



ELSEVIER

Available online at www.sciencedirect.com

ScienceDirect

journal homepage: www.elsevier.com/locate/radcr

Case Report

Catastrophic descending necrotizing mediastinitis of the anterior and posterior compartments: A case report ☆☆☆★★★

Caterina Benedetto, MD^{a,*}, Vincenzo Nicola Tanzariello, MD^b, Annalisa Militi, MD^a, Gianluca Elio Fallica, TSRM^a, Delia Di Marco, TSRM^a, Francesco Monaco, MD^c, Barbaro Ugo, MD^a

^a Department of Radiology, I.R.C.C.S. Centro Neurolesi Bonino Pulejo, P.O. Piemonte, Viale Europa 45, 98124 Messina, Italy

^b ENT Practice, 98123 Messina, Italy

^c Thoracic Surgery Unit, Policlinico G. Martino, Hospital of the University of Messina, 98125 Messina, Italy

ARTICLE INFO

Article history:

Received 26 May 2020

Revised 14 July 2020

Accepted 15 July 2020

Keywords:

Cervical necrotizing fasciitis (CNF)

Descending necrotizing mediastinitis (DNM)

Odontogenic infection

Computed tomography scan

Empyema

Video-assisted thorascopic surgery (VATS)

ABSTRACT

Descending necrotizing mediastinitis (DNM) is a medical emergency with a high associated morbidity and mortality.

DNM may arise secondary to primary odontogenic or neck infection in susceptible patients and it may spread contiguously via the “danger” space to the mediastinum. This case report is focused on complications following an odontogenic infection in a healthy 48-year-old male that led to a massive inflammation associated an extensive empyema.

After chest and neck computed tomographic scan a diagnosis of cervical necrotizing fasciitis with DNM was made. A multidisciplinary approach with an urgent surgical intervention and the finding of the right antibiotic therapy resulted to be successful. After 2 weeks the patient was dismissed in better health condition.

© 2020 The Authors. Published by Elsevier Inc. on behalf of University of Washington.

This is an open access article under the CC BY-NC-ND license.

(<http://creativecommons.org/licenses/by-nc-nd/4.0/>)

☆ Authors' Contributions: The conception and design of the study: CB and UB; Acquisition of data: GF and DD; Drafting the article: AM and VNT; Revising it critically for important intellectual content: UB and CB; Responsible for the surgical intervention: FM; Final approval: All authors.

☆☆ Guarantor: Caterina Benedetto.

* Competing Interests: The authors declare no conflict of interest.

★★ Informed Consent: The authors obtained from the patient written informed consent for the publication of this case report and images.

* Corresponding author.

E-mail addresses: cate.benedetto@gmail.com, caterina.benedetto@ircsme.it (C. Benedetto), annalisa.militi@ircsme.it (A. Militi), francesco.monaco@unime.it (F. Monaco).

<https://doi.org/10.1016/j.radcr.2020.07.040>

1930-0433/© 2020 The Authors. Published by Elsevier Inc. on behalf of University of Washington. This is an open access article under the CC BY-NC-ND license. (<http://creativecommons.org/licenses/by-nc-nd/4.0/>)

