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ACUTE RESPIRATORY INFECTIONS IN THE MIDDLE-BELT REGION OF NIGERIA

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ABSTRACT

Background: ARI continues to be a leading cause of death among children globally beyond the year 2000. Close 12 million children under the age of 5 years die each year in the developing countries, mainly from preventable causes and approximately 2.28 million (19%) were due to acute respiratory infections (ARI). It therefore became necessary to assess the present status of the disease in Nigeria to mastermind workable plans for reducing the mortality and morbidity burden.

Methods: A designed pro-forma was used to collect and collate information from mothers or direct care givers of children at both hospital and community levels relating to family background, home setting, anthropometry, clinical presentation of ARI, previous medications, investigations, complications and outcomes of illness.

Results: A total of 163 children were recruited for the study. One hundred and six had moderate and severe form of ARI while 57 had mild form. The in-patients accounted for 15.2% of all the admission within the study period. All children were under 12 years of age with male preponderance. Fast breathing, Tachypnoea, Cough and Fever were the leading ways of presentations. The immunization coverage of study population by various antigens in the EPI were poor. Majority of the hospital children had pre-consultation antibiotics while none of the children from the rural community had pre-recruitment antibiotics. Streptococcus pneumoniae and Staphylococcus aureus were the leading organisms isolated with good sensitivity to Quinolones, Gentamycin and Cephalosporins. Heart failure was the leading complications. Mortality was 12.3% among the hospitalized patient and none among the community children.

Conclusion: It was concluded that ARI is still a major cause of morbidity and mortality among children with opportunity for burden reduction.

Keywords: Acute Respiratory Infection, present outlook, burden

INFECTIONS RESPIRATOIRES AIGUËS DANS LA REGION DE MOYEN - CENTRE DU NIGERIA

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RÉSUMÉ

Contexte: Les infections respiratoires aiguës (IRA) continuent d'être une cause de décès chez les enfants dans le monde au-delà de l'année 2000. Près de 12 millions d'enfants de moins de cinq ans meurent chaque année dans les pays en voie de développement principalement des causes évitables et environ 2,28 millions (19%) sont dus à des IRA. Il devient donc nécessaire d'évaluer l'état actuel de la maladie au Nigeria pour orchestrer des plans réalisables visant à réduire la mortalité et la charge morbide.

Méthodes : Un pro - forma conçu a été utilisé pour recueillir et rassembler les informations de la mère ou soignants directe des enfants, tant au niveau de la communauté relatives aux antécédents familiaux, l'établissement d'accueil, l'anthropométrie, la présentation clinique des IRA, les médicaments précédents, les enquêtes, les complications et l'impact de la maladie.

Résultats: Un total de 163 enfants ont été recrutés pour l'étude. Cent six avaient la forme modérée à sévère de l'IRA tandis que 57

avaient la forme bénigne. Les patients hospitalisés ont représenté 15,2 % de l'ensemble de l'admission pendant la période de l'étude. Tous étaient de moins de 12 ans avec une prédominance masculine. La respiration rapide, la tachypnée, la toux et la fièvre étaient les principaux moyens de présentations. La couverture vaccinale de la population étudiée par divers antigènes du PEV était très basse. La majorité des enfants de l'hôpital avait des antibiotiques pré-consultation alors qu'aucun des enfants de la communauté rurale n'avait d'antibiotiques pré-recrutement. *Streptococcus pneumoniae* et *Staphylococcus aureus* étaient les principaux organismes isolés avec une bonne sensibilité aux quinolones, gentamycine et céphalosporines. L'insuffisance cardiaque était la complication conséquente. La mortalité était de 12,3 % chez les patients hospitalisés et aucun parmi les enfants de la communauté.

Conclusion : Il a été conclu que l'IRA est encore une cause majeure de morbidité et de mortalité chez les enfants avec possibilité de réduction de la charge.

Mots-clés: infection respiratoire aiguë, perspectives actuelles, la charge

INTRODUCTION

Nearly 12 million children under the age of 5 years die each year in the developing countries, mainly from preventable causes. Of these approximately 2.28 million (19%) were ascribed to acute respiratory infections (ARI) (1,2). A more recent 1997 report from the World Health Organization (WHO) indicated a rising trend with as high as 17.2 million potentially preventable deaths in developing countries. ARI especially that involving the lower respiratory tract was reportedly responsible for as many as 3.9 million of these. This figure is almost twice the number of deaths from malaria (3).

