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# CLINICO-EPIDEMIOLOGIC STUDY OF ACUTE LOWER RESPIRATORY TRACT INFECTIONS IN CHILDREN LESS THAN 5 YEARS OF AGE NEEDING HOSPITAL ADMISSION

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**ABSTRACT**

**Background:** In children under 5 years of age Acute Lower Respiratory Tract Infections (ALRI) contributes to a major share of childhood illnesses and deaths. As per WHO report in 2010, four and half million deaths among children per year were because of respiratory tract infection. Globally 5.9 million (including 1.2 million deaths in India alone) deaths have been reported among children due to RTI. Present study was undertaken to study various risk factors, clinical profile and outcome of ALRI in children below 5 years of age. **Material & Methods:** 300 ALRI cases needing hospital admission, below 5 years of age were evaluated for risk factors, clinical profile and outcome in the Pediatric Department of JNU Medical College and Hospital, Jaipur, Rajasthan, India. **Results:** Study showed that ALRI was more common in male children, in the age group of 2 to 12 months, from lower socioeconomic class family, with malnutrition and with incomplete immunization status. **Conclusion:** Morbidity and mortality in children, specially, below five years of age, can be brought down drastically, by dealing with potential risk factors responsible for ALRI.

**Keywords:** Acute Lower Respiratory Tract Infection (ALRI), Respiratory Tract Infection (RTI), Protein Energy Malnutrition (PEM).

## INTRODUCTION

Acute respiratory tract infections (ARI) of under 5 constitute a major public health problem all over the world especially in developing countries .There are nearly 156 million new episodes each year, of which India accounts for a bulk of 43million **(1)**

WHO estimated burden of respiratory tract infections in 2010, estimates four and half million deaths due to respiratory tract infections among children every year **(2)**. Of the 5.9 million deaths which occured world-wide due to respiratory tract infections, 1.2 million deaths were in India. **(3)**. A child under 5 years of age suffers from ARI for around five times in a year leading to a massive figure of total 238 million episodes per year. **(4)**. About 30-50 percent of health care facility visits are due to ARI and ARI related admissions are about 20-40 percent of total admissions into hospitals **(5)**

ARI is an acute infection of less than 30 days (<14 days for middle ear infection) duration of any part of respiratory tract and related structures.

ARI is classified according to the principal sites of infection as upper (AURI) or lower (ALRI) respiratory tract infection.

Common cold, pharyngitis, tonsillitis, pharyngotonsillitis, sinusitis, and otitis media are included under the broad term AURI.

Epiglottitis, laryngitis, bronchitis, bronchiolitis and pneumonia are included in the spectrum of ALRI. ALRI are more serious as compared to AURI, among all ALRI- bronchiolitis and pneumonia are more common in children. Pneumonia accounts for most deaths in children under 5 years of age **(6)**. Under the WHO ARI control programme guidelines

Pneumonia is defined as cough and tachypnoea (respiratory rate >50/min in children aged 2 months to 12 months and >40/min in children aged 13 months to 60 months) and severe and very severe pneumonia as the presence of chest in-drawing and central cyanosis, lethargy, convulsions and refusal of feed respectively **(7)**

ALRI is not a single disease entity but a group of infections with different etiology, risk factors, pathogenesis, clinical presentation, and outcomes **(2)**. These LRTI are affected by socio demographic and sociocultural factors which are modifiable by simple interventional measures **(8)** Risk factors which are modifiable were lack of breast feeding, overcrowding, under nutrition, delayed weaning and pre lacteal feeding **(2)**. Conditions which increase the ARI related mortality and morbidity are protein energy malnutrition, infectious diseases, superimposed bacterial infections **(2)**. LRTI is caused by viruses, bacteria or both together (9). WHO estimate 2002, shows that serious to fatal pneumococcal respiratory tract infection cases (about 1.6 million cases all over the world) occured mostly in infants and elderly people **(2)**. Haemophilus Influenza type b (Hib) bacteria is estimated to cause 3 million cases of severe pneumonia and meningitis, and approximately 386000 deaths per year in children under 5 years of age **(10)**.

