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Original Article

Influence of Early Goal-Directed Therapy Targeting Capillary Refill Time, Serum Lactate or Base Deficit Levels on Morbidity and Mortality in Septic Shock Patients

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ABSTRACT

Background: For patients with septic shock, early resuscitation is crucial in preventing organ failure and mortality. This study aimed to assess the influence of early goal-directed therapy targeting capillary refill time, serum lactate, or base deficit levels on 28-day mortality in septic shock patients.

Methods: This Prospective randomized clinical single blinded study included 75 patients with septic shock distributed into three equal groups: Capillary Refill Time (CRT**)** group targeted by normalization of capillary refill time <2 seconds, Lactate group targeted by serum lactate <2mmole/L or decrease by 20% every two hours, and the 3rd group targeted by normalization of base deficit (2 to -2 mmol/L). Measuring capillary refill time, lactate level, and base deficit were performed at baseline and during follow-up. Resuscitation was done according to surviving sepsis campaign guidelines. The primary outcome was to follow up on morbidity after 72 hours by changes in SOFA score; the secondary outcome was to assess 28-day mortality and length of ICU stay.

Results: In the CRT group, CRT value differed significantly at 4,6,8,24,72 hours post-resuscitation in comparison to the basal level on admission (p=0.042, 0.001, 0.001, 0.001, 0.001) respectively. In the lactate group, the lactate value differed significantly at 4,6,8,24,72 hours post-resuscitation in comparison to the basal level on admission (p=0.025, 0.001, 0.001, 0.001, 0.001, 0.001, 0.001) respectively. In the BD group, the base deficit value differed significantly at 4,6,8,24,72 hours post-resuscitation in comparison to basal level on admission (p=0.015, 0.001, 0.001, 0.001, 0.001), respectively. Out of the cases, mortality was reported in 33 cases (44%).

Conclusions: Disturbances of lactate, base deficit, and capillary refill time are from the pathogenic mechanisms in the sepsis and septic shock, and their correction is from the suggested management plan for the sepsis and septic shock.

Keywords: Early Goal-Directed Therapy; Capillary Refill Time; Serum Lactate; Base Deficit; Septic Shock.

INTRODUCTION

Sepsis is a potentially fatal malfunction of an organ caused by an uncontrolled immune response to an infection. Septic shock is a subtype of sepsis characterized by severe abnormalities in cellular metabolism and circulation that significantly raise the risk of death [1]. Those individuals who still need vasopressors to keep their mean arterial pressure (MAP) at 65 mm Hg or higher (indicating circulatory dysfunction) and whose lactate level is greater than two mmol/L are in clinical septic shock [2].

Unfortunately, hypoperfusion is still hard to diagnose, which can lead to severe complications such as coagulopathy, infections, organ failures, and late death. An undersupply of oxygen, which does not meet metabolic demands, is thought to be the cause of organ damage in critically ill patients. A

lack of oxygen to tissues causes anaerobic metabolism, which causes metabolic acidosis, serum lactate buildup, and oxygen debt [3]. Patients with septic shock have a low chance of survival unless they receive early resuscitation quickly [4].

Research examining the utility of capillary refill time (CRT) as a resuscitation target should be encouraged due to the positive outcomes linked to normalizing CRT, the short amount of time it takes to administer fluids, and the fact that it is easy to implement and accessible even in settings with limited resources [5]. Capillary refilling time is among the first parameters to be normalized in individuals who survive septic shock [6].

Adults in critical care can monitor their blood lactate levels to see if tissue hypoxia is developing, how bad their sickness is, and how well they will do. When assessing prognosis and treatment response, serial measures of blood lactate concentrations are superior to single measurements [٧]. Lactate normalization or decreasing by 20 % every two hours is recommended as a resuscitation target, according to recent guidelines in surviving sepsis campaigns [8].

One millimole of base is required to bring the pH of one liter of whole arterial blood to 7.4, with the sample being oxygen-saturated at 37 degrees Celsius and a PaCO2 of forty millimeters of mercury. This quantity is known as the base deficit (BD). A global tissue acidosis approximation can also be obtained from base deficit [9].

Another way to measure tissue perfusion in severely sick patients is by measuring serum base deficit concentrations. Base deficit is strongly correlated with tissue oxygen utilization indices and reflects tissue oxygen use, even in compensated shock [10].

