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Supraglottitis complicated by mediastinitis

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Abstract
A rare case of supraglottitis complicated by mediastinitis is presented. Despite aggressive treatment with broad-spectrum intravenous antibiotics, the patient persisted to have generalized supraglottitis. Subsequent computed tomography (CT) scanning revealed that she had developed a frank fluid collection starting at the suprasternal notch, extending retrosternally into the superior mediastinum. She recovered with conservative management and did not require aggressive mediastinal drainage as advocated by the literature.

Key words: Laryngeal Diseases; Infection; Mediastinitis

Introduction

Supraglottitis complicated by mediastinitis has rarely been reported in the literature. Our patient is an unusual case of successful conservative management of mediastinitis, avoiding the morbidity of surgical intervention.

Case report

A 66-year-old woman presented to the Accident and Emergency department complaining of sore throat for the past two days and inability to eat or drink. On examination she was pyrexial with a temperature of 37.5°C . Her tonsils were not inflamed. She had no stridor, cyanosis, neck cellulitis or neck swelling. Using flexible fibre-optic laryngoscopy a diagnosis of supraglottitis was made.

The patient was admitted and started on intravenous cefuroxime and metronidazole and intravenous dexamethasone. Laboratory studies showed an elevated white cell count of 20.3×10^9/L with raised neutrophils. The monospot test was negative. She became apyrexial and clinically felt well by the next day. However, the following day she again spiked a temperature of 37.5°C. Repeat flexible fibre-optic laryngoscopy revealed persistent generalized surpaglottitis with healthy and mobile vocal folds. Intravenous antibiotics were continued.

On day 4 of hospitalization, she developed cellulitis over the front of her neck and anterior chest and spiked a temperature of 38°C. Blood cultures were taken and later revealed no growth of organisms. Intravenous flucloxacillin was added to her antibiotic regimen to cover for *Staphyloccus aureus* cellulitis.

On day 5 of hospitalization, she again spiked a temperature of 37.8°C. Her voice was noted to be husky, and she complained of dysphagia for solids. On examination she now had a hot swelling over her anterior neck with no fluctuance. Flexible fibre-optic laryngoscopy revealed worsening supraglottitis. Her antibiotic regimen was changed to intravenous cefotaxime and flucloxacillin on the advice of the microbiologist.

On Day 6 of hospitalization, a CT scan of her neck and chest was performed (Figure 1). The scan revealed a frank fluid collection starting at the medial rim of the clavicle,

Fig. 1
CT scan of neck showing the starting point of the fluid collection.

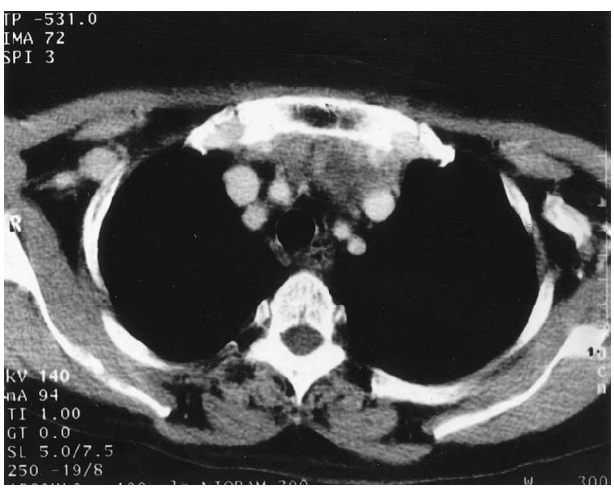

Fig. 2
CT scan of mediastinum showing a retrosternal fluid collection.

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extending retrosternally into the superior mediastinum at the level of the aortic arch and carina (Figure 2). She was also noted to have bilateral small pleural effusions. A cardiothoracic surgical opinion was sought, and the decision was made to continue conservative treatment with intravenous antibiotics as the patient was improving clinically. Repeat laryngoscopy revealed resolution of the supraglottitis, and she was discharged on day 15 after two weeks of intravenous antibiotics.

Discussion

Supraglottitis is an infection that was seen mainly in children prior to the Hib vaccine. When present in an adult, the infection is often bacterial in origin rather than of viral aetiology.[1] Mediastinitis as an associated complication has only been reported twice in the literature.[2,3] In both these cases, management required mediastinal drainage. Our patient is an unusual case of successful conservative management of mediastinitis, avoiding the morbidity of surgical intervention.

