

**PREVALENCE OF RESPIRATORY PATHOGENS IN VENTILATED PATIENTS: A STUDY FROM SOUTH INDIA**Jacob C. E<sup>1</sup>, Miriam George Fenn<sup>2</sup>, Sara Korula<sup>3</sup>, Shareen George<sup>4</sup>**HOW TO CITE THIS ARTICLE:**

Jacob C. E, Miriam George Fenn, Sara Korula, Shareen George. "Prevalence of Respiratory Pathogens in Ventilated Patients: A Study from South India". Journal of Evolution of Medical and Dental Sciences 2014; Vol. 3, Issue 17, April 28; Page: 4504-4512, DOI: 10.14260/jemds/2014/2466

**ABSTRACT: OBJECTIVE:** To assess the bacterial profile of endotracheal (ET) tube aspirates in ventilated patients and to know their drug sensitivity pattern. **SETTING:** A tertiary care teaching facility situated in Kerala, South India. All patients were on ventilator in the medical, surgical, trauma or neuro intensive care units of the hospital. Isolation of the organisms was done by inoculation of sample on agar medium, and after 24 hours of incubation each organism was identified. Antibiotic sensitivity testing was carried out by Disc Diffusion Method. The results were analyzed. **RESULTS:** A predominance of multi drug resistant (MDR) gram negative microbes is evident in this analysis of endotracheal sample cultures. Of the 434 samples inoculated, 145 Acinetobacter, 100 pseudomonas aeruginosa and 92 klebsiella pneumonia were isolated. These lethal strains needed high end antibiotics mostly Inj. Colistin for their eradication. Prevention of pneumonia in ventilated patients is of paramount importance for obvious reasons. **CONCLUSIONS:** For these 3 major microbes mentioned, colistin was the best bet, and all 3 were uniformly resistant to ceftazidime and aminoglycosides. Piperacillin / tazobactam combination holds some promise in case of E.coli, non-fermenting Gram Negative Bacilli and Serratia. Staphylococcus aureus was 45% sensitive to cloxacillin. The remaining resistant (MRSA) strains were sensitive to vancomycin and linezolid.

**KEYWORDS:** Drug resistance, microbial.

**INTRODUCTION:** A few hours after intubation, the distal airways become colonized. Although the upper respiratory tract is colonized by mixed aerobic and anaerobic flora, no more than 10 micro-organisms are recovered in ventilated patients. Because of their peculiar susceptibility patterns, oxacillin-resistant Staphylococcus aureus (ORSA), Acinetobacter baumannii and Pseudomonas aeruginosa should be considered in the initial decision tree for the choice of an antimicrobial therapy.<sup>1</sup> Antibiotic choice should be institution specific and patient oriented.

There is variability between Intensive care units within the same hospital itself, in susceptibility of bacterial pathogens to various antibiotics. This may have implications in the design of empiric antibiotic strategies and the planning of the hospital formulary.<sup>2</sup>

A European study found out that antibiotic resistance across all species and drugs was, with some exceptions, highest in southern European countries and Russia, and lowest in Scandinavia. They also recommended that effective strategies are needed to control the selection and spread of resistant organisms.<sup>3</sup>

The profound difficulty in treating MDR (multi drug resistant) organisms is unfortunately arriving at a time when we have a dearth of new systemic antibiotics available. Only 2 new classes of antibiotics have been introduced in the past 40 years – namely oxazolidinones (linezolid) and the cyclic lipopeptides (daptomycin). Both of these are for treatment of gram-positive organisms. Options for resistant gram negative organisms is limited.<sup>4,5,6</sup>

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Outbreak of Imipenem resistant *Acinetobacter baumannii* (IRAB) has also been reported following prior use of the antibiotic imipenem and admission to Intensive care unit and Respiratory care unit.<sup>7</sup>

