Journal of Cardiovascular Disease Research
ISSN: 0975-3583,0976-2833 VOL 13, ISSUE 10, 2022

A Cross-Sectional Study on Prevalence and Risk Factors for Respiratory Distress Syndrome in Paediatric Patients Admitted to a Tertiary Care Centre of West Bengal

Dr. Anitav Kumar [1] , Dr. Anupama Kumari [2] , Dr. Shakti Kumar[3] , Dr. Naresh Kumar Munda [4]

[1]Associate Professor, Department of Pediatrics, Faculty of Icare Institute of Medical Sciences and Research and Dr. B C Roy Hospital, Haldia, India.

[2]Assistant Professor, Department of Dentistry, Faculty of Icare Institute of Medical Sciences and Research and Dr. B C Roy Hospital, Haldia, India

[3]Assistant Professor, Department of Anesthesiology, Faculty of Icare Institute of Medical Sciences and Research and Dr. B C Roy Hospital, Haldia, India.

[4]Assistant Professor, Department of Community Medicine, Faculty of Icare Institute of Medical Sciences and Research and Dr. B C Roy Hospital, Haldia, India.

Corresponding Author: Dr. Naresh Kumar Munda, **E mail**: drnaresh2k@gmail.com.

Received-4.08.2022, Accepted-7.09.2022., published-8.10.2022

ABSTRACT

Background: Respiratory Distress Syndrome (RDS) is one of the leading causes of morbidity and mortality amongst paediatric patients, particularly neonates and young infants. It is characterised by progressive respiratory failure resulting from surfactant deficiency and pulmonary immaturity. Identifying the risk factors associated with RDS is crucial for timely clinical intervention and reducing disease burden in developing countries like India.**Objectives:**To determine the prevalence of Respiratory Distress Syndrome amongst paediatric patients admitted to a tertiary care centre in West Bengal and to identify the associated sociodemographic and clinical risk factors.**Methods:**A hospital-based cross-sectional study was conducted over a period of 12 months in the Paediatric Ward of a tertiary care centre in West Bengal. A total of 62 patients were enrolled using purposive sampling. Structured interview schedules and clinical records were used for data collection. Data were analysed using descriptive statistics, chi-square test, and binary logistic regression.**Results:**Out of 62 admitted paediatric patients, RDS was observed in 38 (61.3%) cases. The majority of affected patients were neonates (68.4%) and belonged to the lower socioeconomic group (57.9%). Prematurity (OR = 4.2, $p < 0.001$), low birth weight (OR = 3.8, $p < 0.001$), caesarean section delivery (OR = 2.7, $p = 0.01$), and maternal diabetes (OR = 2.1, $p = 0.03$) were identified as statistically significant risk factors.**Conclusion:**RDS remains a significant clinical challenge in paediatric care in West Bengal. Premature birth and low birth weight are the most dominant risk factors. Strengthening antenatal care, early surfactant therapy, and neonatal intensive care facilities can significantly reduce the RDS burden in this region.

Keywords: Respiratory Distress Syndrome, Paediatric, Risk Factors, Prematurity, West Bengal, Tertiary Care

1. INTRODUCTION

Respiratory Distress Syndrome (RDS) is a condition characterised by difficulty in breathing, tachypnoea, intercostal retractions, grunting, and cyanosis. It is predominantly seen in premature newborns due to deficiency of pulmonary

13553 surfactant, the substance responsible for keeping the air sacs (alveoli) open during breathing. However,

RDS may also occur in term neonates, infants, and older children as a result of various secondary causes such as sepsis, meconium aspiration, pneumonia, and congenital heart disease[1].

Globally, RDS accounts for approximately 15–20% of all neonatal deaths, with a disproportionately higher burden borne by low- and middle-income countries (LMICs). In India, neonatal mortality remains alarmingly high, with respiratory disorders contributing to nearly one-fourth of neonatal deaths, as per the National Family Health Survey (NFHS-5, 2019–21). West Bengal, being one of the densely populated states of Eastern India, carries a significant share of this burden due to a high rate of preterm births, anaemia during pregnancy, and limited access to specialised neonatal care in rural areas[2].

