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Prevertebral Abscess with Anterior Pharyngeal Shift and Epidural Involvement

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Agenda

- **Brief introduction to our patient**
- Review anatomy and different infections of the Head and Neck
- Return to our patient and the relevant imaging findings
- Discuss different imaging modalities
- Review treatment options for retropharyngeal/prevertebral abscesses
- Outcome of our patient
- Take-home Points



Our Patient: Clinical Presentation

- A.B., a 29 year old female with a history of IV drug use presents with posterior neck pain radiating down to her shoulders for the past seven days and difficulty swallowing for the past 2 days
- She was febrile and has bilateral tender cervical lymphadenopathy without trismus on physical exam



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Submandibular Space: Anatomy

Figure 1: This figure depicts the **sublingual space, aka supramylohyoid compartment** and the **submylohyoid space, aka inframylohyoid compartment**. Collectively, these two compartments comprise the submandibular space, which is separated by the **mylohyoid muscle**. The **hyoid bone** is pictured with the **arrow**.

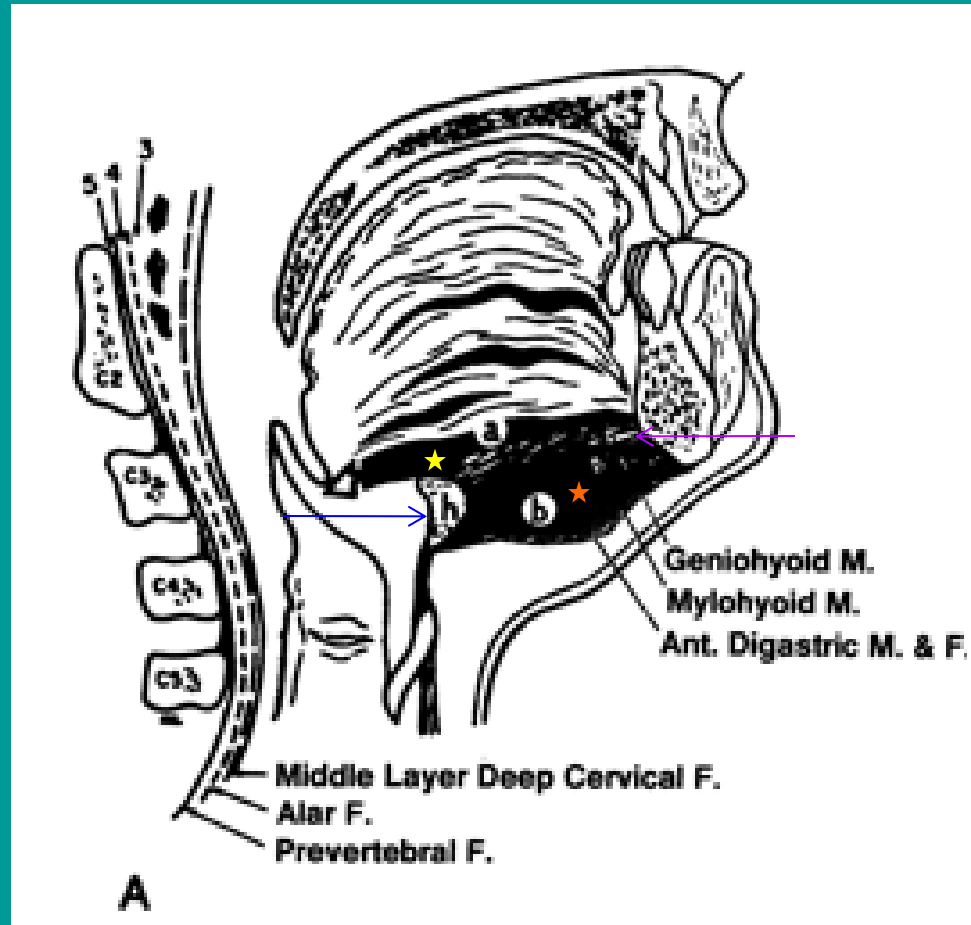


Image taken from:

¹Chow, AW. Life-threatening infections of the head and neck. *Clin Infect Dis*. 1992 May;14(5):991-1002.



Submandibular Space: Infection

- Ludwig's angina is the characteristic infection of the submandibular space, which is often caused by spread of odontogenic infections, and infection is therefore usually caused by oral flora such as gram positive cocci and anaerobic bacteria.²
- The clinical presentation of Ludwig's angina includes fever, chills, malaise, mouth pain, neck stiffness, drooling, dysphagia, and "hot potato" voice without trismus²
- Physical examination is notable for "woody" inflammation of the submandibular area in addition to tongue protrusion with a tender, elevated, and erythematous oropharyngeal floor.²

²Reynolds, SC, Chow, AW. Severe soft tissue infections of the head and neck: a primer for critical care physicians. Lung. 2009 Sep-Oct;187(5):271-9.



