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ORIGINAL ARTICLE

Rate of Admission and Risk Factors of Sepsis and Septic Shock Patients in Emergency Intensive Care Unit

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ABSTRACT

Background: Every year, millions of people are affected with sepsis and septic shock, which pose significant challenges to healthcare providers. Septic shock is the most severe form of sepsis. We aimed to assess rate of admission and risk factors in sepsis and septic shock patients in Emergency Intensive Care Unit (EICU) at Zagazig University Hospitals. And to compare between sepsis and septic shock patients regarding frequency and risk factors in EICU.**Methods:**This prospective cohort research 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 three groups in accordance with the cause of admission; Group A involved 284 cases with non-sepsis non-septic shock indications, Group B involved 40 cases with sepsis, and Group C involved 36 cases with septic shock.**Results:**There was a significant variance among the studied groups concerning age, gender, BMI, vital signs, laboratory parameters, kidney function, systemic inflammatory markers (CRP), serum procalcitonin (PCT), serum electrolytes, sodium levels, serum potassium and liver function tests (serum bilirubin and hepatic transaminases). While there was no significant difference regarding prevalence of medical comorbidities. The indication for ICU admission included sepsis (11.1%) and septic shock (10%), while the remaining patients had non-sepsis non-septic shock indications.**Conclusion:**Incidents of sepsis and septic shock, which can lead to increased mortality and morbidity, continue to be prevalent in ICUs in low and middle-income countries (LMICs).

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

INTRODUCTION

Major healthcare concerns include sepsis and septic shock, which afflict millions of individuals annually and kill one-third to one-sixth of those people. If sepsis is detected and treated throughout the first few hours of its onset, the prognosis is much improved [1].The most dangerous kind of sepsis is septic shock, which manifests with low blood pressure, abnormal tissue perfusion, and elevated lactate levels in the blood. Several factors can predispose people to septic shock as diabetes mellitus, lymphoproliferative disorders, cirrhosis, invasive procedures or devices, burns, intravenous drug use, chronic organ failure prolonged antibiotic therapy, cancer, and neutropenia [2].

Guidelines for the treatment of sepsis symptoms and their effects were published in 2004 by the Surviving Sepsis Campaign (SSC) [3].In subsequent years, the majority of healthcare systems supported and adopted this. These guidelines were updated in 2017, 2018 and in 2021 [4, 5, 1].

The aim of this study was to assess rate of Admission & Risk factors in sepsis and septic

shock cases in EICU at Zagazig University Hospitals. And to contrast among sepsis and septic shock patients as regards frequency and risk factors in EICU.

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 and septic shock patients in EICU at Zagazig University Hospitals. Our cases were separated into three groups concerning the cause of admission; Group A involved 284 cases with non-sepsis non-septic shock indications, Group B involved 40 cases with sepsis, and Group C involved 36 cases with septic shock.

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: These were suspected or proved infection and confirmed organ dysfunction (i.e., increase in "The Sequential Organ Failure Assessment" SOFA score of ≥2 points) because of infection. At the bedside, patients who may have an infection can be quickly recognized by SOFA, which consist of changes in mental state (GCS < 15), systolic blood pressure ≤ 100 mmHg, or respiration rate > 22/minand septic shock criteria according to Sepsis-3 conditions that involve sepsis, persistent hypotension (systolic blood pressure (SBP) < 90 mm Hg, mean arterial pressure (MAP) < 60 mm Hg, or a drop in SBP > 40 mm Hg from baseline despite sufficient volume resuscitation), necessitating the usage of vasopressors to keep MAP ≥ 65 mm Hg, and serumlactate level of more than 2 mmol/L (>18 mg/dL).

How the different causes of sepsis affect the patient population: Cases of sepsis that were identified either at hospital admission or within 48 hours afterward were categorized as either community-acquired or hospital-acquired, according to Westphal *et al.*[7].

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 hours.

Sample size:A power analysis program called G. power 3.1.9.2 from "The Universität Kiel, Germany" was utilized to determine the sample size. Many factors were taken into account while determining the sample size: Based on prior research, the average length of time spent in an ICU is 11.188 ± 5.152 days, whereas this research utilizes a 0.05 α error and an 80% power level to show an effect size of 0.323. Fourteen cases were added to overcome dropout. Therefore, 360 patients included in this study as a comprehensive study. [6].