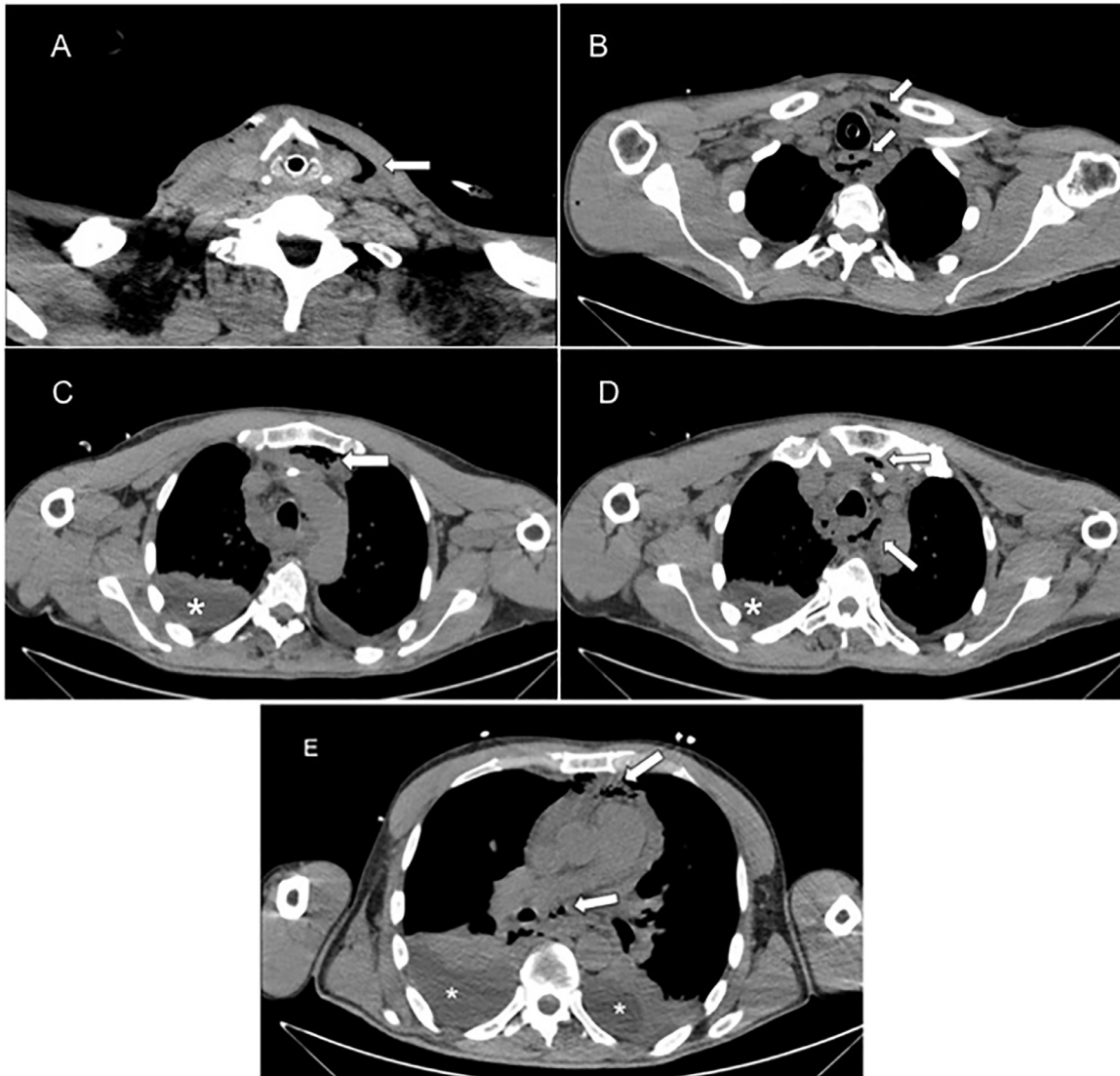


Fig. 1 – (A-E) Cervical and thoracic CT scan show air collection at the left carotid space (A). Left subclavian space and retroesophageal space are also involved by infection (B). Other collections are placed on the upper (C), anterior and posterior mediastinum (D, E). Bilateral pleural effusions are noted (asterisks in C, D, and E).

Introduction

Descending necrotizing mediastinitis (DNM) is a rare and lethal mediastinitis, which can rapidly lead to sepsis.

DNM usually arises from oropharyngeal, cervical or odontogenic infections, due to the anatomical contiguity of the fascial planes between neck and mediastinum.

The symptomatology is initially mild and no specific. Therefore, the diagnosis of DNM is delayed and is generally made when the sepsis is already developed.

An early diagnostic computed tomographic (CT) scanning is mandatory for all cervical infections, including neck and chest examination, to confirm the DNM, to detect its complications and to establish an optimal management of the case.

