

# Retrospective Study on the Antibiotic Sensitivity Pattern of Bacterial Isolates in Patients with Chronic Suppurative Otitis Media at the National Ear Care Centre Kaduna, Nigeria

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## ABSTRACT

**Background:** The management of Chronic Suppurative Otitis Media primarily employs the use of antimicrobial agents. In light of varying susceptibility of the infective organisms associated with Chronic Suppurative Otitis Media to antimicrobials; with respect to geography, patient peculiarities and rise in antimicrobial resistance, it is important to study these patterns of susceptibility/resistance to aid in rational use of antimicrobials. Knowing these patterns would help curtail excessive (most times, unjustifiable) use of antimicrobials, leading to reduced side effects and cost. Hence, this study is aimed at studying these patterns at the National Ear Care Centre, Kaduna, Nigeria.

**Methods:** The study was conducted in the National Ear Care Centre, Kaduna. It involved a retrospective review of Culture and sensitivity results of patients across all age groups who presented to the National Ear Care Centre, Kaduna, within a period of 2 years (February 2018 – January 2020). Total number of 315 cases identified, with 253 case files retrieved. Sensitivity data (for cases with such) were extracted and entered into Microsoft Excel 2010 for descriptive analysis.

**Results:** Of the 315 patients who presented with CSOM, only 253 (80.32%) case files were accounted for. Patient ages ranges from 0.2 years to 78 years (Mean age 22.8 years), prevalence highest amongst age group 0-5 years (n=69, 21.9%). Clinical Isolates were *Pseudomonas aeruginosa* (n=32, 50.0%), *Staphylococcus aureus* (n=20, 31.25%), *Streptococcus specie* (n=5, 7.81%), *Candida specie* (n=3, 4.69%), *Proteus specie* (n=2, 3.13%), *Klebsiella specie* (n=1, 1.56%) and *Escherichia coli* (n=1, 1.56%); *Staphylococcus aureus*, *Pseudomonas specie*, *Streptococcus specie*, *Proteus specie* and *Candida specie* isolates were found to predominate in male. Antibiotic sensitivity was greatest with the Quinolones (89.4%), amongst all the recommended antimicrobials for treating Chronic Suppurative Otitis Media, which are involved in this study.

**Conclusion:** This study showed that both gram positive and gram negative bacteria are significantly involved in the aetiology of Chronic Suppurative Otitis Media with single bacteria specie involved in majority of cases. Treatment is best guided by Culture and sensitivity data. However, the broad spectrum antibiotics (Quinolones) are the best option for empirical treatment.

## 1. Introduction

Chronic Suppurative Otitis Media (CSOM) is a chronic inflammatory process involving the middle ear cleft, resulting in irreversible pathological changes, with perforation of the tympanic membrane, through which a mucoid or mucopurulent discharge is emitted recurrently or persistently, for a duration of at least 8 weeks <sup>1,2,3</sup>. Chronic Suppurative Otitis Media is the most common cause of visit to the otolaryngology clinic in Nigeria, and the common ENT condition responsible for Children visit to the General

Practitioner <sup>1, 4</sup> and has significant morbidity <sup>1</sup>. The occurrence of CSOM is common in the developing world, with higher prevalence in children aged 0 – 5 years <sup>1,3,5,6</sup>. Sex distribution of cases showed higher incidence in Males than in Females <sup>3, 4, 5, 6</sup>. The two most important aetiologies in CSOM are Eustachian Tube (ET) dysfunction and Microbiological colonization of the middle ear through a perforated Tympanic Membrane or through the dysfunctional ET from the nasopharynx <sup>1</sup>. It is however, argued that bacteria isolate from ears with CSOM are

secondary invaders of mucosa which is inflamed because of other factors rather than that they are the primary cause of the disease<sup>6</sup>. Pathogenesis is multifactorial, with genetic and environmental factors implicated, as well as the anatomical and functional characteristics of the ET<sup>1</sup>. It may occur as end result of untreated/poorly managed Acute Otitis Media<sup>4</sup>. Signs and Symptoms includes history of otorrhoea (intermittent or continuous), hearing loss, perforated membrane, edematous middle ear mucosa (sometime forms polyps), and occasional pain, indicating a more invasive pathology<sup>7, 8</sup>. Management options for CSOM include aural toileting, topical and systemic antibiotics, and surgical procedures<sup>1, 2</sup>. Poorly managed CSOM may result in serious (sometimes life-threatening) complications ranging from facial paralysis to encephalitis amongst others<sup>1, 2</sup>. Hearing loss (conductive & sensorineural) is often an outcome<sup>1</sup>.

