RATE OF OUTCOMES OF SEPSIS AND SEPTIC SHOCK PATIENTS IN EMERGENCY INTENSIVE CARE UNIT

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Article History: Received 1st April 2023, Accepted 1st May 2023, published online 5th May 2023

Abstract

Background: Severe organ failure due to an uncontrolled immune response to infection is known as sepsis. One kind of sepsis is septic shock.

Aim & objectives: Objective: to evaluate the characteristics of outcomes in cases of septic shock and sepsis brought to the Emergency Intensive Care Unit (EICU)at Zagazig University Hospitals. Additionally, we are interested in comparing the outcomes for cases with sepsis & septic shock in the critical care unit.

Patients and methods: This prospective cohort study was done on 360 cases that were collected in 6-months period, aged 18 years old or more both sexes sepsis & septic shock cases in EICU at Zagazig University Hospitals. Our cases were separated into 3 groups rendering to the cause of admission; **Group A** involved 284 cases with non-sepsis non-septic shock indications, **Group B** involved 40 cases with sepsis & **Group C** involved 36 cases with septic shock.

Results: matched to Group A, Groups B & C showed significant differences in age, gender, BMI, GCS, APACHE II score, SOFA score, PH, PaO2, PCO2, HCO3, serum lactate, hospitalisation length, mechanical ventilation, and death ($p < 0.001$). The kind of bacteria in sepsis and septic shock groups was similar.

Conclusion: There is still a significant rate of sepsis & septic shock in ICU in low- and middle-income countries LMICs, and these conditions are often linked to worse outcomes for patients.

Keywords: Sepsis, Septic shock, Emergency Intensive Care Unit (EICU)

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DOI: - 10.53555/ecb/2023.12.4.297

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Introduction

According to the definition provided by the sepsis-3 committee, sepsis is a potentially fatal organ failure that is brought on by an immune response to infection that is not well managed. Septic shock is a variant of sepsis that is distinguished by more severe cellular, circulatory & metabolic abnormalities that, in comparison to sepsis, increase the likelihood of mortality **.)1(**

A wide variety of microbial classes can trigger sepsis. Sepsis can develop in the absence of microbial infiltration of the bloodstream. Microbial signal molecules or toxins can also trigger an immune response, either locally or systemically**.)2(**

Sequential [Sepsis-related] score rise of two points or more SOFA indicates organ dysfunction for clinical operationalization. The increase is linked to over 10% in-hospital deaths. **.)3(**

In 2016, the Sepsis-3 Task Force replaced SIRS **(1)** with the SOFA score or bedside quick SOFA (qSOFA) criteria for early sepsis identification and risk assessment.

National Early Warning Score (NEWS) & Modified Early Warning score systems **(5, 6)**, APACHE II scoring **(4)**, and biomarkers like procalcitonin and C-reactive protein **(7)** are also used to detect and prognose sepsis in the ICU.

Sepsis syndrome has a high overall fatality rate, albeit it varies from case to case. As an example, a 2003 research in Spain found that the death rate varied between 12.8% for sepsis and 45.7% for septic shock. A research conducted in a Saudi intensive care unit also indicated a value of up to 58%. Critical care unit-acquired sepsis was associated with substantially increased mortality rates **(8).**

This research set out to examine the features of outcomes for cases who were hospitalized to the (EICU) at Zagazig University Hospitals with sepsis or septic shock. To evaluate the effects of sepsis & septic shock on ICU outcomes.

Patients and Methods

This prospective cohort study was done on 360 cases that were collected in 6-months period, aged 18 years old or more both sexes sepsis & septic shock cases in EICU at Zagazig University Hospitals. Our patients were separated into 3 groups as regarding the cause of admission; **Group A** involved 284 cases with non-sepsis non-septic shock indications, **Group B** included 40 cases with sepsis, and **Group C** included 36 cases with septic shock.

We made sure to get the patient's informed written permission. Along with a secret code number, each subject was informed of the study's goal. Encrypted and stored in separate files for each patient, all information provided was only for the purpose of the ongoing medical study.

Sample size: German researchers from Kiel University utilised G. power 3.1.9.2 to calculate sample size. These factors determined sample size: The research's effect size was 0.323, with α 0.05 α error and 80% power, showing that the average length of time spent in the (ICU) was 11.188 ± 5.152 days, compared to 13.441 ± 8.389 days in the prior study. The addition of fourteen cases helped prevent dropouts. Hence, a thorough investigation was conducted with 360 patients in that study. **(9)**.

