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Original Article

Factors Influencing the Outcome of Severe Pneumonia among Children Having Age from 2 Months to 5 Years in a Tertiary Healthcare Hospital

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ABSTRACT

One of the leading causes of high rate of morbidity and mortality among pediatrics under the age of five years is pneumonia. A report of WHO published in 2013 stated that pneumonia is accountable for about one hundred and twenty million patients each year and the most vulnerable are developing countries. **Objective:** To find out the rate of occurrence of different factors and pneumonia's outcome among children having age from two months to five years in tertiary healthcare hospital. **Methods:** It was carried out at ICU of Pediatric Department of Ziauddin Hospital Karachi, from June 2021 to December 2021. It included 145 patients under the inclusion standard. **Results:** Average weight, height, age and duration of hospitalization in this research work was 7.72 ± 3.87 kilograms, 68.23 ± 15.28 centimeters, 8.72 ± 4.24 years and 8.72 ± 4.24 days. Total were 63.40% (n: 92) male and 36.60% (n: 53) female patients. out of total 145 patients, 27.60, 73.10, 29.70, 38.60, 35.20, 40.0 and 7.60% patients had mechanical ventilation's requirement, delayed hospitalization, URTI history in family, mostly suffered children suffered from pneumonia in less than 2.5yrs of age. And regarding outcome, prolonged hospital stay, mechanical ventilation and mortality has significant association with younger age. **Conclusions:** It was concluded that association can cause the improvement in the management strategies and possibility of the survival for the children suffering from pneumonia. So, there is need of close monitoring of all the patients with consistent follow up visits.

INTRODUCTION

In the whole world, one of the leading causes of high rate of morbidity as well as mortality among pediatrics under the age of five years is pneumonia [1]. Microbes including fungi, bacteria and viruses can be the cause of this infection which involves the lung alveoli. It is the major causative factor of death and long hospitalization [2]. A global report of WHO published in 2013 stated that pneumonia is accountable for about one hundred and twenty million patients each year, among these patients there is progress towards severe pneumonia in fourteen million (12.0%) patients and the most vulnerability is in the countries which are under development stage (95.0%) [3]. In accordance with the guidelines of WHO, there is requirement of hospitalization for supportive therapy like, nutritional management, oxygen therapy, suctioning and vigilant monitoring for the successful controlling of pediatric pneumonia [4]. There is an estimation that ten million patients of pediatric pneumonia are appearing every year and it is also a pertinent cause of mortality of under five-year patients in our country, Pakistan. pneumonia is responsible for higher than 920000 mortalities of children under five years and our country Pakistan is among top 5 countries which are accountable for ninety nine percent pediatric patients [5]. Literature shows that certain factors have associated with poor outcome of severe pneumonia in children, such as immunization status; of about 47.66 % children were found to have partially immunized or unimmunized, 43 % were found malnourished, while positive family history of upper respiratory infection (URTI) was found in 48.6% children

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and 11.2 % had preceding history of pneumonia [6]. A vital role is played by these factors in influencing the outcome of severe pneumonia among children. Moreover, research conducted previously have assessed the outcomes associated with above mentioned factors that demonstrate that, 51% of children hospitalized for greater than five days, there was need of mechanical ventilation for 20.50% patients and 10.50% patient could not survive and met their final destination [7]. Pneumonia is a lung-affecting inflammatory disease. It is characterized by fluid accumulation in the alveoli, which impedes regular breathing. Pneumonia is primarily but not exclusively caused by bacteria, viruses, and fungus. Streptococcus pneumoniae is the leading cause of bacterial pneumonia in children, whereas Hemophilus influenzae type b (Hib) is the second most cause. In children, respiratory syncytial virus is the leading cause of viral pneumonia, while *Pneumocystis jirovecii* is the leading cause of fungus pneumonia. Globally, pneumonia is the leading cause of child mortality, particularly among children under the age of five. UNICEF reported in 2015 that one in six children died of pneumonia before the age of ten, primarily in the poorest regions of low- and middle-income nations. From 77% in 2000 to 82% in 2015, the number of deaths in these regions has risen steadily. Since 2000, this astonishing number of pneumonia-related deaths has been centered primarily in the Democratic Republic of the Congo, India, Nigeria, and Pakistan [5]. To reduce childhood pneumonia-related mortality, however, a greater understanding of the risk factors impacting pneumonia severity is required. Studies from low- and middle-income countries (LMICs) have sought to determine the risk factors for severe pneumonia, however few studies in Pakistan have identified these variables. Therefore, additional national clinical trials are required for the investigation of factors influencing the outcome of severe pneumonia among children.

