Determination of pneumonia case management and outcome in children under-five years of age at arthurdavison children's hospital (ADCH)

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ABSTRACT

Background: Pneumonia is amongst the top 10 causes of hospitalisation and mortality in children below the age of five at Arthur Davison Children's Hospital, in Ndola, Zambia. Despite having protocols of management such as the WHO standard case management or the hospital protocols, there are no studies concerning case management of in-patients and their associated outcomes. The study aims to describe pneumonia case management and its associated outcomes in children under the age of five. **Methods:** Deploying a retrospective study, 289 in-patient records for the year 2015, Staffing levels, hospital registers and equipment were used to determine pneumonia case management and outcomes. **Results:** Of the 289 in-patient pneumonia case-files files reviewed, they showed that more males (56.7%) than females (43.3%) were admitted for pneumonia and that there was inadequate assessment of pneumonia signs and symptoms in 62.3% of the total number, and this seemed to be the cause of lack of uniformity and standard in treatment received by patients. These findings reflected the clinician's failures and weaknesses in management of pneumonia. Children's monitoring was inadequate. Only oxygen therapy (17.3%) had charts for recording signs of respiratory distress, and that routinely monitored signs temperature, pulse and respiratory rate count predominated (41.5%).These inadequacies in assessment and treatment led to prolonged hospitalization in some children(16.3%). **Conclusion:** Findings indicate that much needs to be done by the clinicians in the area of assessment of under-five children for improved and better outcomes, and this can be through training, algorithmic charts of case management and standardized hospital protocols.

Key words: Arthur Davison Children's Hospital (ADCH), case management, Outcome, Pneumonia, Under-fives, Zambia.

Introduction

Pneumonia is one of the significant causes of morbidity and mortality in children below the age of five in developing countries, in spite of preventive measures in place such as immunization. And Zambia as a developing country shares the burden of this disease with the rest of the world. Pneumonia is inflammation of the lung parenchyma that involves consolidation of the affected part. It can be caused by infectious agents such as bacteria, viruses, fungus or it can either be of chemical or traumatic origin [1]. However, childhood pneumonia in its severe and life threatening form is commonly caused by bacterial organisms such as Streptococcal pneumoniae (30-50%), haemophilus influenza type B (10-30%) staphylococcus aureus and viral causes such as respiratory syncytial virus (RSV)[4]. Pneumonia as a respiratory tract infection is characterised by coughing, wheezing, shortness of breath, fever, and can be complicated with life threatening features. These complications include pneumatocele, empyema, pleural effusion and pneumothorax [2]. Hence, early recognition of signs and symptoms and management of the condition is important; as such complications are potentially life-threatening. According, to UNICEF and WHO, pneumonia has been identified and labelled as the major "forgotten killer of children". The disease kills a larger number of children than any other illness. Its mortality rates are higher than Acquired Immune deficiency Syndrome (AIDS), malaria and measles combined. An estimated 2 million children die from pneumonia each year, accounting for almost 1 in 5

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under-five deaths worldwide [3]. In the year 2015, alone an estimated 922, 000 deaths recorded worldwide due to an infectious cause were attributed to pneumonia. This accounted for 15% of all deaths of children below the age of five [5]. With these figures of mortality, the burden of disease is emphasised and mortality being an outcome in some cases, good and standardised case management should be followed and emphasised for positive and improved outcomes. This can be via standardised WHO protocols or the individualised hospital protocols. For example, Zambia amongst other countries such as Bangladesh, India, Kenya and Uganda, have developed district, state and country wide plans to intensify actions for control of pneumonia and diarrhoea [5]. In Zambia, as was a situation for ADCH, pneumonia in the year 2015 was ranked as the second and third, on the top ten (10) cause of hospital admission in the under 1s and 1 to 4 year olds respectively. Furthermore, in the under ones of the total 7550 children admitted, 1009 had pneumonia which translated into 13.4% whilst in those between 1 to 4 years old, from a total number of 7731 admitted, 1169 had pneumonia representing 15.1% [7]. Therefore, these figures show the magnitude of the problem and the caseload the hospital is faced with. Nonetheless, insofar as management of pneumonia is concerned, early recognition of pneumonia signs and symptoms is cardinaland prompts early treatment [8]. Many factors can lead to mismanagement of patients, and these can be personal, logistics or equipment related. According to a study done by chompolola and Macwan'gi in Luapula 2002 to 2003, they highlighted four important reasons which are drawbacks to case management. These were as follows: Poor recognition of the signs of the illness, delay in reaching a health facility, delay in receiving a definitive diagnosis and, poor compliance with recommended treatment and/or referrals mainly due to lack of confidence in the health care [6]. These drawbacks can greatly contribute to morbidity and mortality especially in the developing nations. Thus, it is the focus and objective of this study to determine the in-patient management at ADCH and associated outcomes

