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EVALUATION OF SERUM LACTATE AS A PREDICTOR OF MORBIDITY AND MORTALITY IN SEPSIS AND TRAUMA PATIENTS

General Surgery

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ABSTRACT

Lactate is produced in the cells in anaerobic metabolism of glucose for the generation of adenosine triphosphate (ATP) and may be an indicator of occult or global hypoperfusion. Thus, early serum lactate measurement may be a prognostic indicator of the outcome in critically ill patients. Therefore, the present study was conducted to assess the value of serial measurements of serum lactate levels in the predicting the outcome. After obtaining approval from the Institutional Ethics Committee and written voluntary informed consent from the relatives/patients, a total of 50 cases of trauma to chest or abdomen and patients with sepsis as per quick Sequential Organ Failure Assessment (qSOFA) score or having Systemic Inflammatory Response Syndrome (SIRS) were included. Serum lactate levels were measured at 24 and 48 hours and the final outcome and duration of discharge was noted. It was observed that serum lactate levels were similar in terms of gender, presence of multiple organ dysfunction syndrome (MODS) and type of treatment. Baseline lactate levels were similar. Death was associated with significant increase in serum lactate levels at 24 and 48 hours while a decrease in levels were associated with early discharge (at less than 7 days). It can be effectively concluded that serial measurements of serum lactate levels are of prognostic value to predict the outcome in critically ill patient with increasing levels being a harbinger of potentially fatal outcomes.

KEYWORDS

Critical care, Intensive Care Unit, Multiple Organ Dysfunction Syndrome, Lactate, Sepsis

INTRODUCTION

Critically ill patients admitted in the Intensive Care Unit (ICU) have a narrow window for revival of the cells and organs. Multiple organ dysfunction syndrome (MODS) is the leading cause of morbidity and mortality in the ICU.1 It is a clinical condition associated with longer ICU stays, increased mortality, requires extensive clinical management and utilisation of huge healthcare resources.[2] There has been search for a biomarker for early prediction of morbidity and mortality in such cases. One such predictor is serum lactate.

Normally, glucose is metabolised at the cellular level by aerobic mechanism and adenosine triphosphate (ATP) is generated.3 However, in the event of decreased oxygen supply (as in respiratory or circulatory failure), pyruvate is converted to lactate anaerobically.[4] As almost half of the lactate uptake is done in liver and a third in kidney,[5] therefore, in the absence of underlying liver and kidney diseases, tissue lactate levels may be an indirect measure of oxygen debt and indicator of shock state. It is an indicator of tissue level hypoxia while organ damage is yet to set in. Therefore, it may help in predicting the outcome and in early institution of resuscitation measures.

In the recent years, there has been an increase in research in the usefulness of serum lactate as a marker for outcome in critically ill ICU patients. Studies have observed that serial measurements of lactate with early normalisation may be a more useful prognostic indicator as compared to an isolated single value.[6,7] However, the ideal duration of measurements is yet to be established. Therefore, the present study was conducted to assess the role of serum lactate levels in predicting the outcome of critically ill patients admitted in the ICU.

MATERIALS AND METHOD

This prospective observational study was conducted under the Department of General Surgery, MGM Medical College, Kamothe, Navi Mumbai from October 2023 to March 2024. A total of 50 patients aged above 18 years and admitted in the ICU with a history of trauma to chest or abdomen or in sepsis as diagnosed by quick Sequential Organ Assessment (qSOFA) score were included in the study.[8] Systemic inflammatory response syndrome (SIRS) was defined by any two of the following criteria: body temperature less than 36 degree Celsius or more than 38 degree Celsius, heart rate greater than 90 beats/minute, respiratory rate greater than 20 breaths/minute or partial pressure of carbon dioxide (CO2) less than 32 mmHg or leukocyte count greater than 12000 or less than 4000/microliters or over 10% immature forms or bands.[9]

Patients with known history of alcoholism or any known comorbidities involving coronary artery disease, renal dysfunction, liver dysfunction, malignancy and pregnant patients were excluded from the study.

After getting approval from the Institutional Ethics Committee, the research was started. Patients meeting the aforementioned inclusion and exclusion criteria were enrolled in the study after obtaining written, informed consent from their relatives/patients. Once patients were enrolled, details of present, past and personal histories were noted. Patients were diagnosed with SIRS or MODS in case of involvement of two or more organ systems.

