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Research Article

Prevalence of odontogenic deep neck space infections (DNSI): a retrospective analysis of 76 cases of DNSI

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ABSTRACT

Background: Deep Neck Space Infections (DNSI) are serious diseases that involve several spaces of neck. Commonest sources of DNSI are dental and oropharyngeal infections. With widespread use of antibiotics, the prevalence of DNSI has been reduced but odontogenic DNSI are still common due to poor oral hygiene. Management mainly comprises of airway management, antibiotic therapy and surgical intervention. This study was conducted to find out the prevalence, distribution, presentation, sites involved, bacteriology and management of odontogenic DNSI.
Methods: This retrospective study was done from October 2010 to January 2013 and included 76 patients with DNSI. Then, etiological factors of DNSI were studied and prevalence of odontogenic DNSI was calculated. All parameters including age, sex, co-morbidities, presentation, site, bacteriology and interventions required in odontogenic DNSI cases were studied.
Results: Odontogenic infections were the most common etiological factor in DNSI, with a prevalence of 34.21% among DNSI. Toothace was commonest symptom, followed by neck swelling, pain and odynophagia. Submandibular space involvement (42.30%) was the most common clinical presentation of odontogenic DNSI patients, followed by Ludwig's angina and masticator abscess.
Conclusions: DNSI are common and life threatening infections. For management, early diagnosis is essential. In developing countries majority of DNSI are of odontogenic origin. In our country lack of adequate nutrition, poor orodental hygiene, tobacco and beetle nut chewing and smoking has increased the prevalence of odontogenic DNSI. So, prevention of odontogenic DNSI can be achieved by making population aware of oral and dental hygiene and by conducting regular check-up camps at community level.

Keywords: Deep neck space infection, incision and drainage, Ludwig's angina, Odontogenic infections, Submandibular abscess, Tonsillar and pharyngeal infections

INTRODUCTION

Deep Neck Space Infection (DNSI) means infection in the potential spaces and facial planes of the neck, either with abscess formation or cellulitis.[1] At least 11 deep spaces are part of the complex structure formed by the facial planes, they compose possible infection sites and based on their relationship with the hyoid bone, they may be classified as follows: spaces localized above the hyoid level (peritonsillar, submandibular, parapharyngeal, buccal, parotid, masticatory/temporal); spaces that involve the entire circumference of the neck (retropharyngeal, danger space, prevertebral and carotid) and the anterior or pretracheal visceral space, below the hyoid bone.[2]

DNSI are bacterial infections originating from the upper aerodigestive tract and involving the deep neck spaces.[3] The most common primary sources of DNSI are the dentition, tonsils, salivary glands, foreign bodies and malignancies. DNSI often occur following preceding infections like dental caries, tonsillitis, pharyngitis, trauma to head and neck or in intravenous drug abusers. Infections originating from teeth or their supporting structures known as odontogenic infections have been one of the most common diseases in the oral and maxillofacial region especially in developing countries.[4] Previously before the advent of antibiotics, tonsillar and peritonsillar infections were the source of infection in 70% cases of DNSI,[5] but now dental origin is considered as the most common cause.[6] Two basic causes of odontogenic infections are periapical lesions with pulp necrosis and bacterial invasion into periapical tissues and periodontal lesions associated with periodontal pockets. Pulp necrosis as the result of deep tooth caries promotes bacterial leakage to periapical tissues. When the periapical tissue is invaded by bacteria, an active infection will occur. The infection expands in all directions, but it has minimum expansion in pathways with the most resistance. Infection invades the spongy bone until it reaches the cortical plate. If the cortical plate is thin, the infection passes through it and enters soft tissues.[7] Odontogenic DNSI may cause an upward spread to the brain which may result in brain abscess, cavernous sinus thrombosis and meningitis or a downward spread may cause mediastinitis or pericarditis.[8]

DNSI are usually polymicrobial. Streptococci, Peptostreptococcus species, Staphylococcus aureus, and anaerobes are the commonly cultured organisms from DNSI.[9,10] Clinical manifestations of DNSI depends on the spaces involved, and include pain, fever, malaise, fatigue, swelling, odynophagia, dysphagia, trismus, dysphonia, otalgia and dyspnoea.[11]

