Predominant *Actinobacteria baumannii* among bacterial isolates from neonatal bacteremia and their antimicrobial susceptibilities

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Abstract

**Background:** Nosocomial bacteremia caused by *Acinobacter baumannii* is of increasing presence in critically ill patients and has been found naturally in soil and implicated in causing a wide range of clinical conditions in hospitals. *Acinobacter baumannii* is resistant to a wide range of antimicrobial agents, i.e. multidrug resistant Gram-negative bacteria. **Objectives:** The aim of the study is to find out the predominant *Acinobacter baumannii* through its prominent role in cases of neonatal bacteremia as compared to other bacterial isolates from the same clinical conditions. It is also aimed to find out the multidrug-resistant *Acinobacter baumannii*. **Methods:** This work was conducted on neonates attending the Central Child Hospital and Al-Yarmouk teaching hospital laboratories at Baghdad, Iraq during the period January 2017- January 2018 two hundred and fifty neonates attending the above mentioned hospitals were the sources of 2-3 ml of blood samples collected aseptically from each
newborn. Each blood sample was subjected to established microbiological standard methods for blood culturing and final identification of each isolate. All isolates were tested for whether sensitive or resistant to the commonly used antimicrobial according to manufacture instructions. **Results:** In this study in which 250 neonates were the source of 180 bacterial isolates (72%) from which *Acinetobacter baumannii* are 75(41.7%) isolates, followed by *Group B Beta Hemolytic Streptococci* which is 35(19.4%) and *Streptococcus pneumonia* 32(17.8%) bacterial isolates, while *E.coli* is 14(7.8%), *Pseudomonas aeruginosa* as 13(7.2%) and the least of the isolates is *Staphylococcus epidermidis* which is 11(6.1%). Multidrug resistant were documented in this work in which *Acinetobacter baumannii* were almost completely resistant for Amoxicillin (94.4%), Penicillin G (93.4%), Vancomycin (91.9%), followed by Imipenem (88%) and all of the remaining drugs as in table (2). The only drug for which *Acinetobacter baumannii* reveals the least resistance is Colistin (20%). **Conclusion:** It seems that *Acinetobacter baumannii* plays the major role in causing neonatal bacteremia, followed by *GB BS*. It is also concluded that multidrug-resistance in *Acinetobacter baumannii* is confirmed. This necessitates the advice for future work to find a modified antimicrobials specific treatment for *Acinetobacter baumannii* infections in neonate.

**Keywords:** Neonatal bacteremia, *Acinetobacteria baumannii*, Multidrug resistance, Bacterial isolates, Antimicrobial susceptibility, Nosocomial

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**Introduction**

*Actinobacteria baumannii* is a Grams-negative coccobacillus which has been a frequent pathogen in hospital and health care setting (1,2) Since 1970 A. *baumannii* has emerged as a prominent nosocomial pathogen (3), increasingly implicated in bloodstream infections and pneumonia (3,4). *Actinobacteria* species have increased in recent years and this might be due to their minimum nutritional requirements and highly resistance to antimicrobial agents (5). Among these species *A. baumannii* is the most frequently encountered species in clinical samples and causes infections that are difficult to treat.
because of its resistance to most antimicrobial staff (6,7). A. baumannii is also known to be the cause of bacteremia, infection of wounds, respiratory, gastrointestinal and genitourinary tracts (8,9).

Since A. baumannii was recovered from female genital tract it has been mistaken for Neisseria gonorrhea (10), and it acts as opportunistic pathogen in producing sepsis and difficult to treat because of its resistance to all antimicrobials drugs except Colistin (Polymyxin E) (11-14). Escherichia coli is another common gram-negative organism that is usually associated with bacteremia and its recurrence most likely represents a multifactor process that occur in patients with impaired host defenses (15). Meanwhile other important species which play a role in fatal sepsis and invade blood stream is Pseudomonas aeruginosa which is present in moist environment in hospitals (16). Group B Beta Hemolytic Streptococci and Streptococcus pneumoniae are the most common cause of life threatening infections in newborn and children causing pneumonia, meningitis and neonatal sepsis and may cause middle ear or sinuses infections which lead to bacteremia (14-18).

Staphylococci represent the main causes of hospital and community acquired infections and coagulase-negative Staphylococcus epidermidis is the leading cause of nosocomial bacteremia in most pediatric hospitals which develops antimicrobial resistance (19).

**Materials and Methods**

In this study, 250 neonates are the source of blood samples. The neonates were referred by specialists who suspected that they have bacteremia. A blood sample (2-3 ml) from each neonate was collected aseptically and each blood specimen was subjected to well-known established microbiological standard techniques, specifically blood culture techniques in addition to specific techniques followed for the isolation and identification of G-ve and G+ve bacterial isolates. Antibiotic sensitivity test was performed according to Kirby-Bauer technique (20).