Lateral Pharyngeal Space: Anatomy

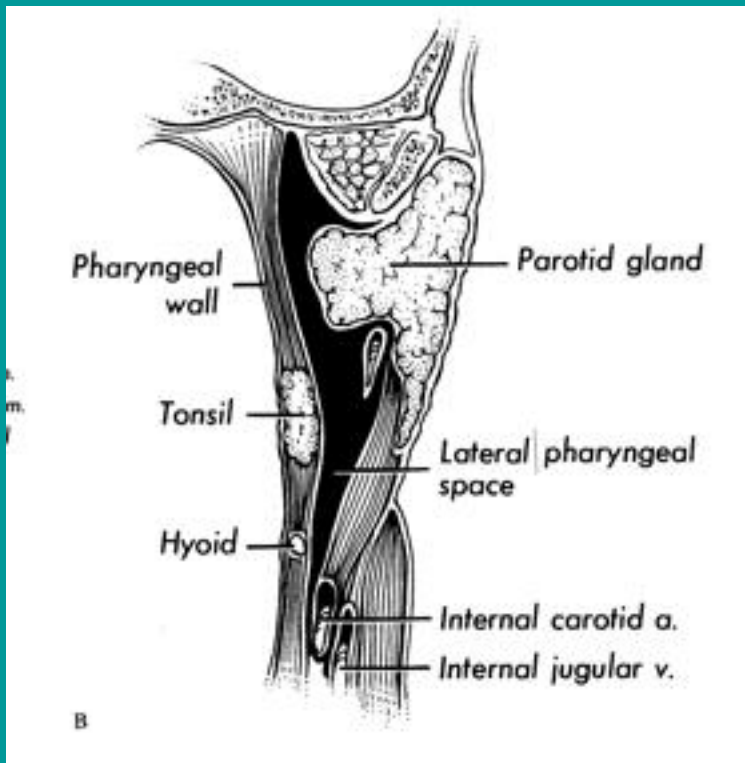


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Figure 2: This figure shows the lateral pharyngeal (aka parapharyngeal space).

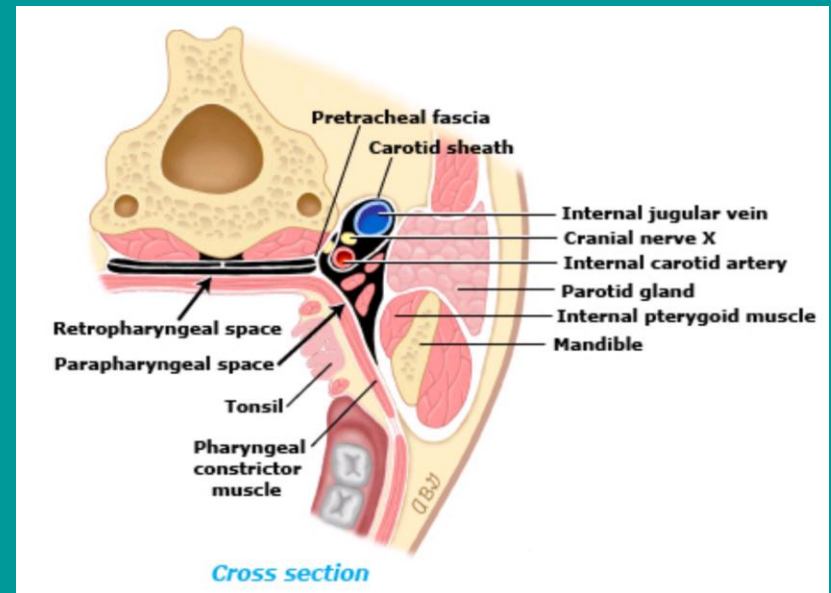


Image taken from:

³Chow, AW. Deep neck space infections. In: *UpToDate*, Basow, DS (Ed), *UpToDate*, Waltham, MA, 2013.

Figure 3: The figure depicts the lateral pharyngeal or parapharyngeal space in relation to the retropharyngeal space and other deep neck structures in cross section.



Lateral Pharyngeal Space: Infection

- Lateral pharyngeal infections often arise from contiguous spread of infection from other areas of the head and neck, particularly from peritonsillar abscesses.²
- Infections tend to be polymicrobial with oral flora and often include anaerobic bacteria.²
- Infections are divided into prestyloid or anterior and poststyloid or posterior, referring to the spaces anterior and posterior to the styloid process, respectively.⁴
- Patients with lateral pharyngeal infections tend to present with fever, chills, malaise, dysphagia, trismus, and ipsilateral neck and jaw pain potentially radiating to the ipsilateral ear.²
- Pain is exacerbated by lateral neck flexion to the contralateral side.²
- Induration can be present in the ipsilateral angle of the jaw.²
- Anterior lateral infections are more commonly associated with trismus and have a greater risk of spread to other compartments, such as the retropharyngeal space.²
- Posterior lateral infections can present without trismus, but can have more serious complications, including sudden death from vagus nerve involvement, laryngeal obstruction, carotid artery involvement and erosion, Horner's syndrome, palsies of cranial nerve 9-12, and Lemierre's Syndrome.²

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⁴Vieira, F, Allen, SM, Stocks, RM, Thompson, JW. Deep neck infection. Otolaryngol Clin North Am. 2008 Jun;41(3):459-83, vii.



