

**Short Communication****Open Access****Bacteriological profiles of acute suppurative otitis media in children in Brazzaville, Congo**<sup>1</sup>Otuouana Dzon, H. B., <sup>1</sup>Ngouoni, G. C., <sup>2</sup>Diembi, S., <sup>1</sup>Tsierie-Tsoba, A., <sup>3</sup>Kambourou, J., <sup>1</sup>Itiere-Odzili, F. A., and <sup>1</sup>Ondzotto, G.<sup>1</sup>Otolaryngology Department, Brazzaville University Hospital Center, BP 13356, Congo<sup>2</sup>Otolaryngology Department, General Hospital, Adolph Sicé, Congo<sup>3</sup>Paediatric Intensive Care Department, Brazzaville University Hospital Center, CongoCorrespondence to: [hb.otouana@gmail.com](mailto:hb.otouana@gmail.com); (00242) 069422411**Abstract:****Background:** Acute suppurative otitis media (ASOM) is one of the main indications for antibiotic prescription in children. The close proximity of the middle ear to the brain and the increasing resistance of microbial organisms involved in otitis media make this pathology of great concern in children. The objective of this study is to determine the bacteriological profile of acute otitis media in Congo as a guide to the choice of antibiotics for empirical therapy.**Methodology:** A cross sectional study of children less than 17 years old with acute suppurative otitis media in the otorhinolaryngology service of the Brazzaville University Hospital, Congo, was conducted over a 14 month period. All subjects whose samples were sterile or contaminated (poly-microbial culture) and those who received antibiotic-corticosteroid therapy were excluded. The identification of bacteria to species level was done using conventional biochemical identification tests scheme. Antibiotic sensitivity was performed on isolates using the modified Bauer Kirby disk diffusion test on plain Mueller Hinton (MH) agar and MH agar with 5% horse blood.**Results:** Four bacteria families/species were identified; *Staphylococcus aureus* (32.7%), family Enterobacteriaceae (28.6%), *Streptococcus pneumoniae* (26.5%) and *Pseudomonas aeruginosa* (12.2%). *Ps. aeruginosa* was associated with greenish otorrhea while *S. aureus*, Enterobacteriaceae and *S. pneumoniae* were associated with yellowish otorrhea ( $p = 0.001$ ).**Conclusion:** The bacterial aetiology of acute suppurative otitis media varies from country to country. In Congo, this study reports four main bacteria families/species involved in acute otitis media with high resistance to  $\beta$ -lactam antibiotics but high sensitivity to macrolides and fluoroquinolones.**Key words:** otitis; child; antibiogram; bacteria; Brazzaville

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Copyright 2019 AJCEM Open Access. This article is licensed and distributed under the terms of the Creative Commons Attribution 4.0 International License (<http://creativecommons.org/licenses/by/4.0>), which permits unrestricted use, distribution and reproduction in any medium, provided credit is given to the original author(s) and the source.**Profils bactériologiques de l'otite moyenne suppurative aiguë chez les enfants à Brazzaville, Congo**<sup>1</sup>Otuouana Dzon, H. B., <sup>1</sup>Ngouoni, G. C., <sup>2</sup>Diembi, S., <sup>1</sup>Since-Tsoba, A., <sup>3</sup>Kambourou, J., <sup>1</sup>Itiere-Odzili, F. A., et <sup>1</sup>Ondzotto, G.

1 Département d'oto-rhino-laryngologie, Centre hospitalier universitaire de Brazzaville, BP 13356, Congo

2 Département d'oto-rhino-laryngologie, Hôpital général, Adolph Sicé, Congo

3 Service de soins intensifs pédiatriques, Centre hospitalier universitaire de Brazzaville, Congo

Correspondance à: [hb.otouana@gmail.com](mailto:hb.otouana@gmail.com); (00242) 069422411**Abstrait:****Contexte:** L'otite moyenne suppurative aiguë est l'une des principales indications de la prescription d'antibiotiques chez les enfants. La proximité de l'oreille moyenne au cerveau et la résistance croissante des organismes microbiens impliqués dans l'otite moyenne rendent cette pathologie extrêmement préoccupante

chez les enfants. L'objectif de cette étude est de déterminer le profil bactériologique de l'otite moyenne aiguë au Congo en tant que guide pour le choix des antibiotiques pour un traitement empirique.

