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Clinical and socio-demographic profile of pneumonia in children aged 2 months to 5 years

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ABSTRACT

Background: Among the common childhood illnesses, pneumonia is a substantial cause of morbidity and mortality in children throughout the world. Approximately, 150 million episodes of childhood pneumonia are reported every year, out of which 95% are from developing countries. In addition, socioeconomic and environmental factors like overcrowding, air pollution, passive smoking, practice of bottle feeding etc., contribute to the significant rise in incidence of pneumonia during recent years. The known factors affecting mortality are malnutrition, inadequate vaccination, illiteracy and lack of exclusive breast feeding.
Pneumonia is one of the most prevalent Pediatric infections, and it is a leading cause of morbidity and mortality in children all over the world. Every year, approximately 150 million cases of childhood pneumonia are reported, with 95 percent of cases coming from underdeveloped nations. Furthermore, socioeconomic and environmental variables like as overcrowding, air pollution, passive smoking, and the practice of bottle feeding, among others, have contributed to the large increase in pneumonia incidence in recent years. Malnutrition, inadequate immunization, illiteracy, and a lack of exclusive breast feeding are all documented variables that contribute to mortality.
Materials and Methods: A total of 120 children in the age group of 2 months to 5 years, diagnosed with Pneumonia as per standard definition were enrolled in the study. Detailed history was taken including socio demographic factors and physical examination was done in all children. Appropriate investigations were done.
Results: Children aged between 2 and 12 months constituted 60% of cases. The male to female ratio was 1.5:1. 27.5% children had low birth weight, 63.3% were exclusively breast fed up to 6 months of age. Severe and very severe pneumonia was seen in 90% of children between age group 2 months and 2 years, 63.6% with low birth weight, and 66.6% with partial immunization status. Significant association was found between early weaning and severity of pneumonia (45.45% vs 26.3%).
Conclusion: Children less than 2 years are more prone for developing pneumonia. Low birth weight, partial immunization status of the children, early weaning, history of bottle feeding, lower socioeconomic status, overcrowding, malnutrition and lack of maternal literacy were shown to have an increased risk for severe and very severe pneumonia in children. As most of the above stated factors are modifiable, the implementation of various preventive and educational programs in our society has a likelihood to reduce the occurrence and severity of pneumonia in children

1. Introduction

Pneumonia is the leading infectious cause of death in children under the age of five years around the world. It

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accounts for approximately 9,20,000 deaths each year.[1] India has the highest rate of Pneumonia mortality in the world, with an estimated 4 lakh deaths each year.[2] In underdeveloped countries, the incidence of Pneumonia is more than 10 times greater (0.29 episodes versus 0.03 episodes), and the number of children dying from Pneumonia is roughly 2000 times higher than in developed countries.[1] The high prevalence of malnutrition, low birth weight, and indoor pollution in developing countries account for this disparity.[3] Pneumonia's cost on families and the health system in low-resource nations exacerbates inequities; children who are impoverished, malnourished, and live in remote locations are disproportionately affected by this "forgotten killer."[4] Apart from the infectious agent, other risk factors for pneumonia include the child's genetic and immunological state, as well as low birth weight, malnutrition, and breastfeeding duration. Parental literacy, parental smoking habits, indoor smoke pollution, and overcrowding are all contributing variables.[5,6] Many of these risk factors can be mitigated by taking preventative steps. As a result, understanding these risk factors for Pneumonia will aid in its prevention through effective community health education and appropriate government initiatives, resulting in a healthy community and a healthy nation as a whole.

However, research on the link between these factors and childhood pneumonia is understudied in this region. Therefore, it was decided to undertake this study to identify various modifiable risk factors for Pneumonia in under-five children admitted to our hospital.

2. Materials and Methods

This study was a prospective observational study conducted during January 2019 to June 2020. Children in the age group of 2 months to 5 years, diagnosed with Pneumonia during the study period were enrolled in the study after getting institutional ethical clearance and parental consent. Children with congenital heart disease, tuberculosis, HIV, Primary immunodeficiency and congenital malformations of lung were excluded from the study.

2.1. Method of collection of data: (Correction to be done by Dr Basavaraj)

A case of ALRI is defined as per ARI Control Programme as "presence of cough with fast breathing of more than 60 cycles/min in less than 2 month of age, more than 50 cycles/min in 2 months to 12 months of age and more than 40 cycles/min in 12 month to 5 year of age, the duration of illness being less than 30days".[7] The presence of lower chest wall indrawing was taken as evidence of severe pneumonia. The presence of refusal of feeds, central cyanosis, lethargy or convulsions was taken as evidence of very severe pneumonia. Institutional Ethical Clearance and informed consent of the child's parent/s was taken. A detailed history was taken and physical examination was done according to a predesigned proforma to elicit various potential risk factors.

