

Research article

Prevalence of *Staphylococcus aureus* in Intensive care Units and Post Operative Ward as a possible source of Nosocomial infection: An experience of tertiary care hospital

Bhattarai P, Dhungel BA, Shah P, Amatya J

Think Tank Foundation, Jorpati, Nepal
Kathmandu College of Science and Technology, Kalimati, Kathmandu, Nepal

ABSTRACT

Background and Objectives: Hospital Acquired Infection (HAI) also called nosocomial infection is a global problem. It also acts as a leading cause of death and increased morbidity among hospitalized patients. *Staphylococcus aureus* is one of the commonest pathogens causing HAI and is also closely associated with human body. WHO study has shown highest prevalence of HAI in Intensive care unit (ICU), Neonatal care unit (NICU), Post operative ward (POW). Hence it becomes very imperative to check the prevalence of HAI. Therefore this study was carried out to determine the prevalence of *S. aureus* in hospital environment as a possible source for HAI.

Material and Methods: Environmental samples and blood samples of the patients were collected from ICU, NICU, POW using sterile cotton swabs during study period. Standard protocol was followed to isolate and identify *S. aureus* which was followed by antibiotic sensitivity tests.

Results: A total of 216 environmental samples were collected out of which 18.98% (41) samples showed the presence of *S. aureus*. It was also isolated from the blood samples of patients admitted to ICU (7.5%) and NICU (6.8%). None of the isolates from environmental samples were MRSA (methicillin resistant *Staphylococcus aureus*).

Conclusion: *S. aureus* was found as a prominent environmental flora of hospital setting. Presence of these organisms in sensitive units like ICU, NICU, POW and the isolation of *S. aureus* from clinical samples indicates a possibility of HAI. It indicates the necessity of continuous surveillance of hospital environmental for quality control.

Key words: *S. aureus*, Nosocomial infection, HAI, ICU, NICU

INTRODUCTION

Hospital Acquired Infection (HAI), also called nosocomial infection is defined as an infection

acquired in hospital by a patient who was admitted for a reason other than that infection [1]. This also includes infection acquired in the

hospital but appearing after discharge and occupational infections among staffs working in the hospital [2]. Hospital acquired infection is a global problem. At any time over 1.4 million people worldwide suffer from infectious complications acquired in hospital [3]. A WHO report has shown that frequency of nosocomial infection in South East Asia is 10%. In a study done in Nepal, the overall point prevalence of HAI is reported to be 2.4% [4].

Many factors like old age, underlying disease, chemotherapy, low level immunity, variety of invasive medical procedures promote nosocomial infection among hospitalized patients. This increases the complications of the treatment and may also act as a leading cause of death and increased morbidity among hospitalized patients [3]. Nosocomial infections can also spread among hospital staffs, visitors and may affect community. Emergence of drug resistant bacteria which can cause hospital acquired infection is an alarming state as the treatment and control of such multidrug resistant organism is extremely difficult [2].

Different microorganisms can cause hospital acquired infections. *S. aureus* is one of the commonest pathogens associated with HAI. The emergence of multi drug resistant *S. aureus* has become a major concern because of higher mortality due to hospital acquired MRSA (methicillin resistant *Staphylococcus aureus*) infection [5].

S. aureus is commonly found in the environment including dust, water, air, feaces, clothing and utensils. It is also found closely associated with the human body. Nasal carriage of *S. aureus* has been identified as a risk factor for nosocomial infections [6]. Studies have shown that screening and eradication of nasal carrier for *S.*

aureus decreases the incidence of HAI [7].

HAI in sensitive units like Intensive care unit, Neonatal care unit, Post operative ward is even more frightening. WHO study has shown highest prevalence of HAI in such units. This may indicate further complication among critical patients in terms of cost, morbidity and mortality. Hence it becomes very imperative to check the prevalence of HAI.

Hence this study was performed as a surveillance of a tertiary care hospital environment in most vulnerable wards i.e. NICU, ICU, Post Operative Ward for one of the commonest organisms causing HAI i.e *S. aureus*.

