

MULTIDRUG RESISTANCE ORGANISM CAUSING HOSPITAL ACQUIRED INFECTION – A STUDY AT THE TERTIARY CARE HOSPITAL, DURGAPUR

Dissertation

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In

Hospital and Health Management

By

Dr Akriti Dubey

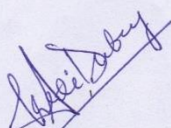
Under the Supervision and Guidance of

Dr Pallavi Choudhary Agarwalla

2021

DECLARATION BY STUDENT

I hereby declare that this dissertation titled “**Multidrug resistance organism causing Hospital-acquired infection - A study at the tertiary care hospital, Durgapur**” is the bonafide record of my original research work. I declare that it has not been submitted to any other university or institution for the award of any degree or diploma. Information derived from the published or unpublished work of others has been duly acknowledged in the text.



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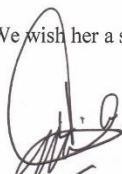
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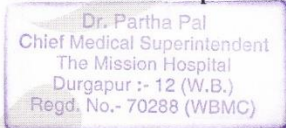
To Whom It May Concern

This is to certify that **Dr. Akriti Dubey** has done her three months dissertation on "A Study on Multidrug resistance organism causing Hospital Aquired Infection at The Mission Hospital, Durgapur" from 22.03.2021 to 21.06.2021.

During the period of dissertation she has been found sincere.

We wish her a successful future and career ahead.


Ramesh Lall
VP – HR


Dr. Partha Pal
Chief Medical Superintendent


CERTIFICATE

This is to certify that dissertation titled ‘A study on Multidrug resistance organism causing Hospital acquired infection at The Mission Hospital, Durgapur’ is a record of the research Work undertaken by Dr Akriti Dubey in partial fulfillment of the requirements for the award of the degree of MBA (Hospital and Health Management) from the IIHMR University, Jaipur under my guidance and supervision and her approach to the research study has been sincere, scientific, and analytical.

Dr. Pallavi Choudhary Agarwalla
Faculty Guide
IIHMR University, Jaipur
Date

Dr. Dhirendra Kumar
School Dean
IIHMR University, Jaipur
Date

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TABLE OF ABBREVIATIONS-

1	MDRO	Multidrug resistance organism
2	MRSA	Methicillin- resistant Staphylococcus aureus
3	VRE	Vancomycin- resistant enterococci
4	ESBL	Extended spectrum beta - lactamases
5	Ampc	Beta lactates enzymes , which covey resistance to penicillin's, Cephalosporin's
6	UTI	Urinary tract infection
7	CLSI	Clinical and laboratory standards
8	CAUTI	Central line associated urinary tract infection
9	CLABSI	Central line associated blood stream infection
10	HAI	Hospital acquired infection
11	SSI	Surgical site infection
12	VAE	Ventilator associated events
13	LIS	Laboratory information system

Acknowledgement

On the completion of my dissertation, I would like to express my gratitude to the people who has been the part of this endeavor in numerous ways Firstly, I want to express my gratitude to almighty god for keeping me in good health during all these difficult time, respects and love to my parents, my brother and my friends for constant encouragement and motivation in my higher studies

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Sincerely,

Dr Akriti Dubey

ABSTRACT

Introduction- Multidrug resistance (MDR) is characterized as a microorganism's insensitivity or resistance to antimicrobial medicines which are structurally unrelated and have different molecular targets despite earlier sensitivity to it. A hospital-acquired infection, also known as a nosocomial infection, is one that was not present or incubating at the time of admission (i.e., the patient was not yet infected).

Aim- The aim of the current study is to understand the trend analysis of Multi drug resistance organism causing hospital acquired infection in The Mission Hospital, Durgapur, West Bengal.

Materials and Methods- Study involved retrospective data collection, classification, and analysis for the period of a year (1 JAN 2020 to 31 DEC 2020). Antibiotic sensitivity data is collected from the LIS system of lab and antibiotic sensitivity is performed by disk diffusion method as per CLSI guidelines.

