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ORIGINAL RESEARCH

Clinical Evaluation and Management of Deep Neck Space Infections

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ABSTRACT

Introduction: Deep neck space infections (DNSIs) present a challenging problem due to the complex head and neck anatomy and potentially lethal complications and are not uncommon, albeit the advent of antibiotics and advanced dental care.

Materials and methods: A total of 50 patients with deep neck infections who met the inclusion criteria were enrolled in this prospective study. Incision and drainage was done at the earliest stage in majority of the patients, pus was sent for culture and sensitivity analysis prior to start of antibiotics. Supportive therapy in the form of intravenous fluids, analgesics, antipyretics, antiemetics, mouthwashes, etc., was given.

Results: The most common presenting symptom was odynophagia (82%). The duration of symptom ranged from 3 to 30 days. Common clinical findings were oropharyngeal abnormalities (70%) followed by neck swelling (60%). Dental infections (45%) are the most common known underlying cause. The most commonly involved neck space was Ludwig's angina (46%). Streptococci species was the most common pathogen isolated by pus culture and sensitivity. Five out of 50 patients developed complications and the mortality rate was 2%.

Conclusion: An inadvertent use of antibiotics has changed the clinical presentation of DNSI leading to the delay in diagnosis and management. High index of suspicion is warranted for timely intervention and better outcome of cases.

Keywords: Deep neck space infection, Ludwig's angina, Odynophagia, Peritonsillar abscess.

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INTRODUCTION

Deep neck space infections affect fascial compartments of the head and neck and their contents. Although the advent of modern antibiotics and surgical techniques have resulted in fewer complications and death following DNSI, they continue to occur in spite of good clinical care. The high incidence of DNSI leading on to large abscess can be attributed to unhygienic living conditions in the urban slums and lack of awareness.[1]

The majority of DNSI before the era of antibiotics originated in the pharynx and tonsil. Since the advent of antibiotics, these oropharyngeal infections are no longer a significant etiological factor. Dental infections and regional trauma are now common causes of DNSI.

They present with a wide variety of symptomatology ranging from vague throat pain to severe respiratory embarrassment and dysphagia. The diagnosis and treatment of DNSI are challenging due to complexity in anatomical and surgical orientation, hence a thorough clinical examination and a high degree of suspicion is warranted.

Inadvertent use of antibiotics and changing bacteriological pattern lead to altered clinical picture and delay in diagnosis of life-threatening conditions.[2,3]

The management protocols have not been well established and are often challenging due to its grave prognosis and complexity of vital neck structure, often posing all important decision and surgical skills in saving the life and preserving vital body functions.

This study makes inroads into detailed analysis on the diagnosis, recent advances in investigations and management of DNSI.

MATERIALS AND METHODS

Only clinically confirmed cases of abscesses of all age groups and both sex were included. This prospective study was conducted on patients presenting with complaints of throat pain, dysphagia, odynophagia, fever, neck swelling, trismus, halitosis, change in voice at a tertiary medical center for a study period of 2 years.

A total of 50 patients with deep neck space infections were chosen for the study. A detailed physical examination was carried out to determine the extent and cause of the DNSI.

Superficial skin abscesses, abscesses due to infections of the external neck wounds and abscesses in relation

to the mastoid and facial bone fractures, patients with congenital and benign neck swellings other than due to DNSI were excluded from the study.

Incision and drainage was done at the earliest stage in majority of the patients, pus was sent for culture and sensitivity analysis prior to start of antibiotics. All patients were initially started on a combination of third-generation cephalosporins, gentamicin and metronidazole. The antibiotics were modified on culture sensitivity reports or clinical unresponsiveness if required. Supportive therapy in the form of intravenous (IV) fluids, analgesics, antipyretics, antiemetics, mouthwashes, etc., were given.

All patients were kept under observation for impending or manifest respiratory distress. Radiology and dental references were sought in appropriate cases. Ethical clearance was obtained from the institutional ethics committee. Informed consent was obtained from the patients participated in this study.

Statistical Analysis

Data analysis was done using Statistical Package for the Social Sciences version 15.0. The demographic and clinical characteristics were represented using descriptive statistics; 90% confidence interval (CI) has been computed for the study characteristics.

RESULTS

This study consisted of 50 cases in which 23 were men and 27 were women of DNSI seen over a period of 2 years. The age of the patients seen ranged from 2 to 80 years. It was observed that the maximum number of cases were seen in the age group of 21 to 30 years. The number of cases in the extremes of age was minimal. The average age of presentation was 36.2 years.

The most common symptoms with which the patients presented were odynophagia (82%), followed by fever (78%), neck swelling (60%), trismus (46%), sore throat (42%), neck pain (30%), toothache (26%), halitosis (12%), and history of tooth extraction (6%) (Table 1).