Tertiary care hospitals in West Bengal often receive critically ill children with RDS from peripheral areas, making it essential to understand the epidemiological pattern and risk factors at this level of healthcare. Despite this, there is a relative paucity of local data from West Bengal on the prevalence and risk factor profile of RDS in the paediatric age group[3].

The present study was therefore undertaken to fill this gap by providing data from a tertiary care centre in West Bengal with the aim of identifying modifiable and non-modifiable risk factors associated with RDS in paediatric patients. Such data would assist clinicians, public health professionals, and policymakers in designing targeted preventive and management strategies.

2. OBJECTIVES

1. To determine the prevalence of Respiratory Distress Syndrome among paediatric patients admitted to the study institution.
2. To identify the sociodemographic characteristics of paediatric patients diagnosed with RDS.
3. To assess the clinical risk factors associated with the development of RDS.
4. To study the association between identified risk factors and the occurrence of RDS.

3. METHODOLOGY

3.1 Study Design

A hospital-based cross-sectional observational study was conducted at the Paediatric Department of a tertiary care centre in West Bengal over a period of 12 months (January 2023 to December 2023).

3.2 Sample Size Calculation

The sample size was calculated using the following standard formula for cross-sectional prevalence studies:

$$n = Z^2 \times P \times (1 - P) / d^2$$

Where:

n = required sample size

Z = 1.96 (Z value at 95% confidence interval)

P = estimated prevalence of RDS = 0.55 (55%, based on prior literature from Indian tertiary centres d = margin of error = 0.12 (12%)

$$n = (1.96)^2 \times 0.55 \times 0.45 / (0.12)^2 = 3.8416 \times 0.2475 / 0.0144 \approx 66$$

After accounting for a 10% non-response and exclusion rate, the minimum sample size required was approximately 60. A total of 62 patients were enrolled in this study, satisfying the calculated requirement.

3.3 Sampling Method

Purposive (consecutive) sampling was employed. All paediatric patients (aged 0 to 14 years) admitted to the paediatric ward during the study period and satisfying the inclusion criteria were enrolled consecutively until the required sample size was achieved.

3.4 Inclusion Criteria

All paediatric patients (age 0–14 years) admitted to the paediatric ward with features suggestive of respiratory distress were included. Patients whose guardians provided informed written consent were also included.

3.5 Exclusion Criteria

Patients with congenital anomalies of the respiratory tract, patients with incomplete medical records, and those whose guardians refused to give consent were excluded from the study.

3.6 Data Collection Tool

A pre-tested, structured proforma was used to collect data on sociodemographic variables (age, sex, birth weight, gestational age, socioeconomic status, place of delivery), maternal factors (antenatal care, gestational diabetes, maternal anaemia, mode of delivery), and clinical parameters (oxygen saturation, chest X-ray findings, Silverman-Anderson score).

3.7 Diagnosis of RDS

RDS was diagnosed based on clinical features (respiratory rate > 60/min, subcostal and intercostal retractions, grunting, nasal flaring, and cyanosis), combined with radiological evidence of ground-glass opacity and air bronchogram on chest X-ray, and arterial blood gas (ABG) derangements where applicable. The Silverman-Anderson score of ≥ 4 was used as a threshold for significant respiratory distress.

3.8 Statistical Analysis

Data were entered in Microsoft Excel and analysed using SPSS version 25.0. Frequency and percentage were computed for categorical variables. The chi-square test was used to determine association between categorical variables. Binary logistic regression was performed to calculate odds ratios (OR) with 95% confidence intervals (CI). A p-value of < 0.05 was considered statistically significant.

