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Assessment of Multidrug Organisms, ESBL Producing Organisms, MRSA and VRE: A Study

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Abstract: **Multidrug-resistant (MDR) organisms or Pandrug resistant (PAN) or Extensive drug resistant (XDN) are an established and growing worldwide public health problem and few therapeutic options remain available. The antibiotic susceptibility profile of different bacterial isolates was studied to detect incidence of MDR organisms. The clinical samples were cultured and bacterial strains were identified in the department of microbiology in tertiary care hospital and measures to control MDR were identified. The 1270 samples were studied.**

Results: shows that there are 36% gram negative bacilli MDR and 4.6% MRSA, 1.7% VRE in gram positive organisms. No PANdrug resistant organism was isolated at all.

Conclusion: Local microbiologic data are extremely important to detect prevalence of MDR organisms, to check the infection trend, and to initiate effective measures to control MDR organism .It also indicates that prior antibiotic exposure of organism is important and antibiotic choices should thus be made at an individual patient level . Administration of unnecessary prolonged broad-spectrum antibiotics should be avoided as is important are proper isolation practices as per infection control guidelines to prevent transmission of infection.

Keywords: **Multidrug-resistant (MDR), Pandrug resistant (PAN), Extensive drug resistant (XDN).**

1. INTRODUCTION

The World Health Organization develop a global priority pathogens list of antibiotic resistant bacteria to help in prioritizing the research and development of new and effective antibiotic treatments .On *7 February 2017* - WHO published its first ever list of antibiotic-resistant "priority pathogens"(2)

Priority 1: critical

Acinetobacter baumannii (carbepenem resistant)

Pseudomonas aeruginosa (carbepenem resistant)

Enterobacteriaceae (carbepenem resistant)

Priority 2: HIGH

Enterococcus faecium (vancomycin resistant)

Staphylococcus aureus (methicillin resistant, vancomycin resistant and intermediate)

Helicobacter pylori (clarithromycin resistant)

Campylobacter (flouroquinolone resistant)

Salmonella spp. (flouroquinolone resistant)

Neisseria gonorrhea (3rd generation cephalosporin resistant, fluoroquinolone resistant)

Priority 3:medium

Streptococcus pneumonia (penicillin non susceptible)

Haemophilus influenza (ampicillin resistant)

Shigella spp.(flouroquinolone resistant)

Mycobacteria including mycobacterium tuberculosis is not included because it is already global priority. Enterobacteriaceae include Escherichia coli Klebsiella pneumonia, Enterobacter spp, Serratia spp., Proteus spp, Providentia spp, Morganella spp.

Multidrug resistant (MDR) was defined as acquired nonsusceptibility to at least one agent in three or more antimicrobial categories. Extensively drug resistant (XDR) was defined as nonsusceptibility to at least one agent in all but two or fewer antimicrobial categories (i.e., bacterial isolates remain susceptible to only one or two antimicrobial categories). Pandrug resistant (PDR) was defined as nonsusceptibility to all agents in all antimicrobial categories.(4) Recent study shows the incidence of MDR, MRSA, ESBL and VRE organisms in tertiary care hospital .

2. MATERIAL AND METHODS

Short term cross-sectional study was conducted between june2016 to Dec2016. Out of 7699 microbiology samples received, 390 were gram positive and 880 were gram negative. Samples were included from both inpatients and out patients. These samples were urine, high vaginal swab, wound swab, blood, sputum, faeces, body fluids.

The samples were inoculated on respective media such as blood agar and CLED agar for urine, blood agar and Mac conkey agar for wound swab, blood agar, chocolate agar and macconkey agar for sputum, blood agar, chocolate agar and Thayer martin agar, subarauds agar for HVS (high vaginal swab) .The plates were read next day for growth and preliminary identification. Furthur processing for identification and susceptibility was done on microscan walkaway. Though disc diffusion method as per Clinical Laboratory Standard Institute (CLSI) guidelines was also used.(5) Any MDR organism, MRSA (methicillin resistant staphylococcus aureus), VRE (Vancomycin resistant enterococcus), ESBL organisms on microscan or disc diffusion method are confirmed by both methods .

ESBL Disc Confirmation:

Combination Disc Test (CDT) and/or Double-Disc Synergy Test (DDST). These tests permit to evaluate the inhibition of ESBL activity by Clavulanic acid

Combination Disc Test (CDT)

For each test discs containing cephalosporin alone (cefotaxime, ceftazidime, cefepime) and in combination with clavulanic acid are applied.

The inhibition zone around the cephalosporin disc combined with clavulanic acid is compared with the zone around the disc with the cephalosporin alone. The test is positive if the inhibition zone diameter is ≥5 mm larger with clavulanic acid than without.