An experienced multidisciplinary approach and an early treatment with drainages or video-assisted thorascopic surgery (VATS) techniques are critical to reach a positive outcome.

Case report

A 48-year-old male patient was admitted to the Emergency Service reporting a 4 days history of toothache, dyspnea, chest pain, sweating, tachyarrhythmia, sore throat, and fever (38.2°C).

On initial examination, there was gross swelling of the lower right cheek, of the submandibular and mental regions, which were erythematous and warm on palpation. The



Fig. 2 – Neck CT scan with sagittal reconstruction depicts air collections at pretracheal space, danger space, and prevertebral space.

patient had difficulties in opening the jaw. The mucous membrane of his oral cavity had inflammatory changes.

The patient was treated at home with ceftriaxone-steroids-based 3 g once daily.

However, the treatment resulted ineffective and the condition of the patient worsened. He started accusing dyspnea and chest pain.

After the hospital admission, blood test examinations revealed an increase in the amount of white blood cells ($WBC = 17 \times 10^9/L$), neutrophils (88%), and the level of C-reactive protein (4 mg/L). Urgent orotracheal intubation was performed; then, an in-depth analysis of chest and neck CT scan showed left pleural effusion, mediastinitis, and right

parapharyngeal abscess due to possible complication of an odontogenic infection.

A professional ENT performed a drainage of the right neck inserting the drain by cervicotomy in the subcutaneous tissue of the submandibular space, while a left chest drain was placed on the left sixth intercostal space by a thoracic surgeon in order to improve ventilation.

At this time, intravenous antibiotic therapy was initiated with 4×500 mg of piperacillin sodium plus tazobactam sodium die.

Although drainage and intravenous therapies had been implemented, the clinical condition of the patient worsened and after 2 days he was transferred to an Intensive Care Unit.

The patient underwent a chest and neck CT scan that demonstrated the presence of air collection in the right submandibular, in the left carotid, in the retrosophageal and pretracheal spaces (Figs. 1A-B and 2). Other collections characterized by air and fluids were noted in the upper, anterior, and posterior mediastinum (Fig. 1C-E). Those findings suggested that the final diagnosis was cervical necrotizing fasciitis with DNM derived.

Since bilateral pleural effusions were also noted, an additive pleural drain was inserted on the right side (Fig. 1).

After 1 day, a chest and neck CT angiography displayed the presence of abscesses in the cervical spaces, an extensive mediastinal empyema, a left pleural effusion and right hydropneumothorax (Figs. 3B and 4A-C). Aggressive mediastinal debridement and VATS were performed to clear out empyema collections located in the upper retrosternal space, in the anterior and posterior mediastinum spaces (1100 mL of yellow-brown secretion). Then, the ENT specialist performed an incision and drainage of the neck abscesses, inserting 2 surgical drains. In addition, the patient was subjected to an oral tooth extraction (48th). The purulent fluid in the cavity below was drained and packed by the maxillofacial surgical team.



Fig. 3 – (A, B) Left sagittal CT angiography reconstruction displays rim-enhancing fluid collections at left carotid space and pretracheal space (A). Coronal CT angiography reconstruction shows abscesses on the cervical spaces, right hydropneumothorax, and extensive mediastinal empyema (B).



Fig. 4 – (A, B) Cervical and thoracic CT angiography represent extensive mediastinal empyema on the anterior mediastinum (A), on the retrosternal space and posterior mediastinum (B). Multiloculated bilateral pleural effusions (triangles) and right hydro-pneumothorax (asterisk) are also displayed.

Microscopy and culture of aspirated fluids and abscesses from cervical and mediastinal spaces revealed the growth of *Streptococcus anginosus*, *Gemella morbillorum*, and *Staphylococcus lugdunensis*.

At this time, antibiotic therapy was initiated with the following regimen:

- Amoxicillin 1000 mg intravenously, 6 hourly.
- Metronidazole 500 mg intravenously, 12 hourly.
- Finally, the patient was dismissed in better health conditions 1 week later.

Discussion

DNM is one of the most lethal mediastinitis with a current mortality rate around 20%-40% [1,2].