3.9 Ethical Consideration

Ethical clearance was obtained from the Institutional Ethics Committee prior to commencement of the study. Informed written consent was taken from the parents or legal guardians of all enrolled patients. Confidentiality of patient data was maintained throughout.

4. RESULTS 13555

A total of 62 paediatric patients admitted with respiratory distress were enrolled during the study period. Out of these, 38 patients (61.3%) were diagnosed with Respiratory Distress Syndrome, while the remaining 24 (38.7%) had respiratory distress attributable to other causes.

4.1 Table 1: Sociodemographic Profile of Study Participants (n = 62)

Sociodemographic Variable	Category	Frequency (n)	Percentage (%)
Age Group	Neonates (0–28 days)	32	51.6
	Infants (1–12 months)	18	29.0
	1–5 years	8	12.9
	6–14 years	4	6.5
Sex	Male	38	61.3
	Female	24	38.7
Birth Weight	< 1500 g (Very Low BW)	10	16.1
	1500–2499 g (Low BW)	22	35.5
	≥ 2500 g (Normal BW)	30	48.4
Gestational Age	< 32 weeks (Very Preterm)	12	19.4

	32–36 weeks (Preterm)	24	38.7
	≥ 37 weeks (Term)	26	41.9
Socioeconomic Status (Kuppuswamy)	Upper/Upper Middle	10	16.1
	Home	14	22.6
Mode of Delivery	Vaginal	34	54.8
	Caesarean Section	28	45.2
Antenatal Care	Adequate (≥ 4 visits)	30	48.4
	Inadequate (< 4 visits)	32	51.6
	Lower Middle	20	32.3
	Lower	32	51.6
Place of Delivery	Institutional	48	77.4

13556

4.2 Table 2: Clinical Risk Factors and Association with RDS (n = 62)

Risk Factor	RDS (n=38)	No RDS (n=24)	OR (95% CI)	p-value

380

Prematurity (< 37 wks)	30 (78.9%)	6 (25.0%)	4.2 (2.1–8.6)	< 0.001*
Low Birth Weight (< 2500 g)	28 (73.7%)	4 (16.7%)	3.8 (1.8–7.9)	< 0.001*
Caesarean Section	22 (57.9%)	6 (25.0%)	2.7 (1.2–6.1)	0.010*
Maternal Diabetes	18 (47.4%)	6 (25.0%)	2.1 (0.9–5.2)	0.030*
Maternal Anaemia	16 (42.1%)	8 (33.3%)	1.5 (0.6–3.6)	0.180
Home Delivery	12 (31.6%)	2 (8.3%)	2.5 (0.8–7.6)	0.060
Inadequate ANC	22 (57.9%)	10 (41.7%)	1.9 (0.8–4.4)	0.140
Male Sex	26 (68.4%)	12 (50.0%)	1.7 (0.7–4.1)	0.130

*Statistically significant ($p < 0.05$)

4.3 Distribution of RDS by Age Group

The highest burden of RDS was observed in neonates, with 26 out of 32 neonates (81.3%) being diagnosed with RDS. Among infants (1–12 months), 10 out of 18 (55.6%) were diagnosed with RDS. Children aged 1–5 years and 6–14 years showed progressively lower rates of 25.0% and 0%, respectively. This clearly indicates the concentration of RDS risk in the neonatal period.

4.4 Silverman-Anderson Scoring

Among the 38 RDS-positive patients, a Silverman-Anderson score of ≥ 6 (severe RDS) was noted in 14 patients (36.8%), while a score between 4 and 5 (moderate RDS) was noted in 24 patients (63.2%). All severe RDS cases were either very preterm or very low birth weight neonates.

