Research Paper

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# Hospital Acquired Infections due to Gram Negative Bacteria Related to Endotracheal Tube at Tertiary Care Hospital

Medical Science

**KEYWORDS :** Ventilator associated Pneumonia, Acinetobacter baumannii, Drug resiatance

**Dr Kanizfatma Durani** Tutor, Department of Microbiology, M.P. Shah Government Medical College, Jamnagar

## ABSTRACT

*Objective: Prolonged use of endotracheal (ET) tube has been recognized as a major threat for developing Ventilator associated Pneumonia (VAP) particularly by Gram negative organisms. So the purpose of the study was to determine the organisms causing VAP and to study their antimicrobial susceptibility pattern. Materials and Method: This retrospective observational study was conducted over a period of 9 months from January -September 2012 in microbiology department, G.G.H. hospital, Jamnagar during which total 82 ET tube samples were received. Identification of bacteria was done by various biochemical tests. antibiotic sensitivity of isolate was done by Kirby-Baur method. Result: 24 (72.73%) isolates are gram negative bacteria & 9 (27.27%) infections are due to gram positive bacteria. Acinetobacter baumannii (18 samples; 54.5%) was the most common organism isolated, which was resistance to commonly used antibiotics. Conclusion: There is a need to improve the effectiveness of integrated infection control programs to control and manage nosocomial infections caused by highly resistant organisms.*

## INTRODUCTION

Nosocomial infections or hospital-acquired infections (HAI), are a major public health problem in hospitals worldwide, accompanied by high rate of morbidities and mortality among hospitalized patients[1]. The burden of HAI is already substantial in developed countries, where it affects from 5% to 15% of hospitalized patients in regular wards and as many as 50% or more of patients in intensive care units (ICUs). In developing countries, the magnitude of the problem has remained underestimated or even unknown mostly because HAI diagnosis is complex and surveillance activities to guide interventions require expertise and enough resources.

Nosocomial infections are frequently encountered in ICUs because of the severity of underlying diseases, the frequency of invasive interventions, and the frequent use of wide spectrum antibiotics[2].

Modern medical and surgical practices have increasingly utilized implantable medical devices of various kinds. Such devices may be utilized only short-time or intermittently, for months, years or permanently. They improve the therapeutic outcome, save human lives and greatly enhance the quality of life of these patients[3]. However, plastic devices are easily colonized with bacteria and fungi, able to be colonized by microorganisms at a rate of up to 0.5 cm per hour. A thick biofilm is formed within 24 hours on the entire surface of these plastic devices once inoculated even with a small initial number of bacteria.

Hospital acquired infection is showing rising trend mainly because of increasing use of invasive procedures[4]. Among iatrogenic procedures, Endotracheal (ET) tube has been recognized as a major threat for developing Ventilator associated Pneumonia (VAP). Colonization of the respiratory tract is very common in intubated patients requiring intensive care and in most instances leads to the increase chances of infection[5]. Intubation with mechanical ventilation increases the risk of pneumonia 6 to 20 folds more among patients and is associated with crude mortality rates of 20% to 40%[6,7]. Among these infections, infections caused by gram-negative bacteria have features that are of particular concern. These organisms are highly efficient at up-regulating or acquiring genes that code for mechanisms of antibiotic drug resistance, especially in the presence of antibiotic selection pressure. Furthermore, they have available to them a plethora of resistance mechanisms, often using multiple mechanisms against the same antibiotic or using a single mechanism to affect multiple drugs. These resistant strain colonize the ET tube which is main threat for ventilator associated Pneumonia in patient by prolong use of ET tube[8].

The purpose of the study was to determine the organisms causing Ventilator associated Pneumonia Particularly by gram negative organisms and to study their antimicrobial susceptibility pattern.

