International Journal of Otorhinolaryngology and Head and Neck Surgery
Verma R et al. Int J Otorhinolaryngol Head Neck Surg. 2019 Nov;5(6):1656-1661
http://www.ijorl.com
pISSN 2454-5929 | eISSN 2454-5937

Original Research Article

DOI: http://dx.doi.org/10.18203/issn.2454-5929.ijohns20194944

Clinical profile of patients with deep neck space infections: a review of 62 patients from a tertiary care hospital of North India

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Received: 26 September 2019
Revised: 11 October 2019
Accepted: 14 October 2019

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ABSTRACT

Background: Deep neck space infection (DNSI) is the infection of the potential spaces in the neck, specifically around the facial planes. Management of DNSI is traditionally by prompt surgical drainage of the abscess followed by antibiotics. In select cases, nonsurgical treatment using appropriate antibiotics may be employed. The objective of this study was to review the clinical profile of patients with DNSI.
Methods: This was a retrospective chart review of 62 patients of DNSI managed at a tertiary care hospital of North India. Various parameters assessed in study included the demographical profile of the patients, symptomatology, possible aetiology, site distribution, bacteriology, the co-morbid conditions and treatment received.
Results: Male preponderance was seen in this study with male:female ratio of 1.69:1. Swelling was the main complaint in majority of the patients (91.9%, 57 of 62 patients). The most common aetiology was odontogenic infection. Diabetes mellitus was seen in 25.8% (n=16) patients. Multiple space involvement was seen in majority of the patients with submandibular space being the most commonly involved site (43.5%). Most patients had negative pus cultures. The most common organism isolated was *Staphylococcus aureus*. All patients underwent surgical drainage.
Conclusions: Odontogenic pathology is the most common cause related to DNSI. So extreme caution should be exercised by dentists in diabetic patients and in those with other immunocompromised status. Pus culture should be obtained before the start of antimicrobial therapy. If not diagnosed and treated in time, DNSI can turn out to be fatal.

Keywords: DNSI, Ludwig's angina, Neck abscess, Parapharyngeal space abscess, Retropharyngeal abscess, Submandibular abscess

INTRODUCTION

Deep neck space infection (DNSI) refers to the infection in the potential spaces of the neck, specifically around the fascial planes, either with abscess creation or cellulitis.[1] Before the antibiotic era, infections of the deep fascial spaces of the head and neck were quite common and were a source of considerable morbidity and mortality.[2] The advent of antibiotics has reduced the overall incidence of profound neck space infections. But the same still occur in the general population, with a definite potential for significant morbidity, and even mortality especially with improper or delayed treatment.[3] DNSI more commonly affect immune-compromised individuals, patients recovering from organ transplants, patients on chemotherapy, individuals with acquired immunodeficiency syndrome (AIDS) and intravenous drug abusers.[2] Infections of the deep neck spaces present

a challenging problem for several reasons. Complex anatomy, deep location, difficult access, closes proximity to vital structures, communication to other regions of the body (e.g., mediastinum) pose a challenge to the treating physician. DNSI are bacterial infections originating from the upper aero-digestive tract and involving the deep neck spaces.[4] They often occur following preceding infections such as dental caries, tonsillitis, pharyngitis, trauma to the head and neck, and among intravenous drug abusers. DNSI are usually polymicrobial in nature. *Streptococci*, *Peptostreptococci, Staphylococcus aureus*, and anaerobes are the most commonly cultured organisms.[5,6] Clinical manifestations of DNSI depend on the spaces involved, and include pain, fever, malaise, fatigue, swelling, odynophagia, dysphagia, trismus, dysphonia, otalgia, and dyspnoea.[7] 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 and haematogenous dissemination to distant organs.[8,9] 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.[10] The advent of modern imaging techniques has made it possible to diagnose these infections earlier and to localize them accurately. Proper diagnosis and prompt management can effectively overcome the disease and provide a cure without complications.

Objective

The main objective of this study was to share experience of a tertiary care referral hospital in terms of presentation, clinical trends, common sites involved, bacteriology, management, complications, and outcomes in patients of DNSI. The study also emphasizes the importance of radiologic evaluation and appropriate treatment selection in these patients.

METHODS

This was a retrospective chart review of 62 patients of DNSI from the Department of Otorhinolaryngology, Dayanand Medical College Ludhiana over a period of 5 years from January 2012 to august 2017.