Result- Out of 206 isolates of MDRO'S is obtained from the culture 56% were K. Pneumonia ,17.47% were A. Baumannii, 13.59% were P. Aeruginosa,9.22% were E.coli respectively and antibiogram shows the decreased sensitivity towards Tigicycline for K. Pneumonia, ,A Baumannii and E. Coli.

Conclusion- In conclusion our study finds MDRO's showed upgoing trends. K. Pneumonia and A. Bumannii were leading isolates in the ICU'S. In addition, tigecycline's sensitivity to several microorganisms that were previously proven to be sensitive has decreased.

Key words- Multi drug resistance organism, Hospital acquired infection, antimicrobial sensitivity.

CHAPTER 1

INTRODUCTION-

The prevalence of microbial infections has risen dramatically over the last few decades. The widespread use of antimicrobial drugs to treat infections has resulted in the emergence of resistance among various microorganism strains. Multidrug resistance (MDR) is characterized as a microorganism's insensitivity or resistance to antimicrobial medicines which are structurally unrelated and have different molecular targets) despite earlier sensitivity to it.

While Multidrug resistance is a natural occurrence phenomenon an increase in the number of immunocompromised patients, such as HIV-infected patients, diabetic patients, people who have had organ transplants, and people who have serious burns, makes the body an easy target for hospital-acquired infectious diseases, leading to the spread of MDR. Since they are linked to infections, these highly resistant species need special treatment in healthcare facilities as it is associated with longer period of stay, higher cost and higher mortality.

A hospital-acquired infection, also known as a nosocomial infection, is one that was not present or incubating at the time of admission (i.e., the patient was not yet infected. Antimicrobial resistance is linked to higher medical costs and has a major impact on antimicrobial effectiveness. Multidrug resistance can lead to obstruction in disease control by intensifying the possibility of spreading of resistance pathogen, thus lowering treatment efficacy and hence result in prolonged time of infection in patients.

The present need is to build a strong antimicrobial stewardship programme that would improve clinical outcomes, reduce unnecessary antibiotic use and healthcare expenditures, and reduce antimicrobial-related side effects (toxicity and resistance). In addition, a comprehensive infection control

policy should be implemented to prevent the spread of drug- resistant microorganisms within the hospital. This study was conducted at The Mission Hospital, Durgapur (A Unit Of Durgapur Medical Centre Pvt. Ltd.) a 350 bedded, state of the art super Specialty hospital, with cutting edge technology. The aim of the present study is to understand the trend of multidrug resistance organism causing hospital acquired infection so as to scrutinize the significant focus area in the hospital.

CHAPTER 2

REVIEW OF LITRATURE

SR NO	TITLE	AUTHOR NAME/YEAR	PLACE OF STUDY	DESCRIPTION
1.	Detection of extended spectrum beta lactames producing Entrobacteriaceae family from UTI patients.	Devipalanisamy, sivapriya olagnathan, Moorty Marimuthu (2021)	Tamil Nadu, India	It aims to detect extended spectrum beta lactames producing E. coli and K. Peumonia isolates from UTI patients In the present study ESBL, producing E coli, K. Peumoniae are considered to be a multidrug resistant strains and majaority of them were resistant to the common antibiotics used in treatment of UTI
2.	The mortality burden of multidrug resistance pathogens in India - A retrospective and observational study	Sumanth Gandra, Katie ktseng et al (2019)	India	This study concluded that while data were observational result provide strong qualification of the association between mortality and MDR pattern in representative LMIC.As MDR bacterial infections pose a significant risk to patients. Future research should aim to elucidate the burden of resistance and the differential transmission mechanisms that drive this public health crisis.