All admitted patients were subjected to the following: Full medical examination at admission (history of ischemic heart diseases, diabetes, liver diseases, renal diseases, hypertension, smoking), Vital signs examination, Physical examination of all body systems and Investigations: blood tests, 12-lead Electrocardiogram (ECG) and Imaging tests: For identification of the Chest X-ray, Ultrasound, Magnetic resonance imaging (MRI), Computerized tomography (CT), Two-dimensional echocardiogram (2D ECHO) and Culture sensitivity test.

Ethical and administrative considerations: Informed written consent was obtained from

the patient. 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. Additionally, approval from the Zagazig University Institutional Review Board's Faculty of Medicine was acquired (IRB). The study was conducted according to Declaration of Helsinki.

STATISTICAL ANALYSIS

All statistical calculations were done using ' Microsoft office Excel ' 2013 program SPSS (statistical package for the social science; SPSS Inc., Chicago, IL, USA) version 22. Descriptive statistics: Quantitative data: were presented as mean and standard deviation (mean ± SD). Qualitative data: were expressed as numbers and percentage. And analytical statistics. Comparing groups was done using Chi square-test (X^2): for comparison of qualitative data and one way ANOVA test for comparison of quantitative data of more than 2 independent sample of normally distributed data. The coefficient interval was set to 95%. The level of significance was calculated according to the following probability (P) values: $P<0.05$ was considered statistically significant.

RESULTS

Patients' age was significant older in cases with sepsis & septic shock ($p < 0.001$); However, sex distribution was statistically comparable between the three groups ($p = 0.956$). There was a significant decline in BMI in association with sepsis & septic shock ($p < 0.001$) (Table 1).

The indication for ICU admission included sepsis (11.1%) and septic shock (10%), while the remaining patients had non-sepsis non-septic shock indications (Table 2).

The prevalence of medical comorbidities did not reveal any statistical variance among the three study The prevalence of medical comorbidities did not reveal any statistical variance among the three study groups ($p > 0.05$), apart from diabetes mellitus, which showed higher prevalence in both sepsis and septic shock groups ($p < 0.001$). It had a prevalence of 29.93%, 57.5%, and 61.11% in Groups A, B, and C, correspondingly. In the septic shock and sepsis groups, abdomen was the most frequent source of infection (32.5% and 33.33% of cases, correspondingly), followed by chest infection (22.5% and 22.22% respectively). Other sources included urinary tract infection, blood born infection, and cellulitis (Table 3).

All vital signs showed a statistical distinction amongst the three study groups ($p < 0.001$). There was a significant rise in pulse, temperature, and respiratory rate, while both systolic and diastolic blood pressures revealed a significant decline in association with sepsis and septic shock, contrasted with Group A (Table 4).

All laboratory parameters showed a significant variance among the three study groups ($p< 0.05$). Concerning hemoglobin, CBC parameters & platelets displayed a significant decline in Groups B and C, contrasted with Group A. On the other hand, WBCs revealed a significant rise in the former two groups contrasted with the latter.Both indicators of kidney function, including serum urea and creatinine, showed a significant increase in association with sepsis and septic shock, compared to group A, also,

serum urea revealed a significant rise in Group C compared to Group B. Likewise, systemic inflammatory markers, including CRP, showed similar changes. Moreover, serum PCT showed a significant rise in Group B compared to Group C (median = 9 vs. 22.85 µg/L respectively, p < 0.001).As regards serum electrolytes, sodium levels revealed a significant reduction in association with sepsis & septic shock, contrasted with group A. While serum potassium showed a significant increase in septic shock contrasted with non-sepsis and sepsis groups. Moreover, liver function tests, including serum bilirubin and hepatic transaminases, revealed a significant rise in groups B and C, contrasted with Group A. the following table illustrates the previous data (Table 5).

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** **-Female**	 149 (52.46%) 135 (47.54%)	 22 (55%) 18 (45%)	 19 (52.78%) 17 (47.22%)	0.956	
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.

Table (2): Indication for admission in the study groups.

Indication for admission	**Percentage**
-Non-sepsis non-septic shock	284 (78.9%)
-Sepsis	40 (11.1%)
-Septic shock	36 (10%)

Table (3): Medical comorbidities and sources of infections in the study groups.

