Original Research Article

Prospective study of acute illness observational scale in children of age 2 months to 5 years with respiratory illness, its corelation with radiological findings prognosis and who grading of ARI in inpatients of teritiary care hospital

Sikha Maria Siromani[1],*, Naveen Kumar Borigama[1], Mangalagiri Swetha[1]

[1]*Dept. of Pediatric, Niloufer Hospital, Hyderabad, Telangana, India*

A B S T R A C T

Background: In children under the age of five, acute respiratory illness (ARI) is the leading cause of preventable mortality. For the early detection of seriousness and
In the current study, timely treatment of ARI Acute illness observation scale (AIOS) an illness severity was used.

Aims: To study correlation of AIOS with WHO grading of pneumonia, radiological findings and prognosis in children of age 2 months to 5years.

Materials and Methods: A two-month hospital-based prospective observational research was done on 80 children aged 2 to 59 months who were admitted to the hospital with pneumonia throughout the study period.

Results: The association between AIOS score versus WHO grading (severity) was statistically significant with P value of <0.0000001. There is a linear positive relationship between the AIOS score and WHO grading (severity the association between AIOS score and WHO grading (severity) is statistically significant with P value of <0.00001. There is a linear positive relationship between the AIOS score and duration of hospital stay. The association between AIOS score and duration of hospital stay is statistically significant with P value of <0.00001. The mean AIOS score at the time of admission was greater in cases which died than the cases which were discharged.

Conclusion: AIOS scoring is useful in anticipate abnormal x-ray findings in acute respiratory illness in 2-59 months old children.

For reprints contact: reprint@ipinnovative.com

1. Introduction

Acute Respiratory illness is the inflammation of the airway tract from nostrils to alveoli. It is divided into upper and lower respiratory tract infections. The airways from the nostrils to the vocal cords in the larynx, as well as the paranasal sinuses and the middle ear, make up the upper respiratory tract. The continuation of the airways from the trachea and bronchi to the bronchioles and alveoli is covered by the lower respiratory tract. Because of the possibility of infection or microbial toxins spreading throughout the body, inflammation, and impaired lung function, ARIs have systemic repercussions.

Pneumonia has become the most common reason for parents to take their children to the doctor or to the emergency room for a paediatric medical concern.[1] According to the United Nations Children's Fund (UNICEF), pneumonia remains the leading cause of death in children around the world, accounting for 18% of all child deaths.[2] Among Pneumonia Deaths in Children Under the Age of Five, India ranked first in the world.[3]

* *Corresponding author.*
E-mail address: 123drsiromani@gmail.com (S. M. Siromani).

Because India has one of the highest rates of pneumonia mortality, it is critical to improve the criteria for triage, early referral, hospitalisation, and treatment initiation. The WHO policy, which streamlines the classification of sickness severity for major acute paediatric illnesses such as pneumonia, has benefited this. According to UNICEF/WHO reports, only approximately half of children with pneumonia receive appropriate medical care, and only one in five caregivers is aware of the risk signals of pneumonia.[4]

In order to effectively manage pneumonia, a system focused on "clinical appearance" rather than "complex symptomatology" that can swiftly quantify the severity of sickness and optimise criteria for triage in a primary care setting will be beneficial. In this context, the AIOS—a three-point scale for six observational criteria created by P.L. McCarthy—is a validated clinical index for estimating the risk of serious bacterial infection in children 36 months or younger who report with febrile infections.[5,6] The World Health Organization (WHO) developed a pneumonia control plan suitable for countries with limited resources and constricted health systems in the early 1980s, in response to the worldwide burden of childhood death due to pneumonia. This strategy's cornerstone was the management of pneumonia cases. Simple indications were discovered to categorise varied degrees of pneumonia severity in contexts where diagnostic technology was limited or unavailable; the classifications indicated the relevant case management strategies.

