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ORIGINAL ARTICLE

Comparison of Odontogenic Space Infection in Diabetic and Non-Diabetic Patients

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ABSTRACT

Objective: This study aimed to assess and compare the etiology; odontogenic spaces involved, and associated complications between diabetic and non-diabetic patients.

Methodology: A cross-sectional study was conducted at the Nishtar Institute of Dentistry, Multan, between October 2021 and March 2022. The study population included 37 participants selected through consecutive non-probability sampling. Eligible participants were individuals of both sexes, aged 18 to 60, with an odontogenic infection. Exclusion criteria comprised localized dental abscesses without fascial space involvement, infections unrelated to odontogenic origin, and unwillingness to participate. Data on demographic characteristics and clinical findings were collected using a self-structured questionnaire. Statistical analysis was performed using SPSS version 20.0, calculating the mean, standard deviation, frequency, and percentages. Statistical significance was set at $p < 0.05$.

Results: The study enrolled 37 patients diagnosed with odontogenic maxillofacial space infections. Among them, 15 (40.5%) were female, and 22 (59.5%) were male, with a mean age of 31.51 years (SD 9.642). Of the participants, 23 (62.2%) had diabetes, while 14 (37.8%) were non-diabetic.

Conclusion: The results of this research suggest that diabetic patients are more susceptible to odontogenic infections, specifically dental caries. Additionally, diabetic patients demonstrated a higher prevalence of multiple involved spaces and an increased likelihood of developing complications.

Keywords: odontogenic infection, diabetes mellitus, odontogenic space, complications

INTRODUCTION

Odontogenic infections have remained a significant concern for humanity, despite extensive research efforts. [(1)]Dental pathology accounts for approximately 90% of odontogenic infections, and clinical observations suggest a potential association between diabetes mellitus (DM) and facial and deep neck infections induced by odontogenic infections. [(2)]

The extension of odontogenic infections into adjacent facial spaces can give rise to additional complications, underscoring the importance of early detection and treatment. [(2)]Abnormalities in the immune system, including impaired neutrophil function, cellular immunity, and complement activation, have been linked to the increased susceptibility of diabetics to bacterial infections. [(3)(4)(5)(6)] The World Health Organization acknowledges diabetes as a contributing factor to secondary immunodeficiency. [(7)]

Previous studies have reported a more unfavorable prognosis for secondary space infections in diabetic individuals compared to non-diabetics. This is attributed to a higher number of affected spaces, abnormal blood findings, increased complications, and the need for additional procedures such as tracheostomy.[(8)]Moreover, investigations conducted in India have identified the submandibular space as the most commonly affected region, with Klebsiella pneumoniae being prevalent among diabetics and Group D Streptococcus among non-diabetics.[(9)]

Given the existing data on an increased tendency to infection among diabetic patients, it is crucial to compare the etiology, involved odontogenic spaces, and associated complications between diabetic and non-diabetic patients. This study aimed to contribute to the understanding and management of odontogenic infections by assessing these variables in both groups.

METHODOLOGY

This cross-sectional study was conducted at the Department of Oral and Maxillofacial Surgery, Nishtar Institute of Dentistry, Multan, from October 2021 to March 2022. The study aimed to assess and compare the odontogenic spaces, etiology, and associated complications between diabetic and non-diabetic groups. Using the WHO sample size calculator, the sample size was calculated, with a 95% confidence interval, a 24% proportion of diabetes mellitus in the infectious population, and a 10% absolute precision. The calculated sample size was 37. Data collection was carried out using consecutive non-probability sampling. The study included individuals of both sexes, aged 18 to 60, with an odontogenic infection. Exclusion criteria encompassed localized dental abscesses without involvement of the fascial space, infections unrelated to odontogenic origin, and individuals who declined to participate. The study obtained permission from the department head and the hospital's ethics committee. Participants were enrolled in the study from the Oral and Maxillofacial Surgery Department of the Nishtar Institute of Dentistry, Multan, based on the specified inclusion criteria. Consent after explanation was received from each of the participants and their accompanying individuals. Prior to conducting detailed clinical examinations and necessary investigations, such as complete blood count (CBC) and erythrocyte sedimentation rate (ESR), each participant's medical history was carefully reviewed. The diagnosis of participants with involvement of odontogenic spaces was determined through a comprehensive extraoral and intraoral clinical examination, complemented by supporting radiographs, including an orthopantomogram (OPG). Laboratory tests, namely fasting blood sugar (FBS) and glycated hemoglobin (HbA1c), were performed to confirm the presence of diabetes mellitus. To collect demographic data and clinical findings, a self-structured questionnaire was utilized. The investigator conducted a thorough examination of each patient, documenting demographic information (age, gender, contact details, and address), medical history (diabetic or non-diabetic), etiology, and concurrent complications. Data analysis was performed using SPSS version 20.0, calculating the mean and standard deviation for age. Frequencies and percentages were used to compare various variables, with a significance level set at $p < 0.05$.

RESULTS

The mean age within the study was 31.51 years (SD± 9.642). Fifteen were females (40.5%), while twenty-two were males

(59.5%). Twenty-three (62.2%) of 37 patients were diabetic, fourteen (37.8%) were nondiabetic, and most (37.8%) of the patients reported a combined submandibular, sublingual, and submental space infection, as shown in Table 1. In 22.58% of diabetic and 16.25% of non-diabetic patients, four patients manifested Ludwig's angina, as shown in Table 2. In comparison to other causes, dental caries was the most prevalent, as shown in Table 3. Intraoperatively, the diagnosis of the affected spaces was confirmed. The significant correlation between diabetics and fascial space infections is illustrated in Table 4. The difference in WBC count between diabetic and non-diabetic patients is depicted in Table 5.

