Original Article

Pattern of Aerobic Bacteria in Adult Patients Isolated from Endotracheal Tubes in Tertiary Care Center

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Abstract

Introduction: *Nosocomial infections have been described as an important issue among intubated patients which leads to significant morbidity and mortality. The pattern of microbiological colonization and antibiotic resistance are much valuable in this regard.* ***Objectives:*** *The aim of present study was to determine the pattern of aerobic bacteria isolated from endotracheal tubes in adult patients and determination of their antimicrobial susceptibility patterns.* ***Materials and Methods:*** *Specimens were collected from tracheal tubes of patients with endotracheal aspiration and microbiological investigations were done. The isolated bacteria were identified by using standard cultural and biochemical tests. Then antibiotic susceptibility testing was performed on the isolates by disc diffusion method according to clinical and laboratory Standards Institute (CLSI) guideline.* ***Results:*** *Among 104 participants 68 (65.4%) were female and 36 (34.6%) were male. Most of the patients were in the age group of 71-80 years (48.0%). From 104 positive growths, both Gram positive and Gram negative organisms were found. Maximum samples showed growth of gram negative organism. Antimicrobial susceptibility testing revealed that the most resistant Gram negative isolate was Klebsiella with highest resistance against Vancomycin (40.4%) and which showed highest sensitive against Cefotetan, Cefoxitin and Norfloxain (39.4%).* ***Conclusions:*** *It may be concluded that this study indicates the emergence of antibiotic resistant infections in the studied 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.*

Key words: *Endotracheal Tubes, Antibiotic Susceptibility, Klebsiella, Acinetobacter*

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Introduction

Nosocomial infections or hospital-acquired infections (HAI) are major public health problem in hospitals worldwide, accompanied by high rate of morbidities and mortality among hospitalized patients.[1] Patients with mechanical ventilation have an increased risk for respiratory tract infection because the tube which has been inserted into the trachea reduces the clearance of bacteria and increases the leakage of secretion around the cuff of the tube and disable the cilliary tract by damaging to it.[2] Because of decreased salivary secretion, colonization of oropharynx with Gram negative bacteria is also probable.[3,4] 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.[5] Infection rates are higher among patients with increased susceptibility because of old age, underlying diseases, or chemotherapy.[6] Invasive medical procedures in the intensive care units remark

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ably increase the risk of such infections. The incidence of respiratory tract infection in relation to intubation and/ or mechanical ventilation has been reported to vary between 4% and 28% and this rate has been thought to be 21 times higher than in patients without endotracheal tube.[7–11]

Colonization of the respiratory tract is very common in intubated patients requiring intensive care and in most instances leads to the increase of infection.[1,2] 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%.[3,4] Tracheal colonization by significant number of potential pathogenic bacteria predispose patients to super infection with presentation of fever, lower respiratory signs and symptoms, and an increase in the number and proportion of polymorphonuclear leukocytes in the sputum.[7] In consequence, nosocomial pneumonia is a common and a life threatening problem among seriously ill patients who are mechanically ventilated. The incidence varies from 9% to 68% with a high fatality rate ranging from 50% to 80%, especially when it is caused by antibiotic-resistant bacteria. This emergence of antibiotic-resistant microorganisms in critically ill patients represents a new challenge for intensive care physicians.8 Bacterial infection due to Gram negative bacilli in the lower respiratory tracts remains a main complication of tracheal intubation in patients requiring ventilator equipments.[2] Widespread use of antibiotics in intensive care units is a potential cause of the emergence of nosocomial infections caused by antibiotic-resistant Gram-negative bacteria.[9] Various studies have proposed different causative microorganism as the most common etiology for intubation related respiratory infections including Pseudomonas aeruginosa, A. baumannii, and methicillin resistant Staphylococcuus aureus (MRSA) or S. aureus in children.[7,12–17] The concerns related to the nosocomial infections are exacerbated by the presence of antibiotic resistant bacteria which increases morbidity rate and the associated costs.[18] Extensive use of fluoroquinolones has lead to alterations in susceptibility patterns of microorganisms.[8,10,11,15] Furthermore, inappropriate prescription of broad-spectrum antimicrobial agents has risen in the last decades with macrolides, fluoroquinolones, and third-generation cephalosporins at the top of the list.[12–14,17,18] Our study hence aimed to determine the type of bacterial colonization and antibiotic sensitivity and resistance in patients with endotracheal intubation or tracheostomy to facilitate initiation of proper empirical antibiotic treatment in these patients. It was aimed to determine the presence or absence of bacterial infections in tracheal tubes and determination of their antimicrobial susceptibility patterns.

