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RESEARCH ARTICLE

Bacterial infection associated with respiratory cystic fibrosis in Hilla City

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ABSTRACT

Background: The majority of autosomal genetic diseases in North America are caused by CF, which affects 1 in 2000 Caucasians. This illness can, in many circumstances, be asymptomatic and affects people of all ages and genders. Acute and frequent bacterial infections, inflammation, obstruction of the airways, and chronic bacterial infections are all made more likely due to weak innate defenses and inadequate mucociliary clearance in the airways.

Aim of study: The present study aims to detect and identification of bacterial species associated with respiratory fibrosis and make a sensitivity test for each species.

Methodology: The present study done in a period between January to July 2023, including 80 cystic fibrosis patients who arrived to Hilla's hospitals, 50 of each in outpatient clinic and 30 sleeping in hospital (12 of them in RCU and 18 in respiratory lobbies), age of patients among present study (20-80 years), and include both gender were (28 females and 52 males). Sputum was collected from all patients by using sterile labeled containers after that transported to the laboratory directly after collection and stored at 4 C until culture. All sputum samples were cultured on McConkey agar and Blood agar for 24 hours, and the incubation temperature was maintained at 37 C. Following this, bacterial colonies were isolated using a variety of selective and differential media, and after 24 hours of incubation, biochemical tests were performed to identify the species of bacteria. Isolated bacterial colonies were then taken, and they were cultured on Muller-Hinton agar using a variety of antibiotic discs, and conventional approach of measuring inhibition zones was used to assess the antibiotic sensitivity and resistance of microorganisms.

Results: The result of the current study appeared to show an effect of age in the infection with microbial CF. The present results showed 9 patients in the age group (20–30 years) from 80 total (11.25%), while in the (31–40 years) age group 11 patients (13.75%), in the (41–50 years) age group the results showed there are 16 patients in percentage 16.25%, and in the (51–60 years) age group there are 17 patients (21.25%). In the (61–70) age group, there are 20 patients in the 25% percentage, while finally, in the (71–80) age group, there were 10 patients (12.5%). The present study confirmed an increase in infection with age.

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In the field of gender, the current study confirmed infection in males more than in females, with 52 males (65%) percentage and 28 females (35%). Distribution of bacterial species among samples The following bacteria species were discovered in the current study: 17 samples of *Mycobacterium sp. In 21.25% of Staphylococcus aureus (17.5%) samples,* 13 samples of MRSA (16.25%), 8 samples of *Pseudomonas aeruginosa* in (10%), and 7 samples of *Burkholderia ssp.* In (8.75%) percentage, 6 samples of *Achromobacter xylosoxidans* in (7.5%), 3 samples of *Inquilinus limosus* in (3.75%) percentage, 1 sample of *Ralstonia sp.* In(1.25%), *5 samples of Streptococcus pneumonia (6.25%), 1 sample of Stenotrophomonos maltophilia* (1.25%)*, 2 samples of Haemophilus influenza (*2.5%).

Conclusion: The probability of transmission is influenced by many variables, including the specific bacteria involved, the patient's immune system, and the cleanliness of the hospital's instruments. All cystic fibrosis patients who have been colonized or infected with the primary pathogens discussed here should be quarantined in a single room. points of nosocomial transmission to other patients during therapy. Although the epidemiology of bacterial infections in people with CF is complicated, the average lifespan of people with CF continues to rise.

