

Original Article:

Etiology of Deep Neck Infection and Determination of their Predisposing Factors and Microbial Pattern

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Abstract

Deep neck infection is an infection in the potential spaces and fascial planes of either with abscess formation or cellulitis. However some of may still result in fatal complications. This paper described the etiology of deep neck infection, their predisposing factors and microbial pattern. More than 50% subject of this study were of younger age group (below 40 years) with male predominance (65%). Regarding the neck space submandibular space was the most commonly involved (32%). Etiology of neck abscess showed that odontogenic cause was the most common (60%) among the respondent, then come infected cyst, tumour. Among the predisposing factors of deep neck infection, Anaemia comprises the highest percentage (45.2%). Then comes diabetes and Liver disease, Oral hygiene, index relates with the odontogenic cause. Among the odontogenic cause patient (71.8%) had poor oral hygiene index. Regarding microbial pattern *streptococcus* was the highest predominance followed by *Staphylococcus* and *E coli*. This results correlates with the common dental infective microorganism which also stands for odontogenic cause of deep neck abscess. This study concluded that maintenance of good oral hygiene can prevent deep neck abscess and their devastating effect of Bangladeshi people.

Keywords:

Introduction

Deep neck infection is an infection in the potential spaces and fascial planes of the neck either with abscess formation or cellulites. However, they appear to be encountered frequently in the far east¹. The main factors responsible for this are the generally poor level of dental hygiene. Dental pathology is a common aetiology².

Although infection were encountered more frequently in the pre antibiotic era and were associated with poor oral hygiene, they can still cause significant morbidity and mortality, Despite the present administration of antibiotics and the improvement of modern dental care. Life threatening complications include Ludwig's angina, descending mediastinitis, septic shock upper air way obstruction, jugular vein thrombosis, septic embolus, pleural empyema, pseudo aneurysm or rupture pleural empyema, pericarditis, pericardial effusion, aorto pulmonary fistula, adult respiratory distress syndrome, acute renal failure, epidural abscess and disseminated intravascular coagulopathy etc^{3,4,5}. If the predisposing factors of complicated deep neck infections are identified, appropriate treatment can be

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provided as soon as possible in order to reduce the mortality and morbidity.

In recent years, several reports have described changing trends in Deep neck space abscess over time^{1, 6, 7}. Differences in incidence, age at presentation, sex, anatomical location and infecting organisms are commonly noted (Staphylococcus aureus, Streptococcus, Klebsiella, Pseudomonas, E. coli etc.). The most crucial issue is perhaps increasing microbial resistance.

The present study is designed to find out the etiology of deep neck infection, their predisposing factors and determination of causative organisms. The study result will be implicated in early diagnosis of deep neck infection,

Materials and Methods:

Overview of study design was cross sectional study having analytical component. Place of Study were Department of oral and Maxillofacial Surgery, Dhaka Dental College Hospital and Dept. of ENT and Head-Neck Surgery, Dhaka Medical college hospital.

Figure1:- Percentages of the respondents according to age.(n=73)

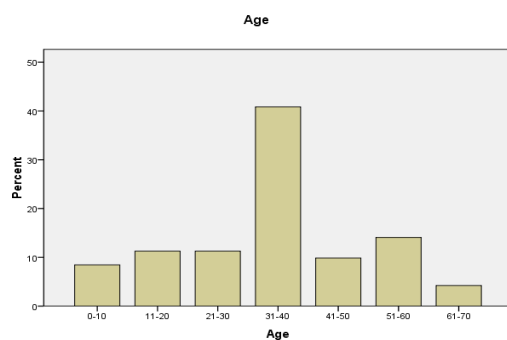


Figure shows highest percentage (38%) patients were between 31-40 years, 12% between 51-60 years. Mean age of the patients 35 year and median 38 years. (n=73)

Study period was January 2010 to March 2011. Inclusion criteria was Patients having deep neck abscess. Exclusion criteria were Patient having infections related to external neck wound (Traumatic or Surgical), having dento-alveolar, preauricular, postauricular, external auditory canal abscesses, Patient refusing to attend regular follow up and refusing to include in the study.

According to exclusion and inclusion criteria patients having deep neck infection will be

assessed. A complete history and physical examination of the patient will be done.