**Méthodologie:** Une étude transversale sur les enfants de moins de 17 ans atteints d'otite moyenne suppurée aiguë dans le service d'otorhinolaryngologie de l'hôpital universitaire de Brazzaville au Congo a été menée sur une période de 14 mois. Tous les sujets dont les échantillons étaient stériles ou contaminés (culture polymicrobienne) et ceux ayant reçu un traitement antibiotique-corticostéroïde ont été exclus. L'identification des bactéries au niveau de l'espèce a été réalisée à l'aide d'un programme d'essais d'identification biochimique conventionnel. La sensibilité aux antibiotiques a été réalisée sur des isolats en utilisant les tests de diffusion sur disque Bauer Kirby modifiés sur gélose Mueller Hinton (MH) et gélose MH avec 5% de sang de cheval.

**Résultats:** Quatre familles/espèces de bactéries ont été identifiées. *Staphylococcus aureus* (32,7%), la famille des Enterobacteriaceae (28,6%), *Streptococcus pneumoniae* (26,5%) et *Pseudomonas aeruginosa* (12,2%). *Ps. aeruginosa* était associé à une otorrhée verdâtre, alors que *S. aureus*, Enterobacteriaceae et *S. pneumoniae* étaient associés à une otorrhée jaunâtre ( $p = 0,001$ ).

**Conclusion:** L'étiologie bactérienne de l'otite moyenne suppurée aiguë varie d'un pays à l'autre. Au Congo, cette étude fait état de quatre familles / espèces de bactéries principales impliquées dans les otites moyennes aiguës présentant une résistance élevée aux antibiotiques  $\beta$ -lactames mais une sensibilité élevée aux macrolides et aux fluoroquinolones.

**Mots-clés:** otite; enfant; antibiogramme; les bactéries; Congo Brazzaville

## Introduction:

Acute suppurative otitis media is bacterial infection of the middle ear cavities with purulent effusion that collects in the middle ear and become externalized as ear discharge (1, 2). It is the usually the first bacterial infection in children under two years of age and one of the leading indication for antibiotic prescription (3, 4). However, the proximity of the middle ear to the brain on the one hand and the increasing resistance of microorganisms to antibiotics on the other hand make otitis media of serious concern in young children (1-3).

The causative pathogens of otitis media vary depending on geographical location and pathogen distributions. In France, the causative organisms such as *Streptococcus pneumoniae*, *Haemophilus influenzae* and *Moraxella catarrhalis* are well established for otitis media thus the choice of antibiotics for empirical therapy is guided (2, 5, 6). This however is not the case in Congo, where no study on bacterial ecology of acute suppurative otitis media has been performed. In order to guide empirical antibiotic therapy, this study aimed to assess the bacteriological profile of microbial pathogens responsible for acute suppurative otitis media in Congo.

## Material and methods:

### Study setting and design

This was a cross-sectional study performed in the otorhinolaryngology service of the Brazzaville University Hospital and the National Public Health Laboratory over a period of 14 months (01 October 2013 to 30 November 2014).

### Subjects, inclusion and exclusion criteria

The subjects were children less than 17 years old with acute suppurative otitis media whose otorrhea had occurred less

than 6 weeks. All subjects whose samples were sterile or contaminated (poly-microbial culture) and those who received antibiotic-corticosteroid therapy were excluded.