Acute mediastinitis can be a life-threatening disease when it presents as descending necrotizing mediastinitis (DNM). Mediastinitis develops from downward extension of a head and neck infection (odontogenic, pharyngeal and rarely, supraglottic in origin), oesophageal perforation or following a trans-sternal cardiac procedure.[4] Infection spreads through contiguous fascial planes into the mediastinum and is facilitated by gravity, breathing and negative intrathoracic pressures.[4] Mediastinitis is characterized by severe dyspnoea, chest pain, persistent fever, and a widened mediastinum.

The anatomy of the cervical fascia and its importance in understanding the spread of deep neck infections is best described by Levitt in 1970.[5] He likened the cervical fascia to American highways around the countryside, 'as both separate one area from another and provide a readily accessible route of communication between various areas.' In 1929, Mosher published a paper discussing the importance of identification of the carotid sheath, the 'Lincoln Highway of the neck', to follow to deep neck abscesses, opening potential spaces along the path.[6] He understood that all three layers of deep cervical fascia contribute to the carotid sheath, 'the key structure in surgery of the head and neck.'

The spread of neck space infections is highly dependent upon the fascial spaces, and Levitt's description is used to illustrate this important concept. Cervical fascia is divided into a single layer of superficial cervical fascia and three layers of deep cervical fascia. The superficial cervical fascia is composed of fibro-fatty tissue and lies superficial to the platysma. It extends from its superior attachment on the zygomatic process down to the thorax and axilla and ensheaths the platysma muscle and the voluntary muscles of expression in the face. The space between the superficial cervical fascia and the deep cervical fascia is filled with superficial lymph nodes, nerves, and vessels. Deep neck infections involving the superficial cervical fascia are readily amenable to treatment with local incision and drainage combined with oral antibiotics.[7]

The superficial layer of the deep cervical fascia or the investing layer surrounds the neck in its entirety, and its fibrous sheath envelops the trapezius muscle posteriorly and the sternomastoid laterally. Superiorly it attaches to the superior nuchal line of the skull, the mastoid process, and the mandible and inferiorly to the spine of the seventh cervical vertebra, the spine of the acromion, the clavicle, and the manubrium. It provides the fascial sheath for the parotid and submandibular glands and also helps form the carotid sheath.[5]

The middle layer of the deep cervical fascia is composed of a muscular division and a visceral division. The muscular division forms a continuous sheath surrounding the strap muscles. It attaches superiorly to the hyoid bone and thyroid cartilage and inferiorly to the sternum, clavicle, and scapula. The visceral division attaches to the base of the skull posterior to the oesophagus and to the thyroid cartilage and hyoid bone and continues inferiorly into the thorax, to enclose the trachea and oesophagus. It blends with the fibrous pericardium.[5]

The deep layer or internal layer of the deep cervical fascia is divided into the prevertebral and alar divisions. The prevertebral division commences anterior to the vertebral bodies, spreads laterally to fuse with the transverse processes, and then extends posteriorly to enclose the deep muscles of the neck, i.e. the erector spinae, the levator scapulae, the three scalene muscles, the longus capitis and longus colli. It extends from the base of the skull to the coccyx and forms the posterior wall of the danger space and the anterior wall of the prevertebral space. The danger space is a potential space between the alar and prevertebral divisions of the deep layer of the deep cervical fascia, posterior to the retropharyngeal space and anterior to the prevertebral space. The danger is the potential for spread of infection from the base of the skull down into the posterior mediastinum to the level of the diaphragm. The alar division lies between the prevertebral division and the middle layer of the deep cervical fascia. It runs from the transverse processes and extends from the base of the skull to the second thoracic vertebra, where it fuses with the visceral fascia of the middle layer of the deep cervical fascia.[5]