Inclusion criteria

All patients presenting in out-patient or emergency department with anticipated or radiologically documented evidence of DNSI.

Exclusion criteria

Patients with post traumatic infected wounds, infected head and neck tumours and superficial abscesses were excluded from the study.

Various parameters assessed in study included the demography (age and gender), symptomatology, aetiology, site distribution, bacteriology, and the associated diseases. Computerised tomography (CT) scan of neck and operative findings were used to establish which neck spaces were involved by the infections. We also analysed was the treatment received by the patients and the data was compared with that in the available literature.

A detailed history and clinical examination was documented in all the patients' charts. History included demographic data, chief complaints, social habits and associated diseases. Clinical examination included the local and systemic examination. CT scan reports were used to establish the neck spaces involved in the disease. Treatment plans and surgical findings were noted. Bacteriological studies were also noted. Data was tabulated for descriptive and statistical analysis.

RESULTS

Male preponderance was seen in our study with 39 (63%) males and 23 (37%) females i.e., male:female ratio of 1.69:1 (Figure 1). Patients from all age groups were found to be affected by DNSI in our study, with maximum patients in the 4th and 5th decades of life (Table 1). The mean age was 45.11 years and the patients' age ranged from 1 year to 77 years.

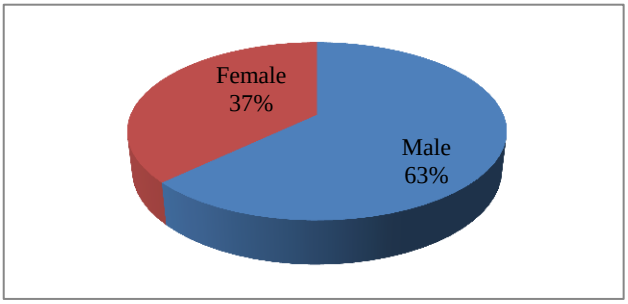

Figure 1: Gender distribution.

Table 1: Age distribution of the patients.

Age range (years)	Number of patients
1-10	3
11-20	3
21-30	8
31-40	4
41-50	21
51-60	19
61-70	3
71-80	1

Swelling in the head and neck region was the main complaint in most of the patients. 57 out of 62 patients (91.9%) had swelling as their chief complaint. The second most common complaint in our study was pain in

40.3% followed by fever in 33.8%, dysphagia in 22.5%, trismus in 19.3%, dental pain in 16.1%, odynophagia in 9.6% and dyspnoea in 9.6% patients (Table 2).

Table 2: Symptom of the patients.

Presenting symptom	Number	%
Swelling	57	91.9
Pain	25	40.3
Fever	21	33.8
Dysphagia	14	22.5
Trismus	12	19.3
Dental pain	10	16.1
Dyspnoea	6	9.6
Odynophagia	6	9.6

The most common aetiology of DNSI in our study was odontogenic infection. 30 (48.3%) patients presented with DNSI after tooth extractions or caries/infectious tooth pathologies. Patients were seen to be presenting with these infections within 8 to 15 days of their tooth extractions. Tuberculosis was seen in 3 (4.8%) patients as the causative factor for DNSI. In 1 patient (1.6%) the abscess occurred after fine needle aspiration cytology (FNAC) of parotid gland. In 1 (1.6%) patient foreign body was the causative factor for the abscess. In the remaining 27 (43.5%) patients the cause was unknown/unclear.

Various co-morbid conditions were also noted in patients with DNSI. Diabetes mellitus was present in 25.8% patients (n=16) in our study group. 10 (16.1%) patients were hypertensive, 2 patients (3.2%) had history of pulmonary tuberculosis, 1 (1.6%) patient had chronic kidney disease, 1 (1.6%) patient had past history of cerebrovascular accident and 1 (1.6%) patient had pancreatitis. Interestingly, no patient was an intravenous drug abuser.

Computed tomography (CT) scan was done in all the cases. The most common location of DNSI in our study was the isolated involvement of submandibular space. This was seen in 43.5% (27) patients. Parapharyngeal space was the next most common space involved in 22.5% (14) patients, followed in frequency by parotid space abscess in 20.9% (13), Ludwig's angina in 19.3% (12), masticator space in 17.7% (11), anterior triangle neck in 14.5% (9), submental space in 9.6% (6), retropharyngeal space in 4.8% (3) patients. Posterior triangle neck, prevertebral space and peritonsillar abscess were seen in 3.2% (2) patients each. Ludwig's angina was seen in 19.3% (12) patients. Ludwig's angina was defined as the bilateral simultaneous involvement of submandibular and sublingual spaces either as abscess or cellulitis. 1.6% (1) patents presented with isolated sublingual space abscess. 1.6% (1) patient had premaxillary abscess. 6.4 % (4) patients presented with extension to infratemporal, frontoparietal and frontotemporal regions (Table 3). Figures 2-4 show the clinic-radiological profile of few of the patients with DNSI.

