ORIGINAL ARTICLE

DELVING INTO PEDIATRIC RESPIRATORY EMERGENCIES: A CLINICO-ETIOLOGICAL STUDY FROM A TERTIARY CARE HOSPITAL IN WESTERN INDIA.

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ABSTRACT

Background: Acute respiratory illness (ARI) remains a leading cause of childhood morbidity and mortality in low-resource settings like India. This study aimed to describe the clinico-etiological profile, management, and outcomes of pediatric ARI cases presenting to the emergency department of a tertiary care hospital in Mumbai.

Methods: This retrospective observational study included 80 children aged 1 month to 12 years admitted with ARI (defined per WHO criteria) over 10 months (August 2024–May 2025). Data on demographics, clinical features, investigations, treatment, and outcomes were extracted from case records. Descriptive statistics and appropriate tests assessed associations with mortality.

Results: Most patients (77.5%) were aged 1 month to 5 years, with slight male predominance (55%; ratio 1.22:1). Common symptoms included increased respiratory effort (93.7%), fever (85.0%), and cough (68.8%). Undernutrition was found in 60% and incomplete immunization in 65%. Hypoxia (43.8%) and anemia (90%) were frequent; blood cultures were positive in 8.8%. Chest radiography showed abnormalities in 96.3%, with consolidation in 60%. Non-respiratory causes contributed to 16.3% of respiratory distress. Ventilatory support was required in 86.3%, with 27.5% mortality. Significant mortality associations included residence outside Mumbai (p=0.002), abnormal nutrition (p=0.012), hypoxia (p=0.001), and inotrope duration (p=0.001).

Conclusion: Severe ARI in tertiary settings carries high mortality, influenced by comorbidities, delays, and resource limitations. Non-respiratory etiologies are notable, emphasizing broad differential diagnosis. Enhancing care in peripheral areas and strengthening referral systems are the need of the hour.

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Introduction

Acute Respiratory Illness (ARI) is a major public health concern in India. Around 4 lakh children aged below five years die from Acute respiratory illness (ARI) related diseases every year, i.e. 16% of all child deaths among pediatric hospital admissions.[1] Respiratory diseases are responsible for approximately 1/4th of the global annual deaths in children <5 years.[2] Although respiratory distress usually indicates an underlying lung pathology, it may be the presenting complaint of illnesses involving other systems as well. In an Indian context, management of ARI is often more challenging due to resource constraints.[3] This study was conceptualized to study the clinico-etiological profile of pediatric patients with ARI presenting to the emergency department of a tertiary care hospital in XXX, India.

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Methodology

Our study was a hospital based, retrospective, observational study. It was conducted in the emergency department (ED) of a tertiary care, government medical college in India. The study duration was 10 months (August 2024 to May 2025). The study included all children, aged 1 months to 12 years, admitted to the hospital with ARI. For the study purpose, ARI was defined as "cough or difficult breathing combined with fast breathing with age specific cut-off values for increased respiratory rate with/without chest indrawing".[4] Children whose presenting chest x-rays (CXR) were suggestive of only hyperinflation of lungs, suggestive of airway diseases like asthma, bronchiolitis, etc were excluded. A convenience-based sampling technique was used and children fulfilling the inclusion criteria were enrolled for the study. The study was approved by the institutional ethics committee. Informed, written consent was taken from parents. Case records from the Medical Record Department (MRD) from admitted patients were scrutinized. In each case, information regarding demography, clinical presentation, relevant past history, co-morbidities,

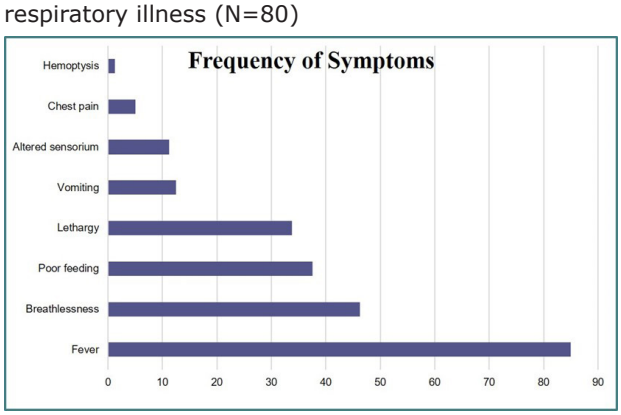
immunization status, anthropometric parameters, examination findings, blood investigations, imaging studies [CXR, ultrasonogram (USG) and computed tomography (CT), when available], treatment and final outcome were obtained and filled in a pre-designed case. Frequencies of variables were analyzed using measures of central tendency (mean, median, mode) after assessing normality of quantitative data. Associations between clinico-etiological parameters and final outcome (mortality) were analyzed using appropriate statistical tests (Paired t-test, Mann-Whitney 'U' test and Kruskal- Wallis tests). All statistical analyses were performed using Microsoft Excel version v16.46 and SPSS version 30 at 5% significance.