Table 1: Distribution of infection in different facial spaces

	Frequency	Percent
Submandibular space	10	27.0
Masticator space	4	10.8
Canine space	3	8.1
Submandibular space, Sublingual, Submental space	14	37.8
Submandibular space, Sublingual	6	16.2
Total	37	100.0

Table 2: Frequency and percentage of associated complication

	Associated Complication			Total
	Respiratory Distress	Ludwig angina	No complication	
Diabetic	13	6	4	23
	35.1%	16.2%	10.8%	62.2%
Non-diabetic	3	4	7	14
	8.1%	10.8%	18.9%	37.8%
Total	16	10	11	37
	43.2%	27.0%	29.7%	100.0%

Table 3: Frequency and percentage of different causes

	Cause		Total
	Dental caries	Pericoronal infection	
Diabetic	17	6	23
	45.9%	16.2%	62.2%
Non-diabetic	13	1	14
	35.1%	2.7%	37.8%
Total	30	7	37
	81.1%	18.9%	100.0%

Table 4: Correlation between Odontogenic Spaces and Diabetic/Non-Diabetic Status

	Odontogenic space					Total
	Submandibular space	Masticator space	Canine space	Submandibular space, Sublingual, Submental space	Submandibular space, Sublingual	
Diabetic	7	0	0	10	6	23
	18.9%	0.0%	0.0%	27.0%	16.2%	62.2%
Non-diabetic	3	4	3	4	0	14
	8.1%	10.8%	8.1%	10.8%	0.0%	37.8%
Total	10	4	3	14	6	37
	27.0%	10.8%	8.1%	37.8%	16.2%	100.0%

Table 5: Distribution of WBC counts

	WBC count			Total
	less than $11*10^9$	(11 to 15)$*10^9$	More than 15*10^9	
Diabetic	7	12	4	23
	18.9%	32.4%	10.8%	62.2%
Non-diabetic	4	7	3	14
	10.8%	18.9%	8.1%	37.8%
Total	11	19	7	37
	29.7%	51.4%	18.9%	100.0%

DISCUSSION

Managing odontogenic infections remains challenging for surgeons, despite advancements in antimicrobial therapy. Many untreated patients present to dental offices with multiple secondary spaces, which pose a significant risk of life-threatening airway obstruction. Diabetic patients, particularly those with suboptimal glucose control, are at a higher risk of developing infectious diseases and exhibit inadequate responses to infections. Systemic hyperglycemia disrupts the immune system, including neutrophil function, cellular immunity, and complement function [6] [10].This cross-sectional study's objective was to contrast the anatomical spaces, etiology, and associated complications between diabetic and non-diabetic patients.

The study found that most of the patients were male, with a mean age of 31.5 years. Diabetes was significantly associated with fascial space infections in over 60% of patients. Maxillofacial infections can be caused by infectious, inflammatory, or traumatic factors, with odontogenic causes being the most common [11] [12] [13].Dental caries was the predominant source of infection in both diabetic and non-diabetic patients, accounting for 81.1% of cases. According to earlier studies, patients with diabetes had a higher rate of multiple space involvement when they presented.[14]The most common combination of spaces involved was the Submandibular, Sublingual, and Submental spaces, regardless of glycemic status. In contrast, non-diabetic patients had a slightly higher frequency of infections in the masticator space and canine space. These findings align with previous research suggesting that diabetes may increase the risk of odontogenic infections, particularly those involving the submandibular space. The elevated frequency of infections in diabetic patients affecting the submandibular space and neighboring regions can be attributed to various factors, including compromised immune function, altered host response, and impaired wound healing [15]. Further research is necessary to validate these findings and investigate the underlying mechanisms.

The present study also revealed that among the diabetic patients, 35.1% of the cases suffered from respiratory distress as an associated complication, followed by Ludwig's angina (16.2%) and no complication (10.8%). On the other hand, among the non-diabetic patients, the majority of cases (18.9%) had no associated complication, followed by Ludwig angina (10.8%) and respiratory distress (8.1%). These findings agree with the study conducted by Khan et al. (2016), which reported that diabetic patients with odontogenic infections had a higher incidence of complications such as Ludwig angina and respiratory distress compared to non-diabetic patients [16]. In contrast, research by Alsarheed and colleagues in 2018 discovered no significant disparity in complications between diabetic and non-diabetic patients. [17].

Table 5 shows the distribution of WBC counts among diabetic and non-diabetic patients with odontogenic infections. Of the 23 diabetic patients, 12 (32.4%) had a WBC count between 11 and 15 $*10^9$, while only seven (18.9%) of the 14 non-diabetic patients had this range. Additionally, four (18.9%) of the 23 diabetic patients had a WBC count more significant than 15 $*10^9$, compared to only three (8.1%) non-diabetic patients. These findings suggest diabetic patients with odontogenic space infections are likelier to have higher WBC counts than non-diabetics. Garg et al. (2014) also examined the association between diabetes and elevated WBC counts in patients with odontogenic infections. Consistent with the present study, it has been found that diabetic patients were more prone to have elevated WBC counts than non-diabetics, which is attributed to the fact that diabetes can affect the immune system, leading to changes in WBC counts.[18]

CONCLUSION

In conclusion, odontogenic infections are a significant health concern, particularly for diabetic patients, who are more susceptible to developing infections and experiencing complications. The most prevalent source of infection was dental caries, and involvement of multiple spaces was more prevalent in diabetic patients, especially in the submandibular space. Our research also indicates that diabetic patients with odontogenic space infections are more likely to have higher WBC values. Additional investigation is necessary to examine the fundamental mechanisms involved in these observations and develop effective approaches for the prevention and management of odontogenic infections in diabetic patients.

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