

## ORIGINAL RESEARCH

## Spectrum Of Non-Fermenting Gram Negative Bacteria Causing Septicemia In A Tertiary Care Hospital Of North India

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### ABSTRACT

**Non-fermenting Gram-negative bacilli (NFGNB) are emerging as important causes of blood stream infections (BSI) and they are a major cause of morbidity and mortality worldwide. Presence of intrinsic resistance of NFGNB to antimicrobial compounds makes the treatment of BSIs caused by them difficult and expensive. The aim of this study was to assess frequency and antibiotic susceptibility pattern of non-fermenting gram-negative rods isolated from blood culture of patients. A total of 3900 blood samples were received in the Department of Microbiology during 6 months period. All samples were processed according to standard microbiological procedures. 131 NFGNB were identified out of which the most common non-fermenters isolated were *Acinetobacter* sp. (90) followed by *Pseudomonas aeruginosa* (41). Most of the non-fermenters were multi drug resistant. Imipenem showed good sensitivity. This study underlines the need to identify NFGNB in tertiary care hospitals and to monitor their susceptibility pattern to guide the clinician for better care and management of patients. Improved antibiotic stewardship and strict infection control measures especially hand washing need to be implemented to prevent emergence and spread of multidrug resistant NFGNB in health care settings.**

**Keywords:** NFGNB, antimicrobial resistance, BSI

### INTRODUCTION

Globally, Blood Stream Infection (BSI) is one of the most important causes of morbidity and mortality<sup>1</sup>. Although gram-positive bacteria are the more common causes of bloodstream infections<sup>2</sup>, but gram-negative bacteremia carries higher risks of severe sepsis, septic shock, and death.

Non-fermenting Gram-Negative Bacilli (NFGNB), such as *Pseudomonas aeruginosa*, *Acinetobacter baumannii*, and *Stenotrophomonas maltophilia*, are important nosocomial pathogens contributing significantly to morbidity and mortality, while others are being increasingly recognized as clinical pathogens<sup>3</sup>.

Non-fermenting gram-negative bacilli (NFGNB) are a taxonomically diverse group of aerobic, non-sporing, bacilli that either do not utilize glucose as a source of energy or utilize it oxidatively<sup>4</sup>.

These organisms cause prolonged patient admission, increased healthcare costs and higher morbidity and mortality rates<sup>5</sup>. Many clinically important non-fermenters are multiresistant organisms<sup>6</sup> and treatment is different for non-fermenters as compared to fermenters.

Inappropriate and irrational use of antimicrobial, poor financial conditions, inadequate infrastructure, a high burden of disease and unregulated over-the-counter sales of cheap antibiotics have amplified the crisis of AMR in India<sup>7</sup>. Awareness towards creating antimicrobial stewardship is necessary to halt the infection.

So, this study was done to identify the various organisms causing BSI in our hospital and to evaluate the antimicrobial susceptibility pattern of isolated strains.

## MATERIAL AND METHOD

This retrospective observational study was conducted over a period of one year at Government Medical College, Jammu, which is a tertiary level teaching hospital. All samples were collected following strict aseptic precautions with 70% alcohol. Blood samples were immediately inoculated into commercially available aerobic Blood culture bottles containing Liquid broth. In pediatric cases, 1-2 ml of blood was collected and in adults, 5 ml of blood was collected. After collection, these bottles were incubated at 37 degree Celsius. On next day, blood was sub-cultured on Blood agar and Mac Conkey agar. Manual identification and antimicrobial susceptibility was determined following established Departmental Protocols.

## RESULTS

During 1 year study period, we received a total of 3900 samples in the laboratory, 131(3.3%) were NFGNB. 6 patients were positive for two species of bacteria. Three patients had bacteremia caused by *Pseudomonas aeruginosa* and *Acinetobacter sp.* Fourth patient had bacteremia caused by *Citrobacter* and *Acinetobacter sp.* 2 patients had bacteremia by *Pseudomonas aeruginosa* and *Klebsiella oxytoca*. Out of 3900 total samples, 426(11%) were Gram Positive Cocci. Rest 234(6%) were *Micrococcus sp.* and discarded as skin contaminant. Growth of budding yeast was obtained in 15 samples (0.4%). In addition to all this, we have also obtained 120(3%) fermenters as causative pathogens, including *Klebsiella pneumoniae*, *Escherichia coli*, and *Enterobacter species*, *Citrobacter sp.* and *Serratia sp.* The most common non-fermenter isolated was *Acinetobacter sp.* (90) followed by *Pseudomonas aeruginosa* (41).