Table 3: Site distribution of deep neck space infections.

Space involved	Number of patients	%
Submandibular space	27	43.5
Parapharyngeal space	14	22.5
Parotid space	13	20.9
Ludwig's angina	12	19.3
Masticator space	11	17.7
Anterior triangle	9	14.5
Submental	6	9.6
Retropharyngeal space	3	4.8
Peritonsillar space	2	3.2
Posterior triangle	2	3.2
Prevertebral space	2	3.2

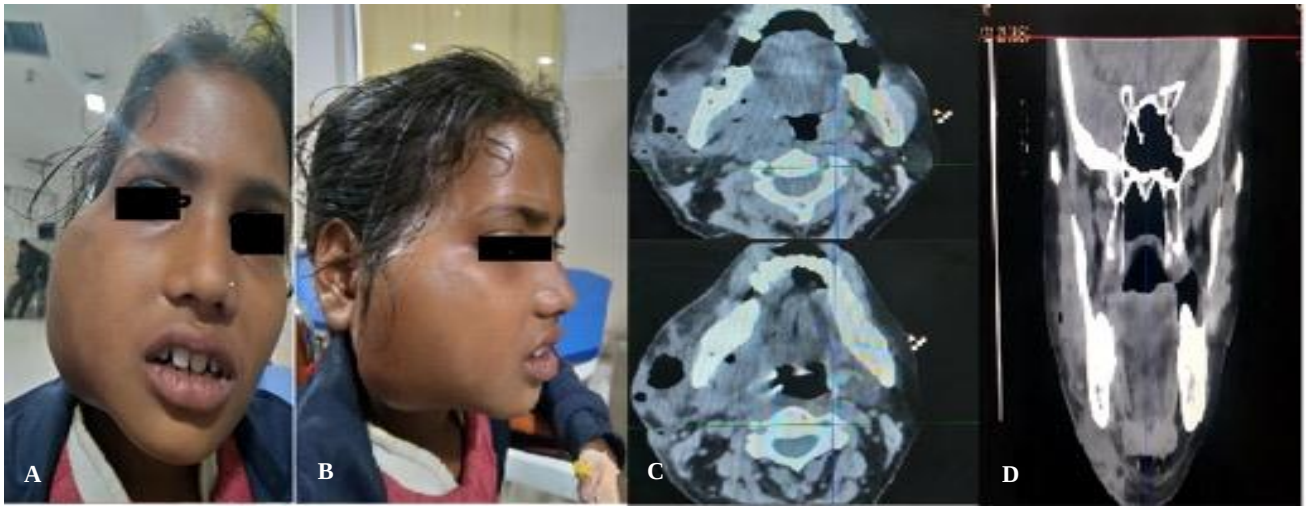

Figure 2 (A-D): 9 years old patient with submandibular and parotid space abscess.