Lemierre's Syndrome: Some Facts

- Lemierre's syndrome is also known as suppurative jugular thrombophlebitis and is associated with posterior pharyngeal infection.²
- Lemierre's syndrome is the occlusion of the internal jugular vein with septic thrombus from anaerobic infection.²
- Lemierre's syndrome is classically caused by *Fusobacterium necrophorum*, but other *Fusobacterium* species, anaerobic *streptococci*, *Prevotella*, or *Bacteroides* may be responsible.²
- In addition to internal jugular thrombosis, Lemierre's syndrome also often results in septic foci spreading to the lung.²
- *Fusobacterium necrophorum* is often penicillin sensitive and Lemierre's Syndrome is often treated with 4-6 weeks of antibiotic therapy.²

²Reynolds, SC, Chow, AW. Severe soft tissue infections of the head and neck: a primer for critical care physicians. Lung. 2009 Sep-Oct;187(5):271-9.

Retropharyngeal, Danger, and Prevertebral Spaces: Anatomy

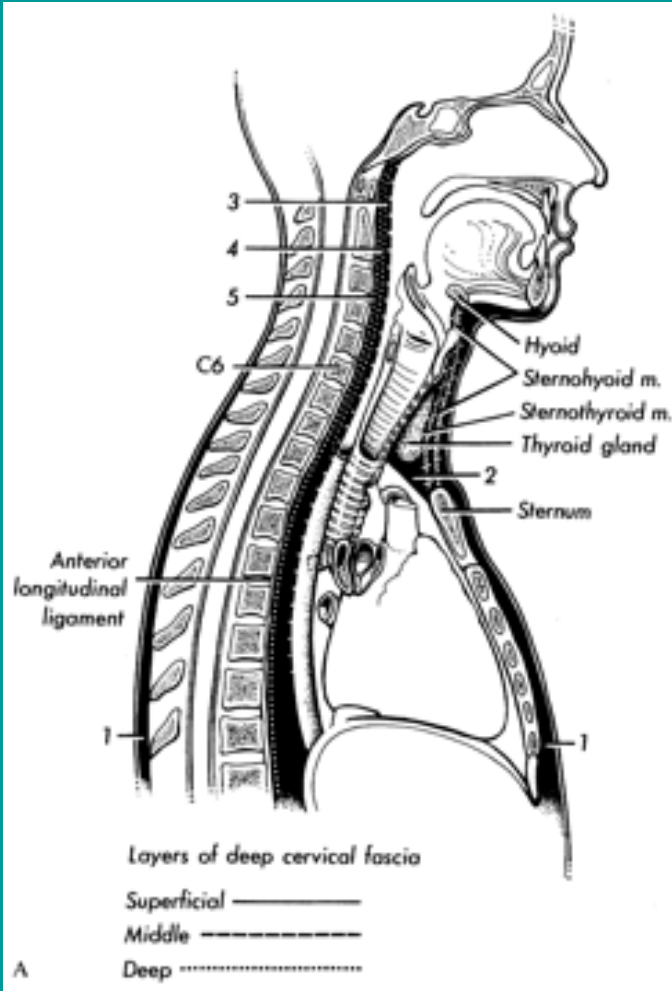


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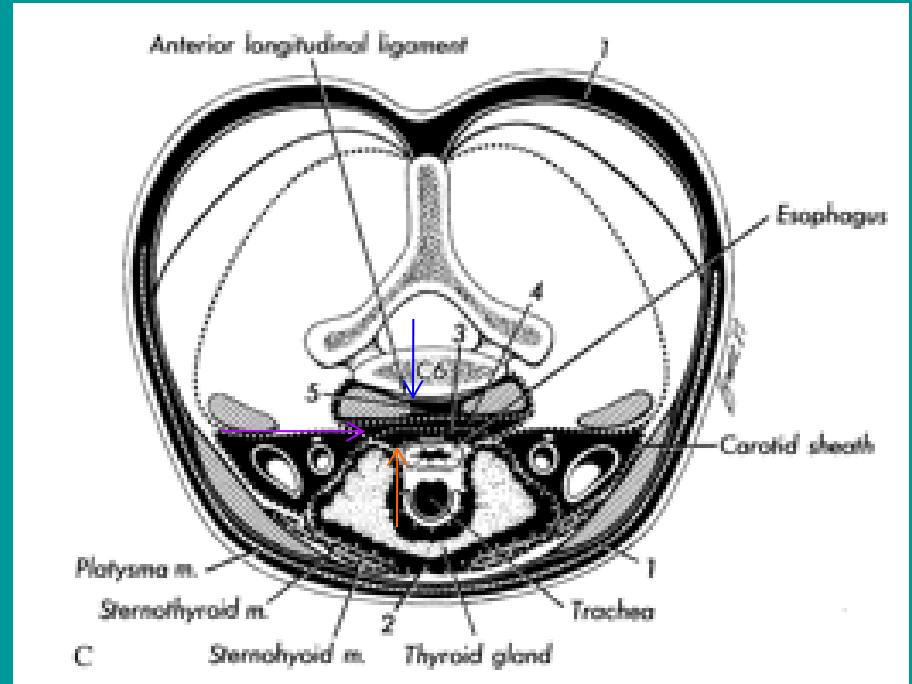


Image taken from:
¹Chow, AW. *Life-threatening infections of the head and neck.* *Clin Infect Dis.* 1992 May;14(5):991-1002.

