Antibiogram Analysis and Altering Antimicrobial Susceptibility Pattern of Multidrug Resistant Pathogens

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Abstract

Introduction: In the current situation of escalating antibiotic resistance it is essential to identify and report sensitivity pattern of these MDR bacteria in order to tailor empirical therapy and hygienic measures. Because there will be hardly any new antibiotics in the near future, a better understanding is needed on the how to optimize the use of existing antibiotics, alone and in combination with other drugs. To achieve this, periodic monitoring and surveillance of hospital antibiogram is mandatory.Materials Methods: Antibiogram surveillance was done for a five year period from Jan-2008 to December 2012 .The report generated was as per CLSI guidelines. A longitudinal analysis of prevalent rates of MDR pathogens-ESBL Enterobactericiae, MRSA, Imipenem resistant Gram negative bacilli isolated from all clinical samples and their sensitivity pattern was done.Results: The most prevalent MDR gram negatives at our centre were ESBL E.coli ESBL Klebsiella pneumonia (73

Index terms— antibiogram, surveillance, changing trends, MDR pathogens.

1 Introduction

he bacterial disease burden in India is among the highest in the world [1, **??**, **??**] ; consequently, antibiotics are playing a critical role in limiting morbidity and mortality in the country. But unfortunately antibiotic resistance which is a global concern now, has reached a pandemic proportion fuelled by human need, greed and irresponsibility [4] . This is particularly pressing in developing nations, including India, where the burden of infectious disease is high and healthcare spending is low. And the worst consequence is that , the bacterial strains that acquire resistance to one or more first-line antimicrobials pose numerous challenges to healthcare, including: increased patient morbidity and mortality, increased drug costs, prolonged illness duration, and more expensive disease control measures. The overall take-home message from studies of resistant infections is that resistance levels have been worryingly high wherever studies have been conducted **??**3,4] . Management of common and lethal bacterial infections has been critically compromised by the appearance and rapid spread of these antibiotic-resistant bacteria. This resistance is affecting patients and therapeutic outcomes, with concomitant economic consequences. Because the anti Microbial Resistance (AMR) genes can be readily transmitted through a bacterial population, surveillance of AMR trends is critical for the rapid detection of new isolates and continuous monitoring of disease prevalence [5]. Surveillance is central to the control of antimicrobial resistance. Data generated by surveillance activities can be used to guide empirical prescribing of antimicrobial agents, to detect newly emerging resistances, to determine priorities for research and to evaluate intervention strategies and potential control measures aimed at reducing the prevalence of resistant pathogens [6][7][8][9][10] .

Antibiogram pattern with specific reference to MDR Organisms is increasingly reported in Indian hospitals [11][12][13][14][15] and worldwide [16][17][18][19][20][21] . Therefore it is crucial to monitor emerging trends in drug resistance at local level to support clinical decision making, infection control intervention and antimicrobial resistance containment strategies.Antibiogram surveillance and changing trends in antimicrobial resistance at our healthcare setting is monitored periodically by annual cumulative antibiogram.The cumulative antibiogram

is done as per the consensus guidelines from CLSI [22] . This report provides an overview of surveillance information on multidrug resistant pathogens at our tertiary care centre for a five year period from 2008 to 2012, and also 73% 55.5% presents data on Sensitivity rates of these drug resistant pathogens, highlighting the probable effective pathogen-drug combinations for most common infections.

2 II.

3 Materials and Methods

Our super speciality hospital is a 300 bedded tertiary care Post graduate teaching centre with CTVS, Cardiology, Urology, Ophthalmology and orthopaedic units. We analysed antibiogram surveillance reported during the five year period from Jan 2008 to December 2012.The following indices were monitored. 3. We analysed the changing sensitivity pattern of most prevalent pathogens of Urinary tract infection , soft tissue infection, and Ventilation associated pneumonia (VAP) during the study period as defined by standard surveillance criteria [1,5] . 4. We also analyzed the Antibiotic Sensitivity pattern of Imipenem resistant gram negative bacilli strain(Pseudomonas aeruginosa, ESBL E.coli, ESBL Klebsiella pneumoniae)

5. We documented modifications in the hospital infection control measures and Empirical antimicrobial Guideline was drafted following the Antibiogram Surveillance for Infections from specific bodily sites.

III.