To determine whether an isolate is sensitive or resistant to certain antimicrobial, the zone of growth inhibition is measured and compared to international values of the manufacturers.

**Results**

This work was carried out during the period January 2017 to January 2018 in the laboratories of two hospitals in Baghdad, Iraq, namely Al-Yarmouk teaching hospital and Central Child Hospital. It was...
possible to obtain 180 bacterial isolates from the 250 blood samples collected from neonates born mostly in these hospital. The neonates were referred by specialist physicians who suspected bacteremia in those neonates.

The results of the present study are presented in tables (1 and 2). As indicated from table (1) *A. baumannii* shows the highest 75 neonates (41.7%) bacterial isolate as compared to other isolates. The results based on gender, isolates from 37 neonates bacterial isolates (49.4%) from males and 38 neonates (50.6%) from females. Other prominent bacterial isolates include *GBβHS* which is isolated from 35 neonates (19.4%) samples and that of *Str. pneumonia* which is isolated from 32 neonates (17.8%) samples. Based on gender, *GBβHS* isolates are 17 neonates (48.6%) in male group and 18 neonates (51.4%) in female group, while that of *Str. pneumonia isolates* are 15 neonates (46.9%) in male group and 17 neonates (53.1%) in female group.

Table (1) also shows that other bacterial isolates are found in a smaller number of samples. The least number of isolates is that of *Staph. epidermidis* which include 11 neonates isolates (6.1%) from which 6 neonates isolates (54.5%) among male neonates and 5 neonates isolates (45.5%) in female neonates isolates. *E. coli* 14 neonates isolates (7.8%) from which 6 neonates isolates (42.9%) in male group and 8 neonates (57.1%) in female group. The *Ps. aeruginosa* which include 13 neonates’ isolates (7.3%) distributed according to gender as 7 neonates isolates (53.8%) in male groups and 6 neonates’ isolates (46.2%) in female group. Though there is no statically significant difference in the number of bacterial isolates between male and female neonates, it can be observed that most of the bacterial isolates are higher in female than in male (Table 1).
Table 1. Distribution of the bacterial isolates and their percentage based on gender

<table>
<thead>
<tr>
<th>Bacterial isolates</th>
<th>Total No. (%)</th>
<th>Male No. (%)</th>
<th>Female No. (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. baumannii</td>
<td>75 (41.7)</td>
<td>37 (49.4)</td>
<td>38 (50.6)</td>
</tr>
<tr>
<td>E. coli</td>
<td>14 (7.8)</td>
<td>6 (42.9)</td>
<td>8 (57.1)</td>
</tr>
<tr>
<td>Ps. aeruginosa</td>
<td>13 (7.2)</td>
<td>7 (53.8)</td>
<td>6 (46.2)</td>
</tr>
<tr>
<td>GBβHS</td>
<td>35 (19.4)</td>
<td>17 (48.6)</td>
<td>18 (51.4)</td>
</tr>
<tr>
<td>Str. pneumonia</td>
<td>32 (17.8)</td>
<td>15 (46.9)</td>
<td>17 (53.1)</td>
</tr>
<tr>
<td>Staph. epidermidis</td>
<td>11 (6.1)</td>
<td>6 (54.5)</td>
<td>5 (45.5)</td>
</tr>
<tr>
<td>Total</td>
<td>180</td>
<td>88 (48.9)</td>
<td>92 (51.1)</td>
</tr>
</tbody>
</table>

The responses of the bacterial isolates to the antibiotics used in this trial are presented in table (2). It revealed that A. baumannii is weakly sensitive to all of the drugs used in this study except for the drug Colistin which shows high sensitivity (80%). A similar trend has been noticed with other bacterial isolates with one exception, GBβHS shows (60%) sensitivity to the drug Vancomycin.

The distribution of the resistance of the bacterial isolates indicates that A. baumannii is highly resistant to most of the drugs used in the present study with values ranging between (84-94%). E.coli on the other hand revealed a high resistance to both Vancomycin and Tobramycin (86.2%) and (85.7%) respectively. Staph. epidermidis isolates has shown the most prominent resistance to all drugs used in this research work.
Table 2. Antimicrobial resistance (R) and sensitivity (S) of bacterial isolates from blood of bacteremic neonates