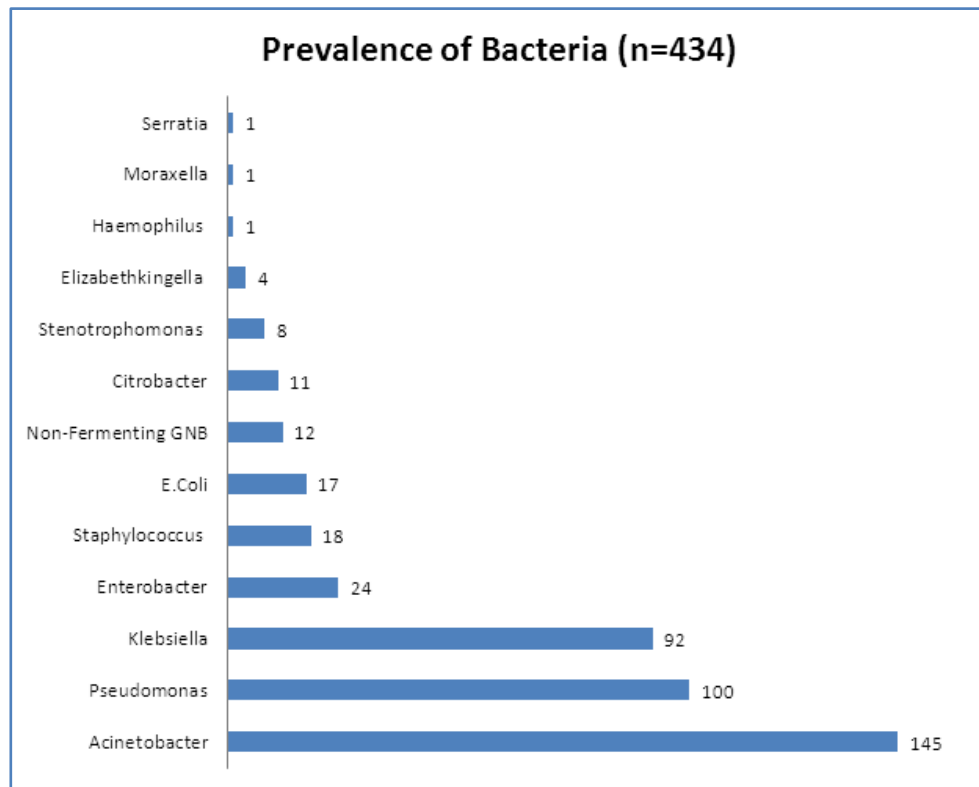
**MATERIALS AND METHODS:** This is a retrospective analysis of data from 434 culture reports of ET (endotracheal) tube aspirates taken from ventilated patients in the Intensive Care Unit from Jan 2013 to Feb 2014. The Culture and sensitivity patterns of endotracheal tube aspirate were analyzed.

Identification of bacteria was done by gram staining. Isolation of the organisms was done by inoculation of sample on agar medium. After 24 hours of incubation each organism was identified on the basis of morphology of colony in culture media and biochemical reactions.

Antibiotic sensitivity Testing was carried out on Muller Hinton Medium by Disc Diffusion Method following Kirby Bauer method.<sup>8</sup>

Patients were admitted in 4 critical care units - namely medical, surgical, trauma and neuro ICU. The setting is a 1250 bedded tertiary referral centre in South India. The objective was to find the prevalent strains of bacteria in patients on ventilator, and their drug sensitivity pattern.

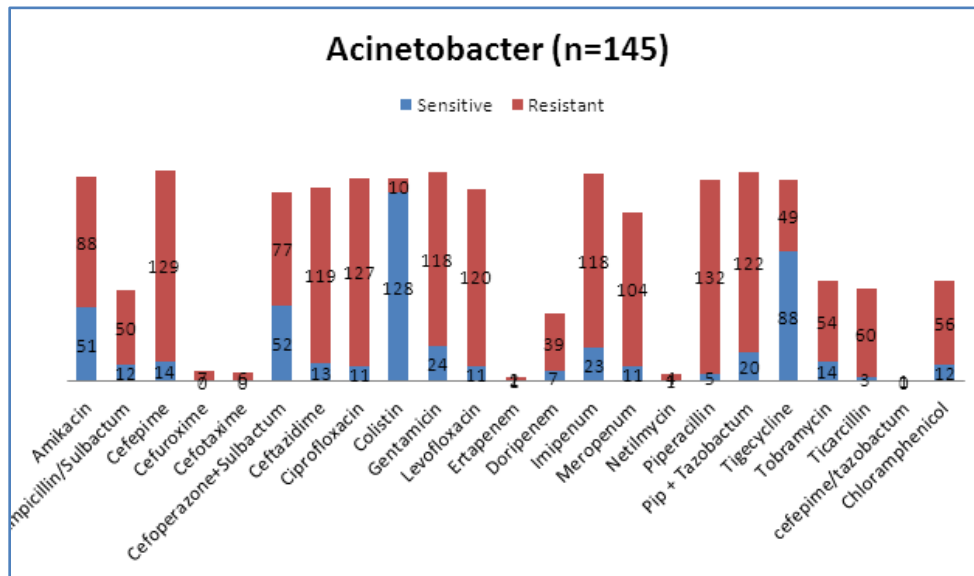
**RESULTS:** A total of 434 endotracheal aspirates were sent for culture and sensitivity. The prevalence of microbes in the study was as follows. Commonest organisms isolated were acinetobacter 33%, pseudomonas 23% and klebsiella 21%.



