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# Deep Neck Space Infections – Our experience

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***Abstract:***
***Introduction:*** *Deep neck space infections (DNSI) are serious diseases that involve several spaces in the neck. The common primary sources of DNSI are dental infections, tonsillar and salivary gland infections, malignancies, and foreign bodies. With widespread use of antibiotics, the prevalence of DNSI has been reduced. Common complications of DNSI include airway obstruction, jugular vein thrombosis, and sepsis. Treatment principally comprises airway management, antibiotic therapy, and surgical intervention. This study was conducted to investigate the age and sex distribution of patients, symptoms, presentation, sites involved, bacteriology, and management and complications of DNSI.*
***Materials and Methods:*** *This prospective study was performed on 60 patients with DNSI. Patients of all age groups and gender were included. All parameters including age, gender, co-morbidities, presentation, site, bacteriology, complications, and required interventions were studied.*
***Results:*** *Out of 60 patients, 28 were females and 32 were males, Most common age group involves 40-60 years (40%),Most common cause is odontogenic origin (50%),Most common space involved is submandibular 30% followed by Parotid space and parapharyngeal space.Most common cause of death is Septicemia 60%.*
***Conclusion:*** *DNSI can be life-threatening in diabetic patients, the immunocompromised, and elderly patients. Early diagnosis and treatment is essential to prevent complications. All patients must be treated initially with intravenous antibiotics, with treatment subsequently updated based on a culture, sensitivity report. DNSI can be prevented by making the population aware of dental and oral hygiene and offering regular check-ups for dental infections.*
***Key Word****: Deep neck space neck(DNSI),comorbidities,odontogenic, septicaemia.*

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## I. Introduction:

Deep neck space infection (DNSI) refers to an infection in the potential spaces and fascial planes of the neck, either with abscess formation or cellulitis .At least 11 deep spaces are part of the complex structure formed by the facial planes, providing possible infection sites. Based on their relationship with the hyoid bone, the deep spaces 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 The most common primary sources of DNSI are the dentition, tonsils, salivary glands, foreign bodies, and malignancies. DNSI often occur following preceding infections such as dental caries, tonsillitis, pharyngitis, trauma to the head and neck, or among intravenous drug abusers. Infections originating from teeth or their supporting structures, known as odontogenic infections are most common, especially in developing countries. Clinical manifestations of DNSI depend on the spaces involved, and include pain, fever, malaise, fatigue, swelling, odynophagia, dysphagia, trismus, dysphonia, otalgia, and dyspnea .staphylococcus and streptococcus are most commonly cultured. A rapidly progressive course of DNSI with a fatal outcome may be seen, especially in Immunocompromised patients with diabetes mellitus, chemo-therapy, steroid therapy,or HIV infection . In past, these infections were fairly common; however, with the adventof broad spectrum antibiotics, the incidence of these infections has decreased. Despite the extensive use of antibiotics, DNSI still remains serious and is associated with significant morbidity. These infections are potentially life threatening and spread rapidly, leading to severe complications. Potentially life-threatening complications have been reported to occur at a rate of 10-20%, even in recent literature on DNSI cases .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 , pleuropulmonary suppuration, and hematogenous dissemination to distant organs . 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 . Proper diagnosis and prompt management can effectively overcome the disease and provide a cure without complications. However, for this to be possible, otorhinolaryngologists must have detailed knowledge of the presentation, etiology, investigations and access to appropriate medical and surgical interventions. The main aim of our stμdy was to share our experience in terms of presentation, clinical trends, common sites involved, bacteriology, management, complications and outcomes .

## II. Methodology and Materials :

In this retrospective study, 60 patients who were admitted and treated for DNSI in the ear, nose and throat (ENT) department of Gandhi hospital from 2017 and 2018 were included. We excluded patients who had an infection related to inhalant injuries or due to any malignancy. Patients of all age groups and both genders were included. All parameters including age, gender, co-morbidities, symptoms, site involved, bacteriology, culture growth, type of interventionrequired, complications, and outcome were studied. All patients were initiated on broad spectrum antibiotics ; the treatment regimen was later modified based on a culture and sensitivity report.

## III. Results:

**Sex ratio and Age group:** There were 60 patients in the study.32 were males (53.3%) and 28 were females (46.6%)Out of the 60 patients ,24 patients (40.6% )of cases were in the age group of 40-60years, 20 patients (33.3%) were above 60years , 10 patients (16.6%) were between 20-40years and 6 patients ( 10% ) were below 20years.