Many studies have been conducted to show that AIOS can be used to diagnose serious disease in febrile children. There have been some studies that have questioned AIOS, but they were mostly limited to babies under the age of eight weeks and those with occult bacteremia in non-toxic children. In India, particularly in South India, there is a scarcity of evidence demonstrating the effectiveness of AIOS in severe pneumonia. As a result, this study was undertaken to investigate the relationship between AIOS and WHO pneumonia grading, radiological findings, and prognosis in children aged 2 months to 5 years.

2. Materials and Methods

The Hospital based prospective observational study conducted in the Department of Pediatrics, Niloufer hospital, affiliated to Osmania Medical College for a period of 2 months. It is the largest tertiary care center in the state of Telangana, situated in the heart of Hyderabad.80 Children between 2 months –59 months who were admitted in Niloufer with pneumonia hospital during the study period.

Patients who satisfying the inclusion criteria were enrolled into the study and admitted after getting informed consent from the parents/guardians.

2.1. Inclusion criteria

Children aged 2 months to 59 months with a fever lasting fewer than 3 days, a cough or difficulty breathing, fast breathing, chest in drawn, stridor in a quiet child, grunting, lethargy, convulsions, and inability to drink. Parents/guardians of children who meet the conditions listed above and are willing to give informed consent.

2.2. Exclusion criteria

Children who were known asthmatics/wheezers and/or duration of illness >2wks, Parents or guardians those who are not willing to give informed consent.

2.3. Procedure

Children aged 2 months to 59 months who met the inclusion criteria were included in the trial and admitted after their parents/guardians gave their informed consent. Each patient is scored using the WHO and Acute Illness Observation Scale (AIOS) to determine the severity of community-acquired pneumonia (CAP). Vital signs and respiratory parameters were recorded.

A chest X-ray was taken and analysed by a radiologist who was unaware of the study and followed WHO guidelines for interpreting X-rays in children with pneumonia. Complete blood count and blood culture were performed as part of the initial investigation On day 5, patients were checked for persisting distress. They were tracked until they were either released or died. The therapy, investigations, and progression of the condition were all documented. The management outcome as well as radiological findings are compared to AIOS and WHO grading.

2.4. Data entry and analysis

Microsoft Excel 2010 was used to enter the data. Microsoft Excel 2010 and Epi Info 7.2.0 were used to examine the data. In this study, descriptive and inferential statistical analyses were used. The results of continuous measurements were provided as Mean SD (Min-Max) and the results of categorical measurements as Number (percent). The significance was determined at a 5% level of significance. For continuous variables, the student t-test is used to compare intergroup variation. The relationship between the two variables was evaluated using Pearson's Correlation Coefficient. The Institutional Ethical Committee of Osmania Medical College in Hyderabad provided ethical approval.

AIOS score a generic illness severity scale developed by P.L. McCarthy- a three point scale for six observational factors is a validated clinical index of quantifying risk of serious bacterial infection in children 36 months or younger presenting with febrile illnesses.[5,6] WHO grading

of Pneumonia and Radiological grading of pneumonia was used to evaluate the patients. [7,8]

3. Results

The results of the present study are as follows:

Table 1: Distribution of study population.

Age	Frequency	Percent
2 months to 1 year	45	56.25%
>1 years to 5 years	35	43.75%
Total	80	100.00%
Gender		
Male	54	67.50%
Female	26	32.50%
Persistent distress on day 5		
Present	47	58.75%
Absent	33	41.25%

Around 57% of the study population belonged to age group of 2 months to 1 year. 43% belonged to age group of >1 year to 5 years.

67.50% were males, 32.50% were females. Among the study population, 58.75% had persistent distress on day 5.Table 1

Table 2: Grading of pnemonia at the time of admission of study population.

