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MICROBIAL PROFILE ANALYSIS OF ASPIRATION PNEUMONIA PATIENTS, IDENTIFYING COMMON ORGANISMS AND THEIR CLINICAL IMPLICATIONS

Fawad Alam[1], Sabina Afzal[2], Muhammad Ijlal Naseer[3], Abdul Hameed[4], Muhammad Latif[5], Sohail Ahmad[6], Faizan Ahmad[7], Nasir Ali[8], Naqeeb Ullah[9]*, Ruknud Din[10], Ayiz Jan[11], Sundas Safdar[12], Zubair Ahmad[13]

[1]General Medicine, Medical "B" Ward, Lady Reading Hospital, Peshawar - Pakistan
[2]Resident Internal Medicine, CMH, Abbottabad - Pakistan
[3]Pulmonology Department, Lady Reading Hospital, Peshawar - Pakistan
[4]General Medicine Unit B, Hayatabad Medical Complex, Peshawar - Pakistan
[5]Pulmonology Resident, Pulmonology Unit, Lady Reading Hospital, Peshawar - Pakistan
[6]Internal Medicine, MCW, Lady Reading Hospital, Peshawar - Pakistan
[7]Emergency Medicine, Lady Reading Hospital, Peshawar - Pakistan
[8]Nephrology Department, Institute of Kidney Diseases Peshawar MTI HMC, Peshawar - Pakistan
[9]*Medical "C" Ward Lady Reading Hospital Peshawar - Pakistan
[10]Medical "A" Ward, Lady Reading Hospital Peshawar – Pakistan
[11]Medical B Unit, Lady Reading Hospital Peshawar – Pakistan
[12]Radiology Department, Lady Reading Hospital Peshawar – Pakistan
[13]Research Medical Officer, Centre for Non-communicable Diseases Karachi, Khyber Teaching Hospital Peshawar – Pakistan

***Corresponding Author;** Dr. Naqeeb Ullah
*****Medical "C" Ward, Lady Reading Hospital, Peshawar – Pakistan. Email: naqeebu481@gmail.com

Abstract

Aspiration pneumonia denotes a lung infection resulting from the inhalation of foreign materials, including food particles, saliva, or liquids, into the lungs. This condition primarily arises from accidental aspiration during swallowing, vomiting, or regurgitation. Common symptoms encompass coughing, breathing difficulties, chest discomfort, fever, and, in severe cases, necessitates medical intervention due to potential complications. The condition predominantly affects individuals with impaired swallowing reflexes, neurological disorders, or those who are unconscious. Treatment typically involves antibiotics to address the infection and supportive measures for symptom management. The current study was carried out to determine microbial profile of aspiration pneumonia patients, identifying common organisms and their clinical implications.

Materials and Methods: This prospective study was conducted at the department of pulmonology and medicine at Lady Reading Hospital, Peshawar from January 2021 to October 2023. A total of 138 patients with suspected aspiration pneumonia, aged 65 years and older, admitted from the emergency department were included. Blood cultures were carried in all participants. For the investigation of *Legionella pneumophila* urine samples were examined, pneumococcus antigens were employed and in the first four hours respiratory specimens were collected for the study. Bacterial growth greater than 10^3 cfu/ml and positive respiratory assay for influenza A and B

antigens were further processed. Three distinct groups were identified based on bacteriologic findings. An aerobic group conforming patients of pneumonia recognized aerobic microorganisms'. An anaerobic group involving patients with pneumonia who had a protected Broncho alveolar lavage specimen containing at least one anaerobic microorganism. A group of patients with unverified pneumonia in whom the diagnostic workup did not reveal the presence of a microbial pathogen. For data analysis Statistical Analysis System, Kaysville (NCSS) was used. . Students T test was used for comparing Continuous variables. And the Mann-Whitney test was used for non-normally distributed variables. When appropriate, the chi-square test with Yates correction or Fisher's exact test was employed to compare proportions

Results; microbial profile of the current study explored that the most dominant microorganisms from aspiration pneumonia were gram negative bacilli followed by gram positive *(S.aureus*). The clinical implications were cough, fever, Delirium and Comorbidities. Mortality rate was most prevalent in this study.