**Associated co morbidities:** 20 patients were diabetic (33.3%). 10 cases were detected denovo diabetic (16.6%) 10 had hypertension ( 16.6%) , 8 had chronic renal failure(13.3%), 4 were HIV positive(6.6%). No associated co morbid conditions noted in 30% patients

**Table 1: Etiology:**

| S.no | causes | number | percentage |
|---|---|---|---|
| 1 | odontogenic | 30 | 50% |
| 2 | tonsillar | 8 | 13.3% |
| 3 | Infective lymphadenitis | 6 | 10% |
| 4 | trauma | 4 | 6.6% |
| 5 | idiopathic | 12 | 20% |

Odontogenic infections found to be most frequent cause (50%), in 30 patients , followed by second most common cause tonsillar origin (13.3%) in 8 patients , 6 patients the cause was infective lymphadenitis in origin (10%) , and in 4 patients the cause was trauma (6.6%) .The cause was idiopathic in 12 patients (20%).

**Symptomatology:**All 60 patients presented with pain and swelling (100%); 40 patients with pain/difficulty in swallowing ( 66.6%) ; fever in 20 cases ( 33.3%); history of tooth pain or tooth extraction in 16 cases (26.6%); 10 patients presented in stridor (16.6%%) ; trismus in 30 patients (50%).

**Table :2 Space of infection :**

| space | Cases number | Percentage |
|---|---|---|
| Submandibular | 20 | 33.3% |
| Parotid | 12 | 20% |
| Parapharyngeal | 12 | 20% |
| Retropharyngeal | 8 | 13.3% |
| Prevertebral | 4 | 6.6% |
| Extended neck space infections | 4 | 6.6% |

Infection was located in the following spaces : Submandibular space involved in 20 cases (33.3%) ; parotid space in 12 cases (20%) ; parapharyngeal space in 12 cases (20%) ; retropharyngeal in 8 cases (13.3%) ; prevertebral space in 4 cases (6.6%) and extended space infections 4 cases (6.6%).

**Modality of treatment**: Mode of treatment was surgical drainage in 50 cases(83.3%) and only conservative treatment was given in 10 cases (16.6%). 10 patients presented with respiratory distress , where emergency tracheostomy was done. External drainage was done in almost all cases except 6 cases were intra oral drainage was done. All patients who were drained received intravenous antibiotics.

**Table 3: Microbial culture results:**

| Cultured bacteria | number | Percentage |
|---|---|---|
| Staphylococcus aureus | 20 | 50 |
| Streptococcus viridians | 4 | 10 |
| Streptococcus pyogenes | 8 | 20 |
| Bacteriods | 2 | 5 |
| Pseudomonas | 3 | 7.5 |
| mycobacterium | 3 | 7.5 |
| No bacterial growth | 20 | 33.3 |

Pus was sent for culture sensitivity and 40 cases were shown positive cultures. Most commonly isolated bacteria was staphylococcus aureus in 20 cases; followed by streptococcus in 10 cases ;20 cases had no bacterial growth Among the complications, septic shock was most common followed by acute kidney injury and mediastinitis. Septic shock was seen in 6 cases (10%) ; acute kidney injury was seen in 4 cases (6.6%) ; skin necrosis seen in 3 cases (5%) ; and mediastinitis in 2 cases (3.3%).Mortality rate was 25% (15cases) . out of these 15 deaths ,8 were male and 7 were females. 5 cases were diabetic and 2 had hypertension. Out of these cases most common site of involvement was submandibular followed by Para pharyngeal . Main cause of death was septicaemia and acute renal failure.

## IV. Discussion:

Our results of the study show some similarities and some differences with the literature. The mean age affected by infection in our study varied from 40 to 60 years, similar to other studies. Nirmal et al age most commonly effected 36 to57years[(1)], similar to our study .The disease was more frequent in males (53.3%)in our study similar to other studies , sethi et al.[(2)] meher et al[(3)]all of which show male predominance, In our study female patients were 28 ( 46.6%) and male patients were 32(53.3%). Female predominance is increasing due to lack of hygiene, associated co-morbidities, lack of knowledge. In our study the most commonly found systemic diseases were diabetes and arterial hypertension. The incidence of diabetes, in our study was 20 patients(33%). This is similar to study of Huang et al.[(4)] 30.3%. The HIV has been found in 10patients(6.6%) which is high in contrast to study of nirmal et al. According to Thiago Pires Britoet al the most prevalent comorbidities were hypertension (19 patients,18.8%), diabetes mellitus (DM) (13 patients). Many studies have shown the association of DM with DNSI[(5),(4)].Huang et al.[(4)]and Lee et al.[(6)]indicated that old patients with DM were susceptible to deep neck infection. The clinical picture of infection, are all similar to other studies of Meher et al.[(7)]with pain and swelling as the most common. Poorer prognosis was noted in the presence of toxemia, tachycardia, respiratory failure and signs of tissue necrosis(8).