**Fig. 1: Prevalence of Bacteria**

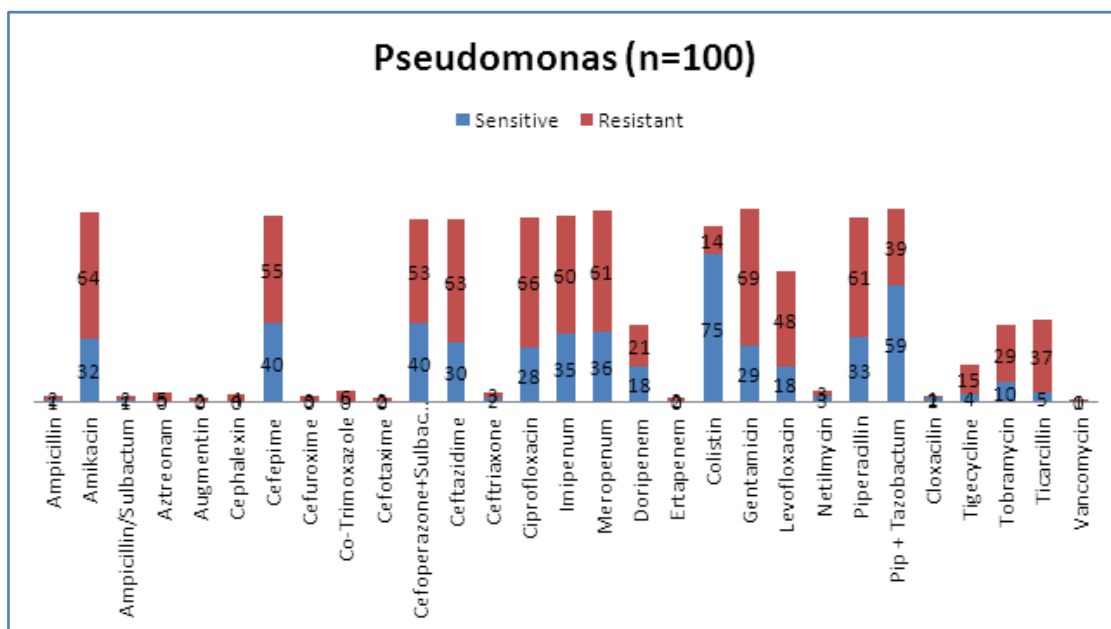
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**Analysis of the antibiotic sensitivity pattern of the microbes:** Acinetobacter strains were sensitive only to colistin (92.8%), and tigecycline (64.2%). They were resistant to cefuroxime / cefotaxime (100%), ceftazidime (90%), cefipime (90%), ciprofloxacin (92%) and also amikacin (63%).



**Fig. 2: Acinetobacter**

*Pseudomonas aeruginosa* strains were sensitive to Netilmycin in 50%, 60% to piperacillin + tazobactam, and 84% to Colistin. They were resistant to carbapenems) resistance ranged from 60% to 100%), to ciprofloxacin, gentamicin and levofloxacin) 70% each), and to amikacin, ampicillin plus sulbactam and ceftazidime (66% each).



**Fig. 3: Pseudomonas**

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**Klebsiella Pneumonia:** Strains were sensitive to amikacin (51%), imipenem (51%), tigecycline (78%) and colistin (92%). They were resistant to ceftazidime (95%), ciprofloxacin (79%), Levofloxacin (73%), gentamicin (72.5%) and netilmycin (80%).

