

Comparison of enterococcal colonization of gut in hospitalized and non-hospitalized patients

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ABSTRACT

Background & objectives: Enterococci are Gram-positive diplococci especially known to cause hospital associated infections. Intrinsic and acquired drug resistance is an important character of this organism and it is ranked next to *E. coli* in hospital associated infections.¹ Hospitalization and use of antibiotics increases their number, making the hospitalized patients prone to develop infections posing a therapeutic challenge to the treating clinicians. A study was, therefore, undertaken to compare enterococcal colonization in the outpatient and inpatient subjects.

Methods: Stool / rectal swab samples from 109 hospitalized and 58 outpatients were collected and evaluated for presence of enterococci. Standard biochemical and physiological tests were used for identification. The antibiotic sensitivity test was performed according to the Clinical and Laboratory Standards Institute (CLSI) guidelines. Results were analysed statistically.

Results: A total of 109 rectal swabs / stool samples from IPD cases and 58 stool samples from OPD group yielded 90.8% (99 of 109) and 37.9% (22 of 58) growth of enterococci respectively. Of the 109 IPD cases, all were receiving antibiotics while only 32 of 58 OPD patients were receiving antibiotics. All isolates were sensitive to vancomycin. The carriage of enterococci in IPD cases was significantly higher compared to the OPD cases.

Interpretation and Conclusions: Enterococcal colonization increases with hospitalization and use of antibiotics. The clinicians must be aware of this phenomenon so as to avoid hospital associated infections by enterococci, especially in the light of their intrinsic and acquired drug resistance.

Keywords: Antibiotics, colonization, enterococci, hospital infection, rectal swab, stool culture

INTRODUCTION

Enterococci are Gram-positive diplococci commonly inhabiting the intestinal tract. The spectrum of infections varies widely causing wound infections, urinary tract infections, blood stream infections and endocarditis. Of late, these organisms have gained importance as hospital pathogens. They are ranked next to *E. coli* in nosocomial infections and account for 12% of hospital infections in the US.¹ However, their role as hospital pathogens is not adequately studied in India. Most infections are thought to be endogenous, the pathogen being derived from the

gastrointestinal tract of the subject. The intrinsic drug resistance of enterococci to cephalosporins, sulphonamides and aminoglycosides make them formidable pathogens once they set in the infection in a hospitalized patient. In addition to intrinsic drug resistance their acquired drug resistance is worsening the problem. Hospitalization and use of antibiotics accentuate the intestinal load of this commensal. Thus in the hospitalized patients their own gut flora acts as a source of infection posing a therapeutic challenge to the treating clinicians. Apart from accentuation of endogenous flora, the hospitalized patients may acquire the hospital enterococci. We therefore, undertook a study to compare enterococcal colonization in the outpatient and inpatient populations.

MATERIAL AND METHODS

The study was conducted at a tertiary care teaching hospital in North Karnataka after obtaining permission from the institutional ethical committee. We collected the stool samples from 109 patients admitted to our hospital.

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The patients who were hospitalized for more than 7 days for complaints other than those related to gastrointestinal tract were included in the study. For evaluation of stool samples from outdoor patients (OPD), we processed 58 consecutive stool samples from non-hospitalized patients visiting the hospital for treatment for complaints other than those related to gastrointestinal tract. For the indoor patients (IPD) we collected rectal swabs. The samples from the OPD cases were collected in sterile universal container. The samples were immediately inoculated on Brain Heart infusion agar, MacConkey's agar and Pfizer *Enterococcus* Selective Agar (PESA) and incubated aerobically at 37°C for 18 to 48 hours. The identification of the suspected colonies was carried out by using standard biochemical and physiological tests. The identification of the isolates as enterococci was confirmed only when the organism showed esculin hydrolysis in 40% bile, growth in 6.5 % NaCl, growth at pH 9.6, growth at 10°C and growth at 42°C.² Further speciation was not attempted. The antibiotic sensitivity test was performed according to the CLSI guidelines for ampicillin (10 µg), chloramphenicol (30 µg), erythromycin (15 µg), ofloxacin (5 µg), teicoplanin (30 µg), tetracycline (30 µg) and vancomycin (30 µg). The antibiotic disks were purchased from Hi Media, Mumbai.³ High level aminoglycoside resistance was not tested. Statistical analysis was performed using Chi square test.

RESULTS

A total of 167 stool specimens / rectal swabs were subjected to culture for detection of enterococci. Of the total specimens studies, 109 rectal swabs/stool samples belonged to IPD cases while 58 stool samples were from OPD group. The rate of enterococcal carriage in IPD and OPD cases was 90.8% (99 of 109) and 37.9% (22

Table I

Frequency of isolation of enterococci and use of antibiotics (n = 167)

| | No of patients studied | Enterococcus isolated (%) | H/o Antibiotic Therapy (%) |
|-----|------------------------|---------------------------|----------------------------|
| IPD | 109 | 99 (90.8) | 109 (100) |
| OPD | 58 | 22 (37.9) | 32 (55.2) |

(IPD - In Patient Department, OPD - Out Patient Department, H/o - History of)

Table II
Sensitivity pattern of the enterococcal isolates from IPD cases (n = 109)

| IPD | A | C | E | O | Te | T | V |
|-------|------|------|------|------|------|------|------|
| S | 35 | 76 | 37 | 39 | 76 | 45 | 87 |
| R | 74 | 33 | 72 | 60 | 30 | 63 | 0 |
| I | 0 | 0 | 0 | 10 | 3 | 1 | 22 |
| Total | 109 | 109 | 109 | 109 | 109 | 109 | 109 |
| S % | 32.1 | 69.7 | 33.9 | 35.8 | 69.7 | 41.3 | 79.8 |
| R % | 67.9 | 30.3 | 66.1 | 55.0 | 27.5 | 57.8 | 0.0 |
| I % | 0.0 | 0.0 | 0.0 | 9.2 | 2.8 | 0.9 | 20.2 |