The most common origins of DNM infection are peritonsillar, dental, and odontogenic abscesses [3]. However, the dental infection is the most usual cause of cervical necrotizing fasciitis, with a prevalence of 43% [4].

Our report is focused on a complicated case of mediastinitis in a healthy 48-year-old man affected by odontogenic abscess. The lethality of this disease is linked to the spreading of the infection at the mediastinum through fascial cervical planes.

Therefore, the knowledge of the anatomy is crucial for the diagnosis and management of DNM.

Research shows that there are 3 primary layers of the deep cervical fascia interesting the spread of the oropharyngeal infections to the mediastinum: pretracheal, retropharyngeal, and lateral pharyngeal [5–7].

When the infection spreads simultaneously into the anterior, middle, and posterior (known as “danger space”) mediastinal spaces, as our clinical case suggests, it can lead to a dangerous inflammation complicated by a wide empyema.

The diagnosis of DNM can be difficult. The infection may be clinically dull for a long time or the symptoms can be weakened by the usage of analgesics [8].

When the diagnosis is made, there is usually an advanced condition of sepsis.

Thus, an early diagnostic CT scan is required to analyze both neck and chest and the mediastinal drainage is recommended.

According to Cortsen et al [9], the mortality rate of the patients who underwent neck and thoracic drainage compared with those who performed neck drainage alone, was statistically significant ($P < 0.05$).

In addition, Scaglione et al [10] demonstrated that CT scan was more efficient than radiographic examinations of chest and neck in confirming diagnosis of soft tissue infiltration, fluid collections with or without the presence of gas bubbles (pneumomediastinum). According to researchers, CT

angiography allows to detect the presence of infection in the neck: thickening of the cutis and subcutis, reticular enhancement of the subcutaneous fat, thickening and/or enhancement of cervical fasciae and/or muscles, cervical and mediastinal fluid collections, mediastinal empyema, pleural or pericardial effusions, venous thrombosis, and lymphadenopathy [7,10-13].

Endo et al (1999) established guidelines and DNM CT classification for surgical management, exploiting the degree of extension of infection diagnosed which were:

1. DNM-type I, localized in the upper mediastinum above the tracheal bifurcation.
2. DNM-type IIA, localized to the lower anterior mediastinum.
3. DNM-type IIB, localized to the anterior and lower posterior mediastinum.

As Endo's classification suggested, our clinical case was categorized as DNM-type IIB [14].

For this type of infection, there is an extended literature for combined cervicotomy and thoracotomy with wide debridement to evacuate all infected and necrotic tissues [15,16].

However, these invasive methods are high-risk approaches for critically ill patients with overwhelming sepsis and may lead to unfavorable outcomes with complications [17].

Many authors reported a successful management of DNM patients with VATS, underpinning the excellent visualization of the entire thoracic cavity, the lower degree of invasiveness and easiness of reaching a favorable outcome [18,19].

To summarize, we have illustrated the importance of using CT scan in order to study DNM cases.

CT scan is a necessary and sufficient tool for detecting and confirming the diagnosis, for assessing a right therapy and avoiding possible complications in a patient who need to undergo a surgical treatment.

CT scan should be executed routinely every 48 hours until the disease improve [6].

The usage of advanced CT scanner with multidetector technology through isotropic voxel dataset has permitted useful multiplanar reconstructions [10-12].

The absence of suspicious CT signs of infection in the neck or chest spaces excluded DNM with a sensitivity of 100% [10].

Finally, a multidisciplinary approach has demonstrated the success of DNM treatment: an early-stage TC study combined with an antibiotic therapy, a surgical intervention and the aid of Intensive Care Unit, had guaranteed the treatment and the quick recovery of a patient affected by DMN disease.

