



## A case of sore throat that can be deadly

**Dr. Siu Hang Nam**

A 61-year-old man with good past health presented to our emergency department complaining of sore throat, odynophagia and dysphagia for 2 days. He complained of pain and swelling over the left submandibular area. He also had increased sputum and shortness of breath. He had previously consulted a general practitioner but failed to improve despite symptomatic treatment.

At triage, his BP was 116/73mmHg and pulse was 91/min. His oxygen saturation was 97% on room air. On physical examination, his left tonsil was found to be swollen, and there was mild swelling at the left soft palate as well, with the uvula mildly deviated to the right. Quinsy was suspected based on the clinical findings. The left submandibular area was tender to palpation with mild swelling but no erythema. The chest was clear on auscultation.

A soft tissue neck X-ray (Figure 1) and a chest X-ray (Figure 2) were performed. The case doctor commented that neck X-ray as unremarkable while there was mild left lower zone haziness on the CXR. He then consulted the on-duty ENT doctor for suspected quinsy. The ENT doctor replied that urgent assessment in the ED was not required, and he suggested referral to the outpatient clinic on the next day.



Fig.1 X-ray neck soft tissue of the patient



Fig.2 Chest X-ray of the patient

In view of concomitant chest infection on the chest X-ray, the case doctor decided to admit the patient to the Emergency Medicine Ward and start empirical intravenous amoxicillin-clavulanate (Augmentin) and consult the ENT team again the next day.

**Serious or life-threatening causes of throat pain**

Sore throat is a common cause for ED visits. Although it is usually due to an uncomplicated upper respiratory tract infection, it can be the presentation for some serious or life-threatening conditions including epiglottitis, Ludwig’s angina, retropharyngeal or paratracheal abscess, Lemierre’s syndrome (septic thrombophlebitis of internal jugular vein caused by Fusobacterium) and mediastinitis. It is important for emergency physicians to be aware of the clinical features of these conditions, as shown in Table 1.

Condition	Clinical features
<b>Acute epiglottitis</b>	<ul style="list-style-type: none"> <li>• Severe throat pain disproportion to exam findings</li> <li>• Dysphonia (muffled or “hot potato voice)</li> <li>• High fever</li> <li>• Drooling &amp; tripod posture (late sign)</li> <li>• Stridor (late sign)</li> </ul>
<b>Peritonsillar abscess /quinsy</b>	<ul style="list-style-type: none"> <li>• Unilateral throat pain</li> <li>• Trismus</li> <li>• Swollen fluctuant peritonsillar area</li> <li>• Uvular deviation</li> </ul>
<b>Retropharyngeal abscess</b>	<ul style="list-style-type: none"> <li>• Neck pain &amp; stiffness</li> <li>• Dysphagia</li> <li>• Torticollis</li> <li>• Stridor (late)</li> <li>• Chest pain or respiratory distress (mediastinitis)</li> </ul>
<b>Ludwig’s angina</b>	<ul style="list-style-type: none"> <li>• Pain in floor of mouth &amp; neck</li> <li>• Bilateral submandibular swelling (“woody firm”)</li> <li>• Tongue elevation</li> <li>• Drooling &amp; stridor (late)</li> <li>• Chest pain or respiratory distress (mediastinitis)</li> </ul>
<b>Lemierre’s syndrome</b>	<ul style="list-style-type: none"> <li>• Prior pharyngitis, tonsillitis or peritonsillar abscess</li> <li>• Neck pain &amp; swelling</li> </ul>

Table 1. Serious conditions presenting with sore throat

**Lateral soft tissue neck X-ray interpretation**

In the setting of sore throat and neck swelling, lateral neck radiographs can provide very useful clues of the underlying etiologies of the infections.<sup>1</sup> Interpretation of the soft tissue X-ray can follow a systemic approach:

1. Confirm the quality of the study
2. Assess for features of acute epiglottitis
3. Assess for prevertebral space
4. Look for abnormal soft tissue swelling, gas shadows or calcifications

A soft tissue neck X-ray must be performed at end-inspiration and with the neck extended in order to ensure a high-quality study. These measures can maximize visualization of the airways and minimize false widening of the prevertebral space respectively. The anatomical structures can be identified as shown in Fig. 3.

