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Comparison of Microbiological Profile of Nosocomial Organisms in ICU and Wards for a Period of 3 Months

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Abstract:-

- ***Introduction***

The increased use of antibiotic in the past decade has resulted in epidemic of multi drug resistant organisms(MDRO) with increased concentration in the intensive care units(ICU).The selection pressure due to the the increased antibiotic results in selective MDRO which spread across the hospital.

- ***Materials and Methods***

This study was a retrospective study conducted for a period of 3 months. The results of the positive culture were noted down from the blood, urine and exudates register for both the wards and the ICU. The identification of the organism and antibiotic suse pattern was noted and tabulated.

- ***Results***

Out of the total 123 isolates, 60.9% were from the ICU and 39.13% were from the wards. Compared to the wards, there was increased resistance to Gram positive cocci, Entero bacteriaceae and non-fermenters in the ICU. For antibiotics like Cefipime and Piperazillum tazobactum there was a drastic difference between the susceptibility of the drug in ward and ICU isolates. The percentage of MRSA was also increased in the ICU.

- ***Conclusion***

Regular monitoring of drug resistance should be strengthened to provide reference for empirical antibiotic therapy. Efforts to use antibiotics rationally and multidisciplinary antibiotic stewardship will help in decreased selection and prevent of spread of MDRO across the hospital.Grouped, easy to follow best practice activities called 'care bundles' have been developed. Microbiological cultures are central to a rapid and accurate diagnosis, which improves outcomes and reduces resistance. The principles of treatment include early antimicrobial therapy (after appropriate specimens are taken) targeted to the local microbes, then de-escalation according to culture and susceptibility results.

Keywords:- *Antibiotic Resistance, ICU, Nosocomial Infection.*

I. INTRODUCTION

Health-care-associated (or nosocomial) infection is a major problem in hospitals worldwide and the prevalence is two- to threefold higher in developing countries compared to Europe or USA (1)Patients in the ICU are at more risk for acquiring nosocomial infection. The risk to acquire MDRO increases with the length of stay in the ICU. Compared to patients with no MDRO on admission, patients carrying at least one MDRO are more likely to be hospitalised fo a longer period. Before ICU admission, prior history of invasive device and exposure to antibiotics in the last three months also play a role.(Georgis)

Patients hospitalized in the ICU's are 5 to 10 times more likely to acquire nosocomial infections than other hospital infections.(2) MSRO result in complications, prolonged hospital stay and increased health care costs.(SARI). It has been reported that in hospitals with an effective program for nosocomial infection surveillance, infection rates can be reduced by approximately one-third. (4,5).Restriction of antibiotic use, antibiotic stewardship and regional surveillance networks will help us to decrease the rate and spread of multi drug resistant organisms.(Georgis)

The present study aims to compare the differences in resistance pattern in the isolates of the wards and the ICU. It is crucial to know the specific antibiotic profile of the organisms in each area to establish preventive measures.(Geogis)

II. MATERIALS AND METHODS

Retrospective study .The data was collected for the period January to March 2019.The date was collected data from Blood , Exudates , Respiratory and Urine Inpatient registers.For the positive growth results ,the organism and the susceptibility pattern were compiled with the help of Microsoft Excel (2007). These compiled data was then analyzed using SPSS software. All the frequencies and percentages were also obtained from this.

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III. RESULTS

A total of 111 isolates during the three month periodwere taken for analysis of the study. Isolates from the ICU and wards were almost equal in number, being 57and 54.

The percentage of samples from the ICU were blood(22%) Urine(20%), Endotracheal aspirates (20%), exudates (20%), Bronchio alveolar lavage(BAL) (10%), Sputum (6%) and tracheal aspirate(2%)

The percentage of samples from the ward included urine (30%), blood (22%), exudates (22%), Sputum (26%). Bacteria isolated from the patients in the wards and the ICU were similar. Their resistance percentage varied

- *Percentage of isolates*

Organism	ICU(percentage)	Ward(percentage)
Klebsiella	18%	14%
Acinetobacter	14%	12.2%
Pseudomonas	10%	12.2%
Enterobacter	10%	8.7%
Coagulase negative Staphylococcus	14%	10.5%
Enterococcus	8%	1.7%
E.coli	6%	21%
Staphylococcus aureus	4%	12.2%
Providentia	4%	
Citrobacter	2%	
Proteus		5.2%
Stenotrophomonas	2%	3.5%
Sphingomonas		1.7%

