A study of Deep Neck Space Infections at Kathmandu University Dhulikhel Hospital

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ABSTRACT

Background

Deep neck infections are severe infections in potential spaces and fascial planes of the neck. Despite antibiotic therapy, these infections continue to cause significant morbidity and mortality.

Objective

To determine the clinical features, predisposing factors, socio demographic factors and complications associated with deep neck infections.

Method

Prospective study conducted in the Department of Otorhinolaryngology, Kathmandu University Dhulikhel Hospital between March 2018 and June 2020. Seventy-five patients with deep neck infections were enrolled.

Result

Submandibular abscess was most frequently observed (41.3%), followed by submental abscess (25.3%), parotid abscess(9.3%), ludwig's angina (6.7%), posterior triangle of neck abscess (4%), retropharyngeal abscess (2.7%), parapharyngeal space abscess (2.7%), and multiple space infections (8%). Staphylococcus aureus was the most common organism (53.3%), followed by Beta hemolytic Streptococcus (12%) and methicillin-resistant Staphylococcus aureus (12%). A negative culture was seen in 22.7%. Sixty-eight percent of patients underwent incision and drainage. Incision and drainage with dental extraction was done in 26.7%, four percent underwent incision and drainage with debridement and dental extraction, whereas 1.3% underwent incision and drainage with tracheostomy. Eight percent patients required Intensive care unit admission. Seven patients had descending mediastinitis, four out of which developed sepsis. When age and duration of hospital stay were correlated by using Pearson correlation coefficient, a remarkable correlation was observed (p=.020). Noteworthy relationship was not observed between different locations of deep neck infections and duration of hospital stay (p=.202).

Conclusion

Early identification of deep neck infections is often challenging. Proper knowledge and extreme vigilance is necessary when dealing with these complex entities to avoid life-threatening complications.

KEY WORDS

Abscess, Complications, Deep neck infections, Tracheostomy

INTRODUCTION

Deep neck space infections (DNI) are a group of severe bacterial infections in potential spaces and fascial planes of the neck.[1] These are often rapidly progressive and can prove fatal due to life-threatening complications. Despite improved diagnostic techniques and widespread availability of antimicrobial therapy, these infections still remain serious and potentially life threatening today, as in the past.[2]

Complications occurring from DNI are usually a result of delay in initiating treatment, and often mandate surgery and prolonged hospitalization. Compromised airway, descending mediastinitis, thrombosis of the internal jugular vein, arterial erosion, pneumonia, pleural empyema, pericarditis, meningitis, septic shock, carotid pseudoaneurysm or rupture and intracranial extensions are the potentially lethal complications, especially in immunocompromised patients or those with comorbidities.[3-5] Hence, timely identification of the associated risk factors can help in reduction of mortality and morbidity related with this fatal disease.

Management of DNI is usually done by prompt surgical drainage of purulent abscesses through an external approach or nonsurgical treatment with appropriate antibiotics.[6]

Our research aims to determine the clinical features, predisposing factors, socio demographic factors and complications associated with DNI.

METHODS

The current study was a prospective study conducted in the Department of Otorhinolaryngology and Head and Neck surgery at the Dhulikhel Hospital, Kathmandu University Hospital between March 2018 and June 2020. The study protocol was approved by the Institutional Review Committee of Kathmandu University School of Medical Sciences (IRC-KUSMS), Dhulikhel Hospital, Kavre, Nepal.

All the patients or the patient's attendants were informed about the nature, objectives and procedures of the study. They were also explained about their right to withdraw from their consent and discontinue the research interviews at any point of time. They were also given the opportunity to ask any questions regarding the study about which they were unclear about. Written informed consent was obtained from patient or patient's attendant who could read and write, while fingerprints were collected from those who were unable to do that.

A total of 75 patients with clinically or radiologically diagnosed DNI presenting to Department of Otorhinolaryngology, Kathmandu University Dhulikhel Hospital, Dhulikhel, Kavre were enrolled in our study. Patients were excluded from the study if they were pregnant or had DNI confined to the peritonsillar space, DNI involving the investing fascia (superficial neck abscesses), DNI confined to a dentoalveolar space ,superficial infections of external neck wounds (surgical or traumatic) or abscesses related to fractures. Convenient sampling technique was used to recruit eligible participants.

