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Pattern of childhood pertussis in a tertiary hospital in Nigeria: a five year review (2007-2011)

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Abstract*:* Pertussis is being increasingly found in previously immunized subjects. In Nigeria, the immunization coverage rates are low. This study was therefore carried out to highlight the cases of pertussis seen in a young Nigerian tertiary health facility, with emphasis on the clinical features, complications and the impact of prior immunization in the affected children.

Methods : This was a hospital based retrospective study, in which data were obtained from case notes of children seen in the Paediatric department of the University of Uyo Teaching Hospital (UUTH) from January 2007 to December 2011 with a diagnosis of pertussis. Information sought included epidemiologic data, duration of illness, signs and symptoms, treatment, complications and outcome.

Results: Fifty three patients were diagnosed with pertussis during the five year period, with majority (29; 54.7%) of cases in the year 2011. Twenty one (39.6%) of the subjects were males while 32 (60.4%) were females. The mean age of the subjects was 29.71 ± 27.73 months. The most common symptoms were Post-tussive vomiting and paroxysmal cough occurring in 48(90%) and 39 (73.6%) of the patients respectively. The average interval between onset of symptoms and presentation at the health facility was 3.35 ± 2.84 weeks. Majority of the patients (25; 47.2%) were adequately immunized for their age. Bronchopneumonia, either alone or in combination with other complications was the commonest complication occurring in nine (52.9%) patients. There was no mortality.

Conclusion: Pertussis is still of public health significance. Routine immunization should be strengthened and booster doses of vaccines should be considered for older children whose immunity may begin to wane.

Key words: Pertussis, pattern, childhood

Introduction

Pertussis is an acute bacterial infection affecting the respiratory tract[1]. It is caused by *Bordetella pertussis (*B.pertussis*)* and occasionally *Bordetella parapertussis*[1]. The illness occurs principally in young unvaccinated infants, but school-age children, adolescents and adults are affected[2]. *It* is usually characterized by progressive, repetitive, and paroxysmal coughing[1,2,3]. Atypical presentations like low grade fever, dyspnoea, apneic episodes and seizures may occur in children less than two years old while, older children and adults have persistent cough[2,4,5]. These unusual forms of presentations often lead to misdiagnosis and poor outcome in the affected children[5]. Older siblings are a frequent source of infection but recent studies are revealing the role of previously immunized adolescents and adults as reservoir of infections[2,3,4].

Classic pertussis has an incubation period lasting 7 to 28 day and the communicability is highest during the first two weeks of infection[2]. After that the disease progresses through three stages of clinical illness: catarrhal, paroxysmal, and convalescent each lasting approximately two weeks[3]. Leukocytosis (20,000 to 100,000 cells/mL) with absolute lymphocytosis is characteristic. A chronic cough may persist for several months[3]. A diagnosis of pertussis is usually made clinically, but the bordetella DNA maybe detected in polymerase chain reaction (PCR) for four weeks after symptom onset, except in infants[6]. The infection can be confirmed by culture of the pathogen from nasopharyngeal swabs or secretions or by serological test but the latter method is not well standardized[6,7].

A number of complications may ensue from the disease[3,8,9]. the most frequent is pneumonia which is seen in almost all fatal cases[8]. Complications like subconjunctival haemorrhage, rectal prolapse, otitis media, umbilical and inguinal hernias are common in older children as against apnea, and encephalopathy in infants[3,9].

Treatment with antibiotics such as, the macrolides are effective in eliminating the bacteria. Even though antibiotic therapy does not necessarily alter the clinical course of the illness, it has the potential of reducing the period of infectivity and modifying the complications of the disease[10]. The recommended treatment is Azithromycin for three to five days and Erythromycin and clarithromycin for seven days[11,12].

Primary vaccination with a combination vaccine is the proven method of prevention.[5] The period of immunity induced by the pertussis vaccine tends to wane within 5 to 10 years and is shorter than that induced by the disease itself[13], hence booster doses are of importance in preschool children and adolescents with waning immunity[14].

