SURVEY OF *STAPHYLOCOCCUS* ISOLATES AMONG HOSPITAL PERSONNEL, ENVIRONMENT AND THEIR ANTIBIOGRAM WITH SPECIAL EMPHASIS ON METHICILLIN RESISTANCE

*K. L. Shobha, P. S. Rao, J Thomas*

**Abstract**

The objective of this study was to find the prevalence of *Staphylococcus* spp. carriage among hospital personnel and hospital environment and their antibiogram with special emphasis on methicillin resistance. A total of 205 samples from hospital personnel and environment were collected from casualty, oncology and multidisciplinary cardiac unit ward of Kasturba Medical College Hospital, Manipal. Samples were collected using sterile cotton wool swabs and inoculated into brain heart infusion broth. Subcultures were done onto blood agar and MacConkey’s agar. Isolates were identified by standard methods up to species level. Antimicrobial susceptibility test was performed according to standardized disc diffusion Kirby-Bauer method. Each of the isolates was screened for methicillin resistance using oxacillin disc on Mueller Hinton agar plate followed by MIC for methicillin and cefoxitin susceptibility test by disc diffusion method. Sixty five out of 205 strains (31.7%) were *Staphylococcus* spp. and all of them were coagulase negative. Most of the strains belonged to *S. epidermidis* 49.23% (32/65) followed by *S. saprophyticus* 26.15% (17/65). Maximum isolates of *S. epidermidis* were from anterior nares 28.12% (9/32 strains of *S. epidermidis*). Highest number of methicillin resistant coagulase negative strains (3/9, 33.33%) were isolated from stethoscope of multidisciplinary cardiac unit ward followed by carriers in the anterior nares (2/9, 22.22%). Methicillin resistant coagulase negative staphylococci are prevalent in anterior nares of hospital personnel and in the hospital environment thereby providing a definite source for hospital acquired infection. All isolates were sensitive to vancomycin, ciprofloxacin and amikacin.

**Key words:** Methicillin resistance, coagulase negative *Staphylococcus* species, stethoscope, anterior nares

Multidrug resistant *Staphylococcus* isolates in hospitals have been recognized as one of the major challenges in the hospital infection control. Isolation of coagulase negative *Staphylococcus* and antibiotic sensitivity patterns are regarded with all seriousness in clinical practice and clinical epidemiology. These strains are not only resistant to multiple antibiotics, but also act as a reservoir for drug resistance gene. Higher percentage of methicillin resistant *Staphylococcus* among carriers can serve as a focus of nosocomial spread of multidrug resistant *Staphylococcus* in tertiary hospitals and cause problems to hospital infection control programs.

In India, the study on the prevalence of *Staphylococcus* species among hospital personnel is much lacking. Here we report the prevalence of *Staphylococcus* spp. isolated from hospital personnel and hospital wards and their antibiogram. We especially determined methicillin resistance among these isolates.

**Materials and Methods**

A total of 205 samples were collected from casualty, oncology and multidisciplinary cardiac unit (MICU) wards of Kasturba Medical College Hospital, Manipal from December 2002 to February 2003. The specimens included swabs from floor, sink, tap, door handles of the wards and swabs from stethoscopes. Other samples included hospital staff’s fingernails, skin swab, scalp hair, nasal swabs and urine from catheterized patients admitted to these wards.

Sterile cotton wool swabs, moistened with sterile normal saline were used to collect the specimen. Urine was collected by aspiration from the catheter using a sterile needle and syringe. Specimens were inoculated into brain heart infusion broth (BHI) immediately. Subcultures were done from BHI broth on to blood agar and MacConkey’s plate. *Staphylococcus* species were identified up to species level as per the scheme described by Baird-Parker. The antimicrobial susceptibility test was performed according to standardized disc diffusion Kirby-Bauer method. Each of the isolates was screened for methicillin resistance by disc diffusion method. Four of five colonies picked from overnight growth were inoculated into 4 to 5 mL of peptone water which was incubated at 35 °C until turbid to 0.5 McFarland standard. The methicillin susceptibility was tested using 1 µg Oxacillin discs (Hi-Media, Mumbai, India). The diameter of the clear zone around the disk was measured and the results were interpreted as susceptible or resistant. Drug free plates were also inoculated for growth control. Methicillin Sensitivity was further confirmed by minimum inhibitory concentration at 0.2 µg/mL to 0.8 µg/mL and susceptibility to cefoxitin was tested.
by disc diffusion method. The zone size of 24 mm or less for cefoxitin was considered as resistant.7

**Results**

Out of 205 samples screened 65 (31.7%) samples yielded *Staphylococcus* spp. and all of them were coagulase negative (CoNS). Resistance to oxacillin was 13.84% (9/65). Highest percentage of oxacillin resistant coagulase negative *Staphylococcus* strains (MR-CoNS) were isolated from the stethoscope 33.33% (3/9) followed by carriers in the anterior nares 22.22% (2/9) of hospital personnel (Table 1). As shown in table 2, 32 out of 65 (49.23%) staphylococcal species belonged to *S.epidermidis* followed by *S.saprophyticus* 17/65 (26.15%).

Antibiotic sensitivity pattern of isolates showed 100% sensitivity to vancomycin, ciprofloxacin and amikacin. Resistance to ampicillin and amoxicillin-clavulinic acid was 70% each. Methicillin resistance was 14% (Table 3).

