PREVALENCE OF BACTERIAL PATHOGENS IN HOSPITAL AIR OF OPERATION THEATRES AND INTENSIVE CARE UNITS AND THREAT OF MDR NOSOCOMIAL INFECTIONS.

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ABSTRACT

Hospitals are the places where people get admitted for remedy for disease or disorder they are suffering for. But is also an environment where infected persons and immuno-compromised individuals congregate. Hospital air quality is important determinant of health of patients. Pathogenic bacteria if present in hospital air then it leads to various hospital acquired infection. Crowded conditions within the hospital and many other factors lead to nosocomial infections. Increasing antibiotic resistance also increases the severity of nosocomial infections. In samples collected from 15 randomly selected hospitals, *K. Pneumoniae* (32.7% and 36.1%), *P. mirabilis* (27.4% and 33.3%), and *S. aureus* (22.1% and 25%) were highest in air samples of ICUs and OTs, respectively. Out of 149 bacterial isolates, 26.17% were found to be resistant to all 12 studied antibiotics (MAR index 1.0). *K. pneumoniae* and *S. aureus* were found to acquire more antibiotic resistance than other studied bacteria and could obscure nosocomial infections.

Key words: - Nosocomial infection, MDR, Hospital air flora,

INTRODUCTION

A hospital is a health care institution providing patient treatment by specialized staff and equipment. Hospitals often but not always, provide for inpatient care or longer-term patient stays. Healthcare is one of India's largest sectors in terms of revenue and employment and the sector is rapidly expanding. The private sector accounts for more than 80% of total healthcare spending in India. Unless there is a decline in the combined federal and state government deficit, which currently stands at roughly 9%, the opportunity for significantly higher public health spending will be limited. [8].

With the large health service infrastructure in India, today the central issue appears to be the quality of its functioning. One of the major concerns of lack of quality culture is often responsible for the adverse effect on the health of hospital visitors as well as of the hospital staff. The chief problem is the possibility of nosocomial infections. Many factors promote infection among hospitalized patients decreased immunity among patients; the increasing variety of medical procedures and invasive techniques create potential routes of infection and the transmission of drug-resistant bacteria among crowded hospital populations, where poor infection control practices may facilitate transmission. Health care setting is an environment where both infected persons and persons at increased risk of infection congregate.[4] Patients with infections or carriers of pathogenic microorganisms admitted to hospital are potential sources of infection for patients and staff. Crowded conditions within the hospital, frequent transfers of patients from one unit to another and concentration of patients highly susceptible to infection in one area all contribute to the development of nosocomial infections [4].

The widespread use of antimicrobials for therapy or prophylaxis is the major determinant of resistance. In some cases Antimicrobial agents are becoming less effective because of resistance. As an antimicrobial agent becomes widely used, the bacteria resistant to this drug eventually emerge and may spread in the health care setting. Increasing antibiotic resistance also increases severity of nosocomial infections. The emergence and spread of resistance are also threatening to create species resistant to all currently available antimicrobial agents. Approximately 20 % of *Klebsiella pneumoniae* infections and 31% of *Enterobacter* species infections in intensive care unit in United States now involve strains not susceptible to higher generation antibiotics [6].

MATERIALS AND METHODS

In the present study, fifteen most populated hospitals of Akola city, Maharashtra were randomly selected. All the hospitals were given a code in order to hide their identity. Air samples from intensive care units (ICU)

and Operation theatre(OT) from each hospital were collected using Himedia air sampler

Isolation and identification: Initial isolation was done on N. agar media strip loaded in Himedia air sampler. Air sampler was operated for fixed period of time i.e., for 5 minutes at each sampling site. All media strips were incubated at 37°C for 24 hours and isolates after further purification were identified by following standard procedures[1].

