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Original Article

Clinical Characteristics and Aetiological Factors of Ludwig's Angina: A Hospital-Based Study

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Abstract:

Background: *Ludwig's angina is a rapidly progressive cellulitis of the submandibular and sublingual spaces that can lead to airway compromise. Identifying its clinical features and aetiology is crucial for timely management.*

Objective: *The study aimed to evaluate the clinical features of Ludwig's angina and their association with aetiology and patient clinical Characteristics.*

Methods: *A hospital-based cross-sectional study was conducted from January to 30 June 2014 in the Departments of Otolaryngology and Head–Neck Surgery at Dhaka Medical College Hospital, Sir Salimullah Medical College & Mitford Hospital, and Shaheed Suhrawardy Medical College Hospital. A total of 50 patients clinically diagnosed with Ludwig's angina and admitted to the respective departments were included using purposive sampling. Patients with other causes of neck swelling (e.g., lymphangioma, haemangioma, cystic hygroma, lymphoma, submandibular gland neoplasm) were excluded.*

Results: *The mean age was 34.8±17.7 years, with the highest proportion (24%) in the 31–40 years age group. Most patients were male (72%), from lower socioeconomic status (70%), and rural areas (82%). All patients presented with neck swelling and pain; fever (90%) and dysphagia (72%) were common. Dental infection was the primary cause (72%), significantly associated with male gender (p=0.034), lower socioeconomic status (p=0.028), rural habitat (p=0.043), and younger age (mean 30.2±14.5 vs 38.4±18.2 years, p=0.037).*

Conclusion: *Ludwig's angina predominantly affects young and middle-aged males from rural and lowers socioeconomic backgrounds, with dental infections as the main aetiology. Early recognition of clinical signs and underlying risk factors is essential for effective management.*

Keywords: *Ludwig's angina, dental infection, trismus. mediastinitis.*

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Introduction:

Ludwig's angina is a serious, rapidly progressive cellulitis involving the submandibular, sublingual, and submental spaces of the floor of the mouth that can lead to life threatening airway compromise if not promptly diagnosed and managed. Historically associated with high mortality, modern antibiotic therapy and advanced airway techniques have significantly reduced fatal outcomes, yet the condition remains a medical and surgical emergency due to its potential for rapid progression and severe complications.[1,2]

The most common source of Ludwig's angina is odontogenic infection, particularly from lower molar teeth, due to the anatomical proximity of tooth roots to the deep fascial spaces of the jaw.[3,4] This odontogenic origin is frequently preceded by poor dental hygiene, untreated dental caries, or recent dental procedures.[5,6] Predisposing factors also include systemic conditions such as diabetes mellitus, immunosuppression, malnutrition, and chronic illnesses, which increase the severity and complication rate of deep neck infections.[7,8]

Clinically, patients typically present with bilateral firm swelling of the neck and floor of the mouth, fever, pain, dysphagia, dysphonia, and trismus; posterior displacement of the tongue and "woody" induration of the submandibular space are hallmark signs.[9,10] These features reflect the rapid spread of infection through fascial planes beneath the mylohyoid muscle, which can rapidly compromise the airway and lead to serious sequelae such as mediastinitis, aspiration pneumonia, sepsis, or death if not addressed.[11,12]

Microbiologically, Ludwig's angina is typically polymicrobial, involving both aerobic and anaerobic oral flora, including organisms such as *Streptococcus* and *Staphylococcus* species, *Bacteroides*, and *Fusobacterium*, necessitating broad spectrum antimicrobial therapy.[13,14] Treatment requires a multi-disciplinary approach with urgent airway management, broad spectrum intravenous antibiotics, and surgical drainage when indicated.[15]

Despite advances in treatment, Ludwig's angina continues to present a clinical challenge, particularly in resource limited settings where access to dental care, early diagnosis, and comprehensive management may be restricted. The study aims to delineate the clinical profile, socio demographic characteristics, and aetiological determinants of Ludwig's angina, providing evidence to support early recognition and tailored intervention strategies in such settings. Understanding the association between clinical features and underlying pathology can improve risk stratification and management protocols, ultimately reducing morbidity and mortality associated with this life threatening condition.

Material and Methods:

This cross-sectional observational study was conducted from January to June 2014 in the Departments of Otolaryngology and Head–Neck Surgery at Dhaka Medical College Hospital, Sir Salimullah Medical College & Mitford Hospital, and Shaheed Suhrawardy Medical College Hospital, Dhaka. The study aimed to assess the clinical presentation of Ludwig's angina and its association with underlying pathology, along with socio-demographic distribution and aetiological factors.