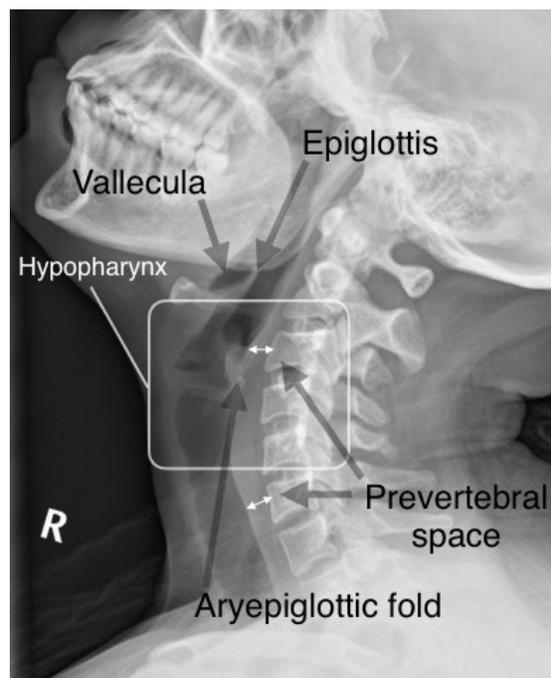


Fig 3. Normal soft tissue neck X-ray (Henry Knipe, Radiopaedia.org, rID: 46366)

For acute epiglottitis, there are a couple of commonly mentioned X-ray signs including thumb sign, vallecula sign (obliterated vallecula), thickened aryepiglottic fold, prevertebral soft tissue swelling and ballooning of hypopharynx. Objective parameters can be measured for more accurate interpretation. In a local case-control study, epiglottis width of 5.5 mm or more was found to be 96.2% sensitive and 100% specific in diagnosing acute epiglottitis in the Chinese population.<sup>2</sup>

When assessing the prevertebral space, focal widening is more important and widening of the prevertebral space more than the adjacent vertebral body width should alert the radiologist of potential pathology.<sup>1</sup> There is no definite cut-off for a normal prevertebral soft tissue thickness, due to the natural near-normal distribution and variation with different body build, and the widely adopted cut-off of <7mm at C2/3 and <21mm at C6/7 resulted in a true positive rate of 53% and false positive rate of 5%.<sup>3</sup> This can be easily remembered using the rule of 7 ( $3 \times 7 = 21$ ). Conventionally, the vertebral body width is often used as reference. The prevertebral space is increased if it is more than half the width of the vertebral body from C1-3 or more than entire vertebral body width from C4-7.

Finally, foreign bodies or abnormal calcifications and soft tissue gas should be identified. Presence of gas in the soft tissue can represent necrotising infection or esophageal perforation. Calculus in the swollen submandibular soft tissue may suggest Ludwig's angina secondary to submandibular sialolithiasis.<sup>1</sup>

Retrospective review of the patient's soft tissue neck X-ray, the prevertebral space was actually increased (29.5mm and wider than the adjacent vertebral body at C6) as shown in Fig.4. This finding is suspicious of a deep neck infection. Meanwhile, the chest X-ray also showed vague bilateral lower zone haziness.



Fig.4. Measurement of prevertebral space in the patient's neck X-ray

### Progress of the patient

The patient had mild desaturation requiring supplemental oxygen of 2L/min in the next morning. The antibiotic was escalated to intravenous ceftriaxone (Rocephin) and the patient was assessed by the ENT doctor. The flexible fiberoptic laryngoscopy examination revealed left lateral pharyngeal wall bulging but with adequate airway, while the tonsils and the epiglottis were not congested. The ENT doctor then suggested to perform a contrast CT scan of the neck and reassessment afterwards. The CT showed a rim enhancing multiloculated fluid collection centering at left palatine tonsil, suggestive of peritonsillar abscess. There was also fat stranding at the retropharyngeal and parapharyngeal space extending inferior to the danger space and superior mediastinum. CT images are as shown in Fig.5 and Fig.6.