Inclusion criteria: First degree relative consent. Age18 years old or more both sex in Emergency ICU with Sepsis-3 committee criteria of either sepsis or septic shock. Sepsis-3 committee criteria of sepsis: Infections and verified organ dysfunction (i.e., SOFA score increase of ≥2 points) were suspected or confirmed. Septic shock can be detected immediately at the bedside in suspected infections using SOFA criteria: GCS < 15, SBB ≤ 100 mmHg, or respiration rate > 22/min. Vasopressors were used to maintain MAP ≥ 65 mm Hg & serum lactate levels below 2mmol/L or 18 mg/dL, despite sepsis and persistent hypotension (SBP < 90 mm Hg, MAP < 60 mm Hg, or SBP decrease > 40 mm Hg from baseline despite adequate volume resuscitation).

Westphal et al. classified hospital-acquired cases as those diagnosed 48 hours after being admitted to the hospital, whereas community-acquired cases were defined as those diagnosed upon hospital admission or within 48 hours. The categorization was determined by the origin of sepsis. **(10)**.

Exclusion criteria: Patient with any type of shock other than septic shock, Patient with preexisting chronic liver disease, Patient with preexisting chronic kidney injury, Pregnant patient and Patients who stay in ICU less than 48 hrs.

Assessment of organ function and prediction of mortality on the 1st and the 2nd admission days: Using (SOFA) score, the organs' functionality was evaluated. Respiratory, cardiovascular, hepatic, coagulation, renal & neurological systems are represented by the six factors that make up the SOFA score. On a scale from 0 (normal) to 4 (very dysfunctional), we rate the health of each organ system. Every 24 hours after a case was taken to the ICU, the most problematic physiological characteristics were serially recorded. Poor organ function and increased mortality are associated with higher SOFA scores, and vice versa.

Assessment of disease severity and prediction of the prognosis of the cases on the first 1st day of admission:

The APACHE II score, which stands for Acute Physiology & Chronic Health Evaluation, was used to conduct this evaluation. A lower APACHE II score indicates a better prognosis & vice versa; the score is based on 12 physiological indicators, age, and underlying health, and it runs from 0 to 71.

Results

Table (1): Demographic data of the study groups.

	Group A (n = 284)	Group B (n = 40)	Group C (n = 36)	P-value	Post hoc test
Age (years)	41.54 ± 6.89	48.68 ± 3.29	53.36 ± 3.55	< 0.001 **	P1=<0.001* P2=<0.001** P3=0.001**
Gender					
-Male	149 (52.46%)	22 (55%)	19 (52.78%)	0.956	
-Female	135 (47.54%)	18 (45%)	17 (47.22%)		
BMI (kg/m2)	32.16 ± 4.07	25.64 ± 2.96	24.90 ± 2.74	< 0.001 **	P1=<0.001* P2=<0.001** P3=0.400

P1: Group A vs Group B, P2: Group A vs Group B, P3: Group B vs Group C

Patients' age was significantly older in cases with sepsis and septic shock ($p < 0.001$), However, gender distribution was statistically comparable between the 3 groups ($p = 0.956$). There was a significant decline in BMI in association with sepsis & septic shock ($p < 0.001$).

Table (2): GCS, APACHEII and SOFA scores in the study groups.

	Group A (n = 284)	Group B (n = 40)	Group C (n = 36)	P-value	Post hoc test
GCS	14 (13 – 15)	12 (9 – 14)	12 (9 – 14)	< 0.001 **	P1=<0.001* P2=<0.001** P3=1.00
SOFA	--	5.90 ± 2	9.03 ± 1.99	< 0.001 **	
APACHE II	2 (0 – 4)	14 (11-18)	23 (19-27)	< 0.001 **	P1=<0.001* P2=<0.001** P3=0.321

There was a significant decline in GCS in Groups B & C in comparison with Group A ($p < 0.001$). APACHE II score showed a significant rise in association with sepsis & septic shock ($p < 0.001$). Additionally, SOFA score had a significant rise in the septic shock group matched to the sepsis group.