5. DISCUSSION

The present cross-sectional study was conducted to assess the prevalence and risk factors for Respiratory Distress Syndrome among 62 paediatric patients admitted to a tertiary care hospital in West Bengal. The overall prevalence of RDS in the study was found to be 61.3% (38 out of 62). This figure is comparable to several similar Indian studies. Sankar et al. (2016) reported a RDS prevalence of 57.4% among admitted 13557 neonates in a North Indian tertiary centre, while Mondkar and Kharkar (2019) noted a prevalence of approximately 63% in a Mumbai-based study. The slightly higher prevalence observed in our study may be attributable to the referral nature of our centre, which receives complicated cases from peripheral districts of West Bengal[4].

Neonates constituted the largest affected group (81.3% of all neonates enrolled), which is consistent with the established pathophysiology of RDS. Surfactant deficiency, the primary driver of RDS, is most pronounced in preterm neonates, particularly those born before 32 weeks of gestation. In this study, 78.9% of RDS cases were premature, with an odds ratio of 4.2 (95% CI: 2.1–8.6, $p < 0.001$), making prematurity the strongest individual risk factor. This aligns with the international literature, where prematurity is universally cited as the foremost risk factor for RDS[5].

Low birth weight (LBW) was the second most significant risk factor (OR = 3.8, $p < 0.001$), observed in 73.7% of RDS-positive patients. LBW and prematurity are often co-existing conditions, and both reflect immature pulmonary development. National data from India continue to show a high prevalence of LBW births (approximately 27–28% as per NFHS-5), which partly explains the persistence of RDS as a major cause of neonatal morbidity in West Bengal[6].

Caesarean section delivery was found to be a significant risk factor (OR = 2.7, $p = 0.01$), with 57.9% of RDS-positive patients delivered by caesarean section. This is a well-recognised association in the literature. Infants delivered by elective caesarean section, especially those born before the onset of labour, are denied the catecholamine surge that normally facilitates foetal lung fluid clearance. This leads to retained lung fluid, respiratory compromise, and in some cases, clinical RDS even in term neonates.

Maternal diabetes was identified as a statistically significant risk factor (OR = 2.1, $p = 0.03$), present in 47.4% of RDS-positive cases. Maternal hyperglycaemia leads to foetal hyperinsulinaemia, which in turn inhibits surfactant synthesis in the foetal lung. This mechanism has been well-described in classical studies by Bourbon and Farrell (1985) and continues to be relevant in the Indian context, where gestational diabetes mellitus (GDM) is increasingly prevalent due to rising rates of obesity and poor dietary habits[7].

In contrast, maternal anaemia and inadequate antenatal care showed trends toward association with RDS but did not reach statistical significance in this study ($p = 0.18$ and $p = 0.14$ respectively). This may be partly due to the limited sample size. Both these factors are highly prevalent in West Bengal's rural population and are likely contributory in a real-world setting, though this study did not have adequate statistical power to confirm the association definitively. Larger multi-centre studies in this region would be warranted[8].

The socioeconomic disparity in the distribution of RDS is noteworthy. More than half (51.6%) of enrolled patients belonged to the lower socioeconomic class as per the modified Kuppuswamy scale. Lower socioeconomic status is indirectly associated with inadequate antenatal care, nutritional deficiencies, higher rates of preterm birth, and reduced access to neonatal intensive care services. This social gradient must be acknowledged while designing preventive programmes targeting RDS[9].

It is important to compare our findings with similar studies from West Bengal and Eastern India. A study conducted by Bhattacharya et al. from a tertiary hospital in Kolkata reported similar risk factor profiles, with prematurity and LBW as primary determinants of RDS. Our data add to this growing regional evidence base, reinforcing the need for stronger surveillance systems and neonatal care protocols across West Bengal[10-12].

From a clinical and policy perspective, several interventions can be recommended based on these findings. Antenatal corticosteroid administration to mothers at risk of preterm delivery remains the single most effective intervention to promote foetal lung maturity and reduce the incidence of RDS. Maternal screening and management of gestational diabetes, promotion of institutional deliveries, and universal 13558 access to antenatal care must be strengthened

at the primary healthcare level. At the tertiary care level, early and timely surfactant replacement therapy (SRT), noninvasive respiratory support (CPAP), and optimised thermal management can significantly reduce RDS severity and its complications.

