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IP International Journal of Maxillofacial Imaging

Journal homepage: <https://www.ijmi.in/>

## Case Report

# Radiological assessment of a rare potentially lethal acute neck infection in emergency: Ludwig's angina (A case report)

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### ARTICLE INFO

#### Article history:

Received 08-02-2022

Accepted 04-03-2022

Available online 07-04-2022

#### Keywords:

Computed tomography

Dental

Infection

Ludwig's Angina

Magnetic Resonance imaging

### ABSTRACT

Ludwig angina is a potentially lethal acute cellulitis of the floor of the mouth and neck, including submandibular, submental and sublingual spaces and ultimately leading to airway obstruction. Computed tomography (CT) of the neck with upper thorax has been used in emergency once the airway obstruction is secured to evaluate the severity of the infection, to assess any abscess and mediastinal extension. Therefore knowledge of imaging features of Ludwig's angina is essential to ensure an accurate diagnosis and initiation of early treatment. CT also plays an important role in evaluation for need of surgical intervention. However, MRI is superior to CT because of its excellent soft tissue contrast and demonstration of various fascial compartments' involvement.

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## 1. Introduction

Ludwig's Angina is an uncommon rapidly progressive bilateral submandibular acute gangrenous cellulitis which progresses to bilateral cervical spaces. It was first described by Wilhelm Frederick von Ludwig in 1836. It's commonly caused by bacterial dental infection of second and third mandibular molar tooth in 90% of cases. Airway obstruction is the most life-threatening complication and is due to extensive soft tissue swelling and posterior displacement of tongue. During pre-antibiotic era mortality rate for Ludwig's angina has exceeded 50%.<sup>1</sup> However, after introduction of antibiotic therapy along with improved imaging modalities and surgical techniques, mortality currently averages approximately 8%.<sup>1,2</sup> Ludwig's angina begins in subgingival space and spreads to the musculature of floor of mouth. Furthermore, it progresses inferiorly to the mylohyoid line indicating progression to

sublingual space. The infection contiguously spreads to submandibular, pharyngo-maxillary and prevertebral space which is a known as the "danger space". Most common cause of infection is odontogenic. Other causes could be peritonsillar or parapharyngeal abscesses, mandibular fractures, oral lacerations/piercing or submandibular sialadenitis and oral malignancy.<sup>1-3</sup> Most common bacterial organisms involved are staphylococcus, streptococcus, peptostreptococcus, fusobacterium, bacteroides and actinomyces.<sup>4</sup> Immunocompromised and diabetic patients are at a higher risk for developing Ludwig's angina. Immediate diagnosis and appropriate treatment are necessary to reduce mortality and complications of Ludwig's angina.

## 2. Case Report

A 37-year-old female reported to the department of ENT with chief complaints of progressive neck swelling, difficulty in mouth opening, dysphagia, dyspnoea, high

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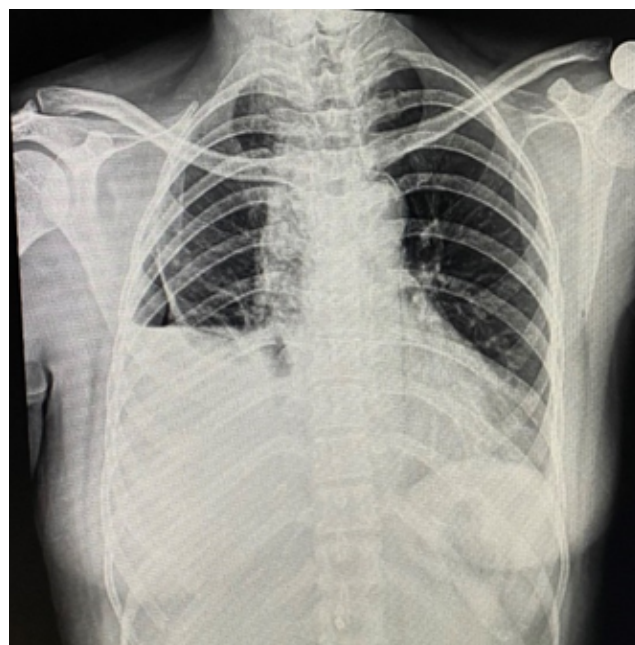
grade fever preceding third lower molar extraction a week back in the emergency. She was a known case of diabetes mellitus from past few years. On physical examination, she was toxic in appearance and her vital signs were monitored immediately. The temperature was 102°F with a pulse rate of 98 beats per minute (BPM), blood pressure (BP) of 100/70 mmHg, and a respiratory rate of 22 breaths per minute. Mouth opening was limited to 1.5 cm (inter-incisor distance). The blood report revealed raised white blood cell count at time of admission which was 15,700thou/ $\mu$ l. The extra-oral swelling was tender, indurated and non-fluctuant involving bilateral submandibular and sublingual regions and extended inferiorly up to suprasternal notch. Suspicion was raised due to clinical history/examination and confirmed by the lateral neck radiograph which revealed air in the soft tissues of the upper neck, pre-laryngeal and retropharyngeal spaces [Figure 1] and the chest radiograph which revealed right sided hydropneumothorax & pneumomediastinum [Figure 2]. An immediate radiological diagnosis of Ludwig's Angina was made and an intercostal drainage tube was placed to relieve hydropneumothorax and drained large amount of purulent fluid (approx. 530cc) within half an hour of insertion and the patient was posted for surgical decompression under local anaesthesia. Aggressive intravenous antibiotic therapy and steroids were begun, but few hours later an emergency tracheostomy was necessitated for impending airway obstruction due to laryngeal edema. Two days later, a contrast enhanced computed tomography (CT) was done which revealed multiple rim-enhancing loculated fluid collections in various cervical planes with cervical necrotizing fasciitis & descending necrotizing mediastinitis with bilateral pleural effusion and pericardial effusions [Figure 3] and consolidation of the right lower lobe, likely related to aspiration pneumonia. A significant clinical improvement was noted after surgical drainage resulting in decompression of fascial compartments of the neck, evacuation of pus and aggressive intravenous antibiotic treatment. The patient was kept in the hospital for close monitoring and discharged after 10 days once the patient was improved and follow up was advised.

