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CORRELATION OF SERUM LACTATE LEVELS WITH CLINICAL AND BEDSIDE NON-INVASIVE PARAMETERS IN SUSPECTED CASES OF SEPTIC SHOCK TO ASSESS OUTCOME IN 24 HOURS

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ABSTRACT **INTRODUCTION:** Sepsis is a common condition that is associated with unacceptably high mortality and long-term morbidity for those who survive. Lactate,CRT, CVP, MAP and IVC diameter can be used to guide management in cases of sepsis. **AIM:** The objective of the study is to correlate the serum lactate levels with CRT, MAP and IVC diameter in patients with suspected septic shock. To find out whether other parameters in resource limited regions can replace lactate. **MATERIALS AND METHODS:** The study was a retrospective, time-bound, hospital-based, observational study. The study was conducted during the period from December 2016 to November 2017 **RESULTS:** The mean age was 45.23 ± 16.84, and 66% were males. There is a weak negative correlation between lactate and MAP at admission and 24 hours, suggesting that as lactate increases MAP tends to fall and vice versa. The correlation between the serum lactate and other parameters like IVC and CRT was very weak and inconsistent at different periods based on clinical improvement. **CONCLUSION:** A weak negative correlation was found between serum lactate and MAP. Maintaining MAP within a normal range is vital for a better outcome. Although MAP is promising as a replacement for lactate, further large multi-centered trials are needed to use it with confidence.

KEYWORDS : Sepsis, Lactate, Map, Ivc, And Cft

INTRODUCTION

Sepsis is a common condition associated with unacceptably high mortality and long-term morbidity for those who survive. The World Health Assembly and WHO made sepsis a global health priority in 2017. They have adopted a resolution to improve the prevention, diagnosis, and management of sepsis.[1]

Sepsis is defined as infection with organ dysfunction. This definition codifies organ dysfunction using the Sequential Organ Failure Assessment score(SOFA). qSOFA scoring has been introduced recently as a quick diagnostic tool for organ dysfunction due to sepsis.[1]

Lactate, MAP, systolic BP, and CFT can be used to guide management either individually or in combination. Lactate has been proven as an essential indicator of diagnosis, a guide for resuscitation. It can be taken as a standard against which other parameters can be compared to guide resuscitation. All these parameters combined can give a better opportunity at successful resuscitation while avoiding complications.[2]

This study helps us correlate the serum lactate levels with CRT, MAP, and IVC diameter in patients with suspected septic shock. To find out whether other parameters can replace lactate in resource-limited regions

MATERIALS AND METHODS

The study was a retrospective, time-bound, hospital-based, observational study. The study was conducted during a period of 12 months from November2016 – December 2017.

All cases presented to the EMERGENCY DEPARTMENT with features suggestive of sepsis were taken as study population and analyzed using Q-SOFA. Sample size was calculated as 100. Patients aged more than 15years and those patients who satisfy the criteria for sepsis and septic shock based on QSOFA and SOFA scores were included in the study.

Patients who were in mechanical ventilation and in whom there are technical difficulties in measuring IVC diameter accurately were excluded from the study.

RESULTS

A total of 100 people were included in the analysis.

The mean age was 45.23 ± 16.84 in the study population, the minimum age was 15 years, and the maximum period was 78 years in the study population

Table 1: Descriptive analysis of age in the study population (N=100)

Parameter	Mean ± SD	Median	Min	Max	95% C.I	
					Lower	Upper
Age	45.31 ± 16.67	45.00	15.00	78.00	42.00	48.62

Table 2: Descriptive analysis of clinical parameter in the study population

Parameter	Admission	24 hours
Lactate max		
<2	12 (12%)	25 (25%)
≥2	88 (88%)	75 (75%)
MAP		
<65	30 (30%)	21 (21%)
≥65	70 (70%)	79 (79%)
IVC diameter		
<2CM	91 (91%)	69 (69%)
≥2CM	9 (9%)	31 (31%)
Capillary refilling time		
≤2 SEC	75 (75%)	77 (77%)
>2SEC	25 (29%)	23 (23%)