So, we aimed this research to assess the influence of early goal-directed therapy targeting capillary refill time, serum lactate, or base deficit levels on morbidity and 28-day mortality in septic shock patients.

METHODS

This Prospective randomized clinical single-blinded study included 75 patients with septic shock who were treated in the emergency and surgical intensive care units of Zagazig University hospitals for one year, from July 2022 to July 2023.

Sample size: Assuming that the capillary refill time is associated with more success in meeting the predefined perfusion target than lactate (62 percent vs 24 percent) [11,12]. At 80% power and 95% CI, the sample size was 69 cases (23 cases in each group)—open epi. An estimated drop of 5- 10 % of the total sample size equals 6 cases, so the total sample size was 75 cases (25 cases in each group); patients were blinded for allocation to each of the 3 groups (Figure 1).

After the institutional review board's approval of the IRB (IRB#9423/11-4-2022), all participants were asked to sign an informed consent form. Human subjects research adhered to the guidelines set in the Declaration of Helsinki, which is part of the World Medical Association's Code of Ethics.

Inclusion criteria: The study included 75 patients who were admitted to the ICU with criteria of septic shock from both sexes aged 21 - 64 years old, BMI 18.5 – 35 (kg/ m^2), patients with serum lactate > 2mmol/L, and first-degree relative acceptance.

Exclusion criteria: Patients with any of the following: who had a type of shock other than septic shock, pre-existing chronic renal diseases or chronic use of renal replacement therapy, pre-existing chronic liver disease, diabetic ketoacidosis, patients receiving metformin medication, pregnant patients were excluded from the study.

Patients were allocated randomly using a computer randomization program (Random allocation software) into three equal groups; the goal-directed therapy of the first group was targeted by capillary refill time (CRT group), the second by serum lactate (Lactate group), and the third by base deficit (BD group).

Perfusion target: The 1st group (CRT group) (n= 25): normalization of capillary refill time <2 seconds. The 2nd group (Lactate group) (n= 25): serum lactate <2mmole/L or decrease by 20% every two hours. The 3rd group (BD group) (n= 25): normalization of base deficit (2 to -2 mmol/L).

Complete medical history from patients or 1st-degree relatives, physical examinations, and laboratory investigations were performed on all study participants. These investigations included CBC, random blood glucose, kidney function test, liver function test, and coagulation profile. Vital data measurements (MAP, HR, SpO2). Measuring capillary refill time, lactate level, and base deficit.

Resuscitation according to surviving sepsis campaign guidelines: The following measurements were assessed: collecting cultures before giving antibiotics, giving broad-spectrum antibiotics, starting to give 30mL/kg crystalloid for hypotension or lactate levels of 4 mmol/L or higher guided by fluid responsiveness, using vasopressors if needed to keep blood pressure at 65 mm Hg or higher during or after fluid resuscitation, and re-evaluating

lactate levels if they were initially elevated (> 2 mmol/L).

In each group, the following was done: The Sequential Organ Failure Assessment Score (SOFA score) [12]. On admission (basal) and at 24 and 72 hours from resuscitation. Serum lactate, capillary refill time, and base deficit on admission (basal) and every 2 hours during the first eight hours of resuscitation and after 24 and 72 hours of resuscitation. Detection of the source of infection, follow-up of hemodynamics, and temperature in the studied groups. Calculation of vasopressor dose used in studied groups, length of hospital stays, survival rate, and mortality was followed up for 28 days.

The primary outcome was to follow up on morbidity after 72 hours by changes in SOFA score; the secondary outcome was to assess 28-day mortality and length of ICU stay.

STATISTICAL ANALYSIS

Data processing was done using SPSS, version 22.0, a statistical analysis tool developed by IBM. To compare two or more groups on one qualitative variable, the Pearson Chi-square ($\chi 2$) test was utilized. When there were more than two groups with normally distributed data, we utilized analysis of variance (ANOVA) or the F test to see if there was a statistically significant difference. We used the Shapiro-Wilk test to ensure that the groups were normally distributed, and we used Levine's test to ensure that the variances were homogeneous. When comparing more than two sets of skewed data, the Kruskal-Wallis test was employed because ANOVA assumptions were violated. Following a significant analysis of variance (ANOVA) test, we utilized the Tukey honestly significant difference (Tukey-HSD) test to account for multiple comparisons and determine the nature of the substantial difference between the two groups. Following a significant Kruskal-Wallis test, we employed the Bonferroni post hoc test.