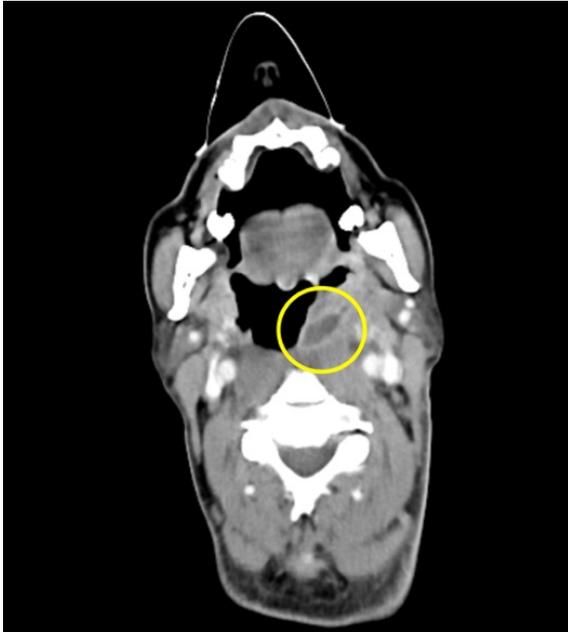


Fig.5 Contrast CT of the neck showing left peritonsillar collection (circle)



Fig.6. CT neck showing fat stranding at the upper mediastinum (square)

The patient's condition continued to deteriorate, and he required oxygen via nasal cannula 5L/min after CT. The on-duty ICU doctor and anesthesiologist were consulted for securing the airway and the patient was intubated at bedside by the anesthesiologist. Emergency operation for incision and drainage was performed by the ENT surgeons. Neck exploration revealed healthy underlying fascia with clear left parapharyngeal

and retropharyngeal space at the thyrohyoid level. The intra-oral findings showed spontaneous ruptured left peritonsillar abscess with defect at left peritonsillar space and posterior pharyngeal wall, with pooling of pus in oropharynx. Left tonsillectomy was performed and the pus was drained.

The cardiothoracic surgeon was also consulted in view of the presence of superior mediastinitis in the pre-operative CT neck scan. A contrast CT of the thorax was done post-operation, which showed no definite mediastinal collection but bilateral pleural effusion with no definite enhancing thickened pleura to suggest empyema. Bilateral pigtail drainage was performed. However, the patient developed septic flare and atrial fibrillation with rapid ventricular response on post-operation day 6, with repeated thoracic CT showing worsened mediastinitis with purulent pericarditis and also loculated empyema. Emergent right video-assisted thoracoscopic decortication with pleural drainage was performed, and the sepsis was eventually controlled with further image-guided pleural drainage and incision and drainage of left submandibular abscess.

### Deep neck space infection

#### Etiology

Deep neck space infections commonly arise from local extensions of various head and neck infections. Infections of odontogenic and submandibular origin can affect masticator and submandibular spaces, while infections of pharyngeal, tonsillar and laryngeal origin can affect parapharyngeal and retropharyngeal spaces.<sup>4</sup> The "danger space" between the alar fascia and prevertebral fascia extends from the skull base to the mediastinum, and retropharyngeal infections can spread to the "danger space" causing mediastinitis.