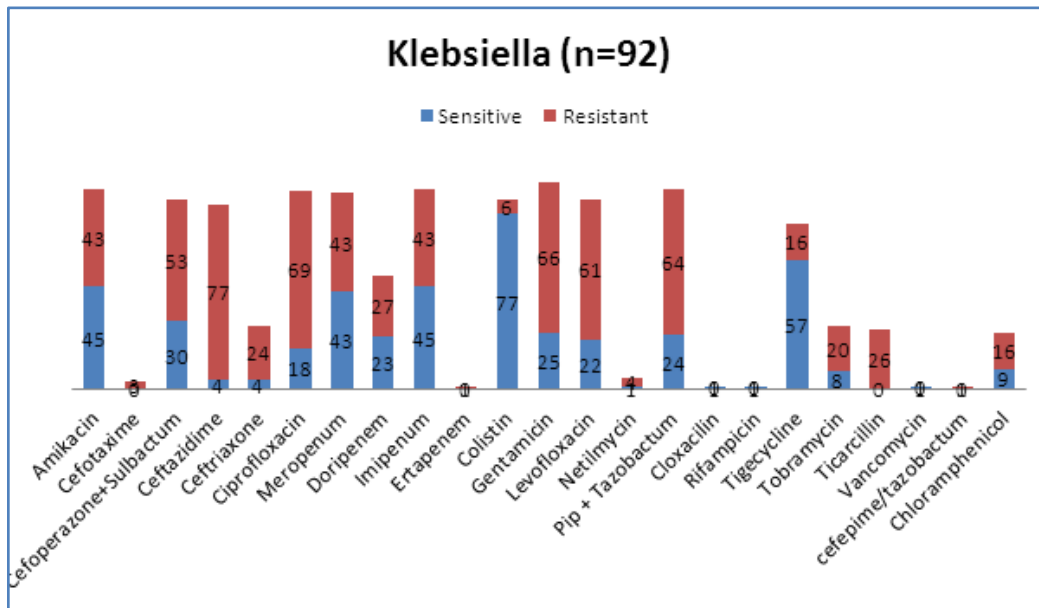


Fig. 4: Klebsiella

**Enterobacter Aerogenes:** These strains were sensitive to imipenem and meropenem (55%), tigecycline (58%), amikacin (75%) and colistin (82%). But they were resistant to quinolones ciprofloxacin (85%) and levofloxacin (83%), and also aminoglycosides gentamicin (85%) and tobramycin (80%).