Double-Disc Synergy Test (DDST)

Discs containing cephalosporin (cefotaxime or ceftriaxone, ceftazidime, cefepime) are applied next to a disc with clavulanic acid, amoxicillin + clavulanic acid or ticarcillin + clavulanic acid. Positive result is indicated when the inhibition zones around any of the cephalosporin discs are augmented in the direction of the disc containing clavulanic acid. The distance between the discs is critical and 20 mm center-to-centre has been found to be optimal for cephalosporin 30 µ g discs; however it may be reduced (15 mm) or expanded (30 mm) for strains with very high or low resistance level

MRSA confirmation : Clinical and Laboratory Standards Institute (CLSI), recommends the cefoxitin disk screen test, the latex agglutination test for PBP2a, or a plate containing 6 µg/ml of oxacillin in Mueller-Hinton agar supplemented with NaCl (4% w/v; 0.68 mol/L) as alternative methods of testing for MRSA. We used both methods for confirmation of MRSA.

Broth microdilution methods usually detect carbapenem resistance when the tests are performed properly. When performed properly, disk diffusion and agar gradient diffusion also are acceptable methods for carbapenem testing.

For routine Quality Control of antibiotic susceptibility test, S. aureus ATCC 25923, E. coli ATCC 25922, and Pseudomonas aeruginosa ATCC 27853 were used. S. aureus ATCC 43300 was used as Quality Control for mecA positive strains. Results were recorded and ward or unit informed about MDR, VRE or MRSA if any and isolation precautions recommended.

3. RESULTS AND OBSERVATION

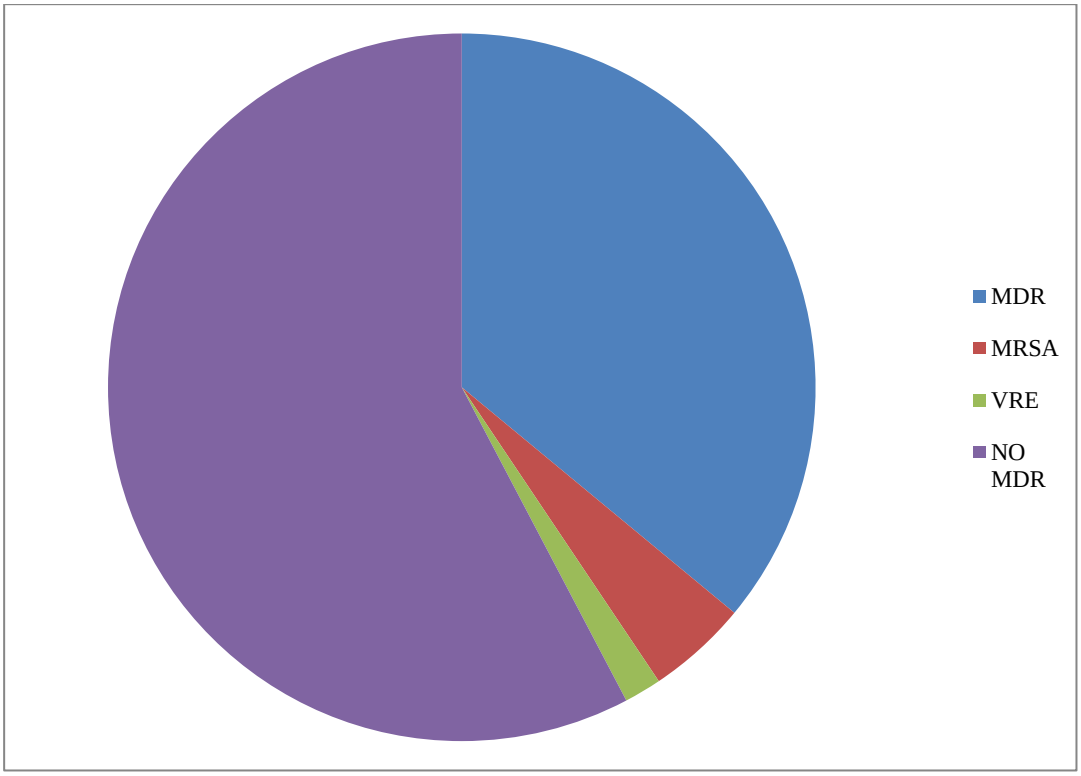
Number of samples received for bacteriological culture in microbiology were 7699. Out of 7699, 1270 were positive for growth, 888 had gram negative bacterial growth and 390 were having gram positive bacterial growth. Out of 1270, 228 samples were from ICU, 418 from ward, 7 samples from NICU and 8 samples from PICU.

