Int.J.Curr.Microbiol.App.Sci (2022) *11*(02): 251-255

International Journal of Current Microbiology and Applied Sciences
ISSN: 2319-7706 **Volume 11 Number 02 (2022)**
Journal homepage: http://www.ijcmas.com

Original Research Article https://doi.org/10.20546/ijcmas.2022.1102.027

Bacteriological Study of Lung Aspirate Cultures of Acute Lower Respiratory Tract Infections with Reference to Blood Cultures and Throat Swab Cultures among Children

P. V. Prasanna Kumar, Suguneswari Giddi* and B.V.Sivamma

[1]*Department of Microbiology, Andhra Medical College, Visakhapatnam, Andhrapradesh, India*
[2]*Department of Microbiology, GSL Medical College and General Hospitals, Rajahmundry, Andhrapradesh, India*
[3]*Department of Microbiology, Siddhartha Medical College, Vijayawada, AP, India*

**Corresponding author*

Keywords

Acute lower respiratory infections, Children, Bacteriology, Antibiogram

Article Info

Received:
10 January 2022
Accepted:
05 February 2022
Available Online:
10 February 2022

A B S T R A C T

Acute lower respiratory tract infections (LRTs) are the leading cause of mortality in below 5 year aged children and shows higher incidence among low income group. Scope: The present study was conducted on one hundred twenty paediatric patients suffering from acute lower respiratory tract infections were evaluated. Lung aspirates, blood samples and throat swabs were investigated bacteriologically to identify the prevalent bacterial isolates and their susceptibility patterns. This study observed that acute LRTIs were predominant among males, effects especially below 5 years aged children. Material and Methods: Lung aspirates were collected under the guidance of paediatrician and processed on sheep Blood agar, Chocolate agar, Nutrient agar and MacConkey's agar followed by incubated for 18-24hrs, simultaneously the blood samples and throat samples were inoculated in appropriate culture media and processed for pathogens. Findings: Bacteriological analysis revealed 47.5 %(57) positivity in lung aspirates, 15.8% (19) positivity in blood culture and 7.5 %(9) positivity for pathogenic organisms in throat swabs. The dominant organism remained *Streptococcus pneumoniae* followed by *Hemophilus influenza, Klebsiella pneumonia*. All the pathogens were subjected to antibiotic sensitivity testing by Modified Kirby-Bauer's method and tested for Meropenem, Ampicillin, Cotrimoxazole, Ciprofloxacin, Cefotaxime, and Amikacin and observed maximum sensitivity to parenteral drugs such as Carbapenems, Cefotaxime and Aminoglycosides. Conclusion: Comparative study with different samples provides statistically significant values.

Introduction

Acute respiratory infections (ARI) are the leading cause of morbidity and mortality among children through the world, particularly in developing countries, (Boor *et al.*, 2001). The WHO (World Health Organization) estimated that LRTI S (Lower respiratory tract infections are the reason for more than 800, 000 of the 5.6 million total deaths in children less than 5 years old in 2016.The hospital

based meta analysis was conducted and concluded that the case fatality rates in developing countries are higher compared to developed countries. Acute respiratory infections and malnutrition are the principle causes of illness and deaths in children in developing countries (Rebecca B Knobbe, 2019).

The commonest lower respiratory tract infection in children is pneumonia. Pneumonia is an infectious disease of lung parenchyma tissue with consolidation. Pneumonia contributes to three fourths of all deaths throughout the world in children. (Agarwal *et al.*, 1998).

Bacterial and viral pathogens are responsible for most cases of acute lower respiratory tract infections; bacterial pathogens include *Streptococcus pneumoniae*, *Hemophilus influenza* and *Staphylococcus aureus* in developing countries (Serges Tchatchouang, 2019; Broor *et al.*, 1999).

