

**Clinical Predictors of Pneumonia Among Under-five Children
At Tikur Anbesa Specialized Hospital**

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Abstract

The aim of the study is to identify simple clinical signs and symptoms in under five children which are predictors of pneumonia at Tikur Anbesa Specialized Hospital (TASH), Department of Pediatrics and Child Health, emergency and regular out-patient units. The design of the study is a prospective cross-sectional study carried out during Aug 2004 – Sep 2005. All children between the age of 2-59 months who attended the regular and emergency pediatrics units at TASH during the study period who had either cough or difficulty of breathing or chest x-ray evidence of pneumonia were included in the study. A calculated sample of 164 was taken. Data analysis was done using SPSS and EPINFO version 1.1.2. Chi-square test was used to calculate the differences in distribution of clinical signs and symptoms between groups with and without chest x-ray (CXR) evidence of pneumonia.

A total of 179 patients were studied of whom 102 were males and 77 females (M:F 1:0.75). Clinical symptoms and signs were related to CXR pneumonia. Tachypnea (94.5% with CXR pneumonia Vs 59.3% without CXR pneumonia) and retraction (86.3% CXR Vs 40.6% without CXR pneumonia) were the best clinical predictors of pneumonia. Tachypnea, flaring of alae nasi and retraction were also independently associated with CXR pneumonia. Vomiting, refusal to feed, history of rapid breathing, grunting and chest findings did not predict pneumonia.

In conclusion pneumonia is a significant cause of morbidity and mortality in developing countries like Ethiopia. Using simple clinical indicators pneumonia can be diagnosed by primary health workers and mortality can be reduced significantly.

INTRODUCTION

Around 10.6 million children die every year before reaching their 5th birth day. Almost all of these deaths occur in low income and middle income countries mainly in Africa and south east Asia. Most deaths among under fives are still attributable to just a handful of conditions, acute respiratory infection(ARI) mostly pneumonia accounts for 19% of all deaths(1,2,3,). Age Specific mortality from lower respiratory infection(LRI) in young Gambian children has been estimated at 10 per 1000 each year(4) . In Ethiopia infant mortality rate is 77 per 1000, under five mortality is 120 per 1000 (5), ARI being one of the major cause of morbidity and mortality.

Taking these into consideration WHO in 1981 initiated a programme for the control of ARI on a case management of pneumonia. One of the strategies is to improve case detection and patient management by primary health care workers (7) and so reduce mortality. The aim of this study is to evaluate the usefulness of simple clinical symptoms and signs in the diagnosis of LRI, mainly pneumonia, which can easily be used by primary health care workers. Despite LRI (mainly pneumonia) being a condition commonly encountered by clinicians, uncertainty remains over the

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society (BTS) guidelines suggested that in children less than 3 years combination of fever > 38.5°C, chest indrawing and RR >50/min indicate pneumonia, breathing difficulty is more reliable sign in older children (18).

Chest x-ray (CXR) is still considered to be the gold standard for diagnosing pneumonia in the developed world. However, there is poor concordance between radiological changes which constitute pneumonia(inter and intra observer variation), consolidation on CXR was most commonly identified by the radiologist was generally agreed to represent pneumonic changes(12) .

WHO has recognized the difficulties with CXR interpretation and developed a tool to standardize the reporting of CXR use in epidemiological studies of pneumonia (8) this system classifies CXR as: normal appearance, infiltrates and end stage consolidation defined
Study population: All children between the age of 2-59 months who attended the regular as well as the emergency pediatrics OPD at TASH during the study period(AUG 2004- SEP 2005) who have either cough or difficulty of breathing or CXR evidence of pneumonia were included. A calculated sample of 164 was taken.

Data analysis: Data was entered and analysis was done using SPSS and EPINFO version 1.1.2 software. Chi-Results

diagnosis, investigation and treatment of the condition. Infants and children may present with a number of different clinical symptoms and signs such as fever, cough and tachypnea. Minority of children may present with fever of unknown origin (FOU) and may have no respiratory symptoms or signs.