Conclusion; The most frequent bacteria were gram negative bacilli followed by *S.aureus* and *streptococcus pneumonia.*), if we talk about the clinical implications in our study some participants died due to aspiration pneumonia so proper management and antibiotic therapy play a vital role in the prevention of mortality .

Introduction

The infectious pulmonary process that takes place after abnormal fluid entry into the lower respiratory tract is known as aspiration pneumonia. (1)The aspirated fluid can be either orally secretions, particulate matter, or gastric contents. After aspiration of sterile gastric contents, an injury to the inhalational lungs is known as "aspiration pneumonitis". An observational study revealed that the risk of developing aspiration pneumonia in patients hospitalized for community-acquired pneumonia is around 13 percent. 8%. Aspiration pneumonia mortality rates can reach up to 70%, depending on the amount and concentration of aspirate.(2,3) The colonization of oropharyngeal secretions by pathogenic bacteria is the cause of aspiration pneumonia, an infectious process. Research indicates that aspiration is linked to 5 to 20% of community acquired pneumonia [4–5]. The discovery of anaerobic bacteria and facultative anabolic bacteria, including *Staphylococcus aureus, Klebsiella pneumoniae*, and *Eisenia coli,* was made in patients with aspiration pneumonia.(6). The etiology differs depending on the amount of aspirate in it, although Streptococci, *Haemophilus*, and Gram-negative bacilli are commonly implicated organisms. (7)Gram-negative bacilli were found to be responsible for 49% with anaerobes contributing only 16%. *Fusobacterium*, Bacteroides, and Peptostreptococcus were the major anaerobes that were discovered. In hospitals necessitates the involvement of gram-negative organisms, such as *Pseudomonas aeruginosa.(*8) If the glottis and cough reflex are not functioning properly, aspiration becomes more likely. Common risk factors include altered mental state, neurologic disorders, esophageal motility disorders (hypertensive disorder), prolonged vomiting, and blocked gastric outlet. (8) The microbiological basis for pulmonary abscesses was established in a 2005 study and Klebsiella pneumoniae was the most common bacterium, with Streptococcus milleris (Streptotrocophores) group being followed. The prediagnosis symptom duration for patients with anaerobic involvement was more than 30 days, and only 20% of cases were isolated as anerobes, which supports the notion that it is less prevalent in acute aspiration events.(9) The current study was carried out to determine microbial profile of aspiration pneumonia patients, identifying common organisms and their clinical implications

Materials and methods this prospective study was conducted at the department of pulmonology and medicine at Lady Reading Hospital, Peshawar from January 2021 to October 2023. A total of 138 patients with suspected aspiration pneumonia, aged 65 years and older, admitted from the emergency department were included

The inclusion criteria of the individuals for the study were, individual with radiographic infiltrate that is compatible with pneumonia, a lower respiratory tract infection is indicated by symptoms or signs, which include cough, sputum production, or fever above 38C or below 35. Patients with chest pain, dyspnea, delirium and increased alveolar arterial gradient, and risk factors for pharyngeal aspiration present were included. Participants with HIV, organ transplantation, steroid therapy for more than two weeks and who had directed antimicrobial treatment or were admitted within the last 30 days were excluded. For each subject demographic data like age, sexe, activity of daily living were collected. Vital signs, radiographic progression. Blood cultures were carried in all participants. For the investigation of *Legionella pneumophila* urine samples examined and pneumococcus antigens were employed and in first four hours respiratory specimens were collected for the study.
According to Bone and colleagues for the conformation of pneumonia the criteria were, positive urinary antigen for pneumococcus and legionella, bacterial growth greater than 10^3 cfu/ml and positive respiratory assay for influenza A and B antigens. Three distinct groups were identified based on bacteriologic findings.
(1) An aerobic group conforming patients of pneumonia recognized aerobic microorganisms
(2) An anaerobic group involving patients with pneumonia who had a protected Broncho alveolar lavage specimen containing at least one anaerobic microorganism
(3) A group of patients with unverified pneumonia in whom the diagnostic workup did not reveal the presence of a microbial pathogen. If the causative pathogen(s) were susceptible to antibiotic therapy during enrollment, antimicrobial therapy was considered effective if the clinical situation remained stable, fever decreased, and leukocytosis improved after 72 hours of treatment. The initial treatment considered failed in all cases.

