

# Routine Nosocomial Infection Screening among Onco-Hematological Patients- Does It Change Management?



Shadma Yaqoob<sup>1</sup>, Areena Hoda Siddiqui<sup>2</sup>, Sunil Sharad Dabadghao<sup>3</sup>

<sup>1</sup>Associate Professor, Department of Microbiology, Eras Lucknow Medical College and Hospital, Lucknow, 226022,

<sup>2</sup>Associate Consultant, Department of Laboratory Medicine, Sahara Hospital, Viraj Khand, Gomti Nagar, Lucknow, Uttar Pradesh, India, <sup>3</sup>Senior Consultant, Department of Onco-Hematology, Sahara Hospital, Viraj Khand, Gomti Nagar, Lucknow, Uttar Pradesh, India

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## ABSTRACT

**Background:** Hospital acquired infection (HAI) or Nosocomial Infection (NI) is a well-known entity among patients. The onco-hematological patients are immune-compromised and are at high risk of acquiring these infections. Routine screening of these patients for the presence of micro-organisms, their identification and sensitivity at the time of admission, and during stay, can help us in identifying infections and guiding therapy. **Aims and Objective:** This study was undertaken to find out the role of routine screening of admitted patients in oncology ward with empirical therapy during neutropenic episodes. Nosocomial Infection Screening (NIS) test was performed for these patients. This test was done to detect Methicillin Resistant Staphylococcus Aureus (MRSA) and Extended Spectrum Beta Lactamases (ESBL) producing Gram Negatives. The NIS results obtained were correlated with organisms isolated from blood cultures. **Materials and Methods:** This retrospective study was done from period of May, 2013 to February, 2017 in patients of oncology ward. Only those patients whose NIS test and blood culture was sent to the lab were included in the study. **Result:** A Total number of 52 NIS tests and blood cultures were included in the study. Among 28 positive NIS samples, 19 samples correlated with blood cultures. Among 24 negative NIS sample 17 correlated with blood cultures. The p value was 0.017, PPV 73%, NPV 64%. SPSS software was used to calculate values. **Conclusion:** This study showed that NIS test can be used as a tool for predictive marker for septic episodes in these patients. There is a higher probability of developing septic episodes with positive NIS samples. At the same time negative NIS result does not rule out infection.

**Key words:** Extended spectrum beta lactamase; Methicillin Resistant Staphylococcus aureus; Multidrug resistance organisms; Nosocomial Infection; Onco-hematological patients; Septic episode

## INTRODUCTION

Nosocomial Infection (NI) or Healthcare Associated Infection (HAI) is defined as infection which is not present at the time of admission but develops after 48 hours of admission.<sup>1</sup> These also include infections which are present in a patient after discharge as in the case of surgical site infections.<sup>2</sup> These HAIs can be many times due to Multi Drug Resistant (MDR) bacteria which are difficult to treat. These MDR Gram negative

bacteria (MDR-GNB) are resistant to third generation cephalosporins, carbapenems. These organisms harbor enzymes which make them resistant towards certain antibiotics. The most important group of MDR organism responsible for colonization are Methicillin Resistant Staphylococcus aureus; and Extended spectrum beta lactamases producing Enterobacteraceae.<sup>3,4</sup>

It is essential to find out the presence of nosocomial infections in patients who are admitted for a very long

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### Address for Correspondence:

Dr. Areena Hoda Siddiqui, Associate Consultant, Department of Laboratory Medicine, Sahara Hospital, Viraj Khand, Gomti Nagar, Lucknow, UP., India. 226010. **Mobile:** +91-9936914436. **E-mail:** drareenahoda@rediffmail.com

duration. It is not needless to comment that such infections or colonization should be investigated at the time of admission.

There are certain groups of patient like onco-hematological patients who are re-admitted several times either for treatment or due to febrile neutropenia. In these patients nosocomial infection screening (NIS) for organisms and their enzymes can help in identification of colonized or infected patients. These infection or colonization can be attributed to their repeated admissions. These patients are immune-compromised and are at high risk of developing infection.<sup>5</sup>

High risk factor for colonization includes prolonged admission especially in intensive care units, immunocompromised state, recent hospitalization and exposure to antibiotics, patients who are on steroid therapy.<sup>6</sup>

Immunocompromised patients or patients on long term immunosuppressive therapy are more likely to get infection from colonizing organisms.<sup>5</sup> Therefore screening for carriage of these organisms can serve as predictive marker for septic episodes of nonhematological patients and immediate action for prevention of infection can be taken.<sup>7,8</sup> This study was undertaken to find the correlation of colonization with extended spectrum beta lactamases (ESBL) producing organism and Methicillin Resistant Staphylococcus aureus (MRSA) in nonhematological patients with septic episodes during periods of neutropenia.