3	Prevalence and antibiotic susceptibility pattern among Klebsiella isolated from patient attending a tertiary care hospital	Saharanya K, Sindhu Cugati, Chitralkha saikimar (2018)	Chennai, India	Aims to assess the diversity and state of resistance of K. Pneumonia to antibiotics in a tertiary care hospital. This study shows that Detection of drug resistance mechanism formulation of a good antibiotics policy and a proper antibiotics stewardship programme should be incorporated to combat emerging MDR cases
4	Nosocomial infection and their control strategies	Hassan Ahmed Khan, Aftab Ahmad, Riffat Mehboob (2015)		This study concluded that the transmission of infection in the hospital setting through healthcare worker can be avoided by the use of infection control practises , improper and frequent use of antibiotics is the important cause of drug resistance organism that are difficult to treat . A well-managed surveillance methodology is required
5	Prevalence of multidrug resistance and extended spectrum beta-lactamases among uropathogenic Escherichia coli isolates in a tertiary care hospital in South India: An alarming trend	Chittur Yerat Ranjini, Leela Rani Kasukurthi et al	Karnataka , India	The aim of this study was to define the current prevalence of MDR and extended spectrum beta-lactamases (ESBL) production among <i>E. Coli</i> isolates from urine samples in hospital. Multidrug resistant strains of <i>E. Coli</i> are widely prevalent in the community. Antibiotics like imipenem require hospitalization, parenteral administration, drug monitoring for toxicity, all of which incur high cost to the patient and have to be used judiciously.
6	Multidrug resistance of pseudomonas Aeruginosa as known from surveillance of nosocomial and community infection in Indian	Mahesh. C.Sahu, Debasmita Dubey et al (2012)	India	Aim of the present study was to record nosocomial and community-acquired accounts of antibiotic resistance in Pseudomonas aeruginosa strains, isolated from clinical samples of a hospital by surveillance, over a period of 18 months (November 2009–April 2011). This study concluded that basic Infection control practises such as

	teaching hospital			proper hand washing, prevention of NSI, proper disposal of hospital waste and sewage. Rational antibiotic policy and regular surveillance are the areas in which we should take proper and pragmatic care of a hospital.
7	Increasing incidence of MDR K. Pneumoniae infection in hospital and community setting.	Savita Jadhav, Rabindranath Mishra et al (2012)	Pune, India	Aims to assess the diversity and state of resistance of K. Pneumonia to antibiotics in a tertiary care hospital. This study shows that Detection of drug resistance mechanism formulation of a good antibiotics policy and a proper antibiotics stewardship programme should be incorporated to combat emerging MDR cases
8	Challenge to healthcare: Multidrug resistance in K. Pneumonia	Archana Singh Sikarwar, Harsh Vardhan. (2011)	India	Key objective of the study was to analyze the sensitivity of MDR of K. Pneumonia in India and challenges faced by Healthcare community during the treatment of multidrug resistance of K. Pneumonia. This study shows that Use of broad spectrum Antibiotics, insufficient aseptic condition and techniques with inadequate control of infection had aggravated this problem. Follow the proper WHO guidelines
9	Surveillance of multi drug resistance organism in tertiary care hospital	Chand wattal, Neeraj goel, JK Oberoi etal. (2010)	Delhi, India	Key objective of the study was -To find out the provenance of drug resistance organism by using their antimicrobiograms. They have suggested that surveillance of antibiotic resistance in hospital flora & pathogens is an investment for future use. The data thus generated can provide an in depth knowledge regarding impending treatment failures and gives a chance to the physician for appropriate therapy that can be initiated right in the beginning, thereby decreases mortality. Multi drug resistant organisms like

				MRSA, VRE, PRP, ESBL, ampc and Carbapenemase producing organisms have come to stay and need to be treated with care and prudence.
10	Role of mechanical ventilation and development of multi drug resistance organism in hospital acquired pneumonia	Chiranjoy mukhopadhyaya (2003)	Lucknow India	This study was undertaken to estimate the occurrences of HAP as well as VAP along with the effect of different variables and to detect the presence of MRDO'S. This study shows mechanical ventilation and duration of ICU stay emerged as important risk factor for the development of HAP and VAP. MDR gram negative bacilli were the commonest respiratory pathogens responsible for increased mortality in the patient with VAP.