Clinical Isolates in cases of CSOM commonly includes *Pseudomonas aeruginosa* (9.5 – 31.3%), *Staphylococcus aureus* (13.5 – 37.8%), *Klebsiella spp.* (5.3 – 23.9%), *Proteus spp.* (14.9 – 24.2%), *Escherichia coli* (1.7 – 8.6%), *Streptococcus spp.* (5.5 – 5.9%), Atypical coliforms (8.6 – 34.7%), *Candida spp.* (0.1 – 3.8%), and *Serratia spp.* (1.3%)<sup>3, 4, 5, 6</sup>. Antibiotic therapy, being the mainstay of CSOM management, is threatened by the constant rise in resistance associated with irrational use of antimicrobials. To curtail the rapid development of resistance to antimicrobials, it is important to emphasize on the implementation of rational prescription and use of these chemotherapeutic agents. One way to achieve that is by evidence based prescribing, guided by sensitivity data. Hence, this work is aimed at studying the microbiological pattern of isolates in CSOM and their sensitivities to various antibiotics, within the National Ear Care Centre, Kaduna.

## 2. Methods

**2.1. Study design:** This study was a retrospective chart review of patients with Chronic Suppurative Otitis Media, who presented to the National Ear Care Centre, Kaduna, between January 2, 2018 and February 28, 2020. Study involved all patients that presented with CSOM to the National Ear Care Centre, Kaduna within the period under review

### 2.2. Inclusion Criteria

- People of all ages and both sexes, who were diagnosed with CSOM within the review period.

### 2.3. Exclusion Criteria

- CSOM with Cholesteatoma
- Acute Suppurative Otitis Media (AOM)
- Otitis Media with Effusion (OME)
- CSOM with Complications.

**2.4. Data collection and analysis:** Convenience sampling was adopted. Using the electronic register, all cases of CSOM diagnosed over a 2-year period at the National Ear Care Centre between January, 2018 and February, 2020, were extracted. Secondary data was obtained from retrieved Case files of these patients; Information obtained includes age, sex, and culture and sensitivity data. Collected data was entered into Microsoft Excel 2010 for descriptive analysis, and results presented on charts. Ethical approval was obtained from the Health Research ethics Committee of the National Ear Care Centre, Kaduna (NECC/ADM/214/V/116).

## 3. Results

Total records of 315 patients diagnosed with CSOM were identified, with 253 (80.32%) patient records retrieved. Patients were aged 0.2years to 78 years (mean 22.8 years). Amongst the total number of patients identified with CSOM (315), distribution is highest in age group 0-5years (n=69, 21.9%), with higher occurrence in Male (n=40, 57.97%) within the said age group (Fig. 1A). However, there was no significant difference in sex distribution of cases in the total population. 65 patients (25.69% of patients whose records were retrieved) had culture results (total of 80 sampled ears), amongst which 51 presented with unilateral discharge and 14 had bilateral discharge. Of the 80 cultured samples, 67 yield positive cultures with 13 showing no growth. Six different isolates were obtained from culture results with a total frequency of 64. Five of the cultured samples showed mixed infections. Of the isolates, *Pseudomonas aeruginosa* has the highest distribution (n=32, 50.00%), then *Staphylococcus aureus* (n=20, 31.25%), *Streptococcus specie* (n=5, 7.81%), *Candida specie* (n=3, 4.69%), *Proteus specie* (n=2, 3.13%), *Klebsiella specie* (n=1, 1.56%) and *Escherichia coli* (n=1, 1.56%), in descending order of distribution (Fig. 1B). Distribution of the isolates with respect to age grouping showed *Pseudomonas aeruginosa* to have the highest occurrence in age groups 0-5, 6-12, 13-19, 30-39, 40-49 and 50-59 years; with peak distribution at

6-12 years. *Staphylococcus aureus* is next with similar distribution pattern as seen in Figure 2. Distribution of the Isolates of *Staphylococcus aureus*, *Pseudomonas aeruginosa*, *Streptococcus specie*, *Proteus species*, and *Candida specie* were higher in Male while that of *Klebsiella specie* and *Escherichia coli* was higher in females (Figure 3).