Routine hematological investigations and chest X-ray were done in all cases to categorize the ALRI into clinical entities and to detect complications, if any. Other specific investigations were done as per requirement in individual cases and all the cases were treated as per the standard protocol depending on the type of ALRI.

2.2. Method of statistical analysis

Sample size was calculated as per prevalence rate of 20% in previous studies with the worst accepted frequency of 40%. The sample size was found to be minimum 97 for 95% confidence interval. Thus a total of 120 cases fulfilling the inclusion criteria during the study period were enrolled. For discrete data, the results were calculated as numbers and percentages, while for continuous data, the results were averaged (mean + standard deviation). The Chi-square test of significance was used to compare proportions. A statistical significance was defined as a "p" value of less than 0.05. The Statistical Package for Social Science (SPSS) package was used to analyze the data.

3. Results

3.1. Sociodemographic characteristics of the study group

Majority of the children (n=72, 60%) were aged between 2 and 12 months followed by 16 (13.3%) children aged between 13 and 24 months. The male to female ratio was 1.5:1. Most common symptom was fever (n=104, 86.6%) followed by cough (n=80, 66.6%), hurried breathing (n=40, 33.3%), chest in drawing (n=26, 21.6%), cold (n=22, 18.3%), noisy breathing (n=20, 16.6%), reduced feeding (n=14, 11.6%), vomiting (n=6, 5%), irritability (n=4, 3.3%), abdominal pain (n=3, 2.5%) and loose stools (n=2, 1.6%). Low birth weight was observed in 33 (27.5%) children. Majority of children (n=76, 63.3%) were exclusively breast fed up to six months of age. History of receiving bottle feeding in infancy was seen in 68 (56.7%) children. According to National Immunization Schedule, 21 children (17.5%) were partially immunized. Majority of the children (n=90, 75%) had normal weight for age and 10% (n=12) had severe PEM. Stunting was observed in 23 (19.2%) children and nine children (7.5%) had severe malnutrition based on MUAC. Majority of children (n=92, 76.7%) belonged to lower middle class families according to Modified Kuppuswamy classification. Exposure to indoor pollution was seen in 38 (31.7%) children and overcrowding in 31 (25.8%) families. Majority (n=89, 81.6%) mothers were literate. Majority (n=84, 70%) of the children had anemia. There were no children with clinical signs suggestive of

Vitamin A and D deficiency.

Majority (n=80, 66.7%) of the children had pneumonia, 28 (23.3%) had severe pneumonia and 12 (10%) had very severe pneumonia. Severe and very severe pneumonia was seen in 36 (90%) children between age group 2 months and 2 years and this result was found to be statistically significant (p value <0.001). No statistically significant association was found between the gender and severity of pneumonia (p=0.11). Among 33 low birth weight children included in this study, 21 (63.6%) had severe / very severe pneumonia. This result was found to be statistically significant (p value <0.001). Majority (n=14, 66.6%) of partially immunized children had severe / very severe pneumonia which was statistically significant (p <0.001). Among 76 children who were exclusively breast fed, only 22 (28.9%) had severe / very severe pneumonia. And out of 44 children who were not exclusively breast fed, 18 (40.9%) had severe / very severe pneumonia. This indicates that less children with exclusive breast feeding had severe / very severe pneumonia. However, this result was not statistically significant (p=0.18). Thirty children (44.1%) who were bottle fed had severe / very severe pneumonia whereas 10 (19.2%) children without bottle feeding history had severe / very severe pneumonia. This result was found to be statistically significant (p=0.004). Among 40 children with severe / very severe pneumonia, 30 (75%) belonged to lower middle and upper lower socioeconomic class. This result was found to be statistically significant (p=0.0012). There was no significant association found between indoor pollution and severity of pneumonia (p=0.052). Among 22 children with mothers who were not literate, 16 (72.7%) children had severe / very severe pneumonia and this result was found to be statistically significant (p<0.001). Among 31 children with overcrowding history, 16 (51.6%) had severe / very severe pneumonia. This result was found to be statistically significant (p=0.012). Among 30 children with malnutrition based on weight for age, 16 (53.33%) had severe / very severe pneumonia compared to 24 (26.6%) children with normal weight for age. This result was statistically significant (p=0.0073). Among 23 children with malnutrition based on height / length for age, 16 (69.5%) had severe / very severe pneumonia compared to 24 (24.7%) children with normal height / length for age. This was statistically significant (p<0.001). Among 25 children with malnutrition based on MUAC, 14 (56%) had severe / very severe pneumonia compared to 26 (27.3%) children with normal MUAC. This was statistically significant (p=0.007). There was no statistically significant association between severity of anemia and pneumonia.