Materials and methods

Study Site

The study was conducted at Arthur Davison children's Hospital (ADCH). It is located in Northrise area at the corner of kalewa and chiwanangala roads in Ndola, the provincial district of the Copperbelt province, in Zambia. ADCH is a 3rd level or tertiary hospital, and an only Zambia's dedicated children's hospital, with a bed capacity of approximately 550 [8].

Study design

The study was a retrospective descriptive study aimed at determining pneumonia case management and outcome in children below the age of five. This was done by reviewing the in-patient files of patients managed as pneumonia cases at the hospital for the year 2015. Additionally, hospital administrative staff was interviewed on staffing levels, equipment, and hospital registers were also used as data sources. This was done over a period of one (1) month.

Study Population

The study population included children below the age of five both males and females. The inclusion criteria used was all children managed as pneumonia and below 5 years, whilst the exclusion criteria were all out-patients even if managed as pneumonia and children managed as pneumonia but above 5 years old.

Sample Size determination and sampling

The sample was computed from the hospital reporting register. This was by using epi info software version 7.1.2.0, and from the 1169 cases of pneumonia a study sample size of 289 was obtained at 95% confidence level. The age picked for sampling was 1 to 4 year olds from the hospital's recording system of age and diseases as under 1s, 1 to 4 year olds and 5-14 year olds. Sampling was done by randomly extracting files from the registry with the help of hospital clerks. The children's file numbers used to obtain files were from the in-patient registers for the wards Muchinga, Luangwa, Kafue, high cost and Observation.

Data collection tools and analysis

Data was collected using a checklist having the child's demographics, that is, age and sex, clinical assessment, comorbidities, and diagnosis made by the clinician. Additionally, the checklist had provision of the treatment given, monitoring of patient and discharge status. Interviews were also conducted with hospital human resource and sisters-in-charge from the various wards of focus. Data collected was entered and analysed using statistical package for social sciences (SPSS) software version 20.0.

Results

Demographics

From 289 files reviewed, 164 were males representing 56.7% and 125 were females representing 43.3%. The age distribution of these was that there were more 1 to 2 year olds managed for pneumonia, a total of 158 accounting for 54.7%. This was followed by 2 to 3 year olds which represented 27% and a frequency of 123. The least admitted and managed for pneumonia were the 3 to 4 year olds adding up to 53 in total and accounting for 18.3% as shown in figure 1 below:

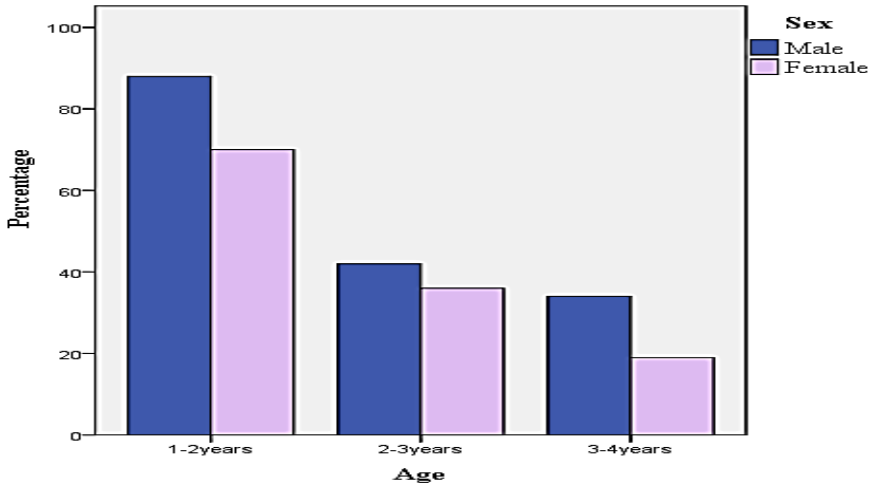

Fig 1: Age relation to sex of the 289 under 5s managed as pneumonia

Inpatient Case Management at ADCH

Assessment

The assessment of pneumonia by clinicians at ADCH revealed that of the 9 signs and symptoms in considered in the study, central cyanosis, cough and fever were the most recorded at 99.6%, 99.0% and 98.7% respectively. This was followed by the respiratory rate at 96.9%. On the other hand, difficulties in breathing accounted for 93.8%, whilst wheezing was the least assessed and recorded at only 25.3%. It was positive in 61 cases, negative in 12 and missing in 216. Nonetheless, of the four (4) danger signs that are used to assess the severity and classification of pneumonia apart from central cyanosis leading at 99.6% was missing in only 1 case, positive in 1 and negative in 287. Chest in drawing and other signs of respiratory distress such as fast breathing (93.4%) was the second most recorded followed by the child's inability to feed, drink or breastfeed (91.3%) and whether the child had convulsed or was lethargic was the least recorded at 84.8%. These danger signs are signs used to classify severe pneumonia are as shown in table 1

Table 1: shows the recording of danger signs of pneumonia as picked by clinicians at ADCH used in the classification of severe pneumonia

Signs recorded n = 289	Frequency	Percentage
Central Cyanosis	288	99.6%
Chest in drawing	270	93.4%
Inability to feed	264	91.3%
Convulsion/lethargy	245	84.8%

Classification according to the assessed signs and symptoms

The classification in this presentation will be presented as what the clinicians recorded as a diagnosis at discharge from the hospital based on the assessment of the patient during their stay in the hospital. With that in

mind a supposed or corrected diagnosis by WHO will be used against the clinician's diagnosis.

It was found that, out of the 289 files reviewed, 39 (13.5%) were diagnosed as severe pneumonia by the clinicians, of which 27 (9.3%) were correctly classified and diagnosed, 9 (3.1%) were incorrectly classified and were supposed to be diagnosed as pneumonia (non-severe) whereas 3 (1.0%) had inadequate assessment hence diagnosis of severe pneumonia was inconclusive and could not be confirmed. On the other hand, another 241 (83.4%) diagnosed as pneumonia, only 82 (28.4%) were correctly classified and diagnosed, 129 (44.6%) were misclassified and were consistent with severe pneumonia and the remaining 30 (10.4%) were assessed inadequately; hence classification and diagnosis are inconclusive. However, it was difficult to categorise 9 (3.1%) files which had 3 diagnoses labelled as respiratory tract infection (RTI) with pneumonia, another 2 with bronchiopneumonia and remaining 4 had febrile illness with pneumonia. Thus, the inadequate assessment considering all the above translates into 62.3% (180) of the total. These were classified as other as shown in the summary table, table 2

Table 2: diagnosis given by the clinician based on assessed signs and symptoms against corrected classification based on WHO Standards

Diagnosis given by the clinician based on assessed signs and symptoms against corrected classification based on WHO Standards						
			WHO Standard/Corrected Diagnosis			**Total**
			Severe pneumonia	Pneumonia	Assessment of danger signs missing	
Diagnosis based on clinician's assessment	Severe Pneumonia	Frequency	27	9	3	39
		% of Total	9.3%	3.1%	1.0%	13.5%
	Pneumonia	Frequency	129	82	30	241
		% of Total	44.6%	28.4%	10.4%	83.4%
	Other	Frequency	2	6	1	9
		% of Total	0.7%	2.1%	0.3%	3.1%
Total		Frequency	158	97	34	289
		% of Total	54.7%	33.6%	11.8%	100.0%