Figure-2: Percentages of respondents according to sex

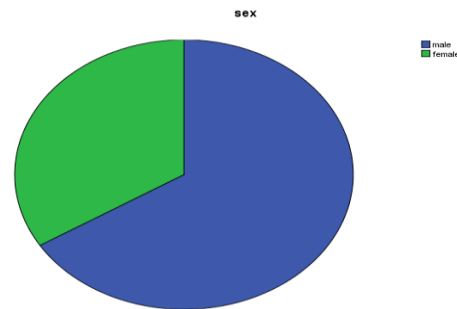
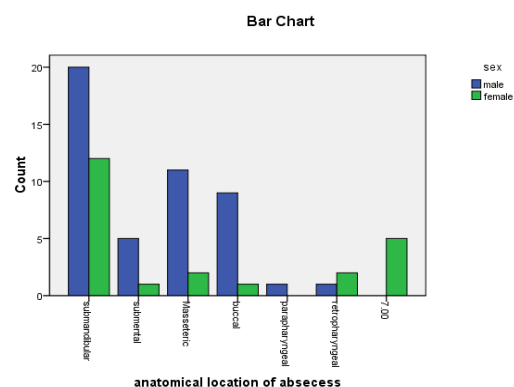


Figure shows sex distribution among the 73 respondents about 67.12% (49) patients are male and rests 32.87% (24) are female.

The following parameter will be noted: age, sex, locations of involved spaces (Submental, submandibular, parapharyngeal, retropharyngeal). Systemic conditions: fever >38°C, chills, neck swelling, neck pain, trismus, dysphagia, dyspnoea, duration of symptoms, WBC >15000 cells/mm³, number of involved spaces (one or two spaces vs. more than two) will be assessed to confirm the diagnosis. Any co-morbid diseases; diabetes mellitus, liver disease, malignant Disease,

Figure-3: Distribution of respondents by anatomical location of abscess.

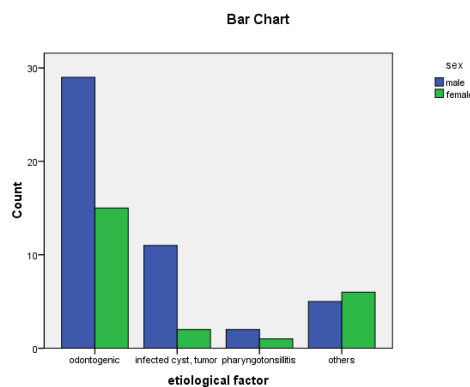


Bar chart shows most of the patients suffered from submandibular abscess 32%. Submental, masseteric, buccal spaces involved more in male than female patients on the other hand female (5%)

Suffered more in retropharyngeal abscess than male (2%). Immunosuppressive disease, renal disease etc will also be assessed to determine the predisposing factor. Causative organisms will be identified according to

microbial test. Etiologies (Odontogenic causes Pharyngotonsillitis and Congenital neck cysts) will also be identified. Sample size and the statistical basis were $n = z^2pq / e^2$, $p=0.05$, $e = .05$, $z= 1.96$ $q = 1- p= 1-0.05= 0.95$ $n=73$ (about). Screening method was clinical examination and laboratory data and sampling method was convenient sampling. Clinical and laboratory data will be recorded. Data was analyzed using the Statistical Soft- ware (SPSS Version 12).

Figure- 4: Bar diagram between sex and etiological factor.



Bar chart shows the etiological factor odontogenic cause between male and female were 29% and 15%, infected cyst 11 and 2 pharyngotonsillitis 2% and 1% . other causes were more in female (5%) than male(4%).

Figure-5: Correlation of anatomical location and organism isolated

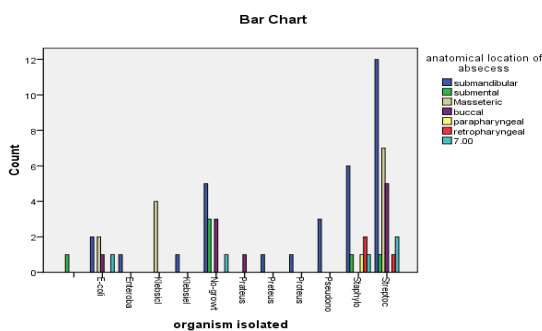


Figure shows abscess in different anatomical location. Staphylococci mainly causes submandibular and klebsiella causes only masseteric abscess.