There is evidence that pediatric respiratory illness can cause abnormalities that persist in adulthood and may account for much of the chronic obstructive lung diseases .It has been estimated that respiratory illness is the cause of 50% of school absences .Repeated short absences from school can lead to discouragement, lowering of self-confidence .Thus ALRI affects not only the physical health of children but also prevents them from achieving their educational potential. **(11)**

## METHOD

A prospective study of ALRI in children under 5 years age was conducted in the department of pediatrics of JNU Medical College and Hospital, Jaipur, Rajasthan.

**INCLUSION CRITERIA:** Children less than 5 years admitted with symptoms and signs of acute respiratory tract infection were taken up for the study.

Clearance from the Institutional Ethical Committee was taken.

Details about their home environment with reference to the presence or absence of animals around the house, number of people staying in one room, presence or absence of separate cooking space, type of cooking fuel used by the family, and smoking habits of family members were recorded.

The socio-economic background of the children, their nutritional and immunization status, their presenting symptoms and signs were recorded. These children were evaluated in detail at the time of admission, investigations done and results were recorded and analyzed.

## RESULTS

**Table 1:** Patient Characterstics

| S. No. | Demographic Character | Total No | % |
|---|---|---|---|
| **1** | Age group | | |
| | 0-2 months | 94 | 31.33 |
| | 2-12 months | 146 | 48.66 |
| | 1-5 years | 60 | 20 |
| **2** | SEX | | |
| | Male | 240 | 80 |
| | Female | 60 | 20 |
| **3** | NUTRITIONAL STATUS | | |
| | NO PEM | 146 | 48.6 |
| | PEM Gr. I | 59 | 19.66 |
| | PEM Gr. II | 58 | 19.33 |
| | PEM Gr.III | 24 | 8 |
| | PEM Gr. IV | 13 | 4.33 |
| **4** | IMMUNIZATION STATUS | | |
| | Complete | 61 | 20.33 |
| | Incomplete | 239 | 79.67 |

**Table 2:** Variables In Home Environment

| S. No. | | No. of Cases | % |
|---|---|---|---|
| **1** | Rural | 173 | 57.7 |
| | Urban | 127 | 42.3 |
| **2** | People per room | | |
| | <2/room | 20 | 6.66 |
| | 2-4/room | 178 | 59.3 |
| | >4/room | 102 | 34 |
| **3** | Animal around home | | |

| | | | |
|---|---|---|---|
| | Yes | 189 | 63 |
| | No | 111 | 37 |
| | Type: | | |
| | Cows& buffaloes | 97 | 51.3 |
| | Dogs | 12 | 6.35 |
| | Goats | 80 | 26.7 |
| **4** | Separate cooking space | | |
| | Yes | 193 | 64.3 |
| | No | 107 | 35.7 |
| **5** | Type of cooking fuel used : | | |
| | Gas | 114 | 38 |
| | Kerosene | 67 | 22.3 |
| | Wood &Cow dung | 93 | 31 |
| | Kerosene &Wood /Cow dung | 26 | 8.66 |
| **6** | Smoking in home: | | |
| | Yes | 210 | 70 |
| | No | 30 | 30 |

**Table 3:** Presenting Symptoms

| S. No. | Symptoms | No of cases | % |
|---|---|---|---|
| **1.** | Cough | 263 | 87.66 |
| **2.** | Fast breathing | 235 | 78.33 |
| **3.** | Fever | 216 | 72.00 |
| **4.** | Chest in drawing | 139 | 46.33 |
| **5.** | Refusal to feed/Reduced oral acceptance | 127 | 42.33 |
| **6.** | Running nose | 75 | 25.00 |
| **7.** | Excessive crying | 38 | 12.66 |
| **8.** | Irritability | 23 | 7.66 |
| **9.** | Lethargy/Altered sensorium | 23 | 7.66 |
| **10.** | Bluishness of face/feet/hands | 7 | 2.33 |
| **11.** | Others | | |
| | i)Noisy breathing | 5 | 1.66 |
| | ii) Grunting | 2 | 0.66 |
| | iii)Altered/hoarseness of voice | 2 | 0.66 |
| | iv)Not passed urine | 2 | 0.66 |
| | v) Generalized swelling over body | 2 | 0.66 |
| | vi)Pain chest | 1 | 0.33 |
| | vii)Bleeding from nose | 1 | 0.33 |
| **12.** | Associated complaints | | |
| | Vomiting | 22 | 7.33 |
| | Loose motions | 21 | 7.00 |
| | Vomiting & loose motions | 14 | 4.66 |
| | Convulsions | 18 | 6.00 |
| | Vomiting & convulsions | 4 | 1.33 |
| | Loose motions &Convulsions | 4 | 1.33 |