A purposive sampling technique was applied to enroll 50 consecutive patients presenting with clinical features of Ludwig's angina who met the study criteria. Eligible participants were those clinically diagnosed with Ludwig's angina and admitted in the Hospitals. Patients with alternative causes of neck

swelling (such as lymphangioma, haemangioma, cystic hygroma, lymphoma, or submandibular gland neoplasm), those unwilling to provide consent, and cases with incomplete data were excluded. Data were collected using a pre-designed structured sheet through detailed history, clinical examination, and relevant investigations, including X-ray, random blood sugar, and culture and sensitivity tests.

Data were entered, cleaned, and analyzed using the Statistical Package for Social Sciences (SPSS), version 25 (IBM Corp., New York, USA). Descriptive statistics were expressed as frequency and percentage for categorical variables; as mean and standard deviation (SD) for continuous variables. Associations between categorical variables and aetiological factors were assessed using the chi-square test. Comparisons of mean age between patients with dental and non-dental causes were performed using an independent sample t-test. A p-value <0.05 at a 95% confidence level was considered statistically significant.

Written informed consent was obtained from all participants, and confidentiality and ethical standards were maintained throughout the study. The study was conducted in accordance with the Declaration of Helsinki (2013 revision), ensuring ethical principles for medical research involving human subjects.

Results:

Table 1 shows that the mean age of the patients was 34.8±17.7 years, with the largest proportion of patients (24%) in the 31–40 years age group. Patients aged d"10 and >60 years constituted 8% and 12% of the study population, respectively. The majority of patients were male (72%), showing a clear male predominance, while females represented 28% of the sample. Regarding socioeconomic status, most patients (70%) belonged to the lower class, followed by middle class (20%) and upper class (10%). Most patients (82%) were rural dwellers, with only 18% living in urban areas.

Table-I

Clinical characteristicsof the patients(n=50)

Variables	Categories	Frequency(n)	Percent(%)
Age groups	≤10	4	8
	11-20	8	16
	21-30	8	16
	31-40	12	24
	41-50	7	14
	51-60	5	10
	>60	6	12
	Mean±SD		34.8±17.7
Gender	Male	36	72
	Female	14	28
Socioeconomic status	Lower class	35	70
	Middle class	10	20
	Upper class	5	10
Habitat	Rural	41	82
	Urban	9	18

Table II demonstrates that all patients (100%) had neck swelling and pain/tenderness, with fever (90%) and dysphagia (72%) being common. Less frequent features included voice change (30%), dental complaints (28%), foul-smelling breath (24%), trismus (10%), and respiratory distress (6%). Physical findings showed firm submental/ submaxillary area (50%) and raised floor of mouth (28%).

Table II

Clinical features of the patients (n=50)

Clinical features	Frequency(n)	Percent(%)
Neck swelling	50	100
Pain and tenderness	50	100
Fever	45	90
Dysphagia	36	72
Dental complaints	14	28
Voice change	15	30
Foul smelling breath	12	24
Trismus	5	10
Respiratory distress	3	6
Firm submental and submaxillary area	25	50
Raised and firm floor of mouth	14	28

*Multiple responses

Figure 1 shows that the majority of patients (72%) had dental infection as the cause of Ludwig's angina, while non-dental causes accounted for 28% of cases.

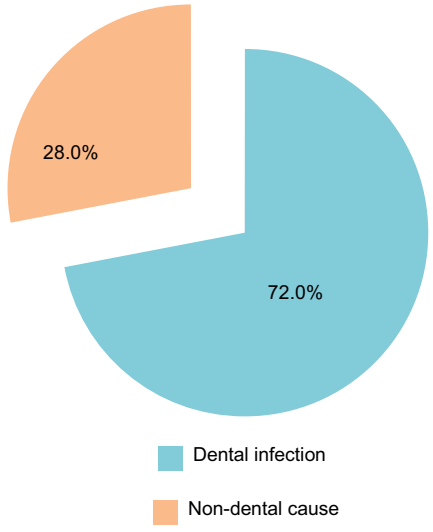

Figure 1: Aetiological determinants of Ludwig's Angina of the patients (n= 50)

Table III interprets the association of aetiological factors with patient-related variables. Among gender, dental infection was markedly more common in male patients (83.3%) compared to females (42.9%), while non-dental causes were higher among females (57.1%). This difference was statistically significant (χ^2= 4.50, p= 0.034). Regarding socioeconomic status, the prevalence of dental infection was highest among patients from the lower socioeconomic class (91.4%), followed by the middle class (30%) and upper class (20%), with non-dental causes inversely distributed. The association was statistically significant (χ^2= 7.12, p= 0.028). In terms of habitat, dental infection was more frequent among rural patients (78%) compared to urban patients (44.4%), whereas non-dental causes were more common in urban residents (55.6%). This difference was also statistically significant (χ^2= 4.10, p= 0.043).

