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Assessment of Bacteriological Pattern and Antimicrobial Susceptibility in Deep Neck Space Abscess

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Abstract

Background: Deep neck abscess is a common clinical entity in developing countries like ours. Despite the widespread use of antibiotics, deep neck infections do not disappear and remain one of the most difficult emergencies encountered in daily clinical practice. The extent and severity of the illness could become life-threatening. Therefore, coping with deep neck abscess remain a challenge to otolaryngologists. This study aimed to analyze the bacteriological pattern and antimicrobial susceptibility in deep neck space abscesses. **Material & Methods:** It was a cross-sectional observational study. 50 patients with deep neck space abscesses fulfilling the inclusion and exclusion criteria admitted to the department of ENT & Head Neck Surgery, Rangpur Medical College Hospital, Rangpur, from 1st July 2017 to 30th December 2017 were enrolled in this study. Pus from deep neck space abscess was collected by either aspiration or incision and drainage with proper aseptic measure and sent by sterile test tube to microbiology department immediately. Data were collected by detailed history taking and clinical examination & investigations with informed written consent and analyzed by SPSS (version 20). **Results:** In this study most commonly involved deep neck spaces were Submandibular (38%), Peritonsillar (32%), Retropharyngeal (14%), and parapharyngeal (8%) spaces. Streptococcus viridans was the most prominent organism 14 (28%) followed by Klebsiella pneumonia 9(18%) and Staph. aureus 4 (8%). The most effective antibiotic was Ceftriaxone 34(79%) followed by Cefuroxime 30 (70%) and Erythromycin 23(54%). Aerobic organisms were highly sensitive to Cefuroxime (83%) and Ceftriaxone (83%) followed by Erythromycin (48%). Anaerobic organisms were sensitive to Clindamycin (100%), Metronidazole (100%), and Erythromycin (100%) followed by Ceftriaxone (75%). **Conclusion:** The most frequently isolated organism in deep neck space abscesses were Streptococcus viridans and Staphylococcus aureus and sensitivity results showed the majority of isolates are susceptible to Ceftriaxone and Cefuroxime.

Keywords:- Deep neck abscess, Bacteriology, Sensitivity, Resistance.

INTRODUCTION

A deep neck abscess is defined as a collection of pus in the fascial planes & spaces of the head and neck.[1] Since 1836, when Wilhelm Friedrich Von Ludwig 30 described the so-called Ludwig Angina, many discussions & studies on deep neck infection and abscess have taken place.[2] The deep cervical fascia has three layers- superficial, middle, and deep which can be