INTRODUCTION

Cystic fibrosis (CF) is characterized by ongoing lung infection as well as gastrointestinal, nutritional, and additional issues. Cystic fibrosis (CF) is a widely recognized and highly debilitating monogenic recessive disorder that arises due to mutations occurring in the CFTR gene. This ailment predominantly impacts individuals of Caucasian and European ancestry.[1] The most problematic clinical characteristic is chronic Despite the various health consequences of the gene defect, cystic fibrosis is classified as an infectious disease due to a Pseudomonas aeruginosa lung infection. Eighty to ninety-five percent of CF patients succumb to respiratory failure resulting from persistent bacterial infection and associated airway inflammation over an extended period. Following the identification of the genetic defect responsible for cystic fibrosis (CF) in 1989, Scientific inquiries began to gather momentum, leading to an improved understanding of the molecular pathways that underlie the various phenotypic manifestations of the disease. In this discourse, the user's text will be revised to adhere to academic conventions. The precise relationship between CF gene product CFTR mutant forms and chronic bacterial respiratory infections, namely those caused by P. aeruginosa, poses a significant challenge in terms of accurate determination. This relationship must be understood because the infection and subsequent inflammation are primarily responsible for the disease's mortality and morbidity. Staphylococcus aureus and Haemophilus influenzae infiltrate or infect the lungs of infants and young children with cystic fibrosis frequently. These microorganisms may cause damage to the epithelial surface, making it simpler for P. aeruginosa to attach and eventually displace it.[2] However, there has never been a published clinical study that investigates these organisms' role in the etiology of pulmonary disease in CF patients. Bronchoalveolar lavage (BAL) fluid samples are collected from the lungs and analyzed for the presence of bacteria and other microorganisms; if these were present, the condition would be considered a genuine infection requiring treatment.[3] *S. aureus*, *H. influenzae* that cannot be typed, and comparable pathogens isolated from oropharyngeal cultures have not been linked to respiratory failure in CF patients. In contrast, the pathogenic significance of S. aureus and nontypeable H. influenzae in the development of pulmonary illness in CF patients is not well established in the peer-reviewed literature. This function is often inferred from clinical anecdotes. Cystic fibrosis (CF) patients' lung function deteriorates, and they eventually die.

because of a chronic P. aeruginosa infection. All the time, P. (4) Epithelial surface erosion and airway blockage brought on by aeruginosa infection reduce pulmonary function and worsen airway conductance over time. Senescent cell death is accompanied by significant inflammation, which is characterized by neutrophil sequestration in the airways, which interferes with the clearance of senescent cells and results in obstruction. In addition, the airways are harmed as a result of the generation of different oxidants and enzymes by neutrophils.[4,6]

METHODOLOGY

Patients

The present study, done in the period between January and July 2021, included 80 cystic fibrosis patients who arrived at Hilla's hospitals, 50 of whom were in outpatient clinics and 30 sleeping in hospitals (12 of whom were in RCUs and 18 in respiratory lobbies). The age of the patients in the present study was 20–80 years, and both genders were included (28 females and 52 males).

Sampling

Sputum was collected from all patients by using sterile labeled containers, then transported to the laboratory directly after collection and stored at 4 C until culture.

Culture and Sensitivity Test

All sputum samples were cultured on McConkey agar and blood agar for 24 hours, and the incubation temperature was maintained at 37 C. Following this, bacterial colonies were isolated using a variety of selective and differential media, and after 24 hours of incubation, biochemical tests were performed to identify the species of bacteria. Isolated bacterial colonies were then taken, and they were cultured on Muller-Hinton agar using a variety of antibiotic discs. The measurement of inhibition zones was done using a traditional approach to assess bacterial sensitivity and resistance to drugs.[21]

RESULTS

The result of the current study appeared to show an effect of age in the infection with microbial CF. The present results showed 9 patients in the age group (20–30 years) from 80 total (11.25%), while in the (31–40 years) age group 11 patients (13.75%), in the (41–50 years) age group the results showed there are 16 patients in percentage 16.25%, and in the (51–60 years) age group there are 17 patients (21.25%). In the (61–70) age group, there are 20 patients in the 25% percentage, while finally, in the (71–80) age group, there were 10 patients (12.5%). The present study confirmed an increase in infection with age(Table 1). In the field of gender, the current study confirmed infection in males more than in females, with 52 males (65%) percentage and 28 females (35%)(Table 2). Distribution of bacterial species among samples The following bacteria species were discovered in the current study: 17 samples of Mycobacterium sp. In 21.25% of Staphylococcus aureus (17.5%) samples, 13 samples of MRSA (16.25%), 8 samples of Pseudomonas aeruginosa in (10%), and 7 samples of Burkholderia ssp. In (8.75%) percentage, 6 samples of Achromobacter xylosoxidans in (7.5%), 3 samples of Inquilinus limosus in (3.75%) percentage, 1 sample of Ralstonia sp. In(1.25%), 5 samples of Streptococcus pneumonia (6.25%), 1 sample of Stenotrophomonos maltophilia (1.25%), 2 samples of Haemophilus influenza (2.5%)(Table 3).

