



**ORIGINAL RESEARCH PAPER**

**ENT**

**MANAGEMENT OF DEEP NECK SPACE INFECTIONS: AN OBSERVATIONAL STUDY FROM A TERTIARY CARE INSTITUTE OF NORTH INDIA**

**KEY WORDS:** Deep neck space infections, Distribution, Management, Complications

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**ABSTRACT**

**Background:** Due to their potential for spread and severe complications the timely management whether medical or surgical of deep neck space infections (DNSIs) is of paramount importance. **Aim and Objective:** The aim of the study was to check the distribution and management of Deep Neck Space Infections (DNSI). Material and **Methods:** This observational study was carried over a period of 18 months in a single hospital. **Results:** More males (60%) reported with deep neck space infections than females (40%) to our hospital. The most common age group involved was 0-20 years (42%) followed by 21-40 years (41%). Majority of the subjects (91%) needed surgical intervention in our study population. **Conclusion:** The timely intervention of deep neck space infections results in good outcome without major complication.

**INTRODUCTION:**

The term deep neck space infection refers to infection in the potential spaces and fascial planes of the neck, which may be either abscess formation or cellulitis [1]. Infections of the deep spaces of the head and neck have been reported since the time of Hippocrates, Galen, and other authors under the names “morbus strangulatorius” “cynanche” (Greek for suffocation), and “angina maligna” [2].

Deep neck space infections (DNSI) are unique among infectious diseases for their versatility and potential for severe complications. Complex head and neck anatomy often makes early recognition of DNSI challenging, and a high index of suspicion is necessary to avoid any delay in treatment. Aggressive monitoring and management of the airway is the most urgent and critical aspect of care, followed by appropriate antibiotic coverage and surgical drainage, when needed [3]. These infections most frequently arise from the local extension of infections from tonsils, parotid glands, cervical lymph nodes, and odontogenic structures. The specific presenting symptoms will depend on the deep neck space involved (parapharyngeal, retropharyngeal, prevertebral, submental, masticator, etc) [4-8].

Despite the widespread use of antibiotics, infections occurring within the deep neck spaces remain serious and have a significant morbidity. Deep neck infections account for approximately 3,400 hospitalizations annually in the United States. Potentially life-threatening complications are still reported in 10%-20% of deep neck space infection (DNSI) cases [9-12].

DNSIs are unique because they develop inside potential spaces formed and lined by layers of the deep cervical fascia [3]. These compartments act as a barrier to limit the extent of infection [13]. As the infection spreads beyond these boundaries, caudal propagation along fascial planes has the

potential to cause upper airway edema and obstruction, mediastinitis, internal jugular vein septic thrombophlebitis, sepsis and septic embolization [14].

Treatment of DNSI includes antibiotic therapy, airway management and surgical intervention. Management of DNSI is traditionally based on prompt surgical drainage of the abscess followed by antibiotics or nonsurgical treatment using appropriate antibiotics in the case of cellulitis [15]. Proper diagnosis and prompt management can effectively overcome the disease and provide a cure without complications. However, for this, otorhinolaryngologists must have detailed knowledge of the presentation, etiology, investigations and access to appropriate medical and surgical interventions. This study was done to document the distribution and management of DNSI in a selected tertiary care institute.

**AIMS AND OBJECTIVES**

To check the distribution and management of Deep Neck Space Infections (DNSI).

**MATERIAL AND METHODS**

This observational study was conducted in the Post Graduate Department of Otorhinolaryngology and Head and Neck surgery, Government SMHS Hospital Srinagar, which is the associated Hospital of Government Medical College Srinagar & caters patients from whole of the Kashmir division. The study was conducted for a period of 18 months from May 2020 up to October 2021. The initial 15 months were utilized for data collection and the last 3 months for data analysis & write-up.

**Inclusion and Exclusion Criteria**

All the consecutive patients presenting with signs and symptoms of DNSI attending the OPD of the department during the study period were included in this study. The patients with superficial skin abscess and abscess due to

infections of external neck wound/neck trauma were excluded from the study.

**Study Procedure**

Written informed consent was sought from the participant for the study. After taking complete medical history from the participant ENT and HNS examination was done to localize the neck space involved and to find out likely etiology for the infection. General ENT examination included otoscopy, anterior rhinoscopy, oral cavity examination and indirect laryngoscopy. Local examination of the swelling was taken to describe the nature of swelling. All the biochemical, hematological and radiological investigations for the final diagnosis were also done.

Conservative or surgical management was given to the participants as per the requirement. The management included intravenous antibiotics, airway maintenance, correction of electrolyte imbalance and drainage of abscess. Antibiotic regimen was altered as per the pus culture and sensitivity reports and after taking the microbiologist opinion. Control of the concomitant medical problems like diabetes mellitus or any other immuno-compromised state was also taken care of.