RESULTS

No statistically significant differences were found between the three studied groups regarding age, gender distribution, weight, height, body mass index, hemodynamic parameters, or body temperature at admission, after 24 hours, or after 72 hours of admission. However, the body temperature decreased in the three studied groups with follow-up. The study found that 48 percent of sepsis cases were caused by chest infections, with UTIs coming in second (28 percent) (Table 1).

Regarding CRT follow-up in the CRT group: As shown in table (2), in the CRT group, the CRT value differed significantly at 4,6,8,24,72 hours post-resuscitation in comparison to the basal level on admission as (p =0.042, 0.001, 0.001, 0.001, 0.001) respectively.

Regarding serum lactate follow-up in the lactate group: As shown in table (3), in the lactate group, the lactate value differed significantly at 4,6,8,24,72 hours post-resuscitation in comparison to the basal level on admission as (p=0.025, 0.001, 0.001, 0.001, 0.001) respectively.

Regarding base deficit follow-up in the BD group: As shown in table (4), in the base deficit group, there was a statistically significant difference between base deficit value at 4,6,8,24,72 hours post-resuscitation in comparison to basal level on admission as (p-value 0.015, 0.001, 0.001, 0.001, 0.001) respectively.

Non-statistically significant differences were found between the three studied groups regarding the SOFA score at admission, after 24 hours, and after 72 hours of admission. There was a decrease in the SOFA score in the three studied groups with follow-up, with no statistically significant differences between the three studied groups regarding the required dose of vasopressors (p= 0.360). The mean dose was 1.06 ± 0.469 μg/kg/min, 1.21 ± 0.422 μg/kg/min, and 1.23 ± 0.478 μg/kg/min in the CRT group, lactate group, and BD group, respectively (Table 5).

As shown in Table (6), non-statistically significant differences in mortality rate were found between the cases in the three studied groups (p= 0.850). The length of hospital stay had a median of 10 days (range, 5– 30). Out of the 75 cases, mortality was reported in 33 cases (48%). In the CRT targeted group, the number of dead patients was ten patients (40.0%), In the lactate targeted group was 12 patients (48.0%), and in the base deficit targeted group was 11 patients (44.0%)

Table (1): Patients characteristics, hemodynamic, Temperature follow-up in the studied groups:

	CRT group (n= 25)	Lactate group (n= 25)	BD group (n= 25)	P	P1	P2	P3
Age (years)	52.92 ± 7.604	52.36 ± 7.857	54.84 ± 5.949	0.445	1	1	0.679
Gender							
Male	15 (60.0%)	14 (56.0%)	13 (52.0%)	0.850	> 0.50	> 0.50	> 0.50
Female	10 (40.0%)	11 (44.0%)	12 (48.0%)				
Weight (kg)	79.84 ± 13.276	75.54 ± 11.389	83.79 ± 14.190	0.088	0.739	0.862	0.084
Height (m)	1.72 ± 0.074	1.71 ± 0.072	1.72 ± 0.071	0.869	1	1	1
BMI (kg/m^2)	27.12 ± 4.172	25.81 ± 3.701	28.15 ± 3.750	0.109	0.714	1	0.109
	CRT group (n= 25)	**Lactate group (n= 25)**	**BD group (n= 25)**	**P**	**P1**	**P2**	**P3**
Heart rate (bpm)							
Admission	132.36 ± 18.325	136.92 ± 18.819	133.32 ± 19.903	0.672	1	1	1
24 hours	113.68 ± 15.266	115.48 ± 16.902	111.52 ± 21.321	0.740	1	1	1
72 hours	93.24 ± 12.286	96.48 ± 15.623	91.84 ± 20.627	0.598	1	1	0.974
MAP (mmHg)							
Admission	59.60 ± 9.500	54.12 ± 8.506	56.72 ± 9.546	0.116	0.116	0.816	0.963
24 hours	72.84 ± 7.712	71.12 ± 7.612	69.48 ± 6.070	0.260	1	0.306	1
72 hours	86.36 ± 10.214	81.80 ± 8.954	81.60 ± 10.496	0.165	0.324	0.281	1
SpO2 (%)							
Admission	90.52 ± 5.425	92.32 ± 5.064	92.28 ± 5.458	0.398	0.706	0.738	1
24 hours	98.08 ± 1.498	97.52 ± 1.388	97.88 ± 1.481	0.392	0.535	1	1
72 hours	97.64 ± 1.319	98.08 ± 1.288	98.04 ± 1.767	0.510	0.885	1	1
Temperature (C)	**CRT group (n= 25)**	**Lactate group (n= 25)**	**BD group (n= 25)**	**P**	**P1**	**P2**	**P3**
Admission	39.42 ± 1.26	39.60 ± 1.14	39.57 ± 1.404	0.629	1	1	1
24 hours	38.96 ± 0.415	38.98 ± 0.582	38.92 ± 0.604	0.916	1	1	1
72 hours	37.47 ± 0.250	37.48 ± 0.302	37.45 ± 0.348	0.915	1	1	1

