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Epidemiological and seasonal variations of pneumonia in children admitted in the University of Uyo Teaching Hospital, Uyo, Akwa Ibom State, Nigeria: A retrospective 5-year study (2013- 2017)

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Abstract *Introduction*: Pneumonia is the highest killer of children worldwide. Nigeria is one of the high burden pneumonia countries. Studies have observed seasonal variations in the prevalence of pneumonia.
Objective: To identify the prevalence and bio-demographics of childhood pneumonia, as well as its epidemiological pattern, seasonal variation, co-morbidities, complications and outcomes in the paediatric ward of a tertiary hospital in Southern Nigeria
Methods: This was a retrospective cross-sectional study. Information on all patients admitted into the paediatric medical ward with pneumonia from January 2013 to December 2017 were extracted from the ward register. Data were analysed using Stata version 12.
Results: The prevalence of Pneumonia was 18% (590 out of 3276). Three hundred (50.9%) of the 590 children with pneumonia belonged to the 0-11 months age group. Pneumonia was commoner in males (57.8%). Five hundred and seventy three (97.3%) children had bronchopneumonia. The mortality rate for pneumonia was 1.2% The median duration of admission for all children with pneumonia was five days with a discharge rate of 96.9%. The commonest complication observed was congestive cardiac failure in 23 out of 29 (79.3%). The three most common co- morbidities with pneumonia were malaria, sepsis and congenital heart disease (27.8%, 10.7% and 8.8% respectively) pneumonia prevalence was higher in the rainy season with a double peak in March and October.
Conclusion: Childhood community acquired Pneumonia prevalence is still high in Nigeria especially in the rainy season. Intensified efforts should be made in the prevention and early treatment of pneumonia so as to prevent prolonged morbidity and mortality.

Key words: Pneumonia, childhood, Nigeria, seasonal variation

Introduction

Pneumonia is an acute lung parenchymal inflammation caused by infectious agents.[1] The common anatomical types are Bronchopneumonia and Lobar pneumonia.[2] Bronchopneumonia is commonly seen at the extreme of ages. Globally Pneumonia is the single most common infectious cause of childhood mortality.[3] About half of childhood consultations in health facilities in low and middle income countries are due to acute respiratory infections inclusive of pneumonia.[4]Each year, about 1.6million children die from pneumonia,[5] with the largest burden in the under-fives.[6] It is also a major cause of childhood morbidity, with about 120 million episodes of pneumonia occurring yearly worldwide.[7,8] Nigeria is among the high burden countries with pneumonia, with about six million cases.[3]

The differences in the morbidity and mortality patterns of respiratory illnesses, including pneumonia, may be due to a variety of factors, one of which is the climatic variations in different parts of the world.[9]

Both bacteremic and non-bacteremic pneumonia seasonality peak in winter,[10,11] and spring[11]in developed countries, while in tropical settings, seasonal pneumonia epidemics occur during the rainy season.[12] It is known, that seasonal variations and peaks place increasing demands on bed-space during these periods and directly contribute to ward overcrowding. Identifying these peaks will enable predictions on clinical demands to be more accurately made and therefore facilitate better planning and utilisation of services.[13]

This study was undertaken to identify the prevalence and bio-demographics of pneumonia, as well as its epidemiological pattern, seasonal variation, co-morbidities, complications and outcomes, in the Department of Paediatrics in a tertiary hospital in southern Nigeria, with the aim of adding to the body of knowledge on this subject, and identifying mechanisms to facilitate better planning and utilisation of clinical services during the peak periods in order to prevent inpatient overcrowding

Methods

This was a retrospective cross-sectional study. Information on all patients admitted into the paediatric medical ward with pneumonia were extracted from the ward register. These included the age and gender of the patients, the diagnosis, month and year of admission, duration of treatment, complications and outcome of treatment.

Data was analysed using STATA version 12. Descriptive statistics (mean and standard deviation) were calculated for continuous variables. Categorical variables were presented as frequency and percentages in tables and bar charts. Trends were presented as graphs. Chi-square test or Fisher's exact test was used to test for association between categorical variables. A p-value of 0.05 was taken as statistically significant.