Analysis of data

For data analysis Statistical Analysis System, Kaysville (NCSS) was used. Results were expressed in means±SD. The clinical data was compared among patients with confirmed pneumonia in aerobic and anerobic groups. Students T test was used for comparing Continuous variables. And the Mann-Whitney test was used for non-normally distributed variables. When appropriate, the chi-square test with Yates correction or Fisher's exact test was employed to compare proportions. Similarly, these data were analyzed between patients with confirmed and unproven pneumonia. By utilizing the variables found significant, a sequential logistic regression was executed. In-hospital mortality is the dependent variable in a univariate analysis of mortality rates. All reported p values are two-tailed. The level of importance was set at 5 percent

RESULTS

A total of 138 participant included in this study out of these 43 were not investigated due to lack of clinical information. Out of 95 individuals done bronchial samplings. From 54 at least one microorganism was isolated. From 11 (20%) anaerobic bacteria were isolated. Characteristic of the study participants displayed in **table** 1. All 95 participants had at least one comorbid illness, with 87% having two or more comorbidities. Stroke (78%) was the most prevalent comorbidity, followed by ischemic heart disease (51%) and chronic obstructive pulmonary disease (35%). The majority of patients presented with dyspnea, fever, and delirium**.**
On physical examination, crepitation were the main auscultator findings (n=62), followed by rhonchi (n=23) and wheezing (n=5). A “silent” chest was present only 5 individuals (5%).

Microbial Etiology

3% of patients who had *Staphylococcus aureus, Klebsiella pneumonia, and Streptococcus pneumonia* were found to have positive blood cultures. No anaerobic bacteria were isolated from blood cultures. Six cases were treated with thoracocentesis. Six cases were examined for signs of a parapneumonic process through fluid analysis, but no bacterial pathogen was recovered from cultures of the pleural fluid. From the samples of bronchial over all 67 pathogens were isolated as

presented in **table 2.** The most prevalent bacteria were gram negative bacilli (49%) anaerobic was (16%) and 12% was *S.aureus* **. Table 3** present the antimicrobial susceptibility patterns of anaerobic isolates. Resistance to penicillin was anaerobic groups were compared at baseline for epidemiologic and clinidetected in 27%. One isolate of Prevotella was resistant to both penicillin and metronidazole.

Outcome and Prognostic Factors

Over all 35 participants died during hospitalization .in aerobic group (14), in anerobic (4) and 17 with unverified pneumonia. the main cause of the death was progressive pneumonia

TABLE 1. DEMOGRAPHIC AND CLINICAL FEATURES OF THE STUDY PEOPLE			
	Aerobic N= 43	Anaerobic N=11	Non verified N= 41
Age , mean SD	81.2±6.6	78.1±6.2	81.6±5.3
Sex (M/F), n	26/43	4/11	19/41
Clinical presentation			
Cough	13(30)	2 (18)	5(12)
Fever	29(67)	7 (63)	33(80)
Dyspnea	37(86)	10 (91)	36(88)
Delirium	20(47)	7 (64)	18(44)
Comorbidities			
Cardiac	23(53)	6 (55)	17(41)
Pulmonary	14(33)	4 (36)	18(44)
Renal	7(16)	2 (18)	5(12)
Hepatic cirrhosis	1(2)	0	1(2)
Central nervous system	36(84)	8 (73	32(78)
Diabetes Mellitus	8(19)	4 (36)	5(12)
Neoplastic	2(5)	0	2(5)