Treatment and monitoring during hospitalisation

Benzyl penicillin was the most used and prescribed first-line antibiotic 91.3% in 264 cases and was given parenterally. It was used in combination at initiation with other antibiotics such as with gentamycin in 235 (81.3%) or with paracetamol 243 (84.1%), with amoxicillin 6 (2.1%) and with a corticosteroid (hydrocortisone, dexamethasone, prednisolone) in 58 (20.1%) cases. In cases, where benzyl penicillin was combined with corticosteroids 23 (8.0%) cases were those diagnosed as severe pneumonia. Benzyl penicillin was also given with 3rd generation cephalosporin either cefotaxime or ceftriaxone on initiation in 35 (12.1%) case. In 5 (1.7%) cases of severe pneumonia a corticosteroids either one or in combination (dexamethasone, hydrocortisone, beclomethasone, prednisolone) was given as first line in with a 3rd generation cephalosporin. Additionally, Benzyl penicillin was given as first line in 35 (12.1%) cases with severe pneumonia, 224 (77.5%) with pneumonia and 5 (1.7%) with the diagnosis as other.

However, benzyl penicillin was switched to chloramphenicol in 4 (1.4%) cases and to cefotaxime in 2 (0.7%) cases. Salbutamol was given as nebulised in 11 (3.8%) of patients presenting with wheezing and 1 case was given ventolin (albuterol). In contrast, salbutamol was also given in 4 (1.4%) patient without a wheeze and 12 (4.2%) where a wheeze was not assessed, hence the rationale for prescribing was unclear. Furthermore, 80 (27.7%) patients had amoxicillin or cephalexin prescribed on discharge and in (0.7%) 2 cases diagnosed as severe pneumonia, the first line was a 3rd generation cephalosporin (cefotaxime or ceftriaxone) in combination with hydrocortisone and oxygen therapy. Oxygen therapy was given in 50 (17.3%) cases in which 26 cases it was for severe pneumonia, 22 for pneumonia and 2 for the diagnosis other (Bronchiopneumonia, RTI with pneumonia, or febrile illness with pneumonia) and in 12 (4.2%) cases oxygen therapy was given even when

not indicated, thus the rationale could not be established. In 227 (78.5%) oxygen therapy was not applicable, hence not indicated. Monitoring of all the 289 patients was found to be done between 3 to 6 hours, with a standard 4 hourly monitoring of temperature, pulse and respiratory rate count (TPR). TPR were the most recorded signs at 41.5% (120) cases, followed by TPR and diet at 26.6% (77 cases). Respiratory distress 15.9% (46) was the third most recorded sign, and this was found to be done in cases were oxygen therapy was indicated. The least recorded signs were the level of consciousness 1.0% (3). Other features monitored were classified as others such as urine output, stool chart, blood pressure 2.4% (7), and were due to either from comorbidities or patient receiving intravenous fluids indicated for dehydration or supportive therapy. Other signs there were recorded on consequent reviews were signs of respiratory distress such as nasal flaring and auscultatory findings on the respiratory system examination.

Duration of antibiotic administration during hospitalization

Table 3: Duration of Antibiotic treatment as given in 289 cases of pneumonia managed at ADCH in 2015

	Frequency	Per cent
24hours	63	21.8
48hours	98	33.9
72hours	95	32.9
>72hours	32	11.1
<24hours	1	0.3
Total	**289**	**100.0**

The table shows that more children 98 (33.9%) and 95 (32.9%) received parenteral antibiotics for 48 hours and 72 hours respectively. This was followed by the 63 (21.8%) who received antibiotics for 24 hours and those for 72 hours were fourth 32 (11.1%). Only one file had a patient receiving antibiotics for less than 24 hours, because were admitted in the short stay or observation ward, and consequently absconded.