### 3. Discussion

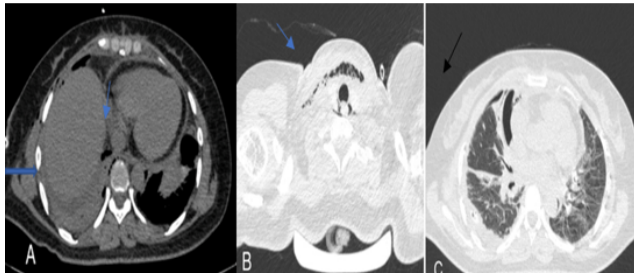
Ludwig angina was first described by a German physician, Ludwig in 1836 as a progressive gangrenous cellulitis which rapidly progresses and a fatal infection of the soft tissues of neck and floor of mouth. Cellulitis from the submandibular space may spread from the styloglossus muscle into the parapharyngeal space, and then continue to the retropharyngeal space and finally to the superior mediastinum.<sup>5</sup> Broad spectrum antibiotics are usually administered during the early stages of disease. Surgical drainage is important if a fluid collection is confirmed on imaging.



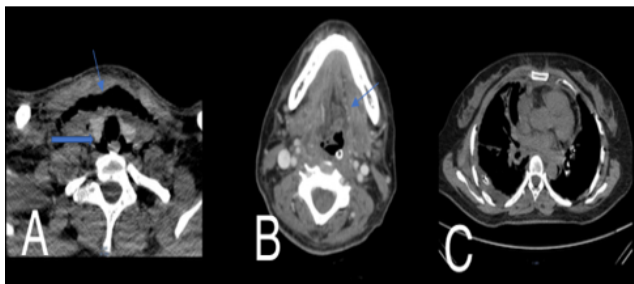
**Fig. 1:** Soft tissue lateral radiograph of neck reveals presence of air within the submandibular and submental and anterior cervical regions, suprahyoid soft tissue, pretracheal and prevertebral spaces.



**Fig. 2:** Frontal chest radiograph on day 1 reveals right side hydropneumothorax and pneumomediastinum



**Fig. 3:** (A) NCCT of chest shows air foci in thoracic prevertebral space (short blue arrow) and right sided pleural effusion with consolidation of the adjacent lung parenchyma (bold long blue arrow). (B) NCCT neck reveals air foci in intermuscular fascial planes of anterior strap muscles (blue arrow), paralaryngeal & surrounding thyroid gland. (C) NCCT of chest in lung window reveals air along the anterior pericardial recess & cardiac border (black arrow)



**Fig. 4:** (A) CECT of neck shows presence of air foci in intermuscular fascial planes of anterior strap muscles, paralaryngeal & surrounding thyroid gland. (B) CECT neck reveals multiple irregular peripherally enhancing fluid collections involving the base of tongue, floor of mouth, bilateral submandibular & sublingual spaces. (C) NCCT of chest reveals air along the mediastinal great vessels, anterior pericardial recess & cardiac borders.

It is a life threatening condition as it can cause airway narrowing because of the massive soft tissue edema and posterior displacement of tongue. Airway management is the primary therapeutic concern.<sup>2</sup> Maintenance of the patient's airway either by endotracheal intubation (if possible) or by tracheostomy or cricothyroidotomy, followed by antibiotic therapy and surgical intervention is required. The bacterial organisms generally isolated include *Streptococci viridans*, *Staphylococcus aureus*, and *Staphylococcus epidermidis*.

Radiologically, the most important aspect is to assess the airway patency. Initially a lateral neck radiograph is essential for immediate assessment for presence of air in neck soft tissues. Computed tomography (CT) is commonly done after intubating the patient as it could delay the initial treatment. Both Magnetic resonance imaging (MRI) and Computed tomography (CT) have equal sensitivity & specificity for diagnosing Ludwig's angina. Once the

airway is secured, a contrast enhanced CT scan can be used to evaluate the severity of the infection and associated complications.<sup>6</sup> Moreover, Magnetic resonance angiography reveals vascular complications such as carotid erosion/rupture, internal jugular venous thrombosis more accurately. Treatment depends upon the severity of disease. If airway is compromised, an immediate tracheostomy is done using local anesthesia but in some advanced cases it's difficult to perform because of the position needed for tracheostomy or because of anatomical distortion of the anterior neck.<sup>7,8</sup> Blind nasotracheal intubation should not be performed as it may be potential for bleeding or abscess rupture.<sup>9,10</sup> Intravenous penicillin G, metronidazole or clindamycin are the antibiotics recommended for use prior to obtaining culture and antibiogram results. Additionally use of intravenous steroids can potentially avoid the need for airway management.<sup>11</sup>

#### 4. Conclusion

Ludwig's angina is a rare emergent and life threatening infection, because it can cause airway compromise, therefore timely diagnosis and management is needed for better patient outcome.

#### 5. Source of Funding

None.

#### 6. Conflict of Interest

None.

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**Cite this article:** Makkar A, Sharma M, Sharma A, Thakur P, Gupta V. Radiological assessment of a rare potentially lethal acute neck infection in emergency: Ludwig's angina (A case report). *IP Int J Maxillofac Imaging* 2022;8(1):28-31.