



A COMPARATIVE STUDY OF DEEP NECK SPACE INFECTIONS (DNSI) IN DIABETIC VERSUS NON-DIABETIC PATIENTS: OUR EXPERIENCE IN A TERTIARY CARE CENTRE

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ABSTRACT

Background: The term deep neck space infections (DNSIs) encompasses infections of several different areas of the neck formed by the potential spaces formed by different fascial layers of the neck. The etiology of DNSI include pharyngo-tonsillar infections (most commonly in children), odontogenic infections, sialolithiasis and sialadenitis, congenital anomalies like cysts and sinuses of the neck. Predisposing factors may include Extremes of age, Immunodeficiency, Diabetes mellitus and Intravenous drug abuse. The microbiology of deep neck infections usually reveals mixed aerobic and anaerobic organisms, often with a predominance of oral flora. Both gram-positive and gram-negative organisms may be cultured. DNSI usually mandate early intervention on an urgent basis because of the risk of potentially fatal complications such as airway obstruction, mediastinitis and vascular complications. Airway assessment and intervention plays a pivotal role in the management of DNSI. **Aims and Objectives:** The present study aims to compare the clinical presentation, complications, treatment outcomes and microbiology of DNSIs in diabetic vs non-diabetic patient populations. The objective is to have a proper understanding of the disease so that a much organized treatment protocol can be established. **Materials and Method:** 70 patients were enrolled for this comparative study in Indoor wards of a Tertiary care centre. The study was conducted from January 2019 to December 2019 for 1 year. Patients diagnosed with DNSI (by imaging studies) and admitted in ward of ENT and Head Neck Surgery were selected. **Results:** Parapharyngeal Space was most common involved space in both Diabetics (52.38%) and Non Diabetics (41.46%), followed by Submandibular Space. Most common organism in both groups was Klebsiella pneumoniae. Odontogenic infection and Upper airway infections were 2 leading causes of DNSI in both Diabetics and Non Diabetics in this study. The Diabetic groups affected had much older age with longer hospital stay and had more frequent complications than Non Diabetic group. Diabetics also needed more frequent tracheostomy (28.57%) than Non Diabetics (2.44%). **Conclusion:** Diabetic patients as a subgroup of DNSIs pose many unique problems including older age at presentation, involvement of multiple neck spaces, prolonged hospital stay and operative interventions. As these patients have higher rate of complications and poorer prognosis, early institution of therapy, strict glycemic control and operative interventions are more often required.

KEYWORDS

INTRODUCTION

The term deep neck space infections (DNSIs) encompasses infections of several different areas of the neck formed by the potential spaces formed by different fascial layers of the neck. As these infections usually one or more such areas by contiguity or through lymphovascular channels, these are usually considered together¹.

The etiology of DNSI include pharyngo-tonsillar infections (most commonly in children), odontogenic infections, sialolithiasis and sialadenitis, congenital anomalies like cysts and sinuses of the neck. Predisposing factors may include Extremes of age, Immunodeficiency, Diabetes mellitus and Intravenous drug abuse. A retrospective study by Almutairi et al of 183 patients with deep neck space infection found that 93 (50.8%) had comorbidities with diabetes and hypertension being the most prevalent (45.2% and 23.7% of comorbidities, respectively².

Anatomical spaces involved may include the peri-tonsillar, parapharyngeal, sublingual, submandibular, buccal, parotid, masticatory spaces as well as the deeper spaces like the Danger space, Retropharyngeal and Prevertebral spaces.

The microbiology of deep neck infections usually reveals mixed aerobic and anaerobic organisms, often with a predominance of oral flora. Both gram-positive and gram-negative organisms may be cultured. Group A beta-hemolytic streptococcal species (Streptococcus pyogenes), alpha-hemolytic streptococcal species (Streptococcus viridans, Streptococcus pneumoniae), Staphylococcus aureus, Fusobacterium nucleatum, Bacteroides melaninogenicus, Bacteroides oralis and Spirochaeta, Peptostreptococcus, and Neisseria species often are found together in various combinations. Pseudomonas species, Escherichia coli and Haemophilus influenzae are occasionally encountered³.