Result of the antibiotic sensitivity is presented on figure 4 below. It is seen that among the antibiotics commonly used for CSOM (with respect to safety and minimal toxicity), the fluoroquinolones as a class, are superior in degree of effectiveness with average sensitivity of 89.4%. Ofloxacin stand out as the most effective member of the class with average of 99.2%. The fluoroquinolones owe their performance to not just being a class of broad spectrum antibiotics, but

also for their activity against *Pseudomonas aeruginosa*. Of the Beta lactam group, Augmentin (Amoxicillin/Clavulanate) and Erythromycin are the two agents with appreciable performance having averages of 79.3% and 86.9%, respectively. With their more favourable toxicity profile compared to most antibiotics, there is no surprise they are the recommended first line Pharmacotherapeutic option in practice. They are a better option in children population. Another agent worthy of consideration is Co-trimoxazole, with moderate average sensitivity of 63.3%. The Aminoglycosides, however, having good average sensitivity (79.8%), and were used (still used without advice from health professionals) topically (as ear drops) for this condition have the set back of having the adverse effect of Ototoxicity.

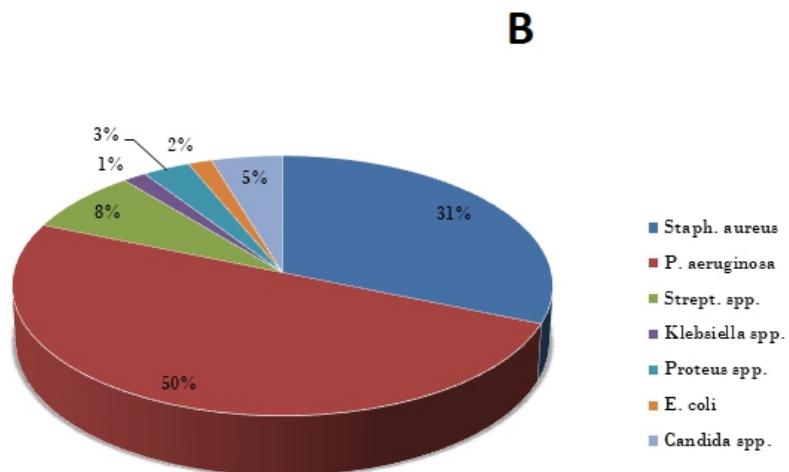
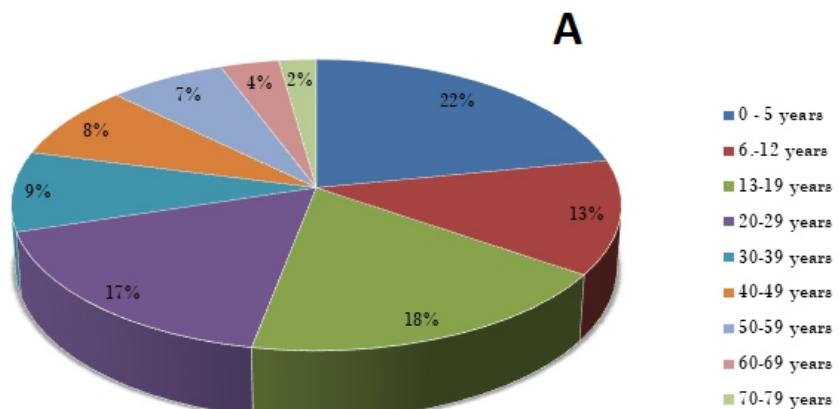


Figure 1 (A) Age Distribution of all CSOM Cases (B) Distribution of Culture Isolates of CSOM