WHO has developed algorithm (8) to aid medical and non-medical health care workers in diagnosis of LRI with out radiological confirmation. The WHO algorithm stresses the importance of tachypnea which has a 74% sensitivity and 67% specificity for radiologically defined pneumonia (8). However, in children who had diseases for less than three days (9), tachypnea had a lower sensitivity and specificity of illness. Clinicians must be aware that the absence of tachypnea does not necessarily mean the absence of pneumonia (10) . Grunting and nasal flaring increase the chance of pneumonia, but their absence cannot be relied upon to rule out the chance of pneumonia (9). Other signs that relate to severity of pneumonia are chest indrawing, nasal flaring and cyanosis. High fever in young children (age up to 3 years) was found to be a sign of pneumonia (11,12).The British thoracic

as significant amount of alveolar type of consolidation. So does a normal x-ray rule out pneumonia? There is anecdotal evidence for having pneumonia with a normal CXR. Fever and tachypnea may present before CXR changes are seen.

Subjects and methods

Study setting: The study was conducted at Tikur Anbessa Specialized Hospital (TASH), department of pediatrics and child health emergency and regular OPD which is one of the very few centers in the country which gives pediatric out patient and in patient services.

Study design: a cross sectional survey was under-taken among children under five children in the period of (AUG 2004- SEP 2005) who have either cough or difficulty of breathing or CXR evidence of pneumonia

square test was used to calculate the differences in distribution of clinical signs and symptoms between groups with and without CXR pneumonia. Signs and symptoms which were significant on univariate analysis were taken for multiple logistic regression analysis.

Ethical consideration: Permission to undertake the study was obtained from the department of pediatrics and child health of TASH.

A total of 179 children among whom 102 (57%) males and 77 (43%) females who fulfilled the inclusion criteria's were

included in this study. The age distribution is shown in table 1 where half of the patients were infants.

Table 1:- Age and sex distribution table

Age(months)	M		F		Total	
	No	%	No	%	No	%
2-11	59	57.8	43	42.2	102	56.9
12-23	23	53.4	20	46.6	43	24
24-35	12	66.6	6	33.3	18	10.05
36-59	8	50	8	50	16	8.9

21 patients have severe PEM,13 patients have rickets,3 have sero-proven pediatrics HIV infection and one patient each have gastroenteritis, malaria, downs syndrome and meningitis (table 3).

Table 2 shows clinical signs that best correlate with CXR pneumonia, these are tachypnea, flaring and retraction ,the other clinical signs and symptoms like vomiting, refusal to feed, cough, fever and grunting and chest findings did not correlate with CXR pneumonia. Table 4 shows the

sensitivity, specificity, 95% confidence intervals and prevalence of selected symptoms and signs and table 5 shows the frequency of clinical signs and symptoms.

In children between the age of 2-59 months, tachypnea (94.5% with CXR pneumonia Vs 59.3% without) and retraction (86.3% Vs 40.6%) were the best predictors of CXR pneumonia. Tachypnea, flaring and retraction were independently associated with CXR pneumonia.

Table 2:- CXR pneumonia

Variables	yes	no	P-value	95% CI
Vomiting Yes no	63 84	14 18	0.539	0.42-2.23
Refusal to feed Yes no	30 117	6 26	0.525	0.39-3.32
Cough Yes no	146 1	31 1	0.326	0-1.78
Fever Yes no	124 23	23 9	0.348	0.76-5.39
Tachypnea Yes no	139 8	19 13	0.000	3.95-36.72
Flaring Yes no	114 33	23 7	0.026	0.04-0.41
Retraction Yes no	127 20	13 19	0.000	3.36-23.77
Chest findings Yes no	101 46	24 8	0.306	0.82-1.09
Grunting yes no	96 51	21 11	0.573	0.86-1.15

Table 3:- Associated conditions

<i>DISEASES</i>	<i>NO</i>	<i>%</i>
Gastroenteritis	1	
MENINGITIS	1	
DOWNS	1	
P.F MALARIA	1	
PEDIATRICS AIDS(SEROPROVEN)	3	
RICKETS	13	
SEVERE PEM	21	
TOTAL	41	

