

Prevalence of Malnutrition Among Under-Five Year Old Children With Acute Lower Respiratory Tract Infection Hospitalized at Udupi District Hospital

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Background: Increased incidence and severity of acute lower respiratory tract infection (ALRI) are variably associated with malnutrition.

Objectives: We aimed to examine the prevalence of malnutrition in under-five year old hospitalized children with ALRI.

Patients and Methods: Children aged from 6 to 60 months, mostly from a low socioeconomic population, admitted with ALRI, were enrolled prospectively. WHO case definition was used for ALRI. The data about the weight, length/height, mid-arm circumference (MAC) in 1-5 year old children and acute respiratory infections (ARI) episodes in the preceding 6 months were collected in addition to demographic characteristics. Nutritional status was assessed using an age independent criteria in the form of ratio of weight (in kilograms multiplied by 100) to the length or height (in centimeter) squared.

Results: Among 206 children with ALRI, 21.9% had pneumonia, 55.8% had severe pneumonia and 22.3% had very severe disease. About 85% of the children were younger than 3 years old. Male to female ratio was 1.34:1. The prevalence of malnutrition was seen in 54.9% of the children. MAC was below 13.5 cm in 59.4%. Severe malnutrition was observed in 68.7% of 3-5 years age group and 59.4% of 1-3 years age group. Severe malnutrition had shown higher percentages among children with pneumonia and severe pneumonia. Severely malnourished children had more ARI episodes in the preceding 6 months although it was not statistically significant (OR 1.22; 95% CI 0.71-2.12; P = 0.47).

Conclusions: High prevalence of severe malnutrition and its significant association with increased ALRI in 1-5 year old children highlights the need for strengthened nutrition intervention programs.

Keywords: Respiratory Tract Infections; Child; Malnutrition

1. Background

Acute respiratory infections (ARI) are the main cause of morbidity worldwide, and pneumonia represents as one of the main causes of death in under five year old children in developing countries. For determining the respiratory infections, risk factors such as poverty, restricted family income, large family size, low parental education level, low birth weight, lack of breastfeeding, pollution, young age and malnutrition have been defined in developing countries (1, 2). Risk factors not only increase the incidence but also increase the severity of the lower respiratory infections. Hence an urgent need for effective interventions for prevention and medical case management (2) as well as studies to help address the most pressing issues has been suggested (3).

Impaired cellular immunity in malnourished children makes them more prone to ARI. Severe malnutrition increasing the risk of acquiring ARI by 1.85 folds (4) and in the absence of other factors malnutrition alone signifi-

cantly influenced the ARI in children younger than two years old (5). It has also been identified that both current and past malnutrition were associated with acute lower respiratory tract infection (ALRI), even after adjusting for potential confounders. Reduction in malnutrition along with timely and proper treatment of ARI likely to improve children health in developing countries (6).

2. Objectives

We aimed to examine the prevalence of malnutrition in children with ALRI and its relationship with ALRI incidence and severity.

3. Patients and Methods

Children aged 6 to 60 months, mostly from a low socioeconomic urban population were admitted to district hospital, Udupi Hospital, for the treatment of ALRI and enrolled for prospective observational study. World

Implication for health policy/practice/research/medical education:

The prevalence of malnutrition was high in children from low socioeconomic urban area who present with ALRI. High prevalence of severe malnutrition among children in 1-5 years old group with ALRI highlights the need for strengthening nutrition intervention programs under integrated child illness management programs for underprivileged urban children.

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Health Organization (WHO) case definition was used for ALRI (7). Pneumonia, severe pneumonia and very severe disease were defined based on tachypnea, chest-in drawing and the presence of other danger signs. Pneumonia was defined as presence of cough with fast breathing of more than 60/min in less than 2 month-old, more than 50/min in 2 to 12 month-old and more than 40/min in 12 to 60 month-old children. The presence of lower chest wall in drawing was considered as severe pneumonia. Poor feeding, lethargy, central cyanosis or convulsions were detected in very severe cases. The data pertaining to weight, length/height and acute respiratory infections (ARI) in the past 6 months was collected, in addition to demographic characteristics. Mid-arm circumference (MAC) was obtained in 1-5 year-old children. The nutritional status was assessed using an age independent criteria in the form of ratio of weight (in kilograms multiplied by 100) to length or height in centimeter squared (8). Ratio of more than 0.14 was considered as normal or mild malnutrition while a ratio of ≤ 0.14 was considered as severe malnutrition.

