

# Ludwig's Angina: A Study on Etiology and Factors affecting the Prognosis and Management

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## ABSTRACT

**Objectives:** To evaluate the various etiological factors contributing to the development of Ludwig's angina, factors affecting the prognosis, and various modalities that will help in the management of this potentially dangerous condition and further complications.

**Materials and methods:** A prospective study was conducted from January 2016 to December 2016 at the Department of ENT, Bangalore Medical College & Research Institute (BMC & RI), Bengaluru, India. Thirty patients with Ludwig's angina were studied. Age, sex, etiological factors, associated systemic diseases, microbiology, antibiotic therapy, duration of hospital stay, and social background of patients were evaluated.

**Results:** Most patients were in the third decade of life; there was a preponderance of females in this study. Dental infection was the most common etiological factor (70%). Neck swelling (100%), pain (83%), fever (75%), and trismus (33%) were the most common complaints. Most common pathogens found were *Streptococcus viridans* (36.6%) followed by *Staphylococcus aureus* (16.6%), *Streptococcus pyogenes* (13.3%), and *Klebsiella* species (10%). Majority of patients (80%) were discharged by 2 weeks following the day of admission.

**Conclusion:** Management of Ludwig's angina can often be challenging. Appropriate and aggressive antibiotic therapy, surgical decompression if required, and removal of infected foci can arrest the progress of disease process and prevent further complications.

**Keywords:** Airway management, Ludwig's angina, Surgical decompression.

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## INTRODUCTION

Ludwig's angina, otherwise known as "Angina Ludovici," is a potentially life-threatening diffuse cellulitis of the

neck, floor of the mouth, and submandibular regions bilaterally, leading to airway obstruction.<sup>1</sup> Synonyms include "Angina Maligna" and "Morbus Strangularis." Angina is derived from the Latin word "angere" which means to strangle. This name refers to the choking effect of Ludwig's angina on its victims. This condition was originally described by the German physician, Wilhelm Frederick Von Ludwig, in 1836.<sup>1</sup> Ironically, he died in December 1865 due to nonspecific neck inflammation, which some believe was due to Ludwig's angina.<sup>2</sup> The disease is notorious for its aggressiveness, rapid way of progression resulting in airway compromise, and high mortality when there is a delay in intervention.<sup>3</sup>

Typically, patients with Ludwig's angina have history of dental infection usually arising from the lower second and third molars. It may also complicate cases of submandibular gland sialadenitis and sialolithiasis,<sup>4</sup> peritonsillar or parapharyngeal abscess.<sup>5</sup> Other causes include mandibular trauma, penetrating injuries of the floor of mouth, oral neoplasm, lymphangiomas, and cultural practices, such as tongue piercing.<sup>6,7</sup> Subsequent swelling can displace the tongue superiorly and posteriorly leading to potential airway obstruction and asphyxiation. The infection begins unilaterally which spreads rapidly to involve both sides.<sup>6</sup> Swelling of the tissues occurs rapidly and may block the airway or prevent swallowing of saliva.

Symptoms include breathing difficulty, confusion, or other mental changes, fever, neck pain, neck swelling, redness of the neck, weakness, fatigue, excessive tiredness, earache, drooling of saliva, and foul smell. Other clinical features include trismus, odynophagia, and dysphagia. The classical signs are brawny hard, tender induration of the submandibular space bilaterally with elevation of the tongue. There are five identifying characteristics for the diagnosis of Ludwig's angina developed by Grodinsky.<sup>8</sup> They are the infection in a cellulitis of the submandibular space, not an abscess; it never involves only one space, it is usually bilateral; the cellulitis causes gangrene with serosanguineous infiltration and very little or no frank pus; the cellulitis attacks the connective tissue, fascia, and muscles, but not the glandular structures and the cellulitis is spread by continuity, not by the lymphatics.<sup>9</sup> Predisposing factors include dental caries, recent dental treatment, systemic illness, such as acquired immune deficiency syndrome, organ transplantation,

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and trauma.<sup>9,10</sup> Mandibular trauma, penetrating injuries of the floor of mouth, oral neoplasm, and lymphangio-mas have been reported as potential causes of Ludwig's angina as well.<sup>8</sup>

The most commonly cultured organisms include *Staphylococcus*, *Streptococcus*, and *Bacteroides* species.<sup>11,12</sup> However, the microbiology of Ludwig's angina is usually polymicrobial with many gram-positive and gram-negative aerobic/anaerobic organisms.<sup>12</sup>

Airway protection has been regarded the most important aspect of treatment where necessary.<sup>3</sup> Aggressive intravenous (IV) broad-spectrum antibiotic is the mainstay of therapy, although IV steroids may help reduce the swelling and hence, risk of airway compromise.<sup>4</sup> Surgical decompression of the fascial planes with removal of source of infection is paramount.<sup>13</sup>

