

Clinical Predictors of Outcome In Childhood Pneumonia

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SUMMARY

FAGBULE D AND ADEDOYIN MA. Clinical Predictors of Outcome in Childhood Pneumonia. *Nigerian Journal of Paediatrics*, 1990; 17:37. Three hundred and thirty children admitted to the University of Ilorin Teaching Hospital with a diagnosis of pneumonia were studied prospectively. Various clinical parameters were examined to determine their sensitivity, specificity and ability to predict the outcome of pneumonia in children. Tachypnoea (respiratory rate >40 per minute), age < 3 years, duration of illness > 3 days before admission, and presence of associated diseases were strong predictors of mortality. Awareness and recognition of these simple clinical criteria at the family and primary health care level will reduce mortality from childhood pneumonia and improve child survival.

INTRODUCTION

MORE than one-quarter of all childhood deaths in developing countries can be attributed to acute respiratory infections (ARI) as either the underlying or the associated cause.¹ If the estimate of the contribution of ARI to infant and early childhood mortality is correct, the problem cannot be ignored in any strategy for child survival.

A prerequisite of primary health care is the use of technologies which are appropriate

for the village level namely, those which people can understand, accept and easily practise.² Shann et al³ suggested that a respiratory rate of ≥ 50 per minute, or a qualitative impression of tachypnoea and chest in-drawing are probably the best indicators of severity for primary health workers. The report however emphasised the need for further prospective studies to determine the ability of these clinical signs to predict the course of ARIs. This study was designed to determine the sensitivity and specificity of various clinical parameters in predicting the outcome of pneumonia in children.

MATERIALS AND METHODS

Three hundred and thirty children (206 boys and 124 girls) with pneumonia, admitted to

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the Emergency Paediatric Unit (EPU) and Children's ward of the University of Ilorin Teaching Hospital, between July 1985 and June 1986, were studied. Bacterial aetiology and the clinical course of pneumonia in the subjects have earlier been reported.^{4 5} Data collected for the present study included age, duration of illness before admission, the severity of illness, respiratory rate, associated diseases and outcome.

The three major symptoms considered were fever, cough and breathlessness based on our earlier study.⁵ Duration of illness was calculated from the onset of the first symptom to the day of admission. Criteria for severity: A patient was said to have a mild disease if he had fever, cough and resting respiratory rate over 40 per minute, moderate, if he had fever, cough and resting respiratory rate of over 40 per minute plus chest in-drawing; and severe, if signs of moderate disease were present plus cardiac failure, grunting and cyanosis.⁶ Associated diseases were either co-morbid conditions or complications.

The predictors of outcome were determined using t^2 statistics where appropriate, and using the standard epidemiological approach to determine sensitivity, specificity and predictive values.^{7 8}

RESULTS

Table I relates the respiratory rate to severity of pneumonia and outcome. No patient with a respiratory rate less than 40 per minute died. All children with a clinical diagnosis of moderate or severe pneumonia had respiratory rates greater than 40 per minute. All cases with a respiratory rate greater than 80 per minute were severe, and the mortality rate was high (23.5%). A

mortality rate of 20% and above was found only among children with respiratory rate of >60 /min. For any given range of respiratory rate, the mortality was higher among the severe than the moderate cases. When patients with respiratory rate ≤ 60 /min and > 60 /min were considered, the sensitivity of respiratory rate as a predictor of mortality was 87.2%, and the specificity was 81.2%. The positive predictive value was 97.7%, and the negative predictive value was only 40.6%.

There were 32 deaths, an overall mortality of 9.7%. Thirty-one (96.9%) of the deaths occurred within the first 3 years of life (Table II). The only death after the age of 3 years occurred in a severely malnourished child.

There was no death among those children admitted within 24 hours of the onset of symptoms (Table III). The longer the duration of symptoms before admission, the higher the case fatality rate ($p < 0.01$). The more severe the pneumonia, the higher the case fatality rate ($p < 0.01$).

When those who were admitted within three days of onset were compared with those admitted later, the sensitivity and specificity of duration of illness before admission as a predictor of death were 49.7% and 71.9% respectively for the moderate and severe cases. The positive predictive value was 94.3%, and the negative predictive value was only 13.3%.

Overall mortality among the children with associated diseases was 38.3% (Table IV). The severe cases with associated diseases had a mortality of 40.7%. In the mild-moderate cases, mortality was 29.0%; a figure which is significantly higher than the 9.7% overall mortality (Table I) ($p < 0.001$).

TABLE I
Respiratory Rate, Severity and Outcome in 330 Children with Pneumonia

Outcome	Respiratory Rate per Minute									
	<40		40-60		61-80		>80		Total	
	Alive	Dead	Alive	Dead	Alive	Dead	Alive	Dead	Alive	Dead
Mild (69 cases)	56	—	13	—	—	—	—	—	69	—
Moderate (167 cases)	66	—	79	2	14	6	—	—	159	8
Severe (94 cases)	—	—	46	4	11	16	13	4	70	24

TABLE II
Age and Mortality rates in 330 Children with Pneumonia

Age (Mon)	No of Cases	No. of Deaths	% Mortality
0-12	136	14	10.3
13-24	121	14	11.6
25-36	31	3	9.7
37-48	7	—	—
49-60	4	—	—
61-72	8	1	12.5
73-84	4	—	—
85-96	9	—	—
97-108	2	—	—
>108	8	—	—
Total	330	32	9.7%

TABLE III
Relationship between Duration of Illness before admission, severity and Outcome