## MATERIALS AND METHODS

This retrospective observational study was conducted over a period of 9 months from January 2012 to September 2012 in microbiology department, G.G.H. hospital, Jamnagar. Specimens, which were collected from endotracheal tubes of patients with clinical manifestations of pneumonia and were on ventilation at least 3-4 days prior to sampling, had been selected for the study. All the samples from patients irrespective of their age, gender or clinical outcome were enrolled for the study. Samples were collected either from the tip of the endotracheal tube or from endotracheal tube aspirates in a sterile container containing glucose broth. Collected samples were incubated at $37^0$c for 24 hour and then subculture was done on Blood agar and Macconkey agar. The culture plates were incubated overnight at $37^0$c and examined for growth. The macroscopic features (like Size, shape, consistency, colour, Hemolytic property of colony etc…) and microscopic features (Gram staining, motility examination) features were studied. Based on these features, standard biochemical tests for Gram negative organisms including oxidase and catalase test, reaction in triple sugar iron agar (TSI) medium, IMViC test, urea utilization and PPA test were performed and for Gram positive organism catalase test, coagulase test were performed and result were analysed. The antibiotic susceptibility of the organisms was determined using the Kirby-Baur method (Disk Diffusion technique) and the results were interpreted as per clinical laboratory standard institutes (CLSI) guidelines.

## RESULTS

Total 82 samples were collected during 9 month study period and analysed to detect organism causing endotrachaeal tube related ventilator associated pneumonia. Out of 82, 33 samples (40.24%) showed growth on culture plate and further evaluated for identification of organism. Gram negative bacteria were found in 24 out of 33 samples (72.73%) and in 9 samples (27.27%), gram positive bacteria were found. Table 1 and 2 shows the various gram positive and gram negative organisms isolated from the culture media.

**Table-1 Isolated Gram negative bacteria**

| Organisms | Positive cases |
|---|---|
| Acinetobacter baumannii | 18(54.55%) |
| E.coli | 3(9.09%) |
| Pseudomonas | 2(6.06%) |
| Klebsiella spp | 1(3.03%) |
| Total | 24(72.73%) |

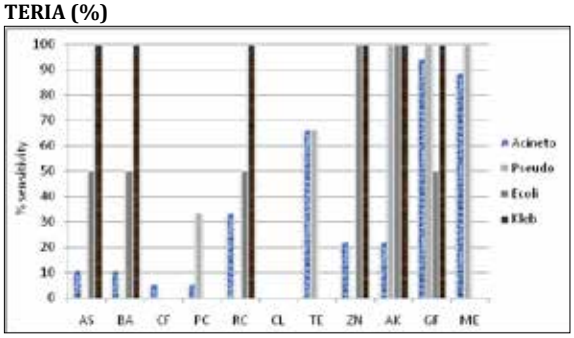
**Table- 2 Isolated Gram positive bacteria**

| Organisms | Positive cases |
|---|---|
| Staph.aureus | 7(21.21%) |
| Coagulase negative Staphylococci aureus | 2(6.06%) |
| Total | 9(27.27%) |

**Sensitivity pattern of isolated Bacteria**

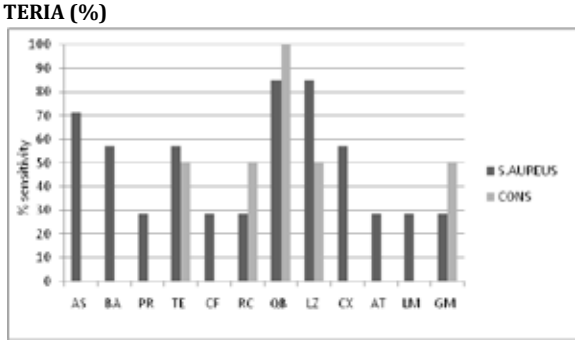
Figure 1 and 2 showed sensitivity pattern of various gram negative and gram positive Bacteria.