**Ethical Clearance:**

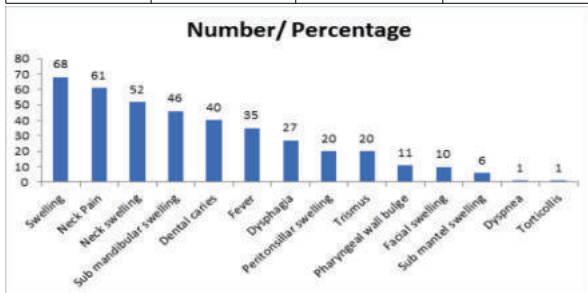
The present study was conducted after obtaining the ethical clearance from the institutional ethical committee.

**OBSERVATION AND RESULTS**

A total of 100 subjects were enrolled in the present study. The gender and age-wise distribution of the study subjects is presented in the **table 1**. Amongst the total enrolled, majority (60%) were males, rest were females. Majority of the subjects (42%) were in the younger age groups 0-20 years followed by 21-40 years (41%).

**Table 1: Gender and Age distribution of the subjects**

		Number	Percentage
Gender	Male	60	60
	Female	40	40
Age Group	0-20 Years	42	42
	21-40 Years	41	41
	41-60 Years	15	15
	>60 Years	2	2

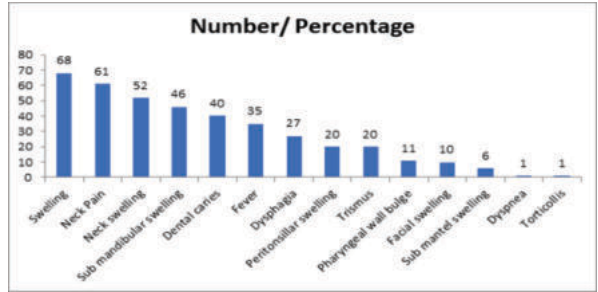


**Fig 1: Signs & Symptom presentation of the subjects (Multiple responses)**

The most common symptom reported was swelling which was seen in 68 cases followed by neck pain in 61 participants. Neck swelling was reported in 52% of subjects, while as dental caries were present in 40% of subjects, trismus and Peritonsillar swelling was found in 20% of subjects each. (Fig. 1)

Erythema was found in 60 subjects while as tenderness was observed in 69 subjects in the current study. We found increased temperature in 50 subjects while as induration in 19 subjects. The data is represented in Table no.7

**Table 2: Characteristics of neck swelling in DNSI patients**



**Table 3: Stratification of the subjects based on management (therapeutic)**

Management	Percentage
Empirical treatment (Amoxiclav plus metronidazole)	100
Antibiotic Changed after pus culture and sensitivity	40

All the 100 subjects were put on empirical treatment and among 40% subjects, antibiotic was changed after pus culture and sensitivity [table 3]. Medical management was done for 9 cases only while as most of the cases needed both surgical and medical intervention. Skin necrosis was observed in 2 subjects, while as mediastinitis was reported in 1 subject [table 4].

**Table 4: Management of DNSI in enrolled subjects**

Management	Number	Percentage
Medical Only	09	09
Surgical + Medical	91	91
Complications of DNSI		
Skin Necrosis	2	2
Mediastinitis	1	1

**DISCUSSION**

In the current prospective observational study, we recruited 100 subjects presenting deep neck space infection (DNSIs) over a period of 18 months. Among all the cases males showed a predominance over females, most of the cases belonged to the age group of ≤ 40 years and only 20% were diabetic. The most common symptom reported were neck pain and swelling. The submandibular space was involved in most of the cases and surgical approach was the frequent treatment modality used. Ultra-sonography seemed better diagnostic approach for the identification of DNSI induced abscess.

While as the widespread use of antibiotics has reduced the prevalence of DNSI, but it remains a fairly common diseases involving several spaces present in the neck [16]. Studies evaluating the prevalence of DNSI have persistently reported that males are more susceptible to the DNSIs [16-20]. Like these earlier reports, in the current study, we also found a male predominance of DNSIs. The enhanced susceptibility of males for developing DNSIs remain poorly understood so far. However, confinement of females to their homes and subsequent late presentation to the tertiary health care facilities cannot be ignored [20]. Moreover, it has been reported that females have a strong innate immunity when compared to males [21], and the effect of the later cannot be ruled out for precluding females from DNSIs, partly. Unlike women, the substance abuse has also been attributed to male predominance in the incidence of DNSIs [22].

Although DNSIs can affect people of all ages, the people in their 3<sup>rd</sup>- 4<sup>th</sup> decade of life have been reported to be more susceptible for DNSIs. In the current study, we also found that the DNSI was prevalent in the subjects with age ≤ 40 years. Several earlier studies have repeatedly found that middle aged men and women (3<sup>rd</sup> and 4<sup>th</sup> decade) are at more risk of developing DNSIs [18, 20], however, Almutairi et al and Kauffmann et. al. reported that the majority of the patients

were in the fifth and sixth decade of their life [17,23]. While as the functioning of the immune function declines with the age, high prevalence of DNSI in younger subjects and the confounding role of age thereof, needs further investigation.

