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Original Article

Prospective Study on Identification of Risk Factors, Assessment of Respiratory Distress in Pediatrics

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ABSTRACT

Introduction: Respiratory tract infection (RTI) is defined as any upper or lower respiratory tract infectious disease. Globally, respiratory infections are the leading cause of infant and child mortality and a substantial burden of morbidity. Proper use of antibiotics is crucial and should be incorporated into the pharmaceutical care plan. **Aim:** The present study aimed to identify risk factors, and assess respiratory distress in pediatrics by using the ReSVinet scale. **Materials and Methods:** A prospective observational study was conducted for the age of < 2 years over 6 months with a sample size of 250 in the pediatrics department. **Results:** The Majority of the patients were from the age group of 0-1 year (81.6%). Female patients are more (56%). Out of 250 cases, most of the patients are from rural (69.2%). Most of the patients are found to be undernourished (72.4%). Cold, cough (78%), and breathing difficulty (19.6%) are more commonly occurring symptoms in patients with pulmonary infections. Respiratory distress (25.6%), and pneumonia (20.8%) are found to be more prominent diseases in pediatrics. Every preterm patient is affected with respiratory distress syndrome (74.8%). In our study upper-middle and lower-middle socioeconomic classes were affected by RTI. **Conclusion:** The study concludes that they are multiple aetiological factors in this group, which include Age, Gender, Residence, Gestation, and Nutrition can cause ARI. The ReSVinet Scale was found to have substantial reliability.

Keywords: Bronchodilators, Gestation, Pneumonia, Resvinet scale, Socio-economic class.

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INTRODUCTION

Respiratory Distress Syndrome (RDS) had identified that it can be caused due to primary lung surfactant inadequacy almost 70 years ago and continuous positive airway pressure was initiated approximately 50 years ago. Thereafter, there have been promoted various developments in pediatrics. RDS is the most prominent reason for neonatal intensive care unit (NICU) admission. Bovine surfactant (Calsurf) supplementation may therefore be advantageous because Neonatal Acute Respiratory Distress Syndrome (NARDS) is a reflection of pulmonary surfactant impairment.[2] These factors include prematurity, meconium-stained amniotic fluid (MSAF), cesarean section delivery, or prenatal ultrasonographic findings, such as oligohydramnios (presence of less volume of Amniotic fluid) or structural lung abnormalities.[3] The preeminent risk factors are prematurity and low birth weight. Other risk factors include gender, late preterm delivery, maternal diabetes, perinatal hypoxia and ischemia, and delivery in the absence of labor.[4] More frequently occurring respiratory diseases are Transient Tachypnoea of Newborn (TTN), RDS, neonatal pneumonia, Meconium Aspiration Syndrome (MAS), and persistent pulmonary hypertension of the newborn (PPHN), which result from obstacles during the prenatal to the postnatal transition period. The lungs are not fully developed until ages 2 to 5 years.[5,6] The primary cause of acute respiratory distress syndrome (ARDS) in children is a viral respiratory infection, although ARDS can be related to many other conditions, including pneumonia, sepsis, trauma, burns, pancreatitis, inhalation, transfusion, and cardiopulmonary bypass.[7] Management is directed as a plan of action to support the infants. Supplemental oxygen is required, and continuous Positive airway pressure (CPAP) and mechanical ventilation are also considered in severe cases. Replacement with exogenous surfactant is common and decreases the requirement for extracorporeal membrane oxygenation (ECMO) and the risk of pneumothorax.[8] Medication therapy is the most important aspect of pediatric management in health care settings like the hospital. Effective hospitalization of a neonatal patient is based upon a prominent diagnosis and the best duration of therapy, which commonly involves a medication regimen. The use of antimicrobial agents, specifical antibiotics has become common usage for the treatment of neonatal illnesses.[9] In rural areas,

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unavailable of fundamental health services, no having of proper knowledge, and other related factors include overpopulation, environmental factors, defects in the immune system, more usage and incorrect usage of antibiotics, poverty, absence of ventilation, and indoor air pollution are responsible factors. Pervasiveness was reported in the range of 21.7 to 40%. It is evaluated that at least 300 million episodes of Acute Respiratory Infection (ARI) occur in India every year, from these about 30 to 60 million are moderate to severe ARI. The Chi-square test was applied for statistical significance.[10] Most studies have announced that socioeconomic status (SES) (measured by parental occupation, education, or family income) had an impact on RDS risk even after proper maintenance of known confounders such as prenatal maternal smoking and indoor allergens, and maternal stress.[11,12]