Variables	**Study cases n= 75**
Source of infection	
Chest infection	36 (48%)
UTI	21 (28%)
Intraabdominal	12 (16%)
Blood stream/Blood born infections	8 (10.7%)
Cellulitis	7 (9.3%)
Bed sores	6 (8%)

Data is expressed as mean and standard deviation. P is significant when < 0.05. P1: CRT group vs Lactate group. P2: CRT group vs BD group. P3: Lactate group vs BD group. Bonferroni adjustment was applied to post hoc p value.

- CRT capillary refill time, BD base deficit, BMI body mass index

Table (2): CRT follow-up in CRT group:

CRT (second)	Mean & SD	Median	Range	IQR	P
Admission	5.04 ± 1.172	5.00	3.00, 7.00	4.00, 6.00	-
2 hours	4.90 ± 0.823	5.00	3.00, 6.00	4.00, 5.00	0.106
4 hours	4.72 ± 0.642	4.00	3.00, 6.00	4.00, 5.00	0.042*
6 hours	4.12 ± 0.833	4.00	3.00, 6.00	4.00, 4.50	< 0.001*
8 hours	3.48 ± 0.653	3.00	3.00, 5.00	3.00, 4.00	< 0.001*
24 hours	2.72 ± 0.678	3.00	2.00, 4.00	2.00, 3.00	< 0.001*
72 hours	1.92 ± 0.702	2.00	1.00, 3.00	1.00, 2.00	< 0.001*
Data is expressed as mean and standard deviation, median, range and interquartile range. *: P is significant when < 0.05. CRT capillary refill time, SD standard deviation , IQR Interquartile Range					

Table (3): Serum lactate follow-up in lactate group:

Lactate (mmol/L)	Mean & SD	Median	Range	IQR	P
Admission	3.84 ± 0.826	3.65	2.76, 6.20	3.24, 4.43	-
2 hours	3.77 ± 0.740	3.59	2.71, 5.96	3.12, 4.20	0.134
4 hours	3.64 ± 0.677	3.30	2.70, 5.69	2.98, 4.02	0.025*
6 hours	3.30 ± 0.632	3.06	2.61, 5.36	2.90, 3.61	< 0.001*
8 hours	3.05 ± 0.559	2.92	2.49, 4.94	2.64, 3.25	< 0.001*
24 hours	2.24 ± 0.425	2.19	1.50, 3.67	2.00, 2.42	< 0.001*
72 hours	1.69 ± 0.327	1.62	1.03, 2.35	1.47, 1.88	< 0.001*
Data is expressed as mean and standard deviation, median, range and interquartile range. *: P is significant when < 0.05. SD standard deviation, IQR Interquartile Range					

Table (4): Base deficit follow-up in BD group:

Base deficit (mmol/L)	Mean & SD	Median	Range	IQR	P
Admission	10.34 ± 2.146	11	8.00, 12.40	9.35, 11.25	-
2 hours	10.45 ± 2.536	10.65	7.32, 12.15	7.9, 11.86	0.064
4 hours	9.73 ± 2.261	9.15	7.14, 11.55	7.56, 10.76	0.015*
6 hours	7.96 ± 2.012	7.40	5.53, 10.27	5.90, 9.52	< 0.001*
8 hours	6.77 ± 1.609	6.40	4.65, 9.40	5.50, 8.75	< 0.001*
24 hours	3.34 ± 2.512	3.4	2.00, 8.00	3.15, 7.55	< 0.001*
72 hours	2.79 ± 1.290	2.9	1.29, 6.20	1.90, 7.00	< 0.001*
Data is expressed as mean and standard deviation, median, range and interquartile range. P is significant when < 0.05. SD standard deviation, IQR Interquartile Range					