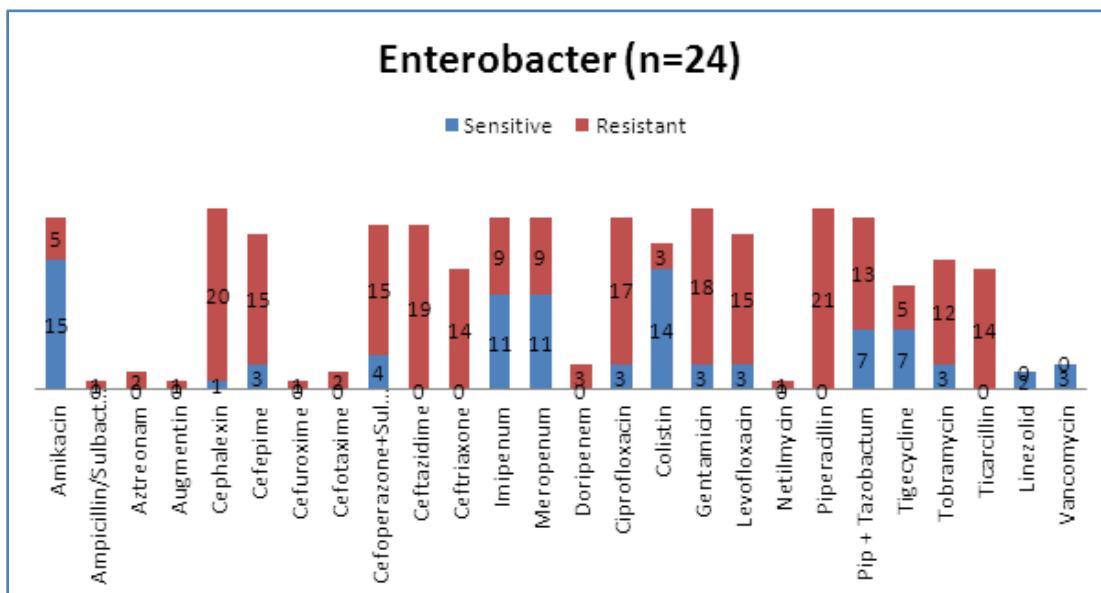
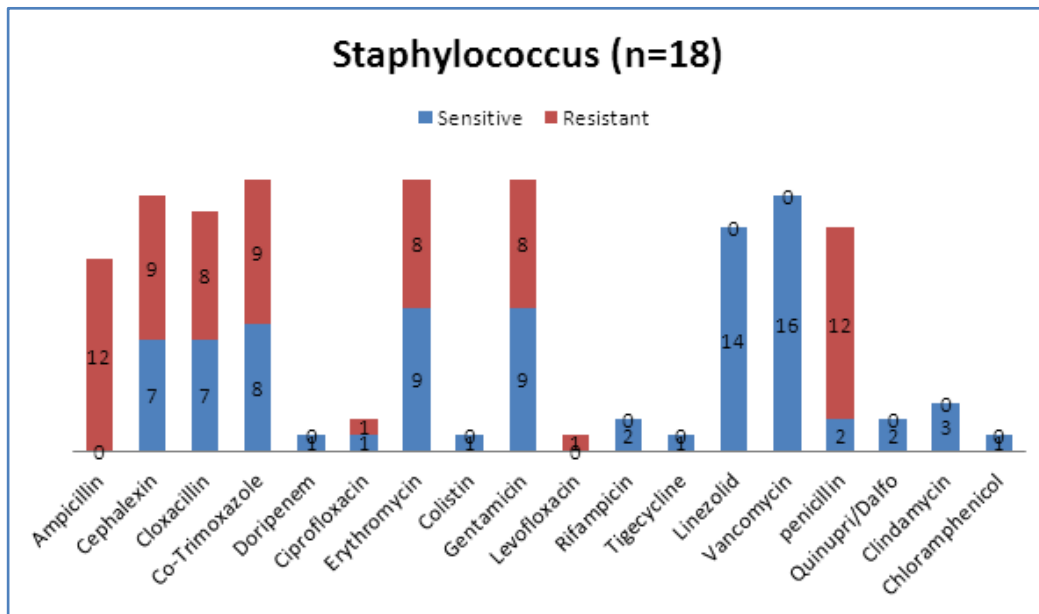


Fig. 5: Enterobacter

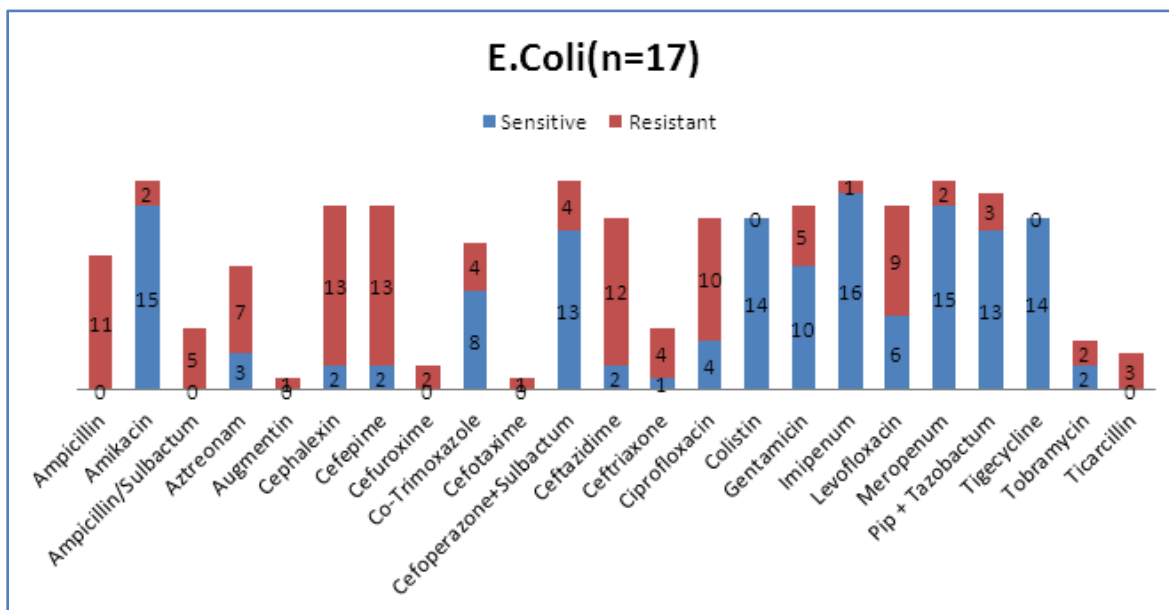
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Of the 18 staphylococcus aureus isolates, only 45% were sensitive to Cloxacillin, and 43% to cephalixin. 100% were sensitive to Vancomycin, Linezolid, Rifampicin, clindamycin.