In spite of the fact that pertussis is a treatable as well as a vaccine-preventable childhood illness, the national and global incidences of the disease has been on the increase in recent years[1,2,3]. This has been attributed to persistent low immunization coverage rates, frequent vaccine stock outs and erratic power supply leading to breaks in the cold chain[15,16,17]. Currently a waning immunity has become a major factor[18].

The aim of this study therefore was, to describe the pattern of clinical presentation and complications of pertussis in Nigerian children.

Materials and methods

Data were obtained from case notes of children managed for pertussis in the paediatric Outpatient clinic and the Paediatric ward of the University of Uyo Teaching Hospital (UUTH) from January 2007 to December 2011. Information extracted from the case records included the patients epidemiologic data, duration of illness, signs and symptoms, treatment, complications and outcome. The diagnosis of pertussis was based on the Centre for Disease Control and Prevention clinical case definition of 1997[19]. A case was defined as coughing illness lasting for at least 2 weeks with at least one of the following: paroxysms of coughing, inspiratory whoop or post-tussive vomiting without other apparent cause. A probable case was one that met the clinical case definition but was not laboratory confirmed or epidemiologically linked to a laboratory-confirmed case.

Data was analysed using the SPSS version 17. Descriptive statistics including the measures of central tendency (mean) and dispersion (standard deviation) were used. Chi-square 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 the UUT H.

Results

Seventy two patients had a diagnosis of pertussis over the five year period. Their age ranged from one month to 14 years. Nineteen cases were excluded because they did not meet the inclusion criteria. Therefore fifty three cases of pertussis were recorded within the five year period (2007-2011). Of this number, 29(54.7%) were seen in 2011. (Figure 1.) Twenty one (39.6%) of the children were males while 32 (60.4%) were females; giving a male to female ratio of 1:1.5. The mean age of the children was 29.71 $\pm$ 27.73 months with a range of 1 -108 months. The proportion of infants (39.6%), were similar to those aged 12-59 months (37.7%).

Of the 53 cases, 16(30.2%) cases had a history of contact with siblings, 25 (47.2%) were adequately immunized for their age, 11 (20.8%) were inadequately immunized for age, while 10 (8.9%) had no immunizations. (Table 1).

The average interval between onset of symptoms and presentation at the health facility was 3.35 $\pm$ 2.84 weeks. The mean duration of illness was 6.1±3.66 weeks with a range of two to 16 weeks.

Table 1: Socio-demographic characteristics of Paediatric Pertussis patients in UUTH from 2007 to 2011

Socio-demographic characteristics	Frequency (n)	Percent (%)
Age groups		
0 -11months	21	39.6
12- 59 months	20	37.7
60 months and above	12	22.6
Gender		
Male	21	39.6
female	32	60.4
Contact history		
Yes	16	30.2
No	37	69.8
Immunization history; n=46		
*Adequate for age	25	54.4
Not adequate for age	11	23.9
Nil	10	21.7

*Twenty three (43.4%) subjects had been completely immunized with three doses of DPT.

Table 2 shows that all the cases presented with cough, which was paroxysmal in 39(73.6%). Post-tussive vomiting, occurred in 48(90%), fever in 19(35.8%), while a whoop was present in 10(30.2%). The other symptoms were catarrh 12(23.6%), difficulty in breathing 11(20.8%), weight loss in 6(11.3%) and red eye in 5(9.4%) cases. The signs patients presented with were flaring of alae nasi, coarse crepitations and hepatomegaly in 2(3.8%) cases respectively and central cyanosis, rhonchi, Subcostal and intercostal recession in 1(1.9%) case respectively.

There was a statistically significant association between age and paroxysmal cough with infants having more cases of paroxysmal cough than the older children (p =0.044). The association between age and post tussive vomiting or age and occurrence of whoop was not statistically significant.

