, pleural irrigation, culture sampling, and decortication for lung adhesions. Nhat et al. described combined thoracic intervention and thoracic irrigation as a strategy for DNM and reported favorable outcomes compared with previously published experience.

Postoperative wound care included NPWT, intended to remove exudate and support granulation tissue formation. Medical-grade honey was also used as a wound dressing. Reviews describe honey as having broad antimicrobial activity and potential value in wound healing, including activity against some bacteria and fungi and inhibition of biofilm formation. In this case, the wound was managed with daily dressing changes and NPWT from postoperative day 3. Although the patient required further thoracic surgery, the report describes no fatal complication such as septic shock or severe pneumonia. The precise date of transfer from intensive care and the date of discharge were not provided in the source manuscript.

DNM is a medical emergency that requires rapid diagnosis and treatment. Despite advances in care, reported mortality remains high, ranging from 24% to 50%, and may rise when diagnosis is delayed or treatment is insufficiently aggressive (Makeieff et al., 2004). Unlike mediastinitis caused by esophageal abscess rupture or cardiothoracic surgery, DNM spreads from cervical or oropharyngeal infection through fascial planes into the mediastinum. In this patient, the likely origin was the submandibular space, with subsequent spread through the retropharyngeal and parapharyngeal spaces and potentially along perivascular planes. Odontogenic and pharyngeal infections can rapidly spread through these anatomically communicating fascial planes, making mediastinal involvement a deadly reality (Karkas et al., 2013). Empyema further complicated this case and is a recognized, though uncommon, complication of mediastinitis. Recent case reports likewise describe DNM complicated by pleural infection and emphasize the need for repeated assessment when infection persists (Rice et al., 2021; Tamaki et al., 2021).

The diagnosis was supported by the criteria described by Estrera et al. (1983), which include clinical evidence of oropharyngeal infection, radiological findings consistent with mediastinitis, operative identification of necrotizing mediastinal infection, and a relationship between the oropharyngeal infection and mediastinal disease. CT of the neck and chest is widely considered the gold standard for defining the source, anatomical extent of the infection, and guiding surgical strategy (Pinto et al., 2018). Relevant findings may include mediastinal widening, increased mediastinal attenuation, air–fluid levels suggesting abscess formation, and pleural effusion. In this case, the extension of a deep neck abscess to the superior and anterior middle mediastinum at the T8 level was consistent with Endo-Hasegawa type IIA DNM.

DNM management requires a highly coordinated multidisciplinary team (MDT) potentially including thoracic surgery, otolaryngology, oral and maxillofacial surgery, infectious disease specialists, and intensive care, which has been shown to significantly improve survival rates and optimize clinical decision-making (Guan et al., 2021). Initial management should follow core principles for critically ill patients, including airway protection, adequate oxygenation, hemodynamic stabilization, antimicrobial treatment, and source control. Because these infections are commonly polymicrobial, heavily involving synergistic aerobic and anaerobic bacteria from the oral flora (Brook, 2014), empirical broad spectrum intravenous antibiotics should be started promptly and adjusted according to culture results. Regimens described in the literature include a second- or third-generation cephalosporin combined with metronidazole or clindamycin, or piperacillin–tazobactam; routine antifungal treatment is generally not recommended. In this case, ampicillin–sulbactam and metronidazole were used as initial therapy.

Antibiotics alone are universally insufficient when purulent collections and necrotic tissue require drainage; aggressive and timely surgical debridement is the cornerstone of survival (Freeman et al., 2000). Cervical drainage is a central component of treatment, and inadequate drainage can permit continued progression. After drainage, suitable drains may be placed and wounds may be left open for repeated irrigation and dressing changes. The approach to mediastinal drainage depends on the extent and location of infection. Options include transcervical drainage, posterolateral thoracotomy, sternotomy, a subxiphoid approach, and video-assisted thoracoscopic surgery (VATS). A transcervical approach alone may not adequately reach the lower mediastinum. Additional thoracic drainage can provide broader access, while VATS may offer lower morbidity and accelerated recovery in selected hemodynamically stable patients by minimizing surgical trauma (Chen et al., 2020). The approach should be individualized according to infection extent, patient condition, and tolerance of the procedure.

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CONCLUSION

Descending necrotizing mediastinitis requires prompt recognition and early, aggressive treatment because delays can increase mortality. In this patient, broad-spectrum intravenous antibiotics were combined with cervical incision, drainage and debridement, management of the odontogenic source, chest tube insertion, and subsequent thoracotomy with pleural evacuation and decortication.

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