

Antibiotic resistance profiles of endotracheal aspirates in intensive care unit patients

Antibiotic resistance of endotracheal aspirates

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Abstract

Aim: In the patients hospitalized in intensive care units (ICU) infectious agents of the lower respiratory tract are nosocomial pathogens that causes severe morbidity and mortality. The aim of our study is to determine the bacterial growth and antibiotic resistance profiles of bacterias isolated from endotracheal aspirate cultures (ETA) obtained from ICU's of our hospital for the last one year. **Material and Method:** Between October 2017 and September 2018, ETA samples from adult intensive care units were examined retrospectively. In addition to conventional methods, identification and antibiotic susceptibilities were studied in accordance with the recommendations of the European Committee on Antimicrobial Susceptibility Testing (EUCAST) using fully automated VITEC (Biomerieux, France). **Results:** Of the 205 ETA specimens from adult ICU's, 113 growths were detected in 103 patients. In ETA, 37 (32,7%) *Acinetobacter baumannii*, 29 (25,6%) *Pseudomonas aeruginosa*, 13 (11,5%) *Staphylococcus aureus*, 12 (10,6%) *Klebsiella pneumoniae*, 6 (5,3%) *Escherichia coli*, 4 (3,5%) *Enterobacter cloacae* and 2 (1,7%) *Stenotrophomonas maltophilia* was isolated. Meropenem and imipenem resistance of *A. baumannii* was 89.1% for both, whereas it was 48,2% and 51,7% for *P. aeruginosa*, respectively. Colistin and tigeciklin resistance was not detected for all isolates. Oxacillin resistant *S.aureus* strains were determined as 46.1% (6/13), while linezolid, teicoplanin, and vancomycin resistance were not detected. **Discussion:** Increased carbapenem resistance observed in antimicrobial susceptibility tests, for the most frequently bacterias isolated from ETA samples in ICU of our hospital, has shown the importance of the antimicrobial susceptibility testing.

Keywords

Endotracheal Aspirates; Antimicrobial Resistance; Intensive Care Units

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Introduction

Antibiotic resistance rates vary from city to city and from hospital to hospital [1]. Patients in ICUs carry a risk of hospital infections 5-10 times more than other service patients due to higher antimicrobial resistance [2]. Eighty percent (80%) of nosocomial infections include lower respiratory tract infections, blood-borne infections caused by the catheter, surgical site infections (SSI) and urinary tract infections due to the catheter [3]. Nosocomial lower respiratory tract infections (NLRTI) consist of ventilator-associated pneumonia (VAP), non-VAP pneumonia and acute bacterial tracheobronchitis. VAP's can be seen in about 45% of them [4]. Inappropriate antibiotic use in nosocomial lower respiratory tract infections leads to both highly resistant strains and high mortality and morbidity rates [5]. Even inappropriate use of broad-spectrum antibiotics due to another infection may be an independent VAP risk factor [6]. Since the sensitivity and specificity of clinical and radiological findings are low in NLRTI's, gram staining and culture of samples taken from such methods as endotracheal aspirate (ETA), broncho-alveolar lavage (BAL) and preserved brush samples are important for diagnosis and treatment [7]. Endotracheal aspirate culture samples are noninvasive microbiological methods commonly used in respiratory tract sampling [8]. In some cases, empirical antibiotic therapy should be started immediately without waiting for the result of culture, as is the case for patients with VAP. For this reason determination of the responsible bacteria and resistance profiles for the related hospital and region, will provide correct empirical antibiotic treatment and decrease resistance strains [9]. The aim of our study is to determine the resistance profile of bacteria and antibiotics in the intensive care units of our hospital for the last year.

Material and Method

Between October 2017 and September 2018, ETA samples of adult patients sent from intensive care units were examined retrospectively. Samples were taken under sterile conditions via special catheters by the aspiration of saline solution given into the intubation tubes. Each sample sent to the laboratory were gram stained and inoculated on 5% sheep blood agar, chocolate agar and eosin methylene blue agar (EMB) plates. Isolates were incubated at 35 ± 2 °C for 18-24 hours and growths ≥ 100 000 cfu / ml were evaluated. In addition to conventional methods, the identification of bacteria and their antibiotic susceptibility were performed with the fully automated VITEC (Biomérieux, France) system. Antibiotic susceptibility results were evaluated according to the European Committee on Antimicrobial Susceptibility Testing (EUCAST) criteria.

Results

Of the 205 ETA samples sent from adult intensive care units, 113 growths were detected in 103 patients. There was dou-

ble growth in 10 of the studied samples. The same microorganisms isolated from different ETA samples of the same patient were not evaluated. Bacteria isolated from the endotracheal aspirate specimens were following: 37 (32.7%) *A. baumannii*, 29 (25.6%) *P. aeruginosa*, 13 (11.5%) *S. aureus*, 12 (10.6%) *K. pneumoniae*, 6 (5,3%) *E. coli*, 4 (3,5%) *E. cloacae* and 2 (1,7%) *S. maltophilia* respectively. The resistance of *A. baumannii* to meropenem and imipenem was 89.1% while it was determined as 48,2% and 51,7% for *P. auroginosa*, respectively. None of the gram-negative isolates had colistin and tigecycline resistance. Oxasiline resistant *S. aureus* strains were determined as 46.1% (6/13) and linezolid, teicoplanin and vancomycin resistance were not found (Table 1).