Antibiotic sensitivity test: All isolates were forwarded for antibiotic resistance against 12 selected antibiotics (Rifampicin, Cephotaxime, Imipenem, Co-Trimoxazole, Linezolid, Cefpodoxime, Ampicillin, Ofloxacin, Ceftriaxone, Ciprofloxacin, Nitrofurantoin and Lomefloxacin). Muller-Hinton agar was used to study antibiotic resistance pattern .On the basis of zone of inhibition, each isolate was categorized into three classes as sensitive, intermediate and resistant for a particular antibiotic.[2]

RESULTS AND DISCUSSION

In the present study the ICUs and OTs of the 15 hospitals were screened for the presence bacterial pathogens by colleting air samples. Air of ICUs was found to be more crowded than that of OTs but bacterial isolates from both sources have shown remarkable antibiotic resistance against studied antibiotics.

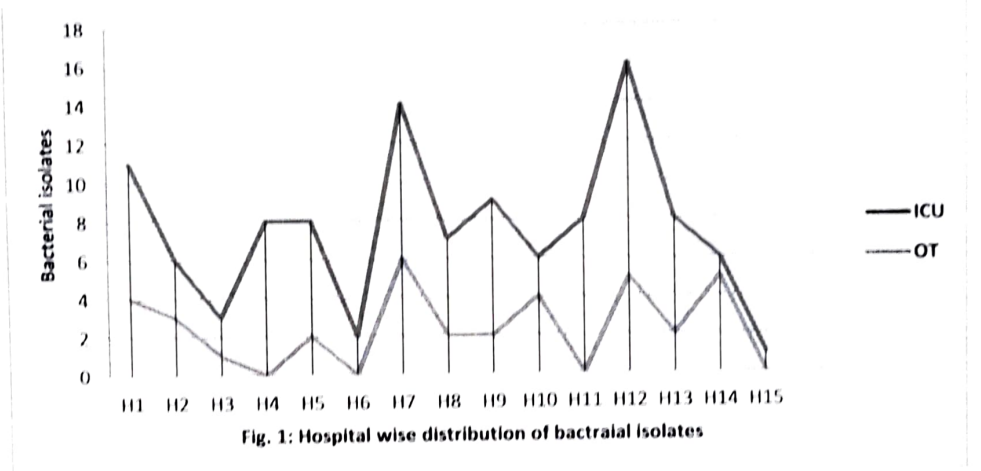

Fig. 1: Hospital wise distribution of bactraial isolates

In present study H7 and H12 hospitals were found to be having more bacterial load in ICU and OT where as H15 was found to have lowest load.

Prevalence of pathogens in air environment of Intensive Care Unit

Air samples of all 15 ICUs were collected and screened for the presence of bacterial isolates which further analysed for antibiotic susceptibly testing. The data in Table 1.1 pertaining to the abundance of pathogen in air environment of ICUs of hospitals, it shows that out of total pathogen population in ICU air environment, 32.7% isolates were *K. pneumoniae* followed by *P. mirabilis* (27.4%) and *S. aureus* (22.1%). However, *C. freundii* (0.9%) and *M. morganii* (0.9%) were least abundant in the ICU air environment. Thus, it may be concluded from the data that pathogen *K. pneumoniae* are present in higher concentrations in ICU air environment of hospitals (Figure 1).

It has been widely reported that bio-aerosols are responsible for respiratory diseases. Besides, the risk of development of respiratory diseases is significantly high in the ICU. Tang *et al.*, 2009 have reported that there is a significant association between the coarse particle concentration and the number of patient visitors. Patient visiting activity impacts the indoor air quality of the ICU environment, especially in terms of coarse particle concentrations. Furthermore, Palaez *et al.*, (2012) reported that the immuno compromised as well as non-immuno compromised patients both present similar risk of developing nosocomial infection when admitted in an ICUs.

Though the ICU has a restricted number of visitors, the positive association between presence of pathogens and the number of visitors

points towards more implementing more restrictions regarding the number of visitors in the ICU area of the hospitals of Akola City.