Socioeconomic status was determined by using modified Kuppuswamy classification (9) that considered the level of education, occupational status and the family income to classify the study groups. Parents filled out the informed consent form of the study.

3.1. Statistical Analyses

Statistical analyses were performed using SPSS for Win-

dows, version 11.5. Association of malnutrition with ALRI was assessed by Chi-square test and strength of association was computed by odds ratio (95% confidence interval). A 'P' value of less than 0.05 was considered significant.

4. Results

A total of 206 children with ALRI were studied over two years from November 2006 to January 2009. Among those, 45 (21.9%) had pneumonia, 115 (55.8%) had severe pneumonia (SP) and 46 (22.3%) had very severe disease (VSD). Of 206 children with ALRI, 106 (51.5%) were in the age group of 1-3 years old, 68 (33%) were 6 to 12 months old and 32 (15.5%) were between 3-5 years old. The number of male children with ALRI was more than female children (57.3% vs. 42.7%; ratio of 1.34:1). About 84.5% (174/206) of children had low socioeconomic status and remaining 15.5% (32/206) had upper or middle socioeconomic status.

Table 1 shows ARI categories at different age groups. Very severe disease was mostly seen in infants and not in children older than 3 years old. The prevalence of malnutrition was observed in more than half (54.9%) of the children with ALRI. MAC was less than 13.5 cm in 59.4% (82/138) of 1-5 year-old children (Table 2). Table 3 shows the prevalence of malnutrition at different age groups in different ARI categories. Most of the children 1-5 years old with pneumonia and severe pneumonia had severe malnutrition. The severity of ARI did not correlate with malnutrition among infants.

Table 1. ARI Categories at Different Age Groups

Age Group, No.	Pneumonia, No. (%)	Severe Pneumonia, No. (%)	Very Severe Disease, No. (%)
6 month-1 year (68)	5 (7.4)	33 (48.5)	30 (44.5)
1-3 years (106)	24 (22.6)	66 (62.3)	16 (15.1)
3-5 years (32)	16 (50)	16 (50)	0 (0)

Table 2. Prevalence of Malnutrition Among ALRI Cases

Variable	No. (%)
Malnutrition (n = 206)	
Mild/none	93 (45.1)
Severe	113 (54.9)
Midarm circumference (n = 138)	
> 13.5 cm	56 (40.6)
≤ 13.5 cm	82 (59.4)

The prevalence of severe malnutrition was nearly equal in both boys (54.2%) and girls (55.7%). Severe malnutrition presented in 68.7% of 3-5 years old group and 59.4% of 1-3 years old group (Table 4). The severity of undernourished state was not significantly correlated with pneumonia and severe pneumonia. Severely malnourished children also had more (but not statistically significant) ARI epi-

sodes in the past 6 months compared to children with normal nutrition status (OR 1.22; 95% CI 0.71-2.12; P = 0.47).

5. Discussion

Acute respiratory infections cause significant morbidity worldwide and pneumonia is an important cause of death in young children in developing countries. Of several risk factors (1-5), malnutrition, a poverty related problem increases the risk of ALRI in young children living in developing countries. In the present study about half of the children with ALRI were in 1-3 years old age group and about 85% were younger than 3 years old. Nikfar R. et al. reported that 63% of hospitalized ALRI cases were younger than 2 years old with a median age of 21 months among, 100 cases studied (10). Zaman K. et al. (11) reported that the highest incidence of ALRI were observed in 0-5 month-old infants

followed by 12-17 month-old children. In contrast, highest incidence of pneumonia in infants was reported by