Table (5): Sofa score follow-up, and Vasopressor dose in the studied groups:

SOFA score	CRT group (n= 25)	Lactate group (n= 25)	BD group (n= 25)	P	P1	P2	P3
Admission	9.16 ± 0.987	9.60 ± 0.913	9.60 ± 1.291	0.255	0.458	0.458	1
24 hours	7.48 ± 1.159	7.76 ± 1.091	7.44 ± 1.417	0.607	1	1	1
72 hours	5.48 ± 1.358	5.92 ± 1.038	5.48 ± 1.418	0.380	0.687	1	0.687
Vasopressor (µg/kg/min)	1.06 ± 0.469	1.21 ± 0.422	1.23 ± 0.478	0.360	0.769	0.563	1
Data is expressed as mean and standard deviation. P is significant when < 0.05. P1: CRT group vs Lactate group. P2: CRT group vs BD group. P3: Lactate group vs BD group. Bonferroni adjustment was applied to post hoc p value. SOFA The Sequential Organ Failure Assessment Score, CRT capillary refill time, BD base deficit							

Table (6): Mortality, and outcome in the current study:

	CRT group (n= 25)	**Lactate group (n= 25)**	**BD group (n= 25)**	**P**	**P1**	**P2**	**P3**
Mortality	no. of died patient (10) (40.0%)	no. of died patient (12) (48.0%)	no. of died patient (11) 11 (44.0%)	0.850	> 0.50	> 0.50	> 0.50

Variables	**Study cases n= 75**
Length of hospital stay (days)	10 (5-30)
Survival	
Died	33 (44%)
Survived	42 (56%)

P1: CRT group vs Lactate group. P2: CRT group vs BD group. P3: Lactate group vs BD group. Bonferroni adjustment was applied to post hoc p value