	Group A (n = 284)	Group B (n = 40)	Group C (n = 36)	P-value	Post hoc test
Diabetes mellitus	85 (29.93%)	23 (57.5%)	22 (61.11%)	< 0.001 **	P1=<0.001** P2=<0.001** P3=0.749
Hypertension	133 (46.83%)	21 (52.5%)	20 (55.56%)	0.526	
Chronic liver disease	55 (19.37%)	9 (22.5%)	7 (19.44%)	0.896	
Chronic kidney disease	39 (13.73%)	9 22.5%)	6 (16.67%)	0.333	
COPD	24 (8.45%)	4 (10%)	4 (11.11%)	0.840	
Sources of infection -Chest infection -Intraabdominal -UTI -Blood born -Cellulitis	---	9 (22.5%) 13 (32.5%) 8 (20%) 7 (17.5%) 3 (7.5%)	8 (22.22%) 12 (33.33%) 7 (19.44%) 6 (16.67%) 3 (8.33%)	0.886	

Table (4): Vital signs on admission in the study groups.

	Group A (n = 284)	Group B (n = 40)	Group C (n = 36)	P-value	Post hoc test
Pulse (bpm)	94.97 ± 5.88	107.55 ± 5.59	118.39 ± 7.45	< 0.001 **	P1=<0.001* P2=<0.001** P3=0.157
SPB (mm Hg)	111.15 ± 17.55	80.13 ± 9.71	69.17 ± 8.24	< 0.001 **	P1=<0.001* P2=<0.001** P3=0.493
DBP (mm Hg)	71.88 ± 17.38	51.25 ± 9.04	39.72 ± 8.19	< 0.001 **	P1=<0.001* P2=<0.001** P3=0.116
RR (cycle per minute)	19.95 ± 2.33	25.75 ± 5.16	23.50 ± 4.51	< 0.001 **	P1=<0.001* P2=<0.001** P3=0.411
Temperature	37.25 ± 0.45	38.42 ± 1.11	39.07 ± 1.25	< 0.001 **	P1=<0.001* P2=<0.001** P3=0.112

Table (5): Laboratory parameters at admission in the study groups.

	Group A (n = 284)	Group B (n = 40)	Group C (n = 36)	P-value	Post hoc test
Hb (gm/dl)	11.78 ± 1.25	9.50 ± 1.41	9.07 ± 1.09	< 0.001 **	P1=<0.001* P2=<0.001** P3=0.723
PLTs (10^6/ml)	416.65 ± 20.02	289.83 ± 87.13	302.22 ± 90.39	< 0.001 **	P1=<0.001* P2=<0.001** P3=1.00
WBCs (10^6/ml)	12.32 ± 1.46	16.57 ± 1.42	20.10 ± 1.39	< 0.001 **	P1=<0.001* P2=<0.001** P3=0.273
Serum urea (mg/dl)	15.01 ± ٤.69	23.35 ± 4.06	72.56 ± 13.05	< 0.001 **	P1=<0.001* P2=<0.001** P3=0.005*
Serum creatinine (mg/dl)	1.11 ± 0.19	1.78 ± 0.43	2.94 ± 0.45	< 0.001 **	P1=<0.001* P2=<0.001** P3=0.066
Serum bilirubin (mg/dl)	٠,٩٥(0.5 – 1.4)	2.45(0.9 – 5.5)	3.7(0.8 – 5.5)	< 0.001 **	P1=<0.001* P2=<0.001** P3=0.621
ALT (Iu/l)	54(21 – 80)	98(37 – 359)	123(45 – 337)	< 0.001 **	P1=<0.001* P2=<0.001** P3=0.173
AST (Iu/l)	50(20 – 80)	101(40 – 317)	156(45– 396)	< 0.001 **	P1=<0.001* P2=<0.001** P3=0.261
Na (mEq/L)	137.65 ± 4.30	132.05 ± 6.5	131.86 ± 4.87	< 0.001 **	P1=<0.001* P2=<0.001** P3=0.558
K (mEq/L)	4.24 ± 0.45	4.29 ± 0.70	4.86 ± 0.99	< 0.001 **	P1=0.628 P2=<0.001** P3=<0.001**
CRP	28.11 ± 9.98	64.13 ± 5.19	116.28 ± 12.73	< 0.001 **	P1=<0.001* P2=<0.001** P3=0.112
PCT (µg/L)	---	9 (3.5 – 15.4)	22.85(3.8 – 47.9)	< 0.001 **	