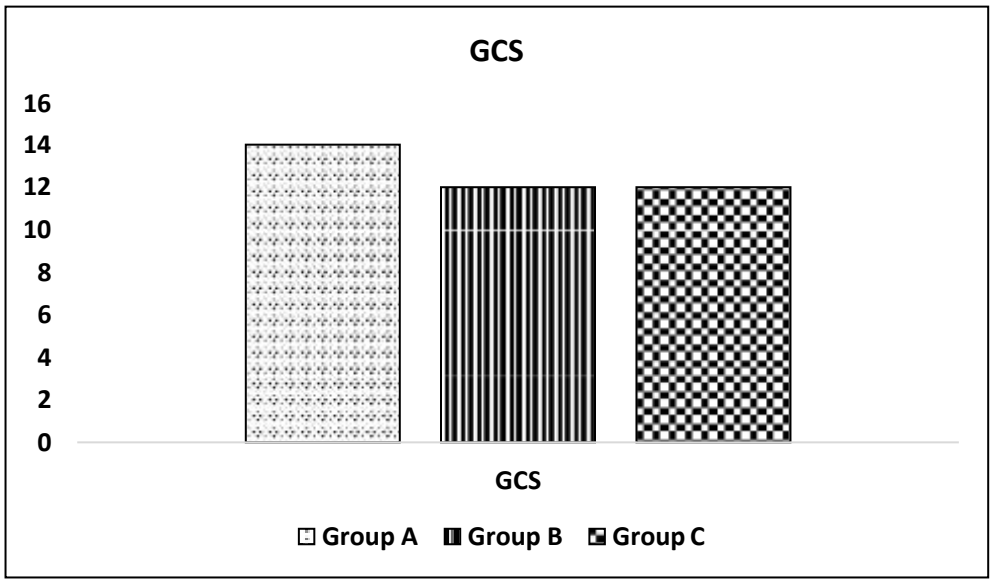

Figure (1): GCS in the three groups.

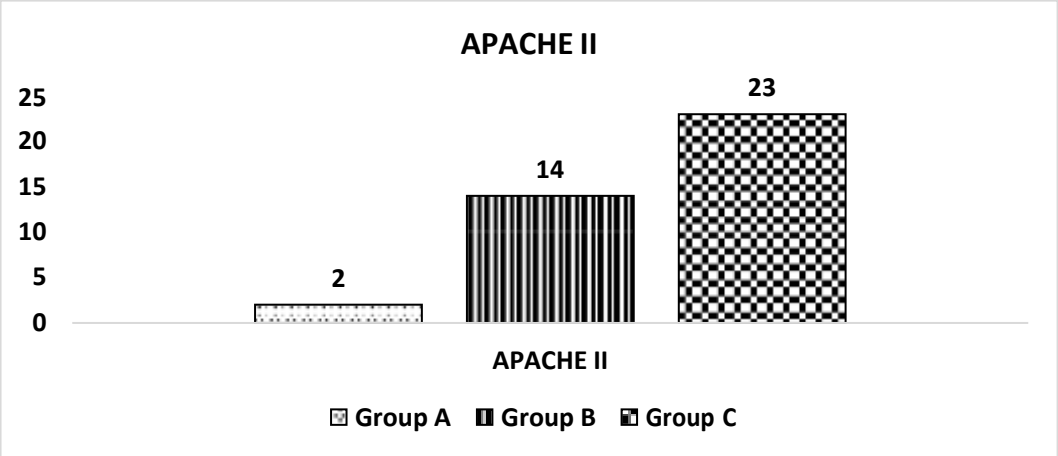

Figure (2): APACHE II score in the three study groups.

Table (3): Arterial blood gas analysis in the study groups.

	Group A (n = 284)	Group B (n = 40)	Group C (n = 36)	P-value	Post hoc test
PH	7.39 ± 0.04	7.33 ± 0.04	7.26 ± 0.05	< 0.001 **	P1=<0.001* P2=<0.001** P3=0.004*
PaO2 (mmHg)	104.56 ± 6.84	93.80 ± 14.18	93.17 ± 12.97	< 0.001 **	P1=<0.001* P2=<0.001** P3=0.751
PCO2 (mmHg)	40.22 ± 2.82	42.35 ± 3.96	43.17 ± 5.05	< 0.001 **	P1=<0.001* P2=<0.001** P3=0.273
HCO3 (mEq/L)	25.45 ± 2.04	21.19 ± 1.17	17.61 ± 2.18	< 0.001 **	P1=<0.001* P2=<0.001** P3=0.291
Serum lactate (mmol/L)	2.57 ± 0.88	3.21 ± 0.41	7.57 ± 0.45	< 0.001 **	P1=<0.001* P2=<0.001** P3=<0.001**

When comparing Groups C to Groups A and B, PH shown a notable decrease ($p < 0.001$). There was a significant decline in PaO2 when sepsis & septic shock were present ($p < 0.001$). On the other hand, as compared to Group A, PCO2 was significantly more associated with sepsis & septic shock ($p < 0.001$). The correlation among sepsis & septic shock and HCO3 decreased significantly ($p < 0.001$). Group C's serum lactate level was 7.57 mmol/l, which was substantially higher than Groups A and B's levels (2.57 and 3.21 mmol/l, respectively), while Group B's level was significantly lower than Group A's.