DNSIs usually mandate early intervention on an urgent basis because of the risk of potentially fatal complications such as airway obstruction, mediastinitis and vascular complications. Airway assessment and intervention plays a pivotal role in the management of DNSIs.

Aims and Objective

The present study aims to compare the clinical presentation, complications, treatment outcomes and microbiology of DNSIs in diabetic vs non-diabetic patient populations. The objective is to have a proper understanding of the disease so that a much organized treatment protocol can be established.

Materials and methods

70 patients were included and followed up in this comparative study from indoor wards of Department of ENT and Head Neck Surgery in a tertiary care centre. The study was conducted for a period of 1 year from January 2019 to December 2019. All patients admitted with deep neck space infections were in the ward were taken as study sample.

Clinical work-up: A detailed history of the patient is elicited including important signs and symptoms like pain, dysphagia, dyspnea, neck and oral cavity infections and trauma. A recent history of dental procedures is important. Important clinical features to note include rate and duration of progress, any rapid increase of size, etc.

Radiological work-up: CT imaging of the neck can offer help with confirming and localizing the presence of a deep neck infection. However, patients are often either too unstable for CT imaging or unable to lie flat on the CT table to have the CT performed. There may be situations where only a portable lateral soft tissue neck x-ray can be obtained and this can help support the diagnosis of neck abscess without much help in localization. A panorex dental film may be obtained if dental source is suspected.

Biochemical: Serum electrolytes and coagulation profile is obtained.

Microbiological: Blood cultures and abscess cultures are obtained.

Treatment protocol: Treatment involves adequate drainage of the abscess in the operating room. Also, antibiotic therapy is paramount. Because cultures are not available at the time of presentation, empirical antibiotics are started at presentation. It is important to determine the underlying cause of the problem and to address that specifically. For example, with odontogenic infections, early dental

extraction is crucial. Airway management must always be a consideration, as there is often swelling and distortion of anatomy, the surgical airway may be preferable. And certainly, in cases of deep neck infection, early notification of comorbidities like diabetes is also needed for proper treatment initiation.. For patients presenting with a compromised airway, prompt transfer to the operating room for simultaneous evaluation, airway management, and treatment may be life saving.

Chi square test was applied and p value less than 0.05 was taken significant. Needed tables were shown as percentage findings.



Fig 1. Incision and drainage for a neck abscess in an operating room set-up

Observations and Results

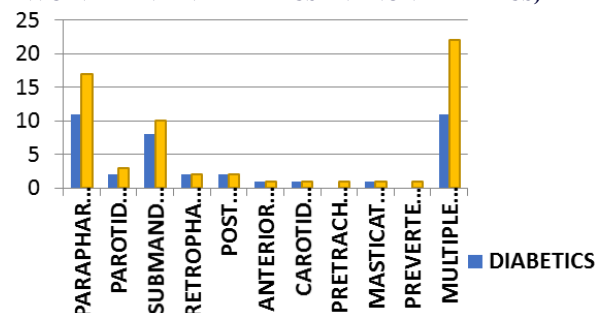
TOTAL DNSI PATIENT SAMPLES n=70	
GROUP A (DIABETICS) n=24	GROUP B (NON-DIABETICS) n=46
lost followup n=3	lost followup n=5
Patients analysed n=21	Patients analysed n=41
TOTAL ANALYSED PATIENTS (n) = 62	

Table 1 (AGE AND SEX DISTRIBUTION OF PATIENTS)

AGE GROUPS IN YEARS	MALES	FEMALES	PERCENTAGE
5-10	2	2	6.45
11-20	3	4	8.06
21-30	5	6	17.74
31-40	5	4	14.51
41-50	8	4	19.35
51-60	7	5	19.35
61-70	5	2	11.29

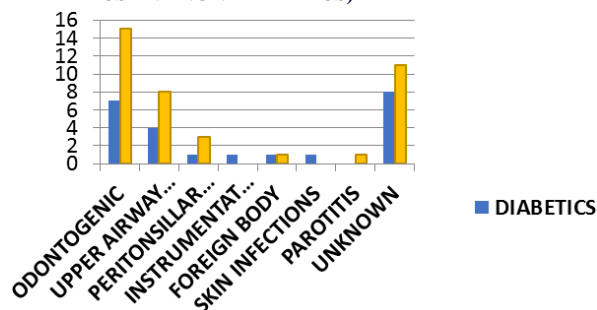
In our study, it was found that most incidence of DNSI were among age groups of 41-50 and 51-60 years, each having 19.35% of patients. 21-30 years age had 17.74% patients. 6.45% patients belonged to 5-10 years, 8.06% patients belonged to 11-20 years, 14.51% patients belonged to 31-40 years and 11.29% of patients belonged to 61-70 years of age group.