Routine hematological investigations were done. Serum lactate level were tested at 24 hours and 48 hours. The patients were followed up till discharge or declared dead after routine resuscitation protocols. The duration was noted.

The data was entered in excel and analysed using Statistical Package for Social Sciences (SPSS), version 22.0. P value of less than 0.05 was considered as "statistically significant" and indicated by "*" in the Tables.

RESULTS

In the present study, there was a male preponderance (90%). The mean age of the patients was almost similar in both the genders (males: 42.89 ± 16 years and females: 47.20 ± 15.63 years); P value: 0.570. There was an equal proportion of cases admitted for trauma and sepsis. MODS was present in 28% of the cases. 42% cases were operated while rest were managed conservatively. After treatment, death was reported in 20% of the cases. Amongst the cases being discharged, majority of the cases were discharged in less than 7 days (60%).

The baseline lactate levels were similar in both the genders (P value: 0.166); trauma and sepsis (P value: 0.091); presence of MODS (P value: 0.783) and according to the type of treatment (P value: 0.428).

When assessed according to the outcome, it was observed that the baseline lactate levels were similar in all the groups (P value: 0.342). Thereafter, an increase in the levels were noted in the cases where the outcome was death as compared to decrease in lactate levels in the cases who recovered fully and were discharged within 7 days; P value: less than 0.001 (Table 1 and Figure 1).

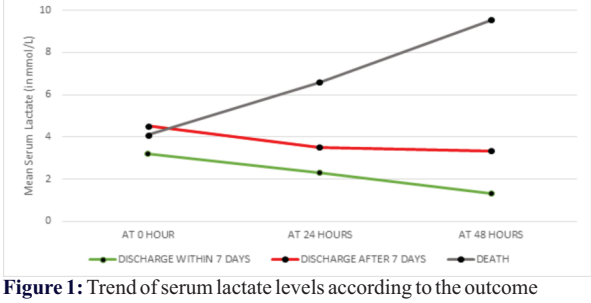

Figure 1: Trend of serum lactate levels according to the outcome

Table 1: Distribution Of The Serum Lactate Levels According To The Outcome

Outcome	Discharge Within 7 Days	Discharge After 7 Days	Death	P Value
AT 0 HOUR	3.21 ± 2.00	4.52 ± 3.73	4.09 ± 2.88	0.342
AT 24 HOURS	2.29 ± 1.65	3.51 ± 1.93	6.60 ± 3.18	<0.001*
AT 48 HOURS	1.30 ± 0.58	3.34 ± 1.57	9.54 ± 3.52	<0.001*

DISCUSSION

In our study, we observed that amongst the cases admitted in ICU for trauma and sepsis, there was a significant association between the outcome and serum lactate levels. Baseline lactate levels at the time of admission were recorded in all the patients, it was observed that the patients having full recovery and discharged within 7 days had a significant decrease in serum lactate levels at 24 and at 48 hours. A mild increase in serum lactate levels was observed in the cases who recovered and were discharged later after 7 days while a significant increase in serum lactate levels were noted in cases ending up in death.

In the study by Dübendorfer C. et al,[10] they conducted a study on 724 adult polytrauma patients. The mean age of their cases (39 years) and male preponderance (77%) was almost similar to the present study. They observed and concluded that lactate showed significant association in the prediction of sepsis or death in all the polytrauma cases, except in those with isolated traumatic brain injury (TBI). Similar significant association of serum lactate was observed with adverse outcomes[11] and mortality.[12,13] Studies have also documented association between adverse outcomes and decreased lactate clearance.[14,15]

It may be of essence to note here that lactate clearance is less preferred option to monitor patients as compared to serum lactate levels due to a number of reasons. Firstly, for assessing clearance, the levels may have to be monitored for upto 6 times per day which limits its feasibility in a limited resource country like ours. Also, it may be a misnomer as the septic state is associated with more of an overproduction of lactate as compared to affecting clearance. Therefore, end point of the serum lactate level may be of more significance.

Limitations:

The present study was limited by the attendance of patients having trauma or sepsis. Therefore, the results may not be generalised.

CONCLUSION

Serum lactate levels may be a potentially useful indicator of the outcome in critically ill patients in ICU. It can be effectively concluded from the present study that serial serum lactate measurements have prognostic significance in the prediction of outcome. A rising serum lactate level, particularly in the first 48 hours, may be a strong indicator for potentially fatal outcome.

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