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Original Research Article

Clinical and bacterial profile of pneumonia in 2 months to 5 years age children: a prospective study done in a tertiary care hospital

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ABSTRACT

Background: Pneumonia is one of the leading causes of mortality among under-five children contributing to 15% of deaths all over the world. More than 95% of all new cases of pneumonia in children less than 5 years occur in developing countries due to increased prevalence of under nutrition, inadequate coverage of vaccination, lack of exclusive breast feeding, illiteracy etc.
Methods: A total 110 subjects with pneumonia aged 2 months to 5 years were included in the study. Pneumonia was diagnosed clinically and classified according to new guidelines of WHO. Nutrition history including breast feeding practices and immunization history was taken. Anthropometry recorded along with thorough clinical examination bacterial cultures of blood, sputum and nasopharyngeal aspirates were done. Chest X-ray was taken for all patients for confirmation.
Results: Out of 110 total subjects, Sixty three cases (57.27%) belonged to the revised WHO classification of 'pneumonia' and 47 (42.72%) cases had 'severe pneumonia'. Ninety cases (81.81%) were less than 3 years of age. The percentage of severe pneumonia was higher in children less than 3 years of age with p value <0.05. No statistical correlation was found between gender and the severity of pneumonia. Out of total subjects, 64 cases were malnourished with weight for age <3rd percentile. 25 cases belonged to IAP Grade I PEM, 30 cases to Grade II, 7 cases to Grade III and 2 Children belonged to grade IV PEM. There is no correlation between the degree of malnutrition and severity of pneumonia. Severe pneumonia was observed in higher proportion in children who were not exclusively breast fed with p value <0.05. Out of 83 fully vaccinated children, 26 (31.32%) cases had severe pneumonia whereas out of 27 cases of not fully vaccinated group, 21 (77.7%) had severe pneumonia with significant P value <0.05. Twenty six (23.63%) blood samples and 34 (30.9%) sputum/ nasopharyngeal aspirates yielded positive bacterial growth. Common organisms were *Staphylococcus aureus* (18), *Klebsiella* (18), CONS (4), *Acinetobacter* (4) *Citrobacter* (3), *Pseudomonas* (1), MRSA (1) and *Streptococcus pneumoniae* (1).
Conclusions: Lack of exclusive breast feeding till 6 months of age, Failure of complete immunization coverage, Child malnutrition, Infancy and toddler age are the risk factors for 'severe pneumonia'. *Staphylococcus aureus* (18), *Klebsiella* (18), CoNS (4), *Acinetobacter* (4), *Citrobacter* (3) are the common organisms isolated from cultures of blood and sputum/naso pharyngeal aspirates.

Keywords: Breast feeding, Infants, Malnutrition, Pneumonia, Vaccination

INTRODUCTION

Pneumonia is a common problem in children with significant mortality. maternal and child epidemiology estimation group (MCEE) of WHO estimated the under-five mortality from its global health observatory data and declared that pneumonia continues to be the leading cause of death among children in developing countries resulting in 15% of under-five child mortality with an estimated 0.9 million child deaths all over the world in 2015 alone.[1] An estimated 143,286 under five children died in India alone due to pneumonia in the post neonatal period during the year 2015 contributing to 28% of post neonatal deaths.[1]

The case fatality rate due to pneumonia among hospitalized children aged 1 month to 59 months reported was 8.2%.[2] Various factors like age of the child, nutrition state, breast feeding practices, vaccination status, bacterial Profile and associated congenital anomalies determine the severity of the pneumonia and mortality due to pneumonia. WHO experts' panel redefined the classification of pneumonia severity as 'pneumonia' with fast breathing and/or chest in drawing and 'severe pneumonia'- pneumonia with any general danger signs.[3] The aim was to study the clinical profile, risk factors of pneumonia and to determine the bacterial etiology of pneumonia in children.

METHODS

A prospective observational study was done from January 2012 to June 2013. The present study was conducted in the Department of Pediatrics, Gandhi hospital, Secunderabad involving 110 children from 2 months to 5 years of age presenting with fever, cold, cough, shortness of breath, and increased respiratory rate with chest in drawing satisfying WHO criteria for pneumonia. According to revised WHO classification cases were classified into two categories as 'pneumonia' and 'severe pneumonia'.[3] Detailed clinical history was taken. Nutrition history including breast feeding practices, immunization history and treatment history was taken.