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thought of as defining a series of cylindrical compartment that extends longitudinally from the base of the skull to the mediastinum. The spaces enclosed by these three layers of deep fascia are called deep neck spaces among which submandibular, parapharyngeal, peritonsillar, masticator and temporal, parotid, retropharyngeal, danger, prevertebral, visceral vascular, anterior visceral spaces are clinically important.[3] Deep neck space abscess poses various challenges to the treating surgeon as it lies deep in the neck and near the neurovascular structures, mediastinum, and skull base. These infections may rapidly spread and can cause fatal respiratory obstruction. Various spaces may intercommunicate facilitating the spread of infection.[4] Life-threatening complications include Ludwig's angina, descending mediastinitis, septic shock, upper airway obstruction, jugular vein thrombosis, septic embolus, pleural empyema, pseudo aneurysm or rupture pleural empyema, pericarditis, pericardial effusion, aortic pulmonary fistula, adult respiratory distress syndrome, acute renal failure, epidural abscess, and disseminated intravascular coagulation etc.[5,6] To cope with this, empiric antibacterial therapy must be started along with adequate drainage of pus as culture sensitivity results require several days or longer to be obtained. It will be helpful if we have recent data on bacteriological patterns and antimicrobial susceptibility in deep neck abscesses. Previous studies showed that the most commonly involved spaces are submandibular, parapharyngeal, peritonsillar, masticator, anterior cervical, and retropharyngeal space.[7,8,9] Mixed flora of aerobes and anaerobes are encountered in neck abscess.[10] Commonly isolated aerobes are Streptococcus viridans, Staphylococcus aureus, Klebsiella pneumonia, Proteus sp, E. coli, and Pseudomonas.[1,5,7,8] Anaerobes are Prevotella, Peptostreptococcus, Bacteroides, and Fusobacterium.[4,11,12] Widely used antibacterial agents are Penicillin, 2nd and 3rd generation Cephalosporin, Ciprofloxacin, Gentamycin, Clindamycin, and Metronidazole.[2,6,7,13] Due to inappropriate and indiscriminate use of antibiotics now the most crucial issue is perhaps increasing microbial resistance.[6,13] Antimicrobial resistance is now a globally worrisome issue. New resistance mechanisms are emerging and spreading globally, threatening our ability to treat common infectious diseases, resulting in prolonged illness, disability, and death. Antimicrobial resistance occurs naturally over time, usually through genetic changes. However, the misuse and overuse of antimicrobials are accelerating this process. In many places, antibiotics are overused and misused in people and animals, and often given without professional oversight.[14] Few studies showed that conventional antimicrobial agents are resistant in many cases.[15,16] For this reason, the selection of empiric antibiotics in deep neck abscesses is difficult for a clinician. Frequent study is necessary to gather knowledge of common pathogens and recent resistance status which will guide clinicians toward the appropriate selection of empirical antibiotics. So the study is aimed to demonstrate the causative micro-organism and to study the sensitivity pattern of the isolated micro-organism to antimicrobial-agent.

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Objective

General Objective

- To assess the bacteriological pattern and antimicrobial susceptibility in deep neck space abscess.

Specific Objectives

- To identify the bacteriological pattern of deep neck space abscess.
- To evaluate the antimicrobial susceptibility in deep neck abscesses.
- To find out the mostly affected deep neck spaces.

MATERIAL AND METHODS

It was a cross-sectional observational study. 50 patients with deep neck space abscesses fulfilling the inclusion and exclusion criteria admitted to the department of ENT & Head Neck Surgery, Rangpur Medical College Hospital, Rangpur, from 1st July 2017 to 30th December 2017 were enrolled in this study. Pus from deep neck space abscess was collected by either aspiration or incision and drainage with proper aseptic measure and sent by sterile test tube to microbiology department immediately. Collected pus was inoculated on blood agar and MacConkey`s agar media. The culture media were incubated aerobically and anaerobically at 37oc up to 48 hours. After incubation, the plates were examined for the growth of any suspicious organism. The isolated organisms were stained by gram stain and a morphological study was done. Then the organism was identified by observation of the pattern of hemolysis on blood agar media, motility test, and standard biochemical test. Subsequently, then the antibiotic sensitivity test was done by disk diffusion method. The organism pattern and their sensitivity to antibiotics were tabled based on the culture and sensitivity reports. All information was endorsed in the datasheet. Data were collected by detailed history taking and clinical examination & investigations with informed written consent and analyzed by SPSS (version 20).

Inclusion Criteria

- Patient with deep neck space abscess.
- Both male and female patients
- Patients of all ages.
- Patients who had given written consent to participate in the study.

Exclusion Criteria

- Superficial neck abscess that extends into the deep spaces.
- Patients who did not give consent to participate in the study.

RESULTS

The most commonly involved deep neck spaces are Submandibular (38%), Pertonsilar(32%), Retropharyngeal(14%), and parapharyngeal (8%) space. [Table 1]

Table 1: Distribution of affected deep neck spaces (N=50).