CHAPTER 3

RESEARCH METHODOLOGY-

- RESEARCH DESIGN- Retrospective observational study.
- DATA COLLECTION TECHNIQUE- This research based on secondary data and all information has been taken from ICN surveillance system and LIS system of lab.
- DATA COLLECTION TOOLS- As this is retrospective study all data has been retrieved from diverse recorded sources.
- SAMPLE SIZE- Sample size is 206
- SAMPLING TECHNIQUE- This study covered whole included population hence no sampling is done.
- SCOPE OF THE RESEARCH- This study was conducted in 350 bedded super specialty hospital, Durgapur, West Bengal. Study involved retrospective data collection, classification, and analysis for the period of a year (1 JAN 2020 to 31 DEC 2020). Information is retrieved from surveillance data of infection control department,

laboratory LIS system and secondary data is collected from various diverse literature reviews. Antibiotic sensitivity data is collected from the LIS system of lab and antibiotic sensitivity is performed by disk diffusion method as per CLSI guidelines.

REVIEW OF DATA-

- As per the records available in the hospital with the focus on multidrug resistance organisms.
- Cases which are detected in less than 48 hr. have been excluded.
- Only data which was retrieved from LIS was used in this study no patient record was checked due to limitation of time.

RESEARCH QUESTION- What is the trend of the Multidrug resistance organism causing Hospital acquired infection at The Mission Hospital, Durgapur?

OBEJECTIVES-

- To understand the trend of multidrug resistance organism causing hospital acquired infection in The Mission hospital, Durgapur
- To identify and scrutinize the significant focus area for the improvement in the hospital.
- To suggest the recommendations for improvement.

CHAPTER 4

ANALYSIS, INTERPRETATION AND FINDINGS

All the relevant data from the case included in the study were tabulated in Microsoft Excel 2010. Prevalence rate of Hospital acquired infection and Antibiotic drug sensitivity were computed. Future Pareto analysis was conducted which aims to identify and scrutinize the focus area in the hospital

For the year 2020, the prevalence of hospital acquired in the hospital is 1.7%, but the stated benchmark was less than 1%, indicating an increase trend in MDRO'S cases in the hospital.

As tables 4.1 depicts that CLABSI, CAUTI and SSI are higher than the defined benchmark hence there is need for reduction of these HAI. For instance reducing usage, minimizing dwelling, antimicrobial catheters, and antibiotic prophylaxis in certain situations help in the prevention of CAUTI. CLABSI incidence can be decreased by increasing awareness and implementation of evidence-based preventive strategies such as aseptic precautions at the time of insertion, removal of unnecessary catheters, chlorhexidine baths, and antimicrobial dressings.

Table 4.1 shows the distribution of Hospital acquired infection

Hospital acquired infection	Actual frequency	Benchmark
Central line associated Infection(CLABSI)	4.5%	1%
Catheter Associated Urinary tract Infection(CAUTI)	5.5%	3%
Surgical Site Infection(SSI)	0.9%	0%
Respiratory Tract Infection	0%	2%
Ventilator Associated Event (VAE)	0%	0%
Skin Infection	0%	0%

These figures indicate that 50% of MDROs are found in MICU, SICU, and the first-floor male ward. Also, K.Pneumonia is responsible for 80% of cases, followed by A.baumannii and E.coli, and 80% of samples are taken from urine, wounds, ET and blood respectively.

