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A STUDY OF PREDICTORS OF HYPOXEMIA IN CHILDREN WITH LOWER RESPIRATORY TRACT INFECTION "(ALRI)"

Pediatrics

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ABSTRACT

Children between the age group 2 months to 5 years admitted in a tertiary care hospital (DMCH) with an acute history of cough and rapid respiration or difficulty in breathing during the period of April 2018 to September 2019.Among 100 children who met inclusion and exclusion criteria, 46 children had hypoxemia (Spo2 <90%) and 54 children had Spo2 ≥90%.53.0% children were male and 47.0% children were female, the male to female ratio is1.1:1. 19.3% children were malnourished. Acute lower respiratory tract infections are the leading cause of morbidity and mortality among children in developing countries.

KEYWORDS

INTRODUCTION

Infections of the respiratory tract are perhaps the most common human ailment. While they are a source of discomfort, disability and loss of time for most adults, they are a substantial cause of morbidity and mortality in young children and the elderly. Acute respiratory infections (ARI) may cause inflammation of the respiratory tract anywhere from nose to alveoli, with a wide range of combination of symptoms and signs. Acute respiratory infection is defined as acute onset of respiratory symptoms including cough, rhinorrhea, fast breathing, chest wall indrawing and wheeze of less than 14 days duration. The upper respiratory tract infections include epiglottitis, laryngitis, laryngotracheitis, bronchitis, bronchiolitis and pneumonia. ARI are the major cause of morbidity and mortality among children in developing countries. In India about 20% of all under 5 years deaths are due to ARI, out of which only pneumonia is responsible for about 18%deaths. Viral pathogens are a prominent cause of lower respiratory tract infection in infants and children <5 years. Of the respiratory viruses, influenza virus and respiratory syncitial virus are the major pathogens in children <3years. Hypoxemia is defined as oxygen saturation less than 90%. Hypoxemia is an important risk factor for mortality in children with ALRI . The most reliable way to detect hypoxemia is an arterial blood gas analysis or the determination of arterial haemoglobin saturation by pulse oximeter. Detection of hypoxemia by use ofpulse oximetry and ABG analysis is not feasible in most situations in developing countries. Therefore it is important to accurately identify hypoxemia in children by use of clinical signs alone. Various symptoms and signs have been evaluated for their ability to predict hypoxemia. Haemoglobin oxygen saturation measured by a pulse oximeter has been shown to predict outcome in Acutelower respiratory tractinfection.

OBJECTIVE

1) To determine the prevalence of hypoxemia in children presenting withALRI.
2) To identify the symptoms and signs which can predict hypoxemia in children withALRI.
3) To compare the clinical outcome in children with ALRI with hypoxemia from those withouthypoxemia.

MATERIALS AND METHODS

SOURCE OF DATA

Children between the age group 2 months to 5 years admitted in a tertiary care hospital with an acute history of cough and rapid respiration or difficulty in breathing during the period of April 2018 to September 2019.

Type of study : Case control study

Duration of study : 18 months (April2018 – September 2019)

Sampling Method: Purposivesampling

Inclusion Criteria: Children between the age of 2 months-5 years presenting with an acute history of cough and rapid respiration or difficulty in breathing and/or abnormal ascultatory finding were included in the study according to the WHO criteria forALRI.

Exclusion Criteria: Children with diarrhoea, convulsion, asthma, congential heart disease, severe anaemia, peripheral circulatory failure, children needing ventilator support and severe dehydration were not included in the study.

METHOD OF COLLECTION OF DATA

100 children between the age group of 2 months to 5 years with history of cough and rapid respiration or breathing difficulty admitted to tertiary care hospital fulfilling the inclusion criteria were included in the study.

At the time of enrollment an informed written consent was obtained from the parents.

The study sample was divided into 2 groups. Group-1 children having oxygen saturation <90%(n = 46) , group 2 ≥90%(n=54) on admission. Baseline characteristics were compared. Frequency of different symptoms/ signs in bothgroups was calculated.

A detail history was obtained from the parents about the presence and duration of various symptoms: Cough, fever, Difficulty in Breathing, cry, Inability to drink/ feed.