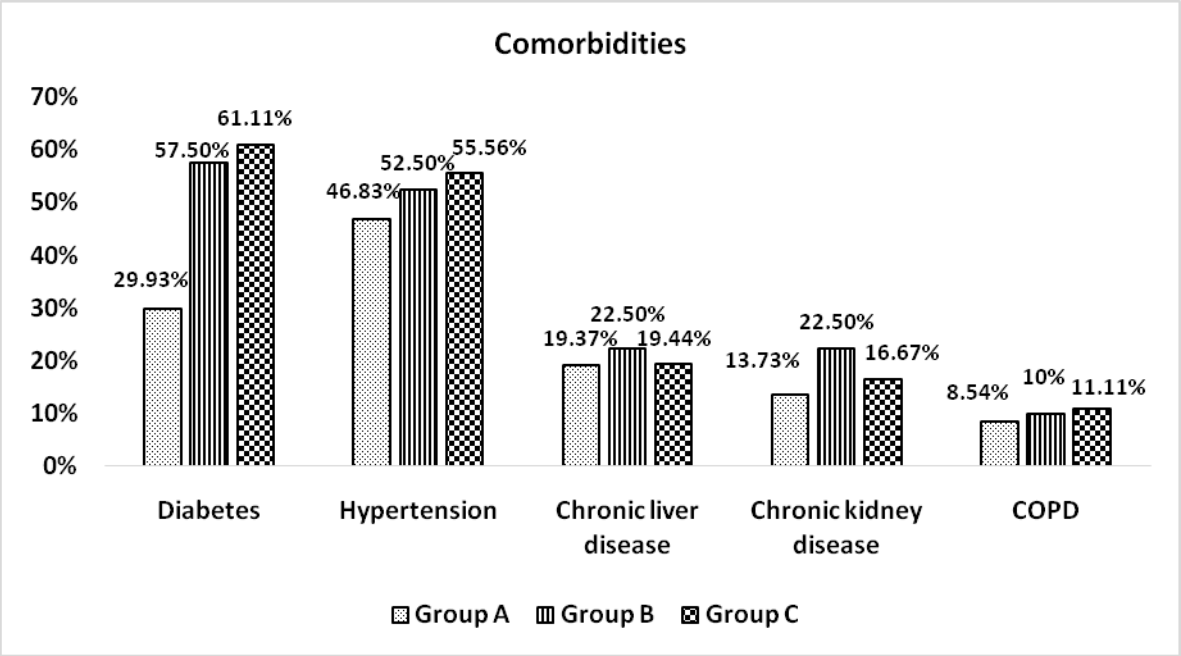

Figure (1): Distribution of medical comorbidities in the study groups.