Deep neck space	N	%
Submandibular space	19	38
Peritonsilar space	16	32

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Retropharyngeal space	7	14
Parapharyngeal space	4	8
Parotid space	2	4
Masticator space	1	2
Anterior visceral space	1	2
Total	50	100

Table 2: Microorganism identified in deep neck space abscess (N=50)

Name of bacteria	**N**	**%**
Aerobic	29	58
Streptococcus viridens	14	28
Klebsiella pneumoniae	9	18
Staphylococcus aureus	4	8
Hemophilus influenza	1	2
Streptococcus β-hemolytic	1	2
Anaerobic	4	8
Peptostreptococcus	2	4
Prevotella	1	2
Bacteroides	1	2
Mixed growth	9	18
No growth	8	16

In this study Streptococcus viridans was the most prominent organism 14 (28%) followed by Klebsiella pneumonia 9(18%) and Staph. aureus 4 (8%). [Table 2]

Table 3: Microorganisms isolated and their antibiotic sensitivity (N=50)

Bacteria	**Strain**	**Cip**	**Amox**	**Clox**	**Cefu**	**Ceft**	**Clind**	**Gent**	**Metr**	**Eryth**
S. viridens	14	5	4	6	12	12	3	4		7
Klebsiella	9	4	0	0	7	8	4	3		5
S. aurieus	4	2	0	3	3	2	0	2		1
β-hemolytic streptococcus	1	1	0	0	1	1	1	0		0
H. influenzae	1	0	0	1	1	1	0	0		1
Peptostrepto-coccus	2	0	0	0	0	1	2	0	2	2
Prevotella	1	1	0	0	1	1	1	0	1	1
Bacteroides	1	0	0	0	1	1	1	0	1	1
Mixed growth	9	2	0	1	4	7	4	3	4	5
No growth	8									
Total	50	15	4	11	30	34	16	12	8	23

Cip=Ciprofloxacin, Amox=Amoxicillin, Clox=Cloxacillin, Cefu=Cefuroxime, Ceft=Ceftriaxone Clind=Clindamycin, Gent=Gentamycin, Metr=Metronidazole, Eryth=Erythromycin,

The most effective antibiotic was Ceftriaxone 34(79%) followed by Cefuroxime 30 (70%) and Erythromycin 23(54%). [Table 3]

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Table 4: Antibiotic sensitivity pattern of aerobic and anaerobic strains. (N=50)

Antibiotics	Microbes			
	Aerobes		Anaerobes	
	Number	(%)	Number	(%)
Ciprofloxacin	12	41	1	25
Amoxycillin	4	13	0	0
Cloxacillin	10	34	0	0
Cefuroxime	24	83	2	50
Ceftriaxone	24	83	3	75
Clindamycin	8	27	4	100
Gentamycin	9	31	0	0
Metronidazole	-	-	4	100
Erythromycin	14	48	4	100

Aerobic organisms are highly sensitive to Cefuroxime (83%) and Ceftriaxone (83%) followed by Erythromycin (48%). Anaerobic organisms are sensitive to Clindamycin (100%), Metronidazole (100%), and Erythromycin (100%) followed by Ceftriaxone (75%). [Table 4]

DISCUSSION

Treatment of deep neck space abscesses remains a challenge to the surgeon over the centuries. Newer imaging modalities and surgical techniques greatly improve the outcome but drug resistance appears as a new threat in the management field. Numerous studies showed evidence of an increasing number of multidrug-resistant bacteria which bears great concern to developing countries because of increased morbidity, mortality, and healthcare cost.[17] In this study among 50 cases, the most frequently involved space was submandibular (38%) followed by peritonsillar space (32%) and retro pharyngeal space (14%). This result is supported by previous studies.[4,6,7,10] Other involved spaces were parapharyngeal(8%), parotid(4%), masticator(2%), anterior visceral space(2%). Prakash BG et al,[4] reported in their study of 50 subjects, 11 were Ludwig angina, 8 were submandibular abscesses, 10 were peritonsillar, 7 were diffuse neck abscesses, 5 were parotid, 4 were parapharyngeal and 2 were retropharyngeal abscess. Eighty-four percent of our bacterial cultures were positive. Nine positive cultures were polymicrobial (18%). When the normal flora of the head and neck region is introduced into a sterile site of the body and results in the formation of an abscess, the bacteriologic pattern is usually polymicrobial including aerobes, facultative aerobes, and anaerobes.[18] Eight bacterial cultures (16%) had no growth of any bacteria. Negative culture results may be due to the liberal use of antimicrobial agents before admission or intravenous antibiotic treatment.[9,19] Aerobes were isolated in 29 cases (58%) and anaerobes in 4 cases (8%). These results were consistent with the previous study.[2,11,13] i.e. In a prospective study of deep neck abscesses of 57 patients Sennes et al,[2] found 20.8% mixed growth, 28.3% no growth, 67.9% aerobic, and 13.3% anaerobic organism. Our data revealed that the most common aerobe was Streptococcus viridans(28%), and the

