CASE REPORT

Taking heed of the 'danger space': acute descending necrotising mediastinitis secondary to primary odontogenic infection

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Accepted 19 May 2018

SUMMARY

Descending necrotising mediastinitis (DNM) is an uncommon clinical entity which may arise secondary to primary odontogenic or neck infection in susceptible patients. Infection may spread contiguously via the alar or 'danger' space, a potential anatomical space posterior to the true retropharyngeal space.¹ Spread of infection to the mediastinum almost always necessitates urgent cardiothoracic surgical intervention.²⁻⁴ This case report describes a male patient whose clinical deterioration following the diagnosis of submandibular abscess was investigated with CT imaging of the chest, where a diagnosis of DNM was made. Diagnosis was confirmed following surgical intervention and aspiration of pus from the mediastinum.

BACKGROUND

Descending necrotising mediastinitis (DNM) constitutes a medical emergency given its high associated morbidity and mortality.^{1,2,5,6} Infection to the mediastinum may result from iatrogenic instrumentation or alternatively spread from contiguous structures, including the anatomical potential space known as the alar or 'danger' space. Spread of infection is facilitated by gravity and negative intrathoracic pressure elicited through respiration.⁷

Knowledge of mechanisms for spread of dental or neck infection to the mediastinum is imperative when assessing the decompensating or septic patient with known oropharyngeal or neck infection.⁸ Early identification and management of infection can reduce both morbidity and mortality and the burden of mediastinal spread of infection, potentially preventing the necessity for aggressive cardiothoracic surgical intervention.²

CASE PRESENTATION

A 34-year-old man presented to a secondary medical centre reporting a 2-day history of facial swelling, odynophagia and dysphonia. Symptoms were associated with subjective fevers.

On initial examination, there was gross swelling of the submandibular region with palpable fluctuance of both submandibular and submental regions. The patient was able to swallow fluid, however ingestion of solids was associated with increasing odynophagia and tooth pain. There was trismus to three finger-widths without lingual proptosis, and clinicians reported a 'hot potato' voice, reflecting

dyskinesia of the peritonsillar musculature. Oropharyngeal examination demonstrated poor overall dentition with multiple areas of visible caries, as well as pharyngeal oedema.

The patient reported a 10-pack-year history of smoking and poor attendance at dental follow-up over the past decade. There was no history of recent dental instrumentation or oral trauma. Systems enquiry was negative for any other medical conditions, and the patient did not take regular medication, except for recreational anabolic steroid use.

In the week following initial surgical incision and drainage for submental and submandibular abscesses with extraction of multiple teeth, there was ongoing drainage of purulent fluid from drain sites, and the patient continued to be intermittently febrile. Reimaging of the neck and chest demonstrated low-attenuating collection within the mediastinum consistent with DNM. The patient was referred to the cardiothoracic surgery team for operative management.

INVESTIGATIONS

Medical imaging

Red arrows on axial CT of the neck indicate gas-forming collection in left buccal space and low attenuation of the left masseter muscle consistent with muscular infection (figure 1). This corresponds to the primary source for mediastinal infection.

Axial CT of the chest demonstrates fluid-density mediastinal collection at the level of the carina with peripheral rim enhancement, consistent with abscess (blue arrow). Small locules of gas are noted within the collection, reflecting the presence of gas-forming organisms (figure 2).

Coronal CT chest slice demonstrates the extent of collection on either side of the trachea (blue circle) (figure 3).

Pathology

Microscopy and culture of aspirated fluid from sublingual space: florid growth of *Streptococcus anginosus*, *Gemella morbillorum* and *Staphylococcus lugdunensis*.

DIFFERENTIAL DIAGNOSIS

The differential for hypoattenuating mediastinal focus on CT chest would include⁹:

- Mediastinitis secondary to seeding of infection by haematogenous rather than direct spread.

To cite: Mark R, Song S, Mark P. *BMJ Case Rep* Published Online First: [please include Day Month Year]. doi:10.1136/bcr-2018-225019

Figure 1 Oral/neck collection.

- ▶ Mediastinitis secondary to recent instrumentation (iatrogenic).
- ▶ Necrotic mediastinal lymph nodes, secondary to malignancy.
- ▶ Mediastinal haematoma—spontaneous (primary) or due to trauma (secondary).

TREATMENT

The patient was admitted under the maxillofacial surgical team and underwent surgery under general anaesthetic for incision and drainage of submandibular and sublingual collections and insertion of surgical drains, as well as extraction of multiple clinically diseased teeth. The patient was then monitored in an intensive care setting given the high risk of airway compromise.

Figure 2 Mediastinal collection—axial section.

Figure 3 Mediastinal collection—coronal section.

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

- ▶ Amoxicillin 1000 mg intravenously, 6 hourly.
- ▶ Metronidazole 500 mg intravenously, 12 hourly.

