

# Ludwig's Angina: Analysing Clinical Profile and Microbiology with Antibiotic Sensitivities at a Tertiary Care Hospital

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Article

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## ABSTRACT

**Introduction:** Ludwig's angina is a form of severe diffuse cellulitis secondary to an odontogenic infection that presents as acute onset and spreads rapidly, bilaterally affecting the submandibular, sublingual and submental spaces resulting in a state of emergency. Early diagnosis and immediate treatment planning could be a life-saving.

**Aim:** To assess the age sex distribution, comorbidity factors, association with odontogenic infection, management protocol, organisms isolated and their antibiotic resistance.

**Patients and Methods:** Retrospective record based study, over 2 years period at JSS hospital, Mysuru.

**Results:** This study showed ludwig's angina to have male preponderance with M:F =1.6:1, most commonly occurring above 40 years of age (61.8%). Commonest etiology was Odontogenic infections 26 cases (76.5%). Diabetes Mellitus (DM) was the commonest comorbidity (32.4%). The cornerstone of treatment was incision and drainage with intravenous empirical antibiotics in 94.1% cases, followed by tooth extraction in all patients with dental caries. A total of 25 bacterial strains were isolated from 32 patients. The bacteria were found to be 88% gram-positive and 12% gram-negative. Alpha hemolytic Streptococcus was the most common organism. Gram positive bacteria showed resistance to penicillin, cotrimoxazole and erythromycin being sensitive to ceftriaxone.

**Conclusion:** A male : female ratio of 1.6:1 and odontogenic infection accounting for 76.5% cases mirrors previous statistics. DM patients had increased risks of complications with longer hospital stays. Incision and drainage must be done immediately to reduce airway compromise and mortality. Empirical antibiotics therapy with ceftriaxone and metronidazole would be ideal till we wait for pus culture and sensitivity reports.

**Key Words:** Culture and sensitivity, Ludwig's angina; microbiology, odontogenic infection.

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## INTRODUCTION

Ludwig's angina is a life-threatening diffuse cellulitis of the neck, the floor of the mouth and submandibular regions bilaterally leading to airway obstruction. Other names used to describe the same condition are "Angina Ludovici", "Angina Maligna" and "Morbus Strangularis"<sup>[1]</sup>. In 1836 a German physician, Wilhelm Frederick von Ludwig first described this condition, but ironically died from "nonspecific neck inflammation" in December 1865 which some believe was Ludwig's angina. The disease is well known for its aggressiveness and rapid progression leading to airway compromise and high mortality when there is a delay in intervention<sup>[2]</sup>.

Patients with Ludwig's angina generally have history and features of preceding dental infection, usually from the lower second and third molars. Lower molars are set eccentrically with the roots closer to the inner than the outer side of the jaw. Roots of the second and third molars may

lie inferior to the mylohyoid line. Root abscess of these teeth therefore drain into the submandibular space<sup>[3]</sup> hence complicating cases of submandibular gland sialadenitis and sialolithiasis<sup>[4]</sup>, peritonsillar or parapharyngeal abscess<sup>[5]</sup>. Mandibular trauma, penetrating injuries of floor of mouth and oral neoplasm and cultural practices such as tongue piercing are rare causes of Ludwig's angina<sup>[2]</sup>. It typically presents as a brawny hard, tender induration of the submandibular space bilaterally also involving submental space, with elevation of the tongue. Potential airway obstruction and asphyxiation occurs as the swelling displaces the tongue superiorly and posteriorly<sup>[2]</sup>. Other clinical features include trismus, odynophagia, and dysphagia. Diabetes mellitus (DM) has been well-documented as a comorbid disease these patients<sup>[6]</sup>.

Although the microbiology of Ludwig's angina is polymicrobial, the most commonly cultured organisms

include Staphylococcus, Streptococcus, and Bacteroides species. In cases of dental origin Streptococcus viridians and Escherichia coli are the most usual organisms cultured<sup>[2,3]</sup>.

Maintaining patency of the airway is of utmost concern with Ludwig's angina. A tracheostomy might be required in some to prevent airway obstruction. Infections of the submandibular space may spread to the lateral pharyngeal and retropharyngeal spaces. From the retropharyngeal space, the infection can pass on to the mediastinum<sup>[7]</sup>. Although intravenous (IV) steroids may help reduce the swelling and hence risk of airway compromise, yet aggressive intravenous broad spectrum antibiotic is the mainstay of therapy<sup>[4]</sup>. Immediate surgical decompression of the fascial planes with removal of source of infection is imperative.