Table 4:-

<i>Variables</i>			
symptoms	Sensitivity	Specificity	Prevalence
Vomiting	43	17.6	43
Rapid breathing	59	18.9	58.6
Refusal to feed	20	18.1	20.1
cough	99.3	50	98.8
SIGNS			
fever	59		56.9
<u>tachypnea</u>	94.5	61.9	88.2
flaring	77.5	21.2	76.5
retraction	86.3	47.3	78.2
Chest findings	69.8	17.3	69.8
grunting	65.3	17.4	65.3

Table 5:- CLINICAL SIGN AND SYMPTOM summary

<i>SYMPTOM</i>	<i>NO</i>	<i>%</i>
vomiting	77	43
Rapid breathing	105	58.6
Refusal to feed	36	20.1
cough	177	98.8
SIGN		
fever	102	56.9
<u>tachypnea</u>	158	88.2
flaring	137	76.5
retraction	140	78.2
Chest findings	125	69.8
grunting	117	65.3

Discussion

In rural areas of developing countries the case fatality rate from LRI in children is most likely to be reduced if primary health care workers can identify the most serious forms of LRI and deal with them appropriately, accurate guidelines to detect LRI (pneumonia) who can be safely treated with antibiotics as outpatients from those who require immediate referral must be based on symptoms and signs that can be readily assessed.

This study has attempted to look into clinical signs and symptoms predictors of pneumonia in less than 5 year children such as vomiting rapid breathing, tachypnea and chest retraction, age and sex distribution, frequency of each clinical signs and symptoms at emergency and regular pediatric out-patient department of TASH over one year period. On a study done by Campbell, et al showed that in infants a fever of $>38.5^{\circ}\text{C}$, refusal to feed (breast feeding) or the presence of vomiting best correlated with CXR pneumonia. In children aged 1-4 year, a fever of $>38.5^{\circ}\text{C}$, RR $>60/\text{min}$ are best correlated with CXR pneumonia (11). Another study done by Cherian et al showed that RR $>50/\text{min}$ in infants and RR $>40/\text{min}$ in

The Bangladesh study suggested that chest indrawing was more specific as a sign of severe pneumonia (17). Tachypnea has been exhaustively demonstrated to be an excellent predictor of radiologically defined pneumonia in a study done by Levantine J et al (10,14). In the present study tachypnea and retraction are very specific signs of CXR pneumonia, this is also consistent with other studies done on the subject (10,14,17,18) and their usefulness is further increased by their high sensitivity and are also easier to teach to non medical staff like primary health care workers. Vomiting, rapid breathing, fever, cough and grunting were not satisfactory predictors of CXR pneumonia.

Since our study is a hospital based study it should be interpreted with caution when community health workers (CHW) training and national guidelines are setup. Such programmes must adopt policies that take into consideration the health resources available to implement them. In rural areas of many developing countries including Ethiopia the referral systems are poorly developed and much of the primary care must be developed to CHWs, this should come from community based studies.

In conclusion pneumonia is still the significant cause of morbidity and mortality in developing countries like Ethiopia. If pneumonia is diagnosed earlier using simple clinical parameters which can also be used by non medical staff like community health workers and other health professional at each level mortality could be reduced significantly. Tachypnea (94.5%) and retraction (86.3%) were the best predictors of pneumonia as evidenced by

children 12-35 months of age, as well as history of rapid breathing and the presence of chest retraction in both age groups were found to be sensitive and specific indicators of LRI. Increased RR and history of rapid breathing were also sensitive in diagnosing less severe LRI that did not necessitate admission to the wards, whereas chest retraction was not. All these clinical signs had a lower sensitivity in diagnosing LRI in children aged 36 months and over (19). Study done by Shan et al showed that chest indrawing was a reliable sign in children between the age of 0-4 years with cough for assessment of severe LRI (pneumonia) and among other children with cough a RR of $>50/\text{min}$ is a reliable basis for diagnosing LRI (14). A multicentric study done by the WHO young infant study group indicated that the best threshold for predicting pneumonia in infants aged less than 2 months was RR $>60/\text{min}$ (15). The best combination of sensitivity (78-82%) and specificity (73-89%) was achieved by wing thresholds of 50 and 40 breaths/min for children aged 2-11 months and 1-4 years, respectively (16).

suggestive CXR (CXR pneumonia). Further studies should be conducted on the subject especially at the community level.

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