AIOS at admission	Frequency	Percent
1-10	41	51.25%
11-20	20	25.00%
21-30	19	23.75%
WHO grade		
No Pneumonia	8	10.00%
Pneumonia	43	53.75%
Severe Pneumonia	29	36.25%
X-ray Finding		
Normal	13	16.25%
Hyperinflation	18	22.50%
End point infiltration	36	45.00%
Non end point infiltration	11	13.75%
Pleural Effusion	2	2.50%

Among the study population, 51.25% had a score of 1-10, followed by 11-20 (25%) and 21-30(23.75%). 53% had pneumonia and 36.25% had severe pneumonia. Only 10% of the population were not having pneumonia. 45% had End point infiltration on X-rays, 22.50% had hyperinflation, 13.75% had Non end point infiltration and 2.50% had Pleural Effusion. 16.25% had normal X-ray findings.Table 2

Among the study population, 72.50% did not develop any complications. 20% developed shock and 7.5% developed emphema.

45% stayed at hospital between 6-14 days, 28.75% were in hospital for 1-5 days. 26.25% had duration of stay >/= 15 days.Table 3

Table 3: Showing Complications and hospital stay of study population.

Complication	Frequency	Percent
None	58	72.50%
Shock	16	20.00%
Emphyema	6	7.50%
Duration of hospital stay		
1-5 days	23	28.75%
6-14 days	36	45.00%
>/= 15 days	21	26.25%

Table 4: Investigator parapmeters of study population.

Haemoglobin (gm/dl)	Frequency	Percent
<7	3	3.75%
7-9.9	34	42.50%
10-11	22	27.50%
>11	21	26.25%
Leukocytosis		
Present	43	53.75%
Absent	37	46.25%
Blood culture		
Positive	13	16.25%
Negative	67	83.75%

Among the study population, 42.50% had hemoglobin levels between 7-9.9 gm/dl, followed by 10-11 gm/dl (27.50%), >11 gm/dl (26.25%). 3.75% of the population had <7 gm/dl. Among the study population, 53.75% had leukocytosis. Among the study population, 16.25% had positive blood cultures.Table 4

The association between AIOS score versus X-ray findings was statistically significant with P value of 0.02.

As the AIOS score is increasing, the severity of pneumonia according to WHO grade is also increasing. The association between AIOS score versus WHO grading (severity) was statistically significant with P value of <0.0000001.Table 5
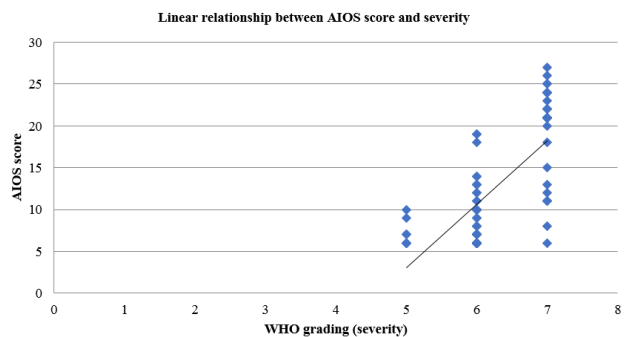

Fig. 1: Showing association between AIOS score and severity

There is a linear positive relationship between the AIOS score and WHO grading (severity). It means that as the AIOS score is increasing, the severity of the

Table 5: Showing AIOS score versus X-ray findings and WHO Grading:

X-ray findings	AIOS at admission			Grand Total	P value
	1-10	11-20	21-30		
Normal	11	0	2	13	
Hyperinflation	7	6	5	18	
End point infiltration	15	10	11	36	0.02(Significant)
Non end point infiltration	8	2	1	11	
Pleural Effusion	0	2	0	2	
Grand Total	41	20	19	80	
AIOS versus WHO grading					
No Pneumonia	8	0	0	8	
Pneumonia	31	12	0	43	
Severe Pneumonia	2	8	19	29	<0.0000001 Significant
Grand Total	41	20	19	80	

Table 6: Showing association between AIOS at the time of admission and other study parameters:

Parameter	Parameter	Co-relation value	P value
AIOS score	Severity	0.707	<0.00001
	Hospital stay	0.52	<0.00001

disease according to WHO grading is also increasing. The association between AIOS score and WHO grading (severity) is statistically significant with P value of <0.00001.Figure 1
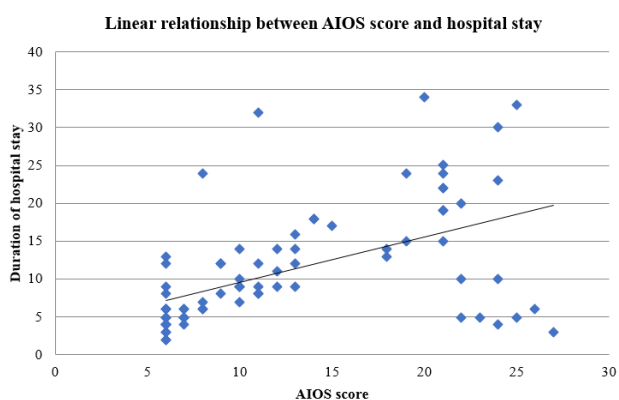
Fig. 2: Showing association between AIOS score and duration of hospital stay.

There is a linear positive relationship between the AIOS score and duration of hospital stay. It means that as the AIOS score is increasing, the duration of hospital stay is also increasing. The association between AIOS score and duration of hospital stay is statistically significant with P value of <0.00001.Figure 2

Among the study population, 8.75% died. 91.25% got cured and were discharged from the hospital. The mean AIOS score at the time of admission was greater in cases which died than the cases which were discharged. The association between difference in means of AIOS score at the time of admission and outcome (discharged/death) is statistically significant with P value of <0.0001.

4. Discussion

Childhood pneumonia clearly represents one of the most common infective illnesses in developing countries and is of great importance as a cause of preventable mortality in children. It is the leading cause of mortality among children of under 5 years of age. The present study was conducted at Niloufer Hospital, Osmania medical college with an objective to study the correlation of AIOS with WHO grading of pneumonia, radiological findings and prognosis in children of age 2 months to 5 years.

In the present study, around 57% of the study population belonged to age group of 2 months to 1 year. 44% belonged to age group of >1 year to 5 years. Our study is coinciding with study done by Murali B.H and Mulage L.[9] Anoop K, Sangeetha P[10] and Reddy MA et al[11] with 52.3%, 57.3% and 66%. This shows that infants are at more risk of developing Community acquired Pneumonia. This can be attributed to the crawling of the infants in the process of achieving milestones.

In the present study, among the study population, 67.50% were males, 32.50% were females with male: female as 2:1. The findings of the present study can be compared with studies done by Murali B.H and Mulage L.,[9] Anoop K, Sangeetha P[10] and Reddy MA et al[11] with male: female of 1.65:1, 1.7:1 and 1.7:1

In our study, among the study population, 51.25% had a score of 1-10, followed by 11-20 (25%) and 21-30(23.75%). Our study is in agreement with Sivakami M et alReddy study done on 60 patients showed ASIO 10 in 7 cases, 11-15 in 12 cases, >15in 41 cases. Reddy MA et al[11] study done on 200 patients showed ASIO 10 in 60 cases, 11-15 in 86 cases, >15 in 56 cases. Murali B.H and Mulage L[9] with ASIO >10 in 44.95% and Anoop K, Sangeetha P[10] showed

Table 7: Showing association between AIOS at the time of admission and outcome:

Outcome	N	AIOS score at the time of admission		P value
		Mean	Standard deviation	
Discharge	73	11.49	5.89	T=4.375 P=<0.0001
Death	7	24.42	1.72	

40% had score >10

In our study, among the study population, 53% had pneumonia and 36.25% had severe pneumonia. Only 10% of the population was not having pneumonia

The findings of the present study can be compared Murali B.H and Mulage L et al[9] study on 200 patients of which 40% had pneumonia, 45% had severe pneumonia and very Severe Pneumonia 24%.