The teeth are the most common primary site (50%), followed by tonsil (13.3%)[(9)(5)]. In a study of Tschiassny et al. 70% of DNSI were odontogenic in origin[(10)]. In parhiscar et al. odontogenic infections were most common cause in 43%.(5) Bottin et al. it was 42%[(11)], Marioni et al [(12)]reported odontogenic infections were most common causative factor for DNSI, in 42%, 38.8% and 49%. Acc to acc to Thiago Pires Brito et al Bacterial tonsillitis was the most common cause of cervical abscess (32 patients, 31.68%), followed by odontogenic infection in (24 patients, 23.7%). Odontogenic infection is most common site in adults and tonsil is the site for children.

The cause remains unknown in 20% of the patients, where the cause was not withstanding a detailed clinical history, physical examination and radiological studies(5)About two thirds of the cultures of secretions were polymicrobial. The most commonly isolated organism are mostly part of the normal orophayngeal flora. In our series, Staphylococcus aureus was the most commonly isolated bacteria followed by Streptococci. There

was no bacterial growth in 20 cultures ( 33.3%) . This is probably due to the indiscriminate use of antibiotics prior to hospital admittance and the high doses of endogenous antibiotics before surgery. Our study showed positive microbial culture in 66.6% cases (40 patients) which is similar to other study .Bakir et al. with positive culture in 58.8% cases.[10] .In our study Infection was located in the following spaces : Submandibular space involved in 20 cases (33.3%) ; parotid space in 12 cases (20%) ; parapharyngeal space in 12 cases (20%) ; The most common space involved in our study was submandibular space 33.3% cases which is in consistent with other study Meher et al.(7)

Acc to acc to Thiago Pires Brito et The site most commonly involved was multispace (31 patients ,41.8%), followed by submandibular space in 19 patients(25.6%), the peritonsillar space in 17 patients (22.9%). The adult patients developed multispace infection more often.Involvement of the parapharyngeal space, the association between the parapharynx and mediastinum and pleura, are the retropharynx + mediastinum were associated with poor prognosis.Since the 1970s, computed tomography has evidently helped to improve the diagnosis of deep neck infections. Tomography of the neck and thorax establish the extension of infection and make it possible to precisely plan the treatment. CT is still the appropriate imaging to help in correct diagnosis indicating the extent of disease, differentiating cellulitis from abscess and helps to decide whether surgical intervention is indicated . patients with radiological evidence of cellulitis respond well to medical treatment , whereas those with abscess have greater complications and usually require surgical management who otherwise may go for complications due to aggressive nature of this condition.Ultrasound of neck should be done and helps in early detection of abscess formation.

All the patients in our study were treated surgically , except for 10 cases(16.6%) which were treated with conservative management (intravenous antibiotics, analgesics..) only in the presence of cellulitis and Infective lymphadenitis which is consistent with the studies by Parhiscar et al [(5)] and Bakir et al.[(13)] in their study of 173 cases showed that 78 patients (40.5%) were treated successfully with only intravenous antibiotics and the remaining 95 patients (59.5%) were treated surgically.Special attention should be given for airway management when patients present with signs of upper airway obstruction, particularly in Ludwig's angina , in which there is edema of the floor of the mouth due to bilateral submandibular space infectionParhiscar et al.analyzed 210 patients with neck abscesses and reported a need for tracheostomy in 44% of cases , which demonstrates the severity of this condition. In our study tracheostomy was done in 16.6 % of the cases (10 out of 60 cases) which is in contrast with the study by Eftekharian et al.[(14)]in which tracheotomy was required in 8.8% cases and Gaurav Kataria et al. in which tracheostomy was done in 5.26% of cases. Our complication rate was 25%, which was similar to other studies in literature which ranged from 12.8- 25.5% .[(5)]The mortality rate in our study was 25% (15 cases). Mediastinitis and septic shock were related to poor prognosis of the infection. Prompt recognition and treatment of DNI is essential for an improved prognosis. Thus, key elements for improved results are the identification for morbid factors , signs and symptoms and computed tomography.

## V. Summary

Deep neck space infections are life threatening infections of the head and neck region .Wide spread use of antibiotics has lowered the life threatening infections and also altered their clinical presentation. Rapid spread of infection from one space to another space results in increased incidence of complication.

Patients with underlying systemic diseases as the condition may progress to life-threatening complications. Early diagnosis and treatment is essential. Thus, all patients should be initiated on treatment with empirical intravenous antibiotic therapy, which should be updated later according to the culture and sensitivity report. All patients with a significant abscess on the CT 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 has led to an increased prevalence of dental and periodontal diseases. In our study, odontogenic infections were the most common etiology for DNSI. Therefore, prevention of DNSI can be achieved by making the population aware of dental and oral hygiene and encouraging regular check-ups for dental infection.

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