Table 1

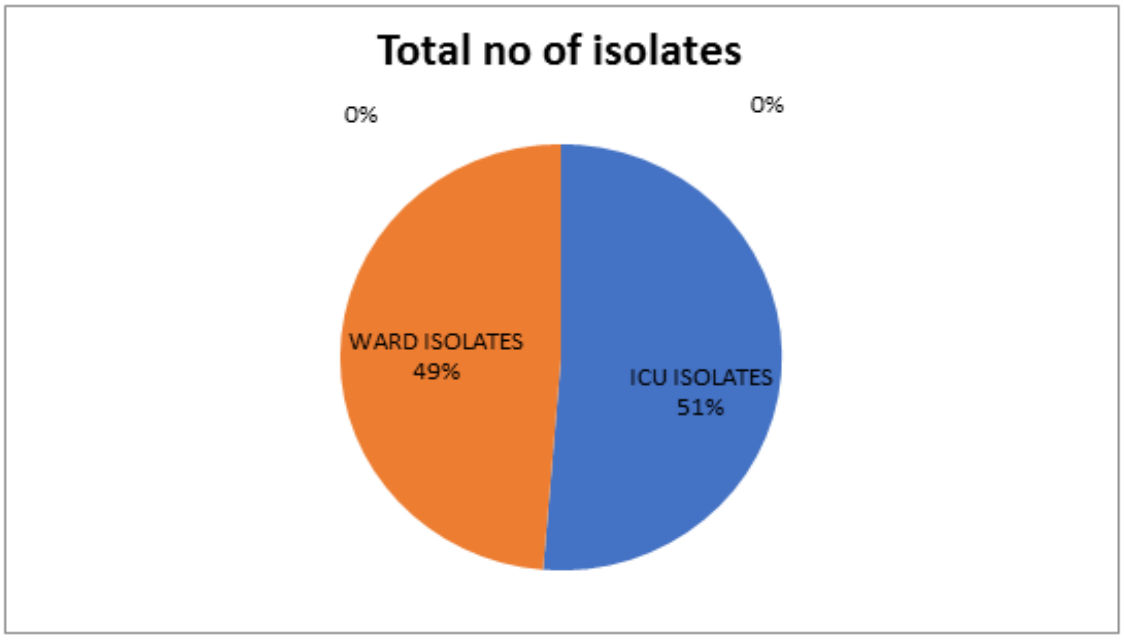

Fig 1

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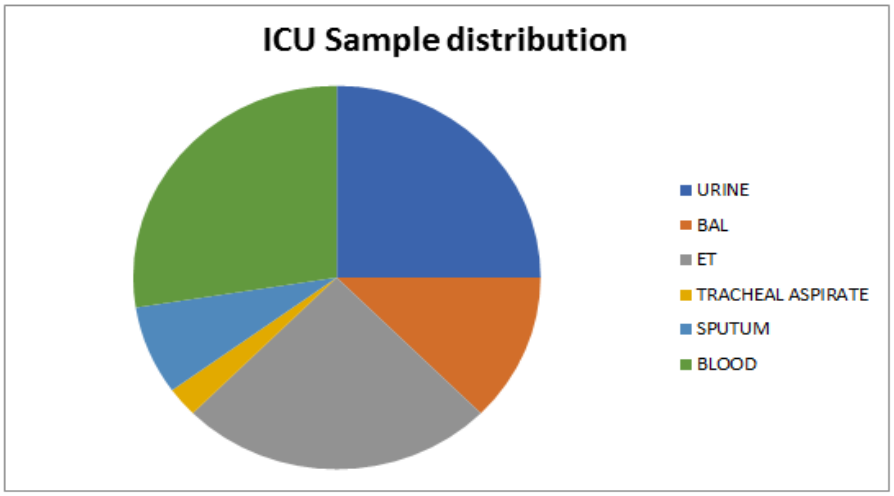

