

**BACTERIAL AETIOLOGIC AGENTS ASSOCIATED WITH UPPER RESPIRATORY TRACT INFECTIONS IN CHILDREN (UNDER FIVE YEARS) ATTENDING SELECTED CLINICS IN JOS, NIGERIA.**

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**ABSTRACT**

**Objectives:** To identify the bacterial agents associated with upper respiratory tract infections in children less than five years old in Jos, Nigeria.

**Materials and Methods:** Throat swabs were collected from a total of 200 children reporting at four (4) hospitals/clinics: Paediatric Units of OLA and Evangel hospitals and Primary Health Care clinics in Nassarawa and Jos Township with symptoms of upper respiratory tract infections (Pharyngitis, sinusitis, epiglottitis, laryngotracheitis etc).They were examined for bacterial pathogens using standard microscopy and culture.

**Results:** One hundred and forty nine (74.5%) subjects harboured bacterial pathogens. The age group 0-5 months accounted for the highest number of isolates, 33(16.5%) while the age

group 54-59 months and 45-53 months accounted for the least number 3(1.5%) each. Five bacterial species were identified; *Streptococcus pneumoniae* 75, (37.31%) had the highest frequency of occurrence while *Corynebacterium species* with 7 (3.48%) had the least occurrence. Others are *Moraxella catarrhalis* 67 (33.33%), *Staphylococcus aureus* 31(14.42%) and *Streptococcus pyogenes* 21(10.45%).

**Conclusion:** The study showed that bacteria were associated with most upper respiratory tract infections. Routine bacterial culture should be considered when children present with upper respiratory tract infections and the accompanying symptoms.

**Key words: Respiratory tract, bacterial pathogens, throat swabs, children.**

## **INTRODUCTION:**

Malaria and Acute Respiratory Tract Infections (ARI) remain important causes of childhood morbidity and mortality in developing countries despite that both conditions are potentially treatable and preventable<sup>1</sup>. Acute respiratory infections cause four and a half million deaths among children especially those in the developing countries<sup>2</sup>.

Many kinds of microorganisms infect the respiratory tract and are transmitted through nasal and throat secretions of infected people which are expelled as aerosols when they cough or sneeze<sup>3</sup>. The organisms range from bacteria, fungi, viruses and other microorganisms that are pathogenic and are present in dust and air<sup>4</sup>.

Upper respiratory tract infections (URTI) are common infections with a respiratory rate of less than 50 usually accompanied with nasal drainage. They include conditions such as pharyngitis, sinusitis, epiglottitis, laryngotracheitis, and the common cold. Although viruses play a significant role in the pathogenesis of many of these infections, bacteria and other organisms are also responsible<sup>5</sup>.

Infections of the upper respiratory systems are by far the most common cause of illness in infancy and childhood, accounting for approximately 50% of all illness in children younger than 5 years of age<sup>6</sup> and approximately 1/3 of all visits to doctors in Primary Health Care Centres<sup>7, 8, 9</sup>. As URTI represent one of the main reasons for antibiotic therapy<sup>7, 10, 11</sup> it would be important to identify the common bacterial pathogens that are prevalent in this locality; this will guide in diagnosis and treatment when the common symptoms are presented. This would also control the indiscriminate use of antibiotics.

## **MATERIALS AND METHODS**

### **Study Populations:**

The subjects used in this prospective study included 200 volunteer children less than 5 years seen at four (4) hospitals/clinics of Jos-North Local Government Area of Plateau State, Nigeria. The hospitals/clinics include: Pediatric Units of ECWA Evangel Hospital and our Lady of Apostles Hospital and Primary Health Care (PHC) Centres located in Nassarawa Gwom and Jos Township. Ethical consideration was

observed by obtaining an informed consent from the mothers after thorough explanation of procedure. All the subjects had signs and symptoms suggestive of upper respiratory tract infections (pharyngitis, sinusitis, epiglottitis etc). The study was carried out between the months January to March 2005.

#### **Collection of Specimen:**

Sterile commercially prepared plain cotton swabs were used to collect throat swabs from the subjects. A sterile disposable wooden tongue depressor was used to depress the tongue and the sterile swab was aseptically removed from the tube and rubbed vigorously in a circular motion over each tonsillar area and posterior pharynx. Any exudate seen was touched, avoiding the tongue and uvular. The swab was immediately returned into its tube carefully and transported within two (2) hours of collection to the laboratory for microbiological analysis.