The child was examined and the followings signs were recorded. Appearance, heart rate, respiratory rate(counted for 60 seconds when the child is quite and at rest and if child is tachypneic according to age repeat count was done), cyanosis, grunting, nasal flaring, suprasternal indrawing, lower chest retractions, intercostal retraction crepitation, rhonchi and decreased air entry.

A portable oximeter was used to measure oxygen saturation with an appropriate sized sensor on the finger or the toe while the child was breathing at room air. Hypoxemia was defined as oxygen saturation <90%. Arterial blood gasanalysis was done in children

with Spo2 < 90%.

RESULTS AND DISCUSSION

Among 100 children who met inclusion and exclusion criteria, 46 children had hypoxemia (Spo2 <90%) and 54 children had Spo2 ≥90%.

Table no. 1 : Age distribution

	Saturation <90%	Saturation ≥90%	Total
<12 months			
count	32	28	60
%	69.5%	51.8%	60%
12 – 60 months			
Count	14	26	40
%	30.5%	48.2%	40%
Total			
Count	46	54	100
%	100%	100%	100%

Table no. 2: Sex distribution

Sex	Saturation<90%	Saturation≥90%	Total
Female	21 45.6%	26 48.2%	47 47%
Male	25 54.4%	28 51.8%	53 53%
Total	46 100%	54 100%	100 100%

Table no. 3: Weight distribution

	Saturation <90%	saturation≥90%	Total
PEM absent			
Count	36	44	80
%	78.3%	81.5%	80%
PEM present			
Count	10	10	20
%	21.7%	18.5%	20%
TOTAL			
Count	46	54	100
%	100%	100%	100%

Table no. 4: Appearance of children with ALRI

	GROUP		
	Spo2<90%	Spo2≥90%	
Well count %	0 0%	15 27.8%	15 15%
Mildly sick count %	21 45.7%	39 72.2%	60 60%
Very sick count %	25 54.3%	0 0%	25 25%
Total count %	46 100%	54 100%	100 100%

X2=45.04831,p<0.001 Highly significant

Table no.5: Distribution of cough in children with ALRI

	GROUP		Total
	SPO2 <90%	SPO2 ≥90%	
Absent Count %	1 2.2%	1 1.9%	2 2%
Present Count %	45 97.8%	53 98.1%	98 98%
Total Count %	46 100.0%	54 100.0%	100 100.0%

Table no. 6: Distribution of fever in children with ALRI.

	Saturation <90%	Saturation ≥90%	Total
Fever Absent Count %	10 21.8%	16 29.6%	26 26%
Fever Present Count %	36 78.2%	38 70.4%	74 74%
Total count %	46 100%	54 100%	100 100%

Table no.7: Distribution of children with difficulty in breathing in children with ALRI Difficulty In Breathing

	GROUP		Total
	Sp2 <90%	SPO2≥90%	
Absent Count %	4 8.7%	32 63%	36 36%
Present Count %	42 91.3%	22 37%	64 64%
Total Count %	46 100.0%	54 100.0%	100 100.0%

x2=27.5642 p<.001 Very highly significant

Table no.8: Distribution of inability to feed in children with ALRI.

	GROUP		Total
	SPO2 <90%	SPO2≥90%	
Normal Count %	0 .0%	10 18.5%	10 10%
Decreased Count %	19 42.0%	44 81.5%	63 63%
Not able Count %	27 58%	0 .0%	27 27%
Total Count %	46 100.0%	54 100.0%	100 100.0%

x2=46.57874, p<.001 Very highly significant

Table no.9: Distribution of cyanosis in children with ALRI

Cyanosis		SPO2<90%	SPO2≥90%	Total
	Absent	44(95.7%)	54(100%)	98
	Present	2(4.3%)	0(0%)	2
	Total	46(100%)	54(100%)	100(100%)

Fisher exact test p =0.209091 Not significant

Table no. 10: Distribution of heart rate in children with ALRI

	GROUP		Total
	SPO2<90%	SPO2≥90%	
Normal Count %	18 39.2%	30 55.6%	48 48%
Tachycardia Count %	28 60.8%	24 44.4%	52 52%
Total Count %	46 100.0%	54 100.0%	100 100.0%

x2=2.6849 p>0.05 Not Significant

Table no.11: Distribution of nasal flaring in children with ALRI.

