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Approach to Deep Neck Infections

Developed by Owen Sieben and Dr. Hamdy El-Hakim for PedsCases.com.
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Introduction

Hello, everyone. My name is Owen Sieben. I am a fourth-year medical student at the University of Alberta. I would like to thank Dr. Hamdy El-Hakim, a pediatric otolaryngologist at the University of Alberta for his help in developing this podcast on 'Deep Neck Infections.' I would also like to thank Dr. Chris Novak and the PedsCases team for their support in creating this podcast.

After listening to this podcast, the learner should be able to:

1. Describe the relevant anatomy and pathophysiology of deep neck infections
2. Recognize the typical clinical presentation of deep neck infections
3. Explain the initial steps of diagnosis and management of deep neck infections

We will focus on the 3 most common pediatric deep neck infections: peritonsillar abscess, retropharyngeal abscess and parapharyngeal infections.

The Case

Let's start with a clinical case. You are working in the Emergency Department. You are assessing Kyle, a previously healthy 3-year-old boy that has been brought in by his mother for a fever, sore throat, and neck stiffness.

We return to Kyle's case as we continue through the podcast.

Anatomy & Pathophysiology

To begin, let's discuss the relevant anatomy and pathophysiology of deep neck infections.

An accurate understanding of the anatomy of the deep neck area is critical to diagnosing and managing infections in this area, so let's spend some time at the start of this podcast discussing the relevant anatomy.

The deep neck area is divided into true and potential spaces by fascial planes.[1] These fascial planes create spaces that can harbour infectious and purulent material, resulting in deep neck

infections. The fascial planes also create tracts that determine the direction of potential spread of infection between the various spaces.[1,2,3]

Deep neck infections are described in terms of the fascial spaces that they occupy. In this podcast, we will focus on infections in the peritonsillar, the retropharyngeal, and the parapharyngeal spaces.[4]

Peritonsillar abscesses form in the peritonsillar space. The peritonsillar space is located on the lateral walls of the oropharynx between the tonsillar capsule medially and the superior constrictor muscle laterally. The space contains loose connective tissue and blood vessels.[1] Peritonsillar abscess is a collection of pus in the peritonsillar space and is generally preceded by tonsillitis or pharyngitis or may be associated with infection in Weber glands which are minor mucous salivary glands that lie in the peritonsillar space.[5]

Retropharyngeal abscesses form in the retropharyngeal space. The retropharyngeal space in general is posterior to the pharynx and esophagus and anterior to the spine. It runs the entire length of the neck from the base of the skull to the posterior mediastinum. More specifically, it is bounded by the buccopharyngeal fascia anteriorly and the alar fascia posteriorly and contains lymph nodes and connective tissue.[1] Most retropharyngeal infections are associated with upper respiratory infections causing suppurative adenitis of the retropharyngeal lymph nodes that receive drainage from the nose, sinuses, and pharynx.[6] Infection of the retropharyngeal space can also result from trauma to the posterior pharynx or extension from an adjacent parapharyngeal space infection.[7]

Just posterior the retropharyngeal space lies the danger space. This potential space is between the alar fascia and the prevertebral fascia and is known as the danger space because it runs from the skull base to the level of the diaphragm and provides a path for the spread of infections from the pharynx to the mediastinum, which poses a significant risk of morbidity and mortality from severe infections such as mediastinitis. Infections of the danger space result from spread from the adjacent retropharyngeal, parapharyngeal, or prevertebral spaces.[4]

Lastly, parapharyngeal infections form in the parapharyngeal space. Parapharyngeal infections may also be referred to as Lateral Pharyngeal or Pterygomaxillary Space Infections.[4] The parapharyngeal space is described as an inverted pyramid shape, with the base of the pyramid being at the skull base and the apex at the hyoid bone. The anterior boundary of the space is the fascia of the pterygoid muscles, the posterior boundary is the prevertebral fascia, the medial boundary is the middle layer of deep cervical fascia, and the lateral layer is the deep lobe of the parotid gland. This space borders many of the other fascial spaces of the neck including the submandibular, retropharyngeal, parotid, and masticator spaces. Infections in the space arise most often from dental infections or peritonsillar abscess but may also occur from otitis media, mastoiditis, or parotitis.

Clinical Presentation

Now that we have covered the anatomy and touched on the pathophysiology of deep neck infections, let's discuss the typical clinical presentation of deep neck infections. Given the risk of potentially life-threatening complications, usual reliance on the parental report rather than the young child, and the subtle and insidious clinical signs, it is crucial to maintain an index of suspicion, and be able to identify a patient presenting with a deep neck infection.

