

## Original research article

## A Study on Bacteriological Profile of Patients Presenting Clinically as Sepsis.

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### Abstract

**Background:** Blood Stream Infections continue to be a leading cause of mortality and morbidity especially in ICU settings. Infections leading to sepsis are usually bacterial, but may be fungal or viral.

**Aim:** The aim of the present study was to identify bacterial etiology in patients with clinically diagnosed blood stream infections.

**Material and methods:** The study was a prospective, observational study which was carried in the Department of Microbiology, MGM Medical College and LSK Hospital, Kishanganj, Bihar, India. A total of 300 patients with clinically diagnosed sepsis were chosen for the study. Suitable specimens from all these patients were subjected to Gram staining and culture on suitable culture media, and isolates were identified by colony characters and the battery of standard biochemical tests.

**Results:** Out of a total of 300 samples, 91 showed positive culture for bacterial isolates; 52 isolates were Gram negative (57.1%) and 39 were Gram positive (42.9%) bacteria. Out of the Gram positive isolates *Staphylococcus aureus* was the commonest and *Klebsiella spp* was the most frequent isolate among the Gram negative organisms.

**Conclusion:** As blood stream infections remain a formidable challenge in clinical settings, it is imperative to know the etiology of an intercurrent infection so that appropriate therapeutic measures can be taken at the earliest.

### Introduction

Blood Stream Infections (BSI) are significant cause of morbidity and mortality worldwide. Septicaemia is a clinical syndrome characterized by fever, chills, malaise, tachycardia, hyperventilation and toxicity.<sup>1</sup>

Approx 200,000 cases of bacteraemia and fungaemia occur worldwide annually with mortality rates ranging from 20-50%.<sup>2</sup> Blood culture provides essential information for the evaluation of variety of diseases like endocarditis, meningitis, pneumonia and pyrexia of unknown origin (PUO).

Recently WHO has recognized sepsis as a Global Health Priority.<sup>3</sup> The empiric antimicrobial therapy remains the cornerstone of treatment. Current guidelines recommend starting antibiotic therapy within one hour of identification of septic shock.<sup>4</sup> Delay in every hour is associated with a 6% rise in mortality.<sup>5</sup> If the pathogen is resistant to antibiotics, early or late initiation of antibiotic therapy cannot improve the outcome.

Infections leading to sepsis are usually bacterial, but may be fungal or viral. Gram-positive bacteria were the predominant cause of sepsis before the introduction of antibiotics in the 1950s. After the introduction of antibiotics, Gram-negative bacteria became the predominant cause of sepsis from the 1960s to the 1980s.<sup>6</sup>

With this background, present study was carried out to evaluate the bacteriological profile of patients with BSI in a rural medical college and tertiary care hospital in northern part of Indian state of Bihar.

### Material and Methods

The study was a prospective, observational study which was carried for a period of 18 months from January 2019 to June 2020 in the Department of Microbiology, Mata Gujri Medical College and LSK Hospital, Kishanganj, Bihar, India.

300 (195 males and 105 females) clinically diagnosed sepsis patients with history of fever for more than 7 days duration were included in the study who reported in the hospital during the period from January 2019 to June 2020. Relevant clinical data of each patient were obtained. Blood samples were collected from the patients in blood culture bottles containing biphasic medium (BHI agar broth). Isolates obtained were identified by standard microbiological techniques.<sup>7</sup>

### Results

In the present study, maximum numbers of samples were obtained from the patients in the age group of 51-60 years (22.3%) followed by 41-50 years (19.3%) and more than 60 years (17.7%). Age group-wise distribution of study subjects is shown in Table 1.

Out of 300 samples, 91 samples were culture positive showing growth of bacteria (30.3%). Age-wise distribution of samples showing positive blood culture is mentioned in Table 2. Blood culture positivity for bacterial isolates was noted highest among paediatric age group (42.9%) followed by more than 60 years age group (35.8%).

Out of the 91 samples that showed positive culture for bacterial isolates showed 52 Gram negative (57.1%) and 39 Gram positive (42.9%) bacteria. Out of the 39 Gram positive isolates, *Staphylococcus aureus* comprised 28 (71.8%), *Coagulase negative staphylococcus* eight (20.5%) and *Enterococcus Spp* comprised three (7.7%) isolates.

Members of the *Klebsiella spp* were the most frequent among the 52 Gram negative isolates, followed by *Escherichia coli*, *Pseudomonas aeruginosa*, *Acinetobacter*, *Citrobacter*, and *Enterobacter aerogenes*. The number and distribution of isolates of Gram negative bacteria are shown in Table 3.