**Table 1: Shows spectrum of pathogens in blood.**

Organism	Total Number	Percentage
Gram Positive Cocci	234	6%
Non- Fermenters	131	3.3%
Fermenters	120	3%
Contaminants	234	6%
Budding yeast	15	0.4%

**Table 2: Shows distribution of NFGNB in blood**

Organism	Total number(131)	Percentage
<i>Acinetobacter sp.</i>	90	69%
<i>Pseudomonas aeruginosa</i>	41	31%

**Table 3: Shows percentage of antibiotic susceptibilities of NFGNB to major antibiotics**

Antibiotics	Acinetobacter sp. n=90 (69%)	Pseudomonas sp. n=41 (31%)
Piperacillin-tazobactam	15(17%)	12(29%)
Ceftazidime	7(8%)	5(12%)
Cefotaxime	4(5%)	-
Meropenem	15(17%)	8(20%)
Imipenem	35(39%)	14(34%)
Minocycline	48(53%)	-
Aztreonam	-	8(20%)
Netilmicin	-	12(29%)
Amikacin	8(9%)	9(22%)
Ciprofloxacin	6(7%)	4(10%)
Gentamycin	4(5%)	3(7%)

## DISCUSSIONS

We obtained 3900 blood samples of indoor admitted patients out of which, 677 blood samples were diagnosed with septicemia, accounting for 17%. 131(3%) were Non Fermenting Gram Negative Bacilli. This is in concordance with the finding of Malini A., *et al*<sup>8</sup>, and Debosmita P *et al*<sup>9</sup>, where the isolation rates were 4.1% and 4.15% respectively. But in the studies by Samantha P *et al*<sup>10</sup> and Sidhu S *et al*<sup>11</sup>, the isolation rate were 10 % and 45.9% respectively. This variation could be related to the adoption of infection control practices in the hospital and geographical difference.

In our study, 234(6%) were *Micrococcus sp.* and discarded as skin contaminant. Growth of budding yeast was obtained in 15 samples (0.4%). In addition to all this, we have also obtained 120(3%) fermenters as causative pathogens, including *Klebsiella pneumoniae*, *Escherichia coli*, and *Enterobacter species*, *Citrobactersp.* and *Serratia sp.* The most common non-fermenter isolated was *Acinetobacter sp.* (90) followed by *Pseudomonas aeruginosa* (41). This finding is similar to other conducted works wherein also these two organisms were concluded as the predominant pathogens<sup>12, 13</sup>. *Acinetobacter species* was found to be the most common NFGNB (54.4%), followed by *Pseudomonas species* (29.67%) in a study of Debosmita P *et al*<sup>9</sup>.

*Acinetobacter spp.* maximum resistance towards ceftazidime, cefotaxime, ciprofloxacin, amikacin, gentamycin, piperacillin-tazobactam and meropenem. This strengthens the findings of other scientists lately where increasing resistance towards cephalosporins has been observed in non-fermenters<sup>14</sup>. Imipenem was sensitive in 39% cases only which is in contrast to the study of Grewal US *et al*<sup>14</sup> where 85.7% sensitivity was noted. In a study of Reddy T *et al*<sup>15</sup>, susceptibility of *A. baumannii* to imipenem was shown to decrease from 99% to 42% from 2003 to 2008. It could be because of reduced outer membrane permeability, increased efflux systems, alteration of penicillin binding proteins and carbapenem hydrolyzing enzymes, i.e. carbapenemases.

In our study, Minocycline showed 53% sensitivity for *Acinetobacter sp.* and 34% sensitivity in case of *Pseudomonas aeruginosa*. Minocycline was re-introduced in 2009 after the intravenous formulation was taken off the US market in 2005 due to decreased use and since then, it has become an important option for the treatment of multidrug-resistant organisms, in particular CRAB (Carbapenem Resistant *Acinetobacter baumannii*)<sup>16</sup>. *Pseudomonas* showed high degree of resistance to the Gentamycin, ceftazidime, ciprofloxacin. This strengthens the findings of other scientists lately where increasing resistance towards cephalosporins has been observed in non-fermenters<sup>14</sup>.

**CONCLUSION:** The organisms which were considered as saprophytic commensal in the past have recently emerged as important causes of morbidity and mortality especially in immunocompromised patients. We found that NFGNB were mostly MDR (multi drug resistant), and the failure of commonly used antibiotics in sepsis management is alarming. They have been assigned as a major upcoming cause of multi-drug resistance in the world. Therefore, it brings the importance of their proper identification and reporting of antibiotic sensitivity and formation of effective antibiotic stewardship programme to the forefront.

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