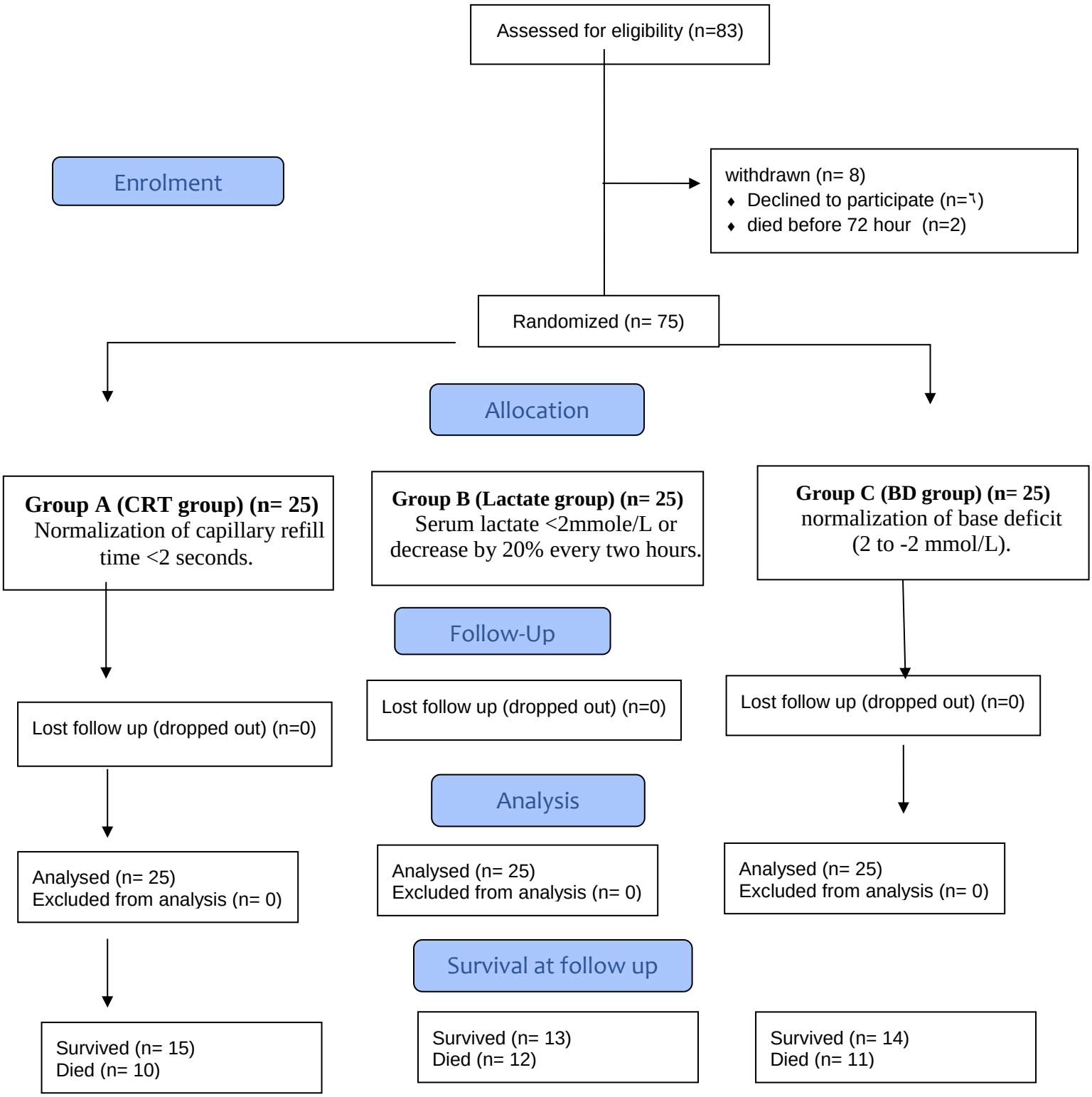

Figure 1: Consort flow diagram

DISCUSSION

Worldwide, sepsis and septic shock rank among the top causes of mortality. When it comes to non-coronary intensive care unit patients, sepsis is the top killer, according to CDC data [13]. A less-than-ideal target for fluid resuscitation, lactate isn't particularly selective and has delayed recovery kinetics [14]. Peripheral perfusion could be a viable alternate target [15]. Normalization of capillary refill time relates to a good prognosis. [5]. Base deficiency is believed to be the first reliable indicator of the non-respiratory part of acid-base balance. Since its discovery in the 1960s, it has been a biochemical indicator of shock, injury severity, and mortality [16].

For this reason, this study was conducted to detect the effects of early goal-directed therapy targeting capillary refill time or serum lactate or base deficit levels on morbidity and 28-day mortality in septic shock patients.

No previous studies have discussed the value of targeting these parameters during sepsis management in single research, and for the first time, targeting the correction of the base deficit has been reported.

In the present study, no statistically significant differences were found between the three studied groups regarding age, gender distribution, weight, height, and body mass index; this indicated efficient randomization to avoid selection bias and its effect on the outcomes.

Since there was no statistically significant difference in the patient data between the cases in Hernandez et al. [6]'s study, which examined the relationship between 6-hour lactate clearance in hyperdynamic septic shock patients and systemic, hepatosplanchnic and microcirculatory perfusion parameters, this finding is consistent with the present study findings.

In the present study, the most common source of sepsis was chest infection (48%), followed by urinary tract infection UTI (28%). This was in line with the findings of Chang et al. [17], who investigated the efficacy of hydrocortisone, vitamin C, and thiamine in treating sepsis and septic shock. They found that pulmonary infections were the most prevalent infections treated with this combination, accounting for 29 percent.

Also, Marik et al. [18], who analyzed the effectiveness of fluid resuscitation in septic shock patients using lactate clearance rate and central venous oxygen saturation as guidelines, discovered that infection most occurred in the lung.

In the present study, the three groups did not differ significantly regarding heart rate, mean arterial pressure (MAP), oxygen saturation, and the required dose of vasopressors after 24 hours and 72 hours of admission.

The current results were in line with Castro et al. [11], who conducted research on the effects of different types of fluid resuscitation on various perfusion parameters in septic shock, including regional, microcirculatory, and hypoxia-related metrics. He found that CRT-targeted fluid resuscitation was not superior to a lactate-targeted one in the primary outcome of fluid administration during the six hours intervention period, in fluid balances, and there were no significant differences in perfusion-related variables or hypoxia surrogates were observed.