In the face of this death burden due to ARI, one major question that will need urgent answer is how optimally children with ARI were being treated or how appropriate is the empirical choice of antibiotics employed in ARI? If treatment is optimal and empirical antibiotic choice correct, then why this high ARI-associated mortality?

This present prospective survey was therefore designed to fill some of the gaps in our knowledge regarding the microbiological characteristics and antimicrobial sensitivity pattern of the bacterial pathogens associated with ARI / ALRI in the entire Paediatrics age spectrum and get data that will form a baseline at the beginning of a new millennium. It is expected that this will lead to better understanding of empirical antibiotics of choice in treatment of clinical cases, better understanding of areas of focus for the pharmaceutical company and drug-related Health Policy decisions, improvement in knowledge that will lead to better health education, increase in the knowledge of the causes, prevention and home-based treatment of diseases as contained in the Integrated Management of Childhood Illness and an overall reduction in ARI-related case fatality.

METHODS

A prospective study of ARI in children in both hospital and rural community was undertaken over a six consecutive month period. For the hospital-based study, the Emergency Paediatrics Unit (EPU) of the University of Ilorin Teaching Hospital was used where children were screened for ARI based on standard criteria. For community-based study Egbejila community, a rural community in Kwara State was

used. A central place was used within the small community. Children were fished out from house-to-house after effective community mobilization was done. Also standard criteria were used to identify children with ARI standard criteria. A designed proforma was applied to collect and collate information from mothers or direct care givers of all children either at the Hospital or at the community levels relating to family background, home setting, anthropometry, clinical presentation of ARI, previous medications, complications and outcomes of illness. All children who were diagnosed as having ARI had at least two of the following investigation carried out: throat swab, blood for cultures and plural aspirate. Those in which organism grew had their antimicrobial sensitivities determined. In those adjudged to require lung / pleural aspiration, a chest X-ray was requested as a prerequisite in addition to the usual investigations. Precautions to avoid procedure related complications as observed. Standard anti-microbial and supportive therapy was provided for all cases and those with complication were managed appropriately in a standard way.

Ethical considerations

Only selected patients with suspected pleural effusion had pleural aspirate. Also, blood culture was considered for only patient with evidence of systemic disease.

Patient recruitment

For the EPU patients had moderately severe and severe disease and needed hospitalization while those in the village were mild form of ARI. The criteria for entry included those with cough, fever, breathlessness, rhinorea or catarrh, and chest-in-drawing. Specimen collected included Blood, Pleural aspirate, and Throat swab for culture.

Specimen collection

Blood cultures

Blood cultures were taken from peripheral veins in the upper extremities after alcohol skin disinfections. Samples were quickly transferred into bottles containing transport media for bacteria and transferred to the laboratory for processing (15).

Throat swabs

Sterile cotton tipped sticks were used to swab the pharynx. The cotton tips were then cut using a new

razor blade into a Stuart-medium containing culture bottles and transferred to the microbiology laboratory of the UIITH Ilorin for processing.

Pleural aspirates

Skin was prepared using alcohol skin disinfectant. Pleural aspirates were taken using a 21G bore needle and 5mls syringes and transferred into sterile bottles for laboratory analysis.

Culturing of organisms

Standard laboratory procedures were followed (4).

Susceptibility testing

Plates were inoculated with the growing organisms. Antibiotics impregnated disk were then applied to the surface of the inoculated plates within 15minutes. This was done by hand using sterile forceps. The disks were then pressed down unto the agar with forceps giving 15mm space allowance from the edge of the plates and in between disks to forestall growth overlapping. Plates 150mm size had 12 disks while 100mm plates had 4 disks. Within 15minutes the plates were inverted and placed in incubator at 37°C in 5% CO₂ atmosphere for 72hours. Standard laboratory procedures were followed for the microbiological analysis.

Additional Investigation

Chest radiographs and haematological screening were done in most hospitalized patients.