MATERIALS AND METHODOS

The prospective observational study was conducted for 6 months from October 2021 to march 2022, in the pediatrics and Neonatal ICU (NICU) wards of tertiary care hospitals in the Khammam region. The sample size was selected by taking a confidence interval of 5% and a confidence level of 95%. A minimum sample size of 230 is sufficient for the study. 250 patients who met inclusion criteria were included in our study. Data was collected by using a specially designed data entry form. The direct observations were made using the ReSVinet scale. The severity of respiratory tract infection was assessed using the ReSVinet scale. The following information was collected for each patient: demographics, smoking history, nutritional history, symptoms, disease diagnosis, socio-economic class, and prescribed treatment. The protocol was reviewed and approved by Institutional Ethics Committee (IEC) before the commencement of the study. Inclusion criteria include both males and females of up to 2 years of age. Infected children with ARI with a hospital visit. Exclusion criteria include children above 2 years. Patients with the non-infective disease.

Data analysis

The statistical analysis will be carried out by Microsoft Office (MS Word, MS Excel, and Graph Pad Prism 8). A chi-square test was used for data analysis based on observations of a random set of variables. Descriptive data analysis was performed in the form of a percentage of demographic variables, SES, and risk factors.

RESULTS

Out of 250 cases, 204 cases (81.6%) are with the age of 0-1 years and 46 cases (18.4) of age 1-2 years. In 250 cases, we have graded the severity of respiratory distress as mild, moderate, or severe. In the age group 0-1 year, 22 cases had mild, 172 cases had moderate, and 10 cases had severe respiratory distress. In the age group 1-2 years, 9 cases had mild, 29 cases had moderate, and 8 cases had severe respiratory distress (Table 1). By performing statistical analysis by using the chi-square p test, the impact of age distribution on respiratory distress syndrome was found to be significant (Chi-square *p*-value- 0.0011) (ODDS ratio: 4.745, 95% CI: 1.684 to 11.99).

Out of 250 cases, 110 cases are male and 140 cases are female. In 110 male cases, we analyzed those 15 cases had mild, 82 cases had moderate, 13 cases were severe and in 140 female cases, 16 cases were mild, 119 cases were moderate, and 5 cases were severe (Table 1). The impact of gender on respiratory distress

Table 1: Impact of age, gender, residence, nourishment, and gestation period on respiratory infections.

Variables	N	%	Gradation of ARI			*P*-value	Odds ratio	95% CI
			Mild	Moderate	Severe			
Age								
0-1 years	204	81.6	22	172	10	0.0011	4.745	1.684 to 11.99
1-2 years	46	18.4	9	29	8			
Gender								
Male	110	44	15	82	13	0.0100	0.2650	0.1017 to 0.7488
Female	140	56	16	119	5			
Residence								
Rural	173	69.2	29	130	14	0.03968	0.5231	0.1823 to 0.9622
Urban	77	30.8	2	71	4			
Nutritional status								
Undernourished	181	72.4	25	150	6	0.0002	5.882	2.109 to 16.30
Nourished	69	27.6	6	51	12			
Gestation Period								
Preterm	187	74.8	20	159	8	0.0009	4.732	1.777 to 12.75
Full-term	63	25.2	11	42	10			

Table 2: Parental smoking and heart rate of pediatrics.

Smoking	Number	Percentage	Heart rate	Number	Percentage
No	187	74.8	<100	11	4.4
Yes	63	25.2	100-150	197	78.8
Total	250	100	>150	42	16.8

syndrome was found to be significant (chi-square *p*-value-0.0100) (ODDS ratio: 0.2650, 95% CI: 0.1017 to 0.7488)

Out of 250 cases, 173(69.2) cases were rural, and 77(30.8) cases were urban. In 173 cases, 29 cases had mild, 130 cases had moderate, 14 cases had severe and in 77 cases, 2 cases had mild, 71 cases had moderate, and 4 cases had severe (Table 1). The impact of residence on respiratory distress syndrome was found to be significant (Chi-square *p*-value 0.03968).

Out of 250 cases, 181(72.4) cases are found to be undernourished, and 69 (27.6) cases are found to be nourished. In 181 cases of Undernourished, 25 cases had mild, 150 cases had moderate, 6 cases had severe respiratory distress, and in 69 cases of Nourished 6 cases had mild, 51 cases had moderate, and 12 cases had severe (Table 1). Nutrition had significant impact on respiratory distress syndrome (Chi-square *p*-value 0.0002) (ODDS ratio: 5.882, 95% CI: 2.109 to 16.30).