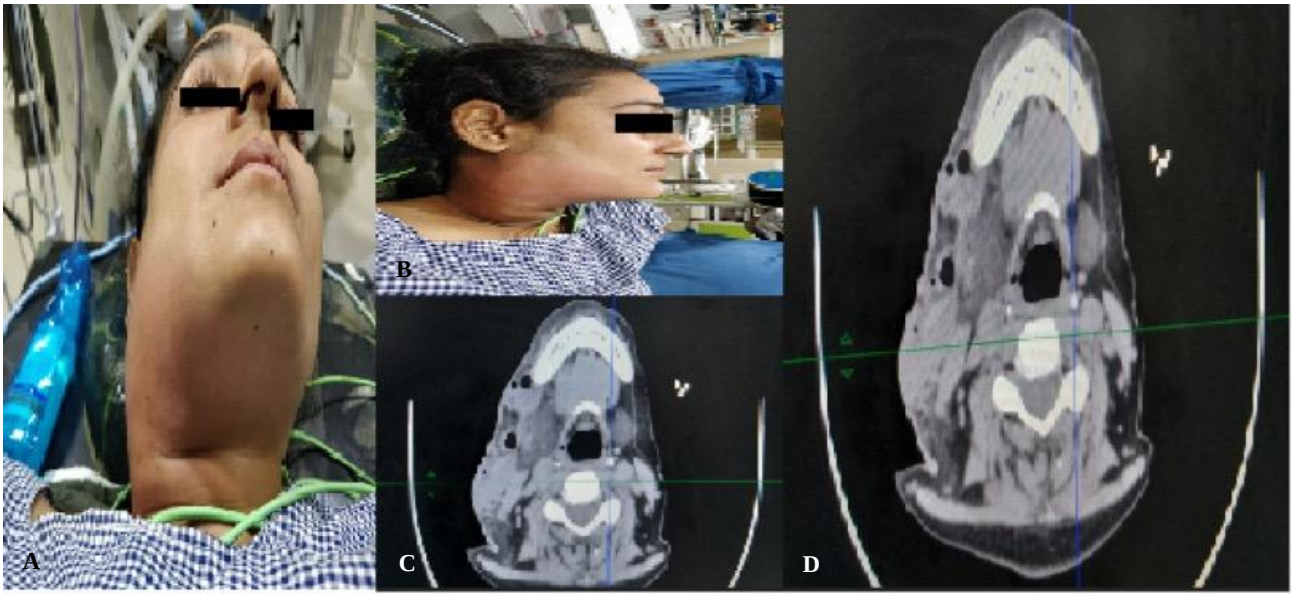

Figure 3 (A-D): 23 years old female with abscess involving submandibular and parapharyngeal space.

Figure 4: 45 years old female with Ludwig's angina.

Table 4: Microbiological profile.

Organism isolated	Number	%
No growth	43	69.3
Staphylococcus aureus	7	11.2
Klebsiella	2	3.2
Pseudomonas	2	3.2
Non haemolytic *Streptococcus*	1	1.6
E. coli	1	1.6
Candida albicans	1	1.6

As per the hospital protocol, all patients admitted for DNSI received empirical antimicrobial therapy using broad spectrum antibiotics along with anaerobic cover. Most commonly used antibiotics were amoxicillin or clavulanate potassium (58%), third generation cephalosporins (23%), metronidazole (76%), and clindamycin (10%). These were used in various combinations. As the antimicrobial therapy was started before the surgical intervention, majority of our patients had negative pus culture reports i.e., 69.3% had no growth in their pus cultures. The most common organism isolated in the pus culture was found to be *Staphylococcus aureus* in 11.2% patients, *Klebsiella* and *Pseudomonas aeruginosa* were the next most common organisms i.e. 3.2% each. Non-haemolytic *Streptococcus* was isolated in 1.6%, *E. coli* in 1.6%, and *Candida albicans* in 1.6% patients. 5 patients (8%) did not have culture reports available in the records (Table 4).

All patients underwent surgical drainage under general anaesthesia or monitored anaesthetic care. 69.3% patients underwent surgical drainage, 22.5% underwent surgical drainage along with tracheostomy, 4.8% underwent surgical drainage with necrotic tissue debridement and 3.2% underwent surgical drainage along with debridement and tracheostomy.

The mean hospital stay was 11.5 days for patients who underwent surgical drainage alone, 14.3 days for patients who underwent surgical drainage with necrotic tissue drainage, 20.2 days for patients who underwent surgical drainage and tracheostomy and 18 days for patients who underwent surgical drainage with debridement and tracheostomy.

DISCUSSION

In our study, majority of the patients (40.2%) were in the 4th and 5th decade of life. The mean age of presentation in our study was 45.1 years. This was in accordance with the published literature.[11-14] Male preponderance of 1.69:1 was found in our study. Similar trend was also seen in studies by Sethi et al, Meher et al and Parhiscar et

al.[11,13,15] Bakir et al showed a female preponderance of 1.16:1 in their study.[14]

In our study, swelling in the head and neck region was the most common presenting complaint (91.9%). This was followed by pain in 40.3% cases. The literature suggests pain as the most common presenting symptom followed by dysphagia/ odynophagia and trismus.[13-16]

In this study, 16 (25.8%) patients were diabetic. Another 10 (16.1%) patients had systemic arterial hypertension. Huang et al had reported diabetes in 30.3% of their patients.[6] Hypertension is a common associated disease with DNSI according to Gujrathi et al.[3]

Odontogenic infections were the most common aetiological factor for development of DNSI in our study. This was noted in 48.3% patients. This is consistent with studies in the literature.[11,14,16-18] Tschiarsny in his study showed that 70% cases of DNSI were odontogenic in origin.[19] So, it is important to stress upon the fact that poor oral/dental health should not be underestimated and ignored. It was interesting to note that we could not ascertain the aetiology in 43.5% of our patients.