Among gram negative organism, commonest isolate was E.coli accounting for 275 number of isolates and next is Pseudomonas aeroginosa accounting for 196 number of isolates.

In gram positive commonest was strep agalactiae (group B) numbering 225, followed by MSSA (methicillin sensitive staphylococcus aureus) numbering 106 .

Out of 275 E coli, 94 strains (34%) were ESBL producing strains. Out of 172 Klebsiella, 68 (40%) were ESBL producing strains, 14 (8%) were MDR. Out of 196 Pseudomonas aeroginosa 39 (19.8%) were MDR. Out of 74 Proteus sp. 33 (44.5%) were ESBL producing strains. Out of 82 Acinetobacter sp 71 (86.5%) were MDR. Out of 32 Enterobacter 10 were ESBL .All gram negative organisms were sensitive to colistin.

In gram positive organisms, out of 124 Staphylococcus aureus, 18 (14.5 %) were MRSA (Methicillin resistant staphylococcus aureus). Out of 30 Enterococcus 2 were VRE (Vancomycin resistant Enterococcus). All gram positive organisms were sensitive to Vancomycin and linezolid

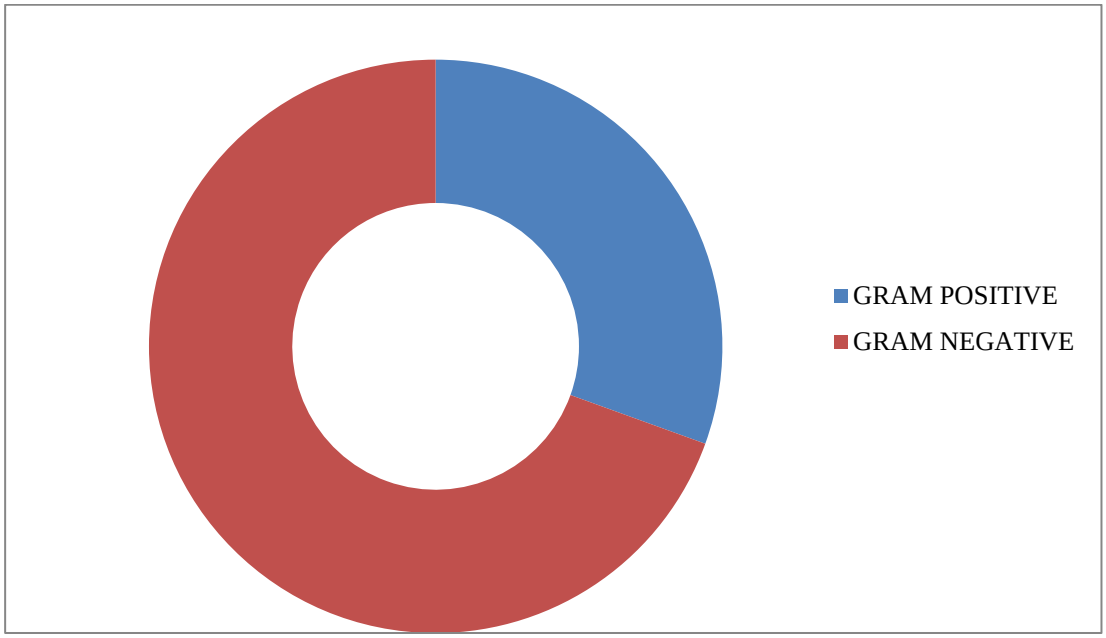


MDR : 36%

MRSA: 4.6%

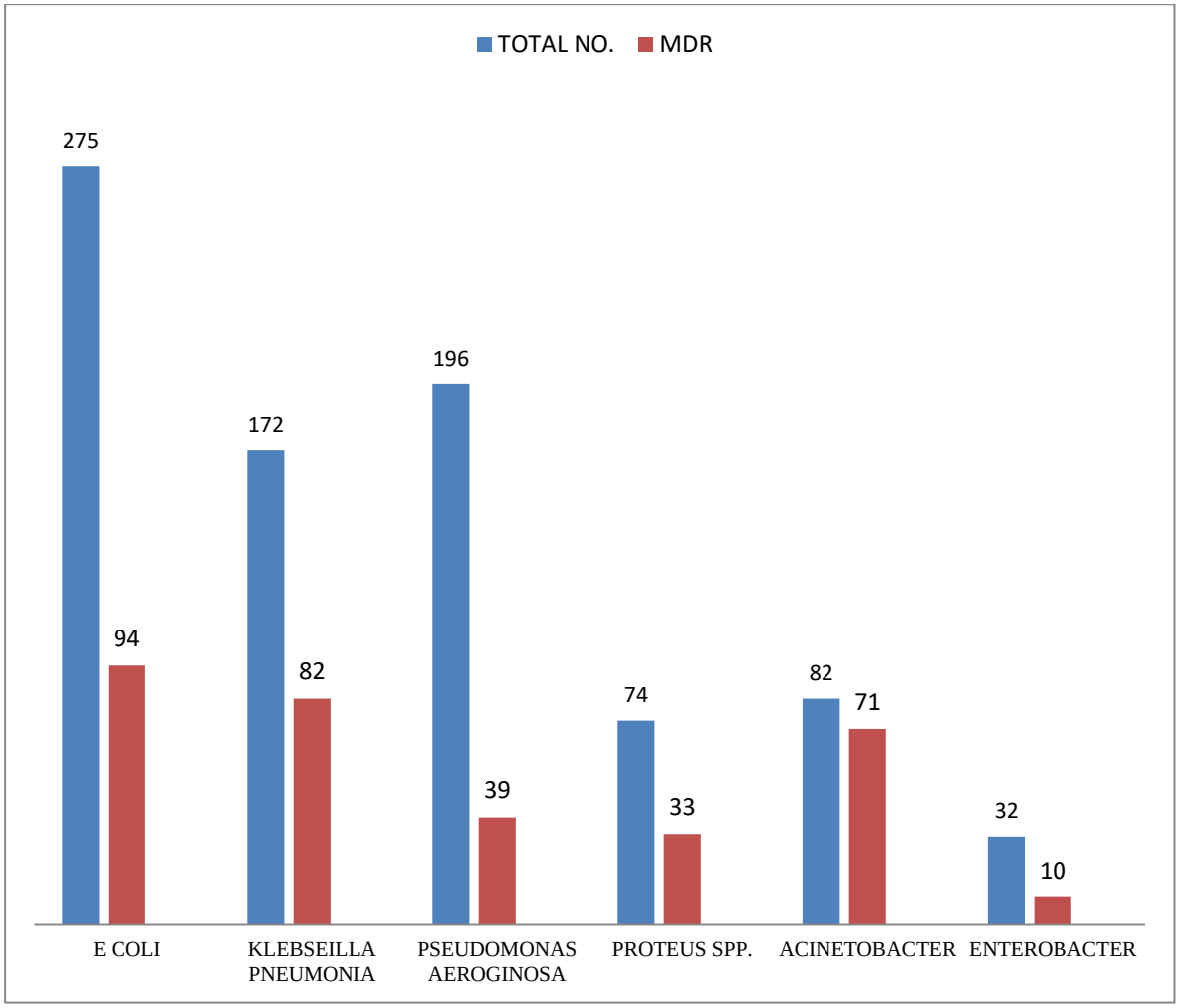
VRE: 1.7%

NO MDR : 57.70%

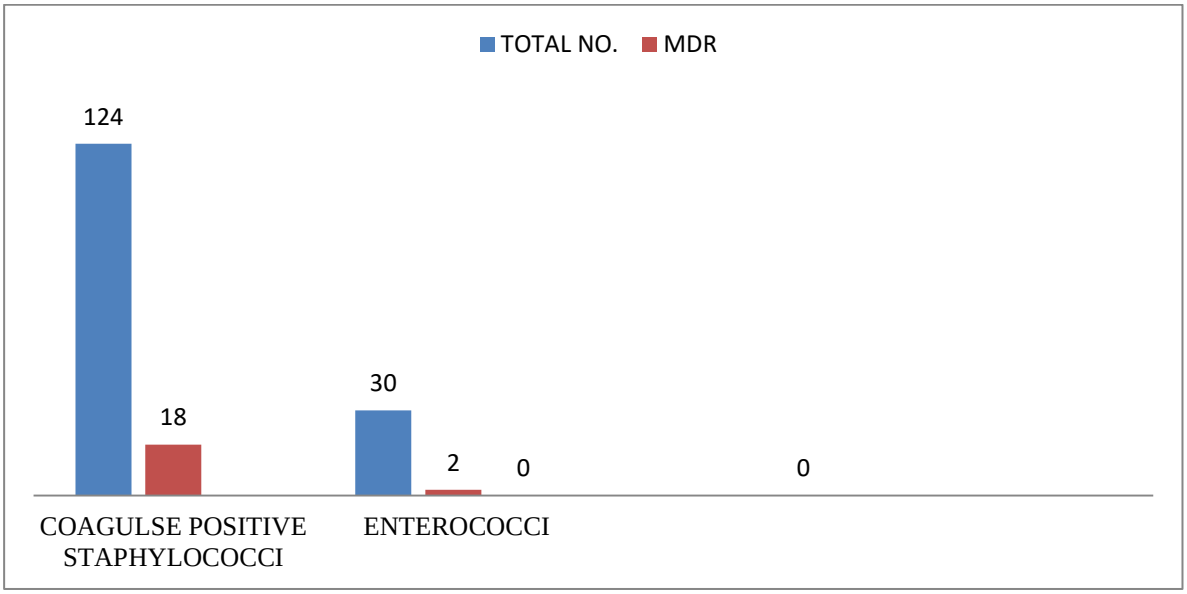


GRAM POSITIVE : 390

GRAM NEGATIVE : 888



Total and MDR organism (gram negative) during June 2016 and Dec 2016



Prevalance of MRSA and VRE during June2016 and December 2016

4. DISCUSSION

Antimicrobial resistance (AMR) threatens the effective prevention and treatment of an ever-increasing range of infections. According to WHO, without effective antibiotics, the success of major surgery and cancer chemotherapy would be compromised. The cost of health care for patients with resistant infections is higher than care for patients with non-resistant infections due to longer duration of illness, additional tests and use of more expensive drugs. Microorganisms that develop antimicrobial resistance are sometimes referred to as "superbugs". (2)