MATERIALS AND METHODS

Sample collection and processing:

This study was carried out prospectively at tertiary care hospital (KIST medical college teaching hospital) during July to September 2010. Surface samples from inanimate objects (bed linings, floor and working table) were collected from ICU, NICU and Post Operative ward. The samples were collected using sterile dry cotton swab soaked in normal saline. Sampled swab sticks were transferred to Nutrient broth and incubated at 37 degree centigrade for 4 hours. Then culture was done on Nutrient agar and incubated at 37 degree centigrade for overnight. This was followed by staining, subculture and processing for isolation and identification of *S.aureus*. Antibiotic sensitivity test for the isolated *S. aureus* was done using Kirby Bauer disc diffusion method. Standard protocol and precaution were followed in the laboratory procedures.

Quality control:

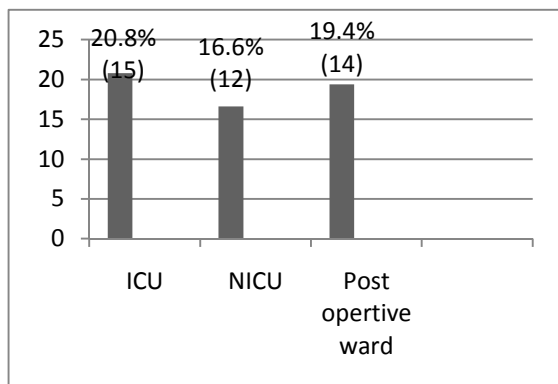
Temperature chart was maintained for incubator and hot air oven to monitor their performance.

Quality check of culture media was done by incubating un-inoculated culture plate from each batch. All the reagents and antibiotic disc were checked for expiry date. Quality check was done using positive and negative control for the biochemical reagents used for the tests. Control strain of *S. aureus* (ATCC 25923) was used along with the suspected *Staphylococcus spp* strain to increase the validity of isolation and identification.

RESULTS

A total of 216 environmental samples were collected during the study period from ICU, NICU, Post operative ward, out of which 18.98% (41) samples showed the presence of *S. aureus*.

Fig 1: Percentage wise distribution of *S. aureus* among different wards



Total of 24 samples were collected each from Bed linings, floor and table of the three wards. The percentage distribution of *S. aureus* in the samples is shown in Figure 2.

During the study period, *S. aureus* was also isolated from the blood samples of patients admitted to ICU (7.5%) and NICU (6.8%) which is shown in Table 1.

Fig 2: Percentage distribution of *S. aureus* in different environment samples of ICU, NICU and POW

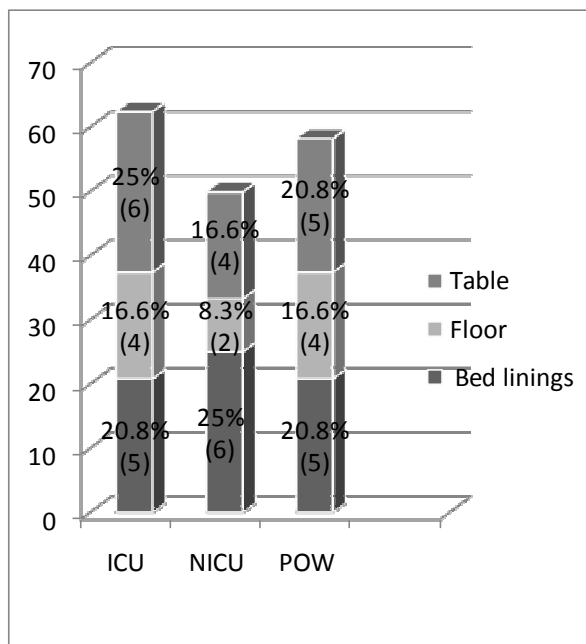


Table 1: Occurrence of *S. aureus* on blood sample of patients in different wards

| Ward | Total number of Patients | Occurrence of <i>S. aureus</i> |
|-------|--------------------------|--------------------------------|
| ICU | 53 | 4(7.5%) |
| NICU | 29 | 2(6.8%) |
| POW | 32 | - |
| Total | 114 | 6 |

Table 2: Antibiotic sensitivity pattern for *S. aureus* isolated from environmental samples

| Antibiotics | Sensitive | Resistant |
|-----------------|-----------|-----------|
| Ampicillin | 100% | 0% |
| Vancomycin | 100% | 0% |
| Chloramphenicol | 100% | 0% |
| Gentamicin | 100% | 0% |
| Oxacillin | 100% | 0% |
| Meropenam | 100% | 0% |
| Cotrimoxazole | 100% | 0% |
| Amikacin | 100% | 0% |

Antibiotic sensitive test for *S. aureus* isolated from environmental samples is presented in table 2.