Figures 4 and 5: These figures show the anatomic relationship of the deep cervical fascial spaces (1= superficial space, 2 = pretracheal space, 3 = retropharyngeal space, 4 = danger space, 5 = prevertebral space)



Retropharyngeal Space: Infection

- Retropharyngeal infections are most common in children.²
- In children, abscess develops from adenitis of deep cervical lymph nodes present in the retropharyngeal space bilaterally.²
- These lymph nodes regress at the age of 4, making adults much less likely to develop retropharyngeal abscess.²
- When retropharyngeal abscess occurs in adults, it is often the result of trauma (instrumentation, foreign bodies) or contiguous spread from other areas.²
- Reynolds and Chow describe the symptoms of retropharyngeal abscess as neck stiffness, dysphagia, odynophagia, and dyspnea.²
- Vieira et al. state that the symptoms of retropharyngeal abscess in adults as neck pain, fever, anorexia, nasal obstruction, snoring, and dyspnea.⁴
- Physical exam may reveal a bulge in the posterior pharyngeal wall.²
- The major complication of retropharyngeal abscess is respiratory distress secondary to obstruction from inflammation and anterior pharyngeal displacement.²

²Reynolds, SC, Chow, AW. Severe soft tissue infections of the head and neck: a primer for critical care physicians. Lung. 2009 Sep-Oct;187(5):271-9.

⁴Vieira, F, Allen, SM, Stocks, RM, Thompson, JW. Deep neck infection. Otolaryngol Clin North Am. 2008 Jun;41(3):459-83, vii.



Danger Space: Infections

- Infections of the danger space occur commonly secondary to contiguous spread from the retropharyngeal space, the prevertebral space, or the lateral pharyngeal space.⁴
- Clinically, these infections resemble retropharyngeal abscesses.²
- The major distinguishing feature of danger space infection is that these infections can spread to the posterior mediastinum.²
- Once the infection spreads to the mediastinum, these infections can involve the pericardium and the retroperitoneum, though this is rare.²
- The purulent fluid produced by the infection can also rupture into the pleural space from the mediastinum, causing pleural effusions and pyothorax.²
- Involvement of the pericardium can lead to pericardial effusions and cardiac tamponade.²
- Finally, mediastinitis is highly associated with aspiration, likely secondary to dysphagia.²

²Reynolds, SC, Chow, AW. Severe soft tissue infections of the head and neck: a primer for critical care physicians. Lung. 2009 Sep-Oct;187(5):271-9.

⁴Vieira, F, Allen, SM, Stocks, RM, Thompson, JW. Deep neck infection. Otolaryngol Clin North Am. 2008 Jun;41(3):459-83, vii.



Prevertebral Space: Infections

- In contrast to nearly every infection discussed thus far, infection of the prevertebral space often does not occur from contiguous extension of other spaces of the neck.²
- It often occurs secondary to osteomyelitis and hematogenous spread, and it is therefore most often caused by *Staph. Aureas*.²
- *Mycobacterium tuberculosis* can also spread to the prevertebral space in Pott's disease.⁴
- Symptoms are not consistent, but range from neck or back pain, fever, nerve root pain, and paralysis.³
- The major complication is spinal cord compression secondary to epidural fluid collection.²
- The prevertebral space is contiguous with the psoas muscle sheathe, leading to possible psoas muscle involvement.²
- However, despite the fact that the prevertebral space spans the entire vertebral column, fibrous attachments between the prevertebral fascia and the deep cervical muscles often prevent spread.⁴
- Patients can have a midline bulge in the posterior pharyngeal wall, in contrast to unilateral bulge in the posterior pharyngeal wall seen in retropharyngeal abscess.⁴

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Our Patient: Lateral C-Spine Plain Films



BIDMC-PACS – Lateral C-Spine Plain Film



BIDMC – PACS – Lateral C-Spine Plain Film

Normal Lateral C-Spine Plain Film

Figure 7: C-Spine from the patient: The double arrow shows a significantly widened space between the vertebral bodies and the pharynx. The pharynx is also laterally displaced.