Fig 2

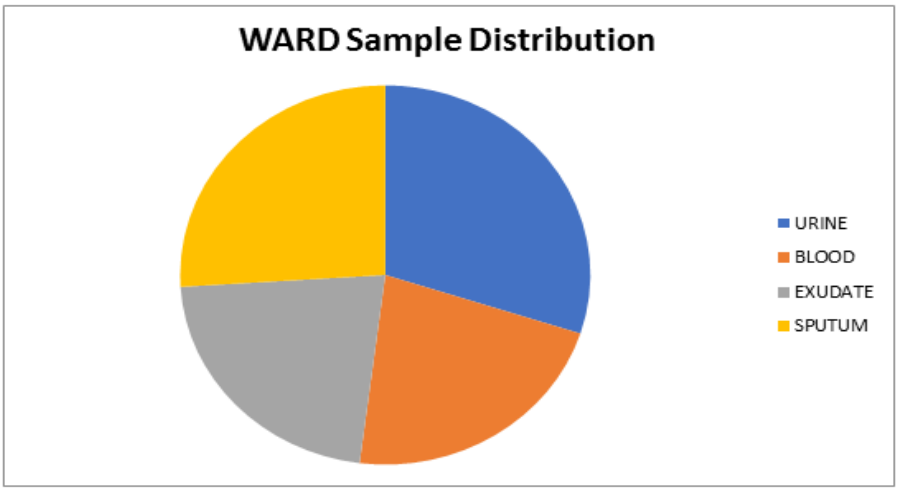

Fig 3

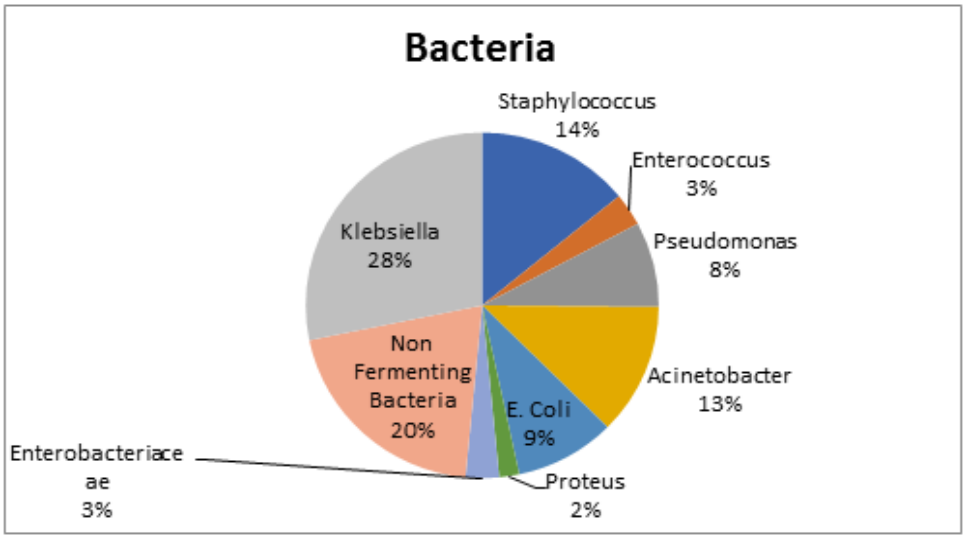

Fig 4

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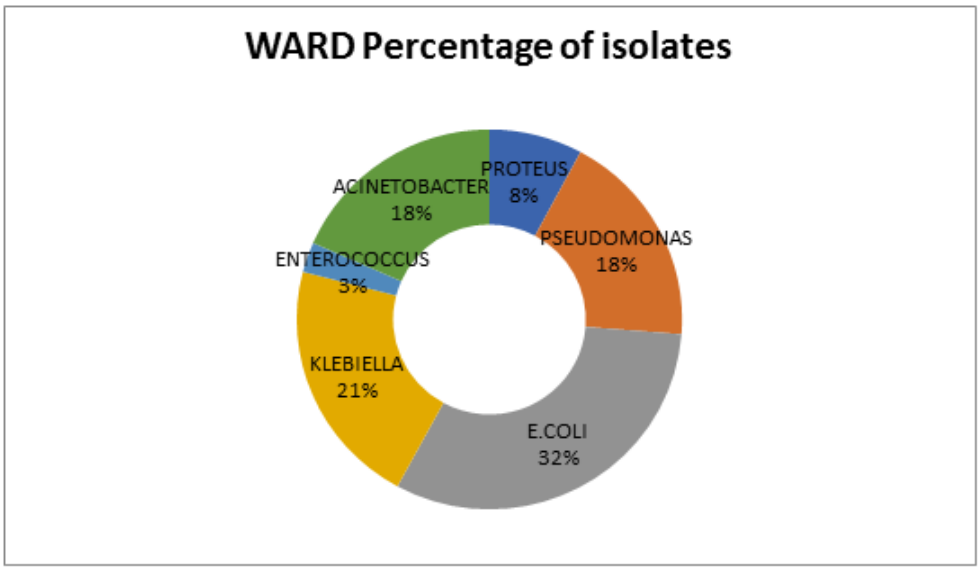

Fig 5

IV. DISCUSSION

In our study the total number of isolates analysed were 111,out of which 54 were from the ICU and 57 were from the wards. In our study,30% of the ICU samples were urine,20% of endotracheal aspirate and exudates,10% of bronchio alveolar lavage,6% of sputum sample and 2% of tracheal aspirate. Respiratory samples amount to about 38%.22% of the samples were blood.