4. Discussion

Pneumonia was shown to be more prevalent in newborns in this investigation (60 percent). Similarly, in a study conducted by Savitha MR et al.[8] and Seth S et al.,[9] infants constituted 62.5% and 63% of pneumonia cases respectively. In the present study, there was significant association between age of the child below 2 years and severity of pneumonia (59.7%). Similar findings were made by Rao GM et al. 10(90%). In the study conducted by Gupta N and Bhadrala N11, 74.3% children were between 2 to 12 months. It was noted that immunity is not well established in young children. Narrow airways, a short bronchial tree, and inadequate lung development are among the other contributing causes.[10]

The study found a male preponderance, with a male to female ratio of 1.5:1. Similarly, male preponderance was seen in studies conducted by Kasundriya SK et al.,[11] Udaya K et al.[12] Taksande AM et al.[13] and Aftab S et al.[14] Gender bias in seeking care cannot be ruled out, which could explain the male preponderance.

In our study, 27.5% children had birth weight less than 2500gm. Similar results were observed in study conducted by Agarwal PK and Patil J[15] (29.7%) and Deepti P and Abha P[16] (31%). Statistically significant association was found between low birth weight babies and severity of pneumonia (63.6%) Similar results were seen in studies conducted by Gupta N and Bhadrala N[17] (41.3%), Rao GM et al.[18] (33%), and Hemagiri K et al.[19] (33%). Study done by Taylor B et al.[20] and Chan K et al.,[21] showed children having a history of low birth weight seemed to be at a higher risk of developing severe Pneumonia. This could be attributed to LBW newborns' poor pulmonary function and inadequate immunity, which makes them more susceptible to ALRI, especially the severe variety.[22]

In present study, exclusive breastfeeding was seen in 63.3% of children and similar results were seen in study conducted by Deepti P and Abha P (64%)[16] and Seth S et al.[9] (71%). Non-exclusive breastfeeding in the first six months of life was associated with severity of pneumonia (40.9%). Similar results were seen in the study conducted by Gupta N and Bhadrala N[17] (40.8%). Champatiray J et al.[23] (40%) found that inadequate breast feeding in the first 6 months of life was associated with severity of pneumonia. Breast milk's well-known protective effect is due to its high concentration of bacterial and viral antibodies, macrophages that synthesise complement, and lysozymes, which not only protect against severe ALRI but also prevent the development of asthma and other allergic illnesses.

In our study, 56.6% of children had a history of bottle feeding. In the study conducted by Aftab S et al.,[14] 25.5% had history of bottle feeding. The practice of bottle feeding was significantly associated with severity of pneumonia (44.1%) in our study. Similar results were seen in study conducted by Gupta N and Bhadrala N[17] (39.9%) where both bottle feeding and mixed feeding were included.

In our study, 17.5% children were partially immunized for age. Similarly, Nirmolia N et al.[24] and Udaya K et al.[12] and found that 27.82% and 30.64% of children

with pneumonia were partially immunized respectively. In our study, there was a statistically significant association between partial immunization and severity of pneumonia (66%). Similar results were obtained by studies conducted by Gupta N and Bhadrala N[17] and Rao GM et al.,[18] where 61.7% and 40% of children were partially immunized or unimmunized respectively. When compared to children who were unimmunized or just partially immunised with children who were completely immunised for their age were less likely to get the disease. This is because measles and pertussis vaccinations can help avoid infections that can lead to pneumonia as a consequence. It's also possible that mothers who use immunisation programmes are more aware of health-care facilities and are more likely to seek early consultations for their children's illnesses, potentially avoiding serious disease.

