Research Letter

Admission Surveillance Cultures Among Patients Admitted to Intensive Care Unit

The occurrence of organisms as normal flora in human body is by and large a necessity for good health and well-being. However, if the carriage shifts in favor of nosocomial pathogens like methicillin-resistant *Staphylococcus aureus* (MRSA), vancomycin-resistant enterococci (VRE) or drug-resistant Gram-negative bacilli, it can lead to long-term sequelae, especially among the patients being admitted to intensive care unit (ICU). The various risk factors leading to carriage of these resistant organisms are conditions like diabetes mellitus, chronic obstructive pulmonary disease, alcoholism, liver disease or previous antibiotic usage, which are often present in patients needing intensive care facilities.[1] The carriage is often asymptomatic, but carriers have a high-risk of subsequent invasive disease. The literature has even described the condition of abnormal carriage of multidrug-resistant organisms as 'a disease in itself.'[2]

The present prospective study was planned to evaluate the rate of nasal and rectal carriage in patients admitted to intensive care facility in our tertiary care center over a period of 10 months (April 2010 to January 2011). During this period, the nasal and rectal swabs were collected from a total of 145 patients, within 24 hours of admission to the ICU. The samples were processed for aerobic bacterial cultures, and strains isolated were identified by standard microbiological procedures. The antibiotic susceptibility testing was done by Kirby Bauer disc diffusion method as per clinical laboratory standard institute (CLSI) guidelines.[3]

Out of 145 patients, 72 (49.65%) patients had nasal carriage (95% confidence interval being 41.3-58.0). Among them, maximum isolates were of MRSA (21; 29.16%) followed by methicillin sensitive *S. aureus* (19; 26.38%), *Klebsiella pneumoniae* (13; 18.05%), *Acinetobacter cbc* (12; 16.66%), *Escherichia coli* (3; 4.16%), *Pseudomonas aeruginosa* (2; 2.77%), *Citrobacter koseri* (1; 1.38%), and *Proteus mirabilis* (1; 1.38%).

The rectal carriage was seen in 45.51% (66/145) patients with 95% CI 37.3-54.0. Among rectal isolates, maximum were MRSA (16; 24.24%) followed by MSSA (13; 19.67%), *Acinetobacter cbc* (13; 19.67%), *K. pneumoniae* (11; 16.66%), *E. coli* (7; 10.60%), *P. aeruginosa* (5; 7.57%), and *C. koseri* (1; 1.51%).

Other than MRSA, among Enterobacteriaceae, we found ceftazidime-resistant organisms (potential extended spectrum beta lactamase, ESBL producers). We did not isolate any carbapenem-resistant Enterobacteriaceae or *Pseudomonas* organism although carbapenem-resistant *Acinetobacter* (CRA) were isolated in 3 and 5 patients as nasal and rectal carriage, respectively. One other patient carried the CRA in both the sites, and the strain was considered to be identical based on similar anti-biogram. All these CRA strains were totally resistant to amikacin, gentamicin, ceftazidime, and cefoperazone- sulbactam, 87.5% resistant to ciprofloxacin and 77% were resistant to piperacillin- tazobactam. However, all these strains were 100% sensitive to colistin.

Determining the exact definition for 'normal' or 'abnormal' carriage is not easy. This depends upon the site of isolation, the type of organism, the concentration of organism at the isolation site, state of the person (normal, diseased, immune-compromised), or admission to ward or ICU. The presence of MSSA in nasal swabs could be a normal carriage, but may not be so in rectal swab. Similarly, *E. coli* in rectal swab could be just normal flora. For the purpose of present study, the abnormal carriage was defined as isolation of highly drug-resistant organisms like MRSA, ceftazidime-resistant Enterobacteriaceae (potential extended spectrum β-lactamase producers), or carbapenem-resistant non-fermenters from either of the two sites in any concentration. The details of these organisms along with demographic features are being given in the Table 1. The carriage for MRSA, CRA, and ceftazidime-resistant Enterobacteriaceae in nasal and rectal isolates were found to be 21/72 (29.2%) [95% CI 19.4-41.2], 16/66 (24.2%) [95% CI 14.9-36.6]; 4/72 (5.6%) [95% CI 1.8-14.4], 6/66 (9.1%) [95% CI 3.6-19.4] and 11/72 (15.3%) [95% CI 8.2-26.1], 13/66 (19.7%) [95% CI 11.3-31.7], respectively.

The detection of abnormal carriage on admission to the ICU helps in identifying those set of patients, who might be at a higher risk of infection and mortality. Previous studies have reported that MRSA acquisition is known to be highly associated with subsequent invasive infection, especially bacteremia.[4] Similarly, colonization by resistant gram-negative bacilli significantly increases the length of stay in ICU, chances of developing nosocomial infections and overall, increased health-care cost.[5,6] Recently, carbapenem-resistant organisms are creating chaos in the hospital settings. They are resistant not only to carbapenems, but to almost all major group of antibiotics.