Data collection and handling

This was done using a questionnaire with 4 sections including the family background, a bio-data, home setting to evaluate predisposing factors, clinical situations that addressed presentations, interventions, compliance and outcome. The last section contains the antibiotics sensitivity. Data was entered in a computer, checked, cleaned and correct data before analysis was done using the EPI info version.

Intervention

All children found with ARI in the community were treated with an empirical antibiotics, sulphamethoxazole plus trimethoprim combination. Antipyretics and haematinics were given as necessary.

RESULTS

A total number of 163 children were recruited for the study comprising 106 from emergence pediatric unit (EPU) university of Ilorin teaching hospital (UIITH) and 57 from Egbejila village, 55.8% were males 44.2% were females. Egbejila community has a total population of 735. Under -five years old children constituted 20% (147) of these 57(38.8%) developed acute respiratory infection (ARI) during the study period. EPU total admission for the study period was 699 out of which 106(15.2%) had ARI. Table II shows the monthly admission by sex and cases of ARI.

Severity of illness and diagnosis

Illness were mild in those recruited from the village but were moderately severe to very severe among those seen at the EPU who required hospitalization. The range of diagnosis was as on Table III.

The family characteristics of the study population

These are as shown in Table V. The fathers mean age for EPU was 33 years and 30.5 years for Egbejila village. Mothers mean ages were 28years in EPU and 25.5 years in Egbejila village. More than 94% of the respondents/ caregiver were married. Seventy-two (68%) in EPU were Moslems while 34(32%) were Christians whereas all (100%) were Moslem in the Egbejila village.

The fathers of the children in EPU were mostly civil servants 41(38.6%) but fathers were mostly farmers in the Egbejila village. Whereas, mothers in both EPU and Egbejila village were mostly traders. About 70% of the fathers in EPU had secondary or post - secondary level education while only about 9% had secondary and post-secondary level education Egbejila village.

Immunization coverage

The coverage of the following antigen were as follows BCG was, 51.8%, OPVo was 59.6%,while DPT1, DPT 2 and DPT3 coverage were 38.6%, 40.4% and 55.3%,respectively and Measles was 50.9%.

Pre-recruitment antibiotic use

For children admitted into the Emergence Paediatrics Unit (EPU) 90(85%) had taken one type of antibiotics or the other before cultured samples were taken. Twenty eight (31%) knew the specific antibiotics that was taken pre-recruitment of which 9 (32%) had Sultamycillin (sulbactam and ampicillin), 6 (21.4%) had Cotrimoxazole, 5 (17.8%) had Gentamycin, 2 (7.2%) had Ampiclox (ampicillin and cloxacillin), 2 (7.2%) had Chloramphenicol, 2 (7.2%) had Cefuroxime, 1 (3.6%) had Ampicillin and 1 (3.6%) Sulphathiazole. None of the children from Egbejila village had pre-recruitment antibiotics.

Microbiological investigations and bacterial causes of acute respiratory infection

Eighty blood samples were taken for cultures 10 (12.5%) grew microorganism. Ninety-five throat swabs were taken of which 18 (19%) grew microorganism. Pleural aspirate as taken for culture in 8 children out of which. 5 (62.5%) grew.

In all 183 specimens were cultured (Blood, throat swab and Pleural aspirate combined) of which 33 grew. This was a growth yield of 18%. The organisms were as follows: *Streptococcus pneumoniae* mainly from throat swabs were 9 (27.3%), *Staphylococcus aureus* mainly from blood culture were 4(12.1%), Coliforms mainly from blood culture were 4(12.1%), *Pseudomonas aeruginosa* mainly from throat swabs

were also 4(12.1%) *Streptococcus pyogenes* mainly from throat swabs were 3(9.1%). Others included *Staphylococcus epidermidis*, *Klebsiella pneumoniae*, *Proteus vulgaris*, *Escherichia coli* and *Acinetobacter*.

Clinical presentations of moderately severe and severe cases of ARI

Fast breathing was the leading presenting feature, present in all the subjects. Cough was present in 92 (86.8%), Fever in 77 (73.7%) and rhinorrhoea/ catarrh in 75 (70.2%).