Most of the infections are polymicrobial, originating from the normal oral cavity flora and upper respiratory tract. In mild cases, the isolation rates of Gram-positive and Gram-

negative organisms are comparable. However, diabetic patients exhibit a significantly higher predisposition to *Klebsiella pneumoniae* infections.<sup>5</sup> On the other hand, patients with severe disease were more likely to be infected by Gram-negative strains.<sup>5</sup>

Apart from diabetes, other risk factors including immunocompromised state and intravenous drug use also influence the type of causative organism.<sup>4</sup>

#### Clinical presentation

The most common presenting symptoms are odynophagia, fever and neck pain or swelling.<sup>6</sup> Associated symptoms may hint the origin of infection and the extent of inflammation. For example, toothache is suggestive of infection of dental origin while chest pain or shortness of breath would raise the suspicion for mediastinitis or thoracic empyema. If a patient with throat or soft tissue neck infection also develops chest pain or respiratory distress, or develops pneumonia, mediastinitis should be considered as a possible complication.

As for physical examination, the majority of the patients have abnormal intra-oral findings, such as elevation of the floor of the mouth (Ludwig's angina), bulging of the soft palate and displacement of the uvula (quinsy).<sup>6</sup> Other common physical findings include trismus, stridor and lymphadenopathy. Physical findings of various conditions associated with deep neck space infection have been shown in Table 1.

#### Management

The airway is the first priority of treatment for patients with deep neck space infections, and securing the airway can be challenging due to the distorted airway anatomy, limited mouth opening, tissue edema and neck immobility.<sup>7</sup> The location of the infection and its effects on normal airway anatomy, rather than the size alone, are critical for airway assessment. Patients are more likely to have a difficult airway if the infection affects the epiglottis and aryepiglottic fold.<sup>7</sup>

After securing the airway, the patients often require multidisciplinary management involving both surgical and non-surgical treatments, including appropriate antibiotics in conjunction with surgical drainage of loculated infection. The empirical choice of antibiotics depends on the likely source of infection and host factors, as shown in Table 2.

In general, amoxicillin-clavulanate (augmentin) is the preferred choice to cover oral anaerobes.<sup>9</sup> The antimicrobial therapy should be continued for two to three weeks until the infection is clinically resolved.<sup>8</sup> Well defined abscesses require surgical drainage especially for those large in size, causing complications or not responding to antibiotics alone. Drainage may be achieved via open incision or under ultrasound guidance, and the latter can potentially shorten the length of stay with significant cost saving.<sup>10</sup>

#### Complications

Deep neck space infections can result in life threatening complications, such as upper airway obstruction, descending mediastinitis, carotid artery pseudoaneurysm and septic shock.<sup>4</sup> The mortality rates can reach 40% to 50% in cases with mediastinitis which can further spread and cause empyema and pericarditis.<sup>11</sup>

Lemierre syndrome is a rare complication of infectious thrombophlebitis of the internal jugular vein due to lateral pharyngeal space infection. Local cases have been reported with common presentations of septic shock, neck pain and cavitary lung lesions in young adults.<sup>12</sup> *Fusobacterium necrophorum* is the classic causative bacteria described in Lemierre's syndrome.

<u>Host</u>	<u>Immunocompetent</u>			<u>Immuno-compromised / Hospital acquired</u>
Source	Dental or Odontogenic	Otogenic	Sinogenic	
Organism	Streptococci, H. influenzae, anaerobes	+ S. aureus + Pseudomonas	+ MRSA	+ MRSA + Pseudomonas
Antibiotics	Augmentin or Rocephin + Flagyl	Tazocin	Vancomycin + Unasyn	Vancomycin + Tazocin

Table 2. List of organisms and antibiotics for deep neck space infection

**Learning points**

1. Maintaining a high index of suspicion for deep neck space infection in patients presenting with sore throat and neck swelling
2. Careful X-ray interpretation is important and the prevertebral space should be measured at both upper and lower cervical spine levels.
3. For patients with suspected deep neck space infection, concomitant pneumonia or respiratory distress should raise the suspicion of mediastinitis
4. Early CT scan of neck (or with thorax) is important to delineate the extent of the infection and early liaison with ENT surgeons for timely interventions.

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