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Changing pattern of antibiotic susceptibility in intensive care units: Ten years experience of a university hospital

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ABSTRACT

The study was performed to assess microorganisms and antibiotic susceptibility patterns during ten years in intensive care units of a University Hospital. Infection Control Committee has active, prospective surveillance in ICUs for thirteen years. Ten years data of ICUs was evaluated retrospectively from surveillance forms. Microorganisms and their antibiotic resistance were recorded according to the years. During ten years, gram negative microorganisms were the most frequent isolated microorganisms from clinical specimens. *Acinetobacter baumannii* (21.8%), *Pseudomonas aerigunosa* (16%), *Escherichia coli* (10.4%) and *Klebsiella pneumoniae* (8%) were the most common gram negative microorganisms. However, *Staphylococcus aureus* was the most prevalent gram positive microorganism, the incidence decreased from 18.6% to 4.8% during ten years. Also antibiotic susceptibility of microorganisms changed during ten years. Carbapenem resistance increased from 44% to 92% in *A. baumannii* and ciprofloxacin resistance increased in *E. coli* from 28% to 60% and in *K. pneumoniae* from 21% to 55% during ten years. However, methicilin resistance decreased in *S. aureus* from 96% to 54%. In conclusion, antibiotic resistance is growing problem in ICUs. Rationale antibiotic policies and infection control measures will prevent the development of resistance.

1. Introduction

Antibiotic resistance is an increasing threat in hospitalized patients worldwide. Multiresistant microorganisms cause greater morbidity and mortality, extended length of hospital stay and higher costs. Critically ill patients are more likely to acquire resistant pathogens, due to severe illness, more comorbidities, greater use of antibiotics and invasive procedures [1–3]. Also, workload affect the adherence of healthcare personnel to infection control measures, especially hand hygiene [4]. Surveillance of antibiotic susceptibility will guide to empirical antibiotic therapy and development of infection control programme in intensive care units (ICUs).

In this report, we retrospectively evaluated the pathogens and antibiotic susceptibility in ICUs from 2000 to 2009 at a university hospital in Turkey.

2. Materials and methods

Erciyes University Hospital is a referral tertiary hospital in Central Anatolia with 1300 beds serving a population of approximately 5 million people. It has seven ICUs with 177 bed-capacity and having 3500 admissions to ICUs annually. The Nosocomial Infection Control Committee of the hospital was established in 1997 and since that year, active, prospective, patient based surveillance has been performed by trained Infection Control Nurse. Antibiotic therapy was prescribed by infectious disease specialists according to surveillance data. In ICUs, the 24-h nurse/patient ratio ranges between 0.5 and 0.7.

Nosocomial infections were defined according to the Centers for Disease Control Criteria [5]. The surveillance of incidence density and device-related infection has been begun after 2003.

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Table 1
Incidence density of infections[a] in intensive care units (ICUs).

ICU[b]	Year						
	2003	2004	2005	2006	2007	2008	2009
MICU	70	39	46	47	49	59	56
NSICU	74	37	33	35	32	46	54
GSICU	78	53	44	53	64	74	68
ARICU	not available	42	53	50	71	71	46
PICU	36	28	29	22	50	40	27
CSICU	12	13	6	18	6	10	12
BICU	32	6	16	13	23	19	19

[a] Number of infection episode/1000 patient days.
[b] MICU: medical ICU, NSICU: neurosurgery ICU, GSICU: general surgery ICU, ARICU: anesthesia and reanimation ICU, PICU: pulmonary ICU, CSICU: cardiovascular surgery ICU, BICU: Burn ICU.

Antimicrobial susceptibility testing was determined by using the Kirby–Bauer disk diffusion test according to the "Clinical Laboratories Standards Institute-CLSI" recommendations [6].

3. Results

During ten years, 21,104 patients admitted to ICUs and 2735 (13%) patients had 4945 infection episode. The incidence density of infection after 2003 is shown in Table 1. Nosocomial pneumonia was the most common infection, and urinary tract infection and surgical site infection were the other frequent nosocomial infections in our ICUs (Fig. 1). Catheter-related infections decreased during the study period. Gram negative pathogens were the most prevalent microorganisms and *A.baumannii* (22%) was the leading one. Furthermore, the incidence of *S. aureus* decreased from 18.6% to 4.8% in ICUs (Fig. 2). Antimicrobial resistance of microorganisms changed during years. Carbapenem resistance of *A. baumannii* and quinolone resistance of *E. coli* and *K. pneumoniae* doubled from 2000 to 2009. However, methicillin resistance of *S. aureus* decreased from 96% to 54% (Figs. 3–7).