TABLE 2. MICROBIAL ETIOLOGY OF PULMONARY ASPIRATION		
	Aerobic Group(n=43)	anaerobic (n=11)
Gram-positive aerobic cocci		
Streptococcus pneumonia	5	-
Streptococcus spp	6	-
Staphylococcus aureus	8	-
Gram-negative aerobic bacilli		
Haemophilus influenzae	2	-
Escherichia coli	11	2
Klebsiella pneumonia	8	2
Serratia spp.	7	1
Proteus mirabilis	6	1
Enterobacter cloacae	1	-
Pseudomonas aeruginosa	2	-
Anaerobic		
Prevotella spp	-	6
Fusobacterium	-	3
Bacteroides	-	1
Peptostreptococcus	-	1

TABLE 3. ANTIMICROBIAL SUSCEPTIBILITY OF ANAEROBIC ISOLATES			
	Penicillin	Metronidazole	Clindamycin
Prevotella, S/R	4/2	5/1	6/0
Fusobacterium, S/R	3/0	3/0	3/0
Peptostreptococcus,S/R	1/0	1/0	1/0
Bacteroides, S/R	0/1	1/0	1/0
Definition of abbreviation: S/R Sensitive/resistant			

Discussion

Aspiration pneumonia is a form of infectious process in which the oropharyngeal secretions colonialize the pulmonary parenchyma proliferation and invasion, while aspiratory pneumonitis is caused by chemical damage from inhalation of sterile gastric contents**.** The amount, nature, frequency, and host response to aspirated material can all impact the occurrence of various pulmonary syndromes after aspulsion**.(**14**).**The present study was conducted to analyze the microbial profile of aspiration pneumonia patients, identifying common organisms and their clinical implications. Community-acquired pneumonia and nosocomial aspiration differ in the types of bacterial pathogens responsible. A large number of aspiration pneumonias are a combination of aerobic and anaerobic diseases. The presence of gram-negative bacilli and S aureus is more frequent in nosocomial aspiration pneumonia. (10) A rigorous and precise classification of the etiology for long-term care facility-acquired aspiration pneumonia is established to allow comparison with future studies. However, current microbial patterns of patients with severe aspergation must be interpreted cautiously due to the lack of diagnostic techniques in the previous studies (11). In our study Gram-negative enteric bacilli were the primary cause of etiology in nursing home-acquired aspiration pneumoniae which were similar to the previous studies reports (7). The role of anaerobic bacteria in the pathogenesis of aspiration pneumonia is still a topic of debate due to the complex and delicate techniques involved in transport media and culture. To facilitate this research, we have made efforts to deliver all bronchial specimens within 30 minutes of sampling and maintain strict anaerobic transport medium. In our study anaerobic were found in combination with enteric Gram negative bacilli. Bartlett and coworkers (12) found comparable outcomes with Tran's tracheal aspirates in patients with doubted aspiration pneumonia. From the findings of this research it was evaluated the there is great diversity of microorganism isolated from aspiration pneumonia patients. Among gram positive cocci. *S.aureus* was the most prevalent bacteria .These findings are similar with the study conducted by Horiuchi et al .(13), if we talk about the clinical implications in our study 35 participants died due to aspiration pneumonia ..Previous studies also reported same rate of mortality in the case of pneumonia (14)

Conclusion

From the current research we evaluated microbial profile from patients with aspiration pneumonia. The most frequent bacteria were gram negative bacilli followed by *S.aureus* and *streptococcus pneumonia.*), if we talk about the clinical implications in our study some participants died due to aspiration pneumonia .so proper management and antibiotic therapy paly a vital role in the prevention of mortality

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