Imaging Deep Neck Infections: Plain Films

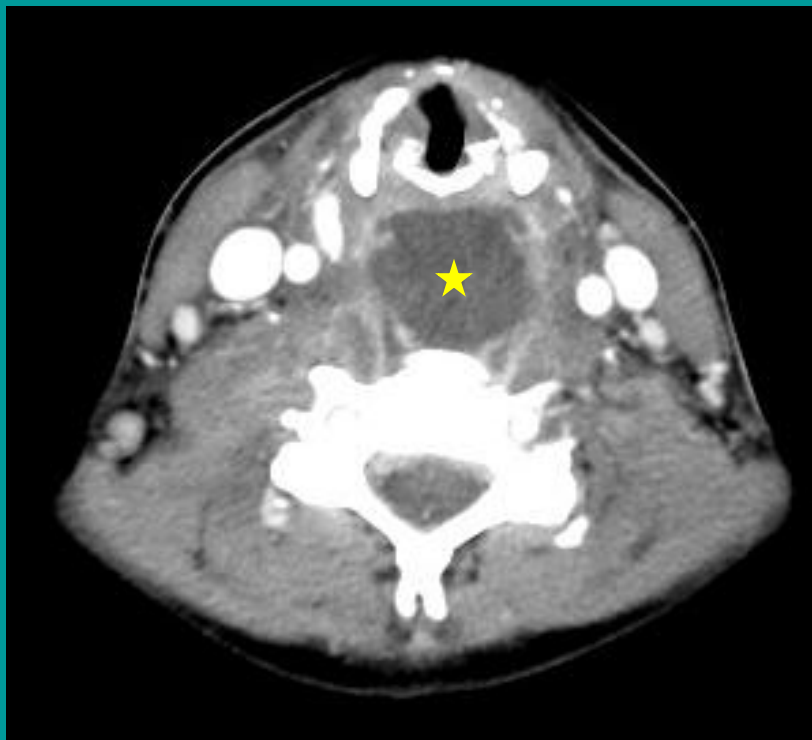
- Plain films are not the imaging modality of choice for imaging infections of the head and neck.
- They can however display retropharyngeal swelling as in this case.
- Additionally, they can also show epiglottitis or acute sinusitis.
- However, more definitive imaging modalities are required in most cases.



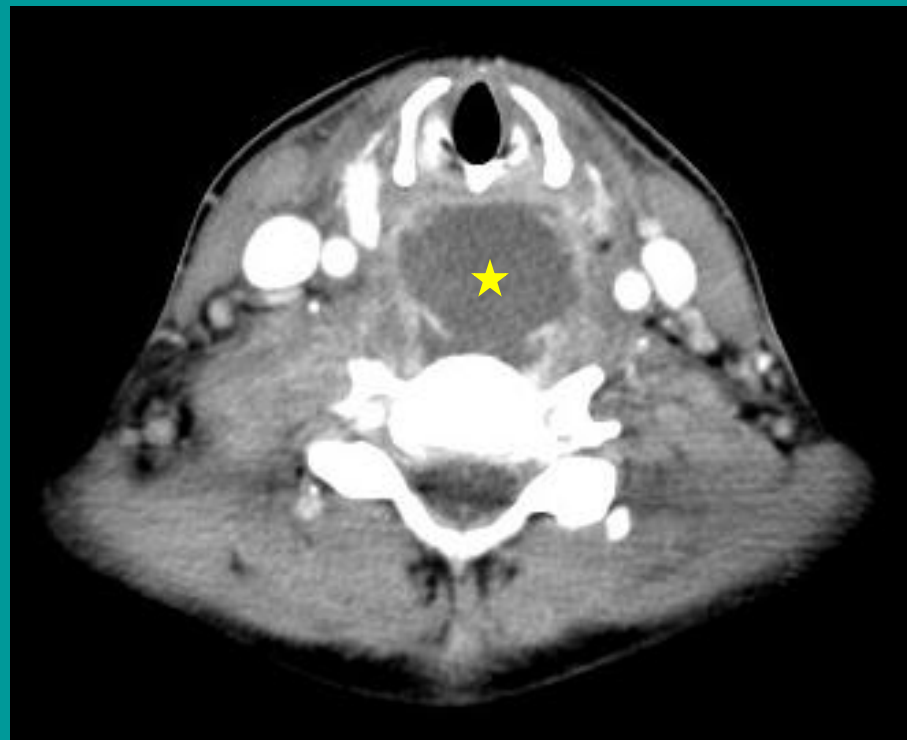
The C-Spine lateral plain films demonstrated a significantly widened space between the vertebral bodies and the pharynx. Continue to view the CT findings in our patient.