4 Our Hospital Antibiogram

5 Software

Our Hospital cumulative Antibiogram is framed periodically using a Software (LIS) from CSC (previous iSOFT). The data entry and analysis is done by a report generator using this isoft software (based on WHONET 5.6). The generated report is based on consensus guidelines given by CLSI [22] .

IV. shows Uropathogenic Pseudomonas spp sensitivity pattern over time. Sensitivity to ciprofloxacin was at a range between 20-40% and Nitrofurantoin less than 10% V.

6 Results

7 Discussion

a) Multi Drug Resistant Pathogens at our tertiary care centre

Our study shows that ESBL producers are the most prevalent Gram negative MDR organism at our tertiary care centre and MRSA is the most prevalent Gram positive pathogen as shown in the Table-1a. Urine samples are the predominantly received clinical sample for culture & sensitivity at our diagnostic microbiology division and the ESBL producers are frequently isolated from all types of Urine specimens submitted at our laboratory. ESBL production among E.coli was greater than 70% and Klebsiella greater than 60% throughout our study period. This data is consistent with many other centres from India & worldwide [23] . MRSA's are prevalent pathogen from wound specimens. The prevalence percentage of MRSA ranged from 11% -40% during the study period at our Institute. Literature evidence indicates that the prevalence can range from 3-66% [24,25] .The prevalence rate started to decline from 2010 in relation to enhanced hospital wide MRSA screening and contact isolation.

Imipenem resistant Pseudomonas spp was the next serious Gram negative MDR pathogen as shown in Table 1b.It shows an overall prevalence rate of 22 % during the five year study period. Even though there was a low prevalence rate of Imipenem resistance seen among ESBL E.coli & ESBL Klebsiella (1.7% and 4.7% respectively), it is still a matter of concern. And these three Imipenem resistant pathogens were frequently isolated from urine specimens (41% from mid stream urine, 44 % from catheterised urine). There was gradual increase in the prevalence rate of Imipenem Resistance As discussed before the most prevalent Gram positive pathogen at our centre was MRSA and the prevalence rate ranged from 11% to 40%. Predominantly 79% of MRSA were from wound swabs, 13% from urine and 9% from Endo tracheal secretions & blood. The overall sensitive pattern of MRSA from all clinical isolate was analysed in TABLE-2. When we look into overall sensitivity pattern both in wards and OPD together, sensitivity to penicillin was Zero percent throughout our study period from 2008 to 2012.This is in accordance with a study by Bandaru etal [26]. Sensitivity to Ampicillin was lowest next to penicillin, followed by Ciprofloxacin, Cotrimoxazole and Erythromycin. Analysis of the changing pattern of Antibiotics for MRSA isolates for the five year period indicated that, the sensitivity percentage for all the above mentioned antibiotics was declining from 2008 to 2012.Ampicillin, Ciprofloxacin & Cotrimoxazole had less than 25 % sensitivity. Erythromycin and Tetracycline percentage was varying during this period. The sensitivity percentage of Clindamycin slowly declined from 92.5 % in 2008 to 50% in 2012 and Rifampicin to 82%.Linezolid had 100 % sensitivity.

In our study 60.5% of MRSA isolates were found to be multidrug resistant, to more than three antimicrobials which are similar to two other studies [25,27] . Other studies which show less than 50% MDR resistant strains are Majumdar et al (23.2%) [28] And Bandaru et al [26] (32.09%).All the MRSA strains were sensitive to Vancomycin except one in the present study which is in accordance with other studies. [29][30][31] Maximum MRSA positive

wound specimens were from Ortho department (57%) followed by CTVS (20.4%) and then Plastic surgery (14 %) and Urology (10 %).Wound specimens sent from Orthopedics were predominantly from outpatient clinic. When the sensitivity percentage of MRSA's isolated from pus/ wound aspirates were analysed as shown in Fig- **??**, a better sensitivity pattern was observed for Erythromicin and ciprofloxacin during the study period. There was a fluctuation in Tetracycline & Cotrimoxazole sensitivity percentage. It consistently decreased to 29% and 3.2% respectively during the year 2011, but an improved sensitivity percentages was observed in 2012. Sensitivity to Clindamycin percentage reduced from 89 %(2008) to 49 % in 2012. Eighty seven percent of non hospitalized MRSA isolates were presumptively identified as CA-MRSA based on Clindamycin susceptibility-a surrogate marker of CA-MRSA. As a result, admission screening for MRSA colonization has been implemented in 2011 in addition to routine infection control measures.