METHODS

This is a descriptive research work. This research work was carried out at ICU of Pediatric Department of Ziauddin hospital located in Karachi, Pakistan. This study covers adoration of complete 6 months from June 2021 to December 2021. The calculation of the sample size was carried out fulfilling the requirements of WHO calculator for sample size and one hundred and forty samples were recruited. All children aged 2 months to 5 years, who got admission in ICU suffering from severe pneumonia were recruited and the exclusion criteria were the Children with any respiratory infection such as reactive airway disease and bronchiolitis that does not fulfill the criteria of severe pneumonia due to entirely different etiology thus could provide false positive results. Children with any congenital lung pathology like cystic fibrosis or with recurrent chest infection in patients with cerebral palsy, due to chronic etiology and poor immune system, depicting results that would not the actual presentation of severe pneumonia. Any preceding history of trauma associated with pneumonia due to entirely different etiology. We took the approval of ethical committee of the hospital to conduct this research study. We also took the consent of administration of health care facility before the start of this study. We obtained the written consent from the wards or parents of all included patients after explaining them the purpose of this research work. We also maintained the confidentiality of the included patients. We obtained the detailed history and performed the clinical examination of all the patients suffering from severe pneumonia. After getting the consent of wards, we drew five cc samples for CBC (Complete Blood Count), culture of blood for examining the organism's development and X ray of chest was done for determination of pneumonic infiltrates. Senior consultant checked all the obtained results before entering them in well-organized performa. We started the procedure of data analysis when we achieved the data about the required samples. We used the SPSS version 22.0 for statistical analysis of the collected information. We presented the quantitative variables in average and SDs including hospitalization duration, height and weight. We presented the qualitative data in frequencies and percentages as status of residence, sex, status of parent's education, monthly income of the family, modifiable risk factors as incomplete process of immunization, malnourishment, past pneumonia history, URTI history in family and outcomes of severe pneumonia. We applied the Chi square test by obtaining the p values of ≤ 0.050 as significant statistically.

RESULTS

145 patients were admitted in Pediatric Department of Ziauddin Hospital located in Karachi and fulfilled the inclusion criteria, were the recruits of this research work. Among these patients lowest age of the patient was one year, and highest age of the patient was five years. The average age of the included patients was 4.14 ± 2.49 years. Whereas, mean length of hospital stay, height and weight in this research work was 8.72 ± 4.24 days, 68.23 ± 15.28 cm and 7.72 ± 3.87 kg respectively. As shown in table 1.

Variable	Mean ± SD	Min-Max
Age (Years)	4.14 ± 2.49	1-5
Length of Hospital Stay (Hours)	8.72 ± 4.24	02-11
Height (Cm)	68.23 ± 15.28	51-99
Weight (Kg)	7.72 ± 3.87	2-11

Table 1: Descriptive Statistics (N=145)

Out of 145 patients, 56 (38.6%) and 89 (61.4%) had and had not incomplete immunization. As shown in figure 1. Out of 145 patients, 58 (40%) and 87 (60%) had and did not have

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malnourishment. As shown in figure 2.