## MATERIALS AND METHODS

Cases of Ludwig's angina that presented to and were managed by the Department of ENT, BMC & RI, Bengaluru, India, from January 2016 to December 2016 comprised the study population. All the patients who were presented with clinical symptoms and signs of Ludwig's angina were included in this study. Those with coexisting other neck space infections were not included in this study. When a patient reported to the hospital, detailed history was taken. This included duration of each symptom, relevant history of present and past illness, dental infection, throat infection, and diabetes mellitus. Following history, local and systemic examination were done. Routine investigations like blood for hemoglobin, total cholesterol, differential count, erythrocyte sedimentation rate, urine routine, random blood sugar/fasting blood sugar, renal function test, human immunodeficiency virus, and hepatitis B surface antigen were done in all cases. Radiological investigations, such as x-ray soft tissue neck anteroposterior and lateral view were done in all cases. When thoracic involvement was suspected, x-ray chest posteroanterior view was done. Where odontogenic infection was thought to be the predisposing factor, dental consultation was taken and orthopantomogram was done to identify the offending tooth/teeth. In some instances, the swelling was aspirated and the pus sent for culture and sensitivity. The patients were treated with IV fluid, parental antibiotics, injectable analgesic, and hydrogen peroxide mouth wash gargling for maintaining oral hygiene. Incision and drainage were done where there was significantly large swelling that resulted in dysphagia and respiratory distress, and when there was no improvement in symptomatology/increase in size of swelling in spite of conservative management. Intraoral drainage was done where infection had spread to sublingual space. External incision and drainage were

performed when the infection involved the perimandibular spaces. Antibiotic treatment changed according to the culture report. Tooth extraction was done in cases where source of infection was found to be of dental origin. Proper wound care and daily dressing were done under aseptic precautions. Most of the patients improved gradually within few days and were discharged with advice regarding dental care and control of diabetes.

## RESULTS

Thirty patients who presented with features suggestive of Ludwig's angina were included in the study. Among the patients, 16 were females and 14 were males. Thus, females (53.3%) were found to be predominantly affected than males (46.6%), with female to male ratio of 1.14:1.

In this study, 23.3% patients were in the third decade of life (Table 1). This was followed by 6th (20%) and 4th decades (16%). Least affected age group was first decade (3.3%).

Seventy percent of the patients had history of dental infections, whereas 63.3% of patients were diabetic. History of tooth extraction was seen in 20% of patients (Table 2).

Most of the patients presented with multiple complaints. Neck swelling (Fig. 1), pain, and fever were the chief complaints, followed by trismus and dysphagia. Respiratory distress was found only in two of the cases, which fortunately was not severe enough (Table 3).

Rural dwellers dominated over the urban dwellers, 23 patients were from rural areas (76.6%), whereas seven were from urban areas (23.3%) with rural to urban ratio of 3.2:1. Majority of patients, 21 (70%) in this series, were undernourished based on body mass index criteria. Only two patients (6.6%) were found to be overweight in this study.

**Table 1:** Age distribution of the patients

Age group	No. of patients
0–10	1
11–20	3
21–30	4
31–40	7
41–50	5
51–60	4
>60	6

**Table 2:** Association with risk factors

Etiology	No. of patients	Percentage
Dental infection	21	70
Diabetes mellitus	19	63.3
Tonsillar infection	1	3.3
Tooth extraction	6	20
Oral mucosal injury	0	0



**Figs 1A to C:** Bilateral woody hard swelling in Ludwig's angina

**Table 3:** Clinical presentation of patients

Presentation	No. of patients	Percentage
Neck swelling	30	100
Pain	20	83
Fever	18	75
Dysphagia	4	16
Respiratory distress	2	9
Trismus	8	33
Sore throat	4	16

In this study, it was found that majority, 70% (21 patients), were from low socioeconomic status as per the Kuppuswami index scale.<sup>14</sup>

Majority of the patients (60%) had poor education status, with primary school-level education only. Three of them were illiterate.

Twenty-one patients (86.6%) were treated by ceftriaxone (1 gm IV twice daily in adults, whereas 500/250 mg IV twice daily in children as per the body weight) and metronidazole (15 mg/kg loading dose over 1 hour, followed by a maintenance dose 7.5 mg/kg infusion over 1 hour TID) before pus culture sensitivity was obtained and was found to be effective. Rest of the patients who were found to be resistant to the above were treated with linezolid (600 mg IV BD for 10–14 days in adults, whereas half dose or less in children as per the body weight).