Guidelines & empirical antimicrobial choice for soft tissue/wound infections from different source were recommended based on the above mentioned analysis along with adequate drainage/wound debridement/ cleaning. **??** b. This is almost similar to two other studies, Taneja et al [34] and Sasikala et al [35] where in the Imipenem resistant Pseudomonas strains had the best in vitro susceptibility to Amikacin and Pipericillin.

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8 Antibiotics % Sensitivity

Our findings suggest that there is a definite increase in the multidrug resistant organisms. This Surveillance study showed that the most prevalent Multidrug resistant Uropathogen at our centre was ESBL producers (E.coli & Klebsiella pneumoniae). MRSA was the predominant MDRO causing soft tissue infections & Pseudomonas prevalent in VAP. We believe that the data analysis on the changing trends in antibiotic resistance from most frequently received clinical samples, is an important pillar in our efforts at improving infection control practices. We proposed a draft Antibiotic guideline in 2012 based on the analysis on the data. The guideline provided recommendations for empiric antimicrobial therapy based on susceptibility pattern and relevant infection control practices for Complicated & Uncomplicated UTI's, for soft tissue infections, VAP's and Blood stream infections. We acknowledge the limitation of disc diffusion antimicrobial susceptibility testing as our tertiary care centre is a charitable institution. Infection control measures including Hand hygiene, antimicrobial stewardship, MRSA screening and restricted use of second line antibiotics had proven to be modestly effective in our study. But still it appears that our MDR Organism antibiograms were largely uninfluenced by infection control measures including institution of Antimicrobial Guidelines in spite of our clinicians adhering to protocols. Probable reasons might be widespread prevalence rates in the community and importation of cases harbouring partially/untreated Multi drug resistant pathogens from other referral hospitals to our tertiary care centre may have negated efforts within our centre. [1] [2]

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Figure 1: Fig- 1 :

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Figure 2: Table 1b :

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[2]. David L. Paterson. Impact of Antibiotic Resistance in Gram-Negative Bacilli on Empirical and Definitive

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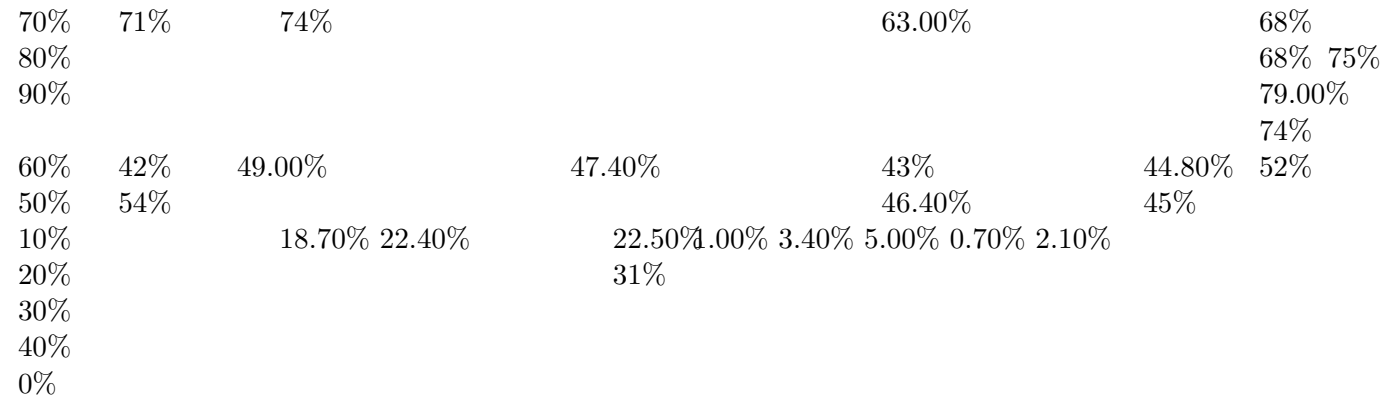