In the study by G. Maniyan et al,36% of the samples were urine,40% were blood,12% were pus,4% each of sputum and endotracheal aspirate, which is very different compared to our study. The increased number of endotracheal aspirates signifies increased susceptibility of infections related to devices. Ventilator associated pneumonia is a difficult situation to handle and the presence of a multi drug resistant organism makes it even more tricky.( )

In our study, the isolates from the wards,30% were from urine,22% from blood,22% from exudates and sputum 26%. In the study by G. Maniyan et al, the samples were 28% urine,2% of blood,28% of exudates,16% of sputum,4% of vaginal swab and 2% of throat swab. This was also different from our study. The blood samples were very minimal in number compared to our study.
The isolates in our study from the ICU were klebsiella (18%),Acinetobacter(14%),Pseudomonas(10%),Coagulase negative Staphylococci (14%),, Enterococcus 8%) and E. coli(6%) and Staphylococcus aureus (4%)

In the study by G. Maniyan et al, there were 32% E.coli,28% Klebsiella,20% Pseudomonas and 16% Acinetobacter. E. coli was significantly lower in our study in the ICU. From the wards ,in our study, there was 14% of klebsiella,12.2% of acinetobacter,12.2% of Pseudomonas,21% of E.coli,10.5% of Coagulase negative Staphylococci,8.7% of enterobacter and 12.2% of Staphylococcus aureus.

In the study by G. Maniyan et al, the percentage of organisms were,E.coli38%, Klebsiella 32%, Pseudomonas 16% and Acinetobacter 6% and citrobacter 8% which was comparable with our study. In the study by B.Ozer et al, there was 49.3% of Acinetobacter and 23% of Pseudomonas in the ICU.

In the SARI,15 year cohort study, among the gram positive cocci,54% were Staphylococcus aureus,26% Enterococcus faecalis and 17% Enterococcus faecium. The percentage of Staphylococcus aureus is significantly increased compared to our study. Among gram negative bacilli,44% were E.coli,27% Pseudomonas and 17% were klebsiella which was opposite compared to our study where klebsiella was the commonest organism and E.coli were small in number.

In our study, for Staphylococcus the resistance percentage to CLOXACILLIN was 55% compared in the ICU to 14% in the wards which shows that there is increased methicillin resistance in the ICU. The resistance to Penicillin, Erythromycin, Clindamycin , Gentamicin and Ciprofloxacin was comparable in the ICU and the wards.

All the enterococcal isolates in the ICU were resistant to Penicillin, Ampicillin and High level Gentamicin and the enterococcal isolates from the wards were susceptible to all the antibiotics.

Among the enterobacteriacae isolates,60% were resistant to Ampicillin in the ICU compared to 40% in the wards. For Gentamicin, there was increased resistancein the isolates from the wards. It was 75% in the wards and 25% in the ICU which reflects the fact that antibiotic resistance is directly

proportional to the use of antibiotics.The resistance to Ciprofloxacin is double in the ICUs.66% in the ICU versus 33% in the wards. The resistance to Cefotaxime was higher in the wards (60%) compared to the ICU(40%) .The resistance to Cefepime in the ICU is 83% ,5 times of that in the wards. The resistance to Piperacillin tazobactum is 100% in the ICU isolates and all the isolates in the wards are susceptible to the antibiotic.The above mentioned lines reiterate the fact that ICU and wards differ in resistance because of the difference in the usage and choice of antibiotics.100% resistance to Piperacillin tazobactum stresses the fact that it is the emperic antibiotic. The resistance to carbapenems was 45% in the ICU and compared to 17.8 in the wards.

In the non-fermenters, all the ICU isolates were resistant to Cefipime and all the ward isolates were susceptible to Cefepime . This also reflects the fact that the antibiotics used in the ICU are higher end. The resistance to cotrimoxazole was 77.7% in the ICU and 22.2% in the like enterobacteriacae, the resistance to Piperacillin tazobactum was significantly higher (87.5%) in the ICU isolates compared to 12.5% in the wards. The resistance to Meropenem (80%) is four times that of the wards (20%). The resistance to Carbapenems is greater non-fermenters compared to enterobacteriacae.

In the study by X Tian et al,in theICU, Pseudomonas isolateshad 41.2% resistance to Cefepime and 39.5 % resistance to Imipenem. In our all isolates were resistant to Cefipime and the resistance to carbapenems was higher. Klebsiella in the ICU had 17.2% resistance to Imipenem which was less compared to our study (45%).In the wards , the resistance percentage was 8.8% compared to 17.8% in the wards.

In the study by Om Cristea et al, the prevalence of klebsiella was 20.8% in the ICU and 16.34 in the surgical ward which is comparable with our study. The highest difference in the resistance rates was observed for the following antibiotics –Gentamicin, Ciprofloxacin, Cefeperazone sulbactum, Imipenem, Ertrapenem, Tigycycline.