Results

Eighty patients were enrolled during the study period. The majority (62/80, 77.5%) were aged 1 month to 5 years, while the remainder (18/80, 22.5%) were older than 5 years. The cohort showed a slight male predominance (44/80, 55%), with a male-to-female ratio of 1.22:1. Of all patients, 61 (76.3%) resided within Mumbai city, 17 (21.2%) were from outside the city but within Maharashtra, and 2 (2.5%) were from outside the state.

The most common presenting symptoms were increased respiratory effort in 75 patients (93.7%), fever in 68 (85.0%), cough in 55 (68.8%), breathlessness in 37 (46.3%), poor feeding in 34 (42.5%), lethargy in 29 (36.3%), vomiting in 13 (16.3%), and altered sensorium in 6 (7.5%) (Figure 1). Only 28 children (35.0%) were fully vaccinated according to the National Immunization Schedule of India.[5] The majority (40/80, 50.0%) were partially immunized, and 12 (15.0%) were completely unimmunized. Undernutrition, as assessed by World Health Organization growth standards, was present in 48 patients (60.0%), including 9 (11.3%) with severe acute malnutrition.[6] Three patients (3.8%) were overweight. Pre-existing comorbidities were documented in 26 patients (32.5%), including congenital heart disease (n=2), structural kidney disease (n=2), type 1 diabetes mellitus (n=2), cerebral palsy (n=1), HIV infection (n=1), and pulmonary tuberculosis (n=1).

Figure 1. Presenting symptoms in patients with acute respiratory illness (N=80)



On admission, 35 patients (43.8%) were hypoxic (peripheral oxygen saturation <94% on room air), and hypotensive shock was present in 4 (5.0%). Laboratory findings included anemia (age- and sex-adjusted hemoglobin below normal) in 72 patients (90.0%), leukocytosis in 46 (57.5%), leukopenia in 14 (17.5%), and thrombocytopenia in 11 (13.8%). Elevated C-reactive protein was observed in 46 patients (57.5%). Arterial blood gas analysis was abnormal in half of the patients, most commonly showing metabolic acidosis (32.5%) or respiratory alkalosis (12.5%). Blood cultures were positive in 7 patients (8.8%), yielding Klebsiella pneumoniae, methicillin-resistant Staphylococcus aureus (MRSA), Acinetobacter baumannii, Candida albicans, non-albicans Candida species, Pseudomonas aeruginosa, and Salmonella Typhi.

Chest radiography was abnormal in 77 patients (96.3%), with consolidation present in 60%. Computed tomography of the thorax was performed in 39 patients (48.8%), revealing abnormalities in 82% and contributing to diagnosis. Two-dimensional echocardiography identified previously undiagnosed structural cardiac lesions in 15 patients (18.8%), including valvular disease in 6. The Xpert MTB/RIF assay confirmed pulmonary tuberculosis in 7 patients (8.8%), with rifampicin resistance detected in 2. Multiplex polymerase chain reaction testing of nasopharyngeal or endotracheal aspirates was performed in only 9 patients (11.3%) and most commonly detected respiratory syncytial virus, Mycoplasma pneumoniae, Klebsiella pneumoniae, and influenza A virus. Clinico-demographic characteristics and treatment details are presented in Table 1.

Sixty-nine patients (86.3%) required ventilatory support, of whom 28 (35.0%) needed invasive mechanical ventilation. Packed red blood cell transfusion was required in 43 patients (53.8%). Notably, 13 patients (16.3%) had non-respiratory causes of respiratory distress, including systemic acidosis due to renal or metabolic disease, congestive cardiac failure secondary to congenital or acquired heart disease, severe anemia, and surgical abdominal conditions.