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Let's start with peritonsillar abscesses. The peritonsillar abscess is the most common deep neck infection in the general population, occurring most frequently in adolescents and young adults. These infections are less common in younger children but may occur especially if the child is immuno-compromised.[8] Patients typically appear ill with fever, and a worsening sore throat. They may speak with a muffled voice often referred to as "hot potato voice," as in trying to speak with a mouth full of hot potato. Patients may also experience dysphagia, odynophagia, and trismus, which is difficulty opening the mouth due to inflammation and spasm of the internal pterygoid muscle. Just imagine the opening of the mouth compressing the hot swollen tonsils in the back of the mouth. The presence of trismus can be helpful to distinguish peritonsillar abscess from severe pharyngitis or tonsillitis.[9] On physical exam, tender cervical lymphadenitis may be palpated more on the affected side, and examination of the oropharynx may show an asymmetric swollen erythematous tonsil, visible exudates, and contralateral deviation of the uvula.[10]

When a younger child like Kyle presents with symptoms suggestive of a deep neck infection, a retropharyngeal abscess should first come to mind. Retropharyngeal infections occur most frequently in young children between the ages of 2 and 4 due to chains of lymph nodes present in children that atrophy before puberty.[11] Early on in the disease process the presentation may be similar to that of uncomplicated pharyngitis. As the disease progresses, inflammatory and potentially airway obstructive symptoms develop. In contrast to peritonsillar abscess, these patients are more likely to have neck stiffness, particularly with extension. Just imagine the extension of the neck compressing the hot swollen abscess sitting next to the vertebrae. Other symptoms may resemble peritonsillar abscess, including fever, dysphagia, odynophagia, and "hot potato voice." Trismus is possible but is much less common than in peritonsillar abscess. On physical exam, tender anterior cervical lymphadenopathy is often present, and when examining the oropharynx, there may be midline or unilateral swelling of the posterior pharyngeal wall. The ability to visualize the oropharynx may be limited by trismus, and special care should be taken to avoid precipitating a laryngospasm by forceful oral cavity exam.[9]

Parapharyngeal infections can occur in individuals of all ages. The presentation in adults is very similar to that of retropharyngeal infections, but symptoms in children presenting with these infections are often subtle and difficult to elicit early on. Overall, the symptoms are similar to what we described for retropharyngeal abscesses, but early symptoms might only include decreased oral intake or irritability. Progression of the condition might lead to anorexia, dysphagia, odynophagia and neck pain.[12] Fever, neck stiffness, neck swelling, a neck mass, and trismus are often seen. As with other deep neck infections, anterior cervical lymphadenopathy is often present. Other physical exam findings might include tenderness, fulness, or fluctuance when palpating the neck, as well as deviation of the lateral wall of the oropharynx towards the midline when completing an oropharyngeal exam, again with caution not to jeopardize the airway.[4]

Patients with deep neck infections may appear quite septic with tachycardia, hypotension, or tachypnea. This presentation, however, is not universal, and it is crucial to maintain an index of suspicion that a deep neck infection might be present if the presentation is more subtle.[4] Subtle deep neck infections can also present with a fever of unknown origin.

Most importantly, high clinical suspicion for signs and symptoms of airway obstruction should be held for all children presenting with any of the deep neck infections. The presentation of children with airway obstruction varies with the degree of obstruction. Drooling, dyspnea, and stridor are

signs indicating that a child is at risk of airway obstruction. Children with an already obstructed airway may appear anxious, positioned leaning forward with their head in the “sniffing position,” with marked suprasternal retractions, as well as nasal flaring or grunting.[13] We will cover airway management later in the podcast.

The Case

Now that we have covered the anatomy, pathophysiology, and typical clinical presentation of deep neck infections, let's return to the case.

Upon walking into the exam room, you notice that Kyle looks unwell. He has a temperature of 39 degrees Celsius, his HR is 130 bpm, his BP is 100/68, and he is saturating 96% on RA with a RR of 33. Upon talking with Kyle’s mom, you learn that Kyle has had a fever for the past few days. Kyle’s mom says that he has not been eating in the past couple of days and has been very irritable. She also tells you that Kyle complains of pain when he moves his neck and when he swallows. Despite some tenderness for Kyle while you do it, you are able to palpate his anterior cervical lymph nodes. A careful oropharynx exam reveals that Kyle is quite dehydrated with dry oral mucosa and fetor. There is midline swelling of the posterior pharyngeal wall, but his tonsils appear symmetric.

Being an astute health care provider, you begin to suspect that Kyle might have a deep neck infection. Due to the similar presentations of the many types of deep neck infections, you know that you will need to get some investigations done for Kyle to help you reach your final diagnosis.

Diagnostic workup

The most important consideration in the evaluation of a patient presenting with a potential deep neck infection is to first assess and stabilize the airway. Patients with signs or symptoms of airway obstruction must be in a safe, monitored environment where an emergent airway can be established if needed. If there are any signs of airway compromise, such as rapidly changing vital signs or shortness of breath, consult anesthesia and otolaryngology right away to help secure the airway followed by surgical drainage in the operating room.[14]

If no immediate airway concerns are present, further investigations can be considered.