Our Patient: Axial CT



BIDMC – PACS – Axial Neck CT +c

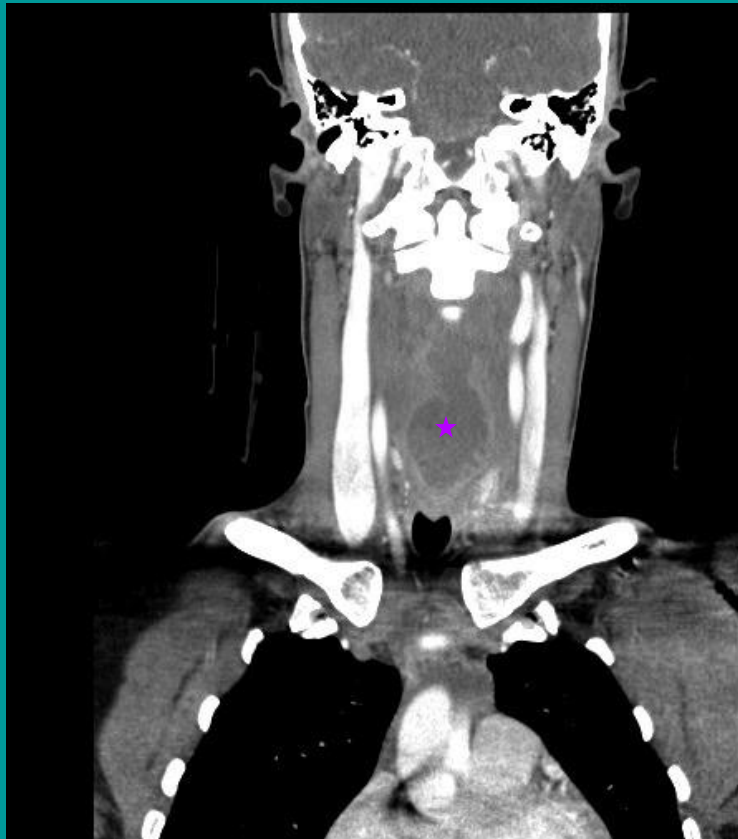


BIDMC – PACS – Axial Neck CT +c

Figures 8 and 9: There is a large **abscess** in the prevertebral space abutting the vertebral bodies.



Our Patient: Coronal and Sagittal CT



BIDMC – PACS – Coronal Neck CT +c



BIDMC – PACS – Sagittal Neck CT +c

Figure 10 and 11: These images show the vertical extent of the abscess much more clearly. On the sagittal section, figure 11, the pharynx is clearly shifted anteriorly by the abscess. Additionally, the sagittal section also shows that the abscess extends from C3-C7.



Imaging Deep Neck Infections: CT

- CT with contrast is the imaging modality of choice for imaging an adult with multiple neck masses/adenopathy or with a unilateral neck mass/adenopathy and fever (CT with contrast is rated as a 9 in both categories by the ACR appropriateness criteria).⁶
- Early signs of retropharyngeal abscess include fat stranding, linear fluid, minimal mass effect with no enhancement around the fluid. There may be reactive lymph nodes that demonstrate enhancement.⁵
- Fat stranding can then progress to central hypoattenuation with necrosis and fluid deposition and peripheral enhancement, a ring-enhancing abscess.⁵
- MRI, not CT, is needed in order to exclude spinal cord involvement and the formation of an epidural abscess.⁵

⁵Hurley, MC, Heran, MK. Imaging studies for head and neck infections. *Infect Dis Clin North Am.* 2007 Jun;21(2):305-53, v-vi.

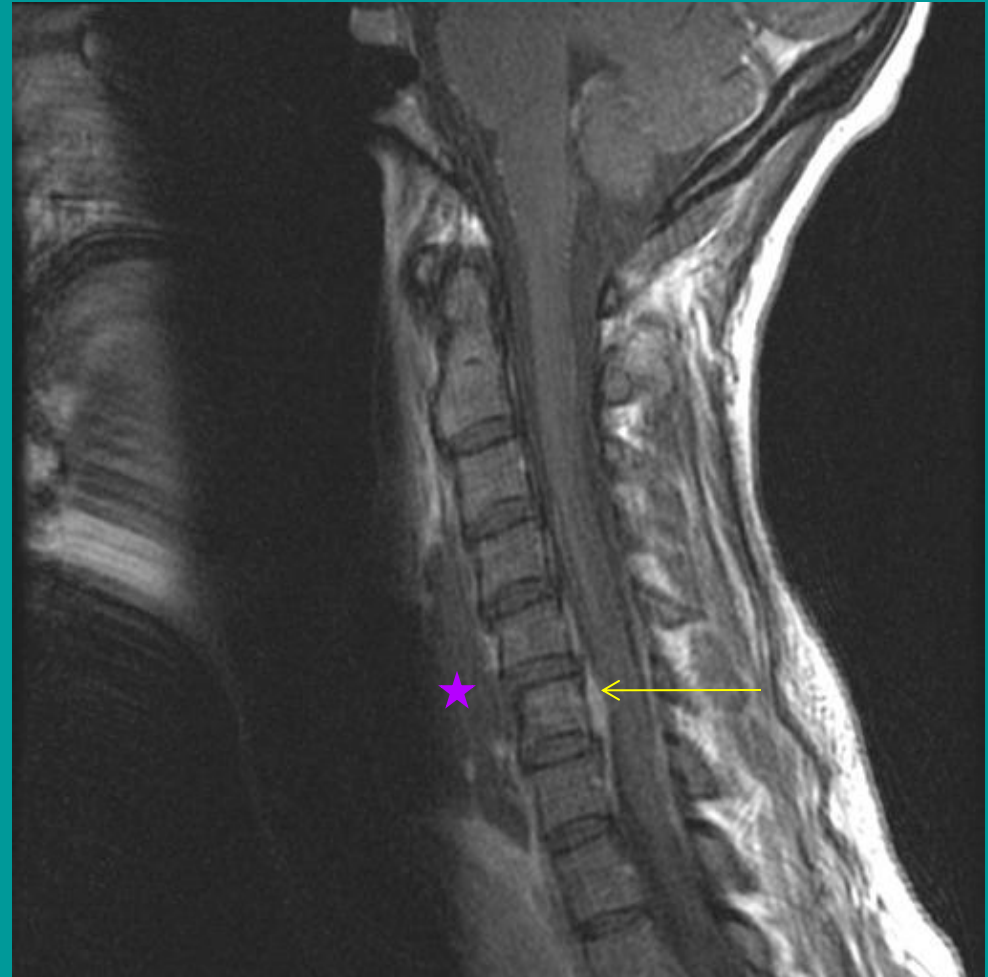
⁶American College of Radiology. ACR Appropriateness Criteria[®]: Neck Mass/Adenopathy . Available at: <http://www.acr.org/Quality-Safety/Appropriateness-Criteria/Diagnostic/Neurologic-Imaging>. Accessed 01/26/2013.



