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Research Article

Morbidity and Mortality of Sepsis at the Department of Anaesthesia and Intensive Care at the Clinical Hospital Center in Zagreb, Croatia

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ABSTRACT

Background: In the least developed countries, sepsis remains the leading cause of death. This Research will show the occurrence of sepsis and septic shock in critically ill patients 10 years after the first attempts of researching incidence of sepsis in Croatia, and give us a better insight into the types of microorganisms that are found in septic patients.

Objective: Determine the number of morbidity and mortality of patients from sepsis, severe sepsis and septic shock in 3 ICUs in Clinical Hospital Centre Zagreb.

Hypothesis 1: Gram-negative bacteria are the leading cause of infection in patients with sepsis.

Hypothesis 2: Number of patients suffering from sepsis, severe sepsis, septic shock and their deaths is less than in the other countries with available data on morbidity and mortality.

Methods: The study was conducted with a specially designed form for data collection, made by researchers, and was approved by the Ethics Committee. As a measuring instrument, researchers used criteria for sepsis, severe sepsis and septic shock defined by the Surviving Sepsis Campaign. Included were 3169 patients. Demographic, clinical and microbiology data were collected prospectively.

Results: The total number of patients admitted was 3169. Sepsis and severe sepsis occurred in 67 patients, while the septic shock affected 16 patients. Total number of ICU patient deaths was 127, of which 31 patients died from the direct consequences of sepsis, severe sepsis and septic shock. In patients with sepsis, the lungs were the most common site of infection (67%). The most common microorganisms were Pseudomonas aureginosa (46%).

Discussion: We confirmed both hypotheses. Gram negative bacteria were the leading microorganism. Morbidity and mortality from sepsis is less than in the other countries with available data. This research shows that Croatian Hospital Centre Zagreb has lower occurrence of sepsis and septic shock than most ICUs in the world.

Keywords: Sepsis, Septic shock, Microorganism, Morbidity, Mortality, Intensive care unit

INTRODUCTION

Sepsis is a systemic response of the host to infectious stimuli, which consists of clinical, hemodynamic, biochemical, and inflammatory components[1], but according to the new definition, sepsis should be defined as life-threatening organ dysfunction caused by a dysregulated host response to infection[2]. During this research, the new definition of sepsis was not applied because it was published in February 2016. The number of deaths from sepsis in the U.S. increased from 154.159 in 2000 to 207.427 in 2007[3], and the numbers of hospitalizations with sepsis have overtaken those from cardial infarction[4]. In the U.S, sepsis accounts for far more deaths than the number of deaths from prostate cancer, breast cancer and AIDS combined. Sepsis strikes an estimated 30 million people worldwide every year. The sepsis syndrome, severe sepsis, and septic shock represent a major therapeutic and economic problem[5].

LITERATURE REVIEW

Literature review showed two large investigations of sepsis occurrence were performed in Croatia. In one study, 314 sepsis episodes that occurred between 2000 and 2005, analysis has shown that the number of admitted patients to ICUs was increased from 3.7% in 2000 to 11.7% in 2005, while the recorded mortality was 14.2% in 2000 and 20.3% in 2005[6]. Second study conducted on 24 ICUs from a 1-year period (November 2004-October 2005) has shown that overall 8.6% of patients

clinically significant were presented with odds ratio (OR) and 95% confidence interval (CI). We also used MedCalc (MedCalc Software) software for analyses.

RESULTS

Through one-year period, a total of 3169 patients were hospitalized in the 3 ICUs; general, cardiac and neurosurgical intensive care unit in Clinical Hospital Center Zagreb. Of the total number of admitted patients 126 of them had a condition as bacteremia, sepsis, severe sepsis and septic shock. Table 1 shows the frequency of individual diagnoses in three ICUs. Obtained data shows the highest representation of sepsis and severe sepsis (53.96%), followed by bacteremia (33.33%) and septic shock placed in third place (12.69%). Of 126 infection affected patients, 83 (65.87%) were male, 43 (34.12%) were female. The median patient age was 65 Years (mean ± SD, 62.2 ± 15.7). There were 3042 (96%) ICU survivors, and 127 (4%) ICU non-survivors. Of 127 deceased patients, 31 (24.40%) of them died of infectious complications.

There was a difference in ICU mortality in patients who died from infections complications (neurosurgical 6.4%, general 74.1% and cardiac 19.3%). Figure 1 shows relationship between intensive care unit morbidity and mortality rates of patients with sepsis, severe sepsis and septic shock in 3 ICUs. Cardiac ICU had the largest number of patients suffering from sepsis, severe sepsis and septic shock (52.3%), but only 4.7% of them died. Characteristics of all 126 patients with bacteremia, sepsis, severe sepsis and septic shock are shown in Table 2. From 126 patient who had sepsis, sever sepsis or septic shock, we isolated 418 positive cultures of various microorganisms. Table 3 shows the type of microorganism distributed in 3 ICUs. The microorganism was considered once per patient even if present in more than one site. The most common type of microorganism was gram negative bacteria. In 418 positive cultures, 216 (51.6%) were gram negative. Pseudomonas were the most common Gram-negative microorganism, found in 58 isolates in all 3 ICUs, followed by the Gram positive micro-organism Staphylococcus, found in 52 isolates. The third most common microorganism was Candida albicans, found in 51 isolate.