**Table 1: Distribution of CoNS and methicillin resistant CoNS in various samples**

| Specimen            | Number screened | No. of CoNS | No. of MR-CoNS |
|---------------------|-----------------|-------------|----------------|
| Stethoscope         | 45              | 17          | 3 (4.61%)      |
| Fingernails         | 31              | 8           | 1 (1.53%)      |
| Anterior nares      | 37              | 17          | 2 (3.07%)      |
| Scalp hair          | 31              | 6           | 2 (3.07%)      |
| Skin                | 31              | 8           | 1 (1.53%)      |
| Floor               | 06              | 4           | 0              |
| Sink                | 06              | 0           | 0              |
| Tap                 | 06              | 0           | 0              |
| Door handle         | 06              | 5           | 0              |
| Catheterized urine  | 06              | 0           | -              |
| **Total number**    | **205**         | **65**      | **9 (13.84%)** |

MR-CoNS – methicillin resistant coagulase negative staphylococci

**Table 2: Distribution of coagulase negative *Staphylococcus* (CoNS) in the study samples**

| CoNS species      | Number (%) |
|-------------------|------------|
| *S.epidermidis*   | 32 (49.23) |
| *S.saprophyticus* | 17 (26.15) |
| *S.hominis*       | 12 (18.46) |
| *S.simulans*      | 3 (4.61)   |
| *S.haemolyticus*  | 1 (1.53)   |
| **Total**         | **65**     |

**Discussion**

Of 205 samples collected from hospital wards and hospital personnel, 65 (31.7%) isolates were CoNS. This correlated well with the study conducted by Baumgart et al8 who reported 23% carrier rate of CoNS. Among the hospital staff, nasal carrier rate of CoNS was 45.94% (17/37 samples). This study is in concordance with the study conducted by Narayani et al9 who reported nasal carrier rate of 62% CoNS. Our study showed a decreased incidence of CoNS in stethoscopes 33.71% (17/54) when compared to other studies, where 100% stethoscopes yielded CoNS. Smith et al1 reported 58% incidence of CoNS from stethoscope.11 Among the carrier isolates, *S.epidermidis* was the leading species followed by *S.saprophyticus*. Narayani et al9 had found *S.epidermidis* as the commonest isolate followed by *S.hominis*. However, in our study *S.hominis* was the third commonest species. It is well known that *S.saprophyticus* is the leading agent among coagulase negative *Staphylococcus* strains associated with urinary tract infection. However, in our study there was no isolation from urine samples. CoNS had maximum resistance to ampicillin 69% (45/65), amoxicillin-clavulinic acid 69% (45/65) and TMP/SMX 65% (42/65). All strains were sensitive to vancomycin, amikacin and ciprofloxacin. Methicillin resistance was 14% (9/65), which was in concordance with the study conducted by Vijayalakshmi et al.12 All these nine strains were confirmed to be methicillin resistant by MIC at 0.2 µg/mL to 0.8 µg/mL. Strains resistant to oxacillin were also resistant to cefoxitin. MR-CoNS carriage rate was highest in stethoscope 33.33% (3/9) when compared to other specimens. Marinella et al10 reported more than 40% methicillin resistant *Staphylococcus* species from stethoscope which correlated with our study.

Methicillin resistant *Staphylococcus* spp. present in hospital personnel may act as carriers and can serve as a focus of nosocomial spread of multidrug resistant *Staphylococci* in tertiary level hospitals and cause problems to hospital infection control programmes.
References

1. Majumder D, Sarma bordoloi JN, Phukan AC, Mahanta J. Antimicrobial susceptibility pattern among methicillin resistant staphylococcus isolates in Assam. *Indian J Med Microbiol* 2001;19:138-40.

2. Jesudasan MV, Anandraj SW, Jagadeesan P. Incidence of methicillin resistant coagulase positive and coagulase negative staphylococcus in blood cultures. *Indian J Med Res* 1997; 105:155-7.

3. Jessen O, Rosendal K, Bulow P, Faber V, Erickson KR. Changing staphylococci and staphylococcal infection, a ten years study of bacteria and cases of bacteremia. *N Engl J Med* 1969; 281:627-35.

4. Joshi JR, Pawar S, Joshi PJ, Samuel A. Biological characters and antimicrobial sensitivity of staphylococcus epidermidis. *Indian J Pathol Microbiol* 1987;30:89-96.

5. Baird-Parker AC. Methods for identifying Staphylococci and Micrococci: In skineer FA and Lovelock DW. (Editors): Identification Methods for Microbiologists. (Academic Press, London) 1979. p. 201-10.

6. Bauer AW, Kirby WM, Sherris JC, Turck M. Antibiotic susceptibility testing by standardized single disk method. *Am J Clin Pathol* 1966;45:493-7.

7. New CLIS/NCCLS Antimicrobial susceptibility testing (AST) Recommendations M100-S15. Available at http://www.phppo.cdc.gov/mln/pdf/2005/4m100%20s15checklist.pdf. Accessed March 5, 2005.

8. Bavmgart S, Hall SE, Campos JM, Polin RA. Sepsis with CONS in critically ill newborn. *AMJ dis child* 1983;137:461-4.

9. Narayani TV, Naseema K, Bhattacharya RN, Shyamkrishnan KG, Shanmugam J. Prevalence of Coagulase negative staphylococcus species Among Hospital personal and Surgical patients. *Indian J Path Micro* 1990;33:258-62.

10. Marinello MA, Pierion C, Chenoweth C. The stethoscope, potential source of nosocomial infection? *Arch Inter Med* 1997;157:786-90.

11. Smith MA, Mathewson JJ, Ulert IA, Scerpella EG, Ericsson CD. Contaminated stethoscopes revisited: *Arch Inter Med* 1996;156:82-4.

12. Vijayalakshmi N, Mohapatra LN, Bhujwala RA. Biological characters and antimicrobial sensitivity of *S. epidermidis* isolated from human source. *Indian J Med Res* 1980;72:16-22.

---

**Guidelines to Authors**

Published once in January issue of the IJMM

Also available online on the IJMM website <www.ijmm.org>