Materials and Methods

This cross-sectional study was performed from January 2016 to March 2016 in Dhaka Medical College Hospital (DMCH) and National Institute of Diseases of Chest and Hospital (NIDCH) in Dhaka. Specimens were collected from tracheal tubes of patients with endotracheal aspiration who were admitted in general intensive care unit (ICU).Tip of the Endotracheal tube or tracheal tube samples were inserted in a sterile tube and transferred to the laboratory where inoculated into thioglycollate broth and incubated for 24 hours in 37^{o}C. The broth was primarily examined for the presence of grown bacteria by a direct Gram-stained smear in the subsequent day, subculture was made for positive samples on chocolate agar, MacConky agar, and blood agar and incubated in 37^{o}C for 24 to 48 hours. Then the macroscopic study of shape and color of colonies, Gram staining and microscopic features were studied on the basis of their morphology, standard identification of biochemical tests for Gram negatives including oxidase and catalase, reaction in triple sugar iron agar (TSI) medium, indole production and motility, urea utilization and catalase, coagulase tests for presence of staphylococci were performed. Antimicrobial susceptibility testing was performed afterward in order to isolate bacteria by disc diffusion method as per clinical and laboratory Standards Institute (CLSI) standard guideline. The antibiotic discs which were used for Gram negative bacilli were: Amikacin, Amoxacillin, Ampicillin, Cefotaxime, Cephaxine, Cefuroxime, Ceftriaxone, Ciprofloxacin, Gentamicin, Netilmicin, Pipercillin, Imipenem, Meropenem, Cefepime and for Gram positive cocci were: Ampicillin, Amoxicillin, Ciprofloxacin, Gentamicin, Cephotaxime, Cephalexine, Cloxacillin, Co-trimoxazol, vancomycin.

Result

Out of 117 recruited samples, after thorough screening, 104 samples were examined. Among them 68 (65.4%) were female and 36 (34.6%) were male (Figure 1).

Figure 1: Sex distribution of the participants

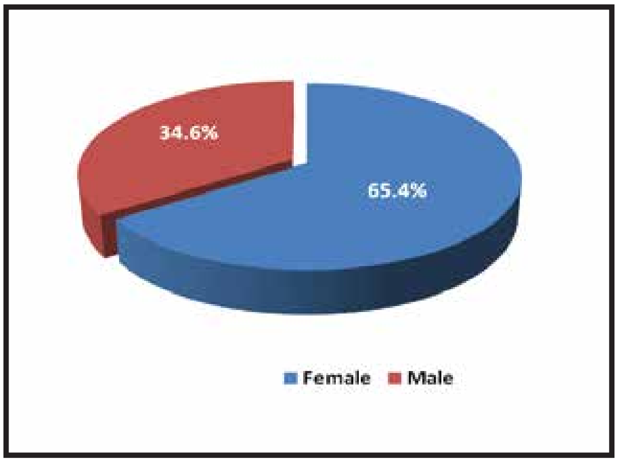


Table I: Age distribution of the patients

Age in year	Frequency	Percent
21-30	4	3.8
31-40	7	6.7
41-50	2	1.9
51-60	10	9.7
61-70	16	15.4
71-80	50	48.0
81-90	13	12.5
91-100	2	2.0
Total	104	100.0

Most of the patients were in the age group of 71-80 years (48.0%); then 61-70 years (15.4%), 81-90 years (12.5%) and 51-60 years (9.7%) (Table I).