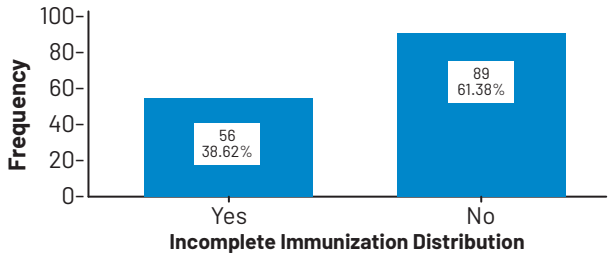

Figure 1: Incomplete Immunization

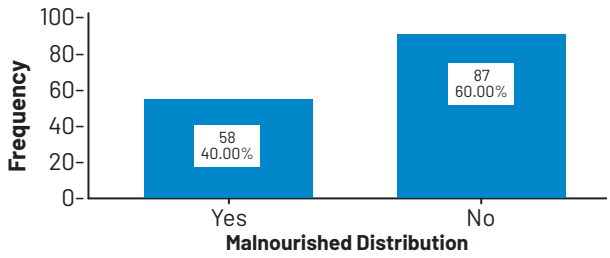

Figure 2: Malnourished Distribution

Out of 145 patients, 51 (35.2%) and 94 (64.8%) had and did not have previous history of pneumonia. As shown in figure 3. Out of 145 patients, 43 (29.7%) and 102 (70.3%) had and did not have family history of URTI. Out of 145 patients, 106 (73.1%) and 39 (26.9%) had and did not have prolonged hospital stay. Age stratification regarding not complete immunization displayed that 35.80% (n: 39) and 47.20% (n: 17) patients of age groups ≤ 2.50 years & more than 2.50 years were present with incomplete or partial immunization correspondingly. While 64.20% (n: 70) and 52.80% (n: 19) patients of age groups ≤ 2.50 years & more than 2.50 years of age were present with complete immunization correspondingly. As shown in figure 4.

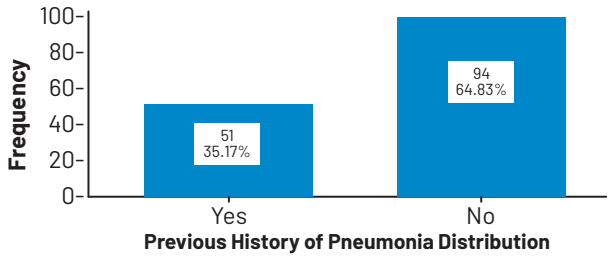

Figure 3: Previous History of Pneumonia

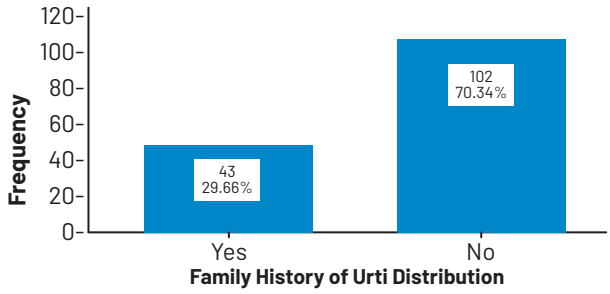

Figure 3: Family History of Urti Distribution n=145

Gender stratification regarding not complete immunization displayed that 37.0% (n: 34) and 63.0% (n: 58) patients of male groups were present with and without incomplete process of immunization correspondingly. While 41.50% (n: 22) and 58.50% (n: 31) patients of female group were present with and without incomplete process of immunization correspondingly. Table 2 is representing this data with p value of 0.220.

Age (Years)	Incomplete Immunization		Total
	Yes	No	
≤ 2.5	39 (35.8%)	70 (64.2%)	109 (100%)
> 2.5	17 (47.2%)	197 (52.8%)	36 (100%)
Total	56 (38.6%)	89 (61.4%)	145 (100%)
p-value	0.22		

Table 2: Incomplete Immunization According to Age (n=145)

Residence status stratification regarding no complete immunization displayed that 37.30% (n: 47) and 62.70% (n: 79) who were present with having urban residence with and without incomplete process of immunization. While 47.40% (n: 9) and 52.60% (n: 10) patients present with having rural residence were with and without incomplete process of immunization correspondingly. Table 3 is representing the 0.580 as p value.