Others were as on Table XII

Antibiotic susceptibility

The antibiotic susceptibility profile of the isolated organisms was a shown on Table XI. There were a total of 33 isolated tested against 17 different types of antimicrobial agents including; ofloxacin,

ciprofloxacin, cefuroxime, ceftriazone, cefotaxime, ceftazidime, gentamycin, streptomycin, penicillin G, cloxacillin, Ampicillin, chloramphenicol, cotrimoxazole, collistin, tetracycline, erythromycin and azithromycin.

Complications

The complications of ARI were seen in 20 of 106 children with moderately severe and severe disease. Complications included Pleural effusion in 8(7.6%) patients, Febrile Convulsion also in 8(7.6%) patients and heart failure in 4(3.8%).

Outcome

Of the 106 cases of moderately severe and very severe cases of ARI admitted into the EPU, UIITH, 13(12.3%) died. None of the 57 patients seen in Egbejila village with mild forms of ARI die.

TABLE I: DISTRIBUTION OF STUDY POPULATION BY SEX

SEX	EPU	EGBEJILA		No	%
		No	%		
Male		65	61.4	26	45.6
Female		41	38.6	31	54.4
Total		106	100	57	100

TABLE II: DISTRIBUTION OF STUDY POPULATION IN EPU BY MONTHLY ADMISSIONS, SEX AND MONTHLY ARI CASES

Month	Total	Male		Female		ARI cases	
		No	%	No	%	No	%
February	101	60	59.4	41	40.6	23	22.8
March	102	59	57.8	43	42.2	24	23.5
April	99	66	66.7	33	33.3	6	6.1
May	108	63	58.3	45	41.7	11	10.2
June	124	61	49.2	63	50.8	19	15.3
July	165	84	50.9	81	49.1	23	13.9
Total	699	393	56.2	306	43.8	106	15.2

TABLE III: SPECIFIC DIAGNOSES AMONG ARI CASES IN BOTH EPU AND EGBEJILA VILLAGE

Diagnosis	No	%
Bronchopneumonia	50	28.8
Lobar pneumonia	5	3.1
Aspiration pneumonia	5	3.1
Bronchiolitis	5	3.1
URTI*	60	36.8
Measles	41	25.
Total	163	100

*57 cases from the rural community included here

TABLE IV: THE FAMILY CHARACTERISTICS OF THE STUDY POPULATION

<u>Characteristics</u>	<u>EPU</u>		<u>Egbejila</u>	
Mean Age				
- Father		33years		30.5years
- Mother		28years		25.5years
Marital status	No	%	No	%
Mothers				
Singles	6	5.7	1	1.8
Married	100	94.3	54	94.7
Widowed	0	0	2	3.5
Religion				
Christianity	34	32.0	0	0
Islam	72	68.0	57	100
Traditionalist	0	0	0	0
Occupation				
Fathers				
Civil servants	41	38.6	3	5.3
Farming	6	5.7	30	52.6
Trading	20	18.9	4	7.0
Driving	8	7.6	3	5.3
Weaving	4	3.8	2	3.5
Others	27	25.5	10	17.5
Mothers				
Trading	45	42.1	32	56.1
Civil servant	28	26.3	0	0
Farming	4	3.5	12	21.1
Weaving	2	1.8	0	0
Others	26	24.6	13	22.8
Settlement type				
Urban	80	75.4	0	0

Peri-urban	22	21.1	0	0
Rural	4	3.5	57	100
Educational level	No	%	No	%
Father				
Nil	4	3.5	36	63.2
Primary	21	19.3	10	17.5
Secondary	35	33.3	2	3.5
Post-secondary	39	36.8	3	5.3
Islamic	4	3.5	0	0
Mothers				
Nil	11	10.5	44	77.2
Primary	16	15.5	6	10.5
Secondary	35	33.3	0	0
Post-secondary	37	35.1	1	1.8
Islamic	2	1.8	0	0

TABLE V: BACTERIAL ISOLATES FROM CASES OF ACUTE RESPIRATORY INFECTIONS

<u>ORGANISMS</u>	<u>FREQUENCY</u>	
	<u>No</u>	<u>%</u>
Streptococcus pneumonia	9	27.27
Staphylococcus aureus	4	12.12
Coliforms	4	12.12
Pseudomonas aeruginosa	4	12.12
Streptococcus pyogenes	3	9.09
Staphylococcus epidermidis	3	9.09
Klebsiella pneumoniae	2	6.06
Proteus vulgaris	2	6.06
Escherichia coli	1	3.03
Acinetobacter	1	3.03
TOTAL	33	100