### Sample collection and culture isolation of bacteria

Ear discharge was collected with sterile swabs after careful disinfection of the auricle. Two samples were taken per patient, which were sent immediately to the National Laboratory of Public Health in thermostable containers for processing. The first sample was used for direct examination by Gram stain microscopy and the second for aerobic culture and isolation of bacteria. The culture media inoculated according to the Gram reaction were Mueller Hinton (MH) and Eosin Methylene Blue (EMB) agar. The identification of bacteria to species level was done using conventional biochemical identification tests scheme.

### Antibiotic sensitivity testing

Antibiotic sensitivity was performed on isolates using the modified Bauer Kirby disk diffusion test on plain MH agar and MH agar with 5% horse blood.

### Data and statistical analysis

Data for analysis entered into Microsoft Excel spreadsheet included age and gender of subjects, macroscopic appearance of otorrhea, Gram reactions, frequency of isolation and susceptibility profiles of bacterial species. Data were analyzed with EPIINFO3.5.4 software Chi square test was used to measure association between types of otorrhea and isolated bacteria, with  $p < 0.05$  taken as significant.

## Results:

A total of 63 patients had clinical features of acute suppurative otitis media out of 716 patients who received pediatric

consultation during the period of study, representing 8.7% or 1.2 cases of acute suppurative otitis media per week. The mean age of subjects was 3 years with 40 (63%) males and 23 (37%) females (a ratio of 1.7:1). The difference in occurrence of ASOM between male and female gender was not statistically significant ( $p > 0.05$ ). Specimens were positive for bacteria in 49 of the 63

patients (78%); Gram-positive cocci in 29 (59%) and Gram-negative bacilli in 20 (41%). Table 1 shows the different species of bacteria isolated, and this differ according to the macroscopic appearance of ear discharge ( $p = 0.001$ ) (Table 2). The susceptibility of bacteria isolates to antibiotics is shown in Table 3.

Table 1: Isolated bacteria from acute suppurative otitis media in Brazzaville, Congo

Bacteria family	Isolated species	Frequency (%)
Micrococcaceae	<i>Staphylococcus aureus</i>	16 (33)
Enterobacteriaceae	<i>Enterobacter species</i>	6 (12)
	<i>Escherichia coli</i>	3 (6)
	<i>Klebsiella pneumoniae</i>	2 (4)
	<i>Proteus mirabilis</i>	1 (2)
	<i>Proteus vulgaris</i>	1 (2)
	<i>Acinetobacter species</i>	1 (2)
Streptococcaceae	<i>Streptococcus pneumoniae</i>	13 (27)
Pseudomonaceae	<i>Pseudomonas aeruginosa</i>	6 (12)
	Total	49 (100)

Table 2: Isolated bacteria and appearance of otorrhea in acute suppurative otitis media in Brazzaville, Congo

Bacteria	Otorrhoea		Total (%)
	Yellowish (%)	Greenish (%)	
<i>Staphylococcus aureus</i>	10 (21)	6 (12)	16 (33)
Enterobacteriaceae	12 (24)	1 (2)	13 (26)
<i>Streptococcus pneumoniae</i>	10 (21)	4 (8)	14 (29)
<i>Pseudomonas aeruginosa</i>	0	6 (12)	6 (12)
Total	32 (65)	17 (35)	49 (100)

Table 3: Susceptibility of bacteria isolates to antibiotics in acute suppurative otitis media in Brazzaville, Congo

Antibiotics	<i>S. aureus</i> (%)	Enterobacteriaceae (%)	<i>S. pneumoniae</i> (%)	<i>P. aeruginosa</i> (%)
Oxacillin	9 (56.3)	8 (57.1)	5 (38.5)	0
AMC	0	0	0	0
Cefalexin	11 (68.8)	12 (85.7)	9 (69.2)	0
Ceftriaxone	5 (31.3)	3 (21.4)	5 (38.5)	4 (66.7)
Erythromycin	0	7 (50)	0	6 (100)
Spiramycin	0	4 (28.6)	0	3 (50)
Ciprofloxacin	14 (87.5)	3 (21.4)	6 (46.2)	6 (100)
Norfloracin	10 (34.5)	7 (24.1)	12 (41.4)	0
Ofloxacin	2 (12.5)	7 (50)	9 (69.2)	3 (50)

AMC = amoxicillin-clavulanic acid

## Discussion:

In this study, acute suppurative otitis media accounted for 8.7% of paediatric consultations in Brazzaville University Hospital (approximately 1.2 cases per week). This incidence seems low compared to the reports of other authors, in particular Levy et al., who reported a higher incidence of 6 cases per week (7). In contrast, Asse et al., reported a much lower incidence of 5 cases per 1000 admissions (8).