Out of 250 cases, 187 cases (74.8%) were preterm, and 63 cases (25.2%) were Full term. In 187 cases, 20 cases had mild, 159 cases had moderate, 8 cases had severe respiratory distress and in 63 cases, 11 cases had mild, 42 cases were moderate, and 10 cases were severe (Table 1). The impact of the Gestation period on respiratory distress syndrome was found to be significant (Chi-square *p*-value 0.0009) (ODDS ratio: 4.732, 95% CI: 1.777 to 12.75).

Out of 250 cases, 63(25.2) cases have parental smoking, and 187(74.8) cases have non-parental smoking (Table 2).

In 250 cases of respiratory distress syndrome, 11 cases (4.4%) have heart rates below 100 bpm (< 100), 197 cases (78.8%) have heart rates of 100-150 BPM, and 42 cases (16.8%) have heart rates above 150 bpm (<150) (Table 2).

Out of 250 cases, we have reported the symptoms like 4 cases with bradycardia, 49 cases with Breathing difficulty, 195 cases with cold and cough, 51 cases with Fever, 58 cases with Wheezing, 24 cases with Noisy breathing, 18 cases with Tachypnoea, 19 cases with an SOB, 5 cases with Respiratory effort, 15 cases with Runny nose, 8 cases with Vomiting, 4 cases with Stuffy nose, 23 cases with Grunting, 10 cases with Sneezing, 5 cases with Rhonchi, 3 cases with Feeding intolerance, fatigue and low fetal movement, 1 case with Dizziness, Cyanosis (Table 3).

Out of 250 cases, diagnostic tests were performed for respiratory tract infections like chest X-ray in 187 cases, CBPin 64 cases, CRP in 22 cases, Complete hemogram (CH) in 19 cases, 2DEcho

Table 3: Symptoms and diagnostic test.

Symptoms	Number	Percentage	Diagnostic tests	Number	Percentage
Bradycardia	4	1.6	Chest X-ray	187	74.8
Breathing difficulty	49	19.6	Complete blood count	64	25.6
Cold, Cough	195	78	C-reactive protein	22	8.8
Fever	151	60.4	Complete hemogram	19	7.6
Wheezing	58	23.2	2D Echo	16	6.4
Noisy breathing	24	9.6	Venous Blood Gas	10	4
Tachypnoea	18	7.2	Blood Glucose Test	9	3.6
SOB	19	7.6	Arterial Blood Gas test	8	3.2
Respiratory effort	5	2	Ca+	6	2.4
Running nose	15	6	Electrocardiography	5	2
Vomiting	8	3.2	Absolute Eosinophil Count	5	2
Stuffy nose	4	1.6	Non-stress test	4	1.6
Grunting	23	9.2	Random blood glucose test	3	1.2
Sneezing	10	4	Nasal swab	2	0.8

in 16 cases, Venous Blood Gas (VBG) of 10 cases, BGT of 9 cases, Arterial Blood Gas (ABG) of 8 cases, ECG of 5 cases, Absolute eosinophil Count (AEC) of 5 cases, NSG of 4 cases, GRBS of 3 cases, nasal swabs of 2 cases (Table 3).

In 250 cases of respiratory distress syndrome, 11 cases (4.4%) have heart rates below 100 BPM (<100), 197 cases (78.8%) have heart rates of 100-150 BPM, and 42 cases (16.8%) have heart rates above 150 BPM (<150) (Table 4).

Out of 250 cases of respiratory tract infections, diseases diagnosed are Bronchiolitis of 64 cases (25.6%) out of which 7 cases had mild, 28 cases had moderate, 7 cases had severe respiratory distress; Lower respiratory tract infection (LRTI) 40 cases (16%) out of which 4 cases were mild, 35 cases were moderate, 1 case of severe; Pneumonia of 52 cases (20.8%) out of which 3 cases had mild, 48 cases had moderate, 1 case of severe; Upper respiratory tract infections (URTI) of 19 cases (7.6%) out of which 1 case was mild, 17 cases had moderate, 1 case of severe; Asthma of 12 cases (4.8%) out of which 1 case was mild, 10 cases of moderate, 1 case of severe; MAS of 6 cases (2.4%) out of which 1 case was mild, 5 cases had moderate; Wheezing associated lower respiratory tract infection (WALRTI) of 5 cases (2%) out of which 2 cases had mild, 1 case of moderate, 2 cases had severe; Perinatal Asphyxia of 4 cases (1.6%) out of which 1 case was mild, 3 cases were moderate (Table 4). The impact of diseases on pediatrics was found to be significant (Chi-square *p*-value 0.0026).