	GROUP		Total
	SPO2<90%	SPO2 ≥90%	
Absent Count %	19 41.4%	41 76.0%	60 60%
Present Count %	27 58.6%	13 24.0%	40 40%
Total Count %	46 100.0%	54 100.0%	100 100.0%

x2=12.4061 p<.001 Very highly significant

Table no.12: Distribution of grunting in children with ALRI

	GROUP		Total
	SPO2 <90%	SPO2≥90%	
Absent Count %	30 65.3%	52 96.3%	82 82%
Present Count %	16 34.7%	2 3.7%	18 18%
Total Count %	46 100.0%	54 100.0%	100 100.0%

X2=16.2554 p<.001 Very highly significant

Table no.13: Distribution of tachypnoea in children with ALRI

	GROUP		Total
	SPO2<90%	SPO2≥90%	
Normal Count %	1 2.3%	1 1.9%	2 2%

IncreasedCount %	25 54.3%	47 87%	72 72%
High Count %	14 30.4%	6 11.1%	20 20%
very high Count %	6 13.0%	0 .0%	6 6%
Total Count %	46 100.0%	54 100.0%	100 100.0%

vx2=15.380658, p<0.001 Highly significant

Table no. 14: Distribution of suprasternal indrawing in children with ALRI

			GROUP		Total
			SPO2<90%	SPO2≥90%	
	Absent	Count	16	43	59
		%	34.8%	79.7%	59.0%
	Present	Count	30	11	41
		%	65.2%	20.3%	41.0%
Total		Count	46	54	100
		%	100.0%	100.0%	100.0%

X2=20.653 p value <0.001 Very highly significant

Table no.15: Distribution of intercostal retraction in children with ALRI

	Saturation <90%	Saturation≥90%	Total
Present			
count	38	15	53
%	82.6%	27.8%	53.0%
Absent count %	8 17.4%	39 72.2%	47 47.0%
TOTAL			
Count	46	54	100
%	100%	100%	100%

X2=29.9798 p value <0.001 Very highly significant

Table no. 16: Distribution of subcostal indrawing in children with ALRI

	Saturation <90%	**Saturation≥90%**	**Total**
Present			
count	46	53	99
%	100%	98.1%	99.0%
Absent count	0	1	1
%	0%	1.9%	1.0%
TOTAL			
count	46	54	100
%	100%	100%	100%

X2=0.0065,At p value <0.05 highly insignificant

Table no. 17: Distribution of crepitation in children with ALRI.

	GROUP		Total
	SPO2<90%	SPO2≥90%	
Absent Count %	11 23.9%	25 46.3%	36 36.0%
Present Count %	35 76.1%	29 53.7%	64 64.0%
Total Count %	46 100.0%	54 100.0%	100 100.0%

x2=5.4015 p<0.05 Significant

Table no. 18: Distribution of Rhonchi in children with ALRI.

	GROUP		Total
	SPO2<90%	SPO2≥90%	
Absent Count %	18 39.2%	44 81.4%	62 62.0%
Present Count %	28 60.8%	10 18.5%	38 38.0%
Total Count %	46 100.0%	54 100.0%	100 100.0%

x2=18.9106 p<0.05 Significant

Table no.19: Distribution of Hb in children with ALRI

Hbgm%	Frequency	Percent
5-10 gm%	27	27.0%
>10gm%	73	73.0%
Total	100	100

Table no. 20: Distribution ofTLC

Total WBC count cells/cumm	Frequency	Percent
4500 -11000	32	32.0%
11000-15000	30	30.0%
15000-25000	30	30.0%
>25000	8	8.0%

Table no. 21: Total leucocyte count with diagnosis

TLC	N	Mean	Std. Deviation	Minimum	Maximum
Acutebronchitis	30	11615.63	3849.517	5100	19600
Bronchiolitis	20	12613.64	4129.141	6700	20500
Bronchopneumonia	18	16335.00	7342.757	3100	37900
Pneumonia	32	10517.00	51943.273	3000	30900

H= 19.264 p<0.001 Very highlysignificant (Kruskal – Wallistest)

