

Infections of the Head and Neck

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Cellulitis and abscess of the potential spaces of the neck, deep to the superficial fascia, have become known as deep neck infections. These infections merit special consideration because of the life-threatening complications that may result if treatment is delayed or inadequate. In the preantibiotic era we have been led to believe that deep neck infections were frequently encountered. More recently, deep neck infections have been less common and knowledge about them is generally obtained from textbooks or anecdotal accounts. Deep neck infections continue to be important, albeit relatively unusual, problems. Furthermore, these clinical situations offer circumstances in medicine in which astute judgment and timely intervention continue to be life-saving.

Anatomic Consideration

Connective tissue envelopes all the viscera of the neck and, in fact, a fascial plane simply represents the condensation of such connective tissue. Infection and abscess formation may cause pressure, and the limits of these infections are defined by the fascial planes of greatest resistance.

A layer of fascia envelops the spinal column and paraspinal muscles. This fascia attaches to the transverse process of the vertebrae laterally, then splits into a prevertebral and alar layer. This forms a potential space known as the *prevertebral space*. The prevertebral space runs from the base of the skull to the diaphragm and, under normal circumstances, it is empty. Most reported infections of the prevertebral space come from direct extension of osteomyelitis of the vertebrae. Immediately anterior to the prevertebral space, and behind the pharyngeal wall, lies the retropharyngeal space. This space extends from the base of the skull to approximately the level of the tracheal bifurcation. It is for this potential connection with the mediastinum that it is called the "danger space". Lymphatic glands of the retropharyngeal space drain primarily the nasopharynx, sinuses, and posterior nose.

The *parapharyngeal space* is adjacent to the retropharyngeal space. This cone shaped space is bounded by the skull superiorly and the hyoid bone inferiorly. The lateral border is the mandible and parotid gland, while medially, it is bounded by the pharyngeal fascia. It is because of the relatively nondistensible superior, posterior, and lateral boundaries of the parapharyngeal space that abscess formation often first produces bulging into the pharynx.

The parapharyngeal space must be distinguished from the site of the peritonsillar abscess which lies medial to the pharyngeal fascia immediately under the capsule of the tonsil. The parapharyngeal space is traversed by the carotid artery, jugular vein, sympathetic chain, as well as cranial nerves IX, X, XI, and XII. The carotid sheath pierces the parapharyngeal space at the hyoid bone before continuing into the mediastinum. The carotid

sheath thus has been termed the "Lincoln highway" of the body. The parapharyngeal space contains lymph nodes that drain primarily the oral cavity and oropharynx.

More anteriorly lies the submandibular space between the skin and the floor of the mouth. This space is divided into a sublingual and submental portion by the mylohyoid muscle. There is relatively free communication between the two portions of the space along the posterior edge of the mylohyoid muscle. However, the primary area of presentation may vary depending on abscess pressure. That is, if the mass is primarily sublingual there may be edema and retrusion of the tongue, with eventual airway compromise (Ludwig's angina), whereas a submental (inframyllohyoid) infection may present primarily as a mass in the neck.

Pathogenesis

Deep infections of the head and neck such as those discussed in this article frequently are related to various types of trauma or focal infection sustained to the oral cavity or its contents. For example, Taffel, in a survey of 45 cases of Ludwig's angina, reported that only 3 (7 per cent) appeared to have no antecedent cause, whereas the remainder (93 per cent) were preceded by diverse events such as recent lower molar extraction (42 per cent), toothache and associated apical abscess (27 per cent), trauma to the mouth floor (4 per cent), previous submaxillary adenitis (4 per cent), compound fractures of the mandible (4 per cent), and sore throat (9 per cent). The role of dental infections or procedures in the development of Ludwig's angina seems important, especially conditions involving the second and third molars, possibly associated with the position of the root apices and the relatively thin cortex of the mandible in this region, both giving dental infections ready access into the submaxillary space.