Table II (a): The overall results of susceptibility testing

		Acinetob	*CoNS*	*Enteroco*	*MRSA*	*Staphylo*	*Streptoc*	*Eshcheri*	*Enteroba*	*Klebsiel*	*Pseudomo*
Amikacin	R	13(12.5 %)	0(.0%)	2(1.9%)	1(1.0 %)	0(.0%)	0(.0%)	1(1.0%)	0(.0%)	1(18.3%)	4(3.8%)
	S	4(3.8%)	0(.0%)	1(1.0%)	0(.0%)	2(1.9%)	0(.0%)	2(1.9%)	0(.0%)	20(19.2%)	15(14.4%)
Amox Clox	R	0(.0%)	1(1.0 %)	0(.0%)	0(.0%)	0(.0%)	0(.0%)	0(.0%)	0(.0%)	0(.0 %)	0(.0%)
	S	1(1.0%)	0(.0%)	1(1.0%)	0(.0%)	0(.0%)	0(.0%)	0(.0%)	0(.0%)	0(.0%)	0(.0%)
Amoxycillin	R	1(13.5%)	1(1.0 %)	1(1.0%)	0(.0%)	2(1.9%)	1(1.0%)	3(2.9%)	1(1.0%)	25(24.0%)	0(.0%)
	S	0(.0%)	0(.0%)	2(1.9%)	0(.0%)	3(2.9%)	0(.0%)	0(.0%)	0(.0%)	7(6.7%)	0(. 0%)
Ampicillin	R	1(14.4%)	2(1.9%)	1(1.0%)	1(1.0 %)	3(2.9%)	1(1.0%)	3(2.9%)	1(1.0%)	33(31.7 %)	0(.0%)
	S	1(1.0%)	0(.0%)	3(2.9%)	0(.0%)	0(.0%)	0(.0%)	0(.0%)	0(.0%)	4(3.8%)	0(.0%)
Cefepime	R	5(4.8%)	0(.0%)	0(.0%)	0(.0%)	0(.0%)	0(.0%)	2(1.9%)	0(.0%)	6(5.8%)	3 (2.9%)
	S	1(1.0%)	0(.0%)	0(.0%)	0(.0%)	1(1.0%)	0(.0%)	1(1.0%)	0(.0%)	2(1.9%)	0(.0%)
Cefotaxime	R	9(8.7%)	0(.0%)	4(3.8%)	1(1.0 %)	2(1.9%)	0(.0%)	0(.0%)	0(.0%)	12(11.5 %)	0(.0%)
	S	5(4.8%)	1(1.0 %)	2(1.9%)	0(.0%)	3(2.9%)	0(.0%)	0(.0%)	0(.0%)	9(8.7%)	1(1.0%)
Cefotetan	S	1(18.3%)	2(1.9 %)	7(6.7%)	1(1.0 %)	6(5.8%)	1(1.0%)	3(2.9%)	1(1.0%)	41(39.4 %)	20(19.2%)
	R	0(.0%)	0(.0%)	0(.0%)	0(.0%)	0(.0%)	0(.0%)	0(.0%)	0(.0%)	1(1.0%)	0(.0%)
Cefoxitin	R	0(.0%)	0(.0%)	0(.0%)	0(.0%)	0(.0%)	0(.0%)	0(.0%)	0(.0%)	1(1.0%)	0(.0%)
	S	19(18.3%)	2(1.9 %)	7(6.7%)	1(1.0 %)	6(5.8%)	1(1.0%)	3(2.9%)	1(1.0%)	41(39.4%)	20(19.2%)
Ceftazidime	IM	0(.0%)	0(.0%)	0(.0%)	0(.0%)	0(.0%)	0(.0%)	0(.0%)	0(.0%)	0(.0%)	1(1.0%)
	R	7(6.7%)	0(.0%)	1(1.0%)	0(.0%)	0(.0%)	0(.0%)	2(1.9%)	0(.0%)	13(12.5 %)	1(1.0 %)
	S	3(2.9%)	0(.0%)	2(1.9%)	0(.0%)	0(.0%)	0(.0%)	0(.0%)	0(.0%)	14(13.5%)	5(4.8%)
Ceftriaxone	R	9(8.7%)	0(.0%)	3(2.9%)	0(.0%)	0(.0%)	0(.0%)	1(1.0%)	0(.0%)	15(14.4 %)	0(.0%)
	S	4(3.8%)	0(.0%)	1(1.0%)	0(.0%)	0(.0%)	0(.0%)	0(.0%)	0(.0%)	8(7.7%)	2(1.9%)
Cef uroxime	R	10(9.6%)	0(.0%)	2(1.9%)	0(.0%)	0(.0%)	0(.0%)	2(1.9%)	0(.0%)	19(18.3 %)	0(.0%)
	S	1(1.0%)	0(.0%)	0(.0%)	0(.0%)	0(.0%)	0(.0%)	0(.0%)	0(.0%)	7(6.7%)	1(1.0%)
Cephalexine	R	10(9.6%)	0(.0%)	3(2.9%)	0(.0%)	1(1.0%)	1(1.0%)	0(.0%)	0(.0%)	14(13.5 %)	0(.0%)
	S	0(.0%)	1(1.0%)	1(1.0%)	0(.0%)	4(3.8%)	0(.0%)	0(.0%)	0(.0%)	2(1.9%)	0(.0%)
Ciproflox	R	10(9.6%)	1(1.0%)	2(1.9%)	1(1.0%)	3(2.9%)	0(.0%)	2(1.9%)	0(.0%)	24(23.1%)	5(4.8%)
	S	4(3.8%)	1(1.0%)	2(1.9%)	0(.0%)	1(1.0%)	1(1.0%)	0(.0%)	0(.0%)	12(11.5%)	14(13.5%)
Cloxaciln	R	0(.0%)	0(.0%)	0(.0%)	1(1.0%)	1(1.0%)	0(.0%)	0(.0%)	0(.0%)	0(.0%)	0(.0%)
	S	0(.0%)	1(1.0%)	0(.0%)	0(.0%)	2(1.9%)	0(.0%)	0(.0%)	0(.0%)	0(.0%)	0(.0%)