**Table 1: Age distribution of study subjects.**

Age Distribution (Years)	Frequency	Percentage
1 - 12	21	7.0
13 - 20	23	7.7
21 -30	42	14
31-40	42	14
41-50	58	19.3
51-60	61	20.3
>60	53	17.7
<b>Total</b>	<b>300</b>	<b>100</b>

**Table 2: Age distribution of study subjects with positive blood culture.**

Age Distribution (Years)	Frequency	Culture positive	Percentage
1-12	21	9	42.9
13-20	23	5	21.7
21 -30	42	10	23.8
31-40	42	11	26.2
41-50	58	17	29.3
51-60	61	20	32.8
>60	53	19	35.8
<b>Total</b>	<b>300</b>	<b>91</b>	<b>100</b>

**Table 3: The number and distribution of isolates of Gram negative bacteria.**

Gram Negative Bacteria	Frequency	Percentage
<i>Klebsiella spp</i>	21	40.4
<i>Escherichia coli</i>	15	28.8
<i>Pseudomonas aeruginosa</i>	08	15.5
<i>Acinetobacter</i>	04	7.7
<i>Citrobacter</i>	02	3.8
<i>Enterobacter aerogenes</i>	02	3.8
<b>Total</b>	<b>52</b>	<b>100</b>

In addition to these 91 bacterial isolates from 91 samples, six samples had shown growth of *Candida spp*; four of these were *Candida albicans* and two were *Candida tropicalis*.

### Discussion

Despite advances in diagnosis and treatment, BSI remains a major cause of morbidity and mortality in developing countries. The causative agent of sepsis and their antibiotic susceptibility patterns also become varied from time to time and from place to place. Isolation of organism in blood remains the cornerstone in the diagnosis in a febrile patient.

In our study, out of 300 patients with clinical sepsis, positive blood culture was found in 91 samples (30.3%). A total of 69.7 % (209/300) samples did not yield any bacterial isolate. There are wide variations in blood culture positivity rates reported in different studies which vary between 10.03% to 45.9%.<sup>8-9</sup>

The rate of culture positivity in septicaemia cases observed in our study (30.3%) is similar to the findings of Wasihun et al (28%) and Sahoo et al (26%).<sup>10,11</sup> In contrast, Khara et al reported a much higher incidence (49.03%) while Kante et al (17%) and Gupta et al (16.5%) found incidences of rate of isolation of bacteria that were lower than present study.<sup>12,13,14</sup>

In the present study, the incidence of blood culture positivity for bacterial isolates was highest (42.9%) in the paediatric age group. The next high rate is observed in the age group of more than 60 years (35.8%). The heightened susceptibility of children to infections including the more serious intercurrent infections is attributed to immunological immaturity in children.<sup>15</sup>

Out of 91 bacterial isolates in the present study, 57.1% were Gram negative bacilli and 42.9% were Gram positive bacteria. These findings are similar to the studies conducted by Kante et al and Sahoo et al who found that the Gram negative bacterial isolates predominated over Gram positive bacteria.<sup>11,13</sup> However, in a study by Dagnew et al Gram positive bacteria

were found to be more prevalent (69%) than the Gram negative bacteria (31%).<sup>16</sup>

The predominant Gram positive isolates in our study was *Staphylococcus aureus* (71.8%) followed by *Coagulase negative staphylococcus* (20.5%). In the studies conducted by Gupta et al, Jadhav et al, Rajeevan et al, and Khara et al *S. aureus* was the commonest isolate.<sup>12,14,17,18</sup> Whereas, Mohanty et al found CONS as the most common Gram positive isolate from blood culture specimens of sepsis patients.<sup>19</sup>

In the present study, among the Gram negative bacterial isolates, *Klebsiella spp* was the most prevalent (40.4%), followed by *Escherichia coli* (28.8%), *Pseudomonas aeruginosa* (15.5%), *Acinetobacter spp* (7.7%), *Enterobacter aerogenes* (3.8%) and *Citrobacter spp* (3.8%). These findings are comparable to studies of Khara et al, Jadhav et al, and Sonawane J et al who found *Klebsiella spp* as the most frequent Gram negative isolates.<sup>12,17,20</sup> In contrast to these findings. Gupta et al found *E. coli* as the most common Gram negative isolate while Kante et al found *Pseudomonas aeruginosa* as the most frequent Gram negative isolate from blood culture samples.<sup>13,14</sup>

Though the 1992-2001 definition gave importance to bacteria/fungi in the pathogenesis of sepsis, in February 2016 the Third International Consensus Definitions for Sepsis and Septic Shock defined sepsis as life-threatening organ dysfunction caused by a dysregulated host response to infection.<sup>21</sup> Thus the 2016 definition does not make any reference to the role of infection or microbes in sepsis. However, it is important to know the type of bacteria which is/are responsible for the pathogenesis that also helps clinicians to choose right treatment when culture and antimicrobial susceptibility results are made available to them.

### Conclusion

We conclude that BSI remains a formidable challenge to health care professionals in clinical settings as widespread resistance to antimicrobials increases the risk of morbidity and mortality to a particular patient apart from increasing the cost of healthcare. Therefore, it is imperative to know the aetiology of an intercurrent infection so that appropriate therapeutic measures can be taken at the earliest.

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