A study of MRSA and VRE screening in pre-operative surgical patients of a Tertiary Referral Hospital

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Abstract:

Background: Microbial Resistance (MR) is a well known and important cause of Healthcare Associated Infections (HAI) leading to increased morbidity and mortality. MRSA and VRE are responsible for MR. They can be effectively detected through simple and cost-effective method of MRSA and VRE screening.

Materials and method: The study was conducted on 50 preoperative surgical patients of General Surgery wards in a Tertiary Referral Hospital after Institutional Ethical Committee approval and informed consent of the patients. The nasal swab and stool sample of each selected patient was taken and MRSA and VRE screening was done. The results obtained were tabulated and statistical analysis was done.

Results: The age range of the patients was 6-80 years. Forty-two (84%) patients were males and 8 (16%) were females. 9 (18%) were cancer patients and remaining 41 (82%) were non-cancer. Out of 50 patients, 5 (10%) were MRSA positive and 7 (14%) were VRE positive. There was a significant association between MRSA positive testing and Cancer patients.

Conclusions: The maximum number of patients were >60 yrs i.e. 21 (42%) and the minimum number were <20 yrs 2 (4%). There were a greater number of males 42 (84%) and the male: female ratio was 5.25:1. Out of the 50 patients, 5 (10%) were MRSA positive and 7 (14%) were VRE positive. There were greater number of MRSA and VRE positive patients 4 (80%) and 5 (71.42%) respectively in the elderly age group >40 years. There were a greater number of MRSA positive patients 3 (60%) among cancer patients. There were a greater number of VRE positive patients 5 (71.42%) among non-cancer patients. This study has important implications for health-care services, training of health-care professional, research and health-care policy.

Keywords: MRSA, VRE, pre-operative

Introduction:

Microbial Resistance (MR) is a well known and important cause of Healthcare Associated Infections (HAI). Methicillin Resistant Staphylococcus aureus (MRSA) and Vancomycin Resistant Enterococcus (VRE) are the common microorganisms responsible for MR. These microorganisms are resistant to Methicillin and Vancomycin respectively and are transferred from patient to patient in the hospital wards. Once a patient developed MRSA/VRE infections they are expensive and difficult to treat, leading to increased cost of hospitalization and increased mortality. Their early detection and timely interventions prevents patients from developing MRSA/VRE and its further complications. There are few studies about MRSA and VRE screening in preoperative surgical patients in the Indian setting. Most studies on MRSA/VRE are foreign studies.
There are also few studies regarding the routine preoperative screening of patients for MR. Our study will examine MRSA and VRE screening in preoperative surgical patients in a Tertiary Referral Hospital. This has implication for patient care, training of medical professional, research and healthcare policy.

**Aims and objectives:**

1. To study the socio-demographic factors of preoperative surgical patients
2. To study the diagnostic categories of preoperative surgical patients
3. To study MRSA screening in preoperative surgical patients
4. To study VRE screening in preoperative surgical patients
5. To study any association between socio-demographic factors, diagnostic categories, MRSA and VRE screening in preoperative surgical patients

**Materials and Methods:**

The study was conducted on 50 preoperative surgical patients of General Surgery wards in a Tertiary Referral Hospital. The study design was approved by the Institutional Ethical Committee. The patients were selected after they met strict inclusion and exclusion criteria. They were given information about the nature of the study and if they were willing then their consent was taken. Consent was taken in the mother tongue of the patients. The nasal swab and stool sample of each selected patient was taken and MRSA and VRE screening was done. The results obtained were tabulated and statistical analysis was done.