TABLE 2 (COMPARISON OF DEEP NECK SPACES INVOLVEMENT IN DIABETICS AND NONDIABETICS)



In this study it is seen that Parapharyngeal space is the most common involved space in both diabetics (52.38%) and non diabetic patients (41.46%). Parotid Space was involved in 2 patients among diabetics and 3 patients among non diabetics. Involvement of multiple spaces was seen among 11 patients among diabetics (52.38%) and in 22 patients among non diabetics (53.69%).

TABLE 3 (ASSOCIATED ETIOLOGIES OF DNSI IN DIABETICS AND NON DIABETICS)



In this study, it is seen that Odontogenic Infection is the most common cause of DNSI in both Diabetics (33.33%) and Non diabetics (36.58%). The 2nd most common cause of DNSI in both Diabetics and Non diabetics is Upper airway Infection. There were 8 patients among diabetics and 11 patients among non diabetics where cause of infection could not be determined.

TABLE 4 (ASSOCIATED COMPLICATIONS OF DNSI IN DIABETICS AND NON DIABETICS)

Complications	Diabetics (n=21)	Non-diabetics (n=41)	Total
Airway Obstruction	6	4	10
Mediastinitis	2	2	4
Skin changes	15	21	36
Sepsis	3	1	4
Pneumoniae	2	0	2

Local Skin changes are the most common complication among both Diabetics (71.42%) and among Non diabetics (51.22%). Airway obstruction was seen among 28.57% diabetics whereas it is seen in 24.39% of non diabetic patients comparatively.

TABLE 5 (RESULTS OF CULTURE OF PURULENT EXUDATE IN 44 PATIENTS WITH ABSCESS FORMATION AND MICROBIAL GROWTH)

Organism	Diabetics (n=21)	Non diabetics (n=41)	Total
Strep viridens	1	2	3
Beta-Hemolytic streptococcus	1	7	8
Strep pneumoniae	0	1	1
Staph aureus	0	2	2
Klebsiella pneumoniae	12	8	20
Pseudomonas	0	1	1
Candida species	2	1	3
Peptostreptococcus	0	1	1
No Growth	3	3	6

In this study, abscess formation seen more common in diabetic patients (19/21) or 90.47% than non diabetics (26/42) or 61.90%. Klebsiella pneumonia infection seems common in both Diabetic and Non diabetic groups. Beta hemolytic streptococci infection is more common in non diabetics rather than diabetic patients.

TABLE 6 (COMPARISON OF TREATMENT OUTCOMES AND MICROBIOLOGY IN DNSI AMONG DIABETICS AND NONDIABETICS)

Treatment Outcome and Microbiology	Diabetics	Non diabetics	P-Value (Significant at <0.05)
Mean duration of Hospital Stay	17.7±11.3	10.2±7.3	0.009
Tracheostomy	6	1	0.007
I & D	17	20	0.005
Klebsiella infection	14	17	-

Mean duration of hospital stay has been found more in diabetic patients with DNSI with significant P value. Tracheostomy in case of airway obstruction patients were needed frequently among diabetics than non diabetics and abscess formation and drainage was also more seen in diabetics rather than non diabetics.

DISCUSSION

Parapharyngeal Space was most common involved space in both Diabetics (52.38%) and Non Diabetics (41.46%), followed by Submandibular Space. Most common organism in both groups was *Klebsiellapneumoniae*.