Antimicrobial susceptibility testing revealed that the most resistant Gram negative isolate was Klebsiella with highest resistance against Vancomycin (40.4%) and which showed highest sensitive against Cefotetan, Cefoxitin and Norfloxacin (39.4%). Acinetobacter was the most resistant Gram positive isolate with highest resistance against (18.3%) which was the highest sensitive to Norfloxacin and Cefoxitin. MRSA found resistant to Gentamycin, Amikacin, Ampicillin, Ciprofloxacin, Cefotaxim and Cloxacillin whereas it was found sensitive to Cefotetan, Cefoxitin, Norfloxacin and Vancomycin (Table III).The overall results of susceptibility testing are shown in Table (IIa & IIb).

Antibiotics		*Acineto b*	*CoNS*	*Enteroc o*	*MR SA*	*Staphyl o*	*Strept oc*	*Eshche ri*	*Entero ba*	*Klebsiel*	*Pseudo mo*
Gentamycin	R	12(11.5%)	1(1.0%)	3(2.9%)	1(1.0%)	2(1.9%)	0(.0%)	2(1.9%)	0(.0%)	21(20.2 %)	5(4.8%)
	S	3(2.9%)	1(1.0%)	2(1.9%)	0(.0%)	4(3.8%)	1(1.0%)	0(.0%)	0(.0%)	12(11.5%)	14(13.5 %)
Meropenam	IM	1(1.0%)	0(.0%)	0(.0%)	0(.0%)	0(.0%)	0(.0%)	0(.0%)	0(.0%)	0(.0%)	0(.0%)
	R	7(6.7%)	0(.0%)	1(1.0%)	0(.0%)	0(.0%)	0(.0%)	0(.0%)	0(.0%)	4(3.8%)	2(1.9%)
	S	1(1.0%)	0(.0%)	1(1.0%)	0(.0%)	0(.0%)	0(.0%)	1(1.0%)	0(.0%)	10(9.6%)	0(.0%)
Nitrofurantoin	R	0(.0%)	0(.0%)	0(.0%)	0(.0%)	0(.0%)	0(.0%)	0(.0%)	0(.0%)	1(1.0%)	0(.0%)
	S	0(.0%)	0(.0%)	1(1. 0%)	0(.0%)	0(.0%)	0(.0%)	0(.0%)	0(.0%)	0(.0%)	0(.0%)
Netilmicin	R	8(7.7%)	0(.0%)	0(.0%)	0(.0%)	0(.0%)	0(.0%)	2(1.9%)	0(.0%)	10(9.6%)	2(1.9%)