We tested odds ratio between patients from whom we isolated gram negative, gram positive bacteria and patients who died from

antimicrobial treatment of patients with sepsis.

Our medical staff was leading with SSC bundles and with 63 recommendations from WFCCNa what shows significance in lower morbidity and mortality of sepsis. Although our methodology was strong, our study had limitations. We studied only patients treated in ICU during their ICU admission, and we excluded variable like Acute Physiology and Chronic Health Evaluation (APACHE II), and instead we used Simplified Acute Physiology Score (SAPS I and II).

Predictors of mortality in sepsis are interesting in studies like this one, but our aim was not focused on that. We can say that older age, male gender and Pseudomonas infection can be used as a mortality predictor based on the results, but no testing was used to prove that[25-29]. In our Department of Anesthesia and Intensive Care at Clinical Hospital Center Zagreb, we don't have a special sepsis team with more competence and knowledge about sepsis treatment, but in further our plan is to train several intensive care nurses to be specialists for the sepsis issue. We think that the early recognition sign of sepsis, that nurses see first, is the key for successful treatment and is lifesaving. The optimum treatment of severe sepsis and septic shock is a dynamic and evolving process and regarding that fact, we will enroll our further interventions (establish register for sepsis, educate nurse experts for sepsis and persist on standard numbers of nurses and doctors needed per patients in ICU)[30].

Given the importance of sepsis as a big ICU morbidity and mortality issue, for further study it will be interesting to follow mainly nurse activities and interventions to see how much effect can nursing have on morbidity and mortality of sepsis.

KEY MESSAGES

- This first research performed on Department of Anesthesia and Intensive Care at the largest Clinical Hospital Center in Zagreb, shows a low morbidity and mortality from sepsis, severe sepsis and septic shock than in other ICUs in different countries.

- Gram-negative microorganism persisted as a leading microorganism isolated from septic patients.

- Use of SSC guidelines and 63 recommendations for nurses, we achieve

envious level of good practice in treating sepsis.

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Table 2: Number of patients, number of infective patients, Simplified Acute Physiology Score (SAPS I – II), frequency of bacteremia, sepsis, severe sepsis and septic shock, ICU mortality rates, and ICU mortality from sepsis, severe sepsis and septic shock according to ICUs.

ICU	No. of patients	No. of infective patients	SAPS I Score Mean ± SD	SAPS II Score Mean ± SD	Bacteraemia	Sepsis & Severe sepsis	Septic shock	ICU Mortality	ICU Mortality from sepsis, severe sepsis and septic shock
Neurosurgical	736	25	43.6 ± 14.1	32.7 ± 12.2	12	12	1	26	2
General	1267	35	47.8 ± 15.1	29.5 ± 12.8	0	22	13	75	23
Cardiac	1166	66	41.1 ± 16.8	21.0 ± 12.7	30	34	2	26	6
Total	3169	126	44.1 ± 15.3	27.7 ± 12.5	42	68	16	127	31

Table 3: Distribution of microorganisms in 3 ICUs. Total number of micro-organisms findings was 418. Gram-negative bacteria were present in 216 isolates. Microorganism was considered once per patient even if present in more than one site.

Table 7: Independent Sample Test. T test of input SAPS score I and output SAPS score II between cardiac and general ICU.

Independent Samples test										
Variables		**Levene's Test for Equality of Variances**		**T-test for Equality of Means**						
		F	**Sig.**	**t**	**df**	**Sig. (2-tailed)**	**Mean Difference**	**Std. Error Diff.**	**95% Confidence Interval of the Difference**	
									Lower	**Upper**
SAPS score II	Equal variances assumed	0.035	0.853				-8.40741	4.08108	-16.56030	-0.25451
	Equal variances not assumed			-2.054	16.212	.056	-8.40741	4.09367	-17.07636	0.26154
SAPS score II	Equal variances assumed	0.062	0.804				-6.72078	3.40138	-13.46985	0.02830
	Equal variances not assumed			-2.042	76.112	.045	-6.72078	3.29138	-13.27598	-0.16558
*Mean: Cardiac ICU input SAPS score I: 41.1364; SD: 16.83027 General ICU input SAPS score I: 47.8571; SD: 15.13108; t: 2.06; p: 0.43										

Table 8: OR for all ICUs, calculated on the number of patients with sepsis, severe sepsis and septic shock.

Department	Infected	Deceased	Survived	% mortality of infected patients	OR	CI	p-value
General ICU	35	23	12	66%	5.8737	2.6204 – 13.1661	<0.0001
Cardiac ICU	66	6	60	9%	0.3065	0.1207 – 0.7783	0.0129
Neurosurgical ICU	25	2	23	8%	0.2665	0.05942 – 1.1951	0.0841
Total	126	31	95	25%	--	--	--
*Patients with sepsis in General ICU have 5.8 times higher mortality.							

Appendix

Appendix 1: Diagnostic criteria for sepsis.