For determining vaccination status national immunization schedule was taken into consideration. Anthropometry recorded along with thorough clinical examination. Nutrition status of subjects was assessed with reference to WHO growth charts and classified as per IAP classification of malnutrition. For the purpose of statistical analysis, categorized into 2 groups; children with weight for age < 3rd percentile and those with weight for age ≥ 3rd percentile. Age wise categories; infants, toddlers and preschool were categorized as two groups: 0-3 Years and 'above 3 years' group.

Basing on duration of stay in the hospital they were divided into 2 groups as - less than one week group and more than one week group. Investigations included CBP, radiograph of chest, cultures of sputum /nasopharyngeal aspirates and blood cultures. Induced sputum was collected after giving nebulization with 5.0% hypertonic saline. When the former could not be collected, nasopharyngeal aspirates were collected.[4] The subjects who received prior parenteral antibiotics were excluded from the study. For statistical analysis, IBM SPSS statistics software, version 16 for windows was used. Chi square test was done for statistical significance. In all instances, a P value of <0.05 was considered statistically significant. Charts were prepared from Microsoft Excel 2007 Version.

RESULTS

Out of 110 subjects in the study, sixty three cases (57.27%) belonged to the revised WHO classification of 'pneumonia' category and 47 (42.72%) cases belonged to 'severe pneumonia' category. Ninety cases (81.81%) were less than 3 years of age: (infants: 59, toddlers: 31). Twenty (18.18%) cases belonged to preschool age group. Out of 90 cases in the 2 months to 3 years age group, 47 (52%) belonged to pneumonia, 43 (48%) cases belonged to severe pneumonia. Out of total 20 cases in 3-5 years age group, 16 (80%) cases belonged to pneumonia and 4 (20%) cases belonged to severe pneumonia. Severe pneumonia was observed in higher proportion in 2 months-3 years age group (Table 1).

Table 1: Distribution of pneumonia cases in relation with age group and gender.

	Infants (59)			Toddlers (31)			Preschool children (20)		
	Males	Females	Total	Males	Females	Total	Males	Females	Total
Pneumonia (63) (57.2%)	17	13	30	11	6	17	9	7	16
Severe pneumonia (47) (42.72%)	14	15	29	10	4	14	2	2	4

Therefore, Infancy and Toddler age formed a risk factor for the incidence of 'severe pneumonia' with p value <0.05.Sixty three (57%) cases were boys and 47 (43%) were girls. We found no significant statistical correlation between gender and the incidence of pneumonia. Out of 110 total subjects, 46 cases were having weight for age ≥

3rd percentile. 64 cases were malnourished with weight for age <3rd percentile. Among malnourished children 25 belonged to IAP grade I PEM, 30 cases belonged to grade II PEM, 7 cases belonged to grade III PEM and 2 children belonged to grade IV PEM. Though 'P' value is not significant by chi square test, the proportion of 'severe pneumonia' is significantly higher in malnourished children with Weight for age <3 percentile (Table 2). There is no correlation between the degree of malnutrition and severity of Pneumonia.

Table 2: Distribution of cases with relation to severity of malnutrition.

Type of pneumonia	Cases with malnutrition: IAP grade					Cases with no malnutrition
	Grade I	Grade II	Grade III	Grade IV	Total	
Pneumonia (63)	17	14	4	Nil	35	28
Severe pneumonia (47)	8	16	3	2	29	18
Total	**25**	**30**	**7**	**2**	**64**	**46**

Though 'P' value is not significant by chi square test the proportion of severe pneumonia is significantly higher in malnourished with weight for age <3 percentile. No correlation is made out between severe malnutrition and occurrence of severe pneumonia.

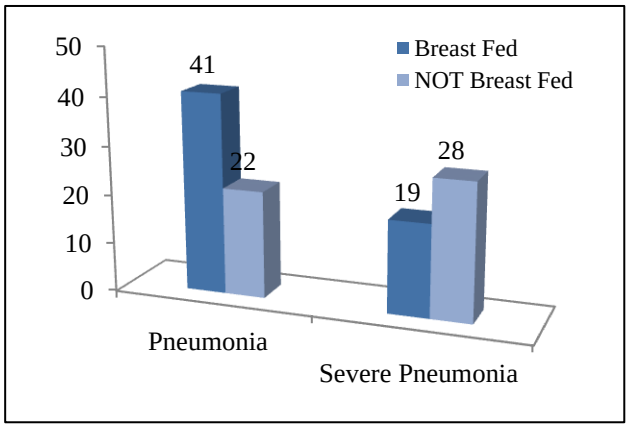

Figure 1: Exclusive breast feeding in pneumonia/severe pneumonia.