The neck CT demonstrates the classic findings of abscess (central necrosis and hypoattenuation with peripheral enhancement). However, it is unclear if the epidural space and the spinal cord is involved. Continue to view our patient's findings on MRI.

Our Patient: MRI

Figure 12: The image clearly shows the ring-enhancing abscess. The arrow points to an area of increased intensity abutting the spinal cord at the level of C6. This increased intensity appears to be compressing the spinal cord slightly. The increased intensity of the region in addition to its proximity to the abscess suggests inflammation of meninges, concerning for possible spread of the infection to the epidural space with possible epidural abscess formation.



BIDMC – PACS – Sagittal C-Spine T1 MRI +c



Imaging Deep Neck Infections: MRI

- MRI with contrast is rated as an 8 (second only to CT with contrast) by the ACR appropriateness criteria for imaging patients with both multiple masses/adenopathy or solitary mass/adenopathy with fever.⁶
- It is inferior to CT in its spatial resolution, but it allows for superior visualization of the spinal cord and is necessary to rule out epidural involvement

⁶American College of Radiology. ACR Appropriateness Criteria®: Neck Mass/Adenopathy . Available at: <http://www.acr.org/Quality-Safety/Appropriateness-Criteria/Diagnostic/Neurologic-Imaging>. Accessed 01/26/2013.



Our Patient: Diagnosis

- In this case, the patient had imaging findings that were concerning for prevertebral abscess that is likely extending into the retropharyngeal space, leading to anterior shifting of the pharynx, which probably led to the patient's symptoms of dysphagia.
- The likely cause of this infection is the patient's history of IV drug use, leading to hematogenous seeding of the prevertebral space.
- Additionally, the imaging findings are concerning for extension into the epidural space and compression of the spinal cord.

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Deep Neck Abscesses: Treatment

- The mainstay of treatment for abscess is drainage, either surgical or fine needle aspiration.²
- Conservative management with antibiotics can also be undertaken if the deep neck abscess is uncomplicated and small.²
- However, if an abscess is greater than 3 cm and involves the prevertebral space, anterior visceral or carotid spaces, or if the infection involves more than one compartment, then surgery is indicated.²
- Empiric antibiotic coverage is always recommended for deep neck infections.²
- Because most deep neck infections involve the oral flora, antibiotics should cover both aerobes and anaerobes.²
- Empiric antibiotic coverage can thus include a penicillin combined with a beta lactamase inhibitor (e.g. amoxicillin/clavulanic acid, ticarcillin/clavulanic acid) with an antibiotic targeted against anaerobes (clindamycin, metronidazole).²
- Prevertebral infections, however, are often caused by hematogenous seeding. Empiric coverage is therefore aimed against gram-positive cocci (Vancomycin) and gram-negative rods (Zosyn or Cefepime).³

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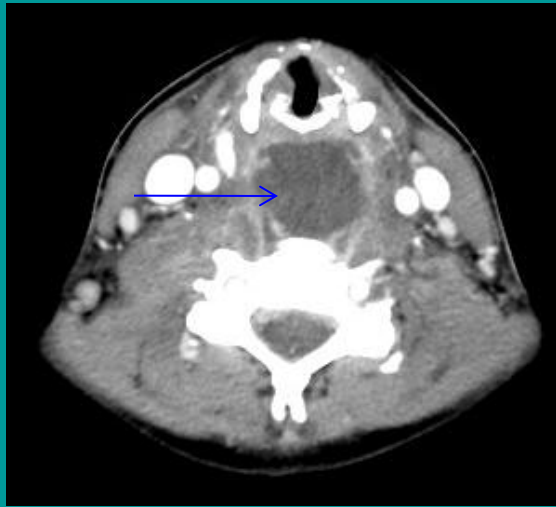
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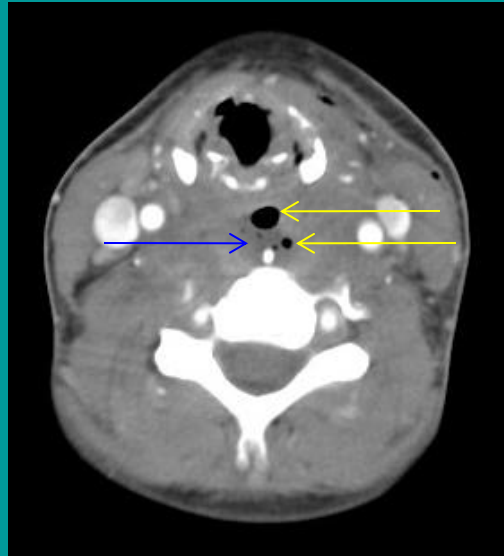
Our Patient: Outcome