Result:

The studies were done in Dhaka Dental College and ENT & Head Neck Surgery

department of Dhaka Medical College from January 2010 to March 2011. Patient attending with facial space infection irrespective to age and sex were recruited. Total 73 patients were recruited in this study. Amongst 38% patients were between 31-40 years, 12% between 51-60 years. Mean age of the patients 35 year and median 38 years.(Figure1) Among the respondents 18 (24.65%) patients had no medical illness, highest 33 (45.20%) had anaemia , 15 (20.54%) had diabetes mellitus , 3(4.10%) have liver diseases, 2 (2.74%) have malignant diseases. (Table 1) Among the 73 respondents about 67.12% (49) respondents are male and rests 32.87 %(24) are female (Figure2)

Table-1: Distribution of the respondent according to their medical history(n=73)

		Frequen- cy	Perce- nt	Valid Percent	Cumulitive Percent
Valid	Normal	18	24.65	24.66	69.86
	Anemia	33	45.20	45.20	90.41
	Diabetes mellitus	15	20.54	20.55	93.15
	Malignancy	2	2.73	2.74	97.26
	Liver diseases	3	4.10	4.11	98.63
	Renal diseases	1	1.36	1.37	100
	Immunosuppres- sant	1	1.36	1.37	
Total		73	99.94	100	100

Table shows among the respondents 18 (24.65%) patients had no medical illness, highest 33 (45.20%) had anemia , 15 (20.54%) had diabetes mellitus , 3(4.10%) have liver diseases, 2 (2.74%) have malignant diseases

Highest number of 51 (69.86%) patients had moderate inflammation, glazing, redness, edema and/or hypertrophy of the marginal or papillary gingival unit ,14 (19.1%) had severe inflammation; marked redness, edema, and/or hypertrophy of the marginal or papillary gingival unit, spontaneous bleeding, congestion or ulceration , 3 (4.1%) had mild inflammation; criteria as above but involving the entire marginal or papillary gingival unit and 2(2.7%) had no inflammation (Table 2)Most of the patients suffered from submandibular abscess 32% . submental,

masseteric, buccal spaces involved more in male than female patients on the other hand female (5%) suffered more in retropharyngeal abscess than male (2%).(Figure 3)66 (90.41%) respondent had involved only one space, 5(6.84%) had two spaces and only 2(2.8%) patient had more than two space involvement.(Table 3)

Regarding the etiological factor odontogenic cause between male and female were 29% and 15% infected cyst 11 and 2 pharyngotonsillitis 2% and 1%. Other causes were more in female (5%) than male (4%). (Figure 4)Most commonly isolated organism are Streptococci 28(39.4%) and staphylococci 11(15.5%) than E.coli 7 (9.9%), klebsiella 5 (7%), pseudomonas 3 (4.2%). 12 patients had failed to reveal any growth (Table 4) Most of the submandibular abscess were due to odontogenic causes which is statistically significant. P- 0.00. (Table5)

Organism in abscess in different anatomical location are staphylococci mainly causes submandibular and klebsiella causes only masseteric abscess.(Figure5) Streptococci were most common isolated organism of all etiological cases. Staphylococci were mostly due to odontogenic and pharyngotonsillitis causes. (Table 6)

Discussion

Deep neck abscesses are less common today than in the past. In the present era of antibiotics most neck infection can be cured by medical treatment. However, some may still result in fatal complications. Recent studies have shown that there are changing trends in the causes, bacteriologic findings, diagnosis and management of deep neck abscesses. This paper describes the recent clinical trends, etiology, microbiology of deep neck abscesses in our hospital.

There is no age limitation for neck abscess. Neck abscesses occur in a wide range of age group as shown in this series. More than fifty percent of our patients were of the younger age group (below 40 years old). In a study of Rahman KL⁸ in BSM Medical University showed that the highest percentage of orofacial infection patient are of age group of 31-40 years. Haque MM⁹ showed the incidence of Ludwig's angina was of 3rd to 4th decades of

life. These results and present study reflects the age limit of orofacial and neck infection of Bangladeshi people. Among the respondents of this study about 65% patients are male and 35% are female which also coincides with the above mentioned study of Bangladeshi people. The anatomy of neck is a complex structure composed mainly of different fascial space. Infection of the oropharynx involves these space first and then spread from one space to another. The most important fascial space of neck are submandibular, parapharyngeal and retropharyngeal. Among the potential spaces submandibular space was the most common single space involved. In our study, the most common space involved in the neck abscess were the submandibular which constituted 32% of our cases, similar to results by Afshin and Gady¹⁰ when they reviewed 210 cases of deep neck abscess. Scaglione M¹¹ describe retrospectively that submandibular space was the most common (85.9%) involved space (2000-2006).

This study shows 66 (93%) respondent had involved only one space, 3(4.2%) had two spaces and only 2(2.8%) patient had more than 2 space involvement. The parapharyngeal, submandibular and masticator spaces were statistically more frequently involved in odontogenic than in nonodontogenic deep neck space infection. Daramola OO et al.¹² studied a case series with chart review between 2001 and 2006.They found that dental infections were the most cause of deep neck abscesses (49.1%).. Therefore proper dental examination is warranted in these patients.