A detail history taking and clinical examination was performed in all patients. The socio-demographic data (age, gender,) presenting symptoms, symptoms of co-morbidities, general medical history, medication use, period of hospital stay were recorded after a comprehensive history taking. Similarly, other parameters noted were airway status at presentation, site involved, bacteriology, culture and sensitivity report, need for Intensive Care Unit (ICU) stay, duration of hospital stay, type of intervention required, complications, and outcome. History about co-existent disease like dental caries, Diabetes mellitus, intravenous drug abuse or substance abuse and human deficiency virus (HIV) infection was also taken.

Initial hematological and laboratory investigations were done for all patients, including Complete blood count (CBC), Differential count (DC), Serum electrolytes, Liver and Renal function tests, HIV and Hepatitis B surface antigen (HBsAg), Random Blood sugar or Fasting Blood sugar and Postprandial blood sugar in diabetics, Glycosylated Haemoglobin (HbA1c) test. Other specific investigations, such as, ultrasonography and X-ray soft tissue neck antero-posterior and lateral views, computed tomography (CT), and magnetic resonance imaging (MRI), were done wherever required. Patients were taken to the operating room to have their airway secured if there was airway compromise. Those with radiologically identifiable abscess on ultrasonography or CT scanning underwent an incision and drainage. Patients with minimal abscess as diagnosed on ultrasonography were started on broad-spectrum intravenous antibiotics and re-assessed in 24 to 48 hrs. If there was no clinical improvement in signs and symptoms, ultrasonography was repeated. If abscess was not resolving or increasing in size, patients were taken to the operation theatre for an incision and drainage. Patients received empirical intravenous antibiotics, alone or in combination, of Amoxycillin with Clavulanic acid, Ampicillin with Cloxacillin, Ceftriaxone, Clindamycin, and Metronidazole. The treatment regimen was individualized later based on the culture and sensitivity report.

All patients were monitored very closely. Tracheostomy was performed if deemed necessary in patients suffering from impending airway obstruction. After confirming the presence of an abscess radiologically, incision and drainage with or without debridement was performed under general anaesthesia. Dental extraction was done in patients who had an `associated dental caries.

The statistical analyses were carried out using the Statistical Package for Social Science software (IBM SPSS Statistics 21, Chicago, USA). We estimated the relationship between age

and duration of hospital stay by using Pearson correlation coefficient. The relationship between location of deep neck infections and duration of hospital stay was analyzed by using One-way Anova test. A p-value < 0.05 was considered to be statistically significant.

RESULTS

The socio-demographic characteristics of the patients have been presented in Table 1. Out of 75 patients 42 (56%) were males and 33 (44%) were females. The minimum age of presentation was 24 days and maximum was 65 years. The mean age was 10.52 (SD 14.59) years. The most frequent site of involvement was submandibular space which was seen in 31 (41.3%) patients, followed by submental space in 19 (25.3%), parotid space in 7(9.3%), ludwig's angina in 5(6.7%), combined retropharyngeal, parapharyngeal and parotid space involvement in 4(5.3%), posterior triangle of neck in 3(4%), retropharyngeal space in 2(2.7%), parapharyngeal space in 2(2.7%), and combined submental, submandibular and parotid space involvement in 2(2.7%) patients (fig. 2).

Table 1. Sociodemographic variables in patients with Deep Neck Infection

Variable	Frequency	Percentage
Sex		
Male	42	56
Female	33	44
Age group (years)		
<10	51	68
11-20	12	16
21-30	3	4
31-40	5	6.67
41-50	2	2.67
51-60	1	1.34
61-70	1	1.34
Total	**75**	**100**