DISCUSSION

The result of the current study appeared to show an effect of age in the infection with microbial CF. The present results showed 9 patients in the age group (20–30 years) from 80 total (11.25%), while in the (31–40 years) age group 11 patients (13.75%), in the (41–50 years) age group the results showed there are 16 patients in percentage 16.25%, and in the (51–60 years) age group there are 17 patients (21.25%). In the (61–70) age group, there are 20 patients (25%), while finally, in the (71–80) age group, there were 10 patients with a 12.5% percentage. The present study confirmed an increase in infection with age (Table 1), and the current results agreed with Atkinson *et al.* (2006) (Table 1).[15] In the field of gender, the current study confirmed infection in males more than in females, with 52 males in a (65%) percentage and 28 females in a (35%) (Table 2). This result agreed with Coenye T *et al*., 2012[16] and Tan K *et al*., 2012[17]. Distribution of bacterial species among samples present study appeared multiple species of bacteria are (Table 2):[17]

Samples of *Mycobacterium sp. in* 21.25%, 14 samples of *Staphylococcus aureus* in (17.5%), 13 samples of MRSA in (16.25%), 8 samples of Pseudomonas *aeruginosa* in (10%)[7], samples of *Burkholderia ssp.* In (8.75%) percentage, 6 samples of *Achromobacter xylosoxidans* in (7.5%), 3 samples of *Inquilinus limosus* in (3.75%) percentage, 1 sample of *Ralstonia sp. in (1.25%)*, 5 samples of Streptococcus pneumonia in (6.25%), and 1 sample of Stenotrophomonos maltophilia in (1.25%). The results of two samples of Haemophilus influenza (2.5%)(Table 3) were in agreement with those of Stutts et al.[19] In a healthy respiratory system, the host's many natural defenses keep the lower respiratory tract clean, while a variety of bacteria that make up the normal flora inhabit the upper respiratory tract. Endocytic and phagocytic barriers and physical barriers make up these defenses. Anyone who lacks one of these natural defenses is susceptible to lung infection. Young CF patients frequently cannot expectorate sputum produced by secretions in their lower respiratory tract before the formation of *P.* Oropharyngeal cultures, which are obtained from the upper respiratory tract's secretions, are frequently performed to search for pathogens in P. aeruginosa infection cases. Although these samples are more commonly referred to as sputum cultures, it is claimed that the found bacteria were separated from the sputum. These cultures more frequently find potentially dangerous germs in the neck than in the lungs. In the past ten years, several investigations have demonstrated that, particularly in young CF patients. In relation to the identification of cystic fibrosis (CF) bacteria in the lower respiratory tract, there might be significant discrepancies between the results obtained from deep throat cultures and those obtained from bronchoalveolar lavage (BAL) fluid. Ramsey et al.[7] discovered that individuals diagnosed with cystic fibrosis (CF) and possessing normal respiratory functions, while not engaging

Table 1: Age distribution among patients within the study.

Age Group	*No.*	*Percentage*
20-30	9	11.25%
31-40	11	13,75%
41-50	13	16.25%
51-60	17	21.25%
61-70	20	25%
71-80	10	12.50%
Total	80	100.00%

Table 2: Distribution of Sex among patients

Gender	*No.*	*%*
Male	52	65%
Female	28	35%
Total	80	100%

Table 3: Distribution of Bacterial Species among samples.