In the current study, among the study population, 45% had End point infiltration on X-rays, 22.50% had hyperinflation, 13.75% had Non end point infiltration and 2.50% had Pleural Effusion. 16.25% had normal X-ray findings. Murali B.H and Mulage L et al[9] study showed Normal CXR finding were present in 36.7% (40/109) and remaining 63.3% (69/109) had significant abnormalities. Among the X-ray abnormalities End- point consolidation was seen in 35.8% while other Non-end point infiltrates was seen in 27.5% (30/109). Our study is concurrent with Sivakami M et al[12] study done in among the 60 children 10% of the children had normal x-rays. Hyperinflation pertinent to bronchiolitis was seen in 26% children. End point consolidation in 30%. Steeple sign and Shock lung contributed to 3.3%.Pleural Effusion in 1.6%. Anoop K, Sangeetha P et al[10] showed Normal CXR finding were present in 46% (114/248) and remaining 54% (134/248) had abnormal findings.

In the present study, among the study population, 42.50% had hemoglobin levels between 7-9.9 gm/dl, followed by 10-11 gm/dl (27.50%), >11 gm/dl (26.25%). 3.75% of the population had <7 gm/dl. Our study is in aggrement with Reddy MA et al[11] study with 43 % of children had moderate anemia as classified by WHO and Murali B.H and Mulage L[9] study showed 46.8% of children had moderate anemia as classified by WHO

By this study 53.75% had leukocytosis. The findings of the present study can be compared with Murali B.H[9] and Sangeetha P[10] and Reddy MA et al[11] with 48.6% and 41% leukocytosis.

In the paper, among the study population, 16.25% had positive blood cultures which is in correlation with Anoop K, Sangeetha P[10] with Positive blood culture in 13.7% (34/248) of cases.

In this report among the study population, 72.50% did not develop any complications. 20% developed shock and 7.5% developed emphema. Other authors reported as 9.2% (10/109) developed complications either in the form of shock, empyema by Murali B.H and Mulage L (9), 9.7% (24/248) developed complications either in the form of shock, empyema or pyopneumothorax reported by Anoop K, Sangeetha P[10] and 8% (16/200) developed complications either in the form of pneumothorax, empyema and lung abscess reported by Reddy MA et al[11].

In the present study, among the study population, 45% stayed at hospital between 6-14 days, 28.75% were in hospital for 1-5 days. 26.25% had duration of stay >/= 15 days. The findings of the present study can be compared with

Murali B.H and Mulage L[9] et al with 69% stayed at hospital between 6-14 days, 32% were in hospital for 1-5 days. 8% had duration of stay >/= 15 days. Anoop K, Sangeetha P[10] showed mean duration of hospital stays (±SD) was 4.58 (±4.94) days and Reddy MA et al[11] showed mean duration of hospital stay (±SD) was 6.35 (±4.0) days.

In the present investigation among the study population, 8.75% died. 91.25% got cured and were discharged from the hospital. Reddy MA et al[10] showed 5 children (2%) expired even after intensive care management

In the present study, the association between AIOS score versus X-ray findings was statistically significant with P value of 0.02 which is consistent with study done by Murali B.H and Mulage L,[9] Sivakami M et al,[12] Reddy MA et al[11] and Anoop K, Sangeetha P.[12]

In the present study, there was a linear positive relationship between the AIOS score and WHO grading (severity). It means that as the AIOS score was increasing, the severity of the disease according to WHO grading is also increasing. The association between AIOS score and WHO grading (severity) is statistically significant with P value of <0.00001. Our study is rational with study done by Murali B.H and Mulage L[9]

In the review there was a linear positive relationship between the AIOS score and duration of hospital stay. It means that as the AIOS score was increasing, the duration of hospital stay is also increasing. The association between AIOS score and duration of hospital stay is statistically significant with P value of <0.00001. The findings of the present study can be compared with Murali B.H and Mulage L.[9]

In the current study, the mean AIOS score at the time of admission was greater in cases which died than the cases which were discharged. The association between difference in means of AIOS score at the time of admission and outcome (discharged/death) is statistically significant with P value of <0.0001.