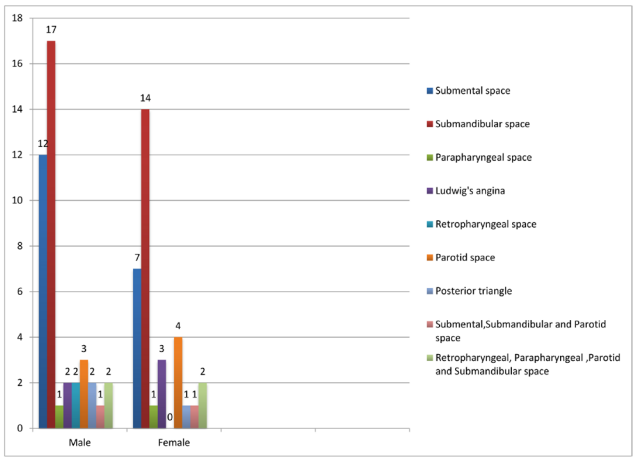

Figure 1. Location of abscesses in patients with Deep Neck Infections

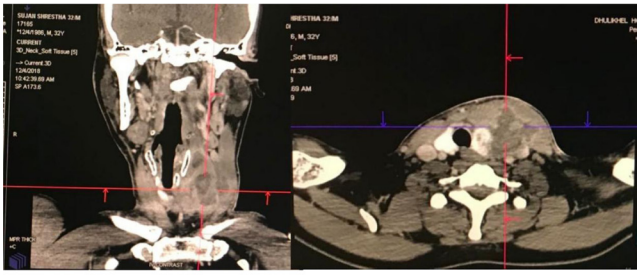

Figure 2. Coronal and axial images of contrast enhanced Computed tomography showing loculated collection at the left side of the neck abutting the Left sternocleidomastoid muscle, displacement of left carotid artery and internal jugular vessels in a patient with DNI

The most frequently occurring symptoms were neck pain in 74(98.7%), neck swelling in 62(82.7%), odynophagia in 54(72%) and fever in 49(65.3%). The other symptoms in the order of frequency were rancid breath in 28(37.3%), trismus in 18(24%), otalgia in 13(17.3%), hoarseness in 8(10.7%) and airway obstruction in 5(6.7%) (Table 2). The comorbidities associated with deep neck space infections were odontogenic infection in 20(26.7%), Upper respiratory tract infection in 12(16%), malnutrition in 9(12%) and diabetes in 4(5.3%). There was no case of known liver, lung, kidney disease or malignancies, trauma, intravenous drug abuse, or immunodeficiency.

Table 2. Symptomatology of patients with Deep Neck infection

Symptoms	Frequency	Percentage
Neck pain	74	98.7
Neck swelling	62	82.7
Odynophagia	54	72
Fever	49	65.3
Rancid breath	28	37.3
Trismus	18	24
Otalgia	13	17.3
Hoarseness	8	10.7
Airway obstruction	5	6.7
Total	75	100

The most common bacteria isolated were Staphylococcus aureus- 40(53.3%), β-hemolytic Streptococci- 9(12%), methicillin-resistant Staphylococcus aureus (MRSA)- 9(12%) and negative culture was seen in 17(22.7%). A total of 51(68%) patients were managed by incision and drainage alone. Incision and drainage with dental extraction was done in 20(26.7%) patients. Three patients (4%) underwent incision and drainage with debridement of devitalized tissue and dental extraction whereas 1 (1.3%) patient who was diabetic and was suffering from ludwig's angina underwent tracheostomy along with incision and drainage. Six (8%) patients required ICU admission. We observed retropharyngeal abscess even in a 24 day old neonate who was managed with intravenous antibiotic therapy along with incision and drainage of abscess. Seven patients had descending mediastinitis, four out of which developed

sepsis. The patients who developed mediastinitis required intravenous antibiotic therapy for a total of 21 days. All these complications were encountered in patients diagnosed with extended space abscesses and Ludwig's angina. The mean duration of hospital stay was 8.23 days. All the patients were discharged in stable condition.

When age and duration of hospital stay were correlated by using Pearson correlation coefficient, a remarkable correlation was observed (p=.020). One way Anova test did not demonstrate any statistical significance (p=.202) when the relationship between different locations of DNI and duration of hospital stay were evaluated.

DISCUSSION

Although, most studies report a lower prevalence of DNI in children as compared to adults, we observed that the prevalence of DNI in children was much higher as compared to adults.[3,4] A possible explanation is that children often have subtle presentation as compared to adults. This may also probably be caused by the history of antibiotics abuse, especially in colds and other viral infections, which are more prevalent in children than in adults.

In our study, there was a slight male predominance. This finding is consistent with studies by Huang et al. and different from Bakir et al.[2,8] The male predilection could be a result of increase tobacco and tobacco related products usage among males which lead to dental infections and hence predispose to DNI.