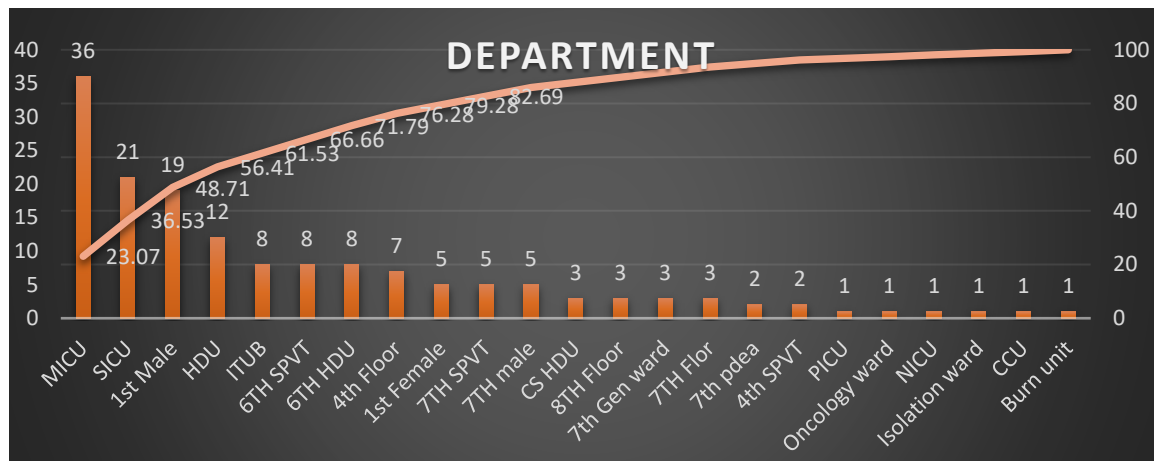


FIGURE 4.1 MDRO'S cases in respective department, Picture
Courtesy Infection control surveillance data Mission hospital, Durgapur.

A total of 206 isolates of MDRO'S is obtained from the culture ,out of total isolates of 206, 56% were K. Pneumonia ,17.47% were A. Baumannii, 13.59% were P. Aeruginosa,9.22% were E.coli, 3.39% were Enterococcus species .Based on the isolates bacteria could be arranged in the following order K. Pneumonia>A. Baumanii>P. Aeruginosa> E Coli.

TABLE 4.2 Bacterial isolate distribution

K. Pneumonia	56%
A. Baumanii	17.47%
P. Aeruginosa	13.59%
E.coli	9.22%
Enterococcus species	3.39%

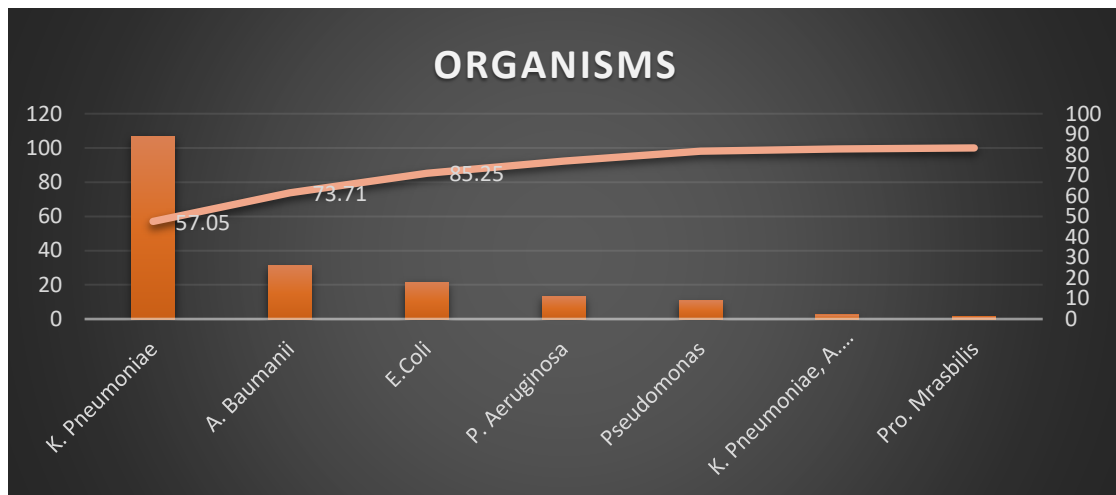


FIGURE 4. 2 this graph depicts 80% of MDRO'S is possibly due to *K. pneumoniae* and *A. Baumannii*. Pic courtesy Mission hospital, Durgapur

Antibiograms of different isolated from specimen collected from the patients in the wards, ICU'S are *K. Pneumonia* and *Acinetobacter* were the leading isolates in MICU, SICU and 1st floor male ward. Most common culture positive specimen received during the study was from urine (33.33%) followed by endotracheal tube (21.5%) and wound (14%) respectively.

