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

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Abstract
Deep neck abscess is a prevalent clinical phenomenon in poor nations like ours. Despite the extensive use of antibiotics, deep neck infections do not disappear and remain one of the most challenging crises faced in everyday clinical practice. The scope and severity of the sickness could become life-threatening. Therefore, coping with deep neck abscess remain a problem to otolaryngologists. This study aims to evaluate the bacteriological pattern and antimicrobial susceptibility in deep neck space abscesses. It was a cross-sectional observational research. 70 patients with deep neck space abscesses fulfilling the inclusion and exclusion criteria admitted to the department of ENT and Head Neck Surgery, from 1st July 2022 to 30th December 2023 were enrolled in this study. Pus from deep neck space abscess was collected by either aspiration or incision and drainage with suitable aseptic precaution and delivered via sterile test tube to microbiology department promptly. Data were acquired by complete history gathering and clinical examination and investigations with informed written consent and analyzed by SPSS (version 20). In this study most typically implicated deep neck areas 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 very susceptible to Cefuroxime (83%) and Ceftriaxone (83%) followed by Erythromycin (48%). Anaerobic organisms were responsive to Clindamycin (100%), Metronidazole (100%), and Erythromycin (100%) followed by Ceftriaxone (75%). The most frequently isolated organism in deep neck space abscesses were Streptococcus viridans and Staphylococcus aureus and sensitivity data showed the majority of isolates are responsive to Ceftriaxone and Cefuroxime.

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Key Words
Deep neck abscess, bacteriology, sensitivity, resistance

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INTRODUCTION

A deep neck abscess is characterized as a collection of pus in the fascial planes and spaces of the head and neck[1]. Since 1836, when Wilhelm Friedrich Von Ludwig 30 reported the so-called Ludwig Angina, many discussions and investigations on deep neck infection and abscess have taken place[2]. The deep cervical fascia contains three layers-superficial, medium and deep which can be thought of as defining a series of cylindrical compartment that stretches longitudinally from the base of the head to the mediastinum. The spaces covered 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 provides many complications to the treating surgeon since it resides deep in the neck and near the neurovascular systems, mediastinum and skull base. These infections may rapidly spread and can cause deadly respiratory obstruction. Various areas may intercommunicate promoting 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 medication must be initiated simultaneously with proper drainage of pus as culture sensitivity results require several days or more to be obtained. It will be beneficial if we had new data on bacteriological trends and antibacterial susceptibility in deep neck abscesses. Previous investigations showed that the most usually implicated spaces include submandibular, parapharyngeal, peritonsillar, masticator, anterior cervical and retropharyngeal region[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 incorrect and indiscriminate usage of antibiotics now the most critical concern is perhaps increasing microbial resistance[6,13]. Antimicrobial resistance is now a worldwide worrying topic. New resistance mechanisms are evolving and spreading internationally, endangering our ability to treat common infectious diseases, resulting in extended sickness, disability and death. Antimicrobial resistance emerges spontaneously over time, usually through genetic alterations. However, the misuse and overuse of antimicrobials are expediting this process. In many regions, antibiotics are overused and mistreated in people and animals and sometimes provided without expert oversight[14]. Few investigations indicated that traditional antibacterial drugs are resistant in many circumstances[15,16]. For this reason, the selection of empiric antibiotics in deep neck abscesses is problematic for a clinician. Frequent investigation is important to gain knowledge of common infections and recent resistance status which will assist clinicians toward the optimal use of empirical antibiotics. So the study is targeted to demonstrate the causal micro-organism and to analyze the sensitivity pattern of the isolated micro-organism to antimicrobial-agent.