**Table-4:** Respiratory system findings at the time of admission

| | No. of cases | % |
|---|---|---|
| **Fever** | 193 | 64.33 |
| **Tachypnea** | 249 | 83.00 |
| **Retractions** | 263 | 87.66 |
| **Cyanosis** | 18 | 6.0 |
| **Flaring of alae nasi** | 292 | 97.33 |
| **Grunting** | 9 | 3.0 |
| **Impaired percussion note** | 12 | 4.0 |
| **Decrease in breath sounds** | 17 | 5.66 |
| **Crackles** | 223 | 74.33 |
| **Wheeze** | 151 | 50.33 |
| **Stridor** | 10 | 3.33 |

**Table 5:** INVESTIGATIONS

| | Investigation | No | % |
|---|---|---|---|
| **1.** | Haemoglobin ( DONE IN 276 CASES) | | |
| | Normal | 163 | 59.05 |
| | Mild anemia | 15 | 5.43 |
| | Mod. Anemia | 84 | 30.43 |
| | Severe anemia | 14 | 5.07 |
| **2.** | TLC( DONE IN 276 CASES ) | | |
| | Decreased | 17 | 6.16 |
| | Normal | 222 | 80.43 |
| | Increased | 37 | 13.40 |

| | | | |
|---|---|---|---|
| **3.** | X ray findings | | |
| **A.** | Bronchopneumonic patterns | 146 | 49.65 |
| **B.** | Lobar pneumonia | 53 | 18.0 |
| | Side-Right | 44 | 83.0 |
| | Left | 5 | 9.43 |
| | Bilateral | 4 | 7.54 |
| | Zones affected | | |
| | Upper Zone | 20 | 37.73 |
| | Middle Zone | 10 | 18.86 |
| | Lower Zone | 10 | 18.86 |
| | Upper & Middle Zones | 6 | 11.32 |
| | Middle &Lower Zones | 7 | 13.20 |
| **C.** | Reticular shadows/increased B.V. marking | 26 | 8.84 |
| **D.** | Air trapping alone | 6 | 2.04 |
| **E.** | Air trapping &Reticular shadows | 23 | 7.82 |
| **F.** | No abnormality | 39 | 13.26 |
| **G.** | Air/fluid/Air-fluid level in pleural space | 7 | 2.38 |
| | Right | 5 | 71.42 |
| | Left | 2 | 28.57 |
| | Bilateral | 0 | 0 |
| **H.** | Cardiomegaly | 20 | 6.80 |
| **I.** | Abnormal contour of heart | 13 | 4.42 |

**Table 6:** DISTRIBUTION OF CASES ACCORDING TO SEVERITY OF ILLNESS

| | **No. of Cases** | **%** |
|---|---|---|
| **No pneumonia** | 5 | 1.66 |
| **Pneumonia** | 42 | 14.0 |
| **Severe Pneumonia** | 101 | 33.7 |
| **Very severe Pneumonia** | 152 | 50.66 |

## RESULTS

80% of all children admitted were under the age of 1 year, 80% of ALRI related admissions were males, suggesting a gender preference in seeking medical care.79.67% of the children included in the study were incompletely immunized. 51.4% had some grade of malnutrition, 12.33% had severe (grade III/IV) malnutrition.91.66% cases belonged to lower middle class and lower class families. Parents of 70% of the children were smokers.1.66% children had no pneumonia,14% had pneumonia, 33.7% had severe pneumonia and 50.66% had very severe pneumonia at the time of admission.87.66% had cough,78.33% had fast breathing, 72% had fever, 42.33% had refusal to feed as presenting symptoms. Alae nasi flaring was present in 97%, retractions in 87.66% and tachypnea in 83.0% of cases at time of admission.40.9% had associated anaemia, while 30.43% were moderately anaemic. TLC was within normal range in 80.43% cases. Chest X-ray was done in 98.0%cases. A Bronchopneumonic pattern was in 50%, lobar pneumonia in 18.0%, while X-ray chest was found to be normal in 13.26%.