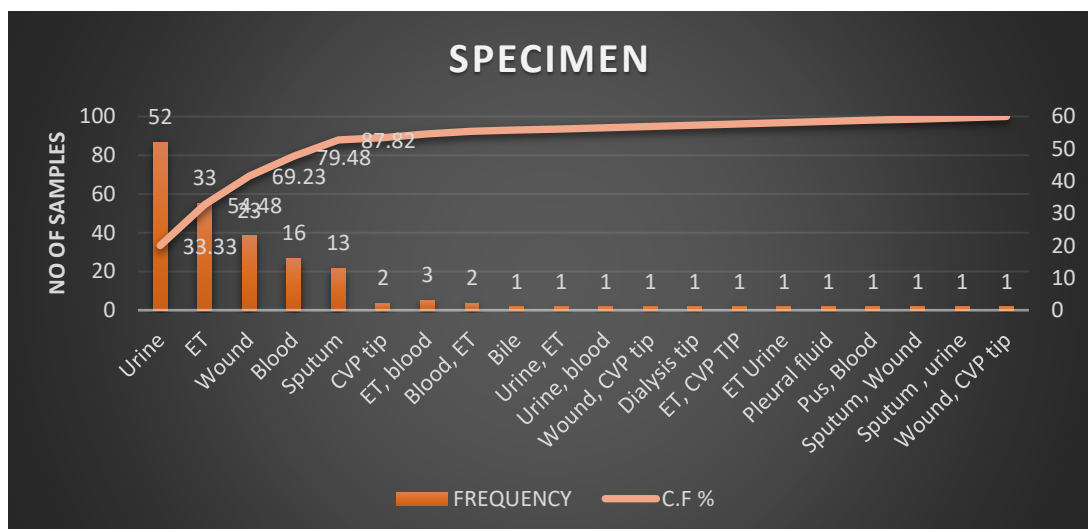


FIGURE 4.3 this graph depicts 50% of culture positive sample is taken from Urine, ET, and wound respectively. Picture courtesy Mission Hospital, Durgapur

For K. Pneumonia, Colistin has 81% sensitivity; tigecycline has 19% sensitivity respectively.