Comorbidities

A number of comorbidities were recorded besides pneumonia. From the 289, malaria was investigated in 270 (93.4%) cases by either blood slide or rapid diagnostic test (RDT), of which in 29 (10.0%) cases it was confirmed positive and all these received treatment of either artesunate or coartem (artemether-lumefantrine), 241 (83.4%) were negative and 19 (6.6%) cases were neither sought clinically nor investigated for malaria. For anaemia, the reference ranges for ADCH laboratory for haemoglobin level were as follows at 3 months is 9.5 – 13.5g/dl, at 1 year it is expected to be ranging between 10.5 – 13.5g/dl and 3 – 6years between 12 – 14g/dl [9]. Therefore, using those reference ranges of the 260 (90%) investigated, 135 (46.7%) were confirmed anaemic, 125 (43.3%) were negative and 29 (10%) had their results missing in the files. Of those anaemic only 103 were treated whilst 32 had no treatment recorded in the drug chart hence not treated for anaemia. It was found that those between the ages of 1 -2 years were leading with more anaemia 72 (24.9%) with haemoglobin level below 10.5g/dl, followed by 2 – 3 year olds 35 (12.1%) and 3 – 4 year olds 28 (9.7%) were in both age categories the haemoglobin levels were below 12g/dl. Another comorbidity in this study was malnutrition which was positive in 14 (4.8%) cases, whilst 6 (2.1%) had no malnutrition and 269 (93.1%) were not applicable, meaning were not investigated for malnutrition or didn't have the disease. All those who had malnutrition were managed as appropriate.

Table 4: Summary of other comorbidities recorded in 289 pneumonia cases at ADCH

Morbidity	Frequency	Per cent
Sickle cell anaemia	8	2.8
Acute diarrhoeal disease or acute gastroenteritis	14	4.8
HIV positive	4	1.4
Down syndrome	1	0.3
Tonsillitis	12	4.2

Bronchiolitis	2	0.7
Congestive cardiac failure	1	0.3
Conjunctivitis	3	1.0
Failure to thrive	2	0.7
Congenital heart disease (ventricular Septal defect)	1	0.3
Not applicable[a]	241	83.4
Total	**289**	**100**

a. Are cases in which patients didn't have any other comorbidities

Determination of outcome pneumonia inpatient management

To determine pneumonia outcome as managed by the clinicians at ADCH, the diagnosis was used against the status of the patient at discharge. From the 289 cases, it was found that despite the large proportion of inadequate assessment of patients, there was no mortality in recorded in this study except for morbid states.

Table 5: Diagnosis in relation to discharge status at ADCH in 289 pneumonia cases

		Discharge status from the hospital					
		Discharge after 24 hours	Discharge after 48 hours	Discharge after 72 hours	Discharge after 3 – 14 days	Abscondee	**Total**
Diagnosis	Severe pneumonia	3	13	13	9	1	39
	Pneumonia	55	80	69	37	0	241
	other	1	4	3	1	0	9
	Total	59	97	85	47	1	**289**
	% total	20.4%	33.6%	29.4%	16.3%	0.3%	**100%**

ACDH equipment and staffing level

ADCH's staffing levels as of 2015 had 5 consultants, 1 senior registrar, 3 general resident medical officer (GRMO), 10 senior resident medical officers (SRMO) and 39 Junior resident medical officers (JRMO) also known as interns, a total number of 58 clinicians. These interns were those trained locally and those from abroad, and were made to rotate after about 6 months. And these, medical personnel are distributed and assigned in units from 1 to 5, and manage patients as per specified unit.

The equipment for each ward is as follows

Table 6: Staff assigned to a paediatric ward for nursing care and equipmentin 2015

	Muchinga	**Kafue**	**Luangwa**	**High Cost**	**Observation**
Sister in charge	1	1	1	1	1
Nurses	12	12	7	7	6
Cot beds	55	29	35	11	10
beds	4	19	5	4	0
Working Oxygen cylinder(supply)	yes	yes	yes	yes	Yes

All the wards had working thermometers, as witnessed by temperature recordings in all the 289 cases. The general paediatric hospital protocol is used as a guide however, there were no algorithmic charts on management of pneumonia in the wards or in the admitting out-patient department (OPD).

Discussion

Case management is a cardinal tool and an effective control strategy to pneumonia, and significantly reduces mortality[11]. It involves classification of illness using simple clinical signs and symptoms such as fast breathing, chest in drawing and general danger signsand appropriate treatment given [12]. In this study of 289 cases, aiming at determining pneumonia case management and associated outcome, it was found that more males (56.7%) were managed for pneumonia than females (43.3%). And it was found that the most affected age group was between 1 – 2 year olds (54.7%), followed by 2 – 3 year olds (27%) and lastly 3 - 4 year olds (18%). This trend confirms other studies that have showing that male sex is a risk of acute lower respiratory tract infections (ALRI)[15, 16].

