

## Original Research Article

# Diabetes mellitus and odontogenic infections: a life threatening combination in Ludwig's angina

Anjana Kumari, Arvinder Singh Maan\*, Satinderpal Singh, Simerpreet Kaur Saran

Department of ENT, Government Medical College, Amritsar, Punjab, India

**Received:** 06 April 2024

**Revised:** 21 April 2024

**Accepted:** 22 April 2024

### \*Correspondence:

Dr. Arvinder Singh Maan,

E-mail: [maanarvinder@yahoo.com](mailto:maanarvinder@yahoo.com)

**Copyright:** © the author(s), publisher and licensee Medip Academy. This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

## ABSTRACT

**Background:** The present study was a prospective study which was aimed to assess the risk factors, microbiological profile, management strategies of Ludwig's angina patients and its association with odontogenic infections and diabetes mellitus.

**Methods:** The study population consisted of 40 patients of Ludwig's angina those presented to and were managed in the department of ENT, Government Medical College, Amritsar, Punjab, India, from January 2022 to May 2023. All the patients exhibiting clinical symptoms and signs of Ludwig's angina were examined and a detailed history of the duration of each symptom, present and past illness, dental infection, throat infection, diabetes mellitus was taken.

**Results:** It was observed that in 85% cases of Ludwig's angina history of dental infection was present. History of diabetes mellitus was present in 50% cases followed by tooth extraction (10%). *Streptococcus viridans* was found in 22.5% patients, *Staphylococcus aureus* (12.5%) and no growth was seen in 52.5% cases. Major co-morbidity was diabetes mellitus (50%), followed by HIV and HCV infections in 15% patients. Surgical drainage was performed in 90% cases including tracheostomy in 12.5% cases rest 10% patients were treated medically.

**Conclusions:** Uncontrolled diabetes mellitus, delayed treatment of odontogenic infection complicates the management of Ludwig's angina and leads to life threatening complications. Ludwig's angina should be actively treated as a surgical and medical emergency in which incision and drainage is required as early as possible. Tracheostomy should be considered as an emergency measure to relieve the respiratory obstruction.

**Keywords:** Ludwig angina, Odontogenic infection, Airway emergency, Immunosuppressed

## INTRODUCTION

Ludwig's angina named after the German physician, Wilhelm Frederick von Ludwig, refers to a rapidly progressive and fatal gangrenous cellulitis of the soft tissues of the neck and floor of the mouth.<sup>1</sup> It is also known as "angina ludovici", "angina maligna" and "morbus strangularis".<sup>2</sup> 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>3</sup> Uncontrolled diabetes and immune-

compromised state of the patient make them more prone to infections and further complications. A most common cause of Ludwig's angina is odontogenic. It typically presents as a brawny hard, tender induration of the submandibular space and the most feared complication of Ludwig's angina is airway obstruction. Other complications include mediastinitis, internal jugular vein thrombophlebitis, empyema, necrotizing fasciitis, osteomyelitis, and aspiration pneumonia.<sup>4</sup> If left untreated, the condition often leads to respiratory obstruction resulting in the mortality rate of 50%.

However, with aggressive surgical intervention, the administration of antibiotics, and improvement of dental care, the mortality rate can be reduced to less than 10%.<sup>5</sup>

## METHODS

The present study was a prospective study of 40 cases of Ludwig's angina that were presented in the ENT department, Government Medical College, Amritsar, Punjab, India from January 2022 to May 2023. All the patients were included in the study after obtaining informed consent. All the observations were recorded and statistically analysed using Chi square tests and outcomes with  $p < 0.005$  were considered significant. History of the duration of each sign and symptom, history of present and past illness, dental infection, throat infection, and diabetes mellitus was obtained. Local and systemic examination was conducted and routine blood investigations including random blood sugar/fasting blood sugar, renal function test, HIV and HCV, and hepatitis B surface antigen test were performed in all cases. Dental consultation was obtained for the treatment of dental cause. Computed tomography and magnetic resonance imaging were done to rule out impending complications. Incision and drainage were performed in most of the cases presenting with significantly large swelling and causing trismus, respiratory distress, and dysphagia. Pus samples obtained were sent for culture and sensitivity test and appropriate antibiotics were given according to culture sensitivity reports. Dental consultation was taken and tooth extraction was done in all the patients for the treatment of dental cause. Normal glycemic status of the patients was achieved with injectable insulin and daily dressing was done. Most of the patients improved gradually and were discharged in satisfactory condition with instructions regarding dental care and control of diabetes.