Following clinical deterioration and diagnosis of mediastinitis, the patient was transferred to a specialist cardiothoracic centre for surgical intervention. Operative management involved attendance of both cardiothoracic and maxillofacial teams, with thoracotomy and insertion of mediastinal drains, extensive surgical washout, formation of a subplatysmal flap and redrainage of neck and supraclavicular abscesses. Antibiotic therapy was continued postoperatively for a total of 10 days, along with daily washout of a mediastinal drain inserted intraoperatively.

OUTCOME AND FOLLOW-UP

The patient remained intubated in the intensive care setting for 3 days postprocedure. Following resolution of sepsis, removal of surgical drains and a period of inpatient rehabilitation, the patient has made a full recovery and has returned home. Antibiotic therapy was continued in oral form, with a 10-day course of amoxicillin 875 mg/clavulanic acid 125 mg two times a day. Maxillofacial and cardiothoracic team follow-ups will continue in the outpatient setting for at least 6 months.

DISCUSSION

DNM is an uncommon and potentially fatal form of mediastinal infection. Recent improvements in patient survival and long-term prognosis have been attributed to early tomographic imaging of the neck and chest, early aggressive surgical intervention and appropriate choice of antibiotic therapy.^{1,2}

Criteria for diagnosis of DNM developed in 1983⁸ are still widely used today. These include clinical evidence of severe oropharyngeal infection, radiological features of mediastinitis on CT imaging, intraoperative or postmortem findings of mediastinal infection and an established timeframe between oropharyngeal infection and development of mediastinitis.

The most commonly described primary site of infection is odontogenic, specifically arising from the second or third mandibular premolar. Other sites for primary infection include acute tonsillitis, peritonsillar abscess and retropharyngeal abscess. Collections rupture into deep spaces of the neck and may reach the mediastinum through the true retropharyngeal

space or posterior potential alar space.¹⁰ Organisms isolated are typically the polymicrobial mixed aerobic and anaerobic bacteria associated with dental infections.¹¹

DNM may be classified surgically by the anatomical region involved—type 1 is isolated to the upper mediastinum superior to the carina, type 2a involves the lower anterior mediastinum and type 2b involves both the lower anterior and posterior mediastinum.³ Choice of surgical intervention is dependent on mediastinitis subtyping and patient comorbidity, with thoracotomy generally reserved for type 2 infection.^{13 14} There is often a need for reintervention involving either percutaneous or surgical drainage of recurrent collections.²

González-García *et al*⁶ recommend a multidisciplinary approach to patients with DNM, with early input from maxillofacial and cardiothoracic teams. Tracheostomy is recommended for patients with deep cervical infection, to facilitate airway management.

Independent risk factors for the development of DNM include untreated dental caries along with immunosuppression, diabetes mellitus, chronic renal failure and liver cirrhosis. Lifestyle factors include smoking and excessive alcohol consumption.¹² Mean age at presentation is 48–56 years.^{12 13}

Complications associated with DNM include cardiac tamponade due to extrinsic compression, erosion of vascular structures with catastrophic bleeding, venous thrombosis and the development of pleuromediastinal or pleuro-oesophageal fistulas.¹⁴ Systemic inflammatory response syndrome, overwhelming sepsis and organ failure (eg, acute renal failure) are all documented complications of mediastinal infection.²

Estimates of mortality and morbidity associated with DNM are limited by a paucity of cases in the published literature. Sarna

*et al*⁵ report mortality of 22%, while a more recent analysis by Sumi reports lower overall mortality of 5.6%.² It is clear that improved patient outcomes are related to early diagnosis and timely surgical intervention.^{4 14}

Contributors RM: reported radiology case in after hours context. Review of literature, planning and write-up of case, search for morbidity and mortality data. Co-ordination of resubmission of paper. SS: reviewed case, provided feedback regarding causative mechanisms for infection, liaison with treating team. PM: liaison with treating surgical team, liaison with patient, follow-up of patient, editing final case report. Also extended follow-up with patient postdischarge.

Funding The authors have not declared a specific grant for this research from any funding agency in the public, commercial or not-for-profit sectors.

Competing interests None required.

Patient consent Obtained.

Provenance and peer review Not commissioned; externally peer reviewed.

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Learning points

- ▶ Acute descending mediastinitis is a medical and surgical emergency necessitating urgent referral, review and intervention.
- ▶ Mediastinitis may arise from a number of mechanisms, one of which includes contiguous spread of oropharyngeal or dental infections through the alar or 'danger' space located posterior to the true retropharyngeal space.
- ▶ Evaluation of the clinically deteriorating patient with known or suspected oropharyngeal abscess should include imaging of the chest to assess for mediastinal spread of infection.
- ▶ The risk of mediastinal infection can be minimised through prompt identification and treatment of dental and oropharyngeal infection.

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