**Inclusion criteria:**

1. Preoperative patients of General Surgery wards of a Tertiary Referral Hospital
2. Both sexes male and female
3. All age groups
4. Patient who gave their consent

**Exclusion criteria:**

1. Critically ill patients
2. Patients on ventilators

**Sample size:** 50 preoperative patients of General Surgery ward of a Tertiary Referral Hospital

**Screening:**

**MRSA (Methicillin Resistant Staphylococcus aureus) screening:** A well moistened sterile cotton swab with sterile normal saline was used to collect the anterior nare swab. The nasal swab was then inoculated on Mannitol Salt Agar and incubated aerobically at 37°C for 24 hours. A day later, the agar was examined for yellow colored colonies. The Tube Coagulase test was done on these yellow colored colonies. Methicillin resistance was detected by the Kirby Bauer technique using cefoxitin disc (30ug). The results were interpreted as per CLSI (Clinical and Laboratory Standard Institute) guidelines. [1]

**VRE (Vancomycin Resistant Enterococci) screening:** The stool sample was collected in a sterile wide mouthed container. It was plated on Bile Esculin Agar (BEA) and incubated aerobically at 37°C for 24 hours. A day later, the plate was examined for black colored colonies. This was confirmed by Gram staining. These colonies were subcultured on BEA containing Vancomycin 6ug/ml to detect Vancomycin resistance. The Minimum Inhibitory Concentration (MIC) of the isolated VRE was done by the Broth Dilution Method as per CLSI (Clinical and Laboratory Standard Institute) guidelines. [1]

**Observations and Results:**
1. In our study, the age range of the patients was 6-80 years. Of the 50 patients, 2 (4%) were <20 years, 7 (14%) 20-40 years, 20 (40%) 40-60 years and 21 (42%) >60 years. 42 (84%) patients were males and 8 (16%) were females.

2. The patients were classified as cancer and non-cancer patients. Nine (18%) were cancer patients and remaining 41 (82%) were non-cancer. Cancer patients: Of all the cancer patients, none were in the age group <20 years and 20-40 years. 5 (55.55%) were 40-60 years and remaining 4 (44.45%) were >60 years. Of all the cancer patients, 6 (66.67%) were males and 3 (33.33%) were females. Non-cancer patients: 41 (82%) were non-cancer patients. Of the 41 non-cancer patients, 2 (4.87%) were <20 years, 7 (17.07%) 20-40 years, 15 (36.59%) 40-60 years and 17 (41.47%) >60 years. Of all the non-cancer patients, 36 (87.80%) were males and 5 (12.20%) were females.

3. MRSA screening: Out of 50 patients, 5 (10%) were MRSA positive (Refer Table-1). None of the MRSA positive patients were <20 years. 1 (20%) MRSA positive patient were in 20-40 years and 40-60 years each, the age >60 years were 3 (60%) MRSA positive. Out of 5 MRSA positive patients 3 (60%) were males and 2 (40%) were females. VRE screening: Out of 50 patients, 7 (14%) were VRE positive (Refer Table-1). The age groups <20 years, 20-40 years and >60 years had 1 (14.28%) VRE positive patient each. The age group 40-60 years were 4 (57.16%) VRE positive. All the VRE positive patients were males.

4. The following findings were non-significant:
   i. The association between MRSA positive patients and age (Refer Graph – 1).
   ii. The association between VRE positive patients and age (Refer Graph – 2).
   iii. The association between MRSA positive patients and sex (Refer Graph – 3).
   iv. The association between MRSA positive patients and sex (Refer Graph – 4).
   v. The association between VRE positive patients and cancer patients (Refer Graph – 6).

5. There was a significant association between MRSA positive patients and cancer patients. Chi square test ($\chi^2=3.84 \ P<0.05$) (OR=9.75; 95%CI=1.3395-70.9685) (Refer Graph – 5).

DISCUSSION
Our study examined the socio-demographic factors, diagnostic categories, MRSA and VRE screening and their associations in 50 preoperative surgical patients of a Tertiary Referral Hospital. In our study, the mean age was 51.64 ± 17 years (range 6-80 years). Males were predominant (84%) as compared to females (16%). Our study findings compares with the following author: Fraser et al (2010) found the mean age to be 59.8 ± 15.6 years (range 16-95 years) in 134 MRSA positive patients. (51.5% were males and 48.5% were females) [2].

