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Original Research Article

Acute Illness Observation Scale in community acquired pneumonia in children aged 2 months to 59 months

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ABSTRACT

Background: Pediatric respiratory disease remains an important cause of morbidity in both the developing and the developed world. Aim of the study is to validate Acute Illness Observation Scale (AIOS) in predicting illness severity and clinical outcome of community acquired pneumonia.
Methods: This was a descriptive study done in a cohort of 248 children at the Department of Paediatrics, at a tertiary care hospital in Chennai. Children between 2 months - 59 months coming to outpatient department with suspected pneumonia, if satisfying the inclusion criteria were enrolled into the study. AIOS scoring is done on each subject on day 1, day 2, day 5 by two persons simultaneously in a reasonably quite state. Respiratory parameters, vital signs and pulseoximeter reading of each patient as in data collection form are documented.
Results: Children scoring abnormally on AIOS (>10) had significantly higher frequency of severe tachypnea (p=0.001), marked chest retraction (p=0.001), grunting, cyanosis (p=0.01), lethargy, inability to drink and so on except incidence of convulsion and wheeze which didn't have any statistical significance. Severe hypoxemia associated with cyanosis (SpO2<85) was observed in 14 children of which 92.9% (13) scored a high value on AIOS (AIOS>15). Complications were absent in those who scored <10, while maximum complications were seen in those who scored >15.
Conclusions: AIOS can be used as a tool to decide on therapeutic modalities and prognosticating a child with pneumonia admitted to the hospital by a physician.

Keywords: Acute illness observation scale, Hypoxemia, Pneumonia, Tachypnea

INTRODUCTION

Pediatric respiratory disease remains an important cause of morbidity in both the developing and the developed world. It has become the most common reason parents cite for taking their children to see the general practitioner, and for attendance to the emergency department with a pediatric medical problem.[1] Community acquired pneumonia (CAP) refers to an infection of the lung by a variety of microorganisms acquired outside the hospital setting, resulting in inflammation of the lung tissue.

India being one of the countries with highest number of pneumonia deaths it is essential to optimize criteria for triage, early referral, hospitalization and treatment.[2,3] This has been aided by the Integrated Management of Neonatal and Childhood Illness (IMNCI) strategy that simplifies the classification of illness severity for major acute childhood illness including pneumonia.

IMNCI strategy will be more effective when supplemented by an illness severity scoring system that can quickly quantify the severity of illness at all stages from onset to recovery.[4] In this regard use of Acute

Illness Observation Scale (AIOS), a generic illness severity scale developed by P.L. McCarthy, based on simple observations instead of complex symptomatology, is found to be useful.[5,6] AIOS focuses on six easily observed factors that, taken together, are a sensitive, indicator of serious illness in children. Total score of AIOS ranges from 6-30.[7] Incidence of serious bacterial infection is less than 2-3% if a febrile child scores 10 or less; 26% if scores are between 11 and 15 and 92% if AIOS score is 16 or above.[7]

METHODS

This was a descriptive study done in a cohort of 248 children at the Department of Paediatrics, at a tertiary care hospital in Chennai. Aim of the study is to validate AIOS in predicting illness severity and clinical outcome of community acquired pneumonia.

Inclusion criteria

Children between 2 months - 59 months presenting with fever and cough with any of the following: fast breathing, chest in drawing, stridor in a calm child, grunting, lethargy, convulsion and inability to drink.

Exclusion criteria

Patients with duration of illness more than two weeks or respiratory distress with prominent wheezing were excluded from the study.

Table.1: Acute illness observation scale: composition, score description.[7]

Scale used	Acute illness observation scale
Items included	Quality of cry
	Response to parent stimulation
	State variation
	Colour
	Hydration
	Response to social overtures
Score interpretation	Each item scored as normal (=1)
	Moderate (=3) and severe
	Impairment (=5)
Total score	6= best score
	30= worst physical score

Children between 2 months - 59 months coming to outpatient department with suspected pneumonia, if satisfying the inclusion criteria were enrolled into the study group after getting parental consent. They were either admitted or given treatment as outpatient based on illness severity as assessed by IMNCI classification or as the physician decides. AIOS scoring is done on each subject on day 1, day 2, day 5 by two persons simultaneously in a reasonably quite state. The composition and score description of AIOS is given in Table 1.

Acute illness observation scale: parameters checked.