<table>
<thead>
<tr>
<th>Bacterial isolates</th>
<th>Amikacin</th>
<th>Ciprofloxacin</th>
<th>Imipenem</th>
<th>Tobramycin</th>
<th>Colistin</th>
<th>penicillin G</th>
<th>Ampicillin</th>
<th>Gentamicin</th>
<th>Amoxicillin</th>
<th>Vancomycin</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No.</td>
<td>%</td>
<td>R</td>
<td>S</td>
<td>R</td>
<td>S</td>
<td>R</td>
<td>S</td>
<td>R</td>
<td>S</td>
</tr>
<tr>
<td>A. baumannii</td>
<td>75</td>
<td>41.7</td>
<td>84</td>
<td>16</td>
<td>85.4</td>
<td>14.6</td>
<td>88</td>
<td>12</td>
<td>82.7</td>
<td>17.2</td>
</tr>
<tr>
<td>E. coli</td>
<td>14</td>
<td>7.8</td>
<td>74.1</td>
<td>25.9</td>
<td>71.5</td>
<td>28.9</td>
<td>71.5</td>
<td>28.5</td>
<td>85.3</td>
<td>14.7</td>
</tr>
<tr>
<td>Ps. aeruginosa</td>
<td>13</td>
<td>7.2</td>
<td>47.1</td>
<td>53.8</td>
<td>47.1</td>
<td>53.8</td>
<td>69.2</td>
<td>30.8</td>
<td>30.8</td>
<td>69.2</td>
</tr>
<tr>
<td>GBfHIS</td>
<td>35</td>
<td>19.4</td>
<td>82.9</td>
<td>17.1</td>
<td>85.8</td>
<td>14.2</td>
<td>54.3</td>
<td>45.7</td>
<td>51.5</td>
<td>48.5</td>
</tr>
<tr>
<td>Str. pneumonia</td>
<td>32</td>
<td>17.8</td>
<td>71.9</td>
<td>28.2</td>
<td>87.5</td>
<td>12.5</td>
<td>56.3</td>
<td>43.8</td>
<td>68.4</td>
<td>31.6</td>
</tr>
<tr>
<td>Staph. epidermidis</td>
<td>11</td>
<td>6.1</td>
<td>72.8</td>
<td>27.3</td>
<td>100</td>
<td>0</td>
<td>100</td>
<td>0</td>
<td>100</td>
<td>0</td>
</tr>
</tbody>
</table>
Discussion

This study provides information regarding the distribution of *A. baumannii* and other isolates and also the antimicrobial susceptibilities pattern in pediatric patients. Our results indicated that bacteremia due to *A. baumannii* and other bacterial isolates represent a serious problem due to their wide distribution in neonates and their high antimicrobial resistance. The present results confirm earlier findings on the medical importance of *A. baumannii* and other bacterial isolates in both neonates and adults (3,4,8,13).

The distribution in our study could be attributed to the number and gender of neonates attending hospitals or due to infection of mothers with certain type of bacterial isolates. The source of bacteremia due to *Acinetobacter* species varies depending on the risk factors (7,8,21).

In the present study the distribution of *A. baumannii* and other isolates based on gender revealed that it is slightly higher in females (50.6%) than that in males (49.4%). Similar trends are exhibited by other isolates, e.g. *E. coli* (57.1%) vs. (42.9%), *GBβHS1* (51.4%) vs. (48.6%) and *Str. pneumonia* (53.1%) vs. (46.9%). Only two types of isolates, i.e. *Ps. aeruginosa* and *Staph. epidermidis* show higher percentage in males than in females, (53.8%) vs. (46.2%) and (54.5%) vs. (45.5%) respectively. The reason behind gender differences in our study might be due to the fact that neonates studied were randomly selected. However, numerous studies have suggested that *A.baumannii* and other nosocomial infections are more frequent in male than in female, this bias might be due to type of pathogen and site of infection, age, hormones, immunity and environment containing bacteria (22-25).

Multidrug resistance among *A. baumannii* and other isolates have been documented in several studies similar findings have been reported in our study (12,16,17,26). Also our results are in agreement with others who reported that *A.baumannii* are highly resistant to the drug Imipenem (27,28).

This acquisition of drug resistance is either due to abuse of antimicrobials like consumption of carbapenem which developed antimicrobial resistance in the G-ve *A. baumannii* and also in G+ve bacteria presumably due to the abuse of the drugs and possibly due to beta-lactamase production. The mechanism of this resistant seems to be mediated by class D-OXA-type enzymes (oxa-23and oxa-24/40) (28,29).
Finally, recent study have shown that multidrug resistance rate to different types of antibiotics in men were higher than in women (30). However, we have not investigated this phenomenon during the present study.

**Conclusion**

In this study *A. baumannii* seems to play a major role in causing neonatal bacteremia followed by GBβHS and to less extent other bacterial isolates. Our findings also support earlier results concerning multidrug resistance in *A. baumannii*. This necessitates the advice for future work to find modified drugs specific for treatment of *A. baumannii* infections in neonates in Baghdad hospitals.

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**References**