Despite modern medicine and improved oral hygiene programs, Ludwig's angina cases presents regularly at our tertiary care hospital most of them as emergency. Various etiologies and comorbid diseases have been documented in patients worldwide, but the South Indian population has not been studied. Till date, only few studies have been conducted in South India, which focuses on the microbiology of the disease. This article is an analysis of 34 cases of Ludwig's angina seen and managed in our facility in Mysuru, Karnataka. To the best of our knowledge, this is the first of such report from this region.

**PATIENTS AND METHODS:**

We conducted a Retrospective Study in JSS Hospital, Mysuru, studying all the Ludwig's Angina cases that presented to the ENT department and were given admission over a period of 2 years. Non probability universal sampling was used to sample the case. A structured proforma was used to collect and store data from each patient that included patient demographics, duration of hospital stay, comorbidities, presence of caries tooth, involvement of molar, whether incision and drainage was done or not, complications and organisms isolated and their antibiotic sensitivities. Data was analyzed using IBM SPSS Statistics for Windows version 20.

**RESULTS:**

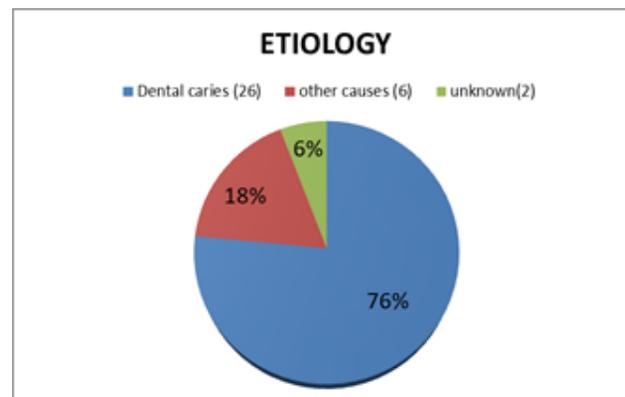
This study showed Ludwig's angina to have male preponderance with 21 males and 13 females (1.6:1), most commonly occurring above 40 years of age (61.8%).

**Table 1:** Age and Sex Distribution

AGE (years)	MALE (21)	FEMALE (13)
0-20	2	2
20-40	6	3
40-60	7	3
>60	6	5

Most common etiology is dental caries/odontogenic infections. In our study population the tooth most affected, was lower 3<sup>rd</sup> molar followed by 2<sup>nd</sup> molar. All patients with dental caries underwent tooth extraction.

**Figure 1:** Etiology Distribution

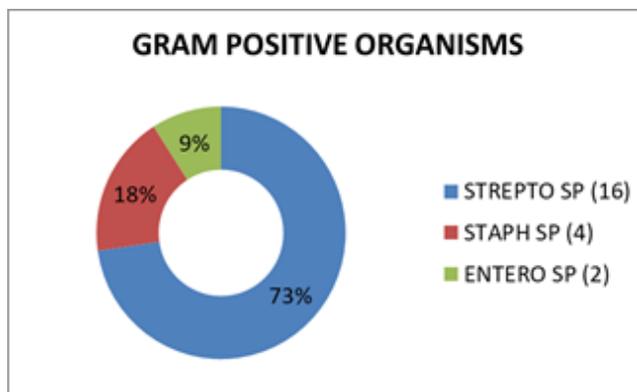


Our study reports diabetes in 11 (32.4%) cases, while hypertension was noted in only 6 (17.6%) cases.

In 32 cases, incision and drainage with empirical intravenous antibiotics was the treatment of choice, while only 2 cases were managed conservatively with only empirical intravenous antibiotics. Corticosteroids were used only in 8 cases to reduce the risk of impending airway complications.

A total of 25 bacterial strains were isolated from 32 patients after 48 hours of aerobic incubation; 22 gram-positive and 3 gram-negative.

**Figure 2:** Gram Positive Organism Distribution



**Table 2:** Sensitivity of Isolated Streptococcus species

Streptococcus species (16)	RESISTANT	SENSITIVE
PENICILLIN-G	31.2% (5)	68.7% (11)
COTRIMOXAZOLE	18.7% (3)	81.2% (13)
ERYTHROMYCIN	18.7% (3)	81.2% (13)
CLINDAMYCIN	12.5% (2)	87.5% (14)
CIPROFLOXACIN	12.5% (2)	87.5% (14)
CEFTRIAZONE		100% (16)
TEICOPLANIN		100% (16)
ERYTHROMYCIN		100% (16)
LINEZOLID		100% (16)
VANCOMYCIN		100% (16)

Gram negative bacteria were resistant to Penicillin, Ceftriazone, and Cefuroxime and sensitive to Meropenem, Imipenem and Colistin.