Quality of cry

- Strong cry with normal tone or contented and not crying
- Whimpering or sobbing
- Weak cry, moaning, or high-pitched cry

Reaction to parental stimulation

- Cries briefly and then stops, or is contented and not crying
- Cries on and off
- Cries continually or hardly responds

State variation

- If awake, stays awake, or if asleep and then stimulated, awakens quickly
- Closes eyes briefly when awake, or awakens with prolonged stimulation
- Falls asleep or will not arouse

Colour

- Pink
- Pale extremities or acrocyanosis
- Pale, cyanotic, mottled or ashen

Hydration

- Normal skin and eyes, moist mucous membranes
- Normal skin and eyes, slightly dry mouth
- Doughy or tented skin, dry mucous membranes and/or sunken eyes

Response (talk, smile) to social overtures, over 2 months

- Smiles or alerts
- Smiles briefly or alerts briefly
- No smile, anxious face, dull expression, or does not alert

Respiratory parameters, vital signs and pulseoximeter reading of each patient as in data collection form are documented. Chest X ray, complete blood count and blood culture were done within 24 hours of admission. Chest X ray was interpreted by a radiologist who was blinded about the study based on WHO guidelines for interpretation of X rays in Paediatric pneumonia. Treatment, investigations and the disease course as per data collection form are documented. Patient is followed up until discharge or death.

RESULTS

Among 248 children who met with inclusion criteria were enrolled in to the study. Statistical analysis was done and

results are presented in terms of general characteristics (clinical features, investigations, treatment and course), AIOS and its clinimetrics and comparison of AIOS with IMNCI.

General characteristics

The age in the study group ranged from 2 months to 59 months (mean 13.38 months; SD=11.2); and infants (2-12 months) (57.3%) being most affected. Among the 248 children 159 (64.1%) were males and the remaining being females with a male to female ratio of 1.7:1.

Regarding danger symptoms, majority had lethargy (25%) while convulsion (4%) and grunt (6.4%) was least common. Vital signs like respiratory rate had a mean of 54.3 (SD-9.9) while temperature and heart rate had a mean of 37.9 and 134.2 respectively. Regarding other respiratory morbidity signs majority had a respiratory rate between 51-60 (48.38%) and retraction was mild-moderate in 53.65% and severe in 32.6%.

Pulseoximeter recording was taken in all children on days 1, 2 and 5. A reading below 85%, which is associated with central cyanosis, was observed in 5.6% (14/248) of cases. Spo2 recording of >92 was seen in 54.4% (135/248) and the remaining being in between. Chest X-ray evaluation was done in all patients at admission. Normal CXR finding were present in 46% (114/248) and remaining 54% (134/248) had abnormal findings. Among other investigations, leucocytosis was seen in 13.7% (34/248) and a positive blood culture in 13.7% (34/248) of cases.

During their management 8.5% (21/248) of children were so severely affected that they needed normal saline boluses to correct the shock and 7.7% (19/248) needed ionotropic support with dopamine or dobutamine. Airway intubation was needed in 2.8% (7/248) of cases either for respiratory failure or shock management. Oxygen was administered for 32.3% (80/248) of cases in view of severe respiratory distress or cyanosis. 28.6 % (71/248) of children required maintenance intravenous fluids because of severe respiratory distress and/or dehydration. Parenteral antibiotics were administered to 50.4% (125/248) patients while remaining were treated with oral antimicrobials. Presence of wheeze necessitated salbutamol nebulization in 25.4% (63/248) of cases. During the hospital stay 9.7% (24/248) developed complications either in the form of shock, empyema or pyopneumothorax. 5 children (2%) expired even after intensive care management. The mean duration of hospital stays (±SD) was 4.58 (±4.94) days.

AIOS - Acute illness observation scale

Inter observer variability in AIOS scoring simultaneously between two observers was analysed using Karl Pearson coefficient and was found be having very good positive correlation. For further analysis first investigator's observations were taken in to account.

Among 40% of children with community acquired pneumonia scored abnormally (AIOS>10) at initial evaluation. Mean score for AIOS 12.32 (SD-6.12) clearly signifies the seriousness of all children enrolled in the study. The frequencies of abnormal AIOS scores as well as mean total scores for different age groups are depicted in Table 2.

Table.2: Score distribution in study population.

Age	AIOS on day 1					
	≤10		11-15		≥16	
	n	%	n	%	n	%
2-12 months	77	54.2	27	19	38	26.8
12- 36 months	65	68.4	14	14.7	16	16.8
>36 months	7	63.6	0		4	36.4

$\chi 2=7.68$ P=0.16

Respiratory morbidity of affected children was also stratified by their illness severity scores at presentation. Children scoring abnormally on AIOS (>10) had significantly higher frequency of severe tachypnea (p=0.001), marked chest retraction (p=0.001), grunting, cyanosis (p=0.01), lethargy, inability to drink and so on except incidence of convulsion and wheeze which didn't have any statistical significance. Univariate analysis of AIOS with respiratory morbidity signs is given in Table 3.