In the study by Georgis Feretzakis et al,56.67 % of Pseudomonaswere resistant to Cefepime and 55.02 were resistant to Carbapenems. The resistance in our study is higher. The resistance of Acinetobacter to Imipenem in the ICU and wards is 80% which is comparable with our study. The resistance of Klebsiella to Carbapenems is 48.86% which is comparable with our study.

In the study by G.Maniyan et al, the resistance of E.coli to Cotrimoxazole is 73.7 in the wards and 87.5 in the ICU. All the ICU isolates are resistant to Ciprofloxacin and 89% of ward isolates are resistant. For Cefotaxime, the resistance in the ward isolates is higher(89%) compared to the ICU (75). This is comparable with our study. The non-fermenters had 25% resistanceto Amikacin both in the ICU and the wards. All the isolates in the ICU were resistant to Cotrimoxazole and Ciprofloxacin. The non-fermenters in the ward were 87.5% resistant to Cotrimoxazole and 100% resistant to Ciprofloxacin. The isolates in our wards had decreased resistance to cotrimoxazole compared to their study.

V. CONCLUSION

The resistant density of gram negative multi drug resistant pathogens in the ICU has increased markedly in the past decade. Carbapenem resistance arouse particular concern. Efforts to use antibiotics rationally and multidisciplinary antibiotic stewardship are the cornerstones of decreasing the emergence of resistant strains. Other intervention measures include strict adherence to hygiene measures and surveillance of antibiotic consumption and antibiotic resistance.Ultimately ,a multidisciplinary and cross sectoral approachbetween human and veterinary medicine,animal husbandry, agriculture and environment,is needed to stop the spread of multidrug resistant pathogens.

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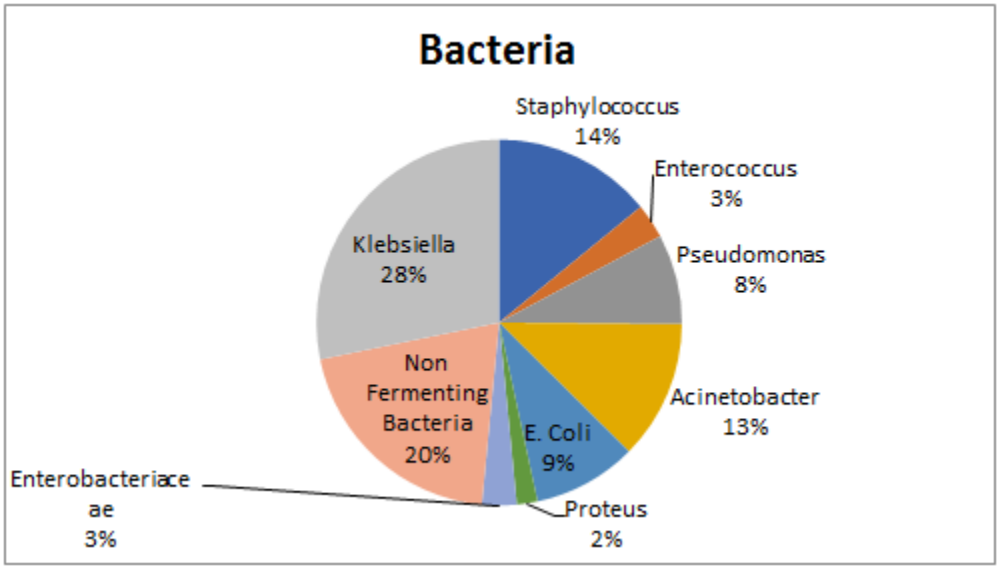