If you are suspecting the patient has a peritonsillar abscess based on the clinical presentation and physical exam findings of a medially displaced tonsil and a deviated uvula, that is often enough to suggest a diagnosis of peritonsillar abscess. The next step following a clinical diagnosis is to confirm the presence of a drainable abscess which is done by needle aspiration or intraoral ultrasound. A collection of pus at the time of drainage, whether it be by needle aspiration or incision and drainage, confirms the diagnosis.[15] Laboratory work up is not needed to make the diagnosis, but gram stain, culture, and susceptibility testing of the abscess fluid may be helpful in complicated patients.[16] Imaging is also not needed to make the diagnosis, but a contrast enhanced computed tomography (CT) scan is required if there is suspicion of spread beyond the peritonsillar space, if attempts to obtain an aspirate have failed, or if a patient has failed to respond to initial antibiotic therapy.[3,17]

The diagnostic work up for children suspected to have a retropharyngeal or parapharyngeal abscess is the same. Again, all attention should first be directed to addressing any airway

obstruction. If the airway is stable, laboratory and imaging studies should be performed. Labs should include a complete blood count which usually shows increased white blood cell count with predominance of neutrophils and bands, blood cultures sent for anaerobic and aerobic cultures, a throat swab to be sent for group A streptococci, and abscess cultures, obtained at the time of drainage, to also be sent for aerobic and anaerobic culture.[9] Imaging plays an essential role in diagnosing a retropharyngeal or parapharyngeal abscess with contrast enhanced CT being the gold standard.[19] A CT scan can differentiate between an abscess collection and cellulitis, otherwise known as a deep neck space phlegmon. CT can also identify any extension of the abscess into other spaces in the neck or chest and help with planning the surgical approach if indicated.[9]

It is important to, again, note that airway stability should always be considered in patients with deep neck infections. Patients should be carefully monitored while they are being transported for imaging and during scanning as sedation and positioning can jeopardize the airway. If a child with moderate to severe respiratory distress is to have a CT, general anesthesia should be induced, and the airway secured with a pediatric otolaryngologist or anesthesiologist prior to CT imaging being obtained.[16]

Back to the Case

Let's jump back into the case.

After assessing Kyle for any airway obstruction, you note that Kyle does have some odynophagia, but no other signs of airway obstruction are present, so you cautiously proceed with some investigations. Blood work is drawn for a complete blood count and cultures, a throat swab is sent for group A streptococci testing, and you arrange for Kyle to have a contrast enhancing CT scan. The complete blood count reveals an elevated white blood cell count of 22,400/microlitre, and the radiologist report's findings suggestive of a right-sided retropharyngeal abscess of 2.6cm. The throat swab and blood culture results are still pending.

Now that we have arrived at a diagnosis for Kyle's symptoms, let's discuss the management of deep neck infections.

Management

The first consideration in the management of deep neck infections is, as I am sure you were able to guess, assessing the airway. Again, if there are signs of airway obstruction, anesthesia and pediatric otolaryngology must be consulted to help secure the airway prior to CT imaging being obtained, and to make arrangements for emergency surgical drainage.[9]

In children with clinically stable airways, the overall management strategy for infection of any deep neck space is based upon three common pillars that consist of drainage when appropriate, empiric intravenous antibiotic therapy, and supportive care.[4]

As we discussed earlier, if patients display clinical findings suggestive of peritonsillar abscess, needle aspiration or incision and drainage should be performed. Once the patient has been discharged, a referral to pediatric otolaryngology should be sent if the patient has a history of recurrent throat infections or previous peritonsillar abscess as tonsillectomy may be considered by the otolaryngologist if the indications are met.[21]

In terms of antibiotic therapy, peritonsillar abscesses are frequently a polymicrobial mixture of aerobes and anaerobes, so empiric therapy with coverage for Group A Streptococci, Staphylococcus aureus, and Respiratory Anaerobes should be chosen. Supportive care should include adequate hydration and pain control. Patients with uncomplicated peritonsillar abscess, who are well hydrated, tolerate a drainage procedure and can take oral medications after the procedure, can be managed as outpatients with oral antibiotics including amoxicillin-clavulanate or clindamycin.[16] Outpatients should be observed for a few hours following drainage of the abscess to ensure they can tolerate oral fluids and medication.[15] Patients discharged from the emergency room or hospital after treatment should be instructed to return for dyspnea, worsening throat pain, neck pain or trismus, enlarging mass, fever, neck stiffness, or bleeding.[16]

Common reasons for admission include dehydration, inability to manage oral fluid intake, airway concerns, and failure of outpatient management. These patients should receive IV antibiotics. Consider giving Cefazolin and Metronidazole. In patients that do not respond to initial treatment, those with moderate or severe disease, or those with MRSA risk factors, consider adding vancomycin. Antibiotic therapy should be delivered parenterally until the patient is afebrile and clinically improved at which point oral antibiotic therapy should be continued to complete a 14-day course.