A rapidly progressive course with fatal outcome may be seen, especially in immunocompromised patients with diabetes mellitus, chemotherapy, steroid therapy or HIV infection.[2] In past, these infections were fairly common; however, with the advent of broad spectrum antibiotics, the incidence of these infections has decreased. In spite of the extensive use of antibiotics, DNSI still remains serious and significant morbidity. Potentially life threatening complications have been reported to be 10 to 20% even in recent literature on DNSI cases.[12,13] Common and potentially life threatening complications include airway obstruction, jugular vein thrombosis, descending mediastinitis, pericarditis, pleural empyema, cavernous sinus thrombosis, sepsis, respiratory distress, disseminated intravascular coagulation,[2] pleuropulmonary suppuration and hematogenous dissemination to distant organs.[14]

Prevention of odontogenic infections includes all aspects of dental care including tooth caries, pulpal and periodontal diseases, pathologic conditions, trauma and restorative surgeries and implants. Treatment of odontogenic infections is mainly surgical aiming at removal of the source. Root canal therapy, dental extractions and incision and drainage of infected spaces are usually supported by antibiotics and other measures to improve patients' defence.[7] Treatment of DNSI includes antibiotic therapy, airway management and surgical intervention. Management of DNSI is traditionally based on prompt surgical drainage of abscess followed by antibiotics or nonsurgical treatment using appropriate antibiotics in case of cellulitis.[15] Proper diagnosis and prompt management can effectively overcome the disease and provides cure without any complication. Otorhinolaryngologists must know about the presentation, etiology, investigations and use of appropriate medical and surgical management. The main aim of our study was to find out odontogenic DNSI, its presentation, clinical trends, common sites involved, bacteriology, management, complications and outcomes.

METHODS

In this retrospective study, 76 patients were included, who were admitted and treated for DNSI in ENT Department of Government Medical College and Rajindera Hospital, Patiala, Punjab, from October 2010 to January 2013. We excluded all those patients who had infections related to inhalant injuries or due to any malignancy. Then, out of these cases, patients only with dental origin DNSI were reviewed. All the parameters including age, sex, co-morbidities, symptoms, site involved, bacteriology, culture growth, type of intervention required, complications and outcome were studied. All of our patients were started on amoxicillin clavulanate and metronidazole which were later changed, based on culture and sensitivity report.

RESULTS

We evaluated 76 indoor patients of DNSI. In our study, the mean age of patients was 33.2 years with a minimum age of 4 years and a maximum of 72 years.

Table 1: Sex distribution of patients.

Sex	Total No. of DNSI patients (%)	No. of patients with odontogenic DNSI
Male	42 (55.26)	15 (57.69%)
Female	34 (44.73)	11 (42.31)
Total	76	26

Majority of patients were in age group of 31-40 years, followed by 41-50 years. Out of total 76 patients, 42 patients (55.26%) were males and 34 patients (44.73%) were females with a male female ratio of 1.23:1 (Table 1). As per demographic distribution, 52 patients (68.42%) were from rural background and 24 patients (31.58%) were from urban background.

Table 2: Prevalence of various etiological factors in patients with DNSI.

Etiology	Number of patients (%)
Odontogenic	26 (34.21)
Tonsillopharyngitis	21 (27.63)
Infected lymphadenopathy	07 (9.21)
Furunculosis	05 (6.57)
Trauma	04 (5.26)
Thyroglossal cyst	02 (2.63)
Salivary gland infections	02 (2.63)
Foreign body	01 (1.31)
Complicated otitis media	01 (1.31)
Unknown	07 (9.21)
Total	76 (100)

In majority of the cases etiological factor was odontogenic in origin (26 patients, 34.21%), followed by tonsillopharyngitis (27.63%), infected lymphadenopathy (9.21%) and furunculosis (6.57%). Etiological factor was unknown in 7 patients (9.21%). So, prevalence of odontogenic DNSI was found as 34.21%. Out of these 26 patients of odontogenic DNSI, males were (57.69%) and females were (42.31%) with a male: female ratio of 1.37:1 (Table 1). Majority of patients were from rural background and in age group of 31-50 years. Twelve patients (46.15%) were tobacco chewers and 7 patients (26.92%) were smokers. Out of 26 patients, 3 patients (11.53%) were having diabetes mellitus, 2 patients (7.69%) were intravenous drug users and 1 patient (3.84%) had chronic kidney diseases.

Table 3: Symptoms of patients of odontogenic DNSI.