## MATERIAL AND METHODS

This is a retrospective analysis done from May 2013 to February 2017 in oncology ward.

All the patients admitted to oncology ward were tested for carriage of bacteria with enzymes ESBL and MRSA at the time of admission. Each admission was defined as “episode”. As per hospital protocol; for NIS testing seven swabs per patient were received in the microbiology Lab. The swabs were taken from both nostril, both groins, both axilla and single perianal swab. Swabs from the nostril were screened only for MRSA as nose is the most common site for harboring MRSA.<sup>9</sup> Other sites were screened for organism carrying ESBLs and MRSA. The swabs received in the lab were then cultured onto Mueller Hinton agar (MHA) with disc ceftazidime (Oxoid, Thermofischer scientific) for detection of ESBL as per CLSI guideline M100.<sup>10</sup> They were also cultured onto oxacillin resistance screen

agar, ORSA base (Oxoid, Thermofischer scientific) for detection of MRSA. The growth around ceftazidime disc confirmed the presence of ESBL enzyme<sup>10</sup> and dark blue color colonies on ORSA confirmed the presence of MRSA as shown in Figure1.

Growth of Gram negative bacilli resistant to ceftazidime in MHA plates and growth of Gram positive organisms in ORSA plate was taken as positive for colonization. Growth on MHA were further identified by automated system; Vitek 2C (Biomereix).

Similarly; a blood culture set was sent to lab for presence of organisms in blood during septic episodes of febrile neutropenia. All the blood cultures were incubated in automated blood culture system (Bactec 9120 BD) .Only those patients whose NIS test and blood culture test was performed were included in this study.

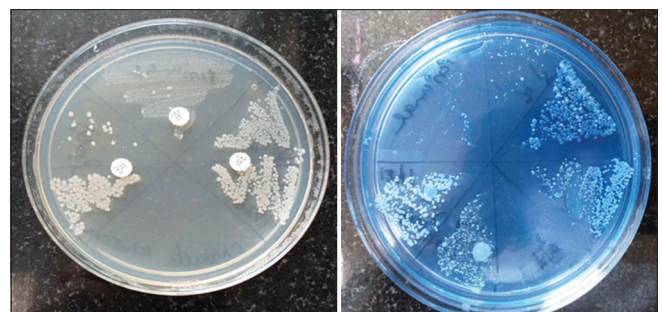
The identification of organisms from positive blood culture was done by Vitek 2C (Biomereix).

Patients with positive NIS were then cleaned with chlorhexidine scrub (4%CHG) for five days and a repeat sample for NIS was sent after five days.<sup>11</sup> Strict infection control measures like hand hygiene, personal protective Equipment (PPE) and isolation was taken care for each positive patient.

Statistical analysis was performed using SPSS software.

## RESULTS

In this study the total number of patients who were screened for NI carriage were 29. For these twenty nine patients, total samples submitted to lab for NIS tests and blood cultures were 52. This could be attributed to repeated admission or “episodes” of same patients. Distribution of NIS result and Blood culture result are shown in Table1.



**Figure 1:** Mueller Hinton Agar showing ESBL positive isolate and Oxacillin Resistance Screening Agar Base showing dark blue MRSA isolates

Among 29 cases 18 (62.02%) were male. Among 52 NIS samples, 28 were positive for either MRSA or ESBL producing Gram Negatives or both. These 28 positive NIS sample were then correlated with organisms isolated from blood cultures. A total of 19 blood cultures (67.8%) showed same organisms.

The remaining 24 NIS negative sample were correlated with blood culture. 70.8% showed no growth. Chi square and odds ratio was calculated. The p value was 0.017. Positive Predictive Value was 73% and negative predictive value was 64%.

A total of 26 blood cultures were positive for organisms as shown below in Table 2.

The most common isolate obtained in blood culture was *Escherichia coli* (n=11,42.3%) followed by *Kebsiellsa pneumonia* (n=7,26.9%) *Pseudomonas aeruginosa* (n=2,7.6%) *Staphylococcus aureus* (n=2, 7.6%), budding yeast cell(n=2,7.6%), *Burkholderia cepacia* (n=1,3.8%) and *Enterobacter cloacae* (n=1, 3.8%).

Among 19 positive samples of NIS and blood culture; correlation was seen among 14 (73.7%) samples. Discordance in NIS positive result with growth in blood culture was seen among 5 (26.3%) samples. Those cases which do not correlate were where there was growth of *Pseudomonas sp* (n=2), *Candida sp* (n=1), *Burkholderia sp* (n=1), *Enterobactercloacae* (n=1).