	S	3(2.9%)	0(.0%)	1(1.0%)	0(.0%)	0(.0%)	0(.0%)	1(1.0%)	0(.0%)	16(15.4%)	12(11.5%)
Norfloxacin	R	0(.0%)	0(.0%)	1(1.0%)	0(.0%)	0(.0%)	0(.0%)	0(.0%)	0(.0%)	1(1.0%)	0(.0%)
	S	19(18.3 %)	2(1.9%)	6(5.8%)	1(1.0%)	6(5.8%)	1(1.0%)	3(2.9%)	1(1.0%)	41(39.4%)	20(19.2%)
Ofloxacin	IM	0(.0%)	0(.0%)	0(.0%)	0(.0%)	0(.0%)	0(.0%)	0(.0%)	0(.0%)	0(.0%)	1(1.0%)
	R	0(.0%)	0(.0%)	0(.0%)	0(.0%)	0(.0%)	0(.0%)	0(.0%)	0(.0%)	0(.0%)	5(4.8%)
	S	0(.0%)	0(.0%)	0(.0%)	0(.0%)	0(.0%)	0(.0%)	0(.0%)	0(.0%)	0(.0%)	12(11.5%)
Piperacillin	IM	0(.0%)	0(.0%)	0(.0%)	0(.0%)	0(.0%)	0(.0%)	0(.0%)	0(.0%)	1(1.0%)	0(.0%)
	R	7(6.7%)	0(.0%)	1(1.0%)	0(.0%)	0(.0%)	0(.0%)	1(1.0%)	0(.0%)	9(8.7%)	1(1.0%)
	S	4(3.8%)	0(.0%)	1(1.0%)	0(.0%)	0(.0%)	0(.0%)	0(.0%)	0(.0%)	10(9.6%)	7(6.7%)
Tobramycin	IM	0(.0%)	0(.0%)	0(.0%)	0(.0%)	0(.0%)	0(.0%)	0(.0%)	0(.0%)	0(.0%)	1(1.0%)
	R	0(.0%)	0(.0%)	0(.0%)	0(.0%)	0(.0%)	0(.0%)	0(.0%)	0(.0%)	0(.0%)	1(1.0%)
	S	0(.0%)	0(.0%)	0(.0%)	0(.0%)	0(.0%)	0(.0%)	0(.0%)	0(.0%)	0(.0%)	8(7.7%)
Vancomycin	R	18(17.3%)	1(1.0%)	7(6.7%)	0(.0%)	5(4.8%)	1(1.0%)	3(2.9%)	1(1.0%)	42(40.4%)	20(19.2%)
	S	1(1.0%)	1(1.0%)	0(.0%)	1(1.0%)	1(1.0%)	0(.0%)	0(.0%)	0(. 0%)	0(.0%)	0(.0%)
Imipenam	IM	1(1.0%)	0(.0%)	0(.0%)	0(.0%)	0(.0%)	0(.0%)	0(.0%)	0(.0%)	0(.0%)	0(.0%)
	R	6(5.8%)	0(.0%)	0(.0%)	0(.0%)	0(.0%)	0(.0%)	0(.0%)	0(.0%)	4(3.8%)	1(1.0%)
	S	3(2.9%)	0(.0%)	1(1.0%)	0(.0%)	0(.0%)	0(.0%)	3(2.9%)	0(.0%)	11(10.6%)	1(1. 0%)

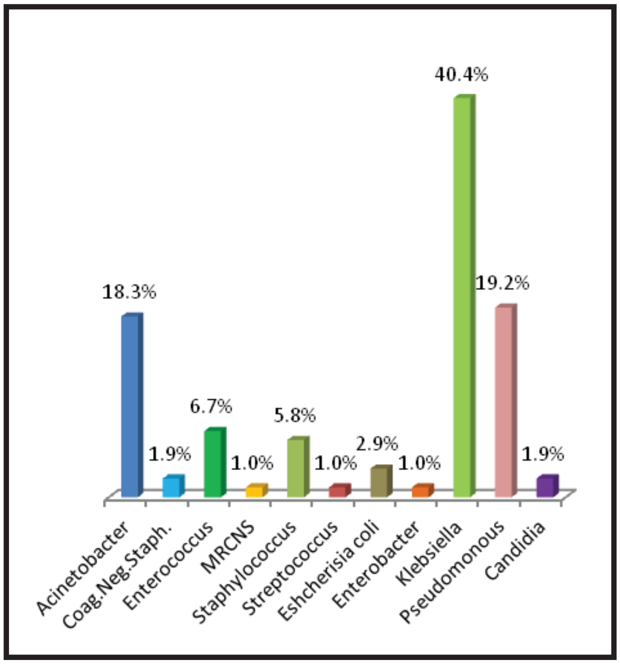
Table III: The summarized results of susceptibility testing