DISCUSSION

A total number of 163 children were recruited for the study comprising 106 from emergence pediatric unit (EPU) university of Ilorin teaching hospital (UIITH) and 57 from Egbejila village, 55.8% males and 44.2% females. Egbejila community has a total population of 735. Under - five years old children constituted 20% (147) of these 57(38.8%) developed acute respiratory infection (ARI) during the study period. EPU total admission for the study period was 699 out of which 106(15.2%) had ARI. Table II shows the monthly admission by sex and cases of ARI. Thirty-eight percent of the Under-5 years in the rural community had mild ARI requiring hospitalization

Pre-recruitment antibiotic usage was common among our patients especially in the EPU. This may be due to easily available off-shelve purchases without doctors' prescription in Nigeria and the widespread of quarks and patent medicine store that do not stay within their certification limits. The rate of pre-recruitment antibiotics usage was more than reported from Ibadan, which showed 41% compared to our 85%(4). It has also been shown that pre-consultation antibiotic usage affects bacterial growth yield from cultures sixty-one (61%) percent of the blood culture negative case had pre-consultation antibiotics(4,5). This might have affected the yield in our cultures.

Majority of ARI cases would be due to viral infections. However majority of ARI-associated deaths have been attributed to the acute lower respiratory tract infection (ALRI) due to bacterial causes(6,7,8). It was therefore justifiable to make attempts to isolate bacterial agents from the blood because of the septicaemia it produce from the throat which serves as feeders to the lower lungs and the pleural which is the target for the organism. Blood culture is known for its specificity for identifying invasive pathogen(9) but it's not very sensitive when compared with lung aspirate(9,10).

The 12.5% growth yield in this study was lower than the 33% yield in the Ibadan study. This may be the compensatory higher prevalence of pre-recruitment antibiotic usage in our series. Lung aspirate was not ethically justifiable because of the risk involved(9). However, pleural aspirate in the patient with effusion

TABLE VI: CLINICAL PRESENTATION OF MODERATELY SEVERE AND SEVERE FORM OF ACUTE RESPIRATORY INFECTIONS AMONG 106 PATIENTS IN EPU

Presentation (symptom/ signs)	Frequency	
	No	%
Tachypnoea	106	100
Cough	92	86.8
Fever	77	72.6
Catarrh	75	70.8
Breathlessness	30	28.3
Vomiting	26	24.5
Creptitations	23	21.7
Weight loss	21	19.8
Transmitted sounds	18	17.0
Chest-in-drawing	16	15.1
Diarrhoea	13	12.3
Abdominal pain	9	8.5
Pallor (conjunctiva)	8	7.6
Pleural effusion	8	7.6
Convulsion	8	7.6
Bronchial breathing	7	6.6
Inflamed throat/eardrum	7	6.6
Chest pain	7	6.6
Gallop rhythm	4	3.8
Others	3	2.8

gave a high yield of 62.5%. This could be frequently employed but most patient may not have pleural effusion. The yield in our study was better than that reported by Johnson et al, Diakparomre et al and Aderole et al in Nigeria and other authors from other parts of the world(5,11,12,13).

TABLE VII: ANTIBIOTICS SENSITIVITIES OF BACTERIAL ISOLATES FROM CASES OF ACUTE RESPIRATORY INFECTION ANTIBIOTICS SENSITIVITY OF BACTERIAL ISOLATES (% SENSITIVITY) IN ACUTE RESPIRATORY INFECTIONS