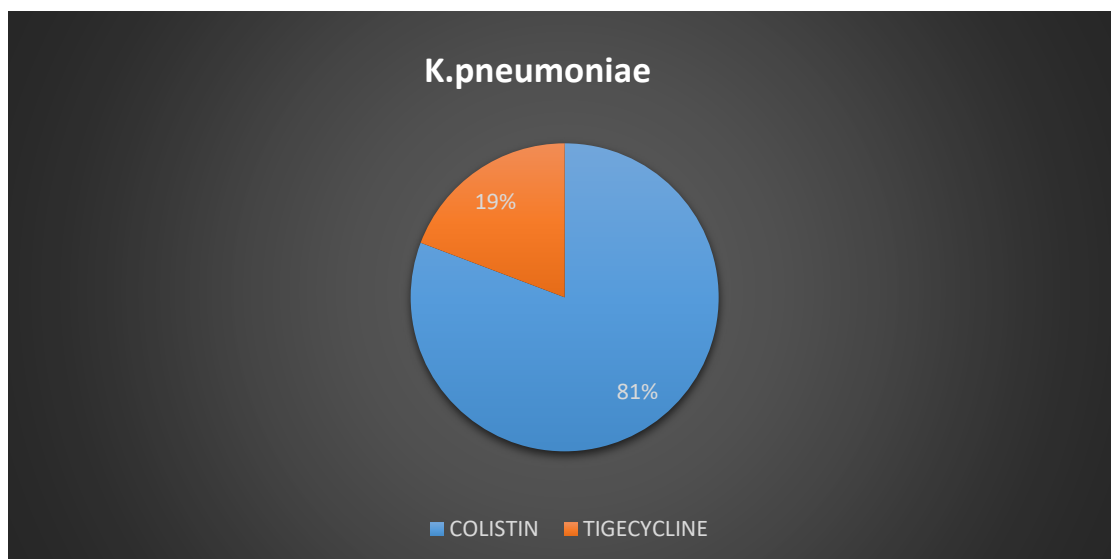


Figure 4.4

Similarly for A. Baumannii shows 83% sensitivity towards colistin, 17% towards tigecycline.

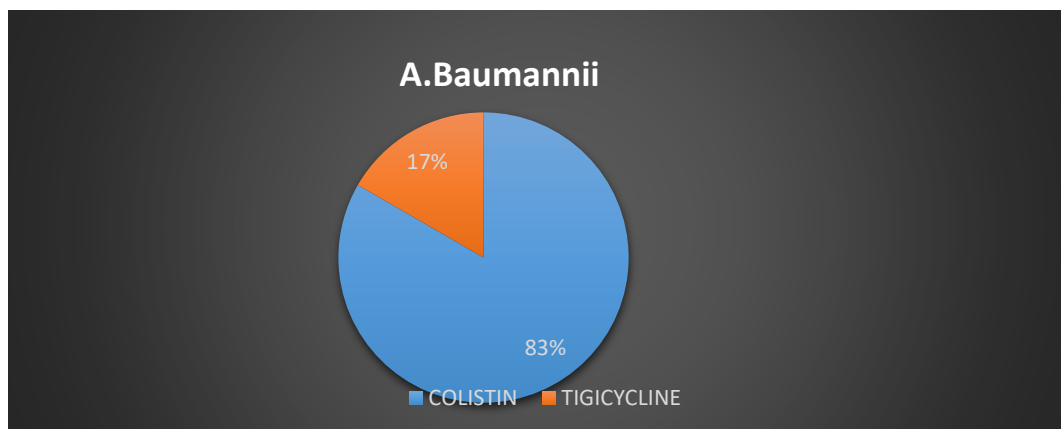


Figure 4.5

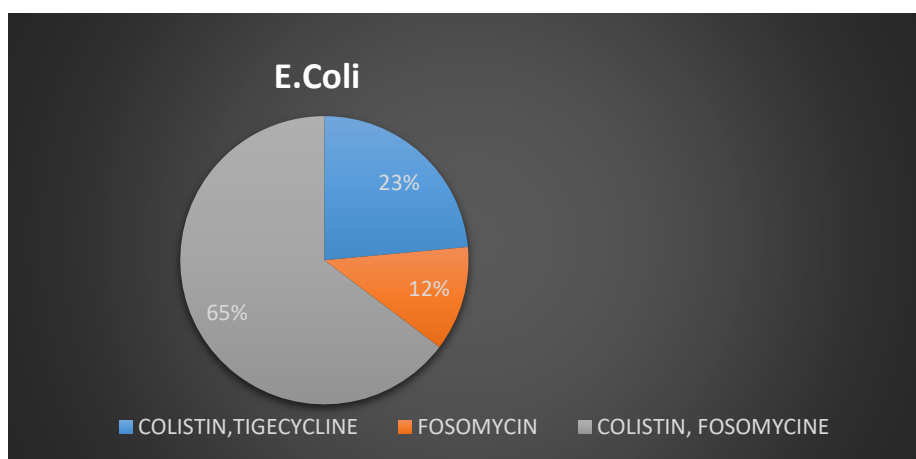


Figure 4.6

Likewise for E. coli 65% are sensitive to colistin and tigecycline, 23% are sensitive to colistin and fosfomycine, and 12% are sensitive to only fosfomycine.