Gender	Incomplete Immunization		Total
	Yes	No	
Male	34 (37%)	58 (63%)	92 (100%)
Female	22 (41.5%)	31 (58.5%)	53 (100%)
Total	56 (38.6%)	89 (61.4%)	145 (100%)
p-value	0.58		

Table 3: Incomplete Immunization according to Gender (n=145)

Stratification for family monthly income status with respect to incomplete immunization showed 46 (41.8%) and 10 (28.6%) had incomplete immunization in patients who belonged to monthly income of ≤ 75000 and > 75000 respectively. Whereas, 10 (28.6%) and 25 (71.4%) did not have incomplete immunization in patients who belonged to monthly income of ≤ 75000 and > 75000 respectively. Table 4 is representing the 0.400 as its p value.

Residence Status	Incomplete Immunization		Total
	Yes	No	
Urban	47 (37.3%)	79 (62.7%)	126 (100%)
Rural	09 (47.4%)	10 (52.6%)	19 (100%)
Total	56 (38.6%)	89 (61.4%)	145 (100%)
p-value	0.40		

Table 4: Incomplete Immunization According to Residence Status (n=145)

DISCUSSION

There is serious effect of pneumonia on lungs due to infection [8]. There is diagnosis of severe pneumonia when there is cough onset or difficult breathing among children in combination with the dangerous signs as incapability to drink, central cyanosis, nausea, unconsciousness, head nodding, grunting and convulsions. Single main infection