Table 4: Impact of diseases diagnosed in respiratory distress syndrome in pediatrics.

Disease diagnosed	Gradation of ARI				Chi-square *P*-value	
	N	%	Mild	Moderate	Severe	
RD(Low surfactant)	64	25.6	10	49	5	0.0026
Bronchiolitis	42	16.8	7	28	7	
LRTI	40	16	4	35	1	
Pneumonia	52	20.8	3	48	1	
URI	19	7.6	1	17	1	
Asthma	12	4.8	1	10	1	
Emphysema	6	2.4	1	5	0	
MAS	6	2.4	1	5	0	
WALRTI	5	2	2	1	2	
Perinatal Asphyxia	4	1.6	1	3	0	

Table 5: Causative agents of respiratory distress syndrome in pediatrics.

Causative agent	Number	Percentage
Environmental	17	46
Preterm	187	22
Smoking	51	20.4
Streptococcus pneumonia	15	6
Klebsiella oxytoca	7	2.8
Klebsiella pneumonia	1	0.4
Desaturation	4	1.6
Asphyxia	2	0.8

Out of 250 cases, the causative agents of respiratory infections in pediatrics include the environment in 17 cases, Preterm in 187, Parental smoking in 51 cases, Causative organisms include *Streptococcus pneumonia* in 15 cases, *Klebsiella oxytoca* in 7 cases, *Klebsiella pneumonia* in 1 case, and others like Desaturation of 4 cases, Asphyxia of 2 cases (Table 5).

Out of 250 cases, the educational status of parents include 150 cases were Professionals, 72 cases were Graduates, 71 cases were Intermediate/Diploma, 43 cases were High school, 18 cases were Middle school, 17 cases were Primary school level of education, 19 cases were Illiterate (Table 6).

Out of 250 cases, the Occupational status of parents includes Manager in 6 cases, Professional in 47 cases, Associate professional in 26 cases, Clerks in 20 cases, Market sales worker in 34 cases, Agriculture and Fishery in 35 cases, Craft and Trade workers of 17 cases, Plant and Machine operator of 5 cases, Elementary occupation of 58 cases, Unemployed of 1 case (Table 6).

The Income status of parents includes 7 cases of <6174, 79 cases are of 6175-18496, 92 cases are of 18497-30830, 60 cases are of 30831-46128, 11 cases are 46129-61662, 1 case is of 61663-123321 (Table 6).

Table 6: Educational, occupational, and income status of parents.

Variables	Number	Percentage
Education		
Professional	10	0.04
Graduate	72	0.29
Intermediate	71	0.28
High school	43	0.17
Middle school	18	0.07
Primary school	17	0.07
Illiterate	19	0.08
Occupation		
Manager	6	2.40
Professionals	47	18.80
Asso. Professionals	26	10.40
Clerks	20	8.00
Market sales worker	34	13.60
Agriculture and Fishery	35	14.00
Craft and Trade workers	17	6.80
Plant and Machine operator	5	2.00
Elementary Occupations	58	23.60
Unemployed	1	0.40
Income in INR		
<6174	7	2.8
6175-18,496	79	31.6
18,497-30,830	92	36.8
30,831-46,128	60	24
46,129-61,662	11	4.4
61,663-1,23321	1	0.4

Table 7: Socio-economic status of parents on the impact on respiratory distress.

Socio-Economic class	N	%	Gradation of ARI			Chi-square P-value
			Mild	Moderate	Severe	
Upper	1	0.4	0	1	0	0.0087
Upper Middle	90	36	6	74	10	
Lower Middle	78	31.2	11	65	2	
Upper Lower	77	30.8	14	59	4	
Lower	4	1.6	0	2	2	

Out of 250 cases, 1 case (0.4%) is of Upper class, 90 cases (36%) are of Upper Middle class, 78 cases (31.2%) are of Lower Middle class, 77 cases (30.8) are of Upper Lower class, 4 cases (1.6%) are of the Lower class. In this we have analyzed that 1 moderate case in the Upper class; 6 cases had mild, 74 cases had moderate, 10 cases had severe respiratory distress in the Upper Middle class; 11 cases had mild, 65 cases had moderate, 2 cases had severe in Lower Middle class; 14 cases had mild, 59 cases had moderate, 4 cases had severe in Upper Lower class; 2 cases had moderate, 2 cases had severe in the Lower class (Table 7). The impact of SES class on

respiratory distress syndrome was found to be significant (Chi-square *p*-value 0.0087).