Regarding the etiological factors odontogenic cause was the highest comprises 60% of the total subjects. Odontogenic cause between male and female were 29% and 15%, infected cyst 11% and 2%, pharyngotonsillitis 2% and 1% other causes were more in female (5%) than male (4%). Mariano G¹³ analysed retrospectively 85 cases of deep neck space infection with dental origin out of 206 consecutive cases of deep neck infection diagnosed in their institution between 2000 to 2006. They concluded that most frequent dental source was periapical infection of the first mandibular molar, followed by second and third molar, respectively. Chen KC⁴ retrospectively reviewed odontogenic infection and the upper airway infections were the 2 leading cause of deep neck infection.

Table-2 : Distribution of the respondents according to oral hygiene index.(n=73)

Status of oral hygiene		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Absence of inflammation	2	2.7	2.8	6.92
	Mild inflammation; slight change in color, little change in texture of any portion of the marginal or papillary gingival Unit.,	3	4.1	4.12	11.04
	Mild inflammation; criteria as above but involving the entire marginal or papillary gingival unit.,	3	4.1	4.12	80.9
	Moderate inflammation; glazing, redness, edema and/or hypertrophy of the marginal or papillary gingival unit.	51	69.86	69.86	100
	Severe inflammation; marked redness, edema, and/or hypertrophy of the marginal or papillary gingival unit, spontaneous bleeding, congestion or ulceration.	14	19.1	19.1	
Total		73	99.86	100	100

Table represent highest number of 51 (69.86%) patients had moderate inflammation, glazing, redness, edema and/or hypertrophy of the marginal or papillary gingival unit. 14 (19.1%) had severe inflammation; marked redness, edema, and/or hypertrophy of the marginal or papillary gingival unit, spontaneous bleeding, congestion or ulceration, 3 (4.1%) had mild inflammation; criteria as above but involving the entire marginal or papill

Table-3: Distribution of respondents by involvement of number of spaces.(n=73)

	Number of involved space	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	One Space	66	90.41	90.4	97.2
	Two space	5	6.84	6.8	100
	More than two	2	2.7	2.8	
Total		73	99.95	100	100

Shows 66 (90.41%) respondent had involved only one space, 5(6.84%) had two spaces and only 2(2.8%) patient had more than two space involvement

Table-4: Distribution of the respondents according to isolated organism (n=73)

Organism isolated	Frequency	Percent	Valid Percent	Cumulative Percent
E-coli	8	9.87	9.88	11.12
Enterobactreoce	1	1.23	1.24	17.3
Klebsiella	5	6.17	6.18	32.12
No-growth	12	14.81	14.82	35.82
Fusobacterium	3	3.70	3.70	39.52
Proteus	3	3.70	3.70	44.45
Pseudomonus	4	4.93	4.93	59.26
Staphylococcus	12	14.81	14.81	100
Streptococcus	33	40.74	40.74	
Total	81	99.96	100	100

Table shows that most commonly isolated organism are streptococci 28(39.4%) and staphylococci 11(15.5%) than E.coli 7 (9.9%), klebsiella 5 (7%), pseudomonas 3 (4.2%), 12 patients had failed to reveal any growth.

Table-5:Cross tabulation between anatomical location of abscess and etiological factors

Etiologic factors	Anatomical location of abscess							Total
	Sub-Mandibular	Sub-mental	Masseteric	Buccal	Para-pharyngeal	Retro-pharyngeal	Others	
Odontogenic	31	0	8	4	0	0	1	44
Infected cyst, tumor	0	2	5	4	0	0	2	13
Pharyngotonsillitis	0	0	0	0	1	2	0	3
Others	1	4	0	5	0	1	2	13
Total	32	6	13	13	1	3	5	7

Most of the submandibular abscess were due to odontogenic causes which is statistically significant. P- 0.00.

Table- 6: Cross tabulation between etiological factors and isolated organisms .

Organisms	Etiological factors				Total
	Odontogenic	Infected cyst, tumor	Pharyngotonsillitis	Others	
E-coli	4	1	0	3	8
Enterobaeterioce	1	0	0	0	1
Klebsiella	5	0	0	0	5
No- growth	7	1	0	4	12
Fusobacterium	1	0	2	0	3
Proteus	1	0	2	0	3
Pseudomonus	3	0	1	0	4
Staphylococcus	6	0	4	2	12
Streptococcus	17	12	2	2	33
Total					81

Table show that streptococci were most common isolated organism of all etiological cases. Staphylococci were mostly due to odontogenic and pharyngotonsillitis causes. .