Table -1:- Prevalence of Pathogens in ICU

Pathogens	No. of Isolates	Percent	Cumulative Percent
C. freundii	1	0.9	0.9
K. pneumoniae	37	32.7	33.6
M. luteus	2	1.8	35.4
M. morganii	1	0.9	36.3
P. aeruginosa	11	9.7	46.0
P. mirabilis	31	27.4	73.5
P. vulgaris	5	4.4	77.9
S. aureus	25	22.1	100.0
Total	**113**	**100.0**	

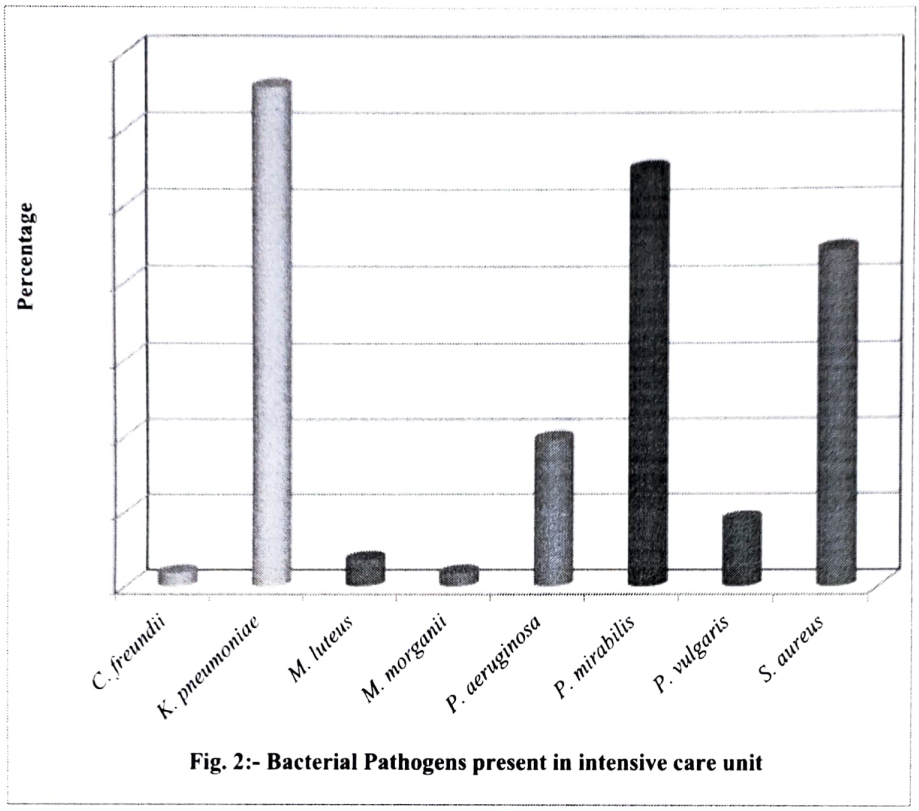

Fig. 2:- Bacterial Pathogens present in intensive care unit

Prevalence of pathogens in air environment of Operation Theatre

OTs are environment where patients body is operated and risk of entry of pathogens increases increased many folds if proper fumigation is not done. Out of 15 hospitals examined OTs of 11 hospitals were found to have bacteria load in air while 4 OTs were found to be contain no culturable bacterial load. Predominant bacterial isolates and its relative percentage is as discussed further.