Table III

Association of aetiological factors with patient-related variables (n= 50)

Variables	Categories	Dental infection n (%)	Non-dental cause n (%)	Total n (%)	χ^2 value	p-value
Gender	Male	30 (83.3)	6 (16.7)	36 (100)	4.50	0.034*
	Female	6 (42.9)	8 (57.1)	14 (100)		
Socioeconomic	Lower class	32 (91.4)	3 (8.6)	35 (100)	7.12	0.028*
Status	Middle class	3 (30.0)	7 (70.0)	10 (100)		
	Upper class	1 (20.0)	4 (80.0)	5 (100)		
Habitat	Rural	32 (78.0)	9 (22.0)	41 (100)	4.10	0.043*
	Urban	4 (44.4)	5 (55.6)	9 (100)		

Chi-square was done; A p-value <0.05 was considered significant value

Table IV

Association of aetiological factors with patient's age(n= 50)

Aetiological factors	n	Age (years) Mean±SD	t-value	p-value
Dental infection	36	30.2 ± 14.5	2.15	0.037*
Non-dental Cause	14	38.4 ± 18.2		

Independent sample t-test was done; A p-value <0.05 was considered significant value

Table III interprets the association between aetiological factors and patient age showed a significant difference in the mean age of patients with dental versus non-dental causes of Ludwig's angina. Patients with dental infection had a mean age of 30.2±14.5 years, whereas those with non-dental causes had a higher mean age of 38.4±18.2 years. The difference was statistically significant (t= 2.15, p= 0.037), indicating that dental-origin Ludwig's angina was more common among younger patients.

Discussion:

The present study provides an analysis of the clinical profile, socio-demographic characteristics, and aetiology of Ludwig's angina in 50 patients from tertiary hospitals in Dhaka. The mean age of patients were 34.8±17.7 years, with the highest proportion (24%) in the 31-40 years age group, indicating that Ludwig's angina predominantly affects young and middle-aged adults. Cases at the extremes of age (d"10 and >60 years) were less frequent, consistent with previous reports that the disease mainly occurs in the working-age population[12,16]

A male predominance (72%) was observed, aligning with prior studies[10,16] . This may reflect gender-related behavioral factors such as reduced attention to oral hygiene, delayed dental care, and higher exposure to risk factors. Most patients were from lower socioeconomic backgrounds (70%) and rural areas (82%), emphasizing the role of limited access to dental services, financial constraints, and lower health literacy in the

development of dental-origin Ludwig's angina.[1,12]

Clinically, all patients presented with neck swelling and pain, with fever (90%) and dysphagia (72%) being common. Less frequent signs, including voice changes, trismus, and respiratory distress, highlights variable disease severity. Physical findings such as firm submental/submaxillary swelling (50%) and raised floor of the mouth (28%) correspond to the typical "woody" induration described in Ludwig's angina, confirming rapid involvement of submandibular and sublingual spaces.[9,17]

Dental infection was identified as the primary cause in 72% of cases, consistent with global literature showing odontogenic infection as the leading factor for Ludwig's angina.[18] Non-dental causes accounted for 28% of cases, more commonly observed in older, female, urban, and higher socioeconomic patients, suggesting alternative sources such as oropharyngeal infections, trauma, or comorbidities.[19,20]

Significant associations were observed between aetiology and patient characteristics. Dental-origin Ludwig's angina was more frequent in males (83.3%), younger patients (mean age 30.2±14.5 years), rural residents (78%), and lower socioeconomic groups (91.4%). Non-dental causes were more common in females, older patients (mean age 38.4±18.2 years), urban residents, and higher socioeconomic classes. These patterns focus disparities in access to preventive dental care, delayed treatment, and differing exposure to risk factors.[12,17]

The study has some limitations, including the use of purposive sampling and a relatively small sample size from only three tertiary hospitals, which may limit the generalizability of the findings. Furthermore, the cross-sectional design precludes assessment of causality or long-term outcomes. Despite these limitations, the findings emphasize the importance of preventive strategies such as oral hygiene promotion, early dental interventions, and community health education. Recognizing demographic and clinical patterns can aid early diagnosis, prompt management, and reduce serious complications, including airway obstruction, sepsis, and mediastinitis.

Conclusion:

Ludwig's angina predominantly affects young and middle-aged adults, with a clear male predominance. Dental infection is the leading aetiological factor, particularly among males, rural residents, and individuals from lower socioeconomic backgrounds. Clinical features such as neck swelling, pain, fever, and dysphagia are common and should prompt early recognition to prevent complications. The study highlights the critical role of preventive measures, including oral hygiene promotion, timely dental care, and community health education, to reduce the incidence and severity of Ludwig's angina. Early diagnosis and appropriate management remain essential to minimize morbidity and potentially life-threatening complications.

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