REFERENCES

- [1] Kinzer S, Pfeiffer J, Becker S, Ridder GJ. Severe deep neck space infections and mediastinitis of odontogenic origin: clinical relevance and implications for diagnosis and treatment. *Acta Otolaryngol* 2009;129:62–70.
- [2] Rocchia F, Pecorari GC, Oliaro A, et al. Ten years of descending necrotizing mediastinitis: management of 23 cases. *J Oral Maxillofac Surg* 2007;65:1716–24.
- [3] Mihos P, Potaris K, Gakidis I, et al. Management of descending necrotizing mediastinitis. *J Oral Maxillofac Surg* 2004;62:966–72.
- [4] Kataria G, Saxena A, Bhagat S, et al. Prevalence of odontogenic deep neck space infections (DNSI): a retrospective analysis of 76 cases of DNSI. *Int J Otorhinolaryngol Head Neck Surg* 2015;1(1):11–16.
- [5] Hollinshead WH. Fascia and fascial spaces of the head and neck. *Anatomy for surgeons*. Hollinshead WH, editor editor. Philadelphia: Harper and Row; 1982.
- [6] Kang SK, Lee S, Kong Oh H, et al. Clinical features of deep neck infections and predisposing factors for mediastinal extension. *Korean J Thorac Cardiovasc Surg* 2012;7:171–6.
- [7] Smith JK, Armao DM, Specter BB, et al. Danger space infection: infection of the neck leading to descending necrotizing mediastinitis. *Emerg Radiol* 1999;6:129–32.
- [8] Ho KL, Chen HL, ChM Lin. Acute descending mediastinitis secondary to an odontogenic infection in a patient initially suspected of having acute thyroiditis. A case report. *J Acute Med* 2011;1:52–4.
- [9] Corsten MJ, Shamji FM, Odell PF, et al. Optimal treatment of descending necrotizing mediastinitis. *Thorax* 1997;52(8):702–8.
- [10] Scaglione M, Pinto A, Romano S, et al. Management of descending necrotizing mediastinitis. *Emerg Radiol* 2005;11:275–80.
- [11] Dwivedi MK, Pal RK, Gupta R, et al. CT findings of descending necrotizing mediastinitis. *Indian J Radiol Imaging* 2001;11:131–4.
- [12] Pinto A, Scaglione M, Scuderi MG, et al. Infections of the neck leading to descending necrotizing mediastinitis: role of multi-detector row computed tomography. *Eur J Radiol* 2008;65:389–94.
- [13] Hoang JK, Branstetter IV BF, Eastwood JD, Glastonbury CM. Multiplanar CT and MRI of collections in the retropharyngeal space: is it an abscess? *AJR Am J Roentgenol*. 2011;196(4):W426–32 PMID: 21427307.
- [14] Endo S, Murayama F, Hasegawa T, et al. Guideline of surgical management based on diffusion of descending necrotizing mediastinitis. *Jpn J Thorac Cardiovasc Surg* 1999;47:14–19.
- [15] Kocher GJ, Hokscho B, Caversaccio M, Wiegand J, Schmid RA. Diffuse descending necrotizing mediastinitis: surgical therapy and outcome in a single-centre series. *Eur J Cardiothorac Surg* 2012;42:e66–72.
- [16] Freeman RK, Vallieres E, Verrier ED, Karmy-Jones R, Wood DE. Descending necrotizing mediastinitis: an analysis of the effects of serial surgical debridement on patient mortality. *J Thorac Cardiovasc Surg*. 2000;119:260–7.
- [17] Y1 Nakamori, S Fujimi, Ogura H, et al. Conventional open surgery versus percutaneous catheter drainage in the treatment of cervical necrotizing fasciitis and descending necrotizing mediastinitis. *AJR Am J Roentgenol* 2004;182(6):1443–9.
- [18] Son HS, Cho JH, Park SM, et al. Management of descending necrotizing mediastinitis using minimally invasive video-assisted thoracoscopic surgery. *Surg Laparosc Endosc Percutan Tech* 2006;16:379–82.
- [19] Isowa N, Yamada T, Kijima T, Hasegawa K, Chihara K. Successful thoracoscopic debridement of descending necrotizing mediastinitis. *Ann Thorac Surg* 2004;77:1834–7.