Speciation and Antimicrobial Susceptibility of Coagulase Negative Staphylococci, Isolated from the Anterior Nares of Health Care Workers, in A Tertiary Care Hospital in South India, with Special Reference to Methicillin Resistance

Ragini Ananth Kashid¹, Kausalya Raghuraman²

ABSTRACT

Introduction: Coagulase negative staphylococci (CoNS) are identified as emerging pathogens causing nosocomial infections, with significant morbidity and mortality. Speciation of CoNS helps in the understanding of their susceptibility patterns, the reservoirs and the epidemiology. CoNS are multidrug resistant and act as reservoirs for drug resistant genes. They are found in health care workers (HCWs), who act as reservoirs and help, in the spread of nosocomial infections. This study was undertaken to determine the occurrence, the species and susceptibility pattern of CoNS isolated from the anterior nares of HCWs working in our tertiary care hospital.

Material and Methods: Anterior nasal swabs were taken from a total of 310 HCWs. Speciation of CoNS was done by a practical scheme adopted from various references. Kirby Bauer disc diffusion method was performed as per CLSI guidelines. Statistical methodology: Percentage description of the data was given.

Results: The rate of isolation of CoNS was 55.8% (173/310). Among the 173 CoNS isolated in this study, 44%(76/173 ) were S. haemolyticus, 30% (52/173) were S. warneri, 14% (25/173) were S. capitis, 5% (8/173) were S. simulans, 4% (7/173) were S. epidermidis, 2% (3/173) were S. schleiferi and 1%(2/173) were S. lugdunensis. 16.18% of the isolates were MRCoNS. Doctors had the highest number of MRCoNS (10/28, 35.7%). Methicillin resistance was highest in S. lugdunensis (50%). Multidrug resistance was seen in the CoNS isolates. All isolates were sensitive to vancomycin.

Conclusion: This study reiterates the need to screen HCWs for CoNS and to adopt simple, economical and user friendly tests for speciation. The species and its susceptibility pattern help to eliminate reservoirs and prevent nosocomial infections.

Keywords: anterior nares, antibiotic susceptibility, Coagulase negative Staphylococci (CoNS), health care workers(HCWs), methicillin resistant Coagulase negative Staphylococci (MRCoNS), multidrug resistant CoNS, speciation of CoNS.

INTRODUCTION

Coagulase negative staphylococci (CoNS) are commonly found on human skin and several biotypes can be detected on a single individual.¹ In Microbiology laboratories, it is a common practice to identify coagulase negative Gram positive cocci as CoNS and the identification process stops there. It was also common to think that these organisms were not pathogenic and were dismissed as contaminants.² But in the last few years, various studies have demonstrated that CoNS are an emerging group of pathogens.² ⁴ They are associated with nosocomial infections.² ³ ⁵ They are identified as the third commonest cause of blood stream infections, which causes significant morbidity and mortality.² Several reports of CoNS infections, involving indwelling foreign bodies, catheters and artificial devices are on the rise.³ It is important to identify CoNS up to the species level, as the epidemiology, the pathogenicity and drug resistance varies from species to species.¹ Multidrug resistant strains have been reported from various studies.² ³ The challenge with CoNS is that, not only are they multi drug resistant, but they are known to act as reservoirs for drug resistant genes.² The presence of such multidrug resistant strains and methicillin resistant strains in species of Staphylococcus, pose a challenge especially if they are found in the health care workers (HCWs). They act as reservoirs and help in nosocomial spread of infections. In addition, they cause problems for hospital infection control programmes in tertiary care hospitals.² The data on the carriage rate of CoNS in HCWs is lacking.⁷ Hence, we undertook this study, to determine the occurrence, the species and susceptibility pattern of CoNS isolated from the anterior nares of HCWs working in our tertiary care hospital.

MATERIAL AND METHODS

This was a purposive sampling done on all health care workers (HCWs), for a duration of six months with an inclusion criteria being that all consenting HCWs working in our hospital to be included in the study. The exclusion criteria were: all non – consenting HCWs, HCWs who were on antibiotics, who had recent upper respiratory tract infection, who underwent recent nasal surgery and who had lesions in the nose, were to be excluded from the study.

We conducted a prospective study for 6 months duration among the health care workers (HCWs) in Raja Rajeswari Medical

¹Associate Professor, ²Post Graduate, Department of Microbiology, Raja Rajeswari Medical College and Hospital, Kambipura, Mysore Road, Bangalore-560074, India

Corresponding author: Dr. Ragini Ananth Kashid, M.B.B.S., M.D. (Microbiology), Flat no. A- 601, Ashwini Apartments, No. 14, Ring Road, Banashankari II stage, Bangalore 560070, India