Organisms	Highest Resistant with			Highest Sensitive with		
	Name of antibiotic	Frequency (n)	Percentage	Name of antibiotic	Frequency (n)	Percentage
Acinetobacter*				Norfloxacin Cefoxitin	19	18.3
Coagulase pos. staph.	Ampicillin	2	1.9	Cefotetan Cefoxitin Norfloxacin	2	1.9
Enterococcus	Vancomycin	7	6.7	Cefotetan Cefoxitin	7	6.7
MRSA	Gentamycin Amikacin Ampicillin Ciprofloxacin Cefotaxim Cloxacillin	1	1.0	Cefotetan Cefoxitin Norfloxacin Vanc omycin	1	1.0
Staphylococcus	Vancomycin	5	4.8	Cefotetan Cefoxitin Norfloxacin	6	5.8
Streptococcus	Ampicillin Amoxicillin Cephalexin Norfloxacin Vancomycin	1	1.0	Cefotetan Cefoxitin Ciprofloxacin Gentamycin	1	1.0
Eshcherisia coli	Amoxicillin Ampicillin V ancomycin	3	2.9	Cefotetan Cefoxitin Norfloxacin Imipenam	3	2.9
Enterobacter	Amoxicillin Ampicillin Vancomycin	1	1.0	Cefotetan Cefoxitin Norfloxacin	1	1.0
Klebsiella	Vancomycin	42	40.4	Cefotetan Cefoxitin Norfloxacin	41	39.4
Pseudomonous	Vancomycin	20	19 .2	Cefotetan Cefoxitin Norfloxacin	20	19.2

*NB: Acinetobacter is described as gram positive in many recent literatures.

From 104 positive growths, both gram positive and gram negative organisms were found. Maximum samples showed growth of gram negative organism. Organisms isolated were cinetobacter, Coagulase negative staphylococcus, Enterococcus, MRSA, Staphylococcus, Streptococcus, Eshcherisia coli, Enterobacter,Klebsiella and Pseudomonous. Also, Candidia had been grown in some specimens (Figure 2).

Figure 2: Distribution of the organisms isolated



Discussion

Out of 117 collected samples, after thorough screening, 104 samples were examined. Among them 68 (65.4%) were female and 36 (34.6%) were male. It was supported by some other studies. In that (those) study, 278 had positive culture with 508 isolates. The positive specimens were belonged to 191 male and 87 female hospitalized patients.[19] A total of 880 patients were enrolled in another study including 531 male (60.3%) and 349 female (39.7%).[20]

Most of the patients were in the age group of 71-80 years (48.0%); then 61-70 years (15.4%), 81-90 years (12.5%) and 51-60 years (9.7%). The majority of these specimens (40.3%), were isolated from patients in age group of 18 to 40 years.[21]
When each antibiotic was considered, different organisms showed various percent of resistance or sensitivity against it and were mentioned in Table (IIa and IIb).