MATERIALS AND METHODS

It was a cross-sectional observational research. 70 patients with deep neck space abscesses fulfilling the inclusion and exclusion criteria admitted to the department of ENT and Head Neck Surgery. Pus from deep neck space abscess was collected by either aspiration or incision and drainage with suitable aseptic precaution and delivered via sterile test tube to microbiology department promptly. Collected pus was inoculated on blood agar and MacConkey`s agar media. The culture media were incubated aerobically and anaerobically at 37ºC up-48 hours. After incubation, the plates were checked for the growth of any suspicious organism. The isolated organisms were stained by gram stain and a morphological analysis was done. Then the organism was identified by observation of the pattern of hemolysis on blood agar media, motility test and routine biochemical test. Subsequently, then the antibiotic sensitivity test was done by disk diffusion method. The organism pattern and their susceptibility to antibiotics were tabled based on the culture and sensitivity reports. All information was endorsed in the datasheet. Data were acquired by complete history gathering and clinical examination and 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 AND DISCUSSIONS

The most commonly involved deep neck spaces are Submandibular (39.2%), Peritonsillar (33.6%), Retropharyngeal (15.3%) and parapharyngeal (9.2%) space. [Table 1]

In this study Streptococcus viridans was the most prominent organism 19 (29.3%) followed by Klebsiella pneumonia 10(19.4%) and Staph. aureus 5 (9.1%). [Table 2]

The most effective antibiotic was Ceftriaxone 43(80.3%) followed by Cefuroxime 38 (71.6%) and Erythromycin 31(55.5%). [Table 3]

Ceft=Ceftriaxone Clind=Clindamycin, Gent=Gentamycin, Metr=Metronidazole, Eryth=Erythromycin 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]

Treatment of deep neck space abscesses remains a challenge to the surgeon over the decades. Newer imaging modalities and surgical techniques considerably improve the outcome yet drug resistance develops as a new concern in the management sector. Numerous research demonstrated evidence of an increasing number of multidrug- resistant bacteria which carries tremendous worry to developing countries because of increased morbidity, mortality, and healthcare expenditure[17]. In this study among 50 instances, the most often involved space was submandibular (38%) followed by peritonsillar space (32%) and retro pharyngeal region (14%). This outcome is backed by earlier studies[4,6,710]. Other affected spaces included parapharyngeal(8%), parotid(4%), masticator(2%), anterior visceral space(2%). Prakash BG[4] observed in their study of 70 cases, 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 typical flora of the head and neck region is introduced into a sterile place of the body and results in the formation of an abscess, the bacteriologic pattern is frequently polymicrobial containing aerobes, facultative aerobes, and anaerobes[18]. Eight bacterial cultures (16%) exhibited no development of any bacteria. Negative culture results may be attributable to the extensive use of antimicrobial drugs before admission or intravenous antibiotic treatment[9,19]. Aerobes were isolated in 29 instances (58%) and anaerobes in 4 cases (8%). These results were consistent with the earlier study[2,11,13]. i.e. In a prospective investigation of deep neck abscesses of 57 patients Sennes[2] reported 20.8% mixed growth, 28.3% no growth, 67.9% aerobic and 13.3% anaerobic organism. Our results revealed that the most prevalent aerobe was Streptococcus viridans (28%), while the second and third ones were Klebsiella pneumonia (18%) and Staphylococcus aureus (8%). The most commonly isolated anaerobes discovered were Prevotella (2%) and Bacteroides (2%). These results were identical to the results reported earlier[5,7,11]. i.e. In one investigation of 3 patients with deep neck infection Streptococcus viridans (39.4%) was the most usually isolated bacterium followed by Staphylococcus aureus (15.5%), Klebsiella (7%) Sultana[5] In our investigation, most of the aerobic organisms showed sensitivity to Cefuroxime (83%) and Ceftriaxone (83%) which signifies second and third-generation Cephalosporin. 48% of organisms showed sensitivity to Erythromycin and 41% to Ciprofloxacin. Fewer demonstrated sensitivity to Cloxacillin, Gentamycin, and Clindamycin. The lowest percentage of organisms demonstrated susceptibility to Amoxycillin. Almost of S. viridans and K. pneumonia were susceptible to Cefuroxime and Ceftriaxone. S. aureus was equally responsive to Cloxacillin and Cefuroxime. These results are in concordance with the study done by Mahalle[13] where they observed 100% susceptibility for Ceftriaxone and Amikacin and 95% for Cefuroxime. All anaerobic organisms demonstrated sensitivity to Clindamycin, Metronidazole and Erythromycin. Two-thirds of organisms demonstrated sensitivity to Ceftriaxone. In a research on anaerobic infection and sensitivity pattern in neck abscesses Prakash[4] reported that Erythromycin, Gentamycin and Cephalosporin sensitive to most aerobes and Metronidazole, Clindamycin effective against anaerobes. Some additional investigations also supported that[16,2]. Ceftriaxone and Cefuroxime were effective against most species except Peptostreptococcus. Erythromycin also was sensitive against all forms of the bacterium except ß-hemolytic streptococci. Ciprofloxacin exhibited little 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. The investigation was conducted in a single hospital with a modest sample size. So, the findings may not represent the total community. Moreover, Immuno