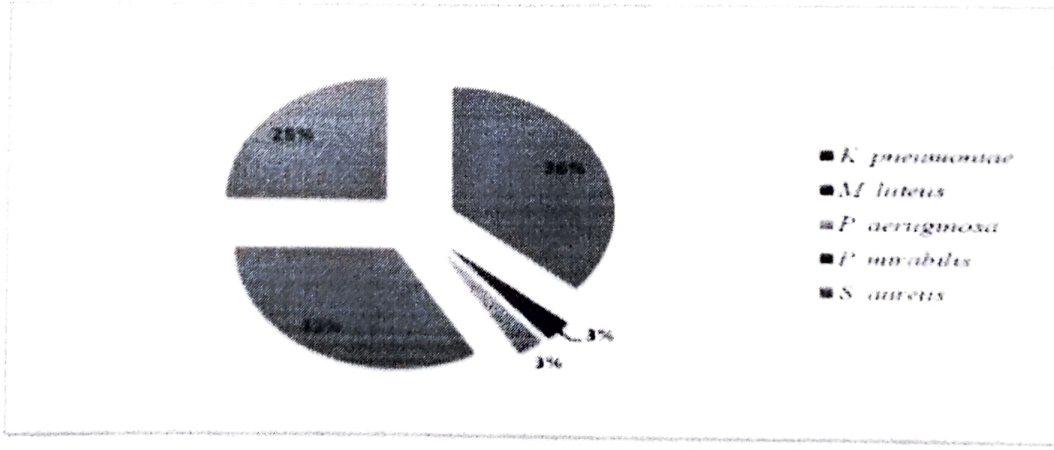

Fig. 3 Percent distribution of Bacterial pathogens in OT

Fig. 3 shows data pertaining to the prevalence of different pathogens in operation theatre air environment of Akola city hospitals. Data shows that out of total number of isolates in operation theatre air

environment, 36.1% pathogens were *K. pneumoniae* followed by *P. mirabilis* (33.3%) and *S. aureus* (25.0%). However, *M. luteus* and *P. aeruginosa* (2.8% respectively) were present in lowest amounts in the operation theatre air environment. It may be concluded from the data that *K. pneumoniae* are the most prevalent pathogen in the operation theatre air environment of hospitals (Figure 1.2). From the results, it is apparent that the more focused efforts should be taken to eliminate pathogenic organisms from the operation theatre area of the hospitals. In view of this, D'Alessandro *et al.*, (2011) has proposed continuous microbiological air quality monitoring of operating rooms, which can be used to delineate the qualitative and quantitative time trends of contamination levels. Once, know, these results can help for formulating meaningful measures for effective microbial contamination of air environment.

Antibiotic resistance increase risk of nosocomial infection many folds. Out of total 149 isolates from air total 39 isolates were found to be Multi drug resistant (MDR) with MAR index 1.0.

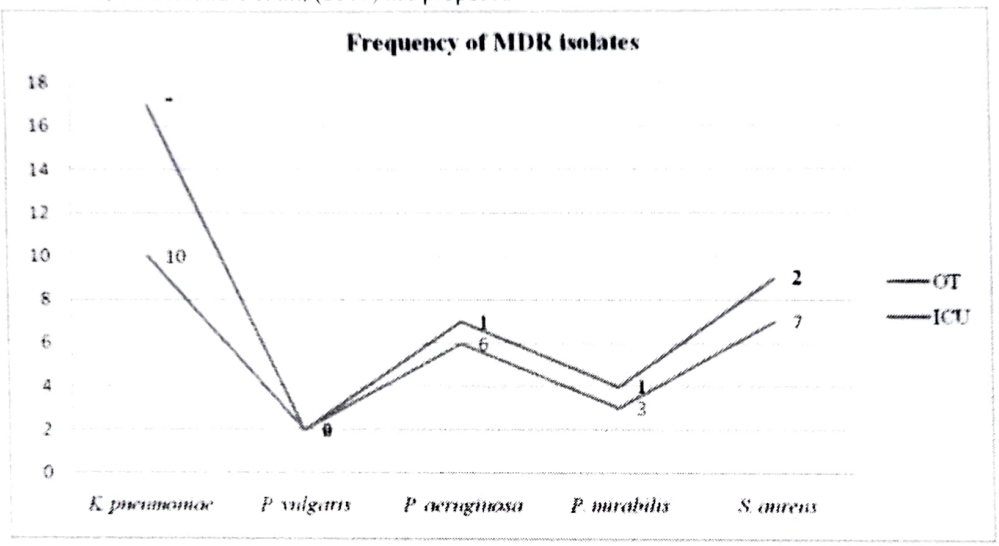

Fig: 4:- Frequency of MDR isolates in ICU and OT.

K. pneumoniae and *S. aureus* were found to be highest, in acquiring antibiotic resistance against studied all 12 antibiotics. *P. vulgaris, P. aeruginosa,* and *P. mirabilis* also gained significant antibiotic resistance.

Many bacterial isolates were found to gained antibiotic resistance and have MAR index in range 0.5 to 1.0. Nosocomial infection with MDR stains are difficult to treat and creates burden not only patient but also on health care systems. Creation of awareness, proper hygiene and not prescribing multiple antibiotics at same time can help to limit this ever-increasing problem

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