Severity	<24 hrs		1-3 days		4-7 Days		>7 Days		Total	
	Alive	Dead	Alive	Dead	Alive	Dead	Alive	Dead	Alive	Dead
Mild (69 cases)	—	—	42	—	24	—	3	—	69	—
Moderate (167 cases)	4	—	70	3	63	3	22	2	159	8
Severe (94 cases)	—	—	32	6	29	7	9	11	70	24
Total (330 cases)	4	—	144	9	116	10	34	13	298	32

TABLE IV
Severity and Outcome in Children with Associated Diseases

Associated Disease	Mild		Moderate		Severe		Total
	Alive	Dead	Alive	Dead	Alive	Dead	
Heart failure	—	—	7	2	37	8	54
Severe anaemia	—	—	3	1	9	7	20
Malnutrition	—	—	—	1	—	9	10
Measles	1	—	1	2	—	4	8
Gastroenteritis	—	—	2	2	—	5	9
Septicaemia	—	—	2	1	8	2	13
Sickle Cell Disease	—	—	6	—	—	2	8
Pleural effusion	—	—	—	—	8	7	15
Others	—	—	—	—	8	4	12
TOTAL	1	—	21	9	70	48	149

DISCUSSION

Efficient case management of ARI within primary health care implies the discrimination of cases according to the degree of severity and the action to be taken. The critical decisions are whether or not to refer the child to a higher level and, if not, whether to give antimicrobials or only supportive measures.⁹ On the basis of a few clearly defined symptoms and signs, our study indicates that the prognosis of pneumonia in children depends on the respiratory rate, the age of the patient, the duration of illness before admission and the presence or absence of associated conditions.

A positive predictive value of 97.7% for respiratory rate implies that tachypnoea is an important prognostic factor. However, when tachypnoea is absent, outcome is unpredictable. We would agree with Shann et al³ that all children with a respiratory

rate ≥ 50 per minute require antibiotics, especially in developing countries where bacteria play a major rôle in aetiology.^{4 10-12}

We recorded an overall mortality of 9.7%. A large majority (96.9%) of these deaths occurred in the first 3 years of life. While studies carried out in adults^{1,3} showed no significant association of age with mortality, age appears to be a strong predictor of mortality among our paediatric population.

Duration of illness before admission is also a good predictor of mortality with a value of 94.3% in the present study. This is similar to reports in the older population.^{1,3}

Co-morbidity or complication is a known risk factor affecting the outcome in pneumonia.¹⁴ This is confirmed by the higher mortality recorded in those patients with associated diseases. Severe anaemia, malnutrition, measles and gastroenteritis are common childhood diseases in Nigeria. These conditions lower the resistance, and it

is therefore not surprising that such children with pneumonia die even with adequate treatment.

Health education should be geared towards increasing the capability of families in recognizing signs of serious acute respiratory infections in children, and seeking medical help. Many deaths from pneumonia in children are preventable, but the failure to recognize simple signs and take appropriate action is holding back further reductions in childhood mortality in developing countries.

ACKNOWLEDGEMENT

The secretarial assistance of Mr. 'Kunle Ojo is gratefully acknowledged.

REFERENCES

1. Pio A, Leowski J and ten Dam HG. The magnitude of the problem of acute respiratory infections. In *Acute Respiratory Infections in Children. Proceedings of an International Workshop*. R. Douglas, (ed) Adelaide : University of Adelaide, 1985 : 3-16.
2. Alma Ata. *Primary Health Care. Health For All Series No. 1*. Geneva, WHO 1978.
3. Shann F, Hart K and Thomas D. Acute lower respiratory tract infections in children: possible criteria of patients for antibiotics therapy and hospital admission. *Bull WHO* 61 : 749 - 54.
4. Adedoyin MA and Fagbule D. Bacterial aetiology of childhood pneumonia. *Nig J Paediat* 1987 ; 14 : 37-40.
5. Fagbule 'Doyin, Adedoyin MA and Nzeh DA. Childhood pneumonia in Ilorin. *Nig J Paediat* (In Press).
6. Riley ID. Technical bases for the standardization of Clinical Management of ARI in Papua New Guinea. *WHO/RSD/ 81. 7; 1 - 5*.
7. Lilienfeld AM. *Morbidity Statistics*. In : *Foundation of Epidemiology* Lilienfeld AM ed. Oxford University Press Inc. USA. 1977 : 130 - 33.
8. Galen RS and Gambino SR. Sensitivity, specificity, prevalence and incidence. In : *Beyond normality*. Galen RS and Gambio SR. eds. John Wiley & Sons. New York 1975; 10 - 14.
9. Pio A. Acute respiratory infections in children in developing countries: and international point of view. *Ped Inf Dis* 1986 ; 5 : 179 - 83.
10. Diakparomre MA and Obi JO. Aetiological diagnosis of pneumonia in childhood by lung puncture. *Nig J Paediat* 1981; 8 : 61 - 4.
11. Silvermann M, Stratton D, Diallo A and Egler LJ. Diagnosis of acute bacterial pneumonia in Nigerian Children. *Arch. Dis Child* 1977; 52 : 825 - 31.
12. Johnson WBR. Studies on acute respiratory infections with particular reference to lower respiratory infections in hospitalised urban young Nigerian Children. *FWACP Part II Dissertation*, 1986.
13. Sofowora EO and Onadeko BO. Complications and prognostic factors in pneumonia among Nigerians. *Nig Med J* 1973; 3 : 144 - 5.
14. Fedson DS and Rusthoven J. Acute lower respiratory disease. *Primary Care* 1979; 6 : 13 - 41.

Accepted 15th May, 1989