Of the total cohort, 22 patients (27.5%) died, 56 (70.0%) recovered fully, and 2 were discharged against medical advice (Figure 2). The leading causes of death were acute respiratory distress syndrome (n=7, 31.8%), disseminated intravascular coagulation with multi-organ dysfunction syndrome (n=5, 22.7%), refractory septic shock (n=5, 22.7%), neurogenic shock (n=1, 4.5%), and pulmonary hemorrhage (n=1, 4.5%). Factors significantly associated with mortality included residence outside Mumbai (p=0.002), abnormal nutritional status (p=0.012), duration of cough at presentation (p=0.015), hypotension at admission (p=0.001), hypoxia at admission (p=0.001), abnormal

Figure 2. Outcome and mortality of patients with acute respiratory illness (N=80)

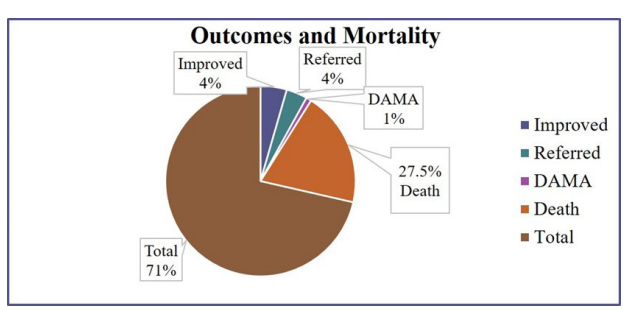


Table 1. Clinicodemographic features of patients presenting with ARI

Variables	n	Median	IQR	Mini-mum	Maxi-mum
Age (months)	80	11.5	55	0	144
Duration of hospital stay (days)	80	16	20	1	95
Day of illness on presentation	80	3	5	1	120
Duration of cough (days)	55	3	5	2	120
Duration of fever (days)	68	3	5	1	120
Duration of respiratory distress (days)	75	2	2	1	31
Duration of feeding issues(days)	31	2	1	1	5
Hemoglobin (gm%) on admission	80	10.05	2.2	2.3	15
Total Leucocyte count on admission	80	12500	11625	6	30000
Platelets (lakhs) on admission	80	3.425	2.55	0.11	8.2
Duration of hospital stay (days)	80	16	20	2	95
Duration of antibiotics (days)	80	10	12	2	35
Duration of oral antibiotics (days)	30	5	5	4	21
Duration of anti-viral therapy (days)	55	10	5	2	38
Duration of anti-fungal therapy(days)	36	14	12	2	40
Duration of anti-tubercular therapy (days)	23	27	25	2	90
Duration of inotropic support (hrs)	68	48	48	24	312

(IQR = Inter-quartile range)

Table 2. Comparison of clinical, demographic, and laboratory characteristics between deceased and survived children (N = 80)

Characteristic	**Deceased (n = 22)**	**Survived (n = 58)**	**P value**
Continuous variables			
Age (months)	8 (37)	12 (56)	0.816
Duration of hospital stay (days)	8 (12)	20 (16)	<0.001
Day of illness on presentation (days)	3 (4)	3.5 (4)	0.374
Duration of cough (days)	2 (1)	4 (4)	0.015
Duration of fever (days)	3 (5)	3 (5)	0.475
Hemoglobin on admission (g/dL)	9.75 (2.1)	10.3 (2.2)	0.647
Total leukocyte count on admission (cells/μL)	14950 (11750)	11350 (11375)	0.161
Platelets on admission (×10^5/μL)	3.67 (3.15)	3.425 (2.51)	0.867
Duration of inotropes (hours)	72 (72)	48 (48)	<0.001
Categorical variables			
Gender			0.291
Female	12 (33.3)	24 (66.7)	
Male	10 (22.7)	34 (77.3)	
Age group			0.914
1–60 months	18 (29.0)	44 (71.0)	
>5 years	4 (23.5)	13 (76.5)	
Residence			0.002
Mumbai	11 (18.0)	50 (82.0)	
Outside Mumbai / Maharashtra	11 (57.9)	8 (42.1)	
Duration of hospital stay			<0.001
≤7 days	10 (83.3)	2 (16.7)	
>7 days	12 (17.6)	56 (82.4)	
Oxygen saturation at admission			<0.001
<94%	19 (54.3)	16 (45.7)	
≥94%	3 (6.7)	42 (93.3)	
Presence of hypotension			<0.001

