



## ROLE OF VITEK 2 AUTOMATED SYSTEM IN OUTBREAK OF MULTIDRUG RESISTANT ISOLATES IN CRITICAL CARE UNITS- A CASE STUDY

**Dr Raksha K**

Junior Consultant- Microbiology & Infection Control Officer, St. Martha's Hospital, Bangalore - 560001

### ABSTRACT

**BACKGROUND:** The role of Microbiology laboratory in aiding Infection Control has increased over the past few decades and with the availability of automated systems, similar isolates with identical antibiotic susceptibility pattern provide us an important alert. Here we describe a practical approach to an outbreak of multidrug resistant microbial isolates through our experience with multidrug resistant *Acinetobacter* species in our medical intensive care unit.

**METHODOLOGY:** An approach to outbreak management through fishbone diagram and root cause analysis revealed colonization of suction jars with multidrug resistant isolates of *Klebsiella* and *Acinetobacter* species. Corrective action was taken on time with cleaning of suction jars as per recommended protocol with subsequent audits showing no such incidence.

**RESULTS:** The clinical isolates i.e. *Acinetobacter* species and the isolates through epidemiological surveillance i.e. *Acinetobacter* and *Klebsiella* species although were multidrug resistant there was no significant association, despite which they pose a high risk for the admitted patients in the critical care units and majority of the times these go underreported.

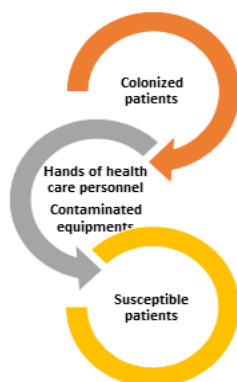
**CONCLUSION:** There exists a significant high risk in critical care settings for transmission of multidrug resistant pathogens. The microbiology laboratory if well equipped with automated VITEK 2 System can give a timely alert to aid in the containment of outbreak and prevent the spread of multidrug resistant health care associated infections.

**KEYWORDS :** Outbreak, multi drug resistant, critical care, healthcare associated infection, VITEK

### INTRODUCTION:

Increasing incidence of Multidrug resistant (MDR) isolates is complex issue in intensive care units (ICUs), where selection pressure and emergence of resistance, as well as the risk of patient-to-patient transmission, (Figure 1) are highest.<sup>1</sup> Epidemiological surveillance for such isolates is a critical and essential element of a successful infection control programme.<sup>2</sup>

Conventionally an outbreak would be described when significantly or unexpectedly larger than normal number of particular infections due to a particular organism occurs over a relatively short period (within days) from a particular area or the rate for a particular infection due to particular organism in a time period exceeds the 95% confidence interval based on the previous year's rates for that period, provided the total number of a particular infection is significantly measurable. However, the definition is microorganism dependent.<sup>3</sup>



**Figure 1: Modes of transmission of *Acinetobacter*<sup>4</sup>**

St. Martha's Hospital has an active programme for management of outbreak in the hospital and all hospital staff are guided to partake in the protocol with the Hospital Infection Control Team. An increase in the number of cases of *Acinetobacter baumannii* infection with isolates having similar susceptibility pattern was observed for a week in the month of January which was identified by the Vitek 2 System in Microbiology Section of Central Laboratory from different samples of patients admitted in our Medical Intensive Care Unit (MICU). When the outbreak is ongoing the Laboratory equipped with the Vitek System is the first to know and at the time of the

investigation we encounter more constraints especially in a resource limited setting when we do not have molecular or epidemiological typing methods, also there is great urgency to find the source and prevent additional cases. This prompted us in the Laboratory to notify the hospital administration, the respective unit and clinicians and conduct this study.

### MATERIALS, METHODS & RESULTS:

**A. PROBLEM:** Cluster of isolates of Multidrug resistant (MDR) *Acinetobacter* from patients in MICU (Case details in Table 1 and Antibiotic susceptibility pattern with MIC details in Table 2) was observed in ten days in the month of January 2018 which was much above our prevalence rate (Table 3)

**B. PROJECT MISSION:** To identify an outbreak (if any) through environmental surveillance for Multidrug resistant (MDR) *Acinetobacter* in the MICU.

**C. TEAM:** 1) Hospital Infection Control Team- Infection Control Officer & Infection Control Nurse; 2) MICU Nursing In-charge 3) Microbiology Section-Central Laboratory 4) Facilitators: Medical Superintendent and Nursing Superintendent.

**D. RISK ASSESSMENT & PRIORITIZATION:** As per the Outbreak Management Policy of the Hospital Infection Control Committee based on NABH Standards this was classified as a high risk situation.

