Bacteriological profile of childhood sepsis at a tertiary health centre in southern Nigeria.

*Oliemen Peterside¹, Kemebradikumo Pondei², Oyedeji O Adeyemi¹

¹Department of Paediatrics and Child Health, Niger Delta University Teaching Hospital, Okolobiri, Bayelsa State, Nigeria
²Department of Medical Microbiology, Niger Delta University Teaching Hospital, Okolobiri, Bayelsa State, Nigeria

*Corresponding Author:

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ABSTRACT

Introduction: Sepsis is a leading cause of morbidity and mortality in children worldwide, even more so in developing countries. Knowledge of common pathogens and their antibiotic susceptibility pattern is useful for guiding initial treatment while awaiting blood culture results.

Objective: To determine the major causative organisms and their antibiotic sensitivity pattern of childhood sepsis at the Niger Delta University Teaching Hospital (NDUTH), with the aim of revising existing treatment protocols.

Methods: Within a 2 year period (1st January 2014 to 31st December 2015) blood culture results of children with clinical suspicion of sepsis were retrospectively studied.

Results: During the study period, 116 (12.11%) of the 958 children admitted into the Children Emergency Ward had blood culture tests. Thirty one (26.72%) had positive blood cultures. Eighteen (58.06%) of the organisms were gram positive while thirteen (41.93%) were gram negative. The predominant organism was Staphylococcus aureus in 16 (51.61%) followed by Klebsiella pneumoniae in 5 (16.13%) patients. The bacterial isolates demonstrated the highest sensitivity to the quinolones.

Conclusion: There is need for periodic surveillance of the causative organisms and antibiotic susceptibility pattern of childhood sepsis to guide effective management of patients.

Keywords: Childhood sepsis, bacteriological profile, antibiotic susceptibility

I. INTRODUCTION

Sepsis is systemic inflammatory response syndrome (SIRS) with documented or suspected infection aetiology.¹² Systemic inflammatory response syndrome comprises at least two of the following events: tachypnoea, tachycardia, fever or hypothermia, leukocytosis or leukopaenia.³ Sepsis can progress to severe sepsis, septic shock and multi-organ dysfunction syndrome.⁴ Sepsis is a leading cause of morbidity and mortality in children worldwide⁵ even more so in developing countries.⁵ It was reported to be the commonest cause of death among children seen at the emergency unit of Nnamdi Azikiwe University Teaching Hospital from 2012 to 2014.¹³ Garba et al⁷ reported sepsis as one of the major causes of death in children aged one to twelve years at a specialist hospital in Zamfara state.

Prompt diagnosis and effective treatment of sepsis is necessary to prevent complications and death.¹⁰ Clinical diagnosis of childhood sepsis depends on blood culture positivity but in most cases only 50% of all positive blood cultures represent true blood stream infection.¹³ International guidelines recommend that appropriate blood cultures should be obtained before commencing antibiotics which should be commenced within the first hour of recognizing severe sepsis.¹⁴ Results of blood cultures and antibiotics susceptibility tests however take about a week thereby necessitating initial empirical treatment of suspected cases with broad spectrum antibiotics.¹⁵ Knowledge of common pathogens is therefore useful for guiding this initial treatment.¹⁵,¹⁶
Methodology

Study centre
This was a retrospective descriptive study, carried out at the Children Emergency Ward of the Niger Delta University Teaching Hospital (NDUTH) Bayelsa State, over a 2 year period (1st of January 2014 to 31st of December 2015).

Ethical consideration
Ethical clearance was obtained from the Research and Ethics Committee of the Niger Delta University Teaching Hospital.

Subjects
All children aged 29 days to 17 years who had blood culture within the study period were recruited for the study.

Specimen collection
Blood samples were aseptically collected at the Children Emergency Ward by Paediatric Residents following established hospital guidelines regarding specimen collection. Samples were collected before the commencement of antibiotics. Five milliliters of venous blood was aseptically collected into sterile blood culture bottles and immediately transported to the microbiology laboratory.