Five different media were prepared according to the manufacturers' instructions; they are: nutrient agar, blood agar (using sheep blood), chocolate agar, tellurite blood agar (TBA) and peptone water.

#### **Culturing of Specimen:**

Each specimen was inoculated into 5 plates (2 blood agar, 2 chocolate agar plates and 1 TBA). One (1) plate each of blood agar, chocolate agar plate and TBA were incubated aerobically while the others were incubated under 5-10% CO<sub>2</sub> in a candle extinction jar at 37°C for 24-48 hours.

#### **Identification of Isolates:**

After the period of incubation the plates were observed with the unaided eye for growth and their colonial morphology. Gram staining was carried out and isolates classified into gram positive and gram negative. The following biochemical tests as described by Cheesbrough<sup>12</sup> were carried out for further identification of isolates: catalase test, coagulase test, oxidase test, nitrate reduction test, bacitracin and optochin sensitivity tests.

#### **RESULTS**

Out of the 200 throat swabs examined by culture for upper respiratory tract pathogens, 149 (74.5%) yielded bacterial growth.

The distribution of children positive for bacterial pathogens showed that the age group 0-5 months accounted for the highest number of isolates 33 (16.5%) while the age group 54-59 months and 48-53 months accounted for the least number of 3(1.5%) each. Other age groups had the following: 6-11 months 30(15.0%); 12-17 months 23(11.5%), 18-23 months 14(7.0%), 36-41 months 12(6.0%) and 42-47 months 6(3.0%) -Table 1.

The male subjects accounted for 84(42.0%) of the positive cases while the females accounted for 65(32.5%). This difference is however not statistically significant ( $P>0.05$ ).

The number of positive cases in relation to the hospitals/clinics was as follows: the PHC clinics accounted for 54.5% of the positive cases, OLA, 11.0% and ECWA 9.0% (Table 2).

Five (5) bacterial species were identified: *Streptococcus pneumoniae*, *Moraxella catarrhalis*, *Staphylococcus aureus*, *Streptococcus pyogenes* and *Corynebacterium sp.*

In terms of number and frequency in occurrence of the isolated bacteria species, *Streptococcus pneumoniae*, 75(37.31%) was the most common bacteria isolated followed by *Moraxella catarrhalis* with 67(33.33%), *Staphylococcus aureus* 31(15.12%), *Streptococcus pyogenes* 21(10.45%) and *Corynebacterium sp* with the least occurrence of 7 (3.48%) -Table 3.

**Table 1: Age and Sex Distribution of Children Positive for Upper Respiratory Tract infection.**

Age (Months)	Males		Females		Total No. Examined	Total No. (%) positive
	No Examined	No.(%) positive	No. Examined	No. (%) positive		
0-5	21	1(16.35)	18	16(16.67)	39	33(16.5)
6-11	27	2 (21.15)	14	8(8.33)	41	30(15.0)
12-17	13	11 (10.57)	15	12 (12.50)	28	23(11.5)
18-23	10	8 (7.69)	12	7 (7.29)	22	15 (7.5)
24-29	9	8 (7.69)	7	2 (2.08)	16	10 (5.0)
30-35	9	6 (5.77)	11	8 (8.33)	20	14 (7.0)
36-41	7	6 (5.77)	10	6(6.25)	17	12 (6.0)
42-47	4	3 (2.88)	5	3 (3.13)	9	6 (3.0)
48-53	2	1 (0.96)	3	2 (2.08)	5	3 (1.5)
54-59	2	2 (1.92)	1	1 (1.04)	3	3 (1.5)
<b>Total</b>	<b>104</b>	<b>84 (42.0)</b>	<b>96</b>	<b>65 (32.5)</b>	<b>200</b>	<b>149 (74.5)</b>

**Table 2: Number of Positive cases in relation to the hospitals/clinics.**

Hospital	No. Examined	No. Positive	% Positive
PHC	145	109	54.5%
OLA	25	22	11.0%
ECWA	30	18	9.0%
<b>Total</b>	<b>200</b>	<b>149</b>	<b>74.5%</b>

PHC – Primary Health Care Centre (Jos Township/Nasarawa Gwom)

OLA – Our Lady of Apostle’s Hospital

ECWA – Evangel Hospital.