**E. IMPACT OF THE PROBLEM:** The isolates during this period probably belong to the patient's own flora owing to their multiple co-morbid factors or could be acquired through the hospital environment but these microorganisms have the potential to spread to the other admitted patients.

### F. BASELINE DATA COLLECTION AND IDENTIFY THE CURRENT PROCESS:

Clinical details of the patients was collected (Table 1) and the HICC Team carried out Environmental Sampling from various areas in the MICU. Culture swabs was collected and tested. Areas of MICU sampled- 1) Swabs from Cots, Lockers, Ventilator, Suction, Alcohol Rubs and outside changing area 2) Hands of Doctors, Nursing staff & Students 3) Culture plates from A/C ducts. Significant growth was seen in the suction jars with two types of Gram negative bacilli >100 colonies being grown. The microorganisms identified were:

1. *Klebsiella pneumoniae*-Multidrug resistant >100 colonies
2. *Acinetobacter baumannii*- Carbapenem resistant >100 colonies

**Table 1: Clinical details of patients with MDR Acinetobacter isolates**

Report date	IP No.	Unit	Sample	Clinical Diagnosis
12-1-2018	31734	M-1	Blood	Right IJV Sepsis, Chronic Kidney Disease V on MHD, Anemia, Bone mineral Disease, Type 2 Diabetes meliitus, Systemic Hypertension
15-1-2018, 16-1-2018	31588	M-2	Sputum and ET	Left emphysematous pyelonephritis with sepsis and septic shock, Acute Myocardial infection, Type 2 Diabetes meliitus, Systemic Hypertension
17-1-2018	31505	M-3	Sputum	Abdominal wall abcess-E.coli, Bilateral Lower Lobe Pneumonia with MDR Acinetobacter, ?Reactivation of Pulomnary Koch's, Subclinical Hypothyroidism, Anemia secondary to IDA, ?Reactive Airway Disease, Prediabetic
22-1-2018	32078	M-2	Blood	Chronic Kidney Disease, Septicemia with MDR Acinewobacter, Acute Myocardial infection, Type 2 Diabetes meliitus, Systemic Hypertension
22-1-2018	31788	M-1	Sputum and BAL	Bilateral Lower Respiratory Tract Infection with bilateral pleural effusion with left collapse with pneumonia (Candida and Acinetobacter), COPD, Systemic Hypertension, Type 2 Diabetes meliitus

**Table 2: Antibiotic susceptibility pattern with MIC details of MDR Acinetobacter isolates**

Report date	IP No.	Unit	Sample	A	Amc	Pit	Cu	Ctr	Cfs	Cpm	Ipm	Mrp	Gen	Cip	Tg	Cot	Cl
12-1-2018	31734	M-1	Blood	>=32	>=32	>=128	>=64	>=64	>=64	>=64	>=16	>=16	8 (I)	>=4	1 (S)	>=320	<=0.5
15-1-2018, 16-1-2018	31588	M-2	Sputum	>=32	>=32	>=128	>=64	>=64	>=64	>=64	>=16	>=16	8(I)	>=4	<=0.5	>=320	<=0.5
17-1-2018	31505	M-3	Sputum	>=32	>=32	>=128	>=64	>=64	>=64	>=64	>=16	>=16	>=16	>=4	<=0.5	>=320	<=0.5
22-1-2018	32078	M-2	Blood	>=32	>=32	>=128	>=64	>=64	32 (I)	>=64	>=16	>=16	>=16	>=4	<=0.5	<=20 (S)	<=0.5
22-1-2018	31788	M-1	Sputum	>=32	>=32	>=128	>=64	>=64	32 (I)	>=64	>=16	>=16	8	>=4	<=0.5	<=20(S)	<=0.5
			BAL	>=32	>=32	>=128	>=64	32 (I)	32 (I)	>=64	>=16	>=16	>=16	>=4	<=0.5	<=20 (S)	<=0.5

from patients

**Table 3: Prevalence Rate of MDR Acinetobacter in St. Martha's Hospital between July2017-April 2018**

	July 2017	Aug 2017	Sept 2017	Oct 2017	Nov 2017	Dec 2017	Jan 2018	Feb 2018	March 2018	April 2018
Blood	2	2	1	-	1	-	2 (5 cases in 10 days from MICU)	-	-	-
Sputum	1	3	3	3	2	-	5	-	1	-
Urine	1	-	2	-	-	-	-	-	-	-
Exudate	2	3	-	-	1	-	1	-	-	-
Total no. of MDR Acinetobacters	6	8	6	3	4	-	8	-	1	-
Total no of samples	1198	1249	1211	1163	993	966	1028	1098	1262	1126
Prevalence Rate	0.50 %	0.64 %	0.49 %	0.25 %	0.40 %	-	0.77 %	-	0.07 %	-

Although no significant association was found between the current cases and the isolate from the suction jar surveyed for culture, the isolates were considered as potential pathogens (multidrug resistant strains) which can cause significant Health Care Associated Infections. The MICU in-charge was informed and necessary remedial measures for cleaning and disinfection of the suction apparatus was carried out as per standard protocol after Root Cause Analysis (Figure 2) A repeat culture post the procedure subsequently showed no growth.