From 104 positive growths, both gram positive and gram negative organisms were found. Maximum samples showed growth of gram negative organism. Organisms isolated were Acinetobacter, Coagulase negative staphylococcus, Enterococcus, MRSA, Staphylococcus, Streptococcus, Eshcherisia coli, Enterobacter, Klebsiella and Pseudomonous. Also, Candidia had been grown in some specimens. Based on the bacteriology results in another study, Enterobacter spp. with 209 cases (41.1%) were the most prevalent genera isolated from positive cultures. The number and frequency of other isolated bacteria were: P. aeruginosa 78 (15.4%), E. coli 71 (13.97.2%), coagulase negative staphylococci 75 (14.8%), S. aureus 71 (14.0%), and proteus spp. 4 (0.8%).21 There was another study in which 19 different microorganisms were isolated including Acineto bacter (213, 24.2%), Pseudomonas aeruginosa (147, 16.7%), Staphylococcus aureus (106, 12%), Proteus mirabilis (90, 10.2%). The most common organism in both genders was Acinetobacter. In patients under the age of 12, Klebsiella was the most common organism while in those over the age of 12, Acinetobacter was the highest prevalent.[22] In the study of Andair et al., Enterobacter spp., P. aeruginosa, and S.aureus were mostly isolated, which was in concordance with the present study, except for CoNS which was the most common Gram positive contaminant of tracheal tubes.[15] However the study of Amini et al. was against the findings of the present study, which in overall they reported S. aureus as the most common isolate and enterobacter as the least one, isolated from tracheal tubes in Tehran.[4] In a similar study undertaken by Rahbar and Hajia in 2006, Gram negative bacteria were accounted for 75% of total positive cultures with Klebsiella pneumonia (20%) and S. aureus (15.2%) as the most prevalent Gram negative and Gram positive isolates respectively.[16] This shows the variety of bacteria isolated from different hospitals and different periods of time and depends on many factors. During the study, it was noticed that most of investigated hospital wards were colonized by mentioned bacteria, though the highest colonization was belonged to general ICU and NICU. This is a matter of concern, since the patients hospitalized in these units are seriously ill or due to age or immunological status are more prone to get infections. Both isolated Gram negative bacteria are responsible for serious infections. In case of Enterobacter spp., it may cause infections including bacteremia, lower respiratory tract, skin and soft-tissue infections.[17] Besides, P. aeruginosa as a main opportunistic pathogen comprises potential capacity to cause nosocomial infections which affects a remarkable number of patients in ICU.

Antimicrobial susceptibility testing revealed that the most resistant Gram negative isolate was Klebsiella with highest resistance against Linezolid and Vancomycin (40.4%) and which showed highest sensitive against Cefotetan, Cefoxitin and Norflox (39.4%). Acinetobacter was the most resistant Gram positive isolate which was the highest sensitive to Norfloxacin and Cefoxitin. MRCNS found resistant to Gentamycin, Amikacin, Ampicillin, Ciprofloxacin, Cefotaxim and Cloxacillin whereas it was found sensitive to Cefotetan, Cefoxitin, Norfloxacin and Vancomycin. In terms of antiobiograms, 82% of Acinetobacter, 35.1% of Staphylococcus aureus, 33.3% of Klebsiella and 55.1% of Proteus mirabilis were resistant to ciprofloxacin found in one study. In that study, those organisms were resistant to ceftazidime in 97.4%, 80%, 85.7% and 59.1% of the cases, respectively and resistant to imipenem in 7.4%, 18.2%, 1.8% and 8.1% of the cases, respectively. In addition, 100% of Acinetobacter, 77.8% of Escherichia coli, 75% of Klebsiella and 88.9% of Proteus mirabilis were resistant to cefepime. On the other hand, 91.7% of Staphylococcus aureus, 100% of Acinetobacter and 88.9% of Staphylococcus epidermidis were resistantto penicillin.[22]

The importance of this bacterium is that it shows a high antibiotic resistance, so it is able to cause severe infections in critically ill patients associated with substantial morbidities and mortality.[18,19] Subsequently in the present study P. aeruginosa isolates were highly antibiotic resistant and apart from other antibiotics, showed 60.4% resistance to Carbapenem antibiot ics. This was higher than the rate reported by Nseir S et al. for this bacterium in their study.[12] Colonization of this organism in different parts of hospitals is a common concern worldwide, and there are reports of severe infections caused by highly antibiotic resistant P. aeruginosa strains in ICU and other wards of hospitals.[18,23] In the later study, the origin of the organism was the water outlets. In present study, enterobacter was the most prevalent isolate with relatively high antibiotic resistance. This finding was similar to other studies in which drug resistant Gram negative bacteria has been reported to isolate from patients in ICUs.[23] In a recent study, non fermenting bacteria such as acinetobacter spp. were among the isolates from ICU patients, while no acinetobacter was isolated from samples in this study.[20] Based on investigations, the potential factors enhancing the emergence of resistant bacteria in hospitalized patients are mainly duration of stay in intensive care wards, using mechanical devices, prior antibiotics use, especially broad-spectrum drugs such as third-generation cephalosporin, fuoroquinolone, and/or imipenem.[24]

Conclusion

So, there should be an effective, integrated infection control programs to control and prevent nosocomial infections caused by highly resistant organisms in the tertiary hospital.

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