Submandibular space was the most common location of DNSI in our study. This was seen in 43.5% patients. Myla et al reported involvement of submandibular space in 57.5% patients of DNSI.[2] In study by Bakir et al submandibular space was involved in 26.1% cases.[14] Gujrathi et al reported the most common presentation to be Ludwig's angina in 17.78% and submandibular space involvement in 13.3%.[3] Parapharyngeal space was the second most common site involved in our study i.e. 22.5%. Moncada et al and Suehara et al also reported submandibular and parapharyngeal as the most common sites for DNSI.[20,21] We believe that due to close anatomical proximity of mandibular dental roots to the submandibular space, this space can get readily involved by dental infections. As odontogenic infections are the leading cause of DNSI, submandibular space involvement by DNSI is extremely common.

Results of pus culture were available in most of the patients (92%). Out of these, 69.3% had no growth in their cultures. This can be attributed to the fact that most of these patients had already received antibiotics before presenting to our hospital. Also, once admitted, the patients are started on intravenous antibiotics empirically before the planned surgical intervention. Among the patients who had positive pus culture reports, *Staphylococcus aureus* was the most common organism isolated. Suehara et al also found *Staphylococcus aureus* to be the most common organism in their study (37.55%).[20] In another study by Myla et al *Streptococcus pyogenes* was the most common organism (70%).[2] Similarly, streptococcus was the most common organism isolated in studies by Parhiscar et al, Mumtaz et aland Gidley et al.[11,22,23] We found non haemolytic gamma streptococcus in one of our patient. Other organisms isolated in our study were *Klebsiella*, *E. coli* and *Candida albicans*.

The standard treatment of DNSI involves prompt surgical drainage of the involved space along with systemic antibiotics. In our study, patients were initiated on antibiotics with amoxicillin or clavulanate potassium (58%), third generation cephalosporins (23%), metronidazole (76%), and clindamycin (10%) in various combinations. Surgical drainage was carried out in all the patients. This is consistent with data in the literature. Studies by Mumtaz et al, Eftekharian et al, Parhiscar et al and Har el et al have reported surgical intervention in 78%, 79%, 100% and 90% respectively.[11,12,18,22] There is literature showing favourable response to treatment with antibiotics alone. Boscolo et al reported successful treatment of DNSI with antibiotics in two thirds of their patients.[24] 25.7% of the patients in our study underwent tracheostomy to manage actual or potential airway compromise. The tracheostomy incidence in our study is higher as compared to studies by Agarwal et al (12%) and Larawin et al (8.7%).[25,26] Kauffmann et al, however, had comparable tracheostomy incidence of 31.7%.[27]

The most common complications of DNSI in literature include airway obstruction, mediastinitis, haemorrhage from great vessels, septic thrombophlebitis and cranial nerve palsies. In our study 9.6% (6 patients) had airway obstruction and 3.2% (2 patients) had mediastinitis. Myla et al in their study reported 3 patients with airway obstruction and 2 patients with mediastinitis.[2]

CONCLUSION

DNSI is a challenging disease for otolaryngologists. These infections are commonly seen in spite of widespread use of antibiotics. Odontogenic infections remain the most common cause related to DNSI. Therefore health education related to dental hygiene is extremely important. Public should be made aware of the need for regular dental check-ups. Dental interventions should be strictly undertaken using all aseptic precautions and special care should be undertaken in diabetic and immune compromised patients. Good clinical examination and early radiological assessment with CT scan provides very useful information regarding the origin, location and extent of DNSI. The treatment approach depends upon the clinical presentation, complications and radiological findings. Incision and drainage along with securing the airway are recognised as the cornerstone for the treatment of DNSI. Pus culture should preferably be obtained before the start of empirical antimicrobial therapy. If not diagnosed and treated in time DNSI can turn out to be a cause of significant morbidity or even mortality.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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Cite this article as: Verma R, Angral S, Singh U. Clinical profile of patients with deep neck space infections: a review of 62 patients from a tertiary care hospital of North India. Int J Otorhinolaryngol Head Neck Surg 2019;5:1656-61.