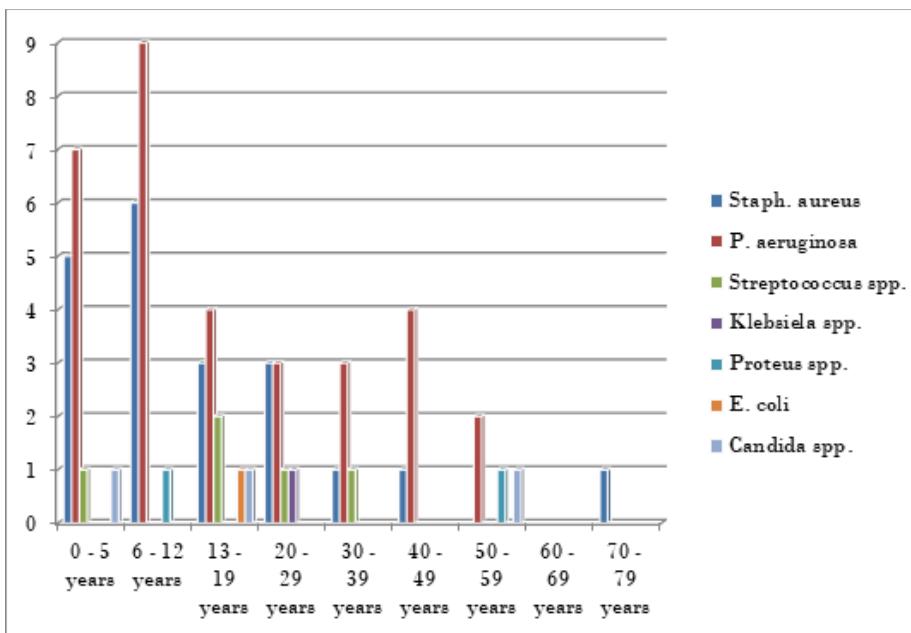


Figure 2: Varying bacterial Isolates Distribution identified in relation to age of patients.