In the present study the patients were classified as cancer 9 (18%) and non-cancer patients 41 (82%). Different authors conducted study in different setups with different diagnostic categories: Fraser et al
(2010) included the cancer and non-cancer patients and found that out of 134 MRSA positive patients, 44 (32.83%) were cancer and 90 (67.17%) were non-cancer patients [2]. Guyot (2006) et al conducted the study on orthopedic surgery department [5]. Pan et al (2012) conducted the study at the ICU [7]. Romero et al (1995) conducted the study on pus and wound patients [4].

MRSA screening: 10% were MRSA positive and 14% were VRE positive. Our study compares with the following studies: Kakru et al (2003) in Srinagar, India found 40.5% to be MRSA positive [3]. Romero et al (1995) found 31% to be MRSA positive from pus and wound swab [4]. Guyot et al (2006) in an orthopaedic surgery unit found that 48% of SSIs were caused by *Staphylococcus aureus*, out of which 68% were MRSA positive [5]. VRE screening: In the present study, the number of VRE in preoperative patients in General Surgery ward in the Tertiary Referral Hospital was 14% of the total patients studied. Our findings compare with the following authors: Vidyalakshmi et al (2012) found that VRE varies between 1.7-20% in tertiary care hospitals of India [6]. Pan et al (2012) at the ICU in the National Taiwan University Hospital (NTUH) found VRE positive screening to be 11.3% [7]. Leven et al (1999) in Belgium [8] and in Saudi Arabia by Khan et al (2008) in Saudi Arabia [9] reported VRE positive patients to be 46.5% and 37% respectively. Kuwait hospitals by Udo et al (2003) found that the rate of VRE positive screening to be 2.6% [10]. These differences in the MRSA and VRE positive screening at different institutes may due to the differences in the samples studied, the difference in the types of patients studied and also due to the quality of medical services provided. Community tertiary-care centres traditionally serve the patients belonging to lower economic status that are usually malnourished and present with illness of greater severity. Association: MRSA positive patients and age: In patients >40 years, 80% were MRSA positive; hence the older patients had higher MRSA positive rate. However the association was found to be non-significant. Our findings compare with the following studies: Dodds et al (2004) found that old age was associated with increase in risk for post-operative wound infection due to MRSA [11]. Romero et al (1995) showed that patient with MRSA positive was more in the older population 69% [4]. VRE positive patients and age: In older patients (>40 years), 71.42% were VRE positive. Our findings compare with the following authors: Salem et al (2012) in Saudi Arabia found the most of the VRE cases in 56-72yrs [12]. This increased number of both MRSA and VRE in the older age group is probably due to decline in the immune-response in this age group thus increasing the patients’ susceptibility to the bacterial infections. MRSA positive patients and sex: Of all the MRSA cases, 3 (60%) were males and 2 (40%) were females. Hence in the present study, the MRSA cases were higher in males than females however the association was not significant. MRSA was more common in males according to a study conducted by Romero et al (1995) [4]. The higher incidence in males is probably due to predominant male patients. VRE positive patients and sex: In the present study the VRE was observed only in male patients. Most studies did not mention about the association between gender and VRE positive testing. MRSA positive patients and cancer patients: There was a significant association between MRSA positive testing and cancer patients. Chi square test (p<0.05) (OR=9.75; 95% CI=1.3395-70.9685). Fraser et al (2010) in Royal Infirmary of Edinburgh found a significant
association between cancer and MRSA (p<0.01) [2].
VRE positive patients and cancer patients: However the
association between cancer patients and VRE positive patients was not found to be significant. The
numbers of VRE positive cases among the cancer patients were 2 (28.52%). Nolan et al (2009) in the
Children’s Hospital of Philadelphia showed the VRE positive patients were 9.6% [13]. This is possibly due
to the fact that cancer patients and children are more prone to infections.

Conclusions:

1. The age range of the patients was 6-80 years. The mean age was 51.64 years
with a standard deviation of 17.00. The maximum number were >60yrs i.e. 21
(42%) and the minimum number were <20 yrs 2 (4%).

2. There were a greater number of males
42 (84%) and the male: female ratio was 5.25:1.

3. 9 (18%) were cancer patients and 41
(82%) were non- cancer patients. The maximum number of cancer patients
were in the age range 40- 60 years and non- cancer patients were >60 years.
There were a greater number 41 (82%) of non-cancer patients.