Specimen processing
Samples were incubated aerobically at room temperature for at least 24 hours, and bottles with signs of growth were immediately sub-cultured on MacConkey Agar, Chocolate Agar and Blood agar. Gram staining was done and bacterial isolates were identified and classified by morphology and appropriate biochemical tests.

Antibiotic susceptibility testing
The Kirby-Bauer disk diffusion method was used to assess the antibiotic susceptibility of the isolates, with the results interpreted according to the standards of the National Committee for Clinical Laboratory Standards (Clinical Laboratory Standard Institute). Antibiotic resistance was quantified based on the zone of inhibition around the antibiotic disc as either susceptible, intermediate or resistant. Intermediate results were considered resistant. Resistance to more than three classes of antibiotics was considered broad-spectrum or multi-drug resistance.

The concentration of the antibiotic discs used were as follows: Gatifloxacin 5 μg, Streptomycin 10 μg, Vancomycin 30 μg, Pefloxacin 5 μg, Cefixime 5 μg, Ofloxacin 5 μg, Gentamicin 10 μg, Chloramphenicol 30 μg, Amoxicillin-Clavulanate 30 μg, Ceftriaxone 30 μg, Erythromycin 15 μg, Cefuroxime 30 μg, Tetracycline 30 μg, Cloxacillin 5 μg, Cefazidime 30 μg, Co-trimoxazole 25 μg, Nitrofurantoin 50 μg, Ciprofloxacin 5 μg. The sensitivity of particular isolates to each tested antibiotic was calculated by the number of isolates susceptible divided by the total number of isolates and expressed as a percentage.

Treatment protocol
After collection of blood culture samples, the patients were empirically commenced on intravenous ceftriaxone and gentamicin according to clinical protocol. Clinical response was monitored daily and antibiotics were subsequently changed to ciprofloxacin if the patients showed poor response after 48 to 72 hours of antibiotics. Antibiotics were subsequently changed according to the sensitivity pattern of isolated organisms after retrieval of blood culture results. All patients with blood culture-proven sepsis were treated with intravenous antibiotics for at least 10 days before discharge if clinically stable.

Data analysis
Data was collected onto an Excel 2013 spreadsheet and presented as means and percentages in tabular and graphical forms.

II. RESULTS

General characteristics
During the 2 year study period, 116 (12.11%) of the 958 children admitted into the Children Emergency Ward had blood culture test. Their ages ranged from 5 weeks to 16 years with a mean age of 3.87 ± 4.48 years. There were 62 males and 54 females with a male to female ratio of 1.1:1.

*Corresponding Author: Peterside O
Thirty one (26.72%) of the 116 patients had positive blood cultures, comprising of fifteen males and sixteen females in a male to female ratio of 1:1.1.

**Isolated organisms**

Eighteen (58.06%) of the organisms were gram positive while thirteen (41.93%) were gram negative. The predominant organism was *Staphylococcus aureus* in 16 (51.61%) followed by *Klebsiella pneumoniae* in 5 (16.13%) patients (Table 1).

### Table 1: Isolated organisms

<table>
<thead>
<tr>
<th>Bacterial isolate</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Staphylococcus aureus</em></td>
<td>16</td>
<td>51.61</td>
</tr>
<tr>
<td><em>Klebsiella pneumoniae</em></td>
<td>5</td>
<td>16.13</td>
</tr>
<tr>
<td><em>Pseudomonas aeruginosa</em></td>
<td>3</td>
<td>9.68</td>
</tr>
<tr>
<td><em>Streptococcus pneumoniae</em></td>
<td>2</td>
<td>6.45</td>
</tr>
<tr>
<td><em>Proteus mirabilis</em></td>
<td>2</td>
<td>6.45</td>
</tr>
<tr>
<td><em>Escherichia coli</em></td>
<td>2</td>
<td>6.45</td>
</tr>
<tr>
<td><em>Escherichia coli</em></td>
<td>1</td>
<td>3.25</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>31</td>
<td>100</td>
</tr>
</tbody>
</table>

**Age range of the patients with positive blood culture**

As shown in table 2, the bacterial isolation rate was highest in children aged 29 days to <1 year and decreased with increasing age.