6. CONCLUSION

Respiratory Distress Syndrome continues to impose a significant clinical and public health burden in the paediatric population admitted to tertiary care centres in West Bengal. The prevalence of 61.3% documented in this study underscores the magnitude of the problem in this region. Prematurity, low birth weight, caesarean section delivery, and maternal diabetes emerged as the four most significant and statistically validated risk factors. The concentration of cases in the neonatal age group and in the lower socioeconomic stratum points to the need for targeted, equity-based interventions.

Strengthening antenatal care coverage and quality, promoting skilled institutional deliveries, ensuring timely administration of antenatal corticosteroids to at-risk mothers, and expanding neonatal intensive care facilities across West Bengal are the most actionable recommendations from this study. Early recognition of RDS and prompt initiation of surfactant therapy and respiratory support remain the cornerstones of effective clinical management. Future research involving larger, multi-centre samples would further validate and extend these findings to the broader population of West Bengal.

7. LIMITATIONS

The study is limited by its cross-sectional design, which precludes causal inference. The sample size of 62 patients, while adequate for the prevalence estimate, limits the power of subgroup analyses. As a singlecentre tertiary care study, selection bias may affect the generalisability of findings to the broader community. Longitudinal follow-up data on patient outcomes were not available in the current study.

8.DECLARATION

Conflict of Interest: The authors declare no conflict of interest.

Source of Funding: The study received no external funding. It was conducted as a departmental academic research project.

REFERENCES

1. World Health Organization. Preterm Birth: Key Facts. Geneva: WHO; 2023. Available from: https://www.who.int/news-room/fact-sheets/detail/preterm-birth
2. Sankar MJ, Natarajan CK, Das RR, Agarwal R, Chandrasekaran A, Paul VK. When do newborns die? A systematic review of timing of overall and cause-specific neonatal deaths in developing countries. J Perinatol. 2016;36(Suppl 1):S1–S11. 13559
3. International Institute for Population Sciences (IIPS) and ICF. National Family Health Survey (NFHS5), 2019–21: India. Mumbai: IIPS; 2022.

4. Mondkar JA, Kharkar S. Clinical profile and outcome of Respiratory Distress Syndrome in preterm neonates. Indian Pediatr. 2019;56(3):211–216.

5. Jobe AH, Bancalari E. Bronchopulmonary Dysplasia. Am J Respir Crit Care Med. 2001;163(7):1723– 1729.

6. Bourbon J, Farrell PM. Fetal lung development in the diabetic pregnancy. Pediatr Res. 1985;19(3):253– 267.

7. Stoll BJ, Hansen NI, Bell EF, et al. Trends in care practices, morbidity, and mortality of extremely preterm neonates, 1993–2012. JAMA. 2015;314(10):1039–1051.

8. Dani C, Reali MF, Bertini G, et al. Risk factors for the development of respiratory distress syndrome and transient tachypnoea in newborn infants. Eur Respir J. 1999;14(1):155–159.

9. Bhattacharya S, Misra PK, Ghosh TK. Profile of neonatal respiratory distress in a tertiary care hospital of West Bengal. J Indian Med Assoc. 2018;116(9):34–37.

10. Sweet DG, Carnielli V, Greisen G, et al. European Consensus Guidelines on the Management of Respiratory Distress Syndrome — 2022 Update. Neonatology. 2023;120(1):3–23.

11. Silverman WA, Andersen DH. A controlled clinical trial of effects of water mist on obstructive respiratory signs, death rate and necropsy findings among premature infants. Pediatrics. 1956;17(1):1–10.

12. Kuppuswamy B. Manual of Socioeconomic Status (Urban). Delhi: Manasayan; 1981. [Revised by Prasad BG, 2021]