We found 49 positive cultures, which represented 77.8% of the total patients sampled. The high proportion of positive cultures is explained by the mode of transport of the sterile swabs in thermostable containers. It is indeed recommended to transport the samples in preservative tubes to prevent the degradation of fragile bacteria (9). The groups of Gram positive and negative cocci reported in this study were also reported by Hounkpatin et al., in Benin (10) but the causative organisms of otitis media are known to vary from country to country.

In France, *H. influenzae* and *M. catarrhalis* are predominant pathogens involved in acute otitis media (11-14) but these organisms were not involved in bacterial ecology of otitis media in our study. Rather, *S. aureus*, Enterobacteriaceae, *S. pneumoniae* and *Ps. aeruginosa* were isolated. In Benin and Cote d'Ivoire, the main isolated organisms were also *S. aureus* and *Ps. aeruginosa* (10, 15), which agrees with our study. In Tunisia however, the predominant organisms were *H. influenzae*, *S. pneumoniae* and *Streptococcus pyogenes* (16).

The appearance of otorrhea may correlate with the bacterial species involved in acute suppurative otitis media. We found that yellowish otorrhea was associated with *S. aureus*, Enterobacteriaceae and *S. pneumoniae* while *Ps. aeruginosa* produced greenish otorrhea ( $X^2=15.76$ ,  $p=0.001$ ). Tanon-Anoh et al., in Cote d'Ivoire reported that yellowish and greenish otorrhea were the two commonly encountered discharges in ASOM though the authors did not report any possible correlation with the causative organisms (15). While some bacteria produce enzymes that enable them break down host cells to produce purulent secretions, others are able to produce pigments responsible for the appearance of discharge. This is the case of pyoverdine which is a pigment produced only by certain strains of family Pseudomonaceae such as *Ps. aeruginosa* responsible for greenish otorrhea (17).

All isolated organisms in this study were resistant to the amoxicillin-clavulanic

acid combination. This high resistance rate in our study can be explained by the fact that there has been inappropriate and over use of this antibiotic combination in Congo (10). Among the beta-lactams tested, only cefalexin was effective on Enterobacteriaceae, but the use of this antibiotic in Congo must be judiciously monitored.

The *S. aureus* isolates were sensitive to ciprofloxacin while the *S. pneumoniae* isolates were susceptible to ofloxacin. Although, the efficacy of the quinolones in this study is encouraging, they must be used with caution in children under 10 years of age because of their potential deleterious effects on growth cartilages (18). The high sensitivity of *S. pneumoniae* to ofloxacin and cefalexin in our study is contrary to the observations of other authors (10, 19, 20). *Ps. aeruginosa* which has been reputed to be resistant to several antibiotics (10), was however 100% sensitive to ciprofloxacin and erythromycin in our study.

## Conclusion:

Acute suppurative otitis media in children is a relatively common condition depending on whether it is paediatric or otolaryngological consultation. Contrary to what obtains in the Western countries where *H. influenzae*, *S. pneumoniae* and *M. catarrhalis* are predominant pathogens of ASOM, in Congo the predominant pathogens are *S. aureus*, family Enterobacteriaceae, *S. pneumoniae* and *Ps. aeruginosa*. Thus empirical antibiotic therapy of ASOM in Congo should cover for these pathogens for effective treatment in order to prevent complications and development of resistance.

## Conflict of interest:

No conflict of interest is declared

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