How to cite this article: Ragini Ananth Kashid, Kausalya Raghuraman. Speciation and antimicrobial susceptibility of coagulase negative staphylococci, isolated from the anterior nares of health care workers, in a tertiary care hospital in South India, with special reference to methicillin resistance. International Journal of Contemporary Medical Research 2016;3(8):2329-2333.
College and Hospital. Doctors, nurses, technicians and class IV workers were included in the study. The institutional ethical committee approved the study. All health care workers who consented to give samples were included in the study. Prior to enrollment in the study, written consent was obtained from the health care workers. Two pre-moistened swabs were used to swab the anterior nares of health care workers. One swab was inoculated on to Mannitol salt agar and the other swab was inoculated into BHI broth, after overnight incubation at 37°C it was subcultured on to blood agar plates. The CoNS gave red coloured colonies on Mannitol salt agar. These red coloured colonies were identified as CoNS based on colony morphology, Gram stain, catalase test, slide coagulase and tube coagulase test. To exclude Micrococc and Stomatococcus species, bacitracin susceptibility test was performed. To identify CoNS up to species level, we chose tests that were simple, user friendly and economical, from Kloos and Schleifer scheme, Mackie and McCartney and Koneman et al. (Table-1).

The tests mentioned in Table-1 were used to identify the common species of CoNS, which are as follows: the S. haemolyticus group (S. haemolyticus, S. auricularis and S. caseolyticus), the S. saprophyticus group (S. saprophyticus subsp. novobiocin and S. hominis subsp. hominis), the S. epidermidis group (i.e., S. epidermidis, S. capitis subsp. ureolyticus and S. caprae), the S. warneri group (S. warneri and S. hominis subsp. hominis), S. lugdunensis, S. schleiferi subsp. schleiferi, S. capitis subsp. capitis, S. simulans and S. cohnii subsp. cohnii, the S. cohnii group (S. xylosus and S. cohnii subsp. ureolyticum). This scheme involved a two-step procedure (Table-1), first step aimed to identify species group and combined slide and tube coagulase with novobiocin resistance, test for urease activity, ornithine decarboxylase and aerobic acid from mannose. If identification required additional tests, a maximum of two tests were selected from Table-1:
14% (25/173) were S. capitis,

Table-2

<table>
<thead>
<tr>
<th>HCW group</th>
<th>Number screened</th>
<th>No. of CoNS isolated (Percentage %)</th>
<th>No. of MR-CoNS isolated (Percentage %)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attenders</td>
<td>105</td>
<td>58 (55.23)</td>
<td>9 (32.2)</td>
</tr>
<tr>
<td>Doctors</td>
<td>78</td>
<td>53 (67.94)</td>
<td>10 (35.7)</td>
</tr>
<tr>
<td>Technicians</td>
<td>75</td>
<td>36 (48)</td>
<td>6 (21.4)</td>
</tr>
<tr>
<td>Nurses</td>
<td>52</td>
<td>26 (50)</td>
<td>3 (10.7)</td>
</tr>
<tr>
<td>Total</td>
<td>310</td>
<td>173 (55.8)</td>
<td>28 (100)</td>
</tr>
</tbody>
</table>

Table-2: Isolation of CoNS and MRCoNS in the various groups sampled

Figure-1: The various species of Coagulase negative Staphylococci isolated

Figure-2: Distribution of HCWs who tested positive for CoNS and MRCoNS in different areas of the hospital.
Kashid, et al. Speciation and Antimicrobial Susceptibility of Coagulase Negative Staphylococci, Isolated

No resistance was seen to vancomycin (Table-3). 

S. capitis showed resistance to the following antibiotics - 8% (2/25) resistance was seen to amoxicillin clavulanic acid, 24% (6/25) to cefoxitin, 8% (2/25) to ciprofloxacin, 36% (9/25) to clindamycin, 16% (4/25) to cotrimoxazole, 8% (2/25) to doxycline, 36% (9/25) to erythromycin, 4% (1/25) to gentamicin, 4% (1/25) to linezolid, 20% (5/25) to oxacillin, 44% (11/25) to penicillin. No resistance was seen to chloramphenicol and vancomycin (Table-3).

S. simulans showed 12.5% (1/8) resistance to each of the following antibiotics: Amoxicillin clavulanic acid, cefoxitin, chloramphenicol, ciprofloxacin, clindamycin, doxycline, gentamicin, linezolid and oxacillin. It showed 25% (2/8) resistance to cotrimoxazole, 37.5% (3/8) to erythromycin and 62.5% (5/8) to penicillin. No resistance was seen to vancomycin (Table-3).

S. epidermidis showed 14.3% (1/7) resistance to clindamycin, cefoxitin and oxacillin, 28.57% (2/7) resistance to penicillin. No resistance was seen to amoxicillin - clavulinic acid, chloramphenicol, ciprofloxacin, cotrimoxazole, doxycline, erythromycin, gentamicin, linezolid and vancomycin (Table-3).

S. schleiferi showed 33.3% (1/3) resistance each, to amoxicillin clavulanic acid, cefoxitin, doxycline, erythromycin and oxacillin. 66.6% (2/3) resistance was seen to penicillin. No resistance was seen to chloramphenicol, ciprofloxacin, clindamycin, cotrimoxazole, gentamicin, linezolid and vancomycin (Table-3).