Ethical clearance for the conduct of the study was obtained from the Ethics committee, of University of Uyo Teaching Hospital. The addresses, names, hospital number and other identifiers of the patients were omitted to maintain confidentiality

Results

The total number of inpatients with pneumonia from January 2013 to December 2017 was 590. This gave pneumonia a prevalence of 18% for all inpatients (590 out of 3276), and 45.1% (590 out of 1307)for all respiratory cases in this period. Majority (50.9%) of the patients with Pneumonia were in the0-11 months old group. There was a male (57.8%) preponderance among children with pneumonia. Most children (96.3%) with pneumonia were discharged after a median hospital stay of five days. Table 1

Majority (90.8%) of the children with bronchopneumonia were in the under- five age group. This is in contrast to those with Lobar pneumonia who were older children (p=0.0001). All (1.2%) the pneumonia deaths resulted from bronchopneumonia. There was a significant presence of co-morbidities and complications with lobar pneumonia compared to bronchopneumonia. (p=0.028 and 0.007). There was no difference in outcome, seasonal variation or duration of admission between lobar and Bronchopneumonia. (Table 2)

Table 1: Socio demographic characteristics of the patients

Socio demographic characteristics	Frequency (n)	Percentage (%)
Age		
0-11 months	300	50.9
12-59 months	228	38.6
Above 59 months	62	10.5
Gender		
Male	341	57.8
Female	249	42.2
Diagnosis		
Bronchopneumonia	573	97.1
Lobar pneumonia	17	2.9
Outcome		
Discharged	568	96.3
LAMA	12	2.0
Absconded	3	0.5
Death	7	1.2

The commonest (79.3%) complication associated with pneumonia was congestive cardiac failure. Malaria (27.8%), Sepsis (10.7%), congenital heart defects (8.8%) and Paediatric AIDS (6.4%) were among the commonest comorbidities seen with Pneumonia. (Table 3)

Table 3: Spectrum of complications and co-morbidities associated with Pneumonia

Parameter	Frequency (n)	Percentage (%)
Complications		
Congestive cardiac failure	23	79.3
Pleural effusion	2	6.9
Others	4	13.8
Total	29	100
Comorbidities		
Malaria	52	27.8
Sepsis	20	10.7
Congenital Heart defects	17	8.8
PaediatricAIDS	12	6.4
Asthma	11	5.9
Sickle Cell Anaemia	10	5.4
Malnutrition	10	5.4
Trisomy 21	10	5.4
Measles	9	4.8
Others	36	19.3
Total	187	100.0

Table 2: Sociodemographic and clinical factors associated with types of pneumonia among the patients

Variables	Type of pneumonia n (%) Broncho (n=573)	Lobar (n=17)	Total (n=590)	Statistical indices
Age (months)				
0-11	299 (52.2)	1 (5.9)	300 (50.8)	$P<0.0001^{+}$
12-59	221 (38.6)	7 (41.2)	228 (38.6)	
Above 59	53 (9.2)	9 (52.9)	62 (10.5)	
Gender				Df=1
Male	327 (57.8)	10 (58.8)	337 (57.8)	=0.0075
Female	239 (42.2)	7 (41.2)	246 (42.2)	*P* value=0.931
Outcome				
Absconded	3 (0.5)	0 (0.0)	3 (0.5)	Df=3
Discharge	551(6.2)	17 (100.0)	568 (96.3)	*P* value=1.000
LAMA	12 (2.1)	0 (0.0)	12 (2.0)	
Death	7 (1.2)	0 (0.0)	7 (1.2)	
Comorbidities				=4.7978
Absent	353 (61.6)	6 (35.3)	359 (60.8)	Df=1
Present	220 (38.4)	11 (64.7)	231 (39.2)	$P=0.028^{+}$
Complication				
Absent	548 (95.6)	13 (76.5)	561 (95.1)	$P=0.007^{+}$
Present	25 (4.4)	4 (23.5)	29 (4.9)	
Seasonal variation				Df=1
Rain (Mar to Oct.)	393 (68.6)	9 (47.1)	402 (68.1)	=4.7978
Dry (Nov to Feb.)	180 (31.4)	8 (52.9)	188 (31.9)	*P*=0.172
Hospital stay (days)				
Median (IQR)	5 (3-7.5)	6.5 (3-8)	5 (3-8)	