Fig 6:- Bacteria found in ICU and WARD

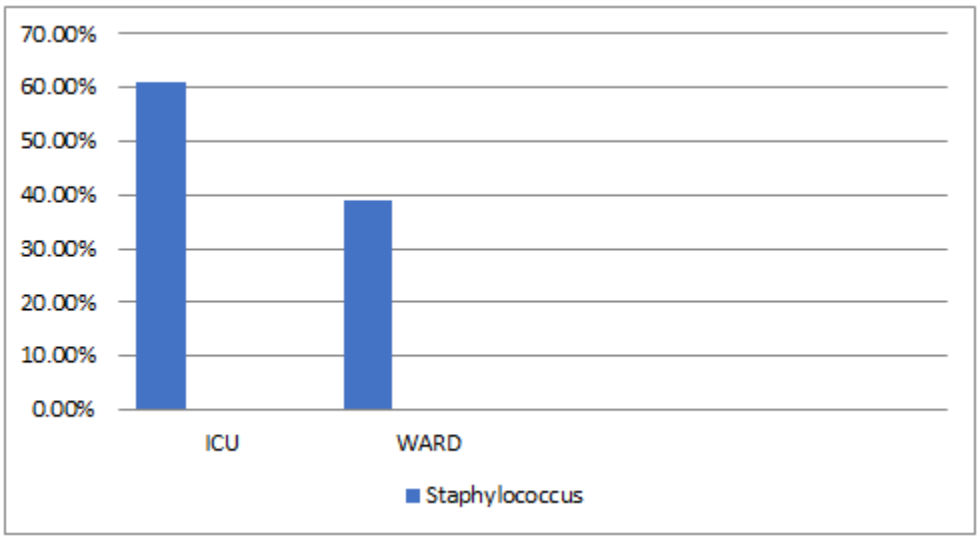

Fig 7:- Staphylococcus

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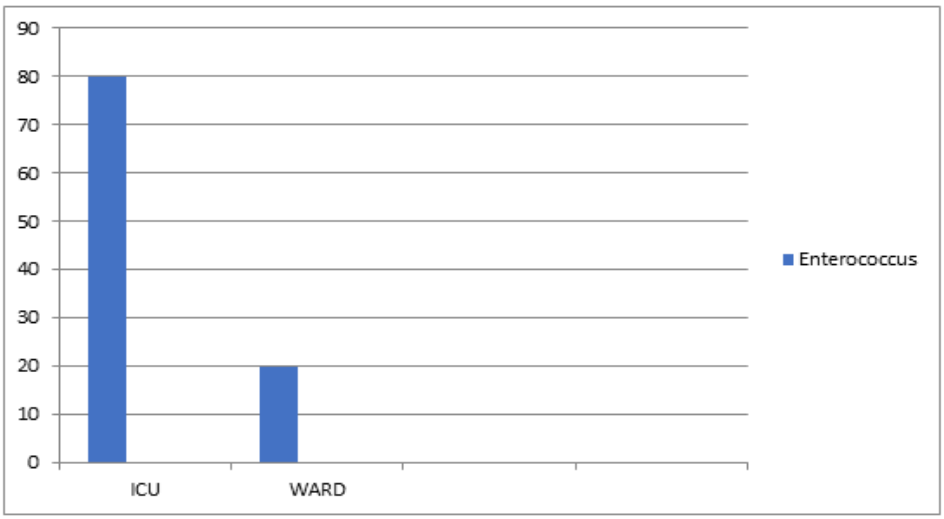