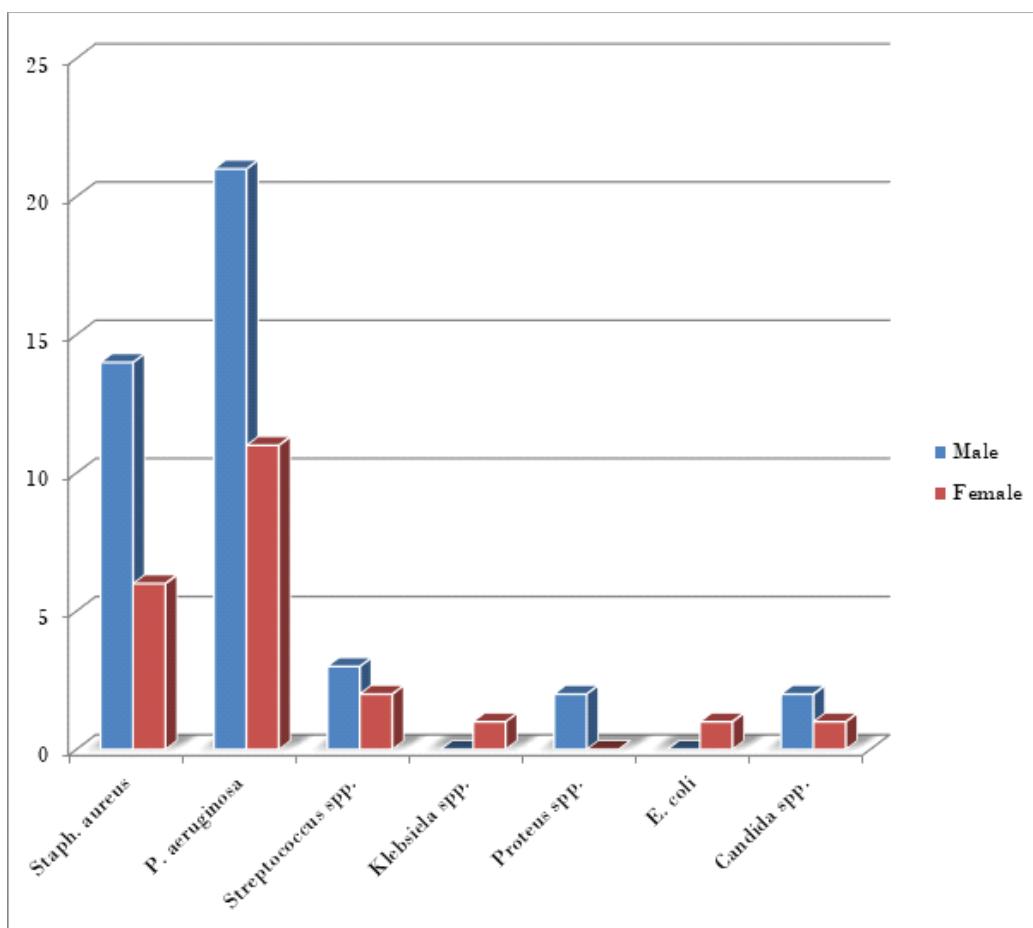
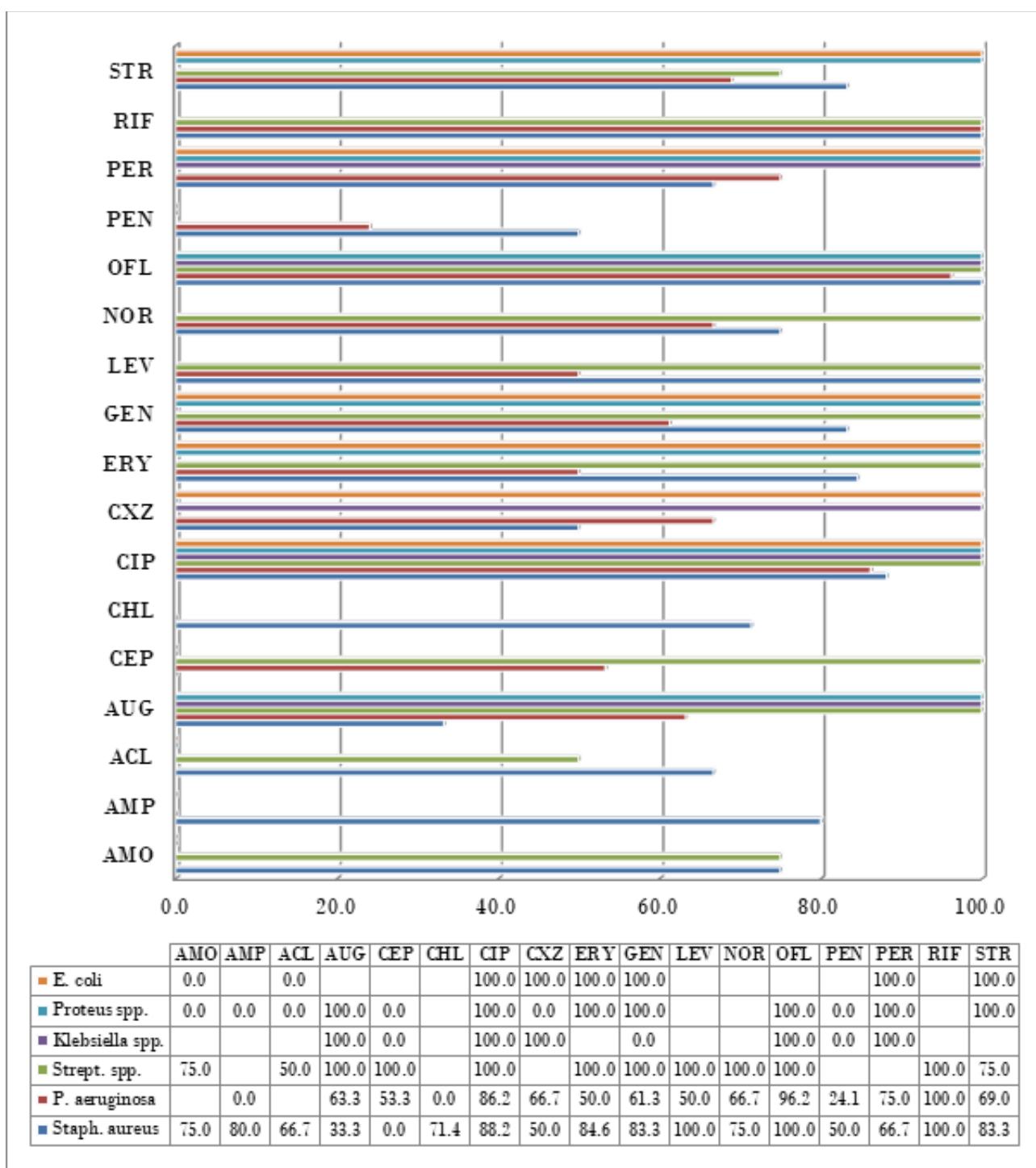


Figure 3: Bacterial isolate distribution in relation to sex of patients.