At initial presentation, 12% participants had lactate max <2 and 88% had lactate max ≥2. 24 hours later, 25 % participants had lactate max < 2 and 75 % participants had lactate max ≥2. On admission, 30% of participants had MAP <65, and 70% had MAP ≥65. After 24 hours, 21 (21 %) participants had MAP <65, and 79 % had MAP ≥65. At the time of presentation, 91 % of participants had an IVC diameter <2cm, and 9 % had an IVC diameter of ≥2cm. After 24 hours, 69 % of participants had IVC diameter <2cm, and 31% had an IVC diameter of ≥2cm. On admission, 75 % of participants had CRT ≤2 SEC, and 25% had CRT >2SEC. After 24 hours, 77% of participants had CRT ≤2 SEC, and 23% had CRT >2SEC.

Table3:Correlation between lactate max at admission and various score in the study population (N= 100)

Parameter	Spearman Correlation	P-value
MAP (mm Hg) at admission	-0.407	<0.001
IVC Diameter (cm) at admission	0.082	0.418
Capillary Refilling time (sec) at admission	-0.057	0.571

At admission, a weak negative correlation was found between lactate max and MAP (mm Hg), a weak positive correlation between lactate max and IVC Diameter (cm), and a weak negative correlation between

lactate max and Capillary Refilling time (sec).

Table4: Correlation between lactate max at 24 hours and various score in the study population (N= 100)

Parameter	Spearman Correlation	P-value
MAP (mm Hg) at 24 hours	-0.338	0.001
IVC Diameter at 24 hours	0.246	0.014
Capillary Refilling time (sec) at 24 hours	0.268	0.007

Even after 24 hours of hospital management, the correlations persisted between lactate max and MAP, MAP, and IVC diameter. But there was a weak negative correlation between lactate max and Capillary Refilling time (sec) at 24 hours.

DISCUSSION

With the advancement of technology and the availability of new imaging modalities and biochemical markers, the list is continuously expanding. The current study has been one such attempt to correlate the serum lactate levels with CRT, MAP, and IVC diameter in patients with suspected septic shock.

Fever (85%) is the most frequent presenting complaint followed by a cough and difficulty in breathing (62%) and vomiting and loose stools in (31%). With the above symptoms, the respiratory system appears to be the most common site of infection leading to sepsis followed by gastrointestinal and genitourinary systems. In a study by Esper, respiratory tract infections were the most common site of infection correlating with the findings of the current research, followed by gastrointestinal diseases, also comparable with the present study.

In the current study, the mean lactate was 5.65 ± 3.48, with a range of 1.09 to 18.In a survey by Houwink et al2, the median lactate level at admission was 1.9, which is comparatively low. The higher lactate levels in the current study can be due to delayed presentations, improper resuscitation before presenting to the ED.

The mean lactate at 24 hours was 4.19 ± 4.02 in the study population, with a range of 0.50 to 21. 25 % of participants had lactate <2, and 75 % of participants had lactate ≥2. In a study by Houwink et al2, the median lactate level after 24 hours was 1.8 (1.2–2.8), which is comparatively low. In a survey by Houwink et al, the number of patients with mean lactate (24hrs) below 2mmol/l and above 2mmol/l was 57.73% and 42.27%, respectively. The mean lactate levels at admission in this study were closer to the mean values reported in the current study. It appears that both lactate build-up and clearance is different in different geological locations. Genetic makeup and level of resuscitation also appear to influence the lactate clearance. We suggest further multi-centered trials to answer this question.