S. warneri showed 12.5% (1/8) resistance to amoxicillin clavulanic acid, cefoxitin, clindamycin, ciprofloxacin, gentamicin, linezolid and oxacillin. 66.6% (2/3) resistance was seen to penicillin. No resistance was seen to chloramphenicol, ciprofloxacin, clindamycin, doxycline, erythromycin and oxacillin. 33.3% (1/3) resistance was seen to penicillin. No resistance was seen to vancomycin (Table-3).

S. lugdenensis showed 50% (1/2) resistance was seen to each of the following: amoxicillin clavulanic acid, cefoxitin, clindamycin, ciprofloxacin, clindamycin, cotrimoxazole, doxycline, erythromycin, gentamicin, linezolid and vancomycin (Table-3).

In S. lugdenensis, 50% (1/2) resistance was seen to each of the following: amoxicillin clavulanic acid, cefoxitin, chloramphenicol, ciprofloxacin, clindamycin, cotrimoxazole, doxycline, erythromycin, gentamicin, linezolid and vancomycin (Table-3).

The various species of CoNS that were isolated are as follows: 44% (76/173) were S. haemolyticus, 30% (52/173) were S. warneri, 14% (25/173) S. capitis, 5% (8/173) were S. simulans, 4% (7/173) were S. epidermidis, 2% (3/173) were S. schleiferi and 1% (2/173) were S. lugdenensis. Studies conducted by, Mohan U (82.29%), Goyal R (41%), Shobha KL (49.23%) report S. epidermidis as their predominant isolate. In our study, S. haemolyticus (44%) was the predominant isolate, followed by S. warneri (30%) and S. capitis (5%). S. epidermidis was the fifth highest isolate (4%) in this study. Highest number of CoNS was isolated from the anterior nares of HCWs working in the Pharmacy (19.7%), followed by HCWs...
working in the laboratory (11.6%) and in the OBG department (11%) (Figure-2). However, the highest number of MRCoNS were isolated from the HCWs working in Orthopaedics (6/28, 21.4%), followed by those working in OBG (4/28, 14.3%) (Figure-2). Therefore, it is important to include all the hospital staff, working in all areas of the hospital for surveillance studies.

In a study conducted by KL Shobha 22.22% of MRCoNS were reported from anterior nares. In our study, 16.18% (28/173) of the isolates were MRCoNS. Anterior nares of HCWs Doctors had the highest number of MRCoNS (10/28, 35.7%). These findings reflect that doctors are important in the chain of transmission of nosocomial infections and have to upgrade their compliance with hospital infection control programmes.

With regards to susceptibility testing, multidrug resistance was seen in many isolates. This correlates with the studies conducted by Mohan U, Goel MM and Pathak J. Maximum resistance was seen towards drugs like penicillin (53.76%), erythromycin (49.13%), clindamycin (29.48%), cotrimoxazole (16.76%), cefoxitin (16.18%) and amoxiclav (9.25%). S. lugdenensis was the only species which showed resistance to almost all the antibiotics on the testing panel except for gentamicin, linezolid and vancomycin. Methicillin resistance was observed in all the species of CoNS isolated in this study. The percentages are as follows: 50% methicillin resistance in S. lugdenensis, 33.3% in S. schleiferi, 24.5% in S. capitis, 14.5% in S. haemolyticus, 14.3% in S. epidermidis, 13.57% in S. warneri and 12.5% in S. simulans.

There are reports of emerging vancomycin resistance among Methicillin resistant CoNS. In our study, all isolates were sensitive to vancomycin. The variability in antibiotic susceptibility pattern is because, we have different species of CoNS as our predominant isolates, there is a geographical variation and, differences in the antibiotic panel used in every hospital.

Today there are several molecular tests, which detect genes like the ica gene (intercellular adhesion – operon – ica ADBC), atlE gene (encodes for the vitronectin – binding cell surface protein involved in primary attachment ) and the mecA gene (controls the synthesis of PBPs). Other tests like plasmid analysis, tests for slime production and adherence help in the better understanding of pathogenesis, diagnosis and epidemiology of CoNS. These tests may not be economically viable for all hospitals to carry out.

CONCLUSION

Therefore, this study, reiterates the need to speciate the CoNS with an easy, user friendly and economical tests. It is important to speciate the CoNS as this study has proved that the species reported in other hospitals (S. epidermidis) may not coincide with the species isolated in our hospital (S. haemolyticus). The study also press the need to screen the HCWs for carriage of CoNS on a regular basis, as these HCWs act as reservoirs for CoNS. CoNS are identified as emerging pathogens and are known for multidrug resistance. CoNS could be potential roadblocks to hospital infection control programmes. The species and its corresponding sensitivity pattern have to be kept in mind so as to eliminate reservoirs and prevent the spread of nosocomial infections.

ACKNOWLEDGEMENT

We like to thank our Chairman, Sri A.C Shanmugam and the staff of Department of Microbiology, for their constant guidance and support.

REFERENCES


Source of Support: Nil  Conflict of Interest: None  Submitted: 28-06-2016; Published online: 29-07-2016