Discussion

The incidence of nosocomial infections has increased in a long time hospitalized ICU patients, especially those used long-term, broad-spectrum antibiotics and immunosuppressed [2]. The most common causes of nosocomial infections are LR-TIs which has a high morbidity and mortality rates. The major causes of NLRTIs are gram-negative nonfermentative microorganisms such as *Acinetobacter* and *Pseudomonas* [10]. In our study, gram-negative bacteria were isolated in 90 (79.6%) samples. Of these, *A. baumannii* in 37 (32.7%) and *P. aeruginosa* in 29 (25,6%) were the most common isolates. *S. aureus* was found in 13 (11.5%) cases in the third frequency. In the study by Tartar et al., 620 growth were identified from ETA samples and isolated bacteria were as follows: 307 (%49,5) *A. baumannii*, 127 (%20,5) *P. Auroginosa*, 101 (%16,3) *K. pneumoniae* 13 (%2,1) *S. aureus*, respectively [10]. In the study by Aydemir et al., 141 bacteria were determined in 130 ETA samples. In this study, isolated microorganisms from the ETA samples were 30 (%21,2) *A. baumannii*, 28 (19.8%) *K. pneumoniae*, 26 (18.4%) *P. aeruginosa*, 20 (14.1%) *S. aureus*, 14 (9.9%) *E. coli*, and 12 (8.5%) *Enterobacter* respectively [11]. In the study by Eroğlu et al., *Acinetobacter* strains were the most common agent of LR-TIs in the ICUs and they isolated 3212 *Acinetobacter* strains.

Table 1. Resistance ratios of isolated microorganisms

Gram-Negative Bacteria	Resistance rate (%)											
	AMC	CZ	GN	AK	CiP	LEV	TZP	IMP	MER	COL	TIG	SXT
<i>A. baumannii</i> n: 37 (%32,7)	-	-	97,2	78,3	97,2	97,2	86,7	89,1	89,1	0	0	-
<i>P. aeruginosa</i> n: 29 (%25,6)	-	-	51,7	37,9	55,1	51,7	86,2	51,7	48,2	0	0	-
<i>K. pneumoniae</i> n: 12 (%10,6)	83,3	66,6	50,0	41,6	50,0	58,3	58,3	8,3	8,3	0	-	-
<i>E. coli</i> n: 6 (%5,3)	83,3	83,3	50,0	50,0	66,6	66,6	33,3	0	0	-	-	-
<i>E. cloacae</i> n: 4 (%3,5)	75,0	75,0	75,0	50,0	75,0	75,0	50,0	0	0	-	-	-
<i>S. Maltophilia</i> n: 2 (%1,7)	-	-	-	-	-	-	-	100	-	-	-	0
Gram-Positive Bacteria	Resistance rate (%)											
	OX				CiP			VA		TEC		LNZ
<i>S. aureus</i> n: 13 (%11,5)	46,1				38,4			0		0		0

AMC: amoxicillin clavulanate; CZ: cephazoline; GN: gentamicine; AK: amikacin; CiP: ciprofloxacin; LEV: levofloxacin; TZP: piperacilline tazobactam; IMP: imipenem; MEM: meropenem; COL: colistin; TIG: tigecycline; SXT: trimethoprim and sulfamethoxazole; OX: oxacillin; VA: vankonycline; TEC: teicoplanin; LNZ: linezolid

They reported that antibiotic resistance rates increased gradually, and the meropenem resistance rates were increased from 4.5% to 77% between January 2006 and June 2011, and, they reported that, depending on this condition the treatment was difficult [12]. In our study, meropenem and imipenem resistance rates in commonly isolated *Acinetobacter* strains were 89.1%. The most effective antibiotics were determined as colistin and tigecycline. In our country, the resistance to these drugs is low and they can be considered as a priority in the treatment [13, 14].

Sader et al. reported that the use of empirical carbapenem was restricted due to the increased antibiotic resistance to *P. aeruginosa* [15]. Increased resistance to carbapenems has been found to be higher in ICUs [16]. Tartar et al. found 70.9% resistance rate in 127 of *Pauroginosa* strains [10]. In our study, the resistance rate of *Pauroginosa* to meropenem and imipenem were 48,2% and 51,7%, respectively. Colistin resistance was not detected for *Pauroginosa* strains. Studies in our country revealed that *Pauroginosa* strains had different and increasing resistance rates [17, 18].

The rates of *methicillin-resistant S. aureus* (MRSA) strains isolated from endotracheal aspirate samples in our country have been reported between 11,4-60% [19]. Sevinç et al. investigated 173 ETA samples obtained from the VAPs. In this study, most frequently isolated microorganisms were *Pseudomonas*, *Acinetobacter* and *S. aureus* respectively [20]. Namıduru et al. found that *P. auroginosa* was the most common isolated microorganism in 47 (33.9%) of 140 ETA samples. In the same study, 42 (30%) *S.aureus* strains were found to be the second most frequent isolates [21]. In our study, *S. aureus* were the third most frequently isolated organisms (11,5%). Oxacillin resistant *S.aureus* strains were determined as 46.1% (6/13) and there was no linezolid, teicoplanin and vancomycin resistance. Morbidity and mortality rates of the *Meticillin-resistant* infections caused by *S. aureus* strains are high and glycopeptide antibiotics are the first choice in the treatment [19].

Conclusion

The use of inappropriate antibiotics in LRTI patients hospitalized in ICUs leads to the formation of multiple resistant strains with high mortality and morbidity rates. Therefore, determination of antibiotic resistance profiles in cities and hospitals is important for appropriate empirical treatment to be given to the patients. In order to prevent the spread of the strains isolated from the intensive care units of hospitals and to increase the success of the treatment, antibiotic susceptibility tests should be monitored regularly and appropriate antibiotherapy protocols should be applied.

Scientific Responsibility Statement

The authors declare that they are responsible for the article's scientific content including study design, data collection, analysis and interpretation, writing, some of the main line, or all of the preparation and scientific review of the contents and approval of the final version of the article.

Animal and human rights statement

All procedures performed in this study were in accordance with

the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. No animal or human studies were carried out by the authors for this article.

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Conflict of interest

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