Hence Antibiotics which were effective against most of the isolates bacteria were colistin, Tigecycline. These antibiotics should never be used empirically and must be reserved for special conditions, like drug failure and life saving measures etc

CHAPTER 5

DISCUSSION-

The risk of infections with MDR bacteria is especially high for patients admitted to the ICU, due to the underlying condition, impaired immunity, extensive antibiotic use, and exposure to invasive devices (e.g., mechanical invasive ventilation, central line catheters, endotracheal tubes, tracheostomy etc.). In the current study, patients with MDR bacterial infections were distributed across various hospital departments. As it is seen that, the percentage of MDR bacteria isolated from ICU patients was higher compared to patients from other units/departments.

The growth of pan-resistant bacterial species, along with a paucity of effective antimicrobials, signifies a deep recession for infection management in hospitals. Simple measures like hand hygiene have been

shown to reduce cross-transmission of resistant microorganisms, therefore this may need a “back to basics” approach to infection control practices which includes simple hand washing and hand rub techniques recommend by who and this will reduce cross contamination of resistance microbes

Aside from the therapeutic problem that multiresistance bacteria provide in hospitals, they are now slowly spreading into the community as patients are discharged from the facility and carry resistant microbes with them.

Readmission of patients colonized with resistant organisms represents a hidden reservoir that also needs monitoring and control.

Thus, the most effective ways to minimize the spread of multiresistance bacteria in hospital settings include basic infection control protocols such as hand hygiene practices, barrier precautions, screening, cohort nursing, environmental cleaning, and judicious administration of antibiotic.

CHAPTER 6

CONCLUSION-

Multidrug resistant organism are widely prevalent and wide distribution of the same in the Hospital is a matter of grave concern.

In conclusion our study finds MDRO's showed upgoing trends. K. Pneumonia and A. Bumannii were leading isolates in the ICU'S In addition, tigecycline's sensitivity to several microorganisms that were previously proven to be sensitive has decreased. Hence antibiotics which were effective against most of the isolates bacteria were colistin, Polymixin B, Tigecycline, ticoplanin, and linezolid. These antibiotics should never be used empirically and must be reserved for special conditions, like drug failure and life saving measures etc.

RECOMMENDATIONS-

The following are some of the methods that can be taken to prevent the spread

of antibiotic resistance in healthcare facilities:

- Administrative support
- At all levels, strict hand hygiene procedures must be implemented.
- Using antibiotics as a daily specified dose per 100 bed days is a smart way to figure out how much of a certain antibiotic is being used.
- In the hospitals, all cadres of staff are educated on infection control practices.
- Patient cohorting in hospitals, cases with the MDRO'S should be isolated from the normal population
- Implementation of Antibiotic justification forms.
- Appropriate and rapid diagnosis of infectious etiologies.
- Prudent use of Antimicrobial agents and formulary restriction.
- Accurate and prompt diagnosis of infectious aetiologies.
- Judicious use of antimicrobials and formulary restriction
- Antimicrobial treatment regimens should be based on pharmacodynamics/pharmacokinetic data.
- Should opt for de-escalation of antibiotic treatment for infections like which required invasive procedures like VAE,UTI etc
- Treatment regimens with high doses and a short duration could be followed in severe cases.
- Adherence to stringent antibacterial prophylactic measures during surgery
- Every institution must develop and implement preventive antimicrobial prescription policy.
- Involvement of the clinical microbiology laboratory, and also effective communication across departments.
- Good Sterilization and disinfection procedures must be followed.

- Implementation of strict perioperative antibiotic prophylaxis guidelines
- Ongoing research monitoring and development of alternative antimicrobials, infection prevention strategies, and regulatory techniques

In nutshell, antimicrobials resistance can't be substitute for fallacies, such as incorrect cleaning and disinfection.

FUTURE SCOPE OF THE STUDY-

There are some limitations in our study as this study only able to recognize the key focus areas, procedures and organisms and drug sensitivity of key organism causing multidrug resistance leading to hospital acquired infection. We could not able to evaluate the patient record for extensive research and analysis of any past Multidrug resistance history due to limitation of the time. Future most, the resistant phenotypes and drug resistance mechanism was not included in this study.

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