Fig 8:- Enterococcus

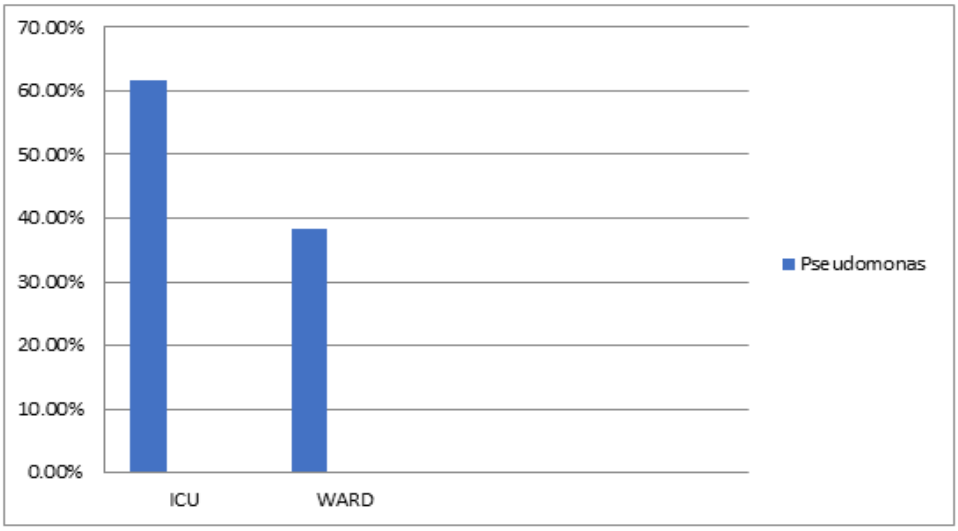

Fig 9:- Pseudomonas

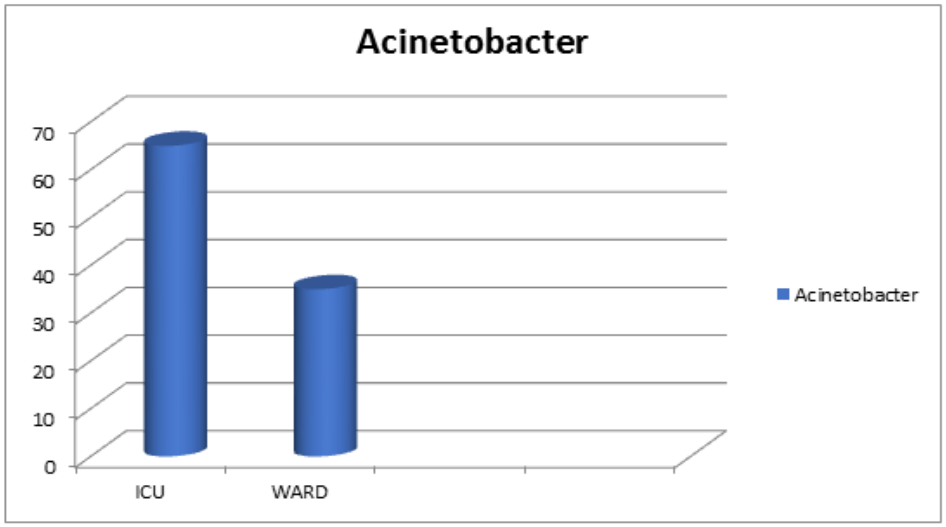

Fig 10:- Acinetobacter

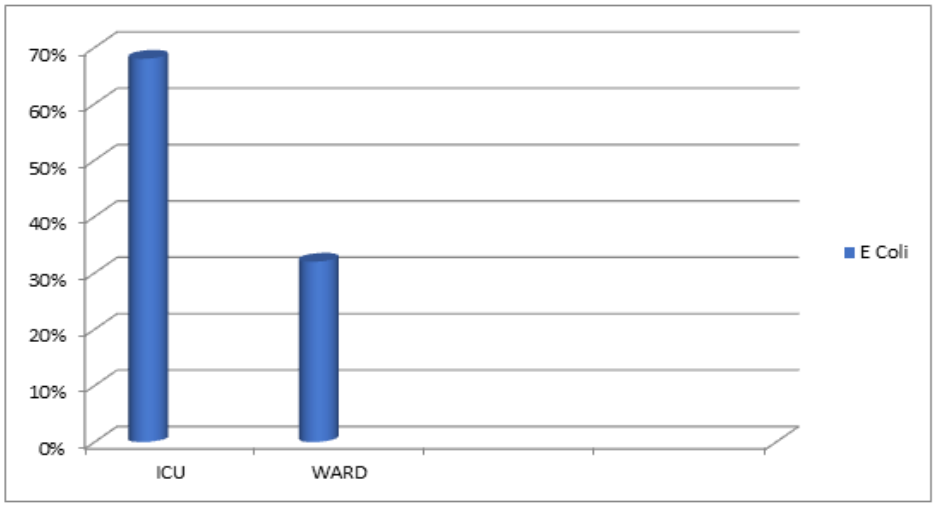

Fig 11:- E . Coli

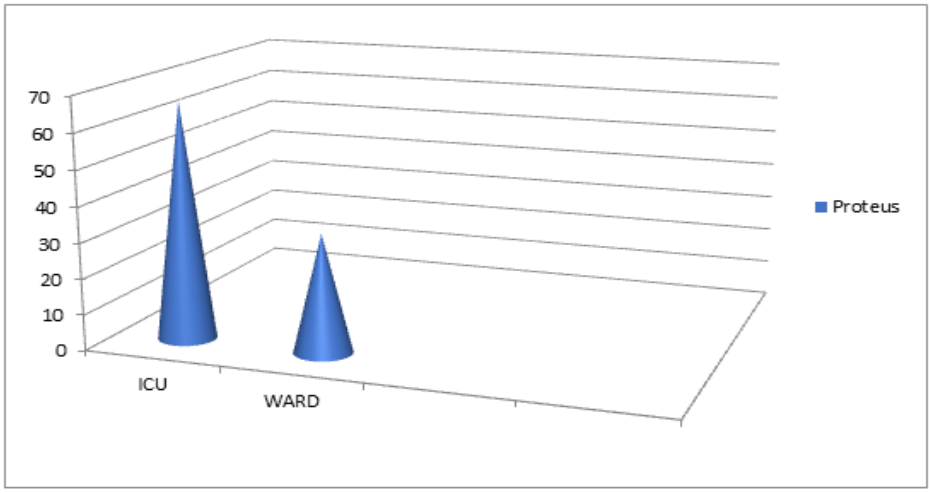

Fig 12:- Proteus