Sensitivity Percentage

	2008	2009	2010	2011
Cipro floxacin	11.1	0	13.9	0
Ampi cillin	3.7	0	0	9
Augmentin	14.8	16.7	0	10
Tetra cycline	69.2	76	71.4	68.2
Co-Trimxazle	23	16.6	19.4	9
Imipenem	88	75	97.2	100
Erythro mycin	42.8	20	48.5	38.1
Penicillin	0	0	0	0
Vanco mycin	100	100	100	100
Linezolid	100	83.3	100	100
Rifampicin	96.3	100	100	100
Clinda mycin	92.5	75	82.3	77.2
Oxacillin	0	0	0	4.5
Nitro furantoin	83.3	66.6	NT	14.3

Figure 3: Table : %

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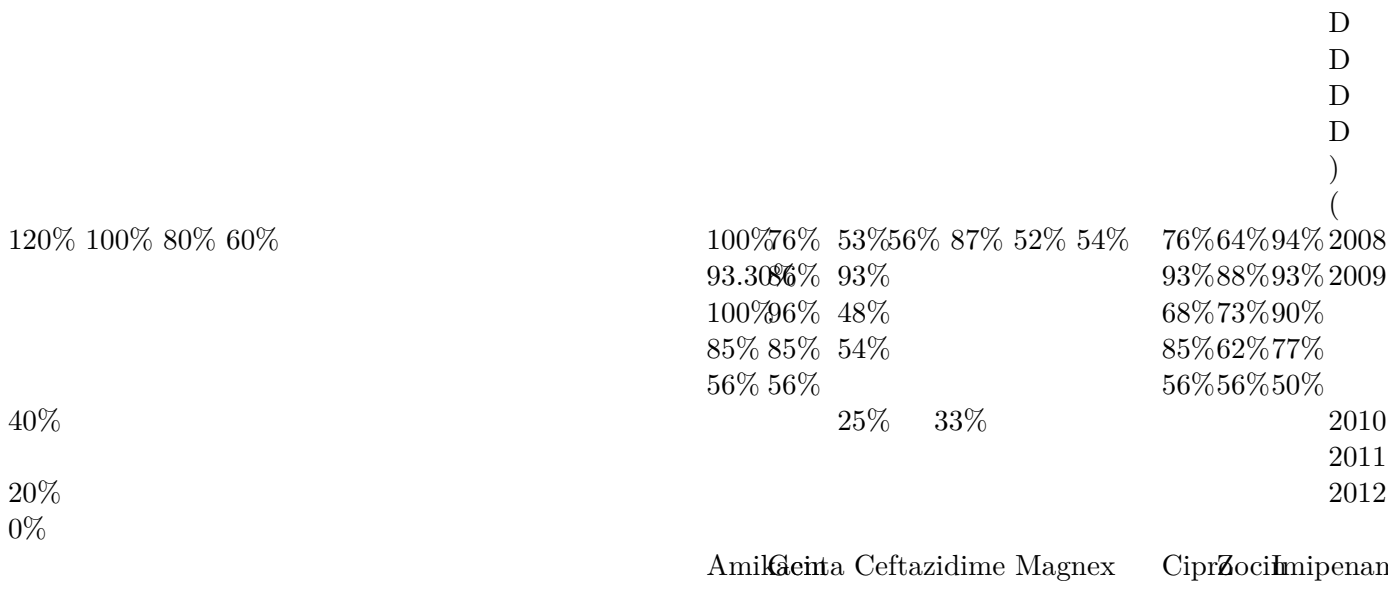
Fig-2 shows the changing sensitivity pattern of MRSA isolated from wound specimens (MRSA was most frequently isolated from Wound specimens). Augmentin & ciprofloxacin sensitivity percentage consistently declined and came dow five year study period. Antibiotics v percentage for Clindamycin, Vancor

Penicillin showed 0% sensitivity throughout the study period.Ampicillin was less than 10% and Augmentin (



[Note: © 2014 Global Journals Inc. (US) C Fig 3 : Antibiotic sensitivity % of Pseudomonas from Endotracheal apirates]

Figure 4: Table : 2

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	Total no of Imipenem resistance isolates	% of Pan resistant isolates	% of Imipenem resistant isolates showing sensitivity to other antibiotics
ESBL E.Coli	44-isolates	47.60%	52.4%-Senitive to other antibiotics* fig -1
ESBL Kleb.	17 -isolates	83.30%	16.3%-Sensitive to Amikacin, Nitrofuratoin
Pseudomonas aerugi-nosa	196-Isolates	68.50%	31.5%-Sensitive to other antibiotics* fig-2

Figure 5: Table 3 :

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