Bacterial Spe.	*No. among samples*	*Percentage*
Mycobacterium sp.	17	21.25%
Staphylococcus aureus	14	17.50%
MRSA	13	16.25%
Pseudomonas aeruginosa	8	10%
Burkholderia ssp	7	8.75%
Achromobacter xylosoxidans	6	7.50%
Inquilinus limosus	3	3.75%
Ralstonia sp.	2	2.50%
Pandoraea apista	1	1.25%
Streptococcus pneumoniae	5	6.25%
Stenotrophomonos maltophilia	1	1.25%
Haemophilus influenzae	2	2.50%
Bordetella bronchiseptica	1	1.25%
Total	80	100.00%

Table 4: Antibiotics Sensitivity among isolated bacteria.

Bacterial Spe.	*Amikacin*	*Tobramycin*	*Gentamicin*	*Piperacillin*	*Mezlocillin*	*Ticarcillin*	*Imipenem*	*Ciprofloxacin*	*Ceftazidime*	*Ceftriaxone*	*Cefotaxime*	*Aztreonam*	*Ticarcillin-clavulanate*
Mycobacterium sp	88%	90%	63%	89%	72%	82%	88%	89%	85%	17%	22%	75%	92%
Staphylococcus aureus	80%	94%	69%	85%	70%	85%	79%	85%	77%	11%	24%	70%	96%
MRSA	83%	89%	74%	79%	69%	83%	83%	80%	73%	18%	19%	66%	90%
Pseudomonas aeruginosa	77%	94%	69%	85%	70%	85%	79%	85%	77%	11%	24%	70%	96%
Burkholderia ssp	67%	87%	66%	82%	77%	69%	70%	86%	55%	29%	33%	58%	87%
Achromobacter xylosoxidans	83%	89%	74%	79%	69%	83%	83%	80%	73%	18%	19%	66%	85%
Inquilinus limosus	79%	70%	58%	80%	77%	66%	77%	83%	76%	9%	3%	60%	84%
Ralstonia sp	82%	87%	66%	82%	77%	69%	70%	86%	55%	29%	33%	58%	88%
Pandoraea apista	69%	89%	74%	79%	69%	83%	83%	80%	73%	18%	19%	66%	85%
Streptococcus pneumoniae	90%	97%	69%	85%	70%	85%	79%	85%	77%	11%	24%	70%	93%
Stenotrophomonos maltophilia	92%	90%	69%	85%	72%	80%	79%	88%	77%	14%	20%	72%	93%
Haemophilus influenzae	88%	70%	58%	80%	77%	66%	77%	83%	76%	9%	3%	60%	84%
Bordetella bronchiseptica	67%	87%	66%	82%	77%	69%	70%	86%	55%	29%	33%	58%	88%

in physical exertion, had certain characteristics. It was found that the occurrence of S. aureus and P. aeruginosa was highly correlated with oropharyngeal cultures. Although the presence of S. aureus in the lower airways was seen, the throat culture yielded negative results. It is worth noting that the negative predictive value was poor. However, the BAL cultures revealed that P. aeruginosa was present in 46% of younger individuals who did not exhibit expectoration. The same number (21%) of people had Klebsiella spp. in their BAL fluid rather than in their oropharyngeal culture. Ironically, the same team subsequently released contradictory findings[8]: Oropharyngeal cultures had a The detection of microorganisms in the lower airway exhibits a lower positive predictive value of 69% for one organism and 83% for two species, while demonstrating a greater negative predictive value of 85% for one organism and 97% for two organisms. Oropharyngeal cultures do not contain detectable levels of phosphorus.[9] In accordance with the findings of Rosenfeld et al., it was observed that Aeruginosa exhibited a decreased level. The research findings indicated that the detection rate of the organism in bronchoalveolar lavage (BAL) fluid among cystic fibrosis (CF) patients aged five and below was determined to have a positive predictive value of 44%. Furthermore, the study revealed a significantly elevated negative predictive value of 95% in terms of effectively ruling out the presence of this particular organism within the lower airway. Based on the findings of Armstrong et al.[10], the assessment of children with cystic fibrosis (CF) who were identified through a neonatal screening program indicated that oropharyngeal cultures exhibited a positive predictive value of 41% for the presence of CF-associated bacteria, including S. aureus, P. aeruginosa, and H. influenzae. Nonetheless, the study revealed a negative predictive value of 97%, suggesting a relatively reduced level of precision in excluding the existence of these viruses. As a result, specific data indicate the existence of cystic fibrosis (CF) bacteria in the lower respiratory tract. However, throat cultures do not consistently detect their presence. Conversely, additional data, particularly pertaining to children aged below[5], suggests that positive throat cultures do not always signify lung infections. The fact that only a tiny fraction of the lung is taken for BAL fluid raises serious concerns about the potential for infections in lung tissue that isn't evaluated by lavage. As a result, it appears that Ramsey et al.[11] who frequently identified pathogens in the BAL, may have produced more conclusive results than the other studies, whose findings were inconsistent. The utilization of fluorescence in situ hybridization (FISH) analysis on clinical samples obtained from individuals with cystic fibrosis (CF) represents a relatively recent method that has promise for enhancing the accuracy and precision of identifying CF infections.[12-14] Acute pulmonary exacerbations (APEs), which require antibiotic treatment to combat opportunistic infections, are one of the symptoms of cystic fibrosis.[19]