However, with clinical assessment, there was generally good assessment, with the danger signs highly recorded as central cyanosis (99.6%), Chest in drawing (93.4%), inability to feed (91.3%) and convulsion or lethargy (84.8%). But with such good assessment, the clinicians still could not correctly classify pneumonia as severe pneumonia or just pneumonia (non-severe) to match up with their findings. This could reflect failure of understanding of the finding or because the signs and symptoms were the same as from referral letters. This means that the clinicians didn't actively look for them. This was similar to the findings in a research done in Sudan in which the signs or symptoms recorded were either offered by parents or because the feature is routinely looked for on general physical examination [17]. With those features assessed, pneumonia was classified as severe pneumonia correctly in 9.3%, wrongly 3.1% and inadequately assessed in 1.0% of the 289 cases. On the other hand, the most misclassified diagnosis (44.6%) was that of non-severe pneumonia, whilst accounting for 10.4% of 289 cases the assessment for pneumonia was inadequate, and thus the classification could not be confirmed. Correct assessment for classification and diagnosis of pneumonia (non-severe) was only done in 28.4% of the 289 cases. These failures to classify could be due to lack of standardised protocols, failure to recognise the signs and symptoms and relate them to severity of pneumonia and individual clinician's differences in depth of knowledge of pneumonia case management. This was also found to be the case in a study of factors contributing to high mortality due to pneumonia in kalabo, western province of Zambia where case management was inconsistent and not standardised. And this was identified as a factor amongst other contributors of high mortality among the under-fives [13]. Similarly, at Arthur Davison Children's hospital, the hospital general paediatric protocol emphasises on clinical presentation of pneumonia as fever >38.5^0 C, tachypnoea, tachycardia, subcostal/intercostal recession and crackles as well as indications for admission in infants and older children based on the danger signs [14]. It was found that the hospital protocol does not adhere to classification, and this could be one of the reasons for clinicians' failure to classify pneumonia despite correct diagnosis. According to the WHO revised classification, severe pneumonia can be diagnosed in a child with fast breathing and/or any of the danger signs whilst pneumonia is fast breathing and/or chest in drawing [12]. With this classification an appropriate course of action concerning case management can be determined [12]. Since classification guides the course of action especially treatment, it can therefore be inferred that those that were inadequately assessed could have been mistreated or inadequately managed. This could thus explain the findings that 16.3% (47) patients were discharged after 3 to 14 days. Additionally, those discharged between 3 to 14 days, 12.8% (37) were diagnosed and classified as pneumonia, and 3.1%(9) had severe pneumonia. This delayed stay in the hospital takes up the limited bed spaces, increases the ratio of health worker to patient and is resource consuming. This coincides with the WHO management guidelines' consideration at discharge that prolonged hospital stay increasing the risk of hospital acquired infections and occupying bed space and staff time [18]. However, there was no mortality recorded as the files for mortality were kept separately from those discharge files where sampling was done, hence, it is not suffice to rule out pneumonia related deaths and this was a weakness of this study. Because in a similar study of case management done in Sudan, though cross sectional descriptive in nature, 4 children out of 224 died due to inadequate assessment [17].

Limitations of the study

The study being retrospective and using files didn't bring out the records for mortality as they were kept separately from the sampled files or patient records. Hence, mortality could not be established.

Conclusion

Case management is a cardinal strategy and tool that can help curb mortality and morbidity related to pneumonia. In this study, it was found that a lot needs to be done by the clinicians in the area of assessment of

children especially the under-fives for improved outcomes. This can be achieved via training, standardised hospital protocols and use of pneumonia management algorithmic charts

Recommendations

- There is need to put up algorithmic charts of pneumonia in-patient case management for all health workers to use from the area where patient are admitted up to the individual wards. This will help with recognition of vital signs and symptoms especially with danger signs.
- The Arthur Davison's Children's hospital general Paediatric protocol can be improvedfurther to include case management which can act as a reminder to clinicians.
- There is need to be conducting workshops to sensitise and educate clinicians on the burden of this disease, and also engage the community to be able to recognise early signs and symptoms of pneumonia to avoid delayed presentation.

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