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Microbial Contamination of Endotracheal Tube of Patients in ICU of a Tertiary Care Hospital in Benghazi , Libya

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ABSTRACT:

Nosocomial infections are one of the most important worldwide health including mechanical ventilation in ICU, which is considerable a life-saving procedure, but it is associated with a high risk of acquiring respiratory infections. Hence to prevent it and initiate empirical antimicrobial therapy, knowledge of microbial profile and their local antimicrobial sensitivity pattern are essential. A prospective analytical study of Endotracheal tube (ETT) aspirates of mechanically ventilated patients in Intensive Care Unit (ICU) of Al-Jalaa Hospital for Surgery and Accidents -Benghazi - Libya, was done over a period of six months (December 2022- May 2023). Endotracheal tube aspirates of patients who had been intubated for ≥48hrs were processed by standard methods with the aim to identify the microbiological profile of ETT aspirates and their antibiogram. Out of the 52 samples, 76.92% were culture positive. Gram negative enteric aerobic bacteria were isolated from most of the patients, most common being Klebsiella species (30%), followed by Acinetobacter (20%) and Pseudomonas (15%). Most of the Gram negative isolates were sensitive to Meropenem, Tigecycline, and Polymixin B but resistant to Penicillin derivatives and Cephalosporins. Gram positive cocci were mostly sensitive to Penicillin derivatives, Vancomycin and Clindamycin. Gram negative organisms are predominant isolates of ETT in our ICU. Hence empirical therapy, based on bacteriological profile and susceptibilities is essential to prevent poor outcomes in incubated patients.

Keywords: Microbial Contamination, Endotracheal Tube Aspirates, Patients, ICU of a Tertiary Care Hospital.

I. INTRODUCTION

Nosocomial infection is an important health-care problem. According to WHO manifestation, (5-10)% of hospitalized patients of developed countries and about (25)% of developing countries were affected by a nosocomial infection in 2005. (Ahoyo *et al.,* 2014).Use of different kinds of catheters, endotracheal tubes, o2 supplying apparatuses and surgeries are the most common pathway of nosocomial infections transmission. Urinary tract infections, ulcer infection and respiratory tract infections are responsible for 80% of nosocomial infections.(Mandal *et al*., 1996)

Approximately,1% of nosocomial infections are lethal and it costs about 10 billion dollars per year.(Carpenter & Grigg, 2001) Mortality rate of nosocomial pneumonia is 50 %. (Braunwald & Harrison, 2001) Nosocomial infections are a serious problem for medical society. During these years, use of invasive diagnostic and therapeutic methods has saved many lives but on the other hand, it can cause some life threatening consequences due to sever, persistence and resistance infections (Mandal *et al*., 1996;Molana *et al*., 2002). According to reported statistics, there are 2 million nosocomial infections per year in the United-States, which lead to an increase in cases of morbidity and mortality rate, and costs and duration of hospital stay (Mandal *et al*., 1996).

Mechanical ventilation is a life-saving procedure for many patients in Intensive care unit, but it is associated with a high risk of acquiring respiratory infections and a high morbidity and mortality in critically ill patients. The etiologic agents may vary according to the population of patients in ICU, type of ICU-whether Medical ICU, Surgical ICU, or Paediatric ICU, pre-existing illness and prior antimicrobial therapy (Sanjai *et al*., 2001). Hence to prevent respiratory infections and initiate empirical antimicrobial therapy, knowledge of microbial profile and their local antimicrobial

sensitivity pattern are essential and therefore this study was undertaken.

A. The aim of study :

The purpose of this study was to determine the prevalence of bacterial species present in tracheal tubes in patients admitted to Al Jalaa Hospital ICU during a period of six months (December 2022 - May 2023), and its correlation with demographic variables.

II. METHODS AND MATERIALS

A. Inclusion criteria :

ETT tips and aspirates of all patients who had been mechanically ventilated for >48hrs for various reasons.

B. Exclusion criteria :

ETT aspirates of Post-op ventilated patients and from patients who had been ventilated for <48hrs.