Medical illness may predispose to the deep neck infection among them diabetes melitus, anemia, immunosuppressive condition, liver diseases and renal diseases are the most common. This would predispose them to infections which may lead to an abscess despite antibiotic treatment. Among the respondents of this study 18 (22.1%) patients had no medical illness, highest 33 (46.5%) had anemia, 15 (21.15%) had diabetes mellitus, 3 (4.2%) have liver diseases, 2 (2.85%) have malignant diseases. Hidaka H¹⁴ showed diabetes was associated with higher prevalence of multispace spread of infection, complications, and failure to identify pathogenesis, with risk ratios (RRs) of 1.96, 2.42, and 1.29, respectively. This results differs with the present study may be due to the poor nutritional status of the Bangladeshi people.

This data considering the oral hygiene index revealed 51(71.8%) patients have moderate inflammation, glazing, redness, edema and/or hypertrophy of the marginal or papillary gingival unit, 14(19.7%) have severe inflammation; marked redness, edema, and/or hypertrophy of the marginal or papillary gingival unit, spontaneous bleeding, congestion or ulceration , 3(4.2%) have mild inflammation; criteria as above but involving the entire marginal or papillary gingival unit and 2 have no inflammation. From this results it can be correlate that poor oral hygiene index predisposes to odontogenic cause of deep neck abscess. This condition can be prevented by maintaining good oral hygiene at personal level of the patient.

This studies have quoted that Streptococcus, Staphylococcus and klebsiella are the most common organism isolated in cases of neck abscess. Aziz SR et al.¹⁵ Gram positive cocci and gram negative rods had the greatest growth percentage in cultures. Streptococcus viridans is the most commonly isolated organism in non-diabetic group and Klebsiella pneumoniae was the most common organism in diabetic group. This results match with the result of Chen KC⁴. In one study of 847 patients with peritonsillar abscess, Fusobacterium necrophorum was the most commonly detected species (23 percent), followed by S. pyogenes (17 percent), and group C or G streptococci (5 %) by Ehlers KT¹⁶. Actinomyces species are abundant on the dental plaque, and such organisms are frequently present in odontogenic cervical fascial space infections. The predominant species is actinomyces israelii according to a case report of Jones JE¹⁷ as a deep neck infection. In contrast to those of dental origin, infections arising from the pharynx frequently contain oral anaerobes and facultative streptococci, particularly streptococcus pyogenes.

Hee Dk ¹⁸ reviewed predisposing factors of complicated deep neck infection of 158 cases and stated that the most common causes of deep neck infections was odontogenic (19 cases ,12%) followed by pre- existing congenital neck cyst (10 cases, 6.3%) and most common pathogens was klebsiella (13.7%) followed by streptococcus viridans (12.3%) methicillin sensitive streptococcus aureus (11%) and haemolytic streptococcus (8.2%) mixed infection 9.6%. most common

predisposing factors was diabetes mellitus followed by liver disease and malignancies. In present study klebsiella comprises only 6.17% which varies with the study of Hee DK¹⁸ may be due to the variations of medical illness.



Picture 1: Left submandibular spaceinfection. Picture 2 : Left buccal and infraorbital space infection. Picture 3 : Left buccal space infection. Picture 4. Left submental and buccal space infection

This study concluded that bacterial infections of the head and neck remain a major health hazard among the respondent with spread of infection commonly involving the submandibular and buccal spaces. Maintenance of oral hygiene and regular dental checkup can prevent this devastating conditions

Conclusion:

The present study investigate the factors that aggravate deep neck infection. Males were more prone to develop deep neck infection. Oral disorders like odontogenic infection has a strong role for developing neck infection. Oral hygiene predisposes to odontogenic cause. Anemia may be due to poor nutritional status is the medical problem of this patient group. Though in most of the studies diabetes mellitus is the most significant for developing deep neck infection but it is not proved in this random sample. It requires further study on diabetes mellitus patient of Bangladesh. Poor oral hygiene status strongly correlate neck infection which subsequently fall in odontogenic cause. In this regard patient

motivation regarding oral hygiene maintenance and general dentist has an important role to prevent deep neck infection. By making an early diagnosis and choice of antibiotic according to the common microbial pattern of Bangladeshi people treatment and addressing the patient's underlying disease we can then avoid complications and reduce the mortality rate of neck abscess. Further study with higher sample size and logistic support requires to investigate to avoid the devastating condition of deep neck infection.

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