Symptom	Number of patients (%)
Toothace	26 (100.0%)
Neck swelling	23 (88.46)
Neck pain	21 (80.77)
Odynophagia	21 (80.77)
Fever	14 (53.85)
Trismus	08 (30.77)
Airway difficulty	02 (7.70)

Toothace was the most common symptom found in all 26 patients (100.0%), followed by neck swelling in 23 patients (88.46%), neck pain and odynophagia each in 21 patients (80.77%), fever in 14 patients (53.85%), airway difficulty in 2 patients (7.70%) and torticollis in 1 patient (3.85%) (Table 3).

Submandibular abscess was the most common clinical presentation of neck abscess in 11 odontogenic DNSI patients (42.30%) followed by Ludwig's angina in 7 patients (26.92%), masticator abscess, submental abscess and parapharyngeal abscess in 2 patients each. Majority of our patients (23, 88.46%) underwent computed tomography scan, in 2 patients (7.69%) ultrasound neck was done and no imaging was done in remaining 1 patient (3.85%).

Table 4: Location of abscess in odontogenic DNSI (n=26).

Presentation	Number of patients (%)
Submandibular abscess	11 (42.30%)
Ludwig's angina	07 (26.92)
Masticator abscess	02 (7.69)
Submental abscess	02 (7.69)
Parapharyngeal abscess	02 (7.69)
Peritonsillar abscess	01 (3.85)
Buccal abscess	01 (3.85)
Total	26 (100)

Out of 26 patients, 22 patients (84.61%) undergone intervention either incision and drainage or needle aspiration or both and pus specimen of all these patients was sent for culture and sensitivity. Eighteen patients had positive culture results. The most common organism cultured was Streptococcus (06, 23.08%), followed by Staphylococcus (05, 19.23%), polymicrobials (2, 7.69%), Pseudomonas (2, 7.69%), Anaerobes (2, 7.69%) and Klebsiella (01, 3.85%). No growth was found in 4 patients.

In term of management incision and drainage, needle aspiration or both were done in 22 patients (84.61%). Four patients (15.39%) were managed by medical treatment alone. All 26 patients were given broad spectrum intravenous antibiotics which were later changed based on culture and sensitivity report. One patient (3.85%) required emergency tracheotomy for airway management.

In few patients complications were encountered. Two patients had upper airway obstruction, one patient had septic shock and 1 patient had skin necrosis. Mean hospital stay was 4.2 days with a minimum of 3 days and a maximum of 15 days.

DISCUSSION

Wide use of antibiotics has decreased the incidence of DNSI but despite that, it is still a fairly common problem. The management and diagnosis of the DNSI is still a challenge for otorhinolaryngologists. Evaluation of variables related to life threatening diseases is very important. In our study, 76 patients of DNSI were included and prevalence and nature of odontogenic DNSI was analysed. In our study, prevalence of odontogenic DNSI was found 34.21%. So, out 76 cases of DNSI, twenty six (34.21%) were of odontogenic origin. Out of these 26 cases, majority of affected were males with a male: female ratio of 1.37:1. Most of the patients were from rural background and in age group of 31-50 years.

In our study male preponderance was seen which is comparable with Sethi et al,[16] Mumtaz et al,[17] Khode et al,[18] Meher et al[19] and Parischar et al.[6] all showing male preponderance. This may indicate that men pay less attention to their oral hygiene than women and do not go to dentist because of their preoccupations. As per age of presentation, prevalence of odontogenic DNSI was very low in older age groups, due to fewer teeth present in oral cavity. Absence of health care facilities and difficulties in accessing them is a probable cause of high prevalence in rural background.

In our study diabetes was associated with 11.53% patients of odontogenic DNSI, which is very low than study of Huang et al[10] with 30.3% patients of diabetes mellitus. Ninteen of our patients of odontogenic DNSI were tobacco chewers and smokers. This results in poor oral hygiene which is reported to affect the host's vulnerability to systemic diseases by the formation of subgingival biofilms acting as reservoirs of Gram-negative bacteria, and through the periodentium acting as a reservoir of inflammatory mediators.[20]

Length of hospital stay as an indicator of severity of infection was related to following factors: socioeconomic status, blood sugar level, haemoglobin level, oral hygiene and WBC counts. In a study by Tschiassny et al,[21] 70% of DNSI were odontogenic in origin. In a retrospective study of Parhiscar et al,[6] odontogenic infections were declared as the most common cause of DNSI (43%). Bottin et al[22] also showed the same results as in Parhiscar et al[6] study with 42% DNSI due to odontogenic origin. In a study by Zamiri et al,[23] prevalence of odontogenic DNSI was found 34.30%. Huang et al,[10] Marioni et al,[24] and Eftekharian et al,[25] reported that odontogenic problem was the most common causative factor for causing DNSI with 42%, 38.8% and 49% cases, respectively. Study of Sethi et al.[16] and Har-El G et al.[26] also shown the major cause of DNSI as dental origin. So our study results correlates with all these studies. So, in total most common etiological factor of DNSI are odontogenic infections.