C. Materials and Methods :

A prospective observational and analytical study of endotracheal tube secretions of mechanically ventilated patients in ICU of Al-Jalaa Hospital for Surgery and Accidents -Benghazi - Libya, was done over a period of six months (December 2022 - May 2023). All endotracheal tube secretions which were obtained from patients after at least 48hrs of intubation were processed (Standard Operative Procedures – Bacteriology, 2015). The suction catheter tip and the secretions both were subjected to Gram's stain and culture by standard protocols. The positive culture samples were identified by standard biochemical reactions and subjected to antimicrobial susceptibility testing by Kirby Bauer Disc Diffusion method as per standard CLSI guidelines (Clinical and Laboratory Standards Institute, 2014.

III. RESULTS AND DISCUSSION

A total of 52 samples were obtained during the study period. Among them, 31 (59.62%) were males and 21 (40.38%) females and 40 were adults and 7 were children. 37 samples (71.15 %) were from Medical ICU, 8 (15.38%) from Surgical ICU and 7 (13.5 %) from Pediatric ICU, that seen in (Fig. I). Growth was observed in 40 (76.92%) samples, while 12 (23.1%) samples showed commensal flora of the respiratory tract or no growth.

Gram negative enteric aerobic bacteria were isolated from most of the patients. The most common being Klebsiella species in 12 (30%), followed by Acinetobacter in 8 (20%) Pseudomonas in 6 (15%), *Staphylococcus aureus* in 4 (10%), Citrobacter spp in 4 (10%) *E. coli* in 4 (10%), Coagulase Negative Staphylococcus (CONS) in 1 (2.5%), Enterococcus in 1 (2.5%), as shown in figure (II). Most of the Enterobacteriaceae isolates were sensitive to Meropenem, Colistin and Polymixin B but resistant to Ampicillin, Amoxyclav, most of the Cephalosporins and Aminoglycosides. Gram positive cocci were mostly sensitive to Penicillin derivatives, Vancomycin and Clindamycin .

Endotracheal intubation and mechanical ventilation are life-saving procedures needed in clinical conditions like sepsis, acute respiratory distress syndrome and neurological dysfunctions. While mechanical ventilation helps to prevent deaths due to respiratory failure, it poses great threat, by leading to life threatening lung infections by itself According to a recent review by Morehead *et al.*, (2000) the incidence of ventilator associated pneumonia was 9 to 24% for patients intubated longer than 48hrs .

Culture positivity was more common in elderly male patients who were smokers, and who were admitted for respiratory causes or patients who had pre-existing lung diseases. This is in coherence with the study by Ferrer *et al.*, (2005). No growth or commensals were obtained in predominantly female and paediatric patients and patients ventilated for causes other than respiratory .

In this study Gram negative enteric bacteria were the most common isolates. The most common being Klebsiella species, followed by Acinetobacter and Pseudomonas. Summaiya *et al.*, (2012) found that most common organisms isolated in ETT which produce strong biofilm are *Pseudomonas aeruginosa* and Acinetobacter spp. Trilok Patil *et al.*, (2014) in their study noted that *Pseudomonas aeruginosa* was the most commonly isolated organism, followed by *Klebsiella pneumoniae*. In another study by George *et al.*, (2010) Acinetobacter was the most common isolate (37.5%), followed by Pseudomonas (21.8%) and Klebsiella (15.6%). amikacin, gatifloxacin and imipenem were the sensitive antibiotics are also common in our study as shown in Table (I).

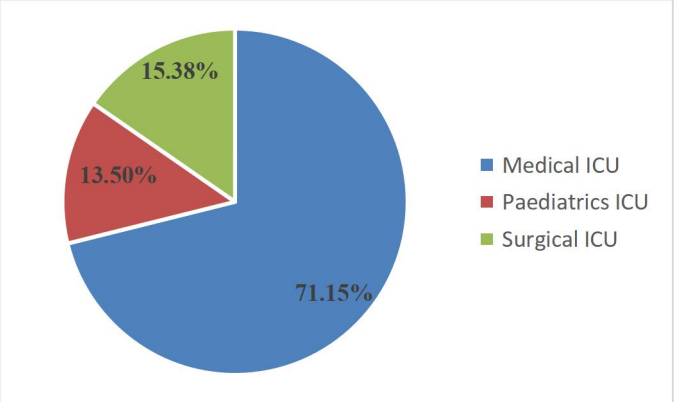

Figure (I) : *Place distribution of samples .*

Table (I): Antimicrobial susceptibility pattern of Gram negative bacteria (% of susceptible isolates):