**Fig. 6: Staphylococcus**

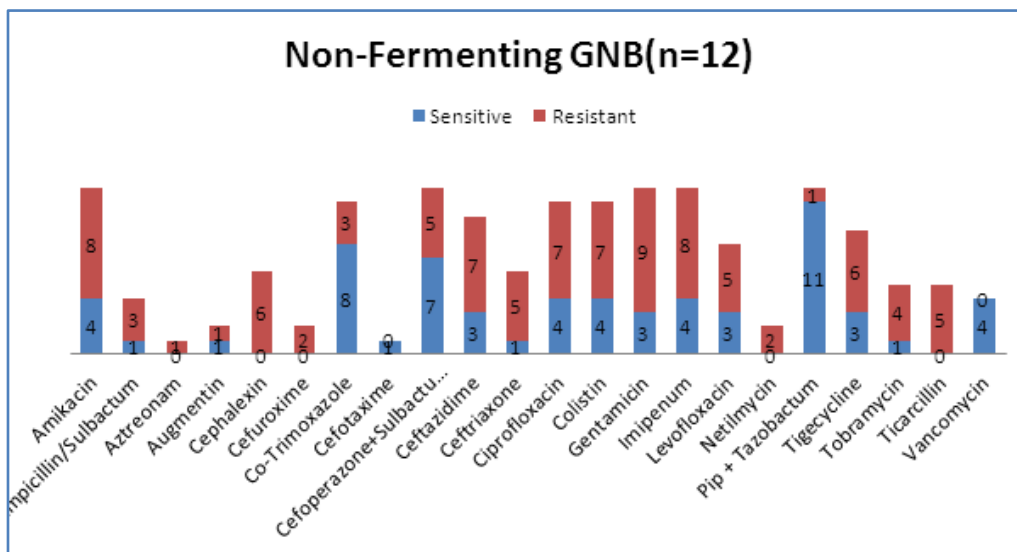
The 17 Escherichia coli strains isolated were resistant to ciprofloxacin (71%), ceftazidime (85.7%) and Ticarcillin (100%). They were sensitive to gentamicin (66.6%), cotrimoxazole) 66.6%), cefoperazone/sulbactam combination (76%), piperacillin / tazobactam combination (81%), amikacin (88%), imipenem (94%) and colistin & tigecycline (100%).