Similarly, the pathogenesis of retropharyngeal abscesses is most likely associated with extension of infection from the pharynx to lymph nodes in this anatomical space which are numerous and large in young children and usually atrophy prior to adulthood. Importantly, infection of the adjacent fascial plane, the prevertebral space, however, is often associated with osteomyelitis of the cervical vertebrae with pyogenic bacteria or mycobacteria rather than with suppurative processes of the nasopharynx.

Finally, peritonsillar abscesses are most frequently associated with preceding pharyngotonsillitis. Other factors that encourage the development of suppuration in some patients and limit the infection to the tonsil itself in others are unknown.

The microbiology of infections of the fascial spaces of the face and neck reflect the endogenous flora of the mouth. The mouth is not a uniform cavity with respect to its microbial contents and can be affected by a variety of factors including age, diet, nutritional status, dentition, the presence of periodontal disease, and the use of antimicrobial therapy. Despite the differences that these factors can bring about in the oral flora, it is important to emphasize that anaerobic bacteria play a large and important part in the bacteriology of the oral cavity. Several authors, for example, have determined that there are approximately 2.7×10^{11} microorganisms per gram of debris found in the gingival crevice and that approximately 90 per cent are anaerobic bacteria (*Bacteroides*, *Peptostreptococcus*, *Veillonella*,

Fusobacterium). Of importance in relating normal mouth flora to the pathogenesis of deep neck infections is the observation that these mouth organisms are found transiently in the blood after tooth extractions and in the infections described in this article.

Clinical Presentation

Although different anatomic spaces are involved in these infections, the presenting symptoms are frequently similar. Of great importance is the possibility of rapidly developing respiratory compromise.

Ludwig's Angina

This infection of the submandibular space most often begins as a cellulitis which causes edema, induration, tenderness, and elevation of the floor of the mouth. The infection may progress to edema of the tongue but principally is characterized by a brawny, tense swelling that is maximum in the region of the submaxillary gland (bull-neck). The process may be unilateral or involve both sides of the neck. Development of fluctuance is rare and the lymph nodes and salivary glands usually are not involved. The infection may progress to the point that speech is difficult or impossible. Drooling because of pain on swallowing is common. Respiratory distress is a late but most serious sequela and is characterized by stridor and in some cases by cyanosis.

Diagnosis of this infection may be difficult because of its rarity and because of its confusion with other infections such as localized abscesses of the salivary glands or cervical adenitis. The importance of accurate and rapid diagnosis of this infection cannot be overemphasized because of the potential for serious complications. The absence of preceding mouth trauma does not eliminate the possibility of the development of Ludwig's angina.

Peritonsillar and Parapharyngeal Abscesses

Focal infections of this region usually begin with unremarkable pharyngitis that progresses despite antibiotic treatment. The most striking feature of peritonsillar abscess is a unilateral medial displacement of the affected tonsil; this feature is often less obvious in the case of parapharyngeal abscesses. In both infections, however, examination of the pharynx may be difficult because of trismus, but adequate physical examination reveals a toxic appearing patient who may be drooling because of the extreme pain associated with these abscesses. The patient's voice may have a quality that, because of the mass effect, is different from the hoarseness associated with vocal cord lesions.

It can be difficult to differentiate between a peritonsillar and parapharyngeal abscess. In both cases, the patient will have medial displacement of the tonsil; however, with a parapharyngeal mass, the critical observer will note that the whole lateral pharyngeal wall is involved, not just the tonsil. Trismus, dysphagia, and drooling are common to both conditions. The key distinction is involvement of the neck in parapharyngeal abscess. This is reflected in diffuse brawny induration often with spasm of the muscles causing stiff neck. Fluctuance is

unusual because of the overlying heavy muscles (sternocleidomastoid). This is to be distinguished from multiple tender but discrete nodes often palpable in peritonsillar abscess.

Peritonsillar

Tonsil pushed medially
Discrete cervical nodes
No stiff neck

Parapharyngeal

Pharyngeal wall pushed medially
Diffuse brawny edema
Torticollis.