+ Significant p-values

There was no difference in pneumonia mortality based on complication, age and gender (p= 0.299; 0.640 and 0.372 respectively). Table 4

Table 4: Correlation of Pneumonia mortality with age, gender and presence of complications.

Variable	Outcome Dead	Not dead	Total (n=590)	Statistical indices
Complication				
Yes	(14.3)	28 (4.8)	29 (4.9)	Pvalue=0.299 (Fischer's
No	(85.7)	555 (95.2)	561 (95.1)	exact test)
Age (months)				
0-11	5 (71.4)	295 (50.6)	300 (50.8)	Pvalue=0.640 (Fischer's
12-59	(28.6)	226 (38.8)	228 (38.6)	exact test)
Above 59	0 (0.0)	62 (10.6)	62 (10.5)	
Gender				
Female	2 (28.6)	247 (42.4)	249 (42.2)	Pvalue=0.372 (Fischer's
Male	5 (71.4)	336 (57.6)	341 (57.8)	exact test)

Pneumonia had a biannual peak in March and October (Figure 1)

Fig 1: The average monthly distribution of Pneumonia from 2013 to 2017

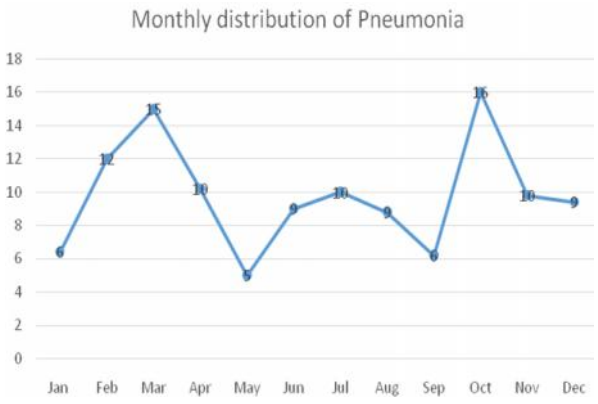
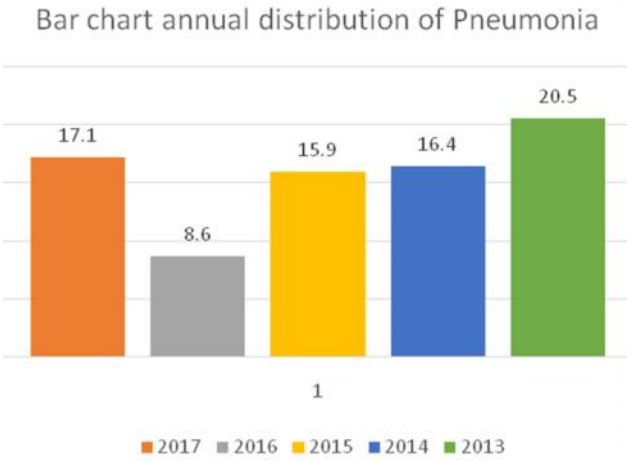


Fig 2: The annual distribution of pneumonia for 2013-2017



Discussion

The 45% prevalence rate of pneumonia for all respiratory admissions is similar to the 41.3% rewarded in another study in Southern Nigeria[14]. This is in keeping with the previously known fact that Nigeria is one of the countries with the high pneumonia burden.[3] The high pneumonia rates obtained in our study could be possibly linked to the fact that most children in our study were less than two years old. This is not surprising as a study has reported that young children less than two years old are 1.7 times more likely to be brought to hospital for treatment of suspected pneumonia, compared to their two to five year old counterparts.[15] However, the prevalence rate of 18% obtained for all ward admissions may not reveal the true burden as only about 40% of under – five Nigerian children with pneumonia are taken to an appropriate health provider for care. In about 38% of children, no care is sought for children with suspected pneumonia.[15] Various reasons explaining the poor care-seeking behavior include financial constraints, an initial trial of home management and a poor recognition of the severity of the illness.[16, 17]In addition, waiting for the child to improve and distrust of government health facilities are also additional factors. [18]