On the other hand, the current results disagreed with Hernández et al. [14] in the ANDROMEDA-SHOCK trial, which was a multicenter, randomized, controlled study comparing CRT versus lactate-targeted resuscitation in 424 patients with early septic shock. They found that CRT-targeted resuscitation was associated with faster improvement ($P<0.001$), fewer resuscitation fluids ($P=0.010$), and less vasopressor ($P=0.020$) than in a lactate-targeted resuscitation.

In the present study, in the CRT group, the CRT value differed significantly at 4,6,8,24,72 hours post-resuscitation in comparison to the basal level on admission as ($p=0.042$, 0.001, 0.001, 0.001, 0.001, 0.001, 0.001) respectively. This was agreed with Lara et al. [5], who investigated the relationship between the duration of capillary refill time during fluid resuscitation and mortality in emergency department patients with sepsis-related hyperlactatemia and found that Hyperlactatemia sepsis patients with normal CRT after initial fluid resuscitation exhibit better clinical outcomes than patients with abnormal CRT. Furthermore, it has been shown by Jacquet-Lagrèze et al. [19] that CRT is a variable sensitive to changes in blood flow and may show quick improvements following an increase in systemic blood flow. Consequently, it can be evaluated more regularly, allowing for discontinuing resuscitation at an earlier stage.

Also, Hernandez et al., 2014 [20] stated that CRT was the first perfusion variable to reach a significant improvement but in his study CRT but in his study improvement was two hours after ICU-based resuscitation, and 70% of septic shock survivors exhibited a normal CRT at two h; this difference could be explained by variations in the sample size

besides variations in the treatment regimen applied.CRT was the first perfusion variable to improve significantly at this point.

In the present study, in the lactate group, the lactate value differed significantly at 4,6,8,24,72 hours post-resuscitation in comparison to basal level on admission as (p= 0.025, 0.001, 0.001, 0.001, 0.001, 0.001, 0.001) respectively. Together with Hernández et al. [14], this resulted from the Andromeda-Shock study, in which 424 patients showed significantly reduced lactate levels after 48 and 72 hours, regardless of their fluid responsiveness status.

In the present study, in the base deficit group, the base deficit value differed significantly at 4,6,8,24,72 hours post-resuscitation in comparison to the basal level on admission as (p-value 0.015, 0.001, 0.001, 0.001, 0.001, 0.001) respectively. This was in the same line with Verma and Cavita. [21] who investigated the relationship between serum lactate and base deficit as a marker of shock patients' risk of morbidity and death in surgical intensive care unit (ICU) settings. They found that resuscitation that reduced base deficit levels to near normal could be a successful treatment.

In the present study, out of the 75 cases, mortality was reported in 33 cases (44%). In the CRT targeted group, the number of dead patients was ten patients (40.0%), In the lactate targeted group was 12 patients (48.0%), and in the base deficit targeted group was 11 patients (44.0%). In the present study, no statistically significant differences were found between the three study groups regarding the incidence of mortality. The data presented here contradict those of Hernández et al. [14], who found that CRT-targeted resuscitation had a trend toward a lower 28-day mortality rate than lactate-targeted resuscitation in the ANDROMEDA-SHOCK trial (43.4 percent vs. 34.9 percent, respectively; P=0.060).

Limitations:

The current study had some limitations; firstly, the sample size might be relatively small, with 75 subjects. The results may not apply to a broader population because of this. There is a lack of significant difference between the study groups. At the same time, the main limitation of the current study is the small sample size of the included cases, which could decrease the power of the obtained results. Further studies should include larger sample cases from more than a single center. Additional studies are needed to test the value of targeting the correction of lactate, base deficit, and capillary refill time during the management of septic shock.

CONCLUSIONS

Lactate, base deficit, and capillary refill time disturbances are caused by the pathogenic mechanisms of sepsis and septic shock, and their correction is part of the suggested management plan for these conditions. However, there was no statistically significant difference in the primary outcomes after targeting the correction of lactate, base deficit, and capillary refill time in septic shock patients.

No potential conflict of interest was reported by the authors.

The authors have no financial interest to declare in relation to the content of this article.

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