No.	Antibiotics/ Organism	Klebsiella n=11	Acinetobacter n=7	Pseudomonas n=5	E. coli n=3	Citrobacter n=3
1	**Ampicillin**	18.18	14.28	00.00	33.33	33.33
2	**Amoxyclav**	27.27	28.57	20.00	66.66	66.66
3	**Amikacin**	27.27	28.57	60.00	66.66	66.66
4	**Ceftriaxone**	9.09	14.28	00.00	00.00	33.33
5	**Cotrimoxazole**	9.09	00.00	00.00	33.33	66.66
6	**Cefixime**	00.00	00.00	00.00	00.00	33.33
7	**Ceftazidime**	18.18	14.28	20.00	33.33	33.33
8	**Ceftazidime- Clavulanic acid**	54.54	42.85	80.00	66.66	66.66
9	**Levofloxacin**	54.54	28.57	40.00	33.33	66.66
10	**Meropenem**	90.90	71.42	80.00	66.66	100
11	**Colistin**	100	85.71	100	100	100
12	**Polymixin B**	100	100	100	100	100

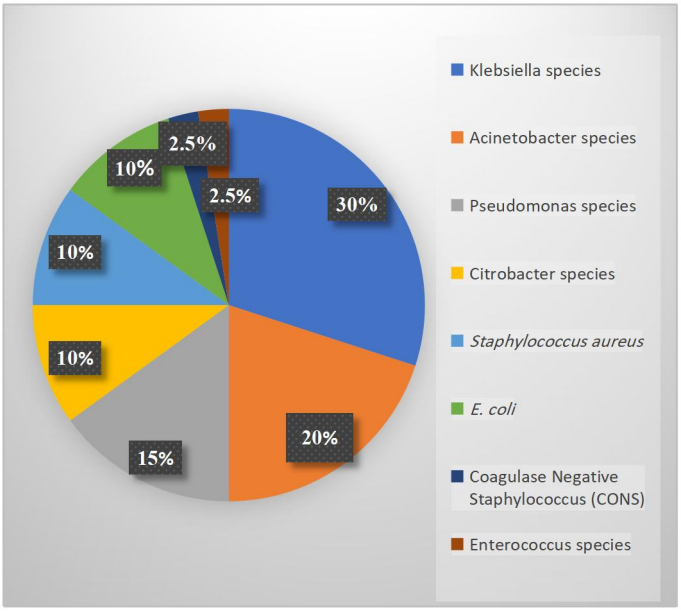

Figure (II): *Microbial profile of ETT secretions .*

The findings of the present study are consistent with the above studies, except for the antimicrobial sensitivities where most of the Gram negative isolates are resistant to ampicillin, cotrimoxazole, amoxyclav, cephalosporins. A significant number of Acinetobacter and Pseudomonas isolates are also resistant to fluoroquinolones and aminoglycosides. Most of the isolates are sensitive to meropenem but approximately 20% of the isolates are resistant to meropenem also, which is an alarming trend. Resistance to beta lactam class of antibiotic is a common occurrence and pan-drug-resistant strains are beginning to emerge. Evolutionary stress such as exposure to antibiotics, bacterial gene transfer is responsible for antibiotic resistant trait (Kumar *et al.*, 2011).

IV. CONCLUSION

In conclusion, gram negative organisms belonging to family Enterobacteriaceae susceptible mostly to carbapenems, colistin and polymyxin antibiotics form the predominant isolates of ETT aspirates in our critical care setup (Table I). They are mostly resistant to penicillin derivatives, cephalosporins and aminoglycosides. The risk of acquiring infection is higher in patients with pre-existing lung diseases. With an empirical antibiotic regimen we can prevent many instances of ventilator associated pneumonias. Thus the microbiological profile and sensitivity pattern of our ICU shall help in framing the appropriate institutional antibiotic policy for better outcomes.

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