4. Out of the 50 patients, 5 (10%) were
MRSA positive and 7 (14%) were VRE positive.

5. There were a greater number of MRSA
positive patients 4 (80%) in the elderly
group >40 years.

6. There were a greater number of VRE
positive patients 5 (71.42%) in the elderly group >40 years.

7. There were a greater number of MRSA
positive patients 3 (60%) among male patients.

8. All the VRE positive patients were exclusively males.

9. There were a greater number of MRSA
positive patients 3 (60%) among cancer patients.

10. There were a greater number of VRE
positive patients 5 (71.42%) among non- cancer patients.

11. There was a significant association
between MRSA positive testing and Cancer patients. Chi square test
(χ² = 3.84, p<0.05)
(OR=9.75; 95%CI=1.3395-70.9685).

Strengths of the study
This is a well-designed study carried out on a
specified group of surgical wards of a Tertiary
Referral Hospital. It highlights the importance of
socio-demographic factors, diagnostic categories in
MRSA and VRE screening in MR. It was carried out
by specialized laboratory of a Government Medical
College with attached Hospital to ensure high quality
of testing.

Limitations of the study
The sample size was small and there were a less
number of female patients. The study was conducted
over a short period of time on preoperative patients of
surgical wards of a Tertiary Referral Hospital. It is
not representative of all preoperative patients of
surgical wards of Tertiary Referral Hospital in the
state. A larger study needs to be undertaken taking
samples from different hospitals in the state.

Implications
Microbial Resistance (MR) is a well known and important cause of Healthcare Associated Infections (HAI) leading to increased morbidity and mortality. MRSA and VRE are the common microorganism responsible for MR. They can be effectively detected through cost-effective method of MRSA and VRE screening.

This study has implications for health-care services, training of health-care professional, research and health-care policy.

Preoperative screening for MRSA and VRE will go a long way in the early detection, prevention and prompt management of MR. This will with help in reducing morbidity and mortality in surgical patients. This will lead to improved health care services and reduce the financial burden of medical treatment. Health-care professionals need training in MRSA and VRE screening procedures.

Larger community based research need to be undertaken to study MR and plan suitable, customized interventions. This will also help in formulation effective health-care policy guidelines to combat MR.

References:


Table 1 – Outcome of MRSA screening among preoperative surgical patients

<table>
<thead>
<tr>
<th>Outcome</th>
<th>MRSA Positive</th>
<th>MRSA Negative</th>
<th>VRE Positive</th>
<th>VRE Negative</th>
</tr>
</thead>
<tbody>
<tr>
<td>No.</td>
<td>5</td>
<td>45</td>
<td>7</td>
<td>43</td>
</tr>
<tr>
<td>Percentage</td>
<td>10%</td>
<td>90%</td>
<td>14%</td>
<td>86%</td>
</tr>
</tbody>
</table>

Graph 1 – Association between MRSA positive patients and age

Chi square test ($x^2 = 0.015; p>0.05$) (OR=1.1563; 95%CI=0.1135-11.7748)
Graph 2 – Association between VRE positive patients and age

Chi square test ($\chi^2=0.010; p>0.05$) (OR=1.75 95%CI=0.2862 -10.7021)

Graph 3 - Association between MRSA positive patients and sex

Chi square test ($\chi^2=0.810; p>0.05$) (OR=4.3333; 95%CI= 0.5953-31.5416)
Graph 4 - Association between VRE positive patients and sex

Chi square test ($\chi^2 = 0.475; p>0.05$) (OR=0; 95%CI=0-NaN)

Graph 5 – Association between MRSA positive patients and cancer patients

Chi square test ($\chi^2 = 3.84; p<0.05$) (OR=9.75; 95%CI=1.3395-70.9685).
Graph 6 – Association between VRE positive patients and cancer patients

Chi square test ($\chi^2 = 0.065, p>0.05$) (OR=2.0571; 95%CI=0.3304-12.809)