Of the Seventeen patients that had complications, the commonest were bronchopneumonia 6(35.3%) and subconjunctival haemorrhage in 6(35.3%) followed by a

combination of bronchopneumonia and subconjunctival haemorrhage in 2(3.8%) cases. (Table 2)

There was no statistical significant association between age groups of patients and development of complications (χ^2 = 1.244; p= 0.537) but the association between gender and development of complications was statistically significant with more males having complications than females (χ^2 = 6.582; p=0.010).

Twenty five (47.2%) of the subjects were treated with Erythromycin, 18 (34.6%) received Azithromycin, while two (3.8%) received a combination of Erythromycin and Azithromycin. Other antibiotics received included Cefuroxime and Cefpodoxime.

There were no deaths recorded among the subjects as all recovered.

Table 2: Symptoms and signs of pertussis in patients seen in UUTH

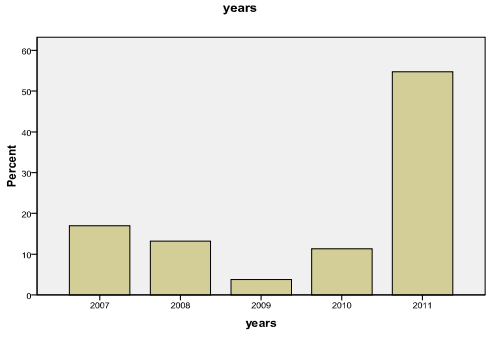
Symptoms	Number %	Signs	Number (%)
Cough	53 (100)	Flaring of alae nasi	2(3.8)
Paroxysmal	39 (73.6)	Sub-coastal recession	1(1.9)
Non-paroxysmal	14(26.4)	Inter-coastal recession	1(1.9)
Post-tussive vomitting	48(90.6)	Coarse crepitation	2(3.8)
Fever	19(35.8)	Hepatomegaly	2(3.8)
Whoop	16(30.2)	Central cyanosis	1(1.9)
Catarrh	12(23.6)		
Difficulty in breathing	11(20.8)		
Weight loss	6(11.3)		
Red eye	5 (9.4)		
*Others	8 (15.1)		

*other symptoms include impaired feeding, fast breathing, epistaxis, chest pain and haemoptysis

Table 3: Pattern of complications seen in pertussis patients in UUTH

Complications	Number (%)
Bronchopneumonia	6(35.3)
Subconjunctival haemorrhage	6(35.3)
Bronchopneumonia with sub-conjunctival haemorrhage	2(11.7)
Bronchopneumonia with heart failure with hernia	1(5.9)
Apnoea	1(5.9%)
Bilateral inguinal hernia	1(5.9)
Total	17(100)

Fig 1: Distribution of Pertusis cases by Years



Discussion

The importance of pertussis as a vaccine preventable disease cannot be overemphasised. Most of the patients with pertussis were seen in 2011. A probable explanation for this local surge of pertussis, may be due to increased awareness and an increased index of suspicion among doctors. It may also be as a result of poor vaccine quality due to poor storage or as a result of the immunity gaps being observed across the globe[17,18]. Another reason may be that the ongoing preparation for the replacement of DPT with pentavalent vaccine in the National Programme for Immunization may have led to a disruption in the supply of DPT vaccines in some states of the country, thereby resulting in low DPT coverage. This was noted in local records that from 2010 to November 2011, there were no DPT vaccines in the state. This was also corroborated by World Health Organisation (WHO) when it noted that in the year 2011 an estimated 22 million infants worldwide were not reached with routine immunization services, with about half of them living in three countries which included Nigeria[20]. The preponderance of infants with pertussis seen in this study has also been noted in earlier reports[4,21,22]. This is probably because mothers provide little if any passive protection to young infants[3] Majority of the patients were females as was also noted in an earlier study[23]. The reason is unknown. In approximately 30% of the patients, a history of contact with a coughing older sibling was given. This is in keeping with earlier reports that show that older siblings are a frequent source of infection even if they have been vaccinated, although in infants the source of infection cannot be detected in 30-69% of cases[2,5] This is attributed to waning immunity in the absence of booster vaccine[17] and the fact that the symptomatology in vaccinated individuals are atypical[1,2,5]. Majority of cases were also seen in adequately immunized patients with 43.7% of them having received three doses of DPT vaccine. The explanation for this may be due to frequent vaccine stock outs and erratic power supply leading to breaks in the cold chain and immunization with suboptimal vaccines[17,20]. The average interval between the onset of symptoms and presentation at the health facility of >21 days in this review was longer than the median of 14 days in the study by Yaari et al[1] in Isreal. This may be due to differences in the treatment seeking behaviour of their caregivers[24]. Late presentation in health facilities is a common observation in the Nigeria especially among those of low socio-economic status. It is well known that this interval has an implication on the infectivity and spread of the causative agent[10,11]. This is because though early treatment with effective antibiotics does not alter the clinical course of the disease, it reduces the period of infectivity of the case[3,12].