**Fig. 7: E. Coli**

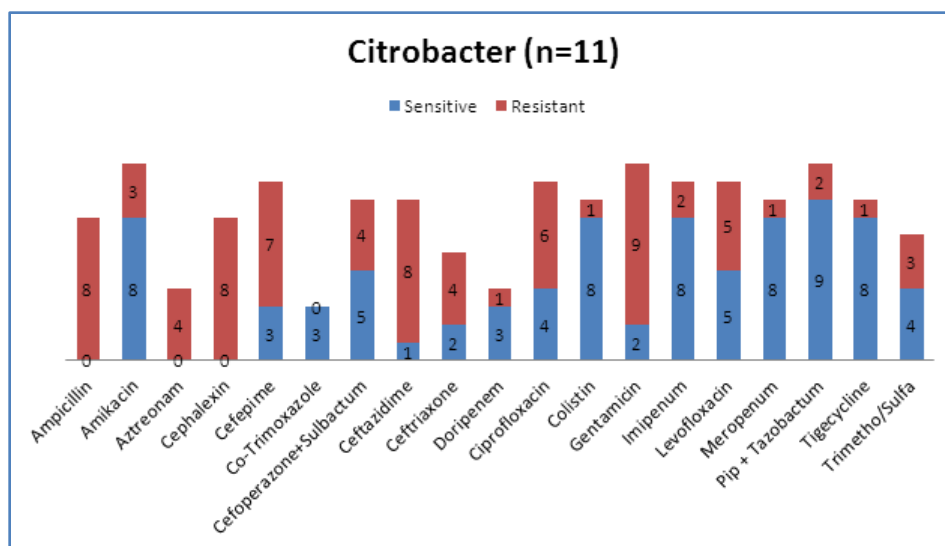
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Of the 12 non fermenting gram negative bacilli isolated, 91% were susceptible to Piperacillin + tazobactam, 72% to cotrimoxazole, and 58% to cefoperazone/sulbactam. But they were resistant to a host of drugs – ticarcillin (100%), tobramycin (80%) gentamicin (75%) and amikacin (66.6%), ciprofloxacin (63.63%) and levofloxacin (62.5%), ceftazidime (70%), imipenem and tigecycline (both 66.6%), colistin (63.63%).



**Fig. 8: Non-Fermenting GNB**

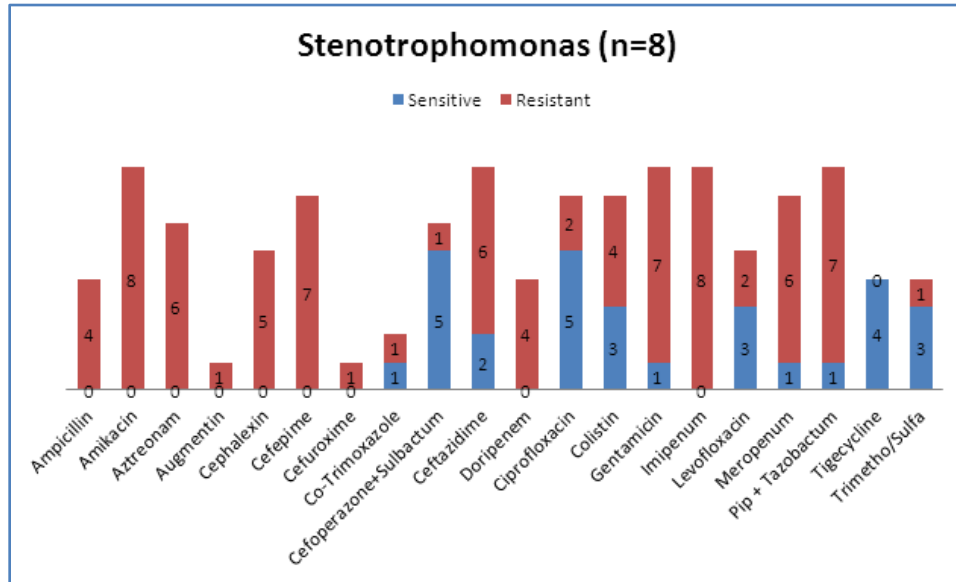
Among the 11 citrobacter growths identified, the carbapenems and tigecycline were very effective (80-88%), colistin in 88.8%, piperacillin/tazobactam in 81.8%, amikacin in 72%. Gentamicin and tobramycin were disappointing (81% and 66% resistance respectively), ceftazidime did poorly (88.8% resistance), and levofloxacin and ciprofloxacin trailing with 50% and 60% resistance respectively.