**Figure 1: SENSITIVITY PATTERN OF GRAM NEGATIVE BACTERIA (%)**




Isolated gram negative Bacteria showed resistance to com monly used antibiotics like Ampicilin - sulbactam (AS : 20 mcg), Cotrimoxazole (BA : 25 mcg), Cefotaxime (CF : 30 mcg), Piperacilin (PC: 100 mcg), Ciprofloxacin (RC : 5 mcg), Ceftizoxime (CL : 30 mcg), Tetracycline (TE : 30 mcg), Ofloxacin (ZN : 5 mcg), Amikacin (AK : 30 mcg), Gatifloxacin (GE : 10 mcg) and meropenem (ME : 10 mcg).

**Figure 2: SENSITIVITY PATTERN OF GRAM POSITIVE BACTERIA (%)**




Isolated gram positive bacteria showed resistance to commonly used antibiotic like Ampicilin-sulbactam (AS : 20 mcg), Cotrimoxazole (BA : 25 mcg), Cephalexin (PR:30 mcg), Tetracycline ( TE : 30 mcg), Cefotaxime (CF: 30 mcg), Ciprofloxacin (RC : 5 mcg), Levofloxacin (QB : 5 mcg), Linezolid (LZ : 30 mcg), Cloxacillin (CX : 1mcg), Roxythromycin ( AT : 15 mcg), Lincomycin (LM : 2 mcg), Gentamycin (GM : 10 mcg).

MRSA (Methicillin resistant staph aureus) were diagnosed in 42.8% of isolated strain of staph aureus.

**DISCUSSION**

Ventilator associated Pneumonias are becoming an increasing problem for hospitalized patients, especially in the ICU, particularly those acquired following insertion of endotracheal tube, are serious cause of concern for hospitals. In our study culture positivity rate is 40.24% which is quite comparable with the other studies done by azar et al[9] (40.3%), Ramna et al[10] (37%). Acinetobacter baumannii was the commonest organism infecting endotracheal tube in our study, followed by Staph aureus, Pseudomonas spp, Ecoli, and Klebsiella pneumoniae, In compared to pseudomonas which was the commonest organism isolated in previous study by ramna et al[10]. The study done previously in our department also showed pseudomonas is the commonest organism. This changing pattern of bacterial isolate is because of multidrug resistance Acinetobacter baumannii which increases hospital stay and are easily disseminated by patient to patient. In our study, more than 80% of A.baumannii isolates are resistant to the third-generation cephalosporins (Cefotaxime), Gentamicin, Amikacin. The study done by praviz at el[12] showed that Acinetobacter baumannii isolates are resistance to third generation cephalosporin as well as fluroquinolones while in our study most of them are sensitive to fluoroquinolones (Ciprofloxacin).

Acinetobacter baumannii is a gram-negative coccobacillus that has emerged from an organism of questionable pathogenicity to an infectious agent of importance to hospitals worldwide. The organism has the ability to accumulate diverse mechanisms of resistance, leading to the emergence of strains that are resistant to all commercially available antibiotics[11]. Present study revealed that imipenem resistant isolates are also increasing (10%). The important risk factors for acquiring an imipenem-resistant A. baumannii include previous carbapenem use, longer duration of hospital admission before occuring infection, ICU admission, urgent surgery, being on total parenteral nutrition, and using tubes and catheter such as central venous catheter, endotracheal tube, urinary catheter, and nasogastric tube[12].

**CONCLUSION**

There is an emergence of Acinetobacter baumannii and its resistant strains infections in the hospital. So, there is a need to improve the effectiveness of integrated infection control programs to control and manage nosocomial infections caused by highly resistant organisms. Apart from being associated with increased morbidity & mortality, hospital acquired infection related to ET tube can lead to the inappropriate use of antibiotic drugs which contribute to bacterial drug resistance & increase toxic effects of drugs. For prevention of all these, educate health care persons & implement policies for disinfection, sterilization & maintenance of respiratory equipment according to evidence based standards and the strategy needs for early reassessment of both diagnosis and therapy usually within 48 to 72 hrs of endotracheal tube intubation.

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