India is considered to be the diabetic capitol of the world [24]. In addition to its classical complications, diabetes mellitus has been associated with reduced response of T cells, neutrophil function, and disorders of humoral immunity, and thereof increases the susceptibility to infections [25-27]. Diabetic patients with DNSI have a more severe clinical course and are likely to have frequent complications and a longer hospital stays and require more vigilance [22]. Interestingly we found a greater number of non-diabetic cases with DNSIs in our cohort, suggesting that the prevalence of the former may not be modulated by diabetes mellitus in our population. However, earlier reports including Almutairi et al reported that diabetes mellitus was prevalent in the cases of their cohort [17,18,23].

Swelling in the neck and associated pain were the most common symptoms reported by the subjects recruited in the current study. Pain in the neck, swelling and the associated fever can be caused by meningitis, apical pneumonia, or subarachnoid haemorrhage. Moreover, asymmetric acute neck pain, can be due to cervical fractures/dislocations leading to trauma, neck muscle hematomas or strains [28]. The occurrence of infection in the deep neck spaces would trigger a series of defensive mechanisms involving inflammatory responses, recruitment of immune cells that release inflammatory mediators at the site of infection, resulting oedema, pain redness etc[29]. Our results are in agreement with many other earlier reports that found swelling and pain as the most common presentation of the patients with DNSIs [17,18,20,30].

Researchers have reported several locations of abscess in the patients with DNSIs I different parts in the neck and adjacent. However, in the current study we found that the submandibular space was the most affected space with the abscess formation. The site of the abscess formation can be attributed to the type, cite and source of infection, while as the host immunity cannot be entirely ruled out. Two earlier studies from India reported Ludwig's angina as the most common presentation [16,18]. However another Indian study, like ours found submandibular space was the most common involved space [20]. Almutairi et al found that peritonsillar abscess, was the most frequent abscess in their cohort, and interestingly we did not find any subject with such an abscess in our cohort [17]. Many earlier studies have reported that parapharyngeal, submandibular and retropharyngeal spaces were the most commonly involved in DNSIs [23,31-34]. Moreover, it has been propounded that with the advancement in the types, availability and usage of antibiotics, more number of infections involve the submandibular and parapharyngeal spaces in the neck, while as, earlier it was as a result of spread from pharyngeal and tonsillar infections [17,35]. In further stratification of the infected space by age, interestingly, we found submandibular space was the most affected in the younger subjects ( $\leq 20$  years), while as older subjects ( $> 60$  years) peritonsillar space and Ludwig's angina was equally affected space. The age dependent shift of the site of infection needs further investigation.

Most of our patients received a surgical intervention. While as the literature, suggests that the rate of requirement of surgical intervention in DNSIs ranges between 60 to 100% [31,36]). however, the surgical approaches depend on the location and extent of the abscess [37]. Moreover, Boscolo Rizzo et al. reported that that nearly two-thirds of their patients with DNSIs were managed medically by the antibiotic administration [38]. Nonetheless, selective patients who respond well to can be managed by the administration of intravenous antibiotics to avoid surgical drainage [23].

Increased prevalence of dental and periodontal diseases has a positive correlation with the incidence of DNSIs. Odontogenic infections invade the spongy bone, reaching or passing through the cortical plate, to the soft tissues. The infection might spread upward to the brain, resulting in brain abscess, cavernous sinus thrombosis, or meningitis. Alternatively, the infections may spread downward and cause mediastinitis or pericarditis, pleural empyema, jugular vein thrombosis, and septic shock. In our study we found dental carries in 40% of the subjects. Therefore, prevention of DNSI can be accomplished by making the population aware of dental and oral hygiene and encouraging regular check-ups for dental infections [18].

The DNSI induces potentially life-threatening complications have been reported to occur at a rate of 10%–20% [38,39]. Common and potentially life-threatening complications include airway obstruction, jugular vein thrombosis, descending mediastinitis, pericarditis, pleural empyema, cavernous sinus thrombosis, sepsis, respiratory distress, disseminated intra-vascular coagulation [40], pleuro pulmonary suppuration, and hematogenous dissemination to distant organs [41]. In the current study we found only subject that reported airway obstruction. moreover, the treatment of DNSI includes antibiotic therapy, airway management and surgical intervention.

Summing up, the advent of advanced testing, radiological investigations, availability of broad-spectrum antibiotics and early surgical intervention has drastically reduced the incidence of DNSIs.

#### CONCLUSION:

Among the DNSI cases recruited in a tertiary care hospital, we report that males showed a predominance over females, most of the cases belonged to the age group of  $\leq 40$  years and only 20% were diabetic. The most common symptom reported were neck pain and swelling. The submandibular space was involved in most of the cases and surgical approach was the frequent treatment modality used. While as in the past DNSIs were not uncommon and were a source of considerable morbidity and mortality. The advent of better laboratory testing, radiological investigations, availability of broad-spectrum antibiotics and early surgical intervention has drastically reduced its incidence.

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