The common symptoms noted were cough (100%), of which 73.6% were paroxysmal in nature, post-tussive vomiting in 90% and a whoop in only 30% of cases. This symptoms are in keeping with the those of earlier studies.[2,3,18] These symptoms are of great importance as they have been shown to be highly sensitive and

moderately specific for culture confirmation of the diagnosis of pertussis[3]. It is of note that there was a significant association between paroxysmal cough and infancy as other studies have reported this finding[2,3,18]. There was a paucity of chest signs among patients in this study, which was expected as chest examination findings are usually normal between paroxysms except in infants with secondary pneumonia[3].

Bronchopneumonia and Subconjunctival haemorrhage, either alone or in combination were the commonest complications noted. The only case of apnoea recorded was in an infant less than three months of age. These findings are in keeping with earlier studies[2,3,9].

The use of the macrolides in the treatment of pertussis in majority of the patients showed that the clinicians were aware of the recommended antibiotics for the treatment of pertussis[10,11]. However the total duration of the illness in the patients was similar to those obtained in earlier literature, an era wherein antibiotics were not instituted for patients with the disease. This goes to buttress the fact that antibiotic therapy does not alter the clinical course of the disease[2,3].

No mortality was recorded among patients in this study. This could be attributed to the small sample size and to the fact that majority of the patients were immunized and so did not present with severe and life threatening complications.

The major limitation of this study was absence of laboratory confirmation of the cases. The additional limitation is potential information bias which is common to retrospective studies. Other factors that may account for the presumed low incidence maybe underreporting due to misdiagnosis especially in atypical cases in infants (no whoop), poor reporting of diseases generally, possible lack of awareness and lack of active surveillance[25].

Also as a hospital based study, this may not give a true burden of the disease as the burden in the community may be much higher considering the poor health seeking behaviour of our local populace and the presence of alternative health providers.

Conclusion

In conclusion, our study documents the clinical and epidemiologic pattern of pertussis in the Paediatric Department of University of Uyo. We have documented the high morbidity in infants, and our study suggests that the source of infection may be older siblings and this may be a consequence of the delivery of suboptimal vaccines and waning vaccine immunity in the context of prevalent pertussis disease in the community. More detailed studies in the community are needed on laboratory confirmed pertussis cases before evidence-based strategies to control the disease in Nigeria can be made.

We therefore recommend the strengthening of our diagnostic capacity as well as our routine immunization services. Additional research on laboratory confirmed cases as well as on the current immunity of children, adolescents and adults is also required in order to determine the need for booster doses of vaccine and at which age these boosters should be administered.

Author's contribution

Dr Oloyede I.P Conception and design of the study, acquisition of data from case notes and writing up of the manuscript. Dr Ekanem AM Data analysis. Dr Udoh EE, Revision of the article for intellectual content. All authors were involved in the final approval of the version submitted.

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