Out of 63 cases in pneumonia group, 15 (23.8%) cases were not breast fed. Out of 47 cases in the severe pneumonia group, 35 (74.46%) cases were not breast fed. Severe pneumonia is observed in higher proportion in children who were not exclusively breast fed with p value <0.05. Out of 83 fully vaccinated children, 26 (31.32%) cases had severe pneumonia whereas out of 27 cases of not fully vaccinated group, 21 (77.7%) had severe pneumonia with significant P Value <0.05. No statistical correlation is found in the severity of pneumonia and duration of stay in the hospital.

Of 63 cases of pneumonia, 28 children had bilateral infiltrates in the X-ray, 31 had either left or right side infiltrates and 4 had lobar consolidation. Of 47 cases of severe pneumonia, 26 cases showed bilateral infiltrates and 16 had both right or left sided infiltrates, 3 had lobar consolidation and 2 cases had synpneumonic effusion.26 (23.63%) blood samples and 34 (30.9%) sputum/ nasopharyngeal aspirates yielded positive bacterial growth. In 10 cases cultures were positive in both types of specimens. Common organisms isolated were *Staphylococcus aureus* (18), *Klebsiella* (18), *CoNS* (4), *Acinetobacter* (4), *Citrobacter* (3), *pseudomonas* (1), *MRSA* (1) *and Streptococcus Pneumoniae* (1).

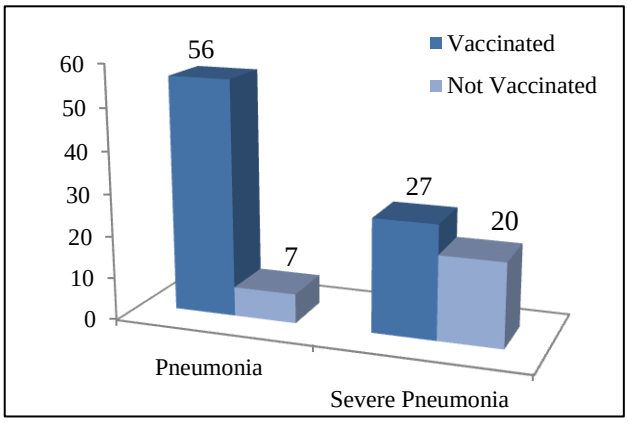

Figure 2: Severity of pneumonia versus vaccination status.

DISCUSSION

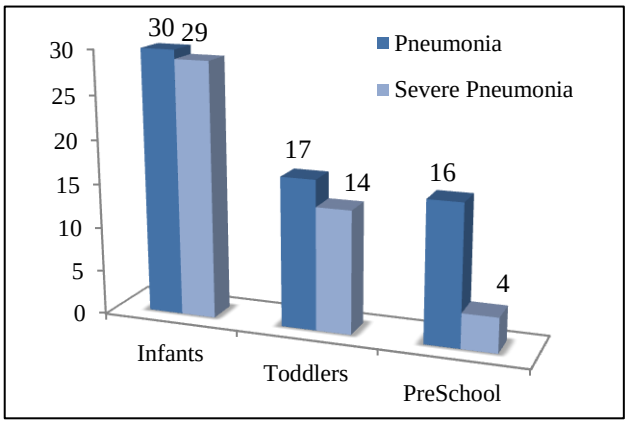

Figure 3: Distribution of pneumonia cases in different age groups.

In infants, 30 (50.84%) cases belonged to pneumonia group and 29(49.15%) cases belonged to severe pneumonia. In toddlers 17 (54.83) had pneumonia, 14 (45.17%) had severe pneumonia. In preschool age, 16(80%) cases belonged to pneumonia and 4 (20%) cases belonged to severe pneumonia (Figure 1).

There is no significant difference in the incidence of severe pneumonia in infants and toddlers. But compared with preschool group, proportion of severe pneumonia is higher in children less than 3 years group. Therefore, infancy and toddler age formed a risk factor for the incidence of 'severe pneumonia' with p value <0.05 in the study. There were 63 (57%) boys and 47 (43%) girls with a male:female ratio1.3:1. We found no significant statistical correlation between gender and the incidence of pneumonia. This is similar to the studies done by Ramachandran et al and Bhat R et al where they have reported 58% boys and 42 % girls.[2,6] Whereas Divyarani DC et al in their study reported a higher incidence of pneumonia in males (62.6%) than in females (37.4%).[5]

Table 3: Statistical analysis: pneumonia and severe pneumonia versus age, gender, weight for age, breast feeding, vaccination and duration of hospital stay.