Huang TT et al⁴ in 2004 conducted a retrospective review of patients who were diagnosed as having deep neck infections in the Department of Otolaryngology at National Taiwan University Hospital from 1997 to 2002. Their demographics etiology, associated systemic diseases, bacteriology, radiology, treatment, duration of hospitalization, complications and outcomes were reviewed. One hundred eighty-five charts were recorded; 109 (58.9%) were men and 76 (41.1%) were women with a mean age of 49.5 ± 20.5 years. Ninety-seven (52.4%) of the patients were older than 50 years old. There were 63 patients (34.1%) who had associated systemic diseases, with 88.9% (56/63) of those having diabetes mellitus (DM). The parapharyngeal space (38.4%) was the most common space involved. Odontogenic infections and upper airway infections were the two most common causes of deep neck infections (53.2% and 30.5% of the known causes). *Streptococcus viridans* and *Klebsiella pneumoniae* were the most common organisms (33.9%, 33.9%) identified through pus cultures. *K. pneumoniae* was also the most common infective organism (56.1%) in patients with DM.

Odontogenic infection and Upper airway infections were 2 leading causes of DNSI in both Diabetics and Non Diabetics in this study.

Ungkanont et al⁵ reviewed 117 patients treated for deep neck infections during a 6-year period. The following distribution results were revealed:

- Peritonsillar infections (49%)
- Retropharyngeal infections (22%)
- Submandibular infections (14%)
- Buccal infections (11%)
- Parapharyngeal space infections (2%)
- Canine space infections (2%)

Vieira F et al⁶ in 2008 found that deep neck infections present significant morbidity and mortality, particularly when associated with predisposing factors that impair a functional immunologic response. The most common primary sources of deep neck infection are odontogenic, tonsillar, salivary gland, foreign body, and malignancy. Microbiology typically reveals mixed bacterial flora including anaerobic species that can rapidly progress to a fulminating necrotizing fasciitis. The treatment cornerstone remains securing the airway, providing efficient drainage and appropriate antibiotics, and improving immunologic status. A prolonged hospital stay should be anticipated in such cases.

There were 90.47% patients with abscess formation in Diabetics compared to 60.98% patients in Non Diabetics in this study. Surgical drainage was performed more frequently in Diabetics (80.95%) than Non Diabetics (48.78%).

The Diabetic groups affected had much older age with longer hospital stay and had more frequent complications than Non Diabetic group. Diabetics also needed more frequent tracheostomy (28.57%) than Non Diabetics (2.44%).

Chen MK et al⁷ in 2000 found that deep neck infections may be lethal if life-threatening complications occur, especially in immuno compromised hosts such as diabetic patients. This study was undertaken to better define the clinical features and prognosis of deep neck infections in the diabetic patients with special emphasis on the use of empirical antibiotics and the role and timing of surgical management. A retrospective analysis of 105 consecutive patients treated at a single institution during a 9-year period was conducted. Of these, 30 patients also presented with diabetes mellitus. Compared with the nondiabetic patients, the unique features of deep neck infections in diabetic patients were as follows: (1) older age, (2) tendency of unclear infection source, (3) tendency to involve multiple

spaces, (4) required more aggressive surgical intervention, (5) prolonged hospitalization, and (6) higher complication rate. The differences were statistically significant ($P < .05$). There were no significant differences in the complete blood count/differential count positive findings and fever between the 2 groups ($P > .05$). Bacterial cultures showed that *Klebsiella pneumoniae* was the most common causative pathogen in diabetic patients. In deep neck infection patients with diabetes mellitus, the clinical course is more severe and there is a poorer prognosis. Thus, in treating them, they should keep close observation, appropriately control the diabetes, detect the life-threatening complications early, perform aggressive surgical treatment if fluctuation or complication occurs and take into account the preponderance of *K pneumoniae* when administering the empirical antibiotics.

CONCLUSION

DNSIs are a common problem faced by all otolaryngologists at tertiary care institutions. These cases demand urgent management in order to prevent potentially serious complications which may cause serious morbidity and mortality. Diabetic patients as a subgroup of DNSIs pose many unique problems including older age at presentation, involvement of multiple neck spaces, prolonged hospital stay and operative interventions. As these patients have higher rate of complications and poorer prognosis, early institution of therapy, strict glycemic control and operative interventions are more often required. Aggressive empirical antibiotic therapy should be instituted in all cases and the presence of *Klebsiella* species should be considered. Airway compromise should be urgently treated.

Thus, early and aggressive treatment of diabetic DNSI patients can be highly useful in averting the risk of serious complications including death of the patients in this subgroup.

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