<5th centile	4 (100)	0 (0)	
5th–90th centile	18 (24.0)	57 (76.0)	
Abnormal nutrition			0.012
Present	20 (35.7)	36 (64.3)	
Absent	2 (8.3)	22 (91.7)	
Blood gases on admission			<0.001
Abnormal	20 (50.0)	20 (50.0)	
Normal	2 (5.0)	38 (95.0)	
CT abnormalities			0.273
Present	7 (21.9)	25 (78.1)	
Absent	15 (33.3)	30 (66.7)	

Continuous variables are presented as median (interquartile range) due to non-normal distribution and were compared using the Mann-Whitney U test. Categorical variables are presented as n (%) with row percentages and were compared using the chi-square test or Fisher's exact test as appropriate. P values <0.05 are considered significant.

arterial blood gas (p=0.001), duration of inotrope use (p=0.001), and duration of hospital stay (p=0.001) (Table 2)

Discussion

Our study highlighted several important issues in the management of ARIs. Our study showed predominance of ARI among children aged 1 month to 5 years (77.5%), with a slight male preponderance (male-to-female ratio 1.22:1) and a mortality rate of 27.5%. These findings align with similar studies in India, where ARI is a leading cause of morbidity and mortality in young children. For instance, a community-based cross-sectional study in Western Maharashtra reported a 50.4% prevalence of ARI among under-five children, with a higher burden in rural areas and a male predominance (51.4% in boys).[7] National surveys, such as the National Family Health Survey 2019-21 too indicate a 2.8% prevalence of ARI symptoms among under-five children, with higher rates in younger age groups (3.4% in 0-11 months) and males (3.0% vs. 2.5% in females), with significant regional and socioeconomical disparities.[8] Mortality rates in hospital-based cohorts vary; a study on acute respiratory failure in North Indian children reported 14.14% mortality, primarily from bronchopneumonia, while another prospective cohort using emergency services noted 7.8% mortality associated with delays.[9,10] The higher mortality in our cohort may reflect the disproportionate severity of cases presenting to a tertiary urban centre, compounded by comorbidities such as undernutrition (60%) and incomplete immunization (65%), consistent with national data linking these factors to worse outcomes.[8]

In resource-limited settings like India, protocol-based ARI management is challenging due to infrastructure constraints, inadequate staffing, and limited access to advanced diagnostics, often leading to suboptimal care and higher mortality.[11] Non-respiratory etiologies accounted for 16.3% of respiratory distress in our study, including cardiac failure, severe anemia, and metabolic acidosis, highlighting the need for a high index of suspicion to differentiate these from primary lung pathologies. Nasopharyngeal multiplex PCR though valuable for etiological diagnosis remains underutilized due to cost and availability, with studies showing its potential to guide targeted therapy but limited implementation in public hospitals.[12] Delays in referral and transport likely contributed to our outcomes, as evidenced by research linking transportation barriers and late presentations to five-fold increased mortality risks in pediatric emergencies.[13] Strengthening peripheral services, improving referral networks, and establishing efficient emergency transport systems could mitigate these issues, reducing ARI-related deaths. This study underscores practical ground-level challenges for paediatricians and intensivists and may help in appropriate resource allocation and health policy planning in high-burden, low-resource settings.

Limitations of this study include referral bias, as it was conducted in a tertiary urban hospital, possibly overrepresenting severe cases and under capturing milder community ARIs. Resource constraints and limited comprehensive etiological testing may have affected the study as well. The retrospective design precluded long-term follow-up, missing post-discharge outcomes. More prospective, multicentre studies are needed to address out-of-hospital deaths, understand referral patterns, and evaluate interventions like better transport and diagnostic access in diverse Indian settings.

Conclusion

This study highlights the high burden and mortality of pediatric ARI in a resource-constrained tertiary setting, driven by undernutrition, incomplete immunization, and delayed presentations. Non-respiratory causes of respiratory distress underscore the need for vigilant systemic evaluation. Targeted improvements in peripheral healthcare, referral networks, and diagnostic access could substantially reduce preventable deaths in high-burden regions like India.

Compliance with Ethical Standards
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Conflict of Interest: None

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