The present study was conducted to determine the specific etiological organism, and of antibiotic sensitivity pattern of organisms isolated from lung aspirates and correlation of these findings with blood cultures and throat swab cultures. The comparative values of cultures of lung aspirates, blood and throat swabs in children suffering with LRTIs were evaluated. The comparative study indicated that evaluation of lung aspirates with throat swabs and blood cultures gives a higher predictive value and may be carried out in acute lower respiratory tract infections in children to manage these cases more efficiently.

Materials and Methods

The present study was conducted on 120 paediatric patients with clinical and radiological evidences of acute lower respiratory tract infections attending to the department of Paediatrics, Government General Hospital; Kakinada with in a period of twenty four months was studied. The material processed for the present study were transthoracic lung aspirations, blood samples and throat swabs from 120 paediatric patients, suffering from acute lower respiratory tract infections with in a period of twenty four months from October by covering all the seasons. The evaluation of the infections was done as evidenced by the clinical symptoms like fever, cough, dyspnoea, tachypnoea and radiological evidence of consolidation etc. (Kliegman, 2020). The cases included individuals of both sexes and age groups of 1 month to 12 years. The transthoracic lung aspirates were collected under the guidance of Paediatrician and with radiological evidence of consolidation.

A 22 or 23 gauge needle was inserted in the area of involvement as determined by chest X-ray. At the midaxillary line into lung during suspended respiration in older children. The specimens were carefully collected in to universal sterile containers, (John G. Bartlett *et al.*, 1999). At the same time 5-10ml of venous blood was also collected with 22G or 23G needle into 50ml of sterile glucose broth in a McCartney's bottles.

From the same patient 2 swabs were collected from mucus membrane of throat region under good light and vision. All the material thus collected was transported to the laboratory immediately. The transthoracic lung aspirates were subjected for direct smear examination which was stained by methylene blue and dilute carbolfuchsin and Gram stained for evidence of microorganisms and their special features microscopically.

The aspirates were inoculated on Nutrient agar, two Sheep agar plates, two Chocolate agar plates, MacConkey agar plate and in Glucose broth. All the inoculated solid and liquid culture media were incubated at 37^0c for about 18 – 24 hrs and another set of plates were incubated anaerobically in Candle jar at atmosphere of 5-10% Co2 for 48 hrs. All the plates were observed for growth and processed according to standard techniques.

All the colonies were processed and confirmed by considering microscopy and growth characteristics on culture plates with necessary biochemical tests such as bile solubility, inulin fermentation Optochin sensitivity, Bacitracin sensitivity, coagulase,

catalase, IMVIC reaction (Indole, Methyl red, Voges- Proskaeur and Citrate tests) and Sugar fermentation tests. All the pathogens were subjected to antibiotic sensitivity tests by Modified Kirby-Bauer's method and tested for Meropenem, Ampicillin, Cotrimoxazole, Ciprofloxacin, Cefotaxime, Amikacin and Gentamicin according to CLSI 2020 guidelines (Clinical and Laboratory Standard Institute).

Statistical analysis

The comparison among groups was done using Chi square test and obtained p-value considered significant (Chi square Statistics-27.80; P value < 00001).

Results and Discussion

A total number of 120 paediatric patients suffering from acute lower respiratory tract infections including pneumonia were investigated bacteriologically for 120 lung aspirates, 120 blood samples and 120 throat swabs as indicated in Table 1.

Ages of children in the study varied as 39 patients (32.5%) in 0-12 months group followed by 41(34.2%) in 1-3 years group, 31 (25.8%) in 4-6 years age group and only 9 (7.5%) in 7-12 year age group. The youngest in the study was 2 months and oldest was 12 years male child. Male preponderance was seen in the study (Table.2). A total of 120 lung aspirates taken from selected cases showed culture positivity in 57 (47.5%) samples. Among the positive isolates in order of prevalence *Streptococcus pneumoniae* 20 (16.7%) followed by *Hemophilus influenza* 12 (10.0%), *Klebsiella pneumonia* 10(8.3%, *Staphylococcus aureus* 8 (6.7%), *Streptococcus pyogenes* 5 (4.2%) and *Pseudomonas aeruginosa* 2 (1.6%) were isolated. Blood cultures were positive in 19 cases and majority of throat swabs were commensals, only 9 (7.5 %) samples yielded pathogenic organisms (Table.3)