#### G. SELECT REMEDIAL MEASURES WITH SELECTION MATRIX:

MICU staff were instructed to clean Suction Jars as per the cleaning and disinfection protocol in the MICU under the supervision of the MICU in-charge also the HICC team recommended o-use disposable suction tubes for each patient.

**H. PLAN THE ACTIONS:** The Microbiology Laboratory reports to the concerned clinician and MICU in-charge if such clustering of cases occurs further on. We identify and report infected cases of MDR strain in the MICU to the HIC Team when excess of the normal expectancy within a certain period of time in reference to the monthly antibiogram report. The HIC Team reports to the HICC Chairperson, Medical Superintendent & Nursing Superintendent.

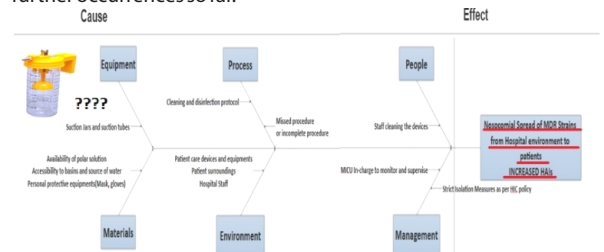
**I. CONDUCT PILOT STUDY IN SPECIFIC AREA:** With clinicians were planned depending on the rates of HAIs from MICU.

**J. CHECK THE PILOT RESULTS:** Ongoing in critical care areas.

**K. ACTION PHASE:** The HIC Team & Microbiology Section carries out Environmental sampling from the specific areas to identify potential source if clustering of cases are identified. Isolation protocol is followed for affected patients as per the Hospital Infection Control Policy to contain spread of such strains to prevent an outbreak.

**L. CONTINUOUS MONITORING OF THE ACTIVITIES:** Regular (Fortnightly) Surveillance Culture samples are carried out from MICU as per protocol.

**M. RE- AUDIT:** Re-audits are done quarterly and there were no further occurrences so far.

**Figure 2: Fish bone Diagram- Root Cause Analysis (RCA) for the current suspected outbreak**

#### CONCLUSION:

Vitek 2 System is a feasible and accurate automated system for timely identification of isolates in a resource poor setting where further molecular epidemiological typing not possible for clonal

identification. Diagnostic Bacteriology has an important role in identifying and disseminating such data to contain such outbreaks and in doing site specific and unit oriented surveillance. Health care associated infections are no more limited to being only medical issues; they are now known to be of administrative and economic concerns. In such situations it is only wise to make use of the available technology in the laboratory and guide the hospital management.

**ACKNOWLEDGEMENT:** I would like to thank Dr. Davy Jacob Olakkengil, Medical Superintendent for his constant guidance and support in this study and also the staff of Microbiology Section of Central Laboratory, St. Martha's Hospital for their help in data collection and analysis.

**CONFLICT OF INTEREST:** None

#### REFERENCES:

1. Montero, J. G., Lerma, F. Á., Gallego, P. R., Martínez, M. P., Rocha, L. Á., Gaité, F. B., ... & Campos, J. (2015). Combatting resistance in intensive care: the multimodal approach of the Spanish ICU "Zero Resistance" program. *Critical Care*, 19(1), 114.
2. Agodi, A., Zarrilli, R., Barchitta, M., Anzaldi, A., Di Popolo, A., Mattaliano, A., ... & Travali, S. (2006). Alert surveillance of intensive care unit-acquired *Acinetobacter* infections in a Sicilian hospital. *Clinical microbiology and infection*, 12(3), 241-247.
3. Reingold, A. L. (1998). Outbreak investigations--a perspective. *Emerging infectious diseases*, 4(1), 21.
4. Dijkshoorn, L., Nemec, A., & Seifert, H. (2007). An increasing threat in hospitals: multidrug-resistant *Acinetobacter baumannii*. *Nature reviews microbiology*, 5(12), 939.
5. National Accreditation Board for Hospitals and Healthcare Providers (NABH). Guide Book to Accreditation Standards for Hospitals (4th edition) 2015: 112-129.