Among 28 positive episodes or admission, 67.85% (19) cases were discharged with negative NIS test screening report.

In this study ESBL carrying organism were more prevalent when compared to MRSA.

## DISCUSSION

Various published literature suggest the predictive utility of screening for MRSA and ESBL in the nose, axilla, groin and perianal region at the time of admission for surveillance. Screening strategies are useful in detection of colonization. Various published literature where studies were performed in hematological patients; previous colonization with ESBL producing enterobacteriaceae was associated with increased risk of bloodstream infections.<sup>8,12-14</sup> In another study it was found that patients previously colonized with ESBL harbouring organisms were at higher rate for blood stream infection.<sup>12</sup> In another study MRSA screening and culture of 273 patients was performed. The sensitivity was 58.3% (95% confidence interval [CI] 28.6%–83.5%), specificity was 93.9% (95% CI 90.0%–96.3%), positive predictive value 30.4% (95% CI 14.1%–53.0%), negative predictive value 98.0% (95% CI 95.1%–99.3%).<sup>15</sup> Colonization with these organisms serves as an important risk factor for invasive infections. In our study septicemia was present in 67.8% of positive NIS samples. This could help guiding empirical therapy.

Screening is more important if the patient is being referred from another healthcare set up. These colonizers are responsible for NIs later during the stay of patient in hospital. NIs can be due to multidrug resistant organisms which at times become difficult to treat. It leads to mortality, increase length of stay and higher treating cost to the patient in long term care, debilitated or immunosuppressed individuals.<sup>16,17</sup>

Colonised patients act as potential source of cross transmission to other patients.<sup>9,17</sup>

Therefore, identification of patients with carriers of resistant bacteria allows infection prevention measures to be taken among these patients in controlling infection from the colonization.

These active surveillance cultures are inexpensive but labour intensive. These are justified on medical and economical grounds. Other studies have also reported utilization of prediction of ESBL and MRSA infection from colonisation.<sup>3,4,15</sup>

It is very critical to judge colonization from infection as inflammatory changes among immunocompromised is minimal. Carriage or colonization with normal commensal can prove lethal to these patients. Care should be taken

**Table 1: Nosocomial Infection screening and blood culture findings**

NIS result	Blood culture result	Total number of correlating episodes
Positive(n=28)	Positive	19
	Negative	09
Negative(n=24)	Positive	7
	Negative	17

**Table 2: Microorganisms isolated from blood cultures**

Organisms	n	%
<i>Escherichia coli</i>	11	42.3
<i>Kebsiellsa pneumonia</i>	7	26.9
<i>Pseudomonas aeruginosa</i>	2	7.7
<i>Staphylococcus aureus</i>	2	7.7
<i>Budding yeast cell</i>	2	7.7
<i>Burkholderia cepacia</i>	1	3.8
<i>Enterobacter cloacae</i>	1	3.8

to minimize the carriage rate among these patients once they are in the healthcare premises. Nosocomial infection screening at the time of admission and also of the admitted patients can help in early detection of MDR organisms and implementation of treatment strategy which can help in reducing mortality, length of stay, and cost benefits.

This study shows a positive correlation with NIS result and blood culture isolation. A strong infection control and preventive measures if implemented can lead to decrease in infection among patients. The potential limitation of this study are lesser number of cases included, clinical correlation of the patient with respect to screening and blood culture result, and lastly sensitivity of screening and blood sample isolates were not correlated. More studies must be performed to find out the clinical implication and justification for empirical antibiotic initiation on the basis of NI screening tests.

This study can serve as a potential need routine NIS surveillance among other patients. A larger group of patients can be considered and their blood cultures can be correlated. It can help in better finding and approximation of these two tests.

## CONCLUSION

This study shows that screening for ESBL and MRSA for immunocompromised patients at time of admission or during prolonged admission can serve as tool for predictive marker of septicaemia. It can help in early identification of patients at risk. The correlation of organisms obtained from NIS tests and blood culture in this study gives an insight and direction for initiating empirical antibiotic therapy in these critical patients. The early and right antibiotic can help in decreasing the morbidity and mortality among these patients. This study also shows that there is a higher probability of developing septicemia in cases that were positive at screening. More studies should be performed with increase sample size which can serve as a better predictor of the analysis.

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**Author's Contributions:**

**SY**-Concept and design of the study, Intellectual content; **AHS**- Data Interpretation, Analysis and preparation of manuscript; **SSD**- Review of literature and Editing of manuscript.

**Orcid ID:**

Dr. Areena Hoda Siddiqui-  <https://orcid.org/0000-0002-2524-1711>

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