5. Conclusions

There was a linear positive relationship between the AIOS score and WHO grading (severity) with correlation co-efficient (r=0.7), with P value <0.00001 . A linear positive relationship between the AIOS score and duration of hospital stay with correlation co-efficient (r=0.5), with P value <0.0001. The mean AIOS score at the time of admission was greater in cases which died (24.42 ±1.72) than the cases which were discharged (11.49 ±5.89). AIOS can be used as an indicator to predict the duration of hospital say and outcome of the patient in hospital care settings. There was better co-relation between the AIOS score and WHO grading of pneumonia, radiological findings with statistically significant P value of <0.05

Source of Funding
None.

6. Conflicts of Interest

There is no conflict of interest.

References

1. Armon K, Stephenson T, Gabriel V, MacFaul R, Eccleston P, Werneke U, et al. Determining the common medical problems presenting to an accident and emergency department. *Arch Dis Child*. 2001;84(5):390–2. doi:10.1136/adc.84.5.390.
2. Liu L, Johnson HL, Cousens S, Perin J, Scott S, Lawn JE, et al. Global, regional, and national causes of child mortality: an updated systematic analysis for 2010 with time trends since 2000. *Lancet*. 2000;379(9832):2151–61. doi:10.1016/S0140-6736(12)60560-1.
3. Pneumonia progress report 2012: International Vaccine Access Center at the Johns Hopkins Bloomberg School of Public Health. November ; 2012.
4. Pneumonia: The forgotten killer of children. The United Nations Children's Fund (UNICEF)/World Health Organization (WHO); 2006.
5. Mccarthy PL, Jekel JF, Stashwick CA, Spiesel SZ, Dolan TF, Sharpe MR, et al. Further definition of history and observation variables in assessing febrile children. *Pediatrics*. 1981;67(5):687–93.
6. Mccarthy PL, Sharpe MR, Spiesel SZ, Dolan TF, Forsyth BW, Dewitt TG, et al. Observation scales to identify serious illness in febrile children. *Pediatrics*. 1982;70(5):802–9.
7. Revised, WHO Classification and Treatment of Pneumonia in Children at Health Facilities.Evidence Summaries, Geneva: World Health Organization; 2014.
8. Harris M, Clark J, Coote N, Fletcher P, Harnden A, McKean M, et al. British thoracic society Guidelines for the management of community acquired pneumonia in children: update. *Thorax*. 2011;66(2):ii1–23. doi:10.1136/thoraxjnl-2011-200598.
9. Murali BH, Mulage L. AIOS v/s IMNCI in Community Acquired Pneumonia. *J Evol Med Dent Sci*. 2014;3(13):3260–6. doi:10.14260/jemds/2014/2277.
10. Anoop K, Sangeetha P. Acute Illness Observation Scale in community acquired pneumonia in children aged 2 months to 59 months. *Int J Contemp Pediatr*. 2020;7(6):1394–9. doi:10.18203/2349-3291.ijcp20202154.
11. Reddy MA, Kannan S, Babu MS. Validation of AIOS (acute illness observation scale) score with radiological findings and pulse oximetry in community acquired pneumonia (cap) among children 2 to 24 months. *IOSR J Dent Med Sci (IOSR-JDMS)*. 2019;18(10):9–15.
12. Sivakami M, Balachandran CS, Chidambaranathan S. Study on Acute Illness Observation Scale in Children with Respiratory Illness with Radiological Correlation. *JMSCR*. 2017;5(11):30972–5. doi:10.18535/jmscr/v5i11.197.

Author biography

Sikha Maria Siromani, Associate Professor

Naveen Kumar Borigama, Assistant Professor

Mangalagiri Swetha, Post Graduate