Majority of the patients had oropharyngeal abnormalities (poor oral hygiene, elevation of the floor of the mouth, bulging of the soft palate, displacement of the uvula, congestion of the pillars, tonsillar congestion, enlargement, displacement, posterior pharyngeal wall abnormalities) (70%) followed by neck swelling (60%), raised body temperature (52%), trismus (48%), dental infection (44%), stridor (6%), lymph node enlargement (6%), and halitosis (4%) (Table 2).

Etiology was not known in 46% of the patients, odontogenic infections are the underlying cause in 44%, followed by recurrent tonsillitis in 4%, foreign body ingestion in 4%, tuberculosis of cervical spine in 2% (Table 3).

The most common infection was Ludwig's angina, (46%) followed by peritonsillar abscess (32%), retropharyngeal abscess, (12%), parapharyngeal abscess (10%), parotid abscess (4%), anterior visceral space infection (AVSI) (2%) (Table 4).

Of the 50 patients chosen for the study, 84% were managed by incision and drainage, 10% were managed on conservative lines, 2% with Ludwig's angina, 4% with retropharyngeal abscess, 2% with AVSI, and 2% with parapharyngeal abscess. One patient with retropharyngeal abscess secondary to tuberculosis was treated with antitubercular drugs. In 6% with peritonsillar abscess, only needle aspiration was done (Table 5).

Table 1: Presenting complaints of DNSI

Presenting complaints	*Total no of patients*	*%*	*90% CI*
Odynophagia	41	82	71.05–89.22
Fever	39	78	67.07–86.06
Neck swelling	30	60	48.38–70.60
Trismus	23	46	34.91–57.50
Sore throat	21	42	31.22–53.80
Neck pain	15	30	20.59–41.46
Toothache	13	26	17.22–37.25
Halitosis	6	12	6.33–21.57
Tooth extraction	3	6	2.42–14.09
Difficulty in breathing	3	6	2.42–14.09

Table 2: Clinical findings in DNSI

Clinical findings	*Total no of patients*	*%*	*90% CI*
Oropharyngeal abnormalities	35	70	58.54–79.41
Neck swelling	30	60	48.38–70.60
Raised body temperature	26	52	40.58–63.22
Trismus	24	48	36.78–59.42
Dental infections	22	44	33.06–55.56
Stridor	3	6	2.42–14.09
Lymph node enlargement	3	6	2.42–14.09
Halitosis	2	4	1.33–11.39

Table 3: Etiology of DNSI

Etiology	*Total no of patients*	*%*	*90% CI*
Unknown	23	46	34.91–57.5
Odontogenic	22	44	33.06–55.56
Recurrent tonsillitis	2	4	1.33–11.39
Foreign body ingestion	2	4	1.33–11.39
Tuberculosis of cervical spine	1	2	0.5–8.48

Table 4: Location of DNSI

Location of DNSI	*Total no of patients*	*%*	*90% CI*
Ludwig's angina	23	46	34.91–57.50
Peritonsillar abscess	16	32	22.31–43.53
Retropharyngeal abscess	6	12	6.3–21.6
Parapharyngeal abscess	5	10	4.9–19.2
Anterior visceral space infection	1	2	0.5–8.5
Parotid abscess	2	4	1.3–11.4

Table 5: Management of DNSI

Type of management	Total no of patients	%	90% CI
Incision and drainage	42	84	73.77–90.74
Conservative	5	10	4.95–19.15
Needle aspiration only	3	6	2.42–14.09

Out of 50 patients involved in this study, 14% had history of diabetes mellitus, they were on irregular treatment; 2% were diagnosed to have tubercular infection of the cervical spine. One patient (2%) had human immunodeficiency virus (HIV) infection. In 47 patients, only one space was involved. In three patients more than one space was involved, two patients had Ludwig's angina and parapharyngeal abscess, one patient with retropharyngeal abscess and parapharyngeal abscess.

Pus for culture sensitivity was sterile in 55%, organisms were isolated in 45%; culture yielded the growth of polymicrobial organisms in 8 samples (16%).

DISCUSSION

Deep neck space anatomy is complex, as no clear definition exists as to when a condensation of connective tissue becomes fascia and fascial spaces which are relatively loose connective tissue. The boundaries of deep neck spaces are ill defined due to the arrangement of multiple investing fascia. However, cervical fascia is unique in terms of functioning not only to direct but also to limit the spread of disease process in the neck.[4,5]

Deep neck space infection refers to an infection in the potential spaces and fascial planes of the neck, either with abscess formation or cellulitis.[6]

The widespread use of antibiotics has decreased the incidence of DNSI, but it remains a fairly common problem with 10 in 100,000 inhabitants/year, with a tendency to increase in children.[7]