The predominant organism was *Streptococcus pneumoniae* showed total sensitivity to Meropenem (100%) followed by Cefotaxime (96.5%), Penicillin (93.1%), Erythromycin (89.6%) and Ampicillin (82.8%).

Table.1 Culture positivity among overall patients with acute respiratory tract infections in lung and blood samples.

S.No.	Clinical Samples Investigated	Number	No. Of Positive Cultures	No. Of Culture Negatives
1.	Lung aspirates	120	57	63
2.	Blood samples	120	19	101
Total		**240**	76	164

(Chi square Statistics-27.80; P value < 00001)

Table.2 Age & Sex wise prevalence of 120 Paediatric patients with acute lower respiratory tract infections.

S.No	Age Group	No Of patients	Males	Females
1	0-12 months	39	21	18
2	1-3 years	41	29	12
3	4-6 years	31	17	15
4	7-12 years	9	6	9
Total		120	73	54

Table.3 Overall incidence of different bacterial pathogens obtained from three different specimens.

S.No.	Organism Isolated	Lung aspirate cultures	Blood cultures	Throat swab cultures
1	*Streptococcus pneumoniae*	20	6	3
2	*Hemophilus influenza*	12	2	1
3	*Klebsiella pneumoniae*	10	5	0
4	*Staphylococcus aureus*	8	4	2
5	*Streptococcus pyogenes*	5	1	3
6	*Pseudomonas aeruginosa*	2	1	0
Total		57	19	9

Table.4 Antibiotic sensitivity pattern of different organisms isolated from 3 different clinical samples from 120 cases of acute lower respiratory tract infections.

S.No	Name of the Organism	Total Number	P	A	CO	CP	E	CE	G	AK	ME
1	*Streptococcus pnemoniae*	29	27 93.1%	24 82.8%	0 0	0 0	26 89.6%	28 96.5%	ND	ND	29 (100%)
2	*Klebsiella pnemoniae*	15	2 13.3%	2 13.3%	1 6.6%	3 20%	2 13.3%	14 93.3%	11 73.3%	13 86.7%	15 (100%)
3	*Hemophilus influenza*	15	2 13.3%	2 13.3%	2 13.3%	3 20%	2 13.3%	14 93.3%	11 73.3%	13 86.7%	15 (100%)
4	*Staphylococcus aureus*	14	3 21.4%	3 21.4%	1 7.1%	4 28.5%	11 78.6%	12 85.7%	11 78.6%	12 85.7%	14 (100%)
5	*Streptococcus pyogenes*	9	8 88.9%	7 77.8%	0	0	8 88.9%	9 100%	ND	ND	9 (100%)
6	*Pseudomonas areuginosa*	3	0 0	0 0	0 0	1 33.3%	0 0	3 100%	2 66.6%	3 100%	3 (100%)

(P-Penicillin; A-Ampicillin; CO-Co-trimoxazole; CP-Ciprofloxacin; E-Erythromycin; CE-Cefotaxime; G-Gentamicin; AK-Amikacin; ME-Meropenem)

Klebsiella pneumoniae exhibited total sensitivity to Meropenem followed by Cefotaxime (93.3%), Amikacin (86.7%) and Gentamicin (73.3%). *Hemophilus influenza* showed total sensitivity to Meropenem followed by Cefotaxime (93.3%), Amikacin (86.7%) and Gentamicin (73.3%).