The deep cervical fascia divides the neck into four potential spaces involving the entire length of the neck, namely, the retropharyngeal space, the pretracheal space, the prevertebral space, and the carotid space. The retropharyngeal space or the posterior visceral space lies behind the hypopharynx and the oesophagus and extends superiorly to the skull base. Inferiorly it extends into the superior mediastinum to the level of T1-T2 where the middle and deep layers of the cervical fascia fuse. Posteriorly lies the danger space which extends from the base of the skull inferiorly to the diaphragm and laterally to the transverse process of the vertebrae. Infection in the retropharyngeal space can readily enter the danger space through the alar fascia and descend into the posterior mediastinum. The pretracheal space or previsceral space surrounds the trachea. It lies against the anterior wall of the oesophagus and is limited superiorly by the hyoid bone. The prevertebral space is the potential space anterior to the vertebral bodies and posterior to the prevertebral division of the deep cervical fascia. It lies posterior to the danger space and is limited laterally by the fusion of the prevertebral division of the deep cervical fascia with the transverse processes of the vertebra. The carotid space, or the visceral vascular space, is the potential space within the carotid sheath. Infection here remains localized. Another potential space worth noting is the parapharyngeal space or the pharyngomaxillary space. It extends from the base of the skull downwards to the hyoid bone. Its medial border is the lateral pharyngeal wall and its lateral border is the superficial layer of the deep cervical fascia overlying the mandible, internal pterygoid muscle, and parotid gland.[5] All these potential spaces may serve as portals of entry for infections into the mediastinum.[4] Oropharyngeal infections such as dental abscess and peritonsillar abscess may enter the parapharyngeal space. A pharyngeal perforation may lead to infection entering the retropharyngeal space or into the pretracheal space

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and thereby entering the mediastinum.[4] Any infection may also spread across fascial planes, cross-contaminating the pleural spaces.[3]

The organisms cultured are often a mix of aerobic and anaerobic bacteria, most commonly *Streptococcus* sp. (alpha and beta group A) and *Bacteroides* sp.[8] Maisel and Karlen[9] advocate use of a third-generation cephalosporin with clindamycin or metronidazole as good initial intravenous antibiotic cover. Our patient was initially treated with cefuroxime and metronidazole.

Suspicion of mediastinitis should be aroused in a patient who continues to spike a temperature and develops neck or anterior chest cellulitis. Diagnosis of early mediastinitis cannot be made on plain radiographs of the lateral soft tissue view of the neck or of the chest. Signs of widening of the retrovisceral space, anterior displacement of the tracheal air column, mediastinal emphysema, and widening of the superior mediastinal shadow appear late in the course of the disease. Instead CT scanning permits early diagnosis of mediastinitis with high accuracy and often shows soft tissue infiltration with loss of normal fat planes or collections of fluid density with or without the presence of gas.[4]

The literature advocates an aggressive approach to treatment of mediastinitis. Descending necrotizing mediastinitis (DNM) has a mortality of 31 per cent, due chiefly to a delay in diagnosis.[2] Management of DNM is partitioned into disease confined to above the level of the carina or disease extending below the tracheal bifurcation anteriorly or the fourth thoracic vertebra posteriorly. Standard transcervical mediastinal drainage is recommended for superior mediastinal infections and transthoracic mediastinal drainage for more extensive disease.[10]

We suggest that, if the patient is clinically well and continues to respond to intravenous antibiotics, then surgical intervention can safely be deferred, even in the presence of mediastinitis confirmed by CT scanning. However, a high index of suspicion of DNM should be maintained if the patient's condition deteriorates.

In conclusion, when presented with a patient with supraglottitis, rare complications such as mediastinitis should be considered if the patient continues to spike a temperature on broad-spectrum intravenous antibiotic therapy, complains of pleuritic chest pain, or develops neck and anterior chest cellulitis. Plain radiographs of the neck and chest are not reliable in confirming the diagnosis of mediastinitis. CT scanning is advocated in the detection of early mediastinitis. It helps to differentiate between cellulitis and abscess and demonstrates involved spaces and the inferior extent of the disease. Characteristics of an abscess include a low-density CT number, contrast enhancement of the abscess wall, tissue oedema surrounding the abscess, and a cystic or multiloculated appearance.[11] In a study by Ungkanont in 1995, the sensitivity of CT scanning was found to be 91 per cent and that of specificity to be 60 per cent for distinguishing deep neck space abscess from cellulitis.[12] Magnetic resonance imaging (MRI) offers increased contrast between inflamed and normal soft tissues without ionizing radiation, but its specific advantages to CT scan are chiefly evident when demonstrating vascular anomalies.[13] As MRI gives similar information to the CT and is not readily available, and is costly and time consuming, CT scanning remains the gold standard for early diagnosis of suspected mediastinitis.[4] Once the diagnosis has been made, we suggest conservative management of mediastinitis in the absence of gas. However if necrotizing mediastinitis develops, aggressive surgical treatment is mandatory.

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