Relating children's score against their pulseoximeter recording on admission, severe hypoxemia associated with cyanosis (SpO2<85) was observed in 14 children of which 92.9% (13) scored a high value on AIOS (AIOS>15) whereas 81.5% of children scored normally on AIOS among the group of 135 with a spo2>92.

Relating children's score against their radiologic finding to assess the concurrent validity, 74.6% (85/114) children with normal CXR had AIOS of ≤10 whereas only 47.8% (64/) had normal scores in the group of abnormal CXR finding ($\chi 2=29.1$ p=0.001).

Culture positivity in blood cultures as well as an elevated leucocytes count was seen in maximum percentage in children scoring >15 in AIOS scale which was statistically significant.

Univariate analysis was done to know the relationship of AIOS with therapeutic decision, except for salbutamol nebulization all other therapeutic modalities were significantly related to initial AIOS score (p=0.001). The details are given in Table 4.

Table 3: Univariate Analysis of AIOS with respiratory morbidity signs.

		AIOS_Day 1						Total	Chi square test
		<=10		11-15		>15			
		n	%	n	%	n	%		
Respiratory rate/minute	40 -50	67	85.9%	8	10.3%	3	3.8%	78	χ2=56.0 p=0.001
	51 -60	67	55.8%	26	21.7%	27	22.5%	120	
	>60	15	30.0%	7	14.0%	28	56.0%	50	
Intercostal recession		35	31.5%	22	19.8%	54	48.6%	111	χ2=83.4 p=0.001
Sub costal recession	Mild-moderate	102	76.7%	25	18.8%	6	4.5%	133	χ2=111.1 p=0.001
	Severe	16	19.8%	16	19.8%	49	60.5%	81	
Grunt						16	100.0%	16	χ2=56.2 p=0.001
Cyanosis		1	16.7%			5	83.3%	6	χ2=12.3 p=0.01
Lethargy		8	12.3%	10	15.4%	47	72.3%	65	χ2=123.3 p=0.001
Convulsion		4	40.0%	1	10.0%	5	50.0%	10	χ2=4.1 p=0.13NS
Inability to d rink		1	2.7%	3	8.1%	33	89.2%	37	χ2=106.2 p=0.001
Abnormal capillary refill time (> 2 sec)		2	6.7%			28	93.3%	30	χ2=93.2 p=0.001
Decreased breath sounds				4	36.4%	7	63.6%	11	χ2=17.6 p=0.001
Bronchial breathing				3	21.4%	11	78.6%	14	χ2=28.5 p=0.001
Crepitation		126	56.0%	41	18.2%	58	25.8%	225	χ2=16.8 p=0.001
Wheeze		52	54.2%	21	21.9%	23	24.0%	96	χ2=3.6 p=0.16 NS
Vocal resonance	Decreased	1	16.7%	2	33.3%	3	50.0%	6	χ2=25.3 p=0.001
	Increased					6	100.0%	6	

Table 4: Univariate analysis of AIOS with therapeutic decision.

Therapeutic decision (n)		AIOS_Day 1			Statistical significance
		≤10	11-15	≥16	
		n (%)	n (%)	n (%)	
Antibiotic	Oral (123)	114 (92.7%)	8 (6.5%)	1 (0.8%)	χ2=111.9 p=0.001
	I.V(125)	35 (28.0%)	33 (26.4%)	57 (45.6%)	
IV fluid received (71)		3 (4.2%)	15 (21.1%)	53 (74.6%)	χ2=164.0 p=0.001
Normal saline bolus (21)		0 (0%)	0 (0 %)	21 (100.0%)	χ2=75.2 p=0.001
Ionotropes (19)		0 (0%)	0 (0%)	19 (100.0%)	χ2=67.4 p=0.001
Ventilation (7)		0 (0%)	0 (0%)	7 (100.0%)	χ2=23.5 P=0.001
Oxygen (80)		5 (6.3%)	22 (27.5%)	53 (66.3%)	χ2=158.3 P=0.001
Nebulisation (63)		35 (55.6%)	16 (25.4%)	12 (19.0%)	χ2=4.98 p=0.08 NS
Intercostals drainage (9)		0 (0%)	4 (44.4%)	5 (55.6%)	χ2=14.1 P=0.001
Decortications (3)		0 (0%)	3 (100.0%)	0 (0%)	χ2=15.3 P=0.001

Comparison of AIOS with IMNCI

Comparing AIOS with IMNCI in assessing illness severity of pneumonia, among the 73 cases of fast breathing pneumonia 95.9% cases scored normal on AIOS (AIOS<10), whereas in 56 cases of severe pneumonia 80.4% (45) cases scored abnormally.