The first step in managing a retropharyngeal abscess with a stable airway is the initiation of appropriate empiric antibiotic therapy immediately upon diagnosis.[4] Retropharyngeal abscesses are typically polymicrobial with both aerobes and anaerobes commonly being present. The empiric antibiotic therapy chosen should include coverage for Staph aureus, Group A strep, and anaerobes. Options include either ceftriaxone or cefazolin with metronidazole or clindamycin to cover anaerobes. In patients that do not respond to initial treatment, those with moderate or severe disease, or if there is high suspicion of MRSA involvement, consider adding vancomycin.[22] Therapy can be tailored based on culture results if drainage is performed, but not all microbes are consistently cultured.[23] Antibiotic therapy should be delivered parenterally until the patient is afebrile and clinically improved, at which point oral antibiotic therapy should be continued to complete a 14-day course. Oral antibiotic therapy options include amoxicillin-clavulanate or clindamycin.[9]

Surgical drainage of retropharyngeal abscesses should be performed if there is airway compromise or other life-threatening complications, if there is evidence of an abscess on CT imaging, and if the patient fails to respond to medial therapy alone.[24] If surgical drainage is performed, the abscess specimens should be sent for aerobic and anaerobic cultures.[9]All children with suspected retropharyngeal abscesses should be admitted and managed in consultation with otolaryngology. Particular attention should be paid to maintenance of the airway, monitoring for complications as well as adequate hydration and pain management.[9] When appropriately recognized and treated early, the overall prognosis is quite good with most infections resolving without long-term consequences and patients being discharged within three to five days.[26]

The management of parapharyngeal abscess is very similar to the management of retropharyngeal abscesses. Antibiotic therapy should follow the same approach, and surgical abscess drainage is indicated for airway obstruction, systemic toxicity, or when clinical presentation or imaging suggests a large abscess or extension into adjacent spaces.[4] Supportive care and monitoring for complications should follow the same principles to that of retropharyngeal abscesses.

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Complications of deep neck infections are rare but can occur if the infection spreads to other deep neck spaces, adjacent structures, and the bloodstream. The list of potential complications includes airway obstruction, aspiration pneumonia from the abscess rupturing into the airway, septicemia, internal jugular vein thrombosis, jugular vein suppurative thrombophlebitis most commonly caused by fusobacterium and otherwise known as Lemierre's syndrome, carotid artery rupture, pseudoaneurysm of the carotid artery, mediastinitis, atlantoaxial dislocation, and necrotizing fasciitis.[16,25] Thankfully, these complications are rare and can be avoided by prompt recognition and treatment of the infection.[17] Overall, when appropriately recognized and treated early, the prognosis is quite good with most infections resolving without long-term sequelae.[16,26]

Case Conclusion

Let's return to the case and see how Kyle was managed. Kyle's airway continued to be secure. With the diagnosis of a large retropharyngeal abscess, Kyle was immediately started on cefazolin and metronidazole, and Otolaryngology was consulted for surgical drainage. Kyle's abscess was successfully drained in the operating room, and specimens were sent for culture. Kyle was admitted in consultation with Otolaryngology. He was continued on IV antibiotics as the culture results came back with a polymicrobial infection that was negative for Methicillin-resistant Staphylococcus aureus. Kyle was monitored for any complications and received supportive care. He responded well with a decrease in symptoms, and he was eventually discharged from the hospital after five days with instruction for follow up and a continued course of oral amoxicillin-clavulanate.

Key Points & Conclusion

1) The presentation of deep neck infections can be subtle and insidious, so it is important to maintain an index of suspicion. Signs and symptoms to watch for include ill-appearing, febrile children with a sore throat, hot potato voice, dysphagia, and odynophagia. Trismus can be a helpful clue for peritonsillar abscess, and neck pain and stiffness can point to a retropharyngeal or parapharyngeal abscess.

2) The most important consideration when evaluating a patient for a deep neck infection is to make sure the airway is secured and protected. If there are any signs of airway compromise, remember to consult anesthesia or pediatric otolaryngology right away to help secure the airway.

3) The three pillars of management for deep neck infection are drainage when appropriate, empiric antibiotic treatment with *Staph aureus*, group A strep, and anaerobe coverage, and supportive care with adequate hydration and pain management.

And that concludes our discussion on deep neck infections. Thank you again to Dr. Hamdy El-Hakim and Dr. Chris Novak for their support in developing this podcast.

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