In our study, the majority of patients were seen in their third and fourth decade. This correlates with the studies by Parhiscar and Har-El[8] and Meher et al[1] in which 50 and 60% patients were in the third and fourth decade of life respectively. There was a slight female preponderance noted in our study, unlike the other studies.[9,10]

Low education, smoking, living >1 hour from a tertiary care center, having tonsillar hypertrophy or streptococcal infections are at increased risk of severe DNSIs and they require early specialist consultation.[11]

The common presenting complaints were odynophagia followed by fever and neck swelling. Neck pain was seen in only 30% of patients, which is in consistent with the study by Panduranga Kamath et al,[12] but fever and neck pain were the most common symptoms in a study by Brito et al[9] and Yang et al.[3]

In collaboration with earlier studies, etiology was not known in majority of the patients. Dental infection was the most common known etiological factor followed by foreign body ingestion and recurrent tonsillitis.[13] The incidence of DNSI was higher in patients with mandibular odontogenic infection and in patients with dental abscess compared with patients with maxillary odontogenic infection and those without dental abscess.[14]

The study conducted by Boscolo-Rizzo et al[15] and Cheng et al[16] indicated that tonsillitis was the most common cause of cervical abscess followed by odontogenic infection. Tonsillar hypertrophy with increased bacterial load harbored within the tonsillar crypts is associated with severe DNSI.[11]

Our study is consistent with those of Parhiscar and Har-El[8] and Boscolo-Rizzo et al,[15] with diabetes as the most common underlying disease (14%) followed by HIV infection (2%) and tuberculosis. Elderly diabetic patients are susceptible to DNSI, have more frequent complications and longer duration of hospital stay, and surgical drainage remains the main method of treatment.[17] In a study by Sakarya et al,[13] anemia was the most common preexisting disease.

Coexisting morbidities, such as liver cirrhosis, hypertension, diabetes mellitus, and chronic renal disease requiring regular dialysis are the risk factors for the extension of DNSI into the mediastinal space.[18]

In agreement with the other studies, Ludwig's angina was the most common DNSI and only 6% patients had multispace involvement.[1,8,10] Crucial to the occurrence of Ludwig's angina is the relationship of the mandibular dentition, second and third molar roots are routinely below the mylohyoid ridge and approach the lingual surface of the mandible which is thinner than the outer cortex, hence apical infections of the mandibular teeth have a tendency to extend lingually.[5]

Like in earlier studies 44.4% pus culture was sterile and 26.6% of pus culture showed *Streptococcus* species followed by *Staphylococcus aureus*.[9,11] *Klebsiella pneumoniae* was the most commonly cultured organism in the diabetic group and its culture rate was significantly higher than that in the nondiabetic group, hence empirical antimicrobial agents should be sensitive to *K. pneumoniae* in diabetic patients.[19]

Imaging evaluation plays a significant role in the diagnosis and rational therapeutic management in deep neck infection. Contrast computed tomography (CT) is the investigation of choice to delineate the exact anatomical location, extent, and identifies the possible sources of the infections detects complications; CT is also beneficial in differentiating between cellulitis and abscess, thus avoiding extensive surgery. Imaging-assisted abscess drainage

procedure is a less invasive option than surgery.[9,20] Lin et al[21] have shown correlation between imaging characteristics and microbiology of the patients with DNSI, which helps in precise presumptive antibiotics according to the identified involved neck space on CT scan.

Worldwide management of abscess has been followed in this study, which involves surgical incision and drainage in 84% of patients.[6,8,9,22] Unlike other studies,[1,9,10] none of the patients in this study required tracheostomy; 10% patients developed complications, such as necrotizing fasciitis, 2% patients had acute renal failure, and 2% developed airway obstruction and succumbed to it. The mortality rate was 2% when compared with the study by Cheng et al,[16] 6.3% of patients developed complications, with mortality of 10.89%.

Older age, a higher white blood cell count, abscess formation, associated systemic disease, diabetes mellitus, anterior visceral space involvement, and multiple space involvement are the risk factors for life-threatening complications of DNSI.[15] The main factors for spread of DNSI into the mediastinum are gravity, respiration, the negative intrathoracic and pleural pressure during inspiration and the absence of barriers in the fascial planes.[18]

A trial of high dose of IV antibiotics in stable children with close observation can be the primary line of treatment specially in small deep neck abscess <25 mm.[23] A study has shown ultrasound-guided drainage as an effective and safe procedure with shorter hospital stay as an alternative to incision and drainage of deep neck abscess.[24]

CONCLUSION

Odontogenic infection was the frequent cause for DNSI. Current evidence suggests that early presentation of the patients to the hospital and early clinical management by surgical intervention decreases the complications and need for tracheostomy. High index of suspicion is required to prevent a delay in diagnosis and appropriate management. Prevention of DNSI can be achieved by regular dental check-up and creating awareness on dental and oral hygiene.

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