In the current study, at admission, the mean MAP was 80.47 ± 23.7 in the study population, ranged between 43 to 136mmhg. In a survey by Houwink et al. 2, the mean MAP at admission was 76.9± 21, similar to our findings. At entry, 30% of participants had MAP <65, and 70% had MAP ≥65. In a study by Houwink et al. 2, the first MAP below 65 mmHg was present in 31 %, similar to our research. The MAP stayed significantly lower over 24 hours than patients with a first MAP above 65 mmHg ($p < 0.001$). At 24 hours, the mean MAP was 78.38 ± 18.02, ranged from 40 to 110mmhg. After 24 hours, 21% of participants had MAP <65, and 79% had MAP ≥65. Overall, patients who had a MAP of <65 didn't show much improvement.

The mean IVC diameter was 1.41 ± 0.4 cm at the time of admission, with a range from 0.40 cm to 2.30 cm. At 24 hours, the mean IVC diameter was 1.78 ± 0.36 in the study population, ranged between 0.60 cm to 2.70 cm. At admission, 91% of participants had IVC diameter <2cm suggesting fluid depletion, and 9% of participants had IVC diameter ≥2cm. After 24 hours, 69% of participants had IVC diameter <2cm, and 31% had an IVC diameter of ≥2cm. Feissel et al [6]have reported IVC can be a useful parameter in guiding fluid management in sepsis patients. The mean IVC values reported in this study are entirely close to the mean IVC values reported in our study. In this study, the mean IVC diameter was 18.5± 6.0 mm. The mean expiratory IVC diameter was 16.7 ± 6.2 mm. Both the inspiratory and expiratory IVC diameters were slightly higher than the current study.

At admission, the mean capillary refilling time was 2.4 ± 0.78 in the study population with a range of 2 sec to 5 sec. In a study by Lara et al. , the median CRT at ED presentation was 3 sec with the interquartile range of 2-4 sec, similar to our research. At admission, 75% of participants had CRT ≤2 SEC, and 25% had CRT >2SEC. After 24 hours, the mean capillary refilling time was 2.49 ± 0.97 in the study population with a range of 2 sec to 5 sec. In a study by Lara et al. , the median CRT post fluid resuscitation was 2 sec with the interquartile range of 1-3 sec, similar to our research. After 24 hours, 77% of participants had CRT ≤2 SEC, and 23% had CRT >2SEC.

There was a weak negative correlation between lactate max at admission and MAP (mm Hg) at the entrance (R-Value: -0.407, P-value: <0.001), suggesting as MAP decreases, lactate is increasing. So MAP and lactate are correlating even though the link is weak. There was a weak negative correlation between lactate max at 24 hours and MAP (mm Hg) at 24 hours (R-Value: -0.338, P-value: 0.001).

There was a week positive correlation between lactate at admission and IVC Diameter (cm) at admission(R-Value: 0.082, P-value: 0.418). There was a week positive correlation between lactate max at 24hrsand IVC Diameter (cm) at 24 hours (R-Value: 0.246, P-value: 0.014). In this case, the current study failed to show a linear relation between lactate and IVC diameter.

There was a week negative correlation between lactate at admission and Capillary Refilling time (sec) at entry (R-Value: -0.057, P-value: 0.571). There was a week positive correlation between lactate at 24hrsand Capillary Refilling time (sec) at 24 hours (R-Value: 0.268, P-value: 0.007).

CONCLUSION

Even though sepsis patients were treated according to standard sepsis protocol, about half of them seemed to deteriorate. This non-improvement might be due to increasing age, associated co-morbidities, and lifestyle habits. Lactate levels and lactate clearance seem to be leading markers to ascertain improvement or deterioration. Keeping lactate <2 is a crucial endpoint in treating sepsis patients effectively.

The current study has found a weak negative correlation between serum lactate and MAP, indicating that as MAP decreases as lactate levels increase. So this calls for maintaining MAP within the normal range for a better outcome. The correlation between the serum lactate and other parameters like IVC and CRT was very weak and inconsistent at different periods and subgroups based on clinical improvement. Such parameters like IVC, CRT alone cannot guide the management of sepsis patients.

This study concludes that no single parameter can be a diagnostic or prognostic indicator. But when all these parameters are combined, and early normalization of all these parameters would achieve a better outcome.

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