DISCUSSION

As per our study, the prevalence of ARI was mostly seen in the age group of 0–1 year old (204/250) when compared to the 1–2-year age group (46/250). The present study found a significant association between the ARI and the Age group (p <0.05). There are several avoidable risk factors for community-acquired pneumonia, like not exclusively breastfeeding for the first six months of life, hence this age group will be more affected.[14]

In our study, female patients were found to have a significantly higher incidence (140/250) when compared to Male patients (110/250). Various studies[13] found a similar association. It has been demonstrated that estrogen affects lung development, leading to abnormalities in surfactant production, lung elasticity, and alveolar shape.[15-17]

According to the residents, the prevalence of ARI was lower in urban areas (77/250) compared to rural areas (173/250). This affects due to factors that include poverty, poor nutrition, bad housing conditions, indoor air pollution (including parental smoking), poor ventilation, overcrowding, industrialization, socio-cultural values, antibiotic abuse, and misuse, lack of basic health care, and lack of awareness but our results are opposite to this study.[18]

The present study found no significant association between ARI and parental smoking history. Our findings are compared with the study done by Gözde İnci *et al*.[19] In newborns and children, second hand smoking causes a variety of health concerns, including more frequent and severe asthma attacks, lung infections, ear infections, and sudden infant death syndrome (SIDS).

There was a strong correlation between nutritional status and the occurrence of ARI. Observations indicate that the child's nutritional status has a direct bearing on his susceptibility to ARI. The present study found a significant association between ARI and nutritional status.[20] Adequate nutrition during infancy and early childhood is critical for ensuring children's optimal growth, health, and development. Exclusive breastfeeding, or feeding newborns just breast milk for the first six months of life, is the safest and healthiest option for children globally and has the greatest potential to save lives. Children's nutritional needs exceed what breast milk alone can offer starting at 6 months of age. From the age of six months, children should be fed solid, semi-solid, or soft foods to avoid deficiencies that could lead to malnutrition.

In our study, preterm infants were more affected when compared to full-term infants because their lungs are not able to make enough surfactant, a foamy substance that keeps the lung fully expanded. Surfactant is produced by lung cells and spread throughout the tissue that surrounds alveoli. This chemical reduces surface tension, making breathing easier and preventing the alveoli from collapsing following exhale.

Children with low birth weight and children who were exclusively breastfed for less than 3 months had higher LRTI-related hospital admissions.

As per our study, the Prevalence of ARI is mostly seen in the upper middle, lower middle, and upper lower classes. Various studies like (14-19) have deviated and do not show any similar association. This is due to poor hygienic conditions, poor sanitation facilities, reduced access to care, and poorer health outcomes.

We used current forms of mechanical ventilation in ventilated neonates, including synchronized intermittent positive pressure ventilation (SIPPV), which is linked with a shorter overall duration of ventilation in term neonates than intermittent obligatory ventilation. With earlier studies, the current study discovered a similar link.[21]

The environmental change in air pollution, LRTI should be recognized as a critical child health problem that may escalate in the future and place a heavy burden on the national health system. In addition, to reduce pollutants and enhance respiratory health, appropriate preventive actions are required. In our study, 40 children were admitted for LRTI, implying that early management of LRTI, particularly in rural areas, could help to reduce the financial burden on the health system and other resource usages, as LRTI is linked to increased healthcare utilization and costs.[22]

In our study, the factors which include the occurrence of ARDS are Age, Gender, Residence, Nutrition, Parental smoking, Gestation period, and socioeconomic status of the parent.

CONCLUSION

Acute Respiratory Tract Infection in pediatrics is influenced by many etiological factors including Age, Gender, Residence, Gestational period, and SES. ARI cases were more seen in rural (69.2%) areas as compared to urban (30.8%) areas. The nutritional status of the child has a direct effect on children's susceptibility to ARI. In our study, the prevalence of ARI is more in children having non-parental smoking than in parental smoking. Early detection of diseases and their severity can decrease mortality and morbidity in children. The present study found a significant association between ARI and preterm (74.8%) births. The prevalence of ARI was highest in children with low levels of education. According to occupation, the prevalence was high in children of the father who were engaged in agriculture and elementary occupation. Many clinical parameters are used to diagnose the disease, like Chest X-ray, ABG, VBG, CBP, etc. Respiratory distress, bronchiolitis, pneumonia, and LRTI are commonly diagnosed in hospitals and NICUs. In Paediatrics, the ResVinet scale can be used to estimate the severity of respiratory infections.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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