## DISCUSSION

Acute lower respiratory tract infections are among the commonest causes of morbidity and mortality among children under 5 years of age, especially in developing countries **(4)**.

Table-1 shows that the most common age group was between 2 months to 12 months 48.66%, similar findings were present in the study done by Dhivyanarayani M et al (61%) **(4)**, while most common age group in the studies of Mungala VK et al & Yellanthoor RB et al was 1-4 years. **(2, 12)**

Table-1 shows that out of the 100 children 80% were male and20% female ,in the study of Munagala VK et al and Yellanthoor RB et al also male preponderance was present **(2,12)**.

This probably represents a preferential treatment of male children in this community, female children being managed at the peripheral level without being brought to this institute .Admitting a child for a few days implies increased expenditure on stay, food and medication as well as reduced income during this period. Parents belonging to lower socioeconomic strata have a tendency to spend more on a male child than on female child.

Table -1, Shows that 33.66% of the 300 children belonged to lower socio-economic class families and 58% to lower middle class families.7.66% children belonged to upper middle class families and none to upper socio-economic class. Although our findings show that majority of the children admitted belonged to lower and lower middle class families, this reflects the low socio-economic background of most children admitted in this institution

LRTI was most common in children from lower socioeconomic status, similar findings were seen in the study done by Munagala VK et al (73.65%), Kabra SK et al **(2, 13)**

This increased risk in this group may be due to ill ventilated houses, overcrowding, use of biomass fuel for cooking, lack of separate cooking space, large family size, malnutrition, poor immunization status.

Table –1 shows that 51.4 % of all children admitted with ALRI were suffering from some grade of

malnutrition, 19.60 % had grade I PEM, 19.66 % had grade II PEM, 8% had grade III and 4.33% had grade IV PEM (all were suffering from very severe pneumonia). 48.6 % were normally nourished.

In the study of Munagala VK et al **(2)** similar findings were present (most of the children were from grade I PEM), 9.87%, 35.20%, 22.13%, 17.87% and 14.93% were from normal, PEM Gr. I, PEM Gr. II, PEM Gr. III and PEM Gr. IV respectively, in their study they concluded that increased incidence in PEM Gr. II, III, IV may be due to disease itself, low intake of food due to illness, anorexia or false belief of not to feed child during their illness.

In the study of Sonego M et al PEM III was the most common risk factor in the development **(14)**, These findings suggest that severe illness occurs in malnourished children .Malnutrition predispose to severe forms of ALRI, but no significant association were found between ALRI severity and nutritional status in the study of Dhivyanarayani M et al **(4)** among 100 ALRI cases, 46% were found malnourished (15%, 13%, 16%, 2% from grade I, II, III, IV PEM respectively) ,main reason was poor socio-economic status **(4)**

Malnutrition causes defective cell mediated immunity because of thymolymphatic depletion leading to gram negative bacterial infection and sepsis **(4)**

Secretory IgA is also reduced, recovery from infection is delayed and that too became serious in malnourished, systemic spread is also more likely **(15)**

Malnutrition is invariably associated with vitamin deficiency like A,D and E. Vitamin A maintain the integrity of the epithelial cells, deficiency of vitamin D may lead to deformity in the thoracic cavity that predisposes for ALRI.

Table- 1shows that only 20.33%children had received complete immunization for their age .The remaining were incompletely immunized .Most of these children has missed doses of DPT vaccine, majority had not received measles vaccine and none had received vitamin A supplementation .Similar findings were present in various studies globally**(2)**.

In the study of Dhivyanarayani M et al. **(4)** 50 % were incompletely immunized for age, because of low socio-economic status, in their study they found highly significant association between ALRI severity and immunization status.

In the study of Janssen R et al 21.15 % and in the study of Letterio II et al 38.2% were partially immunized children. **(16)**

Table shows that 57.66% children from rural areas, our institute is an apex hospital which caters to a large population residing in rural area around Jaipur

Table 2 shows 59.33% of the 300 children included in the study lived in small houses with 2 to 4 person residing in the same room. 34% children came from families with inadequate living space and overcrowding with more than 4 persons residing in a single room. For respiratory illnesses- bed sharing and overcrowding are important risk factors.