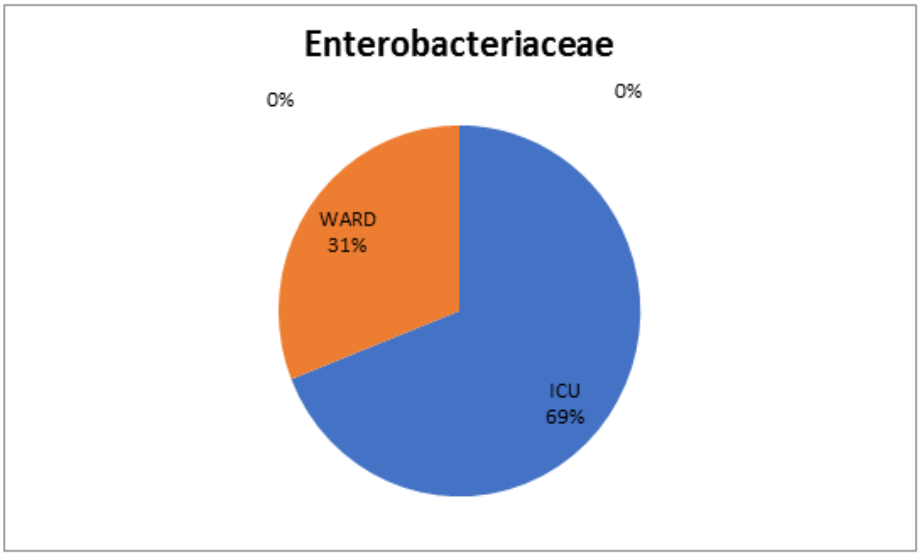

Fig 13:- Enterobacteriaceae

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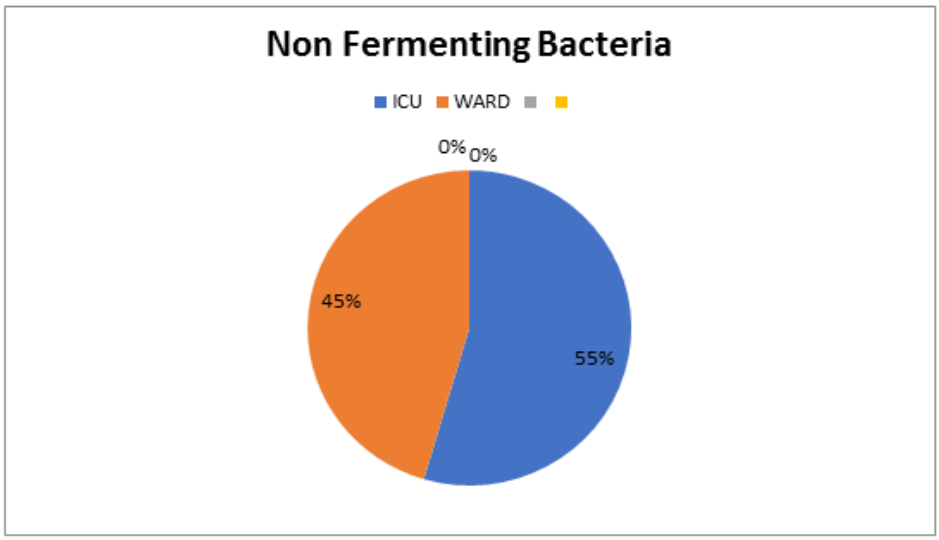

Fig 14:- Non fermenting Bacteria

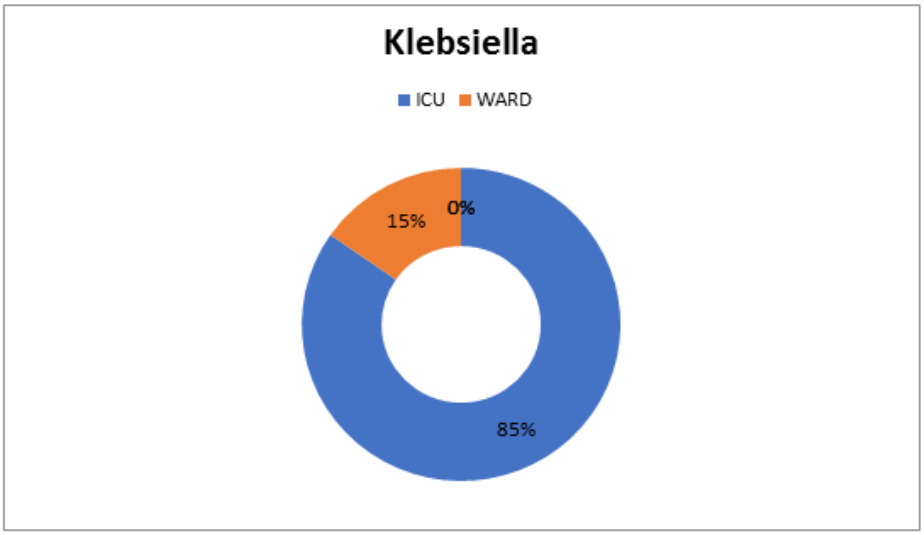

Fig 15:- Klebsiella