Retropharyngeal and Prevertebral Abscesses

Although the pathogenesis of these infective processes may be different, their clinical presentation is similar, with posterior pharyngeal pain and dysphagia that may lead to drooling. Irritation of the paravertebral ligaments may produce meningismus as well. On physical examination, a definite pharyngeal mass may be appreciated. Lateral roentgenograms of the neck will show an increase in the space between the anterior wall of the cervical spine and the pharyngeal wall. This interval has been measured for children of different ages and actual calculation may be helpful in doubtful cases.

Treatment

All patients with deep neck infections must be hospitalized for observation and treatment. Basic considerations such as rehydration by intravenous fluids and fever control can be met. Blood and the suspected sites of infections should be cultured and high dose intravenous antibiotics should be started. Drugs suitable for the suspected organisms should be empirically begun because of the seriousness of these infections, which dictates against withholding drugs until cultures are available. The adequacy of airway must be ascertained and followed closely. The next consideration in management is the stage of the infection. The infection may simply be cellulitis initially, and, as such, may respond entirely to management with fluids and antibiotics.

Although most of the microorganisms that cause these infections are sensitive to penicillin (streptococci and anaerobes), deep neck infections associated with staphylococci and gram-negative bacilli have also been reported, causing some authors to suggest broader coverage than penicillin alone until culture identification and sensitivity testing have been completed. Thus, alternatives such as the combination of ampicillin and a semisynthetic penicillin or one of the newer cephalosporins may be a rational initial choice. In all cases, the drug should be administered intravenously and in large doses until the focal signs of infection have largely disappeared. Reportedly, 10 to 15 per cent of patients will recover on antibiotics alone.

If the infection progresses to abscess, it must be recognized so that drainage may be instituted. The failure to improve objectively over a 24 hour period is an important indication for drainage. Retropharyngeal and parapharyngeal abscesses do not ordinarily develop fluctuance, because of their anatomic position. Fluctuance should not be expected even with a severe abscess.

In every case in which drainage is necessary, the basic tenets of surgical management must be respected, namely, adequate visualization and protection of vital structures, airway protection, and control of hemorrhage. Most healthy, young adults can tolerate incision and drainage of a peritonsillar abscess under local anesthesia while sitting up. Retropharyngeal abscess may often be effectively drained intraorally; however, airway management by either intubation or less often, a tracheostomy, is necessary. The complex anatomy of the parapharyngeal space requires general, endotracheal anesthesia and an external approach. Ludwig's angina and submental abscesses may be drained either intraorally or externally depending upon the relationship to the myelohyoid muscle.

Complications

Should cellulitis progress to abscess there may be increasing pain, corresponding to increasing abscess pressure. This in turn may cause the abscess to "point" either into the pharynx or to track along one of the previously mentioned anatomic planes into other anatomic areas such as the mediastinum. It is to avoid these problems and to obtain controlled drainage and resolution of infection that surgery is necessary. The presence of suppuration in and about the carotid sheath may also result in septic thrombophlebitis or the internal jugular vein or erosion of the carotid artery system. Paralysis of any of the adjacent major nerve trunks occurs on occasion as well. Although these complications are unusual, it behooves the physician managing a patient with a deep neck infection to be familiar with and observe for them.

These complications, should they ensue, require special techniques such as mediastinal drainage, ligation and excision of the thrombosed jugular vein, or ligation of the eroded carotid artery, all of which are beyond the scope of this presentation.

Conclusion

Cellulitis and abscess of the deep structures of the neck, although rare, are important clinical entities. Effective treatment requires early diagnosis and the institution of appropriate therapy. Under these circumstances, many cases of cellulitis may be aborted prior to abscess formation. The failure to improve or the progression of symptoms on therapy is an indication for surgical intervention in order to prevent the potentially dire effects of a complicated deep neck infection.