Commonest presentation of odontogenic DNSI in our study was submandibular abscess (42.30%), followed by Ludwig's angina (26.92%), masticator abscess, submental abscess and parapharyngeal abscess each in 7.69% patients. So, our study correlates with study of Zamiri et al,[23] Meher et al,[19] and Rega et al,[27] with submandibular space abscess as the most common presentation in 32%, 37% and 30% odontogenic DNSI patients. The root apex proximity of mandibular molars to submandibular space was the reason for the majority of infection involvement. So, this was the probable cause of submandibular space involvement.

Contrast CT scan is the most appropriate imaging tool not only for the diagnosis of deep neck space infections, but it also shows the extension of disease. CT scans are not only beneficial in differentiating between cellulitis and abscesses, but also has an important role in evaluation of serious complications. CT scan also helps to decide whether surgical intervention is indicated as patients with radiological evidence of cellulitis respond well to medical treatment, whereas those with abscess have higher incidence of complications and usually require surgical management due to aggressive nature of this condition. Ultrasound also plays an important role in detection of abscess formation.[15,28] In our study CT scan was done in 88.46% odontogenic DNSI patients and ultrasound was done in 7.69% odontogenic DNSI cases.

Worldwide, management of DNSI is usually early surgical drainage of purulent abscesses via an external incision.[1,22,25] In our study all patients were started with intravenous antibiotic therapy with amoxicillin, clavulanic acid and metronidazole, which was later on changed according to culture and sensitivity report. In case of significant abscess on computed tomography scan, prompt open surgical drainage is the most suitable technique of treating DNSI.[10] In our study, surgical intervention was carried out in 84.61% patients of odontogenic DNSI which correlates with study of Mumtaz et al,[17] Eftekharian et al, [25] Parhiscar et al[6] and Har-El et al[26] with approximately 78%, 79%, 100% and 90% undergone surgical intervention. Rest 4 patients of odontogenic DNSI were managed conservatively.

Streptococcus species were most common cultured organism in odontogenic DNSI patients which correlates with study of Ridder et al,[29] Parischar et al[6] and Mumtaz et al.[17] In 4 odontogenic DNSI patients, no organism was cultured, this was probably due to use of antibiotics at the time cultures were sent.

Airway management is challenging in patients with DNSI. Usual causes of airway compromise are laryngeal oedema and pushing of tongue upwards and backwards. In our study, tracheotomy was done in 3.85% cases of odontogenic DNSI which correlates with study of Eftekharian et al[25] with tracheotomy in 8.8% cases. The tracheal intubation with rigid laryngoscopy may be difficult in these patients for the possibility of distortion in the airway anatomy, tissue rigidity and a limited access to the mouth. Thus, the tracheotomy must always be taken into account whenever there is respiratory difficulty. Sometimes attempting intubations can worse an already damaged airway.[30]

CONCLUSION

DNSI are still a common and challenging disease for clinicians. DNSI should be treated on emergency basis. It is also very important to give attention to the high risk groups like diabetics, old age and patients with underlying systemic diseases as they may progress to life threatening complications. Early diagnosis and treatment is essential. So, all patients should be started with empirical intravenous antibiotic therapy which should be later on changed as per culture and sensitivity report. All

patients with significant abscess on computed tomography scan require surgical intervention. Tracheotomy should be considered if airway protection is needed. In developing countries lack of adequate nutrition, poor oral hygiene, tobacco chewing, smoking and beetle nut chewing has led to increased prevalence of dental and periodontal diseases. So, prevention of DNSI can be achieved by making population aware of dental and oral hygiene and regular check-up for dental infections. Prevention can also be achieved by conducting regular dental check-up camps, organizing lectures and demonstration for primary health care doctor and multipurpose health worker by trained dentist. Consequently, the role of dentist to prevent the spread of infections is very important. In our society, more attention needs to be paid to oro-dental hygiene especially in middle and low socioeconomic groups. So, poor oral and dental hygiene are important causes of DNSI. Special attention should be given towards oral and dental hygiene at community level.

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