Antimicrobial agents	S. pneumonia	Staph Aureus	PS aeruginosa	Kleb pneumoniae	Strept Pyogenes	E. coli	P. Vulgaris	Coliform	Acineto-Bacter	Staph epidremidis
1 Ofloxacin	100	100	100	100	100	100	100	100	100	66.7
2 Ciprofloacin	100	100	100	100	100	100	100	100	100	100
3 Cefuroxime	100	100	100	100	100	100	100	66.67	---	100
4 Gentamicin	100	100	100	100	100	100	100	100	---	66.7
5. Cloxaillin	78	75	---	---	100	---	---	---	---	33.3
6. Ceftriaxone	67	75	50	100	100	100	100	66.7	0	33.3
7 Erythromycin	87	100	---	---	100	---	---	---	---	0
8 hloramphenicol	87	50	---	---	100	---	---	66.7	0	---
9. Co-trimoxazole	56	25	0	0	66.7	100	0	---	---	---
10 Colistin	---	---	100	100	---	100	100	---	---	---
11 Tetracycline	100	50	0	0	100	100	0	0	100	---
12 Ampicillin	67	25	0	50	66.7	100	0	0	---	0
13 Streptomycin	56	0	0	50	66.7	100	0	33.3	100	---
14 Penicillin	87	0	---	---	100	100	---	---	---	---
15 Cefotaxime	100	50	50	100	100	100	100	---	---	---
16 Ceftazidime	87	0	100	100	100	100	100	100	---	---
17 Azithromycin	---	---	---	---	---	---	---	---	100	100

Throat swabs culture growth yield in this study was also better than previously reported(5). However previous report, were not in favour of throat swab because it may not be of any therapeutic reassurance. A future case control study will be needed to ascertain the present advantage of throat swab in identifying bacterial agents from ARI. In this study there were some correlates in organism recovered from the throat and blood (*Pseudomonas aeruginosa*).

The commonest organism isolated was streptococcus pneumoniae all from the throat swabs majority from the village where non-use pre-recruitment

antibiotic. Whereas staphylococcus aureus that is not common were mostly from blood and pleural aspirate among patients with pre-recruitment antibiotics. This agrees with other previous reports(5,7,14), except that *H. influenzae* was not isolated at all in our study. Therefore, the finding of staphylococcus aureus and gram negative bacterial may be related to the predominant use of antibiotic before recruitment which possibly wiped off all susceptible gram positive organisms. To truly ascertain pre-recruitment use of antibiotics, we needed facilities for measuring serum or urine level of antibiotic which could not be undertaken in our study due to limitations and hence parental responses were

studied as previously employed(15). The leading role of tachypnea as a sign among children with ARI is understandable. Cough and Fever also were present in majority of our patient. However, crepitation was only found in few of our patient in contrast to previous reports by WHO and other authors(5,7). Bronchopneumonia was the leading diagnosis of ARI in this study. However, the significant role of measles in 38.7% of our in-patients was unparallel. Measles affected males more than females and especially in children who had previously received measles vaccines at nine months of age. Again the question of sero-conversion after a vaccination comes to mind again. The question is what was the quality of the measles vaccines or life span of the antigenicity or immunity it produces. Among those children with measles only 3 who were less than nine months has not previously received the vaccine. Generally in this study there was over 50% coverage for the measles antigen among all the children.

The complications observed in our patients were only among those with severe disease who needed hospitalization. The leading complication of ARI was pleural effusion and febrile convulsion. Heart failure was observed in some few others. This patter of complications agrees with previous reports except the infrequent occurrence of anaemia severe enough to require blood transfusion (5).

There were 13 deaths among patient with severe ARI. The major contributor to mortality was bronchopneumonia. The pattern of antibiotic sensitivities looks inconclusive. However, for now cotrimoxazole and most first line antibiotics may not be performing optimally. There is need to do trial works on the macrolides, the cephalosporins and quinolones.

We concluded that ARI is still common (15.2% of admission), its mortality still unacceptable (12.3%) due mainly to severe forms, a need for reviewing the present first line antibiotics. It was also concluded that pleural effusion, where present, are likely to yield bacterial agents than blood and throat swab. Measles contributed greatly to cases of ARI. A few cases of easles developed before 9 month of age when patients were due for the vaccine.

We recommend the use of Quinolones, Gentamycin and Cephalosporins as first line drugs in severe forms of ARI, Public education on physical management of fevers to reduce incidence of Febrile Convulsion, improvement on Immunization coverage for all antigens, the use of Edmondson-Zagreb measles vaccine that could be given before 9 months and to start a Community based training programme to educate people on ARI prevention as contained in the IMCI.

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