Table (4): The duration of hospitalization and outcomes in the study groups.

	Group A (n = 284)	Group B (n = 40)	Group C (n = 36)	P-value	Post hoc test
Duration of hospitalization (day)	4 (1 – 7)	6 (3-11)	9 (6-22)	< 0.001 **	P1=<0.001* P2=<0.001** P3=<0.001**
Requirement of mechanical ventilation	46 (16.19%)	12 (30%)	26 (72.22%)	< 0.001 **	P1=0.033* P2=<0.001** P3=<0.001**
Mortality	8 (2.82%)	7 (17.5%)	21 (58.33%)	< 0.001 **	P1=<0.001* P2=<0.001** P3=<0.001**

The duration of hospitalization had a significant prolongation in the hospitalization period in association with sepsis and septic shock ($p < 0.001$) more than group A & in group C more than group B. Mechanical ventilation was required 16.19%, 30%, and 72.22% of cases in the same 3 groups, respectively ($p < 0.001$). Additionally, mortality was encountered in 2.82%, 17.5%, and

58.33% of cases in the same groups, respectively ($p < 0.001$) in association with sepsis & septic shock ($p < 0.001$) more than group A & in group C more than group B. There was a significant rise in both mechanical ventilation requirement & mortality in association with sepsis & septic shock, compared to group A & in group C more than group B.

Table (5): Pattern of microorganisms in the sepsis & septic shock groups.

	Group B (n = 40)	Group C (n = 36)	P-value
Types of organisms			
-Gram -ve bacteria	25 (62.5%)	23 (63.89%)	
-Gram +ve bacteria	17 (42.5%)	16 (44.44%)	0.718
-Anaerobes	6 (15%)	7 (19.44%)	

Regarding the patterns of bacteria causing sepsis and septic shock, gram -ve bacteria was the most prevalent type, as it was detected in 62.5% and 63.89% of sepsis and septic shock groups, respectively. That was followed by gram +ve bacteria that was detected in 42.5% and 44.44% of cases in the same two groups respectively. Other organisms included anerobic infections. No significant difference was detected among the sepsis and septic shock groups regarding the type of microorganisms.

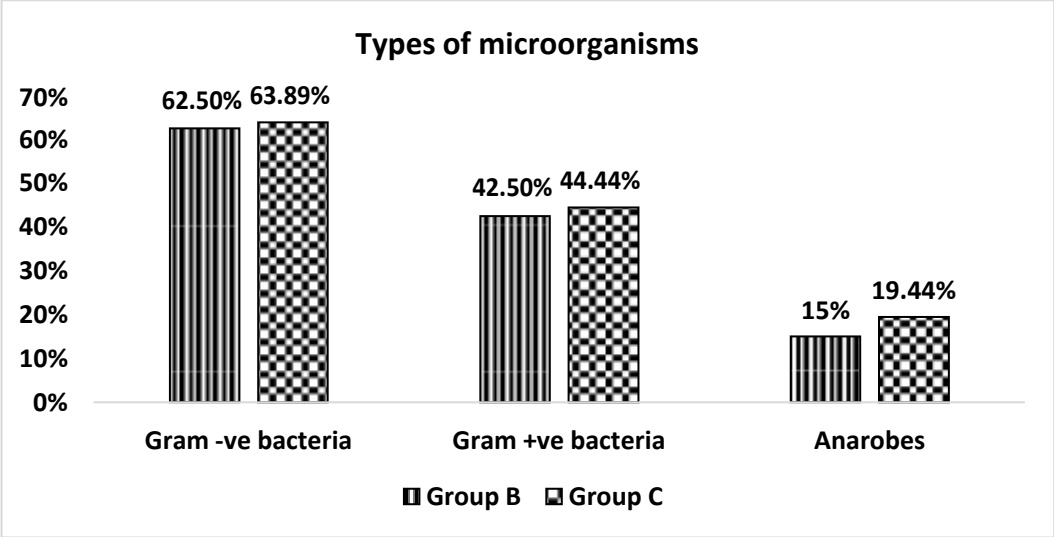

Figure (3): Pattern of microorganisms collected from sepsis & septic shock groups.

Discussion

In our study, cases' age was significantly older in cases with sepsis & septic shock ($p < 0.001$), as it had mean values of 41.54, 48.68, and 53.36 years in Groups

A, B & C, respectively. However, gender distribution was statistically comparable between the three groups, as men represented 52.46%, 55%, and 52.78% of patients in the same three groups, respectively ($p = 0.956$). This lines up with the findings of Rabee et al., who set out to assess the demographics of cases admitted to a Palestinian university tertiary hospital with the goals of determining the nature, severity, and prognosis of sepsis & septic shock. Additionally, it investigates the most prevalent microorganisms found in these individuals.

