

## A Hospital Based Prospective Study to Assess the Early Lactate Clearance For Predicting Hospital Mortality of Children with Sepsis

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### Abstract

**Background:** Sepsis is one of the most common and deadly diseases worldwide. It is characterized by a life-threatening “disproportionate” immune response to infection, with high mortality. Lactate is known to play a major role in energy production and cellular metabolism. Hence, the present study was undertaken for assessing the role of early lactate clearance for predicting n hospital mortality children with sepsis. **Methods:** Assessment of all the patients of the pediatric ICU was done. A total of 50 sepsis patients were enrolled. Complete demographic and clinical details were obtained. Lactate levels were measured in arterial blood using a blood gas analyser at different time intervals. Outcome was recorded. All the results were summered and were subjected to statistical analysis. **Results:** A total of 50 subjects with mean age of 52.1 months were enrolled. Among them, 60 percent were males while the remaining were females. Pneumonia, Encephalitis, Meningitis, Dengue, Burn and Abscess were the underlying pathology in 36 %, 30 %, 20 %, 6 %, 4 %, and 4 % of the patients respectively. Mortality rate was 30 percent. Lactate clearance was found to be significant predictor of mortality. **Conclusion:** From the above results, the authors conclude that persistently high lactate levels are a predictor of mortality in pediatric patients with sepsis.

**Key words:** Lactate, Sepsis, Mortality.

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### Introduction

Sepsis is one of the most common and deadly diseases worldwide. It is characterized by a life-threatening “disproportionate” immune response to infection, with high mortality. The long-term morbidity of survivors is also a major public health problem. In daily clinical practice, serum lactate elevation is among the most often used parameters for outcome prediction. Lactate metabolism had been introduced as one of the most promising approaches for individualized treatment in septic patients. The pathophysiology is still the subject of lively debate; although it is well known that high lactate indicates a patient at risk, we do not know if elevated lactate represents the consequence of, or the physiological response to, critical illness. Historically, lactate has been interpreted as a marker of anaerobic glycolysis following tissue hypoxia. More recent studies show, however, that lactate is a central key in glucose metabolism, and is not the result of anaerobic glycolysis[1-3].

Lactate is known to play a major role in energy production and cellular metabolism. Lactic acidosis can occur in various conditions such as sepsis, liver diseases, trauma, shock, vigorous exercises, drug intoxication, and cancer. Previous studies showed that other nonhypoxic causes can contribute to the elevation of lactate levels. Besides tissue hypoxia, mitochondrial defect in oxygen utilization, impaired function of pyruvate dehydrogenase, mismatch between oxygen delivery and oxygen consumption, and accelerated aerobic

glycolysis driven by sepsis-associated inflammation have been proposed as potential causes of lactate elevation[4-6]. Hence; the present study was undertaken for assessing the role of early lactate clearance for predicting n hospital mortality children with sepsis.

### Materials & methods

The present study was undertaken for assessing the role of early lactate clearance for predicting n hospital mortality children with sepsis. Ethical approval was obtained from institutional ethical committee and written consent was obtained from all the patients after explaining in detail the entire research protocol. Assessment of all the patients of the pediatric