Staphylococcus aureus showed total sensitivity to Meropenem followed by Cefotaxime (85.7%), Amikacin (85.7%), Gentamicin and Erythromycin (78.6%) of each. *Streptococcus pyogenes* showed total sensitivity to Meropenem and also to Cefotaxime and *Pseudomonas aeruginosa* showed total sensitivity to Meropenem and also to Cefotaxime and Amikacin (Table.4).

One hundred twenty paediatric cases suffering from acute respiratory tract infections including pneumonias were investigated bacteriologically for lung aspirates, blood samples and throat swabs to identify the prevalent bacterial species isolated and their antibiotic sensitivity patterns.

In the present study lower respiratory tract infections were predominant among males than females which were similar to the study of Syed Mustaq Ahmed *et*

al., 2013. The most vulnerable age group involved in this study was below 5 year age group in accordance with study of Boor *et al.*, 2001. The predominant pathogen isolated was *Streptococcus pneumoniae* followed by *Hemophilus influenza*, Staphylococcus coincides with Hua CZ *et al.*, 2006 study. Parenteral antibiotics such as Carbapenems (Meropenem), Cefotaxime and Aminoglycosides (Amikacin) were effective which coincides with the study of Syed Mustaq Ahmed *et al.*, 2013.

Acknowledgement

Authors are grateful to Dr. G. V. Subba Rao, Professor of Microbiology, Rangaraya Medical College, and Kakinada for his guidance during the study period.

References

Agarwal A K, *et al.*, 1998: "Chronic anaerobic pneumonitis in a seven year old girl" Journal of Paediatrics Pulmonology, August 26(2):135-137.

Boor, S. *et al.*, 2001: "Risk factors for severe acute respiratory tract infections in under 5 children" Indian Paediatrics 2001; 38: 1361-136.

Broor S *et al.*, 1999: "Acute lower respiratory tract infections in children in India" Indian Journal of Medical Microbiology (1999),17 (1):4-9.

CLSI, (2020): Performance Standards for Antimicrobial Susceptibility Testing; CLSI document M100- 30th ed.Vol 40.No 1, Wayne, PA19087, USA: Clinical and Laboratory Standards Institute.

Hua C Z *et al.*, (2006): "Pathogenic bacteria of childhood lower respiratory tract infection" Zhongguo Dang Dai Er Ke Za Zhi. 2006 Oct;8(5):365-8. Chinese. PMID: 17052391.

John G Bartlett *et al.*, (1998): "Techniques & procedure in clinical microbiology, laboratory diagnosis of lower respiratory tract infections in children" American chest physicians, Cumitech 7 A.

Kliegman, R. (2020), Nelson textbook of paediatrics (Edition 21). Philadelphia, PA: Elsevier.

Rebecca B Knobbe *et al.*, 2019: "Pathogens Causing Respiratory Tract Infections in Children Less Than 5 Years of Age in Senegal" Microbiology Insights Volume 12: 1–8. https://doi.org/10.1177/1178636119890885

Serges Tchatchouang *et al.*, 2019: "Bacterial Aetiologies of Lower Respiratory Tract Infections among Adults in Yaoundé, Cameroon" April 2019, BioMed Research International 2019(11):1-7.DOI:10.1155/2019/4834396.

Syed Mustaq Ahmed *et al.*, 2013: "Lower Respiratory Tract Infections (LTRIs): An Insight into the Prevalence and the Antibiogram of the Gram Negative, Respiratory, Bacterial Agents" J of Clinical and Diagnostic Research, 2013 Feb; 7(2): 253–256.

How to cite this article:

Prasanna Kumar, P. V., Suguneswari Giddi and Sivamma, B. V. 2022. Bacteriological Study of Lung Aspirate Cultures of Acute Lower Respiratory Tract Infections with Reference to Blood Cultures and Throat Swab Cultures among Children. *Int.J.Curr.Microbiol.App.Sci.* 11(02): 251-255.
doi: https://doi.org/10.20546/ijcmas.2022.1102.027