## RESULTS

In the present study, it was observed that out of 40 patients, 22 (55%) were female and the maximum patients were between 15-45 years of age (60.4%).

**Table 1: Clinical presentation of patients.**

Clinical presentation	No. of patients	Percentage (%)
Neck swelling	30	75.0
Pain	32	80.0
Fever	10	25.0
Dysphagia	26	65.0
Respiratory distress	9	22.5
Trismus	22	55.0

Table 1 shows that the majority of the patients reported complain of pain and neck swelling 80% and 70% respectively. Dysphagia was present in 65% and trismus

in 55% of patients on clinical examination. Respiratory distress was the complaint in 9 (22.5%) patients. Chi square test showed a significant p value of  $< 0.005$ .

**Table 2: Aetiological factors.**

Aetiology	No. of patients	Percentage (%)
Dental infection	34	85.0
Tonsillar infection	1	2.5
Tooth extraction	4	10.0
Oral mucosal injury	1	2.5

**Table 3: Associated co-morbidities.**

Co-morbidities	No. of patients	Percentage (%)
Diabetes	20	50
HIV and HCV	6	15
Anemia	1	2.5
Chronic kidney disease	1	2.5
Chronic heart failure	2	5.0
Post chemotherapy	1	2.5
No co-morbidities	9	22.5

**Table 4: Organisms isolated from the pus.**

Organisms	No. of patients	Percentage (%)
<i>S. viridans</i>	9	22.5
<i>S. aureus</i>	5	12.5
<i>E. coli</i>	3	7.5
<i>Klebsiella</i>	2	5.0
No growth	21	52.5

**Table 5: Complications.**

Complications	No. of patients	Percentage (%)
Necrotizing fasciitis	2	5.0
Peritonsillar abscess	1	2.5
Respiratory distress/stridor	9	22.5
Death	3	7.5
No complication	29	72.5

The odontogenic cause was the main aetiological factor in this study out of which 85% of patients were having dental infection and 10% of patients had a history of tooth extraction.

Diabetes mellitus was present in 50% of patients as co-morbidity and 15% of patients had HIV or HCV

infection. One patient each had anemia, chronic renal disease, and history of chemotherapy.

**Table 6: Average hospital stay of the patients.**

Diabetic status	No. of patients	Average hospital stay
Diabetic	20	10 days approx.
Non-diabetic	20	5-7 days approx.

**Table 7: Management of patients.**

Treatment	No. of patients	Percentage (%)
Medical management	4	10
Surgical management With medical management	36	90



**Figure 1: Patient showing swelling in submandibular region.**

Growth of *S. viridans* was obtained in 22.5% of patients on pus culture followed by *S. aureus* in 12.5% and *E. coli* in 7.5% of patients. No growth was seen on culture examination in 52.5% of patients. Chi square test showed a significant p value of <0.005.

Table 5 shows that 12.5% of patients had stridor with respiratory distress and 10% had difficulty in respiration without stridor. Out of the total 40 patients, 5% patients developed necrotising fasciitis and three patients died during the course of treatment.

When the average hospital stay of the patients who were diabetic was compared with the patients who were non-

diabetic it came out to be 10 days and 5-7 days respectively.

Surgical management with medical management was the mainstay treatment in 90% of patients and medical management was done in only 10% of patients.



**Figure 2: Patient with necrotizing fasciitis.**

**DISCUSSION**

Ludwig’s angina develops mostly due to caries tooth and dental infection which may further complicate if associated with uncontrolled diabetes mellitus and compromised immune status.