In our study, 25% children were malnourished according to weight for age criteria, 19.2% children were moderate and severely stunted, and 20.9% children were malnourished according to MUAC. Similarly, malnutrition was seen in 30.4% in study conducted by Seth S et al.[9] and 58.7% by Agarwal PK and Patil J.[15] This difference in the results may be due to different criteria being used to grade malnutrition. In the present study, malnutrition was very significantly associated with severity of pneumonia (53.3% WFA, 69.5% HFA and 56% MUAC). Similar results were seen in study conducted by Gupta N and Bhadrala N[17] (66.4%) and Rao GM et al.[18] (63%), although different criteria were used to grade malnutrition. According to Sehgal et al.[25] severe malnutrition was found to be a predictor of mortality in ALRI children under the age of five. Boor S et al.[26] found children with severe malnutrition had a 1.85 times higher chance of getting ALRI than children with adequate nutritional status. Malnutrition has been linked to a two- to three-fold increase in ALRI mortality. Malnourished children suffer from a lack of cell-mediated immunity as a result of thymolymphatic depletion, which can lead to severe gram-negative infections and sepsis. They may also contain immunoglobulins that are qualitatively aberrant, as well as impairments in critical enzymes involved in leucocyte bactericidal activity.

The majority of children in our study (88.3%) were from the lower middle and upper lower socioeconomic classes. Mirji G et al.[27] found similar results in their research (92%). In our study, we discovered a statistically significant link between lower socioeconomic status and pneumonia severity (57.1%). In studies conducted by Gupta N and Bhadrala N[17] (48.7%), Rao GM et al.[18] (72.6%) and Hemagiri K et al.[19] (72.6%) lower socioeconomic class was associated with higher risk for severe pneumonia. Poverty was found to be substantially linked with the prevalence of Pneumonia in another study by Rahman MM and Rahman AM.[28] Low per capita income was found to be substantially linked with ALRI by Biswas A et al.[29] Low socioeconomic status is likely to result in a lack of access to social, human, and material resources, resulting to an increase in infections.

In our study, exposure to indoor pollution was seen in 31.7% of cases. Similar results were seen in study conducted by Rao GM et al.[18] (30%). However, the association was not found to be statistically significant between indoor pollution and severity of pneumonia (21.05%). A systematic review and meta-analysis of 24 studies have shown that exposure to unprocessed solid fuels increases the risk of Pneumonia in young infants by a factor of 1.8.[30] Similarly, Rao GM et al.[18] study has found that indoor air pollution raises the risk of pneumonia severity in children.

In our study, overcrowding was found in 25.8% of families. However, Udaya K et al.[12] (51%) and Rahman MM and Rahman AM[28] (62%) found higher proportion of families with overcrowding. This was probably because of differences in geographical areas under study. There was a statistically significant association between overcrowding and pneumonia severity in this investigation (51.6 percent). Similar findings were made in a study conducted by Rao GM et al.[18] (43%) Hemagiri K et al.[19] (42.6%) and Gupta N and Bhadrala N[17] (40.98%). Overcrowding may make it more likely for illnesses to spread among family members.

In our study, 18.3% mothers were not literate. Similar results were obtained by studies conducted by Kasundriya SK et al.[11] (10%), and Hemagiri K et al.[19] (34.8%).In the present study, there was a strong association between lack of the maternal literacy and the severity of pneumonia (72.7%). This finding correlated with the findings of Rao GM et al.[18] (70%) and Gupta N and Bhadrala N[17] (57.9%). However, the differences in the results are probably because different education levels were considered in each study. Poor formal maternal education may not be a modifiable risk factor at the individual level, but we have considered it as one of the strong determinant of pneumonia, which can be modified at community level. More educated parents, particularly mothers, are more likely to seek appropriate and timely treatment for their children's ailments.

In the present study, anemia was present in 70% children. Similar results were seen in study conducted by Agarwal PK and Patil J,[15] who observed anemia in 58.7% of ALRI cases. Ramkrishnan K and Harish PS[31] identified low haemoglobin levels as a risk factor, and anaemic children were found to be 5.75 times more sensitive to ALRI. Similarly, in a study done by Malla T et. al.,[32] anemic patients were 3.2 times more susceptible for ALRI. However, in our study, no statistically significant association was found between severity of pneumonia and anaemia.

There were no children with clinical signs suggestive of Vitamin A and D deficiency.

5. Conclusion

Children less than 2 years are more prone for developing pneumonia. The socio-demographic factors which put a

child at risk for developing pneumonia are incomplete immunization, inadequate breastfeeding, bottle feeding, overcrowding and exposure to indoor pollution. Low birth weight, partial immunization status of the children, history of bottle feeding, lower socioeconomic status, overcrowding, malnutrition and lack of maternal literacy were shown to have an increased risk for severe and very severe pneumonia in children.

As most of the above stated factors are modifiable, the implementation of various preventive and educational programs in our society has likelihood to reduce the occurrence and severity of pneumonia in children.

6. Conflict of Interest

None.

7. Source of Funding

None.

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