

## Ludwig's Angina

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A previously healthy 33-year-old man, with a history of type 1 diabetes mellitus, underwent left lower molar extraction. Two days later, he presented to the emergency department with swelling in the left submandibular area and was subsequently treated with meperidine, codeine, and penicillin G. Two days later, after an unsuccessful resolution, he returned with bilateral submandibular swelling and difficulty swallowing and breathing. Vital signs were as follows: heart rate 140 beats/min, respiratory rate 28 beats/min, blood pressure 220/120 mm Hg, and temperature 39°C. After admission, he was taken to the operating room for an emergency tracheostomy and a drainage procedure. Antibiotic therapy was continued with penicillin G and clindamycin, and he made an uneventful recovery.

### INTRODUCTION AND HISTORY

Ludwig's angina is observed infrequently in today's general practice. Ludwig's angina is potentially fatal and requires immediate interventions; thus, it is of the utmost importance to readily identify this uncommon disease in an acute setting. Ludwig's angina is a rapidly progressive bilateral cellulitis of the submandibular space associated with elevation and posterior displacement of the tongue usually occurring in adults with concomitant dental infections. It is named after the Stuttgart physician Karl Friedrich Wilhelm von Ludwig, who first described the condition in 1836. His description was based on the observation of 5 patients with "gangrenous induration of the connective tissues of the neck that advanced to involve the tissues that cover the small muscles between the larynx and the floor of the mouth."<sup>1</sup> Ludwig's angina is known by many alternative names,

including cyananche, carbuculus gangraenosus, angina maligna, morbus strangularis, and garotillo.

Although traditionally associated with pain of cardiac origin, the term "angina" is derived from the Latin word for choke (angere) and the Greek word for strangle (ankhone).<sup>1</sup> In the case of Ludwig's angina, it refers to the feeling of strangling and choking secondary to lingual airway obstruction, which is the most serious potential complication of this condition.

Affected individuals are typically 20 to 60 years old, with a male predominance.<sup>2</sup> This condition is uncommon in children but occasionally presents with no obvious cause. Before the development of penicillin by Alexander Fleming and its mass production in the 1950s, mortality associated with Ludwig's angina exceeded 50%.<sup>3</sup> As a result of current antibiotic therapies and surgical techniques, current mortality estimates are in the range of 8%.<sup>4</sup>

### PATHOPHYSIOLOGY

Ontogenic infections account for 70% of cases.<sup>5</sup> The second mandibular molar is the most common site of origin for Ludwig's angina, but the third mandibular molar is also commonly involved.<sup>5</sup>

The submandibular space is subdivided by the mylohyoid muscle into the sublingual space superiorly and submaxillary space inferiorly. Once an infection is present, it may spread freely through tissue planes because of communicating spaces. This open communication between spaces results in the bilateral nature of Ludwig's angina. Infection can also spread to pharyngomaxillary and retropharyngeal spaces.

Although ontogenic infections are the most common route for the introduction of bacteria into the submandibular space, other causes exist. Mandible fractures, piercings of the lingual frenulum and tongue, and injection of the jugular vein all provide routes of access.<sup>6</sup> Neoplasms and salivary calculi may also alter the normal anatomy and result in persistent infections leading to Ludwig's angina.

The cause is often a polymicrobial bacterial infection that includes group A *Streptococcus* species. Other commonly cultured organisms include *Staphylococcus*, *Fuso-*

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**Figure 1** Bilateral submandibular swelling, dysphagia, dyspnea, tachycardia, and pyrexia.

*bacterium*, and *Bacteroides* species. Patients who are immunocompromised are commonly infected with an atypical organism, such as *Pseudomonas*, *Escherichia coli*, *Candida*, or *Clostridium*.<sup>6</sup>

The majority of Ludwig's angina occurs in patients with no comorbid disease, although individuals with diabetes mellitus, human immunodeficiency virus, malnutrition, and alcoholism are at an increased risk of developing it. A correlation between smoking and poor oral hygiene and the development of Ludwig's angina has been shown.<sup>7</sup>

## SIGNS AND SYMPTOMS

The symptoms of Ludwig's angina vary depending on the patient and the degree of infection. Many general symptoms, such as pyrexia, weakness, and fatigue, develop as the result of the immune response associated with bacterial infection. The inflammatory response leads to edema of the neck and tissues of the submandibular, submaxillary, and sublingual spaces. Significant edema may cause trismus and an inability to swallow saliva. Pain, especially with tongue movement, is common with Ludwig's angina.

Symptoms marking progressive disease with significant obstruction of the airway include respiratory distress with dyspnea, tachypnea, or stridor. Confusion or other mental changes may occur because of prolonged hypoxia. Otagia, dysphagia, dysphonia, and dysarthria are also

observed. As with any bacterial infection, sepsis may occur. Without immediate treatment, the submandibular infection may also rapidly spread to the mediastinal or pharyngomaxillary spaces or to the bone, resulting in osteomyelitis.

An examination of the head and neck will demonstrate submandibular swelling characterized as calloused and tense (Figure 1). The neck under the chin and the floor of the mouth will be edematous and erythematous. The tongue will be enlarged because of swelling of the soft tissue underneath (Figure 2).

Physical signs associated with more progressive disease and airway obstruction include audible stridor, dysphonia, severe dehydration, and enlargement of cervical lymph nodes.

## DIAGNOSIS, EXAMINATIONS, AND TESTS

The diagnosis of Ludwig's angina is made on the basis of clinical presentation. Computed tomography or magnetic resonance imaging scans are helpful in defining the extent and location of infection.

In 1939, Grodinsky developed criteria for the diagnosis of Ludwig's angina.<sup>1</sup> There must be cellulitis, not an abscess, of the submandibular space that never involves only one space and usually is bilateral; produces gangrene with serosanguinous, putrid infiltration but very little frank pus; involves connective tissue, fascia, and muscles but not glandular structures; and is spread by continuity and not by lymphatics.

## TREATMENT

Monitoring and protection of the airway are the most important components of a comprehensive treatment for Ludwig's angina.<sup>5</sup> If the airway becomes compromised, intubation or tracheostomy may be required. An urgent maxillofacial or otolaryngology consultation should be obtained to determine whether operative surgical drainage is



**Figure 2** Acute upper respiratory obstruction caused by the displacement of the tongue.

necessary. Initiation of broad-spectrum antibiotics covering gram-positive, gram-negative, and anaerobic organisms should be done in the emergency department. Although the role of steroids remains controversial, the administration of corticosteroids to reduce edema may occur with the administration of the antibiotics.<sup>3</sup> The patient should be transferred to the intensive care unit.

## CONCLUSIONS

The clinician should be cognizant of the presentation of Ludwig's angina because prompt diagnosis and institution of antibiotic therapy and possible surgical management are essential to prevent the severe morbidity that can be associated with the condition.

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