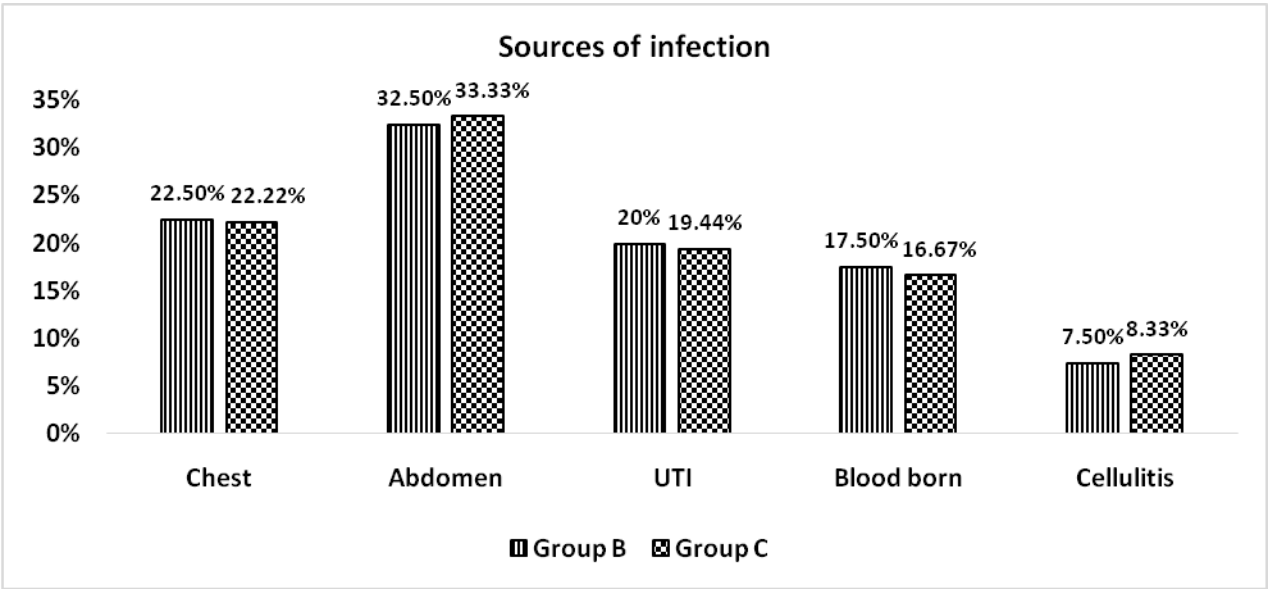

Figure (2): Sources of infection in Groups B and C.

DISCUSSION

In our study, patients' age was significant older in cases with septic shock and sepsis ($p < 0.001$), as it had mean values of 41.54, 48.68, and 53.36 years in Groups A, B, and C, correspondingly. However, gender distribution was statistically comparable between the three groups, as men represented 52.46%, 55%, and 52.78% of cases in the same three groups, correspondingly ($p = 0.956$). This agrees with Rabee *et al.*who aimed to assess the demographics of these patients in a Palestinian university tertiary hospital, as well as the nature, origin, and prognosis of their sepsis and septic shock. Additionally, it investigates the most prevalent microorganisms found in these individuals. They found that patients' ages averaged 57.4 years, and that gender played no role in the results [8].Comparable research

done in Saudi Arabia in 2015 produced results that were very consistent with our gender distribution [9].

In our study, the indication for ICU admission included sepsis (11.1%) and septic shock (10%), while the remaining patients had non-sepsis non-septic shock indications.In accordance, Mulatu *et al.*who sought to evaluate the incidence and prognosis of septic shock and sepsis in ICU located in Addis Ababa, Ethiopia. According to their findings, 26.5 out of 100 intensive care unit admissions were associated with sepsis & septic shock. There was a 15.1% incidence of sepsis (n=173) and an 8.9% incidence of septic shock (n=102) among patients admitted to the ICU according to SEPSIS-3[10]**.**

In our study, the prevalence of medical comorbidities did not reveal any statistical variance among the three study groups ($p > 0.05$), apart from diabetes mellitus, which showed higher prevalence in both sepsis and septic shock groups ($p < 0.001$). It had a prevalence of 29.93%, 57.5%, and 61.11% in Groups A, B, and C, correspondingly. In the sepsis and septic shock groups, abdomen was the most frequent source of infection (32.5% and 33.33% of cases, respectively), followed by chest infection (22.5% and 22.22% respectively). Other sources included urinary tract infection, blood born infection, and cellulitis.

Dabar*et al.*reported that, the distribution of infection sites was not significant distinct among the groups, with respiratory infections being the most prevalent reason for hospitalization. The current series demonstrates that among individuals who had HAI, 37% also had a UTI, with the CAI group exhibiting an even greater incidence of 51.4%. Environmental factors, an elevated proportion of community-acquired resistance bacteria related to the unrestricted administration of antibiotics in the community, and genetics (great frequency of urinary lithiasis) may all contribute to this high proportion of UTIs [11].Studies have shown that the lungs are the most prevalent location of infection in individuals with sepsis [12, 13].Consistent with earlier research, the incidence of abdominal infection was greater here [14].In accordance with Mulatu *et al.*, the respiratory tract was the most prevalent entry point for infections, followed by the urinary tract and the central nervous system [10].

CONCLUSION

According to the results of this study, the ICUs in LMICs still deal with a lot of sepsis and septic shock cases, which often lead to greater rates of mortality and morbidity. To control and avoid this hazard, special care and the development of management bundles are needed.

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