Comparing with IMNCI, sensitivity of AIOS in detecting illness severity in fast breathing pneumonia was very high (95%) but with a poor specificity (55%), where as in severe pneumonia its sensitivity was poor (48%) but had very high specificity (98%). In case of chest in drawing pneumonia both sensitivity and specificity of AIOS score was very poor. Among the 148 who scored AIOS<10 only 2.02% had mild to moderate distress persisting on day5, while out of the 41 who scored 11-55 on AIOS 7.31% had mild -moderate distress persisting. In the worst group of AIOS score, out of the 54 cases 3.7% had severe retraction and 33.3% had mild to moderate distress persisting on day five.

In the IMNCI classification of respiratory illness, among the fast breathing pneumonia cases none had persistent distress on day 5. In the chest in drawing pneumonia group 4.4% had mild-moderate distress and only 0.6%

had severe persistent distress. In the severe pneumonia group 33.3% had mild to moderate distress and 2% had severe distress persisting on day 5.

Complications were absent in those who scored <10, while maximum complications were seen in those who scored >15. Similarly, in the IMNCI classification complications were absent in pneumonia cases and maximum in severe pneumonia cases. Regarding the final outcome, death was seen only in those who scored >15 on AIOS (8.62%). Similarly, IMNCI also predicted death in severe pneumonia.

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. Mc Carthy et al, had already demonstrated that AIOS is useful in identifying febrile children who have serious illness.[5,7-9] The objective of the present study was to validate AIOS score in community acquired pneumonia in assessing illness severity and clinical outcome.

The compromised general status entailing various observation variables of AIOS had already been shown to be significant and independent predictor of serious illnesses.[10-12] Validating the score in illness severity assessment in pneumonia, it was found that the scoring is having good sensitivity but with a poor specificity in fast breathing pneumonia and in severe pneumonia it had a good specificity but a poor sensitivity. In chest indrawing pneumonia it had a poor sensitivity and specificity in diagnosing pneumonia compared to IMNCI. So IMNCI is still the superior sensitive tool in classification of pneumonia.

Being a subjective score, inter observer variation in scoring was analysed using Karl Pearson correlation and was found to be having high positive correlation. This study has brought out the fact that AIOS scoring has a good correlation with initial pulseoximeter reading and decision regarding supplementation of oxygen. So, it can be used as a tool to decide on providing oxygen to patients in resource limited areas.

AIOS scoring also had a good correlation with X ray abnormalities so can be utilized to decide on x ray evaluation and preventing unnecessary exposure to harmful radiations in a child with pneumonia. AIOS also correlated well with initial therapeutic decision like route of antibiotics, need for intravenous fluid administration and other modalities, so can be used for the same purpose in a hospital. This is similar to the findings by Bhavneet Bharti et al.[4] Comparing the ability of AIOS score to predict clinical outcome with that of IMNCI both were found to be more or less equally predictive.

Regarding the persistence of respiratory distress on day 5 of hospital stay severe distress was present in 3.7% of those children scored AIOS≥16 and in IMNCI severe pneumonia group 2% had same finding and both of them were statistically significant.

Similarly, on predicting complications, maximum numbers of complications were present in those with AIOS score ≥16 (35%) and in severe pneumonia group in IMNCI (34.5%) which were almost equal. Regarding final out-come all the deaths occurred in the worst AIOS score group (8.6%) and in the severe pneumonia group in IMNCI (8.9%) which were also similar.

Though AIOS can predict clinical outcome in children with pneumonia it is not superior to IMNCI in same regards. AIOS scoring is usually done by a skilled physician familiar with behaviour of a child in varying degrees of illness severity in the hospital setting where as IMNCI classification of pneumonia is done by peripheral health workers in the field setting. So AIOS scoring can be used by the treating physician in deciding on therapeutic modalities and prognosticating a child admitted to the hospital with pneumonia.

CONCLUSION

AIOS scoring has good internal consistency, external validity and inter observer agreement between two observers in AIOS scoring is very good. IMNCI can be used as a tool to triage and early referral of children with community acquired pneumonia in the fields by peripheral health care workers. AIOS can be used as a tool to decide on therapeutic modalities and prognosticating a child with pneumonia admitted to the hospital by a physician.

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