In this study, most of the patients were treated by parental antibiotics and surgical drainage (Fig. 2). Six patients (20%) were treated successfully with parental antibiotics alone.

Most of the patients improved and were discharged by 2 weeks (24 patients) after the day of admission. Two patients were discharged on the third week, whereas only one patient with uncontrolled diabetes mellitus required one month of hospital stay. Within 1 week, three patients improved and were discharged.

## DISCUSSION

Ludwig's angina reported as a rare clinical condition and mortality in the preantibiotic era was 50%. However, with



**Fig. 2:** The site of incision and drainage

the advent of current therapies, mortality has reduced to <5%.<sup>12</sup>

In this prospective study, 30 patients of Ludwig's angina were included. All cases who presented to the outpatient section of the Department of ENT, BMC & RI, Bengaluru, within the study period of 1 year from January 2016 to December 2017 were included. Patients of all ages and sex were included in this study.

The minimum age, maximum age, and mean age were found to be 8, 67, and 38 years respectively. Majority (23.3%) of patients were in the third decade of life (Table 1). The average age was 38 years, which was nearly consistent with Wang et al<sup>15</sup> who found it to be 41.7 years.

Most of the patients were females with female to male ratio was 1.14:1, which was contrary to the study conducted by Hanif et al.<sup>16</sup> Majority of the patients came from lower social class (70%) which was similar to the study conducted by Fakir et al.<sup>17</sup>

In our study, 76.6% of the patients were from rural areas, whereas 23.3% were from urban areas, with a rural to urban ratio of 3:2, which was similar to other studies.<sup>19</sup> In our patients, (70%) were found to be underweight. Similar studies on Ludwig's angina also showed majority of patients being under weight.<sup>20</sup> This may due to be the

**Table 4:** Treatment plan used

Treatment	Frequency	Percentage
Surgical drainage + IV antibiotics	24	80
IV antibiotics alone	6	20

**Table 5:** Organisms isolated from the pus

Organism	No. of patients	Percentage
<i>S. aureus</i>	5	16.6
<i>S. viridans</i>	11	36.6
<i>Klebsiella</i>	3	10
<i>S. pyogenes</i>	4	13.3
No growth	7	23

fact that most people of our country live in rural areas (as per 2011 census 68.4% of Indian population reside in rural areas) and their socioeconomic conditions and nutritional status were also not good. The patients did not seek proper medical care in the early stage of disease due to poverty and there was also lack of facilities; especially, specialist services are lacking in rural areas.

Clinical presentations of the patients were found to be different. Most patients presented with multiple complaints. Neck swelling, pain, and fever were the commonest presentations (Table 4). Next common presentation was dysphagia. A study conducted by Maras and Hotaling<sup>18</sup> also found symptoms of fever, sore throat, dysphagia, and trismus as common. Here, dental infection was found to be the commonest source of infection (Table 3). A study conducted by Kurien et al<sup>19</sup> also showed that in adults, 60% of Ludwig's angina is caused by dental disease.<sup>20</sup>

An attempt was made in our study to know the organism responsible for Ludwig's angina by culture. *S. viridans*, *S. aureus*, *Klebsiella* species, and *S. pyogenes* were found to be common pathogens in this study (Table 5). A study conducted by Bansal et al<sup>21</sup> also showed similar results. Culture did not yield growth of colony in 23% cases. This might be due to the effect of prior antibiotic therapy they had received before sending culture. Most of the patients were started on antibiotics before sending sample for culture sensitivity.

Intravenous ceftriaxone and metronidazole was the combination antibiotic used in majority of our patients and linezolid in resistant cases. The choice of a third-generation cephalosporin was based on the fact that most of the penicillin-based antibiotics would have been abused with resistant bacteria strains. This combination was modified in accordance with the result of culture and sensitivity.

Here, duration of hospital stay for majority of patients was up to 2 weeks with average hospital stay of 9 days.

## CONCLUSION

Early surgical decompression, aggressive empirical antibiotics, and identification and removal of infective foci like caries teeth might have contributed to low mortality in this series. Airway control is of paramount importance in the management of Ludwig's angina. Majority of patients were found to be females in this study, though this may vary, with most of them being from low socioeconomic class. Dental infection is an important risk factor predisposing to development of Ludwig's angina. Broad-spectrum parenteral antibiotics play an important role in the control of infection. Most of the patients need surgical decompression. The main cause of death is septicemia, mediastinitis, and laryngeal edema. Therefore, proper dental care and adequate control of diabetes mellitus and early intervention will reduce the morbidity and mortality of this disease. Above all, the low educational status, health unawareness all point to the need of a better health education system and awareness, especially among the rural population in our country.

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