**Figure 4: Antibiotic Susceptibility**

Note: AMO= Amoxicillin, AMP= Ampicillin, ACL= Ampicillin/Cloxacillin, AUG= Augmentin, CEP= Cephalexin, CHL= Chloramphenicol, CIP= Ciprofloxacin, COT= Co-trimoxazole, ERY= Erythromycin, GEN= Gentamicin, LEV= Levofloxacin, NOR= Norfloxacin, OFL= Ofloxacin, PEN= Penicillin, PER= Perfloxacine, RIF= Rifampicin, STR= Streptomycin.

#### 4. Discussion

The purpose of this study was to assess the pattern of antibiotic sensitivity of bacteria isolates in cases of Chronic Suppurative Otitis Media within the National Ear Care Centre, Kaduna. A higher prevalence rate of chronic suppurative otitis Media to be at 1.08%, lower than reported in a similar study conducted in the Centre<sup>9</sup>. A close gender ratio was observed as with previous study<sup>9</sup>, though studies elsewhere suggest a higher incidence in Male than in Female<sup>3-6</sup>. The closeness of this ratio could be a result of improved awareness on the importance of hospital visits for women. Prevalence amongst Children aged 0 – 5 years was highest of all age groups corresponding with results from other studies<sup>1, 6</sup>. Factors contributing to that predisposition in children have been reported, and include anatomical & immunological factors peculiar to children<sup>1</sup>.

The bacteriological pattern obtained at the end of this study showed a number of bacteria, commonly associated with Chronic Suppurative Otitis Media, to also be the agents within the Centre. Bacteria isolates of significant frequency of occurrence are *Pseudomonas aeruginosa*, then *Staphylococcus aureus*. The result obtained differed from that obtained a few years ago in the same Centre<sup>9</sup>. Though Microorganisms are widely accepted as the main aetiological factor in CSOM, and are most times the primary focus in treatment, a study pointed that they could arguably be important secondary invaders of an already inflamed mucosa, due to an underlying primary cause other than the microorganisms<sup>6</sup>. Major treatment approaches involve the use of antibiotics (Topical and/or Systemic), which calls for judicious and evidence-based approach guiding the prescription of antimicrobials. The rise in antimicrobial resistance is a global threat<sup>10</sup>, confounded by irrational use of antimicrobials<sup>11</sup>. The sensitivity result from this study showed the Quinolone class as the most effective, as with other studies<sup>3, 5, 6</sup>, with Ofloxacin standing out as the most effective member of the class. The aminoglycosides are the more effective, next to the Quinolones. The widely used β lactams showed outstanding result against the gram positive isolates, with reduced activity against the gram negative isolates. Considering safety and effectiveness, the Quinolones are the most favourable agents to use in majority of cases where no contraindication is established. A Similar study conducted at the National

Ear Care Centre also arrived at a similar conclusion<sup>9</sup>, likewise in another study in the Northcentral state of Ilorin<sup>6</sup>. A study carried out in Gombe State-northern Nigeria, however arrived at a different conclusion, recommending Gentamicin, Cefuroxime, and Cephalexin<sup>4</sup>.

#### 5. Conclusion

The study revealed an almost equal frequency of occurrence both gram positive and gram negative organisms in Chronic Suppurative Otitis Media. This point in favour of the use of broad spectrum antibiotics for empirical treatment, also suggesting treatment is guided by culture and sensitivity data where feasible. The group of antibiotics shown to be most effective was the quinolones. Using the most effective treatment option and guided by sensitivity results, would help in quick resolution of this condition, reducing morbidity and complications. Slowing down the progression of antimicrobial resistance is another possible outcome that may be achieved.

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