In the study of Dhivyanarayani M et al **(4)** overcrowding was seen in 70% among 100 ALRI cases, no significant association found between overcrowding and severity of ALRI

Muhe L et al in Malaysia also found significant association between ALRI and overcrowding in their study **(17)**

Table 2 showed that 63.00% children with ALRI had animals in their surroundings specially buffaloes, cows and goats. This shows that animal surrounding is a potential risk factor for ALRI. Children get infection when they came in contact with animal's waste, saliva or dander. Children are more prone for animal borne diseases because their immune system are still developing.**(18)**

Table 2 showed that 64.33% children were living in home without separate kitchen facility(mostly using kerosene, wood and cow dung for cooking).This proves that biomass fuel is a potential risk factor for ALRI.

Table- 2 Showed that, in 70 % children (with ALRI) history of smoking at home by family member or members was present. About 700 million (almost half) of the world's children breathe air polluted by tobacco smoke, mostly at home **(19)** As per WHO report, infants whose parents smoke, have more respiratory illness specially in first year of life than those who live in smoke free environment.34% of Indian, 69% of Cuba's, 68%of Argentina's and 29% of Peru's children exposed to second hand smoking at home **(20)**

Table-3 showed that the most common presenting symptoms were cough, fast breathing, fever, chest indrawing, decrease oral acceptance which were present in 87.66 %, 78.33%, 72.0%, 46.33% and 42.3% respectively. Cough (98.1%), breathlessness (95.2%), fever (91.2%), in drawing of costal space

(76.8%) were most common symptoms in the studies of Munagala VK et al. **(2)**

In the study of Rashad, Mohamed M et al **(21)** cough and breathlessness and fever were most common clinical symptoms. They also stated that indrawing of intercostal space (76.8%) was associated with severe cases of ALRI.

Table-4 Shows that respiratory distress and fever were most common signs observed in our study, similar finding were reported by Munagala VK et al and Ranganathan SC et al in their study **(2, 22)**

Table–5 shows that bronchopneumonia was the most common LRTI in our study (55%), similar finding were present in the study of Munagala VK et al though the percentage in their study was 38.7%**(2)**

Table-5 shows that anemia was present in 40.05 % children, 5.07%were severely anemic, 30.43 were moderately anemic, In the study of Munagala VK et al 5.9 %had severely anemic while 12.5 % were moderately anemic **(2)**. In the study done by Dhivyanarayani M et al 47% were anemic **(4)**.

Leucocytosis, were present in 13.40% children in our study. In the study of Munagala VK et al Leucocytosis was observed in 13.1% children with leucocyte counts >15000cells/cubic mm. **(2)**. In the study done by Dhivyanarayani M et al leucocytosis was seen in 22% children **(4)**

We conclude that white blood cell count and its differential do not differentiate sufficiently between cases of viral and bacterial pneumonia and are not useful in deciding whether antibiotic should be used in a child with ALRI

Commonest x ray chest finding in our study was Bronchopneumonic patterns (46.65%) followed by lobar pneumonia (18%).

In the study of Mungala VK et al also most common findings was of broncopneumonia (38.7%) followed by bronchiolitis (85%).

Table -6 Shows that most (50.66%) of the cases were admitted with very severe pneumonia. Ours being a tertiary care hospital majority of the cases were admitted with severe or very severe pneumonia because these cases were initially treated in peripheral centers, when not responding to or deteriorating on the treatment being given they were referred for admission to this institution.

## CONCLUSION

From our study we concluded that morbidity and mortality of under, five years old children due to ALRI can be significantly brought down by modifying various risk factors of severe ALRI. By improving nutritional status of children, educating parents about importance of universal immunization in preventing diseases, ensuring wider coverage with BCG, DPT and measles vaccine, Vit. A supplementation, improvement of housing condition by giving monitory help to the lower socio economic class families from the state or central government (in the form of no/ low interest loans), providing LPG / smokeless stoves for cooking at a lower cost, prohibiting cutting of trees for fuel, educating people about harms of smoking and passive smoking ,training and reorientation courses for health personnel including doctors for proper management and timely safe referrals of serious ALRI cases.

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