All Gram positive bacteria were resistant to Penicillin. Some Staphylococcus sp. and Streptococcus sp. were also resistant to Ciprofloxacin and Cotrimoxazole. All were sensitive to Ceftriazone, Vancomycin and Linezolid. 3 Out of 22 isolated bacteria were resistant to Clindamycin.

## DISCUSSION

Ludwig's angina in pre-antibiotic era carried a very high mortality rate of around 50%, but it is still considerably high today at around 8%–10%<sup>[7,8]</sup>. In our study the minimum age and maximum age of the study population were found to be 5 years and 77 years respectively while the mean age of the population was 45 years which is similar to Botha *et al* (40.3 years)<sup>[9]</sup>, Razib *et al* (39 years) and Nikhil M John *et al* (37 years). This study showed Ludwig's angina to have male preponderance with a Male: Female ratio of 1.6:1 as reflected by the study done by Razib *et al* (2.33:1) but contrary to Nikhil M John *et al* (1:1.14). (Table 1) show the age and sex distribution of our study population.

Typically, patients with Ludwig's angina have history of dental infections usually arising from the lower second molar and third molar. As depicted in Figure 1 Dental caries accounts for 76% (26) of the cases in our study. Only 2 peritonsillar abscess and 1 sialadenitis and 3 cases of oral trauma (2 penetrating injury and 1 mandibular trauma) were noted. 2 (6%) cases had an unknown cause. Odontogenic infection is attributed as the main cause for Ludwig's angina which is in accord with other studies by Nikhil M John *et al*, Razib *et al* and Braimah *et al*. Lower 3<sup>rd</sup> molar was most commonly involved followed by 2<sup>nd</sup> molar which is similar to a study by V.N. Ojoje *et al*. All patients with dental caries underwent tooth extraction.

It is a commonly held premise that diabetic patients are susceptible to frequent infections, and infections in diabetic patients are recognized clinical entities that frequently cause significant morbidity. This study revealed 32.4% (11) patients as diabetics and all of whose HbA1c levels were equal or more than 7.8. Since Diabetes mellitus is an important co-morbid condition which should be checked for and proper handling of diabetes is also an important part of comprehensive treatment.

Airway protection has been considered the most important aspect of treatment where necessary. Aggressive intravenous broad spectrum antibiotics is the mainstay of therapy, although intravenous steroids may help reduce the swelling and hence the risk of imminent airway compromise. From our study population 8 patients (23.5%) were identified who had an impending risk of airway compromise and were started on intravenous corticosteroids. In a study done by Barimah *et al* all patients were treated with intravenous hydrocortisone 100 mg twice daily for 5 days irrespective of airway compromise. Surgical decompression of the fascial planes with removal of source of infection is indispensable. 94.1 % (32) cases were treated with surgical drainage and intravenous antibiotics, while only 2 cases were treated conservatively with only intravenous antibiotics.

A horizontal wide skin crease incision was given just above the level of the hyoid to avoid transecting the marginal mandibular nerve extending from one sub-mandibular region to the other. The incision was deepened through the platysma using blunt dissection to reach sub-mandibular space. The mylohyoid muscle which forms superior relation and separates sub-mandibular space from sublingual space was opened to drain pus from the floor of the mouth. Post-operatively all patients were kept in propped-up position on oxygen support through nasal prongs with strict SpO<sub>2</sub> monitoring. It was seen in our set up that an immediate surgical drainage helps to improve mouth opening post op and reduces breathing difficulty, hence decreasing the need for tracheostomy. None of the patients required an advanced airway in the form of tracheostomy or post operative intubation in our study. Post operatively patients required daily dressing for 8 to 10 days till the wound becomes healthy with sufficient granulation tissue formation. The incision wound generally closed by secondary intention with scarring. 4 patients required secondary suturing for wound closure.