Table 1: Various drug-resistant bacterial strains isolated from the patients along with their demographic features

Demographic features	MRSA	Carbapenem-resistant *Acinetobacter cbc*	Ceftazidime-resistant Enterobacteriaceae
Nasal carriage only	15	3	8
Rectal carriage only	10	5	10
Both nasal and rectal carriage, same strain (as per similar antibiogram)	6	1	3 (all *K. pneumoniae*)
Male: Female	17:14	6:3	16:14
Previous antibiotic use (most common being 3rd generation cephalosporins)	5	3	10
History of previous hospitalization	14	6	8
Average stay in ICU during present visit	20 days	9 days	15 days
Underlying cause-medical: Surgical	18: 13	2: 7	12: 18
Bacteremia (Causative organism)	3 (due to PS, AC, EC)	2 (due to AC)	3 (2 with PS, 1 KP)
Ventilator associated pneumonia	2 (due to KP, PS)	1 (due to AC)	3 (2 due to KP and PS and 1 due to KP alone)
Outcome-recovered: Expired	16:15	3: 6	19:11

*KP: *Klebsiella pneumoniae*; AC: *Acinetobacter cbc*; PS: *Pseudomonas aeruginosa*; EC: *E. coli*

Carbapenems first came into use in 1985. Since then, due to their good intrinsic anti-bacterial activity and stability to most of the prevalent beta lactamases, they have been a drug of choice for ESBL-producing organisms, which are uniformly isolated all over the world including India, Europe, and USA. However, it was not long before that the carbapenem-resistant organisms were identified becoming a major public health issue. They are susceptible only to colistin, polymyxin B or to some extent, to tigecyclin. However, even polymyxin B-resistant *Acinetobacter baumanii* strains have been reported in the literature.[7] The problem is compounded in developing countries where these options are either not available or are too toxic/expensive to afford by the patients.[8] But, on the other hand, developing nations have all the pre-requisites like overcrowding, poor sanitation, unhygienic conditions, poor medical care, and poor resources availability to enhance the spread of drug-resistant organisms. Thus, on one hand, KPCs (*Klebsiella pneumoniae* carbapenemase) are playing havoc in *Klebsiella* and *E. coli,* while on the other hand, another different class of carbapenemases i.e. Metallo ß lactamase (MBLs) produced by *Pseudomonas* spp. and *Acinetobacter* spp. are causing significant damage.[9]

Although we have been isolating carbapenem-resistant *Klebsiella* or non-fermenters for some time in our institution from clinical samples, it is the first time that we have detected their carriage in the patients on admission to ICU, raising the possibility of increasing circulation of these strains in the community. Presently, in our hospital, the patients identified with carriage of drug-resistant organisms like CRGNB are given contact isolation. We maintain a strict hand hygiene protocol, and glove practices are followed. Due to unavailability of space, the patients are not shifted to individual rooms, but they are segregated from other patients by cabin separation. Environmental disinfection of the rooms is carried out regularly.

The institution also has a standard antibiotic protocol. In the protocol, 3 types of patient risk categories have been stratified. If the patient is exposed to risk factors namely prolonged hospitalization, invasive procedures, recent multiple antibiotic exposure, neutropenia, or immunodeficiency, the patient is put into category III in patient risk stratification. The empirical therapy given to category III is combination drugs (β lactam drug + β lactamase inhibitor) or carbapenems. The clinical samples are sent for culture and sensitivity (C/S) testing before start of treatment. If on C/S, susceptible non-fermenter organism (whether *Acinetobacter* or *Pseudomonas)* is isolated, the patient therapy is either kept on same beta lactam drug along with aminoglycosides or an anti-pseudomonal fluoroquinolone is given. However, if the isolate is ESBL-producing Enterobacteriaceae, he is de-escalated to combination drugs alone. In case of MDR *Acinetobacter,* the treatment is escalated to colistin or carbapenem + combination drug or tigecyclin, and in case of MDR *Pseudomonas,* escalation is done to colistin or anti-pseudomonal beta lactam with maximum sensitivity. We always try to keep carbapenems as reserve drugs and in case of MDR Enterobacteriaceae, ertapenem is preferred to other carbapenems. Till now, we do not have a protocol for carbapenem-resistant Gram-negative bacilli, especially carbapenem-resistant Enterobacteriaceae (CRE) organisms. The occurrence of CRE leaves us with very few treatment options namely polymyxins and tigecyclin. The burden of carbapenem-resistant organisms is increasing at an alarming rate. Carbapenem-resistant *Acinetobacter* were first noticed when a nosocomial outbreak occurred in United States in 1991. Since then, a

number of outbreaks have been reported worldwide.[10] The published literature from India reports the prevalence of CRGNB to be varying from 5.3% to 59%.[11]

There have not been many studies from India where work on admission surveillance cultures has been reported. Mostly, the studies have been carried out either on health-care workers to see the carriage of organisms or on environmental samples to look for prevalence of MDR organisms in ICU.[12,13]

The admission screening helps in population assessment of the full reservoir of organisms and helps in ensuring proper practice guidelines like contact isolation and sterile barrier precautions to be followed. Not only that, the selective decontamination of the digestive tract (SDD) can be decided accordingly by the clinicians as gastrointestinal tract is the major route for transmission of infection in patients leading to severe complications like septicemia. Carefully chosen SDD can be very rewarding in controlling endogenous and exogenous infections in ICU-admitted patients.

In our case, we have definitely been able to generate a baseline data regarding prevalence of these MDR organisms in our institution. We hope this step will go a long way in deciding our infection control practices and confining the spread of these organisms. There is no doubt that the emergence of antimicrobial-resistant organisms has made it pertinent for the infection-control practitioners, hospital epidemiologists, and clinicians to get together to control the spread of these organisms.

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