Our findings demonstrate that the most frequent site of involvement was submandibular space which was seen in 31(41.3%) patients, followed by submental space in 19(25.3%), parotid space in 7(9.3%), ludwig's angina in 5(6.7%), combined retropharyngeal, parapharyngeal and parotid space involvement in 4(5.3%), posterior triangle of neck in 3(4%), retropharyngeal space in 2(2.7%), parapharyngeal space in 2(2.7%), and combined submental, submandibular and parotid space involvement in 2(2.7%) patients. These findings are similar to study performed by Rega et al. where the authors found that submandibular space was the most frequent location for a single space abscess (30%), followed by the buccal space (27.5%) and the lateral pharyngeal space (12.5%).[9] Our findings are in contrast with some other authors 10 who reported most abscesses in the parapharyngeal space (48%), followed by the submandibular space (31%) and the retropharyngeal space (24%).

Similar to other authors, we recognized that neck pain and swelling of the neck were the most prevalent symptoms.[11] Our findings are different from previously published literature where neck swelling was reported as a major sign followed by fever and trismus.[12,13] In earlier studies, odynophagia, and space specific symptoms like dysphagia, trismus, dysphonia, otalgia, and dyspnea were reported.[9] Studies in the past have established various risk factors like peritonsillar infections, upper respiratory tract infections, odontogenic infection, intravenous drug use or other substance abuse, immunocompromised states, and diabetes.[14,15]

Deep neck infections have a varied etiology which include salivary gland infections, upper respiratory tract infections, trauma and foreign bodies. Other rare causes are branchiogenic cysts, instrumentation, spread of superficial infections, intravenous drug abuse and hypopharyngeal malignancies. No specific cause may be found in few cases.[16,17] However, today the trend seems to have changed and in our study we observed odontogenic infections as the most common predisposing factors. This is in accordance with findings of previous studies.[8,12,18,19]

Our findings also suggest that immunocompromised states like malnutrition and diabetes play a key role in development of DNI. This finding is supported by previous studies.[2,20]

The common causative microorganisms involved in development of DNI may differ considerably among various countries or even among different areas of the same country. The difference in the etiology may be the contributing factor. For instance, intravenous drug abuse, mandibular fractures and skin infections were common causes of deep neck infections in the report by Parhiscar and Har-El et al.[14,19]

In our study, the most common bacteria isolated were Staphylococcus aureus-40(53.3%), β-hemolytic Streptococci-9(12%), methicillin-resistant Staphylococcus aureus (MRSA)-9(12%) and negative culture was seen in 17(22.7%). This finding is in concordance with study by Huang et al. and Parhiscar et al. and different from some of the former studies.[3,10,14,21] Our findings have important implications because MRSA infections also contributed to a significant percentage in our study. Our findings are similar to study done in the USA and Taiwan.[21,22]

There was a significant rate of negative cultures in the current study. The reason for this could be because many of our patients received antibiotic therapy before admission.

Complications of Deep Neck infections may be life threatening and comprise of upper airway obstruction, jugular venous thrombosis, descending mediastinitis, pleural effusion, pneumonia, pericarditis, septic venous emboli, carotid artery rupture, hepatic failure, adult respiratory distress syndrome, septic shock, and disseminated intravascular coagulopathy, septic shock, and death.[4,7] The mortality rate may be as high as 40% with these complications.[8]

In our study, the most common complication was descending mediastinitis (7 patients; 9.3%). Out of these 7 patients with mediastinitis, 4 developed sepsis. The antecedent illnesses associated with these patients were

odontogenic infection with diabetes (n=2), history of penetrating foreign body removal (n=1) and malnutrition (n=4). All the patients with complications recovered with effective intravenous antibiotics for 21 days after surgical drainage.

It is noteworthy to mention that none of our patients had mortality in this study. The reason behind this could be early presentation and prompt initiation of antibiotics. Also, among five patients who developed airway obstruction, only one required tracheostomy. The other four patients had minimal airway obstruction without stridor which was managed with intravenous antibiotics and steroids followed by prompt incision and drainage of abscess which sufficed to relieve the obstruction. Among these patients who had mild airway obstruction two were diagnosed as ludwig's angina and two presented with retropharyngeal and parapharyngeal infections.

Our study also has some limitations. This was a single center study yielding a relatively small sample size. Hence, we may not be able to generalize results in the context to general population in Nepal.

CONCLUSION

Deep neck infections (DNI) are unique for their versatility and potential for severe complications. Early identification of DNI can be often challenging. Proper knowledge and extreme vigilance is necessary while dealing with these complex entities to avoid life-threatening complications.

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