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which is cause of high rate of mortality in whole world is severe pneumonia [9, 10]. Regardless the reality that there is impact of this disease on children in whole world, there is more risk of this complication in the countries which are poor or under development [11]. Children under the age of two years are the main victim of this complication [12]. It is the main cause of hospitalization of children in the countries with less resources. The duration of hospitalization is much greater in the countries which are developed as compared to the countries which are developing [13]. Mean age, length of hospital stay, height and weight in our study was 8.72 ± 4.24 years, 8.72 ± 4.24 days, 68.23 ± 15.28 cm and 7.72 ± 3.87 kg. 92 (63.4%) and 53 (36.6%) were male and female. Out of 145 patients, 38.6%, 40%, 35.2%, 29.7%, 73.1%, 27.6% and 7.6% had incomplete immunization, malnourishment, previous history of pneumonia, family history of URTI, prolonged hospital stays, need for mechanical ventilation and mortality [14]. Of a study on two hundred children, 56.50% (n: 113) patients required antibiotic change, 51.0% (n: 102) got stay of more than five days, 20.50% (n: 41) patients were having need of mechanical ventilation and 10.50% (n: 21) children died. In Cecil *et al.,* analysis of multivariate nature, absence of exclusive feeding through breasts [RR (95.0%=CI) 2.630 (2.160-2.860)], over-crowding [RR (95.0%=CI) 1.940 (1.350-2.380)] and an anomalous X ray of chest [RR (95.0%=CI) 2.290 (1.220-3.440)] were having association with the requirement of antibiotic change [15]. Absence of the exclusive feeding through breasts [RR (95.0% = CI) 2.560 (2.00-2.930)], over-crowding [RR (95.0% = CI) 2.590 (1.780-3.230)] and an anomalous X ray of chest [RR (95.0%=CI) 2.990 (1.650-4.380)] were detected as the elements for long stay at hospital [16]. Nodding of head [RR (95.0%=CI) 8.340 (2.710-12.770)], changed sensorium [RR (95.0% = CI) 5.440 (1.340-17.560)], abnormal count of leukocyte [RR (95.0%=CI) 5.850 (1.360-17.140)] and pallor [RR (95.0% = CI) 10.880 (2.950-20.400)] were having close association with the mortality of the patients. Nodding of head (RR (95.0% = CI) 4.730 (1.500-6.360)] and cyanosis (RR (95.0% = CI) 5.060 (1.800-11.340)] were identified as the elements for requirement of mechanical ventilation. In confirmed pneumonia by radiography, factors of determination for antibiotic change were absence of exclusive feeding through breasts [RR (95.0%=CI) 2.050 (1.690-2.200)] and low weight at the time of birth [RR (95.0%=CI) 1.590 (1.100-1.890)] [17]. For long stay in the hospital, identified factors were education of the mothers lower than graduation RR (95.0% CI) 1.50 (1.190-1.70)], absence of exclusive feeding through breast [RR (95.0% = CI) 1.770 (1.190-2.090)] and saturation of O_2 < 90.0% at presentations [RR (95.0% = CI) 2.060 (1.420-2.420)] [18]. Determining factors indicating mechanical ventilation were education of mothers lower than graduation [RR (95.0% = CI) 3.60 (1.150-6.300)] and cyanosis at the time of presentation [RR (95.0% = CI) 10.90 (1.560-18.90)]. While determining the mortality, single determinant factor was pallor [RR (95.0% = CI) 10.540 (1.800-21.790)]. Kalra *et al.,* examining other two hundred and seventy patients, sixty four percent (95.0% CI 57.90-69.40) were present with severe pneumonia [19]. The logistic regression identified the following risk factors; premature birth (Adjusted OR=7.5; 95.0%CI 2.220-25.310; p=0.0010); measles history (Adjusted OR=6.350; 95.0%CI 1.730-23.300; P=0.0050); inadequate vaccination (Adjusted OR=2.660; 95.0%CI 1.090-6.480; p= 0.0310); CHD (Congenital Heart Disease) (Adjusted OR=9.210; 95.0% CI 2.290-36.990; p= 0.0020); treatment tried at home (Adjusted OR=3.840; 95.0%CI 1.420-10.390; p= 0.0080); living in mud houses (Adjusted OR=3.890; 95.0%CI 1.510-10.010; p= 0.0270); over-crowding (Adjusted OR=4.500; 95.0%CI 1.750-11.510; p= 0.0020); poor condition of ventilation (Adjusted OR=16.370; 95.0%CI 4.670-57.380; P< 0.0010); and practice of open defecation (Adjusted OR=16.920; 95.0%CI 4.950-57.850; p< 0.0010). Acknowledgement about these linked factors is necessary to decrease the high rate of mortality because of the severe pneumonia [20]. Important risk factors are lack in breast feeding, incomplete immunizations process and pollution in region of living area and low weight at the time of birth, age, gender, nutritional status, mother's educational status are not the vital risks factors for severe pneumonia. One other study on 689 pediatrics, 8% (n: 55) patients were in need of intensive care and 4% (n: 28) patients died. Total 72.80% (n: 502) patients were present with having good prognosis and 27.20% (n: 187) patients were with adverse prognosis. Prematurity's history [OR(Odd Ratios) 2.5, 95.0% CI (Confidence Interval) 1.240-5.040], fever (OR=2.250, 95.0% CI 1.320-3.830), smokers residence (OR=1.790, 95.0% CI 1.180-2.720), abnormal consciousness (OR=10.960, 95.0% CI 2.880-41.730), cyanosis (OR=2.090, 95.0% CI 1.050-4.150), pallor (OR=2.270, 95.0% CI 1.340-3.840) and present with bronchi on the auscultation (OR=2.450, 95.0% CI 1.580-3.790) were the risk factors with full independency for poor outcome. Among children with significant co-morbidities, the length of hospitalization may influence the underlying medical or social difficulties, not the severity of the respiratory infection. Significant associations exist between prolonged hospitalization and preterm birth, stunting, underweight-for-age, and high CRP levels. The causality to these connected factors was linked to the length of hospitalization that caused severe respiratory infection, but also by other associated illnesses, nutritional rehabilitation, or addressing social problems or eating patterns. Previously, we demonstrated that HEU children

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have a higher incidence of pneumonia in the first six months of life in this analysis; we demonstrate that they do not have a higher risk of catastrophic outcomes but do have a higher risk of protracted hospitalization [21]

CONCLUSIONS

This research study identified different risk factors of modifiable risk factors responsible for severe pneumonia particularly inadequate immunization and malnourishment. Skilled pediatricians and workers of health care field should have well awareness about the risk factors associated with severe pneumonia when treating the patients suffering from this complication. The controlling of these risk factors which have modifiable nature may decrease the high rate of mortality because of this complication.

Conflicts of Interest

The authors declare no conflict of interest

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