4. Discussion

Antimicrobial resistance of gram negative microorganisms increased in our ICUs during ten years. Unfortunately, we couldn't evaluate antimicrobial consumption in our ICUs, antimicrobial use is the key driver of resistance. Antimicrobial use selects resistant mutant species and it allows the emergence of resistant pathogen in flora [2,3]. Multidrug *A. baumannii* is endemic in our ICUs and the main pathogen of serious nosocomial infections with high mortality rate [7–10]. In recent years, extended-spectrum β-lactamase (ESBL) producing *E. coli* and *K. pneumoniae* are a global threat, particularly in ICUs. Moreover, increased carbapenem consumption is associated with carbapenem-resistant *K. pneumoniae* and *A. baumannii* [11]. In our ICUs, quinolone and third generation

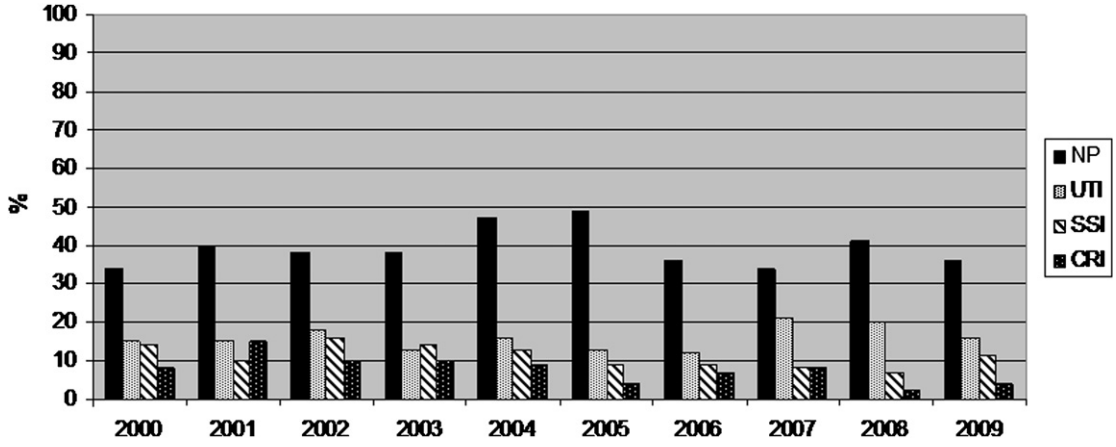

Fig. 1. Nosocomial infections in ICUs from 2000 to 2009.

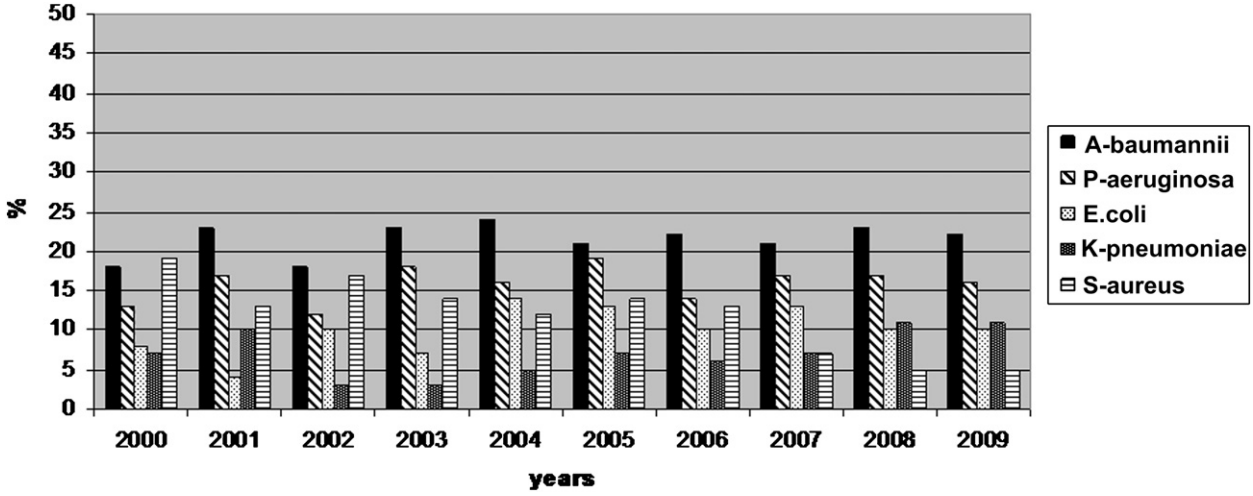

Fig. 2. Microorganisms isolated from nosocomial infections.