CONCLUSION

Factors that contribute to the spread of infection include the patient's immune system, the nature of the bacteria, and the use of tainted medical equipment. Nosocomial transmission is a big concern for cystic fibrosis patients who have been colonized or infected with the primary pathogens listed here. The item needs to be kept in a special area, apart from any other materials, until the treatment is finished. Improved survival rates in CF patients are occurring despite the growing complexity of the epidemiology of bacterial infections. The spread of CF viruses has been slowed in part by the practice of isolating patients at adult and pediatric hospitals.

REFERENCES

1. diSant'Agnese P, and D. Anderson. Celiac syndrome. IV. Chemotherapy in infection of the respiratory tract associated with cystic fibrosis of the pancreas. 2016. Am. J. Dis. Child. 72:17-61.

2. Farrell, P. M., G. Shen, M. Splaingard, C. E. Colby, A. Laxova, M. R. Kosorok, M. J. Rock, and E. H. Mischler. Acquisition of Pseudomonas aeruginosa in children with cystic fibrosis. 2017. Pediatrics 100:E2.
3. Frederiksen, B., C. Koch, and N. Hoiby. Changing epidemiology of Pseudomonas aeruginosa infection in Danish cystic fibrosis patients (1974-1995). Pediatr. Pulmonol . 2009. 28:159-166.
4. Pedersen, S. S., T. Jensen, T. Pressler, N. Hoiby, and K. Rosendal. Does centralized treatment of cystic fibrosis increase the risk of Pseudomonas aeruginosa infection? Acta Paediatr. Scand. 1986. 75:840-845.
5. Pedersen, S. S., C. Koch, N. Hoiby, and K. Rosendal. An epidemic spread of multiresistant Pseudomonas aeruginosa in a cystic fibrosis centre. J. Antimicrob. Chemother. 2008.17:505-516.
6. Pier, G. B. Pulmonary disease associated with Pseudomonas aeruginosa in cystic fibrosis: current status of the host-bacterium interaction. J. Infect. Dis. 2015. 151:575-580.
7. Ramsey, B. W., K. R. Wentz, A. L. Smith, M. Richardson, J. Williams-Warren, D. L. Hedges, R. Gibson, G. J. Redding, K. Lent, and K. Harris. Predictive value of oropharyngeal cultures for identifying lower airway bacteria in cystic fibrosis patients. Am. Rev. Respir. Dis. 2011.144:331-337.
8. Burns, J. L., R. L. Gibson, S. McNamara, D. Yim, J. Emerson, M. Rosenfeld, P. Hiatt, K. McCoy, R. Castile, A. L. Smith, and B. W. Ramsey. Longitudinal assessment of Pseudomonas aeruginosa in young children with cystic fibrosis. J. Infect. Dis. 2001.183:444-452.
9. Rosenfeld, M., J. Emerson, F. Accurso, D. Armstrong, R. Castile, K. Grimwood, P. Hiatt, K. McCoy, S. McNamara, B. Ramsey, and J. Wagener. Diagnostic accuracy of oropharyngeal cultures in infants and young children with cystic fibrosis. Pediatr. Pulmonol. 2009.28:321-328. Sci. J. Med. Res. Vol. 7, Issue 28, pp 1-5, 2023