- The patient in this case underwent surgical incision and debridement of her neck with neck exploration and drainage of abscess.
- She was also treated empirically for prevertebral infection with vancomycin and zosyn
- Cultures taken from the abscess grew MSSA with no anaerobic growth
- Antibiotic coverage was then narrowed to IV nafcillin for 5 weeks
- Follow-up imaging showed full resolution of the abscess

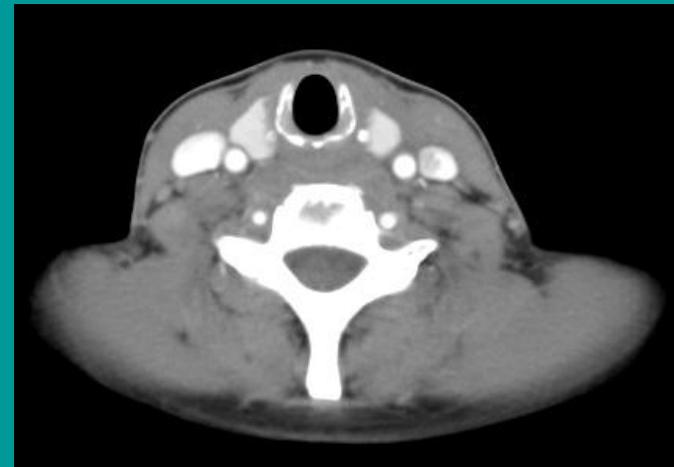
Our Patient: Follow-up Imaging



BIDMC – PACS – Axial Neck CT +c
Initial CT



BIDMC – PACS – Axial Neck CT +c
CT on POD #1



BIDMC – PACS – Axial Neck CT +c
CT one month post-treatment

Figures 13-15: These figures show the patient's response to treatment. The **abscess** is clearly reduced in size in the middle image one day after surgical drainage. The **lucencies** correspond to air bubbles in the **abscess**, which were likely introduced during drainage. After one month, the abscess has completely resolved and is no longer visible on the right image.

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Take-home Points

- **Clinical course of deep neck infections:**
 - Deep infections of the head and neck can lead to serious complications such as sudden death from vagal nerve involvement (lateral pharyngeal infection), airway obstruction (Ludwig's angina, retropharyngeal abscess), mediastinitis (danger space infection), spinal cord compression (prevertebral space infection).
- **Imaging deep neck infections with plain films:**
 - Plain films can show retropharyngeal swelling or epiglottitis, but are not definitive.
- **Imaging deep neck infections with CT:**
 - CT with contrast is the imaging modality of choice to visualize deep infections of the head and neck
 - Typical appearance of an abscess on CT is central hypoattenuation (necrosis) and peripheral enhancement (inflammation)
- **Imaging deep neck infections with MRI:**
 - MRI with contrast is the second line imaging modality for viewing infections of the head and neck
 - Epidural fluid collections and spinal cord compression can be best seen on MRI
- **Treatment of deep neck abscesses:**
 - The mainstay of treatment of abscesses of the head and neck is drainage with appropriate antibiotic coverage



References

1. Chow, AW. Life-threatening infections of the head and neck. Clin Infect Dis. 1992 May;14(5):991-1002.
2. Reynolds, SC, Chow, AW. Severe soft tissue infections of the head and neck: a primer for critical care physicians. Lung. 2009 Sep-Oct;187(5):271-9.
3. Chow, AW. Deep neck space infections. In: UpToDate, Basow, DS (Ed), UpToDate, Waltham, MA, 2013.
4. Vieira, F, Allen, SM, Stocks, RM, Thompson, JW. Deep neck infection. Otolaryngol Clin North Am. 2008 Jun;41(3):459-83, vii.
5. Hurley, MC, Heran, MK. Imaging studies for head and neck infections. Infect Dis Clin North Am. 2007 Jun;21(2):305-53, v-vi.
6. American College of Radiology. ACR Appropriateness Criteria®: Neck Mass/Adenopathy . Available at: <http://www.acr.org/Quality-Safety/Appropriateness-Criteria/Diagnostic/Neurologic-Imaging>. Accessed 01/26/2013.

Acknowledgements

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