	Pneumonia	Severe pneumonia	Total	'P' Value by chi square test
Age: 0-3 years	47 (52%)	43 (48%)	90	<0.02
Age: > 3 Years	16 (80%)	4 (20%)	20	
Male	37 (58.73%)	26 (41.26%)	63	Not Significant
Female	26 (55.31%)	21 (44.68%)	47	
Weight for age <3 percentile	35 (54.68%)	29 (45.31%)	64	Not Significant
Weight for age >3percentile	28 (60.86%)	18 (39.13%)	46	
Exclusively breast fed	48 (80%)	12 (20%)	60	<0.05
Not exclusively breast fed	15 (30%)	35 (70%)	50	
Fully vaccinated	57 (68.67%)	26 (31.32%)	83	< 0.05
Not fully vaccinated	6 (22.22%)	21 (77.77%)	27	
Duration of hospital stay < 1 week	28 (60.86)	18 (39.13%)	46	Not Significant
Duration of hospital stay >1 week	35 (54.68%)	29 (45.31%)	64	

- Cases 0-3 years of age show significantly higher proportion of severe pneumonia with p value <0.02
- The proportion of pneumonia and severe pneumonia in males and females is similar
- Though 'P' value is not significant, the proportion of Severe Pneumonia is significantly higher in malnourished cases with weight for age <3 percentile
- The proportion of severe pneumonia is significantly higher in not exclusively breast fed babies with P value < 0.05
- The proportion of severe pneumonia is significantly higher in not fully vaccinated group with P value <0.05
- Though 'p' value is not significant, the proportion of severe pneumonia is higher in cases with duration of hospital stay more than 1week.

Out of 110 cases in the study group, malnutrition was observed in 64 (58.18%) cases which is closer to the results reported by Bhat R et al (54.9%).[6] Out of 63 cases in Pneumonia group, 35 (55.55%) cases were malnourished with weight < 3 percentile. Out of 47 cases in the severe pneumonia group, 29 (61.70%) children were malnourished with weight less than 3rd percentile. Though 'P' value is not significant by chi square test, the proportion of severe pneumonia is higher in children with Weight for age < 3 percentile. The results have shown that there is no correlation between the degree of malnutrition and severity of Pneumonia. This could possibly due to presence of very small number (9 cases) of cases with significant malnutrition (Grade III and Grade IV) in the present study. Whereas Arpita G et al in their study showed a positive correlation between severity of malnutrition and severity of Pneumonia.[11] Severely malnourished children due to impairment of their immunity, especially cellular immunity are more prone to pneumonia. Out of 63 cases in pneumonia group, 15 (23.8%) cases were not breast fed. Out of 47 cases in the severe pneumonia group, 35 (74.46%) cases were not exclusively breast fed. This finding is statistically significant with p value <0.05. This is similar to the studies done by Victoria et al in their review article have reported that lack of exclusive breast feeding is a potential risk factor for severe pneumonia and higher mortality.[7] Lamberti L et al in their systematic review of literature and meta-analysis conclude that lack of exclusive breast feeding result in increased occurrence of pneumonia and also responsible for increased mortality due to severe pneumonia.[10] In addition to passive protection, breast milk seems to affect the infant's systemic immune system via maturational, anti-

inflammatory, immuno-modulatory and antimicrobial action. Out of 83 fully vaccinated children, 26 (31.32%) cases had severe pneumonia and whereas out of 27 cases of not fully vaccinated group, 21 (77.7%) had severe pneumonia with significant P value <0.05. None of the 110 cases received pneumococcal and/or *Hemophilus influenza* type b vaccines.

Decreased incidence of severe pneumonia in vaccinated group might be a direct consequence of DPT vaccination, which would be expected to give some protection against childhood pneumonia. Alternatively the observed reduction could have arisen because of their health awareness and positive attitude of parents of children who were fully vaccinated. They would be practicing better health care practices and seeking medical interventions at an early stage of illness which could otherwise lead to serious illness resulting in severe pneumonia. Complete vaccination status acts as a marker for increased use of health care services, better child-care practices. No statistical correlation is found in the severity of pneumonia and duration of stay in the hospital. Probably the microbial etiology and antibiotic sensitivity are the key factors that determine the recovery and hospital stay.