### Table 2: Age range of the patients with positive blood culture

<table>
<thead>
<tr>
<th>Age range</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>29 days to &lt;1yr</td>
<td>12</td>
<td>38.71</td>
</tr>
<tr>
<td>1-&lt;5yrs</td>
<td>10</td>
<td>32.26</td>
</tr>
<tr>
<td>5-10yrs</td>
<td>6</td>
<td>19.35</td>
</tr>
<tr>
<td>10-&lt;18yrs</td>
<td>3</td>
<td>9.68</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>31</td>
<td>100</td>
</tr>
</tbody>
</table>

**Clinical outcome of the patients with positive blood culture**

Twenty five (80.65%) of the 31 patients with positive blood cultures showed good clinical improvement with treatment and were discharged home, 4 (12.90%) of them died and the parents of 2 (6.45%) took them home against medical advice before completion of their treatment.

**Bacterial isolates in the patients that died**

*Klebsiella pneumoniae* was isolated in two (50%) of the 4 patients that died, *staphylococcus aureus* in 1 (25%) and *Escherichia coli* in 1 (25%).

**Antibiotic susceptibility pattern of *Staphylococcus aureus***

As shown in figure 1, *staphylococcus aureus* demonstrated the highest sensitivity to ofloxacin (62.5%), followed by amoxicillin/clavulanic acid (43.75%) and ceftriaxone (43.75%) respectively.
Antibiotic sensitivity pattern of Klebsiella pneumoniae

As shown in figure 2, Klebsiella pneumoniae demonstrated the highest sensitivity to ciprofloxacin (60.0%), followed by ofloxacin (40.0%), amoxicillin/clavulanic acid (40.0%) and gentamycin (40.0%) respectively.

![Figure 2: Antibiotic sensitivity pattern of Klebsiella pneumoniae](image)

III. DISCUSSION

Twenty six point seven two percent of samples in the present study showed significant bacterial growth. This is not surprising as it has been reported that though diagnosis of childhood sepsis depends on blood culture positivity, less than 50% of all positive blood culture represent true blood stream infection. Okon et al. at the University of Maiduguri Teaching Hospital reported a lower bacterial growth rate of 11.5% while Ogunleye et al. reported a much higher rate of 34.16% among septicemic children seen at the children emergency ward of the University College Hospital Ibadan. These low bacterial isolation rates may be due to administration of antibiotics prior to blood culture collection which is not uncommon in our society.

There were more gram positive bacterial isolates compared to gram negatives, which is similar to reports from Uzodima et al. in Lagos and Prabhu et al. in India. Okon et al. however had a higher prevalence of gram negative bacterial isolates. Staphylococcus aureus was the predominant bacterial isolate in the current study. This is similar to findings from other authors in Nigeria and India. Bacterial isolation rates in the present study showed a decrease with increasing age which is similar to findings by Okon et al. in Northern Nigeria. This may be due to the fact that immunity to infections in childhood tends to increase with increasing age.

Bacterial isolates in the present study demonstrated the highest sensitivity to the quinolones which is similar to reports from other centres in Nigeria. This could be attributable to the fact that microorganisms tend to become resistant to commonly used antibiotics while remaining sensitive to the rarely used ones like the quinolones. In addition, indiscriminate use of antibiotics for both prophylaxis and treatment of sick children which is the common practice in Nigeria may lead to emergence of resistant strains. Studies show that though use of fluoroquinolones in children may be associated with tendon, bone and joint disorders, these were comparable with their occurrence in a control group. These disorders from fluoroquinolone use also tend to be transient.

IV. CONCLUSION

Childhood sepsis is a common cause of morbidity at the Niger Delta University Teaching Hospital, Bayelsa State, Nigeria. Gram positive organisms were the predominant bacterial isolates with Staphylococcus aureus being most prevalent. The bacterial isolates demonstrated the highest sensitivity to the quinolones. There is need for periodic surveillance of the causative organisms and antibiotic susceptibility pattern of childhood sepsis to guide effective management of patients.
References


*Corresponding Author: Peterside O