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second and third ones were Klebsiella pneumonia(18%) and Staphylococcus aureus (8%). The most commonly isolated anaerobes found were Prevotella (2%) and Bacteroides (2%). These results were similar to the results obtained previously.[5,7,11] i.e. In one study of 3 patients with deep neck infection Streptococcus viridans (39.4%) was the most commonly isolated organism followed by Staphylococcus aureus (15.5%), Klebsiella (7%) Sultana F et al.[5] In our study, most of the aerobic organisms showed sensitivity to Cefuroxime(83%) and Ceftriaxone(83%) which means second and third-generation Cephalosporin. 48% of organisms showed sensitivity to Erythromycin and 41% to Ciprofloxacin. Fewer showed sensitivity to Cloxacillin, Gentamycin, and Clindamycin. The lowest percentage of organisms showed sensitivity to Amoxycillin. Almost all S. viridans and K. pneumonia were sensitive to Cefuroxime and Ceftriaxone. S. aureus was equally sensitive to Cloxacillin and Cefuroxime. These results are in concordance with the study done by Mahalle et al,[13] where they found 100% susceptibility for Ceftriaxone and Amikacin and 95% for Cefuroxime. All anaerobic organisms showed sensitivity to Clindamycin, Metronidazole, and Erythromycin. Two-thirds of organisms showed sensitivity to Ceftriaxone. In a study of anaerobic infection and sensitivity pattern in neck abscesses Prakash BG et al,[4] concluded that Erythromycin, Gentamycin, and Cephalosporin sensitive to most aerobes and Metronidazole, Clindamycin effective against anaerobes. Some other studies also supported that.[6,12] Ceftriaxone and Cefuroxime were effective against most organisms except Peptostreptococcus. Erythromycin also was sensitive against all types of the organism except β-hemolytic streptococci. Ciprofloxacin showed no sensitivity against H. influenza. Peptostreptococcus and Bacteroides. Cloxacillin was sensitive in a few cases with S. viridans. Most of S. aureus and H. influenza. Gentamycin was sensitive against a few cases of S. viridans, K. pneumonia, and S. aureus. For mixed growth, the most effective single antibiotic was Ceftriaxone followed by Erythromycin.

Limitations of the Study

The study was conducted in a single hospital with a small sample size. So, the results may not represent the whole community. Moreover, Immunocompromised patients such as patients with diabetes mellitus, and CKD were not included in this study.

CONCLUSIONS

This study concluded that various microorganisms, both aerobic and anaerobic, are involved in deep neck space abscesses. In this study regarding the microorganism, Streptococcus viridans is the commonest aerobe and Peptostreptococcus is the commonest anaerobe and Ceftriaxone is still the most sensitive antibiotic. This study was carried out over a short period and with a small number of patients. So, further study with a larger number of samples and a longer period is recommended to get a more accurate result.

Recommendation

Deep neck space infection is common in our country mostly among the poorer group. The microbiology of deep neck infection might change with time and the resistance to antibiotics might influence the selection of empiric antibiotics. So, further studies should

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Page no- 249-255 | Section- Research Article (ENT)

be conducted involving a large sample size and multiple centers in this regard.

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