In the present study, most of the patients (31.5%) were between 31-45 years of age, followed by 15-30 years (28.9%). Females (55%) were more commonly affected than males (45%).

The main etiological factor in our study was odontogenic infection with caries tooth (85%) and a history of tooth extraction (10%) (Table 2).

In a study done to evaluate the medical treatment of Ludwig’s angina in 47 patients, the odontogenic cause was found in 85.1% of cases.<sup>6</sup>

Thus, poor oral hygiene accounted for the majority of cases.

In a study by Ojoke et al odontogenic focus was present in almost all the 13 patients of Ludwig’s angina.<sup>10</sup>

A study by Neal et al concluded that odontogenic infection is the main cause of Ludwig’s angina.<sup>12</sup>

The most common symptoms reported by patients in our study were neck swelling (75%), neck pain (80%), dysphagia (65%), trismus (55%) and fever (25%). Some

patients reported complain of difficulty in breathing (22.5%) and amongst these five patients had stridor at presentation so tracheostomy was performed (Table 1).

A study conducted by Fakir et al in 50 cases of Ludwig angina showed neck swelling, neck pain and fever in 100% of cases, whereas dysphagia was present in 80% of cases.<sup>7</sup>

In our study most common co-morbidity was diabetes mellitus in 50% cases, followed by HIV and HCV infection in 15% of cases. There was 1 (2.5%) case each of CKD, anemia, post chemotherapy and 2 (5%) cases of chronic heart disease (Table 3).

In a study involving 185 cases of deep neck infections, 34.1% had underlying systemic disease, among them 88.8% had diabetes mellitus, 9.5% had chronic renal failure, 4.8% had liver cirrhosis, 2.4% had myelodysplastic syndrome and 1.2% had gastric malignancy.<sup>8</sup>

In another study conducted by John et al in 30 patients diabetes mellitus was present in 63.3% patients.<sup>13</sup>

Surgical drainage was performed in 36 (90%) cases whereas only 4 (10%) patients received only medical treatment. Emergency tracheostomy was performed in 5 (12.5%) patients who were having respiratory distress with stridor at the time of presentation. All patients were given systemic antibiotics based on culture sensitivity report (Table 7).

In a study conducted in Dhaka, out of 50 cases, 40 (80%) had to be drained surgically, whereas only 10 cases could be treated medically, the reason for surgical drainage again being abscess formation and airway compromise.<sup>7</sup>

Study by Ojoke et al also showed that surgical intervention was done in almost all the 13 patients of Ludwig's angina.<sup>10</sup>

Ambikavathy et al in the study of 40 patients concluded that only 25% of patients were managed conservatively and surgical intervention was done in rest the 75% patients.<sup>11</sup>

The most common organisms found in our study was *S. viridans* which was found in 9 cases (22.5%), followed by *S. Aureus* in 5 cases (12.5%). Some patients had *Escherichia coli* (7.5%) and *Klebsiella* infections (5%). No growth was observed in 52.5% cases. Thus, the majority of cases were associated with aerobic bacterial growth (Table 4).

In a study done by Fakir et al out of 32 samples, *Streptococcus* was the most common organism (13) followed by *Staphylococcus* (6), *E. coli* (4) and *Pseudomonas* (3).<sup>7</sup>

In another study of 30 patients on culture examination *S. viridans* was found in 36.6% patients, *S. aureus* in 16.6%, *S. pyogenes* in 13.3% patients and no growth was seen in 23% patients.<sup>13</sup>

In another study conducted by Sharma et al 12 samples were cultured, anaerobic growth was not seen in any sample, whereas five samples showed no growth.<sup>6</sup>

In the present study, 11 patients experienced complications 2 patients developed necrotizing fasciitis requiring ICU management. 2 patients presented along with peritonsillar abscess, which was later drained. 5 patients presented with stridor and respiratory distress requiring emergency tracheostomy. 3 patients died due to septicemia (Table 5).