Table no. 22: Arterial blood gas analysis

Group Statistics

GRP		N	Mean	Std. Deviation	Std. Error Mean
PH	Satur<90%	46	7.3404	.03553	.00508
	Satur>90%	0	.	.	.
Po2	Satur<90%	46	67.76	6.303	.900
	Satur>90%	0	.	.	.
PCO2	Satur<90%	46	34.67	7.429	1.061
	Satur>90%	0	.	.	.
HCO3	Satur<90%	46	18.37	2.698	.385
	Satur>90%	0	.	.	.
O2 SATURATION%	Satur<90%	46	83.86	4.021	.574
	Satur>90%	0	.	.	.

CHEST XRAY

In children with ALRI, Chest x ray was normal in 15 children with non hypoxemia and 9 children with hypoxemia. 1 chest x ray with hypoxemia had prominent bronchial markings suggestive of bronchitis. Chest x ray showing hyperinflation suggestive of Bronchiolitis was seen was seen in 12 children with hypoxemia.11 children in hypoxemic children and 8 children in non hypoxemic group had chest x ray showing bilateral non homogenous opacity suggestive of bronchopneumonia. 1 child in non hypoxemic group had chest x ray suggestive of bronchiectasis.13 children in hypoxemic group and 19 children innon hypoxemic group had chest x ray suggestive of lobarpneumonia.

Table no. 23: Frequency of symptoms associated with hypoxemia

Symptoms	**Hypoxemic Children (n=46)**	**Non-hypoxemic children (n=54)**	**Sensitivity**	**Specificity**	**P value**
Cough	45	53	97.8%	1.8%	0.906
Fever	36	37	78.2%	31.4%	0.316
Difficulty in breathing	42	20	91.3%	62.9%	<0.001
Inability to feed	46	44	100%	18.5%	<0.001

Among the symptoms, inability to feed, cough and difficulty in breathing had high sensitivity of 100%,97.8% and 91.3% respectively to predict hypoxemia. Difficulty in breathing had high specificity of 62.9% among the symptoms to predict hypoxemia in children with ALRI. On comparison between hypoxemic and non hypoxemic children difficulty in breathing and inability to feed had a p value <0.001 and was statisticallysignificant.

Among the signs, appearance, lower chest retraction, tachypnoea and intercostal retraction had high sensitivity of 100%,100%, 97.8% and 82.6% respectively to predict hypoxemia in children with ALRI. Central cyanosis, grunting, suprasternal indrawing and nasal flaring had specificity of 100%,96.2%,79.6% and 75.9% respectively to predict hypoxemia in children with ALRI. On comparison between

hypoxemic and non hypoxemic children p value was very highly significant in appearance, nasal flaring, grunting, suprasternalindrawing parameters, highly significant with tachypnoea, significant in tachycardia and crepitationvariables.

On combination of variables, model – 4 (cough, inability to feed, tachypnoea) and model – 1 (cough, difficulty in breathing, tachypnoea) had high sensitivity of 96% and 90% to predict hypoxemia in children with ALRI. Model -2(cough, difficulty in breathing, nasal flaring), model – 3(cough, inability to feed,intercostal retraction) and model – 5(cough, tachypnoea, intercostals retraction) had a sensitivity of 82%, 80% and 80% respectively to predict hypoxemia in children with ALRI.

In our study none of the children in the study group expired. Children with bronchitis required mean duration stay of 3- 5 days. In children with bronhiolitis required a mean duration stay of 6-8 days in hypoxemic children and 5- 7 days in non hypoxemic children. In children with pneumonia mean duration of stay was 6- 8 days in hypoxemic children and 4- 6 days in non hypoxemic children. In children with bronchopneumonia required a prolonged stay of 8 -10 days in hypoxemicchildren.

In children with ALRI with Spo2 <90% hypothermia was present in 13.0% as compared to 5.5% in children with Spo2 ≥90%. It was statistically not significant with p < .05. Sensitivity was 13.0% and specificity was 94.5%.