The cases' average age was 57.4 years & they found no statistically significant difference based on gender **(8).** Consistent with a 2015 research in Saudi Arabia, we had a fairly even distribution of genders .**(11)**.

This study found that Groups A, B, and C had median hospitalisation durations of 4, 6, and 9 days, respectively. When sepsis & septic shock were present, the hospitalisation period was significantly longer than in the non-septic shock group, and the difference was even more pronounced in septic shock ($p < 0.001$). In the groups that experienced sepsis, 30% of patients needed mechanical ventilation, and 72.22% of patients in septic shock required mechanical ventilation as well. These rates were significantly greater in septic shock matched to the non-sepsis group ($p < 0.001$). The average duration of stay was 8 days, according to **Rabee et al.,** even though their hospital serves as the only tertiary centre for patients from all neighbouring regions.**(8)**.

In our study, there was a significant decline in GCS in Groups B & C in comparison with Group A ($p <$

0.001). It had median values of 14, 12 & 12 in Groups A, B & C, respectively. APACHE II score showed a significant rise in association with sepsis and septic shock ($p < 0.001$). It had median values of 2, 14, and 23 in the three study groups, respectively ($p < 0.001$). Additionally, SOFA score had mean values of 5.9 & 9.03 in Groups B & C, respectively, with a significant rise in the septic shock group compared to the sepsis group.

Researchers **Mulatu et al.** found that a mSOFA score ≥ 10 or above was linked to a higher risk of complications in sepsis & septic shock. Despite the fact that SOFA have been described using the SOFA score for quite some time .**)12(**

SOFA scores cannot be used daily in resource-limited settings because arterial blood gas data are not always available. Alternative approaches of evaluating sequential organ failure, such as mSOFA, which was validated in a comparable context not long ago, are thus required **(13).** Other studies have also shown that the modified SOFA score can predict death**. (14).**

In the course of our study, we found that mortality occurred in a total of 2.82%, 17.5%, and 58.33% of cases within the same categories, respectively ($p < 0.001$). In comparison to the group that did not have sepsis, there was a substantial increase in the need for mechanical ventilation & mortality in cases who had sepsis & septic shock. In the case of septic shock, the increase was greater than in the case of sepsis. According to **Baykara et al.,** cases that were diagnosed with septic shock had a greater fatality rate when compared to those that were diagnosed with sepsis alone. **(15)**.

Critical care units in Saudi Arabia had a 58% fatality rate from severe sepsis, whereas those in Turkey, Brazil, and India had rates of 55.7%, 64.6%, and 55.7%, respectively**.)17-15 ,11(**

cases with septic shock seem to have a poorer prognosis compared to those with severe sepsis, even when their severity scores upon admission to the ICU are equal. Our findings are consistent with the most current French statistics on septic shock incidence and death, **Quenot et al**. **(18)**.

In our study, regarding the patterns of bacteria causing sepsis & septic shock, gram -ve bacteria was the most prevalent type, as it was detected in 62.5% and 63.89% of sepsis and septic shock groups, respectively. That was followed by gram +ve bacteria that were detected in 42.5% and 44.44% of cases in the same two groups respectively. Other organisms included anaerobic infections. The types of bacteria in sepsis and septic shock groups were similar.

The majority of sepsis patients (61.6%) had microbes isolated from them, according to **Wang et al**. A third of the patients had +ve infections, whereas more than 70% had -ve infections. The use of carbapenems and other multidrug-resistant Acinetobacter species, as well as different control strategies, may explain why this study found 29.0% of sepsis patients to have Acinetobacter, a higher proportion than previously reported. Although there has been a marked improvement in the quality of treatment and the emphasis on sanitary procedures, nosocomial infections do still happen. Furthermore, the microorganism distributions in their study varied, and the reasons for these changes are unclear; these findings are likely related to the cultivation techniques and methodologies used. There were also notable geographical disparities in the organisms extracted from the cultures. **(19)**.

According to the findings of a statewide epidemiologic research conducted by Vincent et al., the most prevalent gram-negative pathogens were Escherichia coli, Klebsiella pneumonia & pseudomonas aeroginosa. Our findings were likewise in agreement with the findings of this investigation. **(20)**.

Conclusion

Sepsis and septic shock, according to this study, are prevalent issues in ICU in (LMICs) and are often linked to increased death and morbidity rates. To control and avoid this hazard, special care and the development of management packages are needed.

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