In a study by Prasad et al out of 15 patients 1 patient died during the course of treatment.<sup>14</sup>

In another study by Okoje et al out of 13 patients 2 patients died during treatment.<sup>10</sup>

In a study conducted in Nigeria, septicemia, mediastinitis, empyema thoracis, necrotizing fasciitis, laryngeal spasm and renal failure were the complications recorded in five cases (31.3%).<sup>9</sup>

Thus, despite the availability of antibiotics in the present era, odontogenic infections along with co-morbidities like diabetes mellitus, HIV and HCV infections pose a major threat and resulted in development of life threatening complications in patients of Ludwig's angina. The disease can be fatal if neglected. Surgical management should be done at the earliest as medical treatment alone is not sufficient

### **Limitations**

Sample size of the study was small and needs to have bigger sample size with more number of patients.

### **CONCLUSION**

Ludwig's angina can prove fatal if not treated promptly. Uncontrolled diabetes combined with odontogenic infections is the root cause in majority of the cases. Surgical management should be done at the earliest along with medical treatment. Immediate tracheostomy should be done if the airway is compromised. Diabetic and immune-compromised patients are more susceptible to frequent infections which increase the risk of complications, hospital stay and can also lead to mortality.

*Funding: No funding sources*

*Conflict of interest: None declared*

*Ethical approval: Not required*

## REFERENCES

1. Saifelddeen K, Evans R. Ludwig's angina. *Emerg Med J.* 2004;21:242-3.
2. Murphy SC. The person behind the eponym: Wilhelm Frederick von Ludwig (1790-1865). *J Oral Pathol Med.* 1996;25:513-5.
3. Braimah R, Taiwo, A, Ibikunle A. Ludwig's angina: Analysis of 28 cases seen and managed in Sokoto, Northwest Nigeria. *Saudi Surg J.* 2016;4(2):77.
4. Read-Fuller A, Mueller A, Finn R. Maxillofacial infections. *Sel Readings Oral Maxillofac Surg.* 2015;23:1-23.
5. Britt JC, Josephson GD, Gross CW. Ludwig's angina in the pediatric population: Report of a case and review of the literature. *Int. J Pediatric Otorhinolaryngol.* 2000;52:79-87.
6. Sharma V. Ludwig's angina: evaluation of its medical treatment in 47 cases. *J Col Med Sci Nep.* 2011;7(3):1-5.
7. Fakir MA, Bhuyan M. Ludwig's angina: a study of 50 cases. *Ban J Otorhinolaryngol.* 2008;14(2):51-6.
8. Huang TT, Liu TC. Deep neck infection: Analysis of 185 cases. *Head Neck.* 2004;26(10):854-60.
9. Ugboko V, Ndukwe K. Ludwig's angina: an analysis of sixteen cases in a suburban Nigerian tertiary facility. *Afr J oral Health.* 2005;2(1):16-23.
10. Okoje VN, Ambeke OO, Gabolahan OO. Ludwig's angina: an analysis of cases seen at the university college hospital, Ibadan. *Ann Ibd.* 2018;16(1):61-8.
11. Ambikavathy M, Kumar S. Ludwig's angina: report of 40 cases and review of current concepts in emergency management in a rural tertiary facility teaching hospital. *Int J Head Neck Surg.* 2017;8(1):11-4.
12. Neal TW, Schlieve T. Complications of severe odontogenic infections: A review. *Biology.* 2022;11:1784.
13. John NM, Kumar RA, Subbegowda SH. Ludwig's angina: a study of etiology and factors affecting the prognosis and management. *Int J Otorhinolaryngol Clin.* 2018;10(2):47-51.
14. Prasad PV, Das CP, Mohanty D, Rout MR, Prasanna EV. Ludwig's angina: treatment protocol and observation at a tertiary care hospital: a case series. *Ind J Appl Res.* 2017;7:100-1.

**Cite this article as:** Kumari A, Maan AS, Singh S, Saran SK. Diabetes mellitus and odontogenic infections: a life threatening combination in Ludwig's angina. *Int J Res Med Sci* 2024;12:1502-6.