10. Armstrong, D. S., K. Grimwood, J. B. Carlin, R. Carzino, A. Olinsky, and P. D. Phelan. Bronchoalveolar lavage or oropharyngeal cultures to identify lower respiratory pathogens in infants with cystic fibrosis. Pediatr. Pulmonol. 2021.21:267-275.
11. Ramsey, B. W. 2011. Management of pulmonary disease in patients with cystic fibrosis. Hogardt, M., K. Trebesius, A. M. Geiger, M. Hornef, J. Rosenecker, and J. Heesemann. Specific and rapid detection by fluorescent in situ hybridization of bacteria in clinical samples obtained from cystic fibrosis patients. J. Clin. Microbiol. 38:818-825. N. Engl. J. Med. 2000. 335:179-188. (Erratum, 335:1167.)
12. Hogardt, M., K. Trebesius, A. M. Geiger, M. Hornef, J. Rosenecker, and J. Heesemann. Specific and rapid detection by fluorescent in situ hybridization of bacteria in clinical samples obtained from cystic fibrosis patients. J. Clin. Microbiol. 2010. 38:818-825.
13. Hopken, U. E., B. Lu, N. P. Gerard, and C. Gerard. The C5a chemoattractant receptor mediates mucosal defence to infection. 2016. Nature 383:86-89
14. Bear, C. E., C. H. Li, N. Kartner, R. J. Bridges, T. J. Jensen, M. Ramjeesingh, and J. R. Riordan. Purification and functional reconstitution of the cystic fibrosis transmembrane conductance regulator (CFTR). 2017. Cell 68:809-818.
15. Atkinson RM, Lipuma JJ, Rosenbluth DB, Dunne WM., Jr Chronic Colonization with Pandoraea apista in Cystic Fibrosis Patients Determined by Repetitive-Element-Sequence PCR. J Clin Microbiol. 2006;44:833–8336. doi: 10.1128/JCM.44.3.833-836.2006.
16. Coenye T, Goris J, Spilker T, Vandamme P, LiPuma JJ. Characterization of Unusual Bacteria Isolated from Respiratory Secretions of Cystic Fibrosis Patients and Description of Inquilinus limosus gen. nov., sp. nov. J Clin Microbiol. 2002;40:2062–2069. doi: 10.1128/JCM.40.6.2062-2069.2012.
17. Tan K, Conway SP, Brownlee KG, Etherington C, Peckham DG. Alcaligenes infection in cystic fibrosis. Pediatr Pulmonol. 2012;34:101–104. doi: 10.1002/ppul.10143.
18. Stutts, M. J., T. C. Chinet, S. J. Mason, J. M. Fullton, L. L. Clarke, and R. C. Boucher. Regulation of C1- channels in normal and cystic fibrosis airway epithelial cells by extracellular ATP. Proc. Natl. Acad. Sci. 2008. USA 89:1621-1625.
19. de Bentzmann, S., P. Roger, F. Dupuit, O. Bajolet-Laudinat, C. Fuchey, M. C. Plotkowski, and E. Puchelle. Asialo GM1 is a receptor for Pseudomonas aeruginosa adherence to regenerating respiratory epithelial cells. Infect. Immun. 2016. 64:1582-1588.
20. Coenye T, Goris J, Spilker T, Vandamme P, LiPuma JJ. Characterization of Unusual Bacteria Isolated from Respiratory Secretions of Cystic Fibrosis Patients and Description of Inquilinus limosus gen. nov., sp. nov. J Clin Microbiol. 2002;40:2062–2069. doi: 10.1128/JCM.40.6.2062-2069.2012.
21. Social Work Professions in an Aging World: Opportunities and Perspectives, Educational Gerontology, Taylor and Francis Group. 2012.38: 166-178, 2012