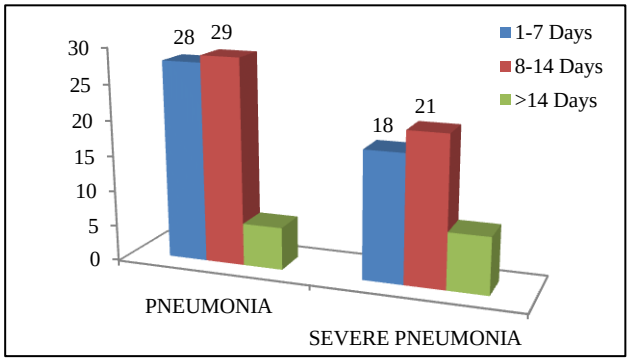

Figure 4: Duration of hospital stay in pneumonia/severe pneumonia.

Of 63 cases of pneumonia, 28 children had bilateral infiltrates, 31 had either left or right side infiltrates and 4 had lobar consolidation. Of 47 cases of severe pneumonia, 26 cases showed bilateral infiltrates and 16 had either right or left sided infiltrates, 3 had lobar consolidation or 2 cases had synpneumonic effusion. Whereas the study done by Bharti et al published in Indian pediatrics in 2008, out of 83 X-rays taken in severe pneumonia cases, lobar consolidation (n = 43, 51.8%) was the most common radiological abnormality, 26 (31.3%) had interstitial abnormalities and 14 (16.9%) had normal chest radiographs.[12] Bacterial culture was done in blood and either sputum or nasopharyngeal aspirate. In 60 cases, cultures were negative in both. In 10 cases bacterial growth was seen in both the specimens. The organisms isolated were the same in both the specimens. In 40 cases bacteria were grown in only one specimen either blood (16) or sputum/nasopharyngeal aspirates (24). Staphylococcus aureus was isolated in 11 (10%) blood samples, coagulase negative *Staphylococcus* (CoNS), *Klebsiella pneumonia* and *Acinetobacter* each was grown in 4 (3.64%), cases *Citrobacter* was isolated in 2 samples and *Methicillin Resistant Staphylococcus aureus* (MRSA) was isolated in one blood sample.

Table 4: Bacteriological profile of blood cultures.

Organism isolated	No/ percent
Staphyloccus aureus	11 (10%)
CoNS[*]	4 (3.64%)
Klebsiella	4 (3.64%)
Acinetobacter	4 (3.64%)
MRSA[**]	1 (0.91%)
Citrobacter	2 (1.82%)
NBG[$]	84 (76.36%)
Grand total	**110**

CoNS [*]Coagulasive negative staphylococcus; MRSA** Methicillin resistant staphylococcus aureus; NBG[$] No bacterial growth

Klebsiella was isolated in 16 (14.0%) of cases from sputum/nasopharyngeal aspirates, *Staphylococcus* was isolated in 15 (13.6%) samples, *Streptococcus pneumoniae, pseudomonas* and *Citrobacter* were isolated in one sample each. In the present study none of the cultures were found to be positive for *Haemophillus influenzae* type B, probably because of fastidious growth requirements of the organism. Simlarly, Karambelkar et al study in western India reported that *Methicillin Sensitive Staphylococcus aureus, Streptococcus pneumoniae* and *Klebsiella species* were the commonest organisms isolated.[13] The other pathogens identified were *Methicillin Resistant Staphylococcus aureus*, and *Pseudomonas* species. Blood culture was positive in 26 (23.63%) of cases whereas nasopharyngeal aspirates yielded organisms in 34 (31%) samples in the present study. Oberoi A et al eported blood culture positivity in 21.9% cases of severe pneumonia.[14]

Table 5: Bacterial profile: culture of sputum/nasopharyngeal aspirates.

Organism isolated	No/percent
Klebsiella	16 (14.0%)
Staphylococcus aureus	15 (13.6 %)
Streptococcus Pneumonia	1 (0.91%)
Pseudomonos	1 (0.9 %)
Citrobacter	1 (0.9 %)
NBG[*]	76 (69.0%)
Grand total	**110**

NBG*No bacterial growth.

CONCLUSION

Lack of exclusive breast feeding till 6 months of age, failure of complete immunization coverage, child malnutrition, infancy and toddler age are the risk factors

for the pneumonia that can lead to increased severity of the disease resulting in 'severe pneumonia'. No significant correlation between x-ray changes and severity of pneumonia was observed. Bacterial cultures of blood and nasopharyngeal / induced sputum have grown predominantly *Staphylococcus,* and *Klebsiella pneumoniae* in this study unlike in the western literature but similar to Indian and South East Asian studies as most of the children here are malnourished.

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Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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