(A – Ampicillin, C – Chloramphenicol, E – Erythromycin, O – Ofloxacin, Te – Teicoplanin, T – Tetracycline, S – Sensitive, R – Resistant, I – Intermediate Sensitive)

Table III

Sensitivity pattern of the enterococcal isolates from OPD cases (N = 58)

| OPD | A | C | E | O | Te | T | V |
|-------|------|------|------|------|------|------|------|
| S | 28 | 42 | 18 | 22 | 29 | 11 | 47 |
| R | 30 | 15 | 39 | 32 | 26 | 46 | 0 |
| I | 0 | 1 | 1 | 4 | 3 | 1 | 11 |
| Total | 58 | 58 | 58 | 58 | 58 | 58 | 58 |
| S % | 48.3 | 72.4 | 31.0 | 37.9 | 50.0 | 19.0 | 81.0 |
| R % | 51.7 | 25.9 | 67.2 | 55.2 | 44.8 | 79.3 | 0.0 |
| I % | 0.0 | 1.7 | 1.7 | 6.9 | 5.2 | 1.7 | 19 |

(A – Ampicillin, C – Chloramphenicol, E – Erythromycin, O – Ofloxacin, Te – Teicoplanin, T – Tetracycline, S – Sensitive, R – Resistant, I – Intermediate Sensitive)

of 58) respectively (Chi square = 53.07, **f = 1 and P < 0.001) All the 109 IPD cases were receiving one or the

other antibiotic while 32 of 58 OPD patients were receiving antibiotics for their present illness (Table I). All isolates showed sensitivity to vancomycin by disk diffusion method. Ampicillin was the least effective antibiotic.

DISCUSSION

Enterococcal infections are mainly endogenous in origin; patient's own gastrointestinal tract being the common source of infection. It is documented that hospitalization is one of the major factors leading to remarkable increase in the enterococcal colonization of the gut.⁴⁻⁶ In the present work, the carriage of enterococci by IPD cases was significantly higher compared to the OPD cases. The higher yield of enterococci among the IPD cannot be ascribed to play of chance of numbers. Colonization rate of 90.8% in IPD cases against only 37.9% in OPD cases clearly points to the fact that hospitalization is a predisposing cause of enterococcal colonization in patients. Some parameters of the patients were significantly associated with higher yield of enterococci in IPD cases. This was ascribed to the IPD environment and use of antibiotics.

Increase in enterococcal colonization rate is associated with increased chances of enterococcal infections in hospitalized patients.^{6,7} Mechanisms to colonize bowel and access to the lymphatics and/or bloodstream are incompletely understood.⁸

Most of the hospitalised patients receive antibiotics for various reasons. Cephalosporins and aminoglycosides are the frequently administered antibiotics in hospitalized patients. This could be the cause of greater enterococcal colonization rates in IPD patients as enterococci are intrinsically resistant to antibiotics belonging to both these groups. Reduction in the intestinal sensitive flora caused by these antibiotics may facilitate enterococcal colonization.⁹ All our IPD cases (100%) were receiving antibiotics, compared to only 55.2% of OPD cases. Increased colonization rate in hospitalized patients may be indicative of acquisition of hospital flora.^{6,7} Most people carry commensal enterococci in their bowel but they are quantitatively minimal and the Gram-negative bacilli and anaerobes outnumber them. This may elude the routine culture methods from detecting enterococci from stool samples. Once the patient is put on antibiotics, enterococci get an opportunity to replace the sensitive flora and are easily detectable on culture because of their increased number.

It was expected that the isolates recovered from hospitalized cases would be more resistant to antibiotics in comparison to the isolates from OPD cases. The sensitivity pattern of the IPD, OPD isolates from study group and IPD, OPD isolates from routine clinical samples at our laboratory were compared. However, on statistical analysis no significant differences were noticed. The differentiation between the hospital flora and community acquired strains, therefore, could not be made on sensitivity pattern. It may be said that the drug resistant strains have already been established in the community.

The promotion of intestinal colonization of enterococci because of hospitalization and use of antibiotics in IPD cases may be very important to clinicians, especially surgeons. Utmost care must be taken while performing surgical procedures on patients admitted to hospital over longer periods. These patients being characteristically colonized by enterococci may have higher chances of developing post-operative enterococcal infections. The routine preoperative protocol can include careful investigation to assess intestinal enterococcal colonization, at least in elective surgeries. Avoiding unnecessary use of antibiotics; especially minimizing use of cephalosporins and aminoglycosides should be practiced by the hospitals to reduce colonization of patients with hospital enterococci. Careful and continuous monitoring of hospital environment will give an idea of enterococcal strains present in hospital flora. The monitoring of the antibiogram will provide a guideline for empirical use of antibiotics in suspected enterococcal infections in hospitalized patients. An important species of this genus *E. faecium* is known to be intrinsically resistant to vancomycin. This species is thought to have passed on vancomycin resistance genes to staphylococci. Considering these factors, careful and continuous monitoring of the indoor patients on antibiotics and their frequent monitoring for enterococcal colonization should be considered by the tertiary care centres for prevention of enterococcal hospital associated infections.¹⁰⁻¹³

CONCLUSIONS

Enterococcal colonization increases with hospitalization and use of antibiotics. Endogenous flora is the most common source of infections. The clinicians must be aware of this phenomenon so as to avoid hospital infections by enterococci, especially in the light of their intrinsic resistance to aminoglycosides and cephalosporins.

Conflict of interest- There is no conflict of interest.

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