The most common currently cultured organisms include Staphylococcus, Streptococcus and Bacteroides species. However, microbiology of Ludwig's angina is usually polymicrobial with many gram-positive and

gram-negative, aerobic/anaerobic organisms. In this study, a total of 32 pus culture and sensitivities were sent. Out of which a total of 25 aerobic organisms were isolated and 9 yielded no growth after 48 hours of aerobic incubation. A total of 25 bacterial strains were isolated from 32 patients. The bacteria were found to be 88% gram-positive (22) and 12% gram-negative (3). Alpha hemolytic Streptococcus (14) was the most common organism isolated followed by Staphylococcus sp (4). Figure 2 gram positive organism distribution. Antibiotic sensitivity reports revealed gram negative bacteria were resistant to Penicillin, Ceftriaxone, and Cefuroxime. They were sensitive to Meropenem, Imipenem and Colistin. Gram positive bacteria were resistant to Penicillin. Some Staphylococcus sp. and Streptococcus sp. was also resistant to Ciprofloxacin and Cotrimoxazole. All gram positive bacteria were sensitive to Ceftriaxone, Vancomycin and Linezolid as shown in Table 2.3 out of 22 gram positive bacteria were resistant to Clindamycin. In our hospital, patients are treated with empirical intravenous antibiotic combination of Ceftriaxone and Metronidazole.

Ludwig's angina can lead to several life threatening complications such as acute airway obstruction, descending mediastinitis, acute respiratory distress syndrome, necrotizing fasciitis, epidural abscess, jugular vein thrombosis, septic embolus, systemic sepsis, and disseminated intravascular coagulopathy. Long-standing or significant sepsis followed by multi-organ failure leads to death in such cases<sup>[10]</sup>.

In a case report Manasia *et al.* described that the clinical course was complicated by septic shock, acute respiratory distress syndrome and acute renal failure eventually resulting in death<sup>[11]</sup>. Out of 11 deaths accounted by Botha *et al.*, descending mediastinitis was recorded in 8 cases. We report only 1 death due to severe sepsis resulting from descending mediastinitis in a poorly controlled diabetic.

## CONCLUSION

The prompt use of appropriate antibiotics, aggressive surgical drainage, adequate supportive care including appropriate fluid resuscitation, analgesia, nutritional support, airway support and management of underlying systemic conditions as indicated, possibly accounted for a more positive outcome in the management of Ludwig's Angina in our centre. Based on our findings we would like to suggest that a) the empirical combination of Injection. Ceftriaxone and Injection. Metronidazole should be started at first contact till the pus culture and sensitivity report comes back, b) a surgical decompression should be done as soon as possible which improves mouth opening and reduces risk of airway compromise. In a developing

country like ours, with poor nutritional status, poor dental hygiene and lack of proper medical support, neck space infection is a major problem.

## CONFLICT OF INTEREST

There are no conflicts of interest.

## REFERENCES

1. Murphy SC. The person behind the eponym: Wilhelm Frederick von Ludwig (1790-1865). *J Oral Pathol Med* 1996;25:513-5.
2. Braimah R., Taiwo, A. and Ibikunle, A. (2016). Ludwig's angina: Analysis of 28 cases seen and managed in Sokoto, Northwest Nigeria. *Saudi Surgical Journal*, 4(2), p.77.
3. Razib S, Banerjee S, Uddin M, Shameeussalam K, Rahman M. Distribution and Determinants of Ludwig's Angina: Experience of 30 Cases in Bangladesh. *Journal of Current and Advance Medical Research*. 2016;3(1):16-21.
4. Honrado CP, Lam SM, Karen M. Bilateral submandibular Gland infection presenting as Ludwig's angina: First report of a case. *Ear Nose Throat J* 2001;80:217-8, 222-3.
5. Wong TY. A nationwide survey of deaths from oral and maxillofacial infections: The Taiwanese experience. *J Oral Maxillofac Surg* 1999;57:1297-9.
6. Huang T, Tseng F, Liu T, Hsu C, Chen Y. Deep neck infection in diabetic patients: Comparison of clinical picture and outcomes with nondiabetic patients. *Otolaryngology-Head and Neck Surgery*. 2005;132(6):943-947.
7. Fakir M, Bhuyan M, Uddin M, Rahman H, Al-Masum S, Khan A. Ludwig's Angina: a study of 50 cases. *Bangladesh Journal of Otorhinolaryngology*. 1970;14(2):51-56.
8. Doldo G, Albanese I, Macheda S, Caminiti G. Ludwig angina: A disease of the past century. Case report. *Minerva Anesthesiol* 2001;67:811-4.
9. Botha A, Jacobs F, Postma C. Retrospective analysis of etiology and comorbid diseases associated with Ludwig's Angina. *Annals of Maxillofacial Surgery*. 2015;5(2):168.
10. Kamala KA, Sankethguddad S, Sujith SG. Ludwig's Angina: Emergency Treatment. *J Health Sci Res* 2017;8(1):46-48.
11. Manasia A, Madisi N, Bassily-Marcus A, Oropello J, Kohli-Seth R. Ludwig's angina complicated by fatal cervicofascial and mediastinal necrotizing fasciitis. *IDCases*. 2016;4:32-33.