Deb S.K. (12). In the present study, the number of hospitalized male patients with ALRI was higher than the

Table 3. Prevalence of Malnutrition in Different Age Groups With Different ARI Categories

Age Groups	No.	Severe Malnutrition, No. (%)	Mild/No Malnutrition, No. (%)
6 month-1 year (n = 68)			
Pneumonia	5	4 (80)	1 (20)
SP ^a	33	11 (33.3)	22 (66.7)
VSD ^a	30	13 (43.3)	17 (56.7)
1-3 years (n = 106)			
Pneumonia	24	15 (62.5)	9 (37.5)
SP	66	42 (63.6)	24 (36.4)
VSD	16	6 (37.5)	10 (62.5)
3-5 years (n = 32)			
Pneumonia	16	10 (62.5)	6 (37.5)
SP	16	12 (75)	4 (25)
VSD	-	-	-

^a Abbreviations: SP, severe pneumonia; VSD, very severe disease.

Table 4. Relationship of Malnutrition With Gender, Age and ALRI Characteristics

	Malnutrition	
	Severe, No. (%) (n = 113)	Mild/None, No. (%) (n = 93)
Sex		
Male	64 (54.2)	54 (45.8)
Female	49 (55.7)	39 (44.3)
Age group		
3-5 year	22 (68.7)	10 (31.3)
1-3 year	63 (59.4)	43 (40.6)
0.5-1 year	28 (41.2)	40 (58.8)
Severity of ARI		
Very severe disease	19 (41.3)	27 (58.7)
Severe pneumonia	65 (56.5)	50 (43.5)
Pneumonia	29 (64.4)	16 (35.6)
ARI episodes in the past 6 months		
< 2	49 (43.4)	45 (48.4)
≥ 2	64 (56.6)	48 (51.6)

female ones (male to female ratio was 1.34 : 1). An Iranian study reported a male to female ratio of 3 : 2 among 107 children hospitalized with pneumonia (13).

The prevalence of malnutrition was observed in more than half (54.9%) of the children with ALRI participated in the present study which is close to 57.5% of all ARI children who had protein energy malnutrition, which was reported in another study conducted in a village involving 1600 children (14). In that study, children aged 12-14 months had highest level of malnutrition (78.6%). The

malnutrition rate in the present study was higher than that observed in (48%) the 2005-06 national family health survey (NFHS-3) of India (15). MAC was below 13.5 cm in 59.4% (82/138) of 1-5 year-old children participated in the present study. Significant association of decreased MAC and ARI was recognized earlier (14).

Malnourished children had considerably shown immunity impairment, especially cellular immunity deficiency. Hence they are more prone to ARI/ALRI. Malnourished unvaccinated children had higher risks of ARI in children

younger than 2 years old (5) and severe malnutrition 1.85 times (95 percent CI: 1.14-3.0) increased the risk (4) of ARI in under-five year old children. Association of current and past malnutrition with ALRI, even after adjusting for potential confounders (odds ratio: 2.03; 95% confidence interval: 1.2-4.3) was previously identified (5).

In the present study, more than half of the children with ALRI with 1-5 years old were severely malnourished. A relative risk of developing pneumonia of 2.3 in malnourished children was reported by Deb S.K. (12). Author also reported that ARI was more common among malnourished children compared to well-nourished children (52.2% vs. 28.8%; $P = 0.001$). The increased incidence of ARI with deteriorating nutritional status ($P = 0.05$) and decreasing midarm circumference ($P = 0.001$) was reported by Kaushik et al. (14).

In conclusion, most of ALRI cases occurred in children younger than 3 years old. The prevalence of malnutrition was higher among children from low socioeconomic urban area with ALRI. The high prevalence of severe malnutrition in 1-5 year-old children with ALRI highlights the need for strengthening nutrition intervention programs under the integrated child illness management programs for underprivileged urban children.

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Authors' Contribution

RB and VKBS involved in treatment of cases, data collection, manuscript and draft preparation. RB acted as guarantor for the study.

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