In the present study, amongst 330 GNB-MDR strains isolated, the commonest MDR strains were detected from E. coli 94/330 (28.4%), followed by Klebsiella pneumoniae 82/330 (24.8%), Acinetobacter sp.71/330 (21.5%), 14/330(4%), Pseudomonas aeroginosa 39/330 (11.8%), Our findings correlated well with other studies.

Aly and Balkhy reported that the most prevalent microorganism was E. coli (44%) followed by K. pneumoniae (20%) and P. aeruginosa (18.7%). MRSA and Acinetobacter were found to be less frequently observed by nearly equal percentages (5.4% and 5%, resp.)(9). In a previous study done on patients admitted to ICU in Riyadh Military Hospital in Saudi Arabia, similar isolates were obtained among which Acinetobacter baumannii was the most common MDRO (40.9%). In Saudi Arabia also, El Tahawy and Khalaf evaluated 100 isolates and found that P. aeruginosa, K. pneumoniae, E. coli, and Enterobacter were the most commonly isolated, with imipenem, ciprofloxacin, and amikacin showing greatest efficacy (10) . Another study carried out at a tertiary care hospital in Riyadh over a one-year period showed the most frequent pathogens to be P. aeruginosa, E. coli, S. aureus, K. pneumoniae, and S. marcescens.(11).

In 2013; the CDC highlighted the need to improve antibiotic use as one of four key strategies required to address the problem of antibiotic resistance .CDC recommends, antibiotic stewardship program for implementation in all acute care hospitals.

A growing body of evidence demonstrates that hospital based programs dedicated to improving antibiotic use, commonly referred to as "Antibiotic Stewardship Programs (ASPs)", can both optimize the treatment of infections and reduce adverse events associated with antibiotic use(12). Once MDROs are introduced into a healthcare setting, transmission and persistence of the resistant strain is determined by the availability of vulnerable patients, selective pressure exerted by antimicrobial use, increased potential for transmission from larger numbers of colonized or infected patients ("colonization pressure") and the impact of implementation and adherence to prevention efforts(13)

Results of our study is solely based on positive culture results without accompanying clinical information, they do not distinguish colonization from infection, and may not fully demonstrate the burden of MDRO-associated disease. Despite these limitations, according to CDC – MDRO guideline, incidence measures based on clinical culture results may be highly correlated with actual MDRO transmission rates derived from information using ASC (active surveillance culture), as demonstrated in a recent multicenter study. (Huang J Infect Dis). These results suggest that incidence measures based on clinical cultures alone might be useful surrogates for monitoring changes in MDRO transmission rates.

5. CONCLUSION

AMR is an increasingly serious threat to global public health that requires action across all government sectors and society. Antimicrobial resistance occurs naturally over time, usually through genetic changes. However, the misuse and overuse of antimicrobials is accelerating this process. The simplest form of MDRO surveillance is monitoring of clinical microbiology isolates resulting from tests ordered as part of routine clinical care and checking their percentage susceptibility to different antibiotics. This is important to assess the MDRO burden and initiate control measures like Isolation precautions, hand hygiene, environmental decontamination, antimicrobial stewardship programs. More research on molecular mechanisms controlling MDR is needed to facilitate the development of novel therapies to combat these intransigent infections and will help cultivate a deeper understanding of the pathobiology of microbial organisms.

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