The case fatality rate of 1.2% observed from our study is lower than the 3.5% seen in the study by Ugwu *et al.*[14] This low fatality rate maybe due to the fact that children in our series presented earlier and had fewer complications. In addition, there is a possibility that most mortality would have occurred in the emergency room in more severe cases with late presentation before they could be moved to the paediatric ward. Furthermore, the short hospital stay in our series is an attestation to the fact that early diagnosis and prompt treatment with appropriate antibiotics prevents prolonged morbidity, and mortality from pneumonia.[19]

The presence of Lobar pneumonia in older children is consistent with prior published studies and this could be attributed to the better immunity in older children which aids the localization of infection to a single lobe or segment.[2] The significant presence of co- morbidities and complications in Lobar pneumonia compared to bronchopneumonia may however be a result of the small number of subjects with lobar pneumonia which gives an exaggerated effect to the level of significance. In our study, age, gender and the presence of complications were not significant factors for childhood pneumonia mortality. This is in contrast with a study that showed that younger male children have more severe disease, with more complications possibly leading to a higher mortality.[20] Our observations may be explained by the low mortality rate in our series.

The seasonal variation seen for pneumonia with a double peak in March and October which corresponds to the rainy season has been observed in other studies. [9,12] Previous published data has observed that yearly pneumococcal and respiratory syncytial virus epidemics occur in the rainy season in the tropics.[10, 21,22]Various speculations exist, one of which is that the co-incidence of Respiratory syncytial virus infection and streptococcus pneumoniae has a synergistic effect and may increase pneumococcal virulence. [5] Other studies had also observed that seasonal variations in environmental factors such as humidity and sunshine influence Pathogen survival and virulence in the tropics.[23,24] Respiratory Syncytial Virus and other enveloped viruses tend to survive better at lower humidity on environmental surfaces.[25,26] In addition, the occurrence of household crowding as people tend to stay indoors more often during the rainy season thus encouraging the spread of pathogens may be an additional factor. Furthermore, October in particular corresponds to the start of a new school year after the long vacation, therefore the crowding of children into classrooms/creche could also lead to the spread of pathogens, therefore accounting for the surge in pneumonia admissions seen in October. Our finding is however in contrast to the study by Oguonu[et al9]who observed a double peak in July and October.However in the earlier study, October was defined as dry season while in our study, October is part of the rainy season. The differences noticed in both studies could also be due to methodological issues such as the use of the emergency room by Oguonu[et al] while our study used the Paediatric ward.

Conclusion

Pneumonia is still highly prevalent among Nigerian children in spite of the available, low cost interventions for its' prevention and readily available antibiotic treatments. The epidemiological factors identified in pneumonia prevalence in our study, include young age, male gender, and seasonal variations. The incidence of complications and mortality rate of pneumonia in our study is low and is probably an attestation to the fact that early presentation, prompt and appropriate antibiotic treatment will lead to a quick resolution of pneumonia in most children. We therefore recommend intensified efforts in the prevention of community acquired pneumonia through adequate feeding, immunization, and good hygiene. In addition, increased community awareness on the signs and symptoms of pneumonia and the promotion of good health seeking behavior among caregivers is imperative in the control of childhood pneumonia.

Limitation

Due to the retrospective nature of our studies we had some problems with missing data and we also did not look at other epidemiological factors that may have contributed to the high prevalence of pneumonia in our study like feeding practices, immunization status, socioeconomic status, use of biomass fuels and the effect of overcrowding. Prospective studies will be needed in the future to correctly assess the impact of these factors on the prevalence, morbidity and mortality pattern in Nigerian children with community acquired Pneumonia.

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