**Fig. 9: Citrobacter**

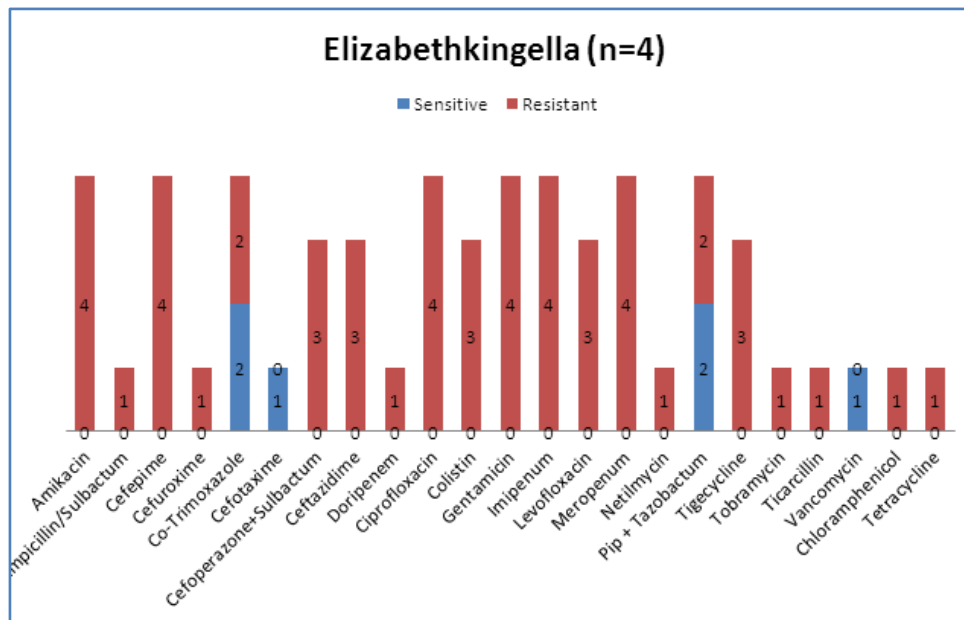
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*Stenotrophomonas* cases were only 8 in number. 100% responded to tigecycline. 83% responded to cefoperazone plus sulbactam, 71% and 60% respectively to ciprofloxacin and levofloxacin. Ceftazidime (75% resistance), gentamicin (87.5%), and the carbapenems) 85-100% resistance) fared poorly in their antibacterial activity.



**Fig. 10: Stenotrophomonas**

There were 4 cases of *Elizabethkingella* who responded to ceftazidime, piperacillin, vancomycin and cefotaxime.



**Fig. 11: Elizabethkingella**

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The Hemophilus influenza strain was sensitive to ceftriaxone, cefotaxime and Cefuroxime and co-trimoxazole. It was resistant to ampicillin and erythromycin. The moraxella strain was sensitive to cefuroxime, cefotaxime, co-trimoxazole and erythromycin. It was ampicillin resistant.

The single growth of serratia species was sensitive to gentamicin and amikacin, cloxacillin and piperacillin, co trimoxazole, cefoperazone /sulbactam and the carbapenem antibiotics and tigecycline. But it was resistant to cefuroxime.

**DISCUSSION:** Hospitals may be considered as reservoirs and breeding grounds within the world of antibiotic resistance. Prevention of cross infection and good quality antimicrobial prescribing contribute to the prevention of antimicrobial resistance. Infection Control and Clinical Microbiology are inextricably linked. Drug resistance among Gram Negative Bacilli is on the rise, and for any species, multi resistance is the norm than the exception.

Optimal management of these infections requires knowledge of local epidemiology and practices to control their spread.<sup>9</sup>

**CONCLUSION:** This study is an attempt to identify the common respiratory pathogens found in ventilated patients in our Intensive Care Units, so as to help formulate the antibiotic protocols to be followed. It is very obvious that this South Indian teaching hospital has the dreaded problem of MDR gram negative organisms.

Colistin is the only effective drug to combat Acinetobacter species. Colistin also gives 84% cover against Pseudomonas and there is no role for ciprofloxacin, levofloxacin and gentamicin or amikacin. Klebsiella pneumonia was sensitive to tigecycline (78%) and colistin (92%). Enterobacter species was sensitive to amikacin (75%) and colistin (82%). Staph aureus isolates were 45% sensitive to cloxacillin. The remaining strains (MRSA) were sensitive to vancomycin and linezolid, also clindamycin.

Piperacillin+Tazobactam shows promise in case of E.coli (80%) sensitive and non- fermenting Gram negative bacilli (91%), also some cases of Elizabethkingella (50%) and in serratia.

Stenotrophomonas species was sensitive best to Tigecycline (100%), then to Cefoperazone/sulbactam (83%). Both H. influenza and the moraxella strain were sensitive to cefuroxime as well as cefotaxime.

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Date of Submission: 27/03/2014.  
Date of Peer Review: 28/03/2014.  
Date of Acceptance: 05/04/2014.  
Date of Publishing: 23/04/2014.