Table 1: Distribution of affected deep neck spaces (N=70).

Deep neck space	N	percentage
Submandibular space	24	39.2
Peritonsillar space	21	33.6
Retropharyngeal space	9	15.3
Parapharyngeal space	6	9.2
Parotid space	4	5.4
Masticator space	3	3.1
Anterior visceral space	3	3.1
Total	70	100

Table 2: Microorganism identified in deep neck space abscess (N=70)

Name of bacteria	N	percentage
Streptococcus viridens	19	29.3
Klebsiella pneumonia	10	19.4
Staphylococcus aureus	5	9.2
Hemophilus influenza	2	2.8
Streptococcus ß-hemolytic	2	2.8
Peptostreptococcus	3	5.3
Prevotella	3	2.8
Bacteroides	2	2.8
Mixed growth	12	17.1
No growth	12	17.1

Table 3: Microorganisms isolated and their antibiotic sensitivity (N=70)

Bacteria	Strain	Cip	Amox	Clox	Cefu	Ceft	Clind	Gent	Metr	Eryth
S. viridens	19	6	6	7	13	13	4	5		8
Klebsiella	10	5	0	0	8	9	5	4		6
S. aurieus	5	3	0	4	4	3	0	3		2
ß-hemolytic streptococcus	2	2	0	0	2	2	2	0		0
H. influenzae	2	0	0	2	2	2	0	0		2
Peptostrepto-coccus	3	0	0	0	0	2	3	0	3	3
Prevotella	3	2	0	0	2	2	2	0	2	2
Bacteroides	2	0	0	0	2	2	2	0	2	2
Mixed growth	10	3	0	2	5	8	5	4	5	6
No growth	12									
Total	70	21	6	15	38	43	23	16	12	31

Cip=Ciprofloxacin, Amox=Amoxicillin, Clox=Cloxacillin, Cefu=Cefuroxime,

Table 4: Antibiotic sensitivity pattern of aerobic and anaerobic strains. (N=70)

Antibiotics	Microbes			
	Aerobes		Anaerobes	
	Number	(%)	Number	percentage
Ciprofloxacin	13	41.4	2	26.1
Amoxycillin	5	14.1	0	0
Cloxacillin	11	35.3	0	0
Cefuroxime	25	83.9	2	51.3
Ceftriaxone	25	83.6	4	76.3
Clindamycin	9	28.3	5	100
Gentamycin	10	31.9	0	0
Metronidazole	-	-	5	100
Erythromycin	15	49.2	5	100

compromised individuals such as patients with diabetes mellitus, and CKD were not included in this study.

CONCLUSIONS

This study concluded that numerous bacteria, both aerobic and anaerobic, are implicated in deep neck space abscesses. In this investigation addressing the microorganism, Streptococcus viridans is the commonest aerobe and Peptostreptococcus is the commonest anaerobe and Ceftriaxone is still the most sensitive antibiotic. This investigation was carried performed over a short period and with a small number of patients. So, further study with a bigger number of samples and a longer period is suggested to acquire a more reliable result. Deep neck space infection is widespread in our country especially among the poorer population. The microbiology of deep neck infection could alter with time and the resistance to antibiotics might influence the selection of empiric medications. So, more studies should be conducted involving a large sample size and multiple centers in this regard.

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