Among 100 children, 46 children were hypoxemic and 54 children were non hypoxemic with the prevalence of hypoxemia about46%. 53.0% children were male and 47.0% children were female, the male to female ratio is1.1:1. 19.3% children weremalnourished. Among symptoms in children with ALRI, inability to feed, cough and difficulty in breathing had a sensitivity of 100%, 97.8% and 91.3% respectively and specificity was maximum for difficulty in breathing(63.0%) to predict hypoxemia. On comparison between hypoxemic and non hypoxemic children difficulty in breathing and inability to feed had a p value <0.001 and was statistically significant. Among signs in children with ALRI, appearance of the child , lower chest retraction , respiratory rate had a sensitivity of 100%,100% and 97.8% respectively to predict hypoxemia .Central cyanosis was the most specific sign with the specificity of 100% to predict hypoxemia followed by grunting with a specificity of 96.3%. On comparison between hypoxemic and non hypoxemic children p value was very highly significant for appearance, nasal flaring, grunting, suprasternalindrawingparameters. No significant difference in mean Hbin children with hypoxemia and non hypoxemia. Arterial blood gas analysis done in hypoxemic children(Spo2 < 90%) had a mean pH of 7.34, Po2 of 67%, PCo2 of 34.67, HCo3 of 18.3% and oxygen saturation of83.86%. In children with ALRI, Chest x ray was normal in 26 children. 1 chestx ray was suggestive of bronchitis. Hyperinflation suggestive of Bronchiolitis was seen was seen in 21 children. 19 children had features suggestive of bronchopneumonia. 1 child had chest xray suggestive of broncheictasis.32 children had chest x ray suggestive of lobarpneumonia. On combination of variables, a combination of cough, inability to feed, tachypnoe and the combination of cough, difficulty inbreathing, tachypnoeahad high sensitivity of 96% and 90% to predict hypoxemia in children with ALRI. In our study none of the children in the study group expired. Children with bronchitis required mean duration stay of 3- 5 days. In children with Bronchiolitis required a mean duration stay of 6-8 days in hypoxemic children and 5- 7 days in non hypoxemic children. In children with pneumonia mean duration of stay was 6- 8 days in hypoxemic children and 4- 6 days in non hypoxemic children. In children with bronchopneumonia required a prolonged stay of 8 -10 days in hypoxemicchildren.

CONCLUSION

- Acute lower respiratory tract infections are the leading cause of morbidity and mortality among children in developing countries.
- Inability to feed, cough, respiratory rate and appearance of the child had good sensitivity to predict hypoxemia.
- Cyanosis and grunting had good specificity to predict hypoxemia.
- None of the clinical symptom/ sign alone has sufficient sensitivity and specificity to predicthypoxemia.
- Combination of symptoms and signs will increase the sensitivity to predict hypoxemia.

REFERENCES

1. Anne.B.Chang, Christina.C.Chang, K.O'Grady, P.J.Torzillo.Pediatric Clinic of North America. Lower respiratory tract infection2009;56:1303-1321.
2. Kimberly Danieli Watts, Denise M. Goodman. editors. Wheezing ,bronchiolitis and bronchitis: Nelson Textbook of Pediatrics, 19th ed. Philadelphia: Saunders. 2011:1456-1460.
3. SudhaBasnet , Ramesh Kant Aadhikari and ChitrakumarGurung. Hypoxemia in childrenwithpneumoniaanditsclinicalpredictors.IndianJPediatr 2006;73(9);777-778.
4. Voets Serge, Van Berlaer, Gerlant, Hachimi – Idrissi. Clinical predictors of the severity of bronhiolitis. Eur J Emerg Med2006;13(3):134-138.
5. Made Supartha ,PutuSiadiPurniti, KoniNaning , Ida BagusSubanada . Clinical predictors of hypoxemia in 1 – 5 year old children with pneumonia. Pediatric Indones.2010;50:355-60.
6. Rijal P, Sharma A ,Shrestha S , U padhyay . Profile of acute lower respiratory tract infection in children under 14 years of age at Nepal Medical College Teaching Hospital. Nepal Med CollJ2011;13(1):58-61.
7. Govt. of India(2015), National Health Profile 2015, DGHS, Ministry of Health and family welfare, New Delhi.
8. BMC pulmonary medicine 18(1), 7, 2018.
9. The Lancet Infectious Diseases Volume 18, Issue 11, November 2018,Pages 1191-1210.