Nosocomial infection is a global concern. Infection acquired in health care settings are among the major causes of death and increased morbidity among hospitalized patients [2]. Five to ten percentage of hospitalized patients develop nosocomial infections [8]. A prevalence survey conducted under WHO in 55 hospitals of 14 countries representing 4 WHO regions (Europe, Eastern Mediterranean, South East Asia and Western Pacific) showed an average of 8.7% of hospitalized patients had nosocomial infection. In our study also, from a total of 216 environmental samples collected during from ICU, NICU, Post operative ward, 18.98% samples showed the presence of *S. aureus*.

S. aureus is one of the commonest organisms causing HAI. It is spread from nasal carrier, skin and inanimate objects. These organisms are present in the air, dust and surfaces where they may survive along with fungal and bacterial spores and so are the major environmental inhabitants [8]. In our study 18.9% of the samples showed the presence of *S. aureus* in them. Similarly, Banjara et al. have reported *S. aureus* to be the predominating isolate of indoor air of the hospital [9]. Another study by Weinstein has shown that *S. aureus* together with Coagulase negative Staphylococcus aureus and Enterococci accounted for 24.9% of nosocomial infections [10]. Similar study done at Tribhuvan University Teaching Hospital has shown that *S. aureus* as one of the commonest organisms prevailing in the hospital settings [11]. Over the past 50 years, *S. aureus* has acquired resistance to previously effective antimicrobials including penicillinase resistant methicillin [12]. In our study, all the strains of *S.*

aureus were sensitive to the antibiotics tested and none were detected to be MRSA.

S. aureus can also cause nosocomial bacteremia [13]. In our study, *S. aureus* was isolated from blood of 7.5% patients in ICU and 6.8% patients in NICU. This is an indication that these strains may be the same as those prevalent in hospital environment giving rise to HAI. However, further confirmation by molecular method is essential to prove the strain identity.

The inanimate environment of the hospital comprising of contaminated air, water, food, soiled linen, hospital waste, used equipments, table, floor acts as an important source of HAI [8]. In this study also, samples were taken from bed linings, floor and table. Out of 72 samples collected from bed linings of the three wards, the occurrence of *S. aureus* was higher in NICU (25%) than in ICU and POW (each 20.8%). *S. aureus* was found higher in ICU and POW (each 16.6%) than in NICU (8.3%). Among the three, working table of POW showed higher prevalence of *S. aureus* (25%).

Studies have shown that highest prevalence of nosocomial infection occur in ICU, NICU, POW [2]. In our study also, *S. aureus* was detected in all the three wards; 20.8%, 16.6%, 19.4% respectively. This is not a good indication, as all the three wards admit very sensitive patient who has even higher chances of acquiring nosocomial infections. Quality check of the three units regarding sterility and aseptic technique will help to control the prevalence of *S. aureus* in the hospital environment and thereby reducing the outbreak of HAI.

CONCLUSION:

S. aureus is a common organism found in hospit-

al environment which is also a leading cause of HAI. In our study also, *S. aureus* was found in different environmental samples of ICU, NICU, POW. Effective control of these organisms before it causes break out of HAI is essential. Therefore, regular study like this, will help to guide hospital for quality control policy. During the study period, *S. aureus* was also found in the blood samples of patients in ICU and NICU. If these strains are same as those found in hospital environment, which can be confirmed by molecular method, it will indicate a serious problem of nosocomial infection. Hence, regular correlation between quality control report of hospital environment and isolates from patients will help to identify the association of similar source of infectious organisms. This helps to manage HAI before it becomes a serious outbreak.

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