**Table 3: Morphological and Biochemical Characterization of the Isolated Organisms**

Tests	A	B	C	D	E
Gram staining	Gram +ve	Gram -ve	Gram +ve	Gram +ve	Gram +ve
Morphology (microscopy)	Diplococci	Diplococci	Clustered cocci	Cocci in chains	Coccobacilli
Catalase	-	+	+	-	+
Coagulase	-	-	+	-	-
Oxidase	ND	+	ND	ND	+
Nitrate reductase	ND	+	+	ND	ND
Bacitracin	ND	ND	ND	+ve	ND
Optochin	+	ND	ND	ND	ND
Number of isolates	75	67	31	21	7

**Keys:**

A - *S.pneumoniae*

B - *M.catarrhalis*

C - *S.aureus*

D - *S.pyogenes*

E - *Corynebacterium species*

ND-Not Done

**DISCUSSION**

The results of this study have identified the important bacterial pathogens associated with URTI in children less than 5 years in the Jos metropolis. The most prevalent organisms were *Streptococcus pneumoniae*, *Moraxella catarrhalis* and *Staphylococcus aureus*. Similar studies carried out by Berman<sup>2</sup> reported that the most important bacterial agents associated with acute respiratory infections in children of developing countries include *Streptococcus*

*pneumoniae*, *Haemophilus influenzae* and *Staphylococcus aureus*. In this study however, in addition to the above listed organisms, *Moraxella catarrhalis* was also isolated even at higher frequency than *Staphylococcus aureus*.

The high frequency of occurrence of *Streptococcus pneumoniae* (37.31%) and *Moraxella catarrhalis* (33.33%) could be due to their commensal status in the nasopharynx. This is because they are potential pathogenic bacteria

that are often present in nasopharyngeal samples taken from healthy children and even adults<sup>9</sup>.

Colonization of the URTI with *M.catarrhalis* has been reported to range from 28-100% in the first year of life<sup>3</sup>. It has also been noted that the prevalence of pathogenic bacteria in healthy individuals decreased with age<sup>9</sup>, which was also the case in this study as there was an appreciable decline in isolation of organism with age.

Capelletty<sup>13</sup> also reported that the URT may become susceptible to bacteria infection as a result of health condition such as allergies and viral infections, as well as the effects of smoke and air borne environmental pollutants with *Streptococcus pneumoniae*, *Haemophilus influenzae* and *Moraxella catarrhalis* being the most common bacterial pathogens in both upper and lower RTIs. The author further stated that *Streptococcus pyogenes* is the predominant bacterial pathogen in pharyngitis and tonsillitis, which also may have been the reason of the 10.45% isolation of *S.pyogenes* in this study. However, the 3.48% of *Corynebacterium sp.* isolated could be worrisome. Children in Nigeria are routinely vaccinated against

diphtheria using the DTP vaccine. More studies need to be carried out to ascertain if this occurrence is not related to vaccine failure or due to some antigenic variation among the *Corynebacterium species*.

In a study on the knowledge, attitude and practice of mothers and child carriers to acute respiratory infections in five (5) communities of Isuikwato Local Government Area of Abia State, Nigeria carried out by Idika *et al*<sup>14</sup> it was reported that the knowledge, attitude and practice of mothers and child carriers were inadequate thus affecting early detection and appropriate treatment. This may account for the seemingly high prevalence recorded in this study. If this assertion is valid, then training programmes and health education campaigns should be organized to improve the home management of acute respiratory infections. Also Douglas<sup>4</sup> in a study carried out in Caribbean Australia on acute respiratory infections in children in the developing world stated that a case management approach making antibiotics available on a rationale basis worldwide, is capable of saving lives, and until mothers in the developing world have

confidence in the survival of their children, they are likely to be attracted to control their fertility.

The isolation of different bacterial species from the upper respiratory tract of children with symptoms of upper respiratory tract infections revealed that bacteria are associated with most of the URTI. Therefore, it is necessary to give greater attention to children so as to detect the early signs of the infection (i.e. the initial viral infection). Also bacterial aetiologic agents should be routinely sort for to avoid indiscriminate abuse of antibiotics which may lead to bacterial resistance. Predictive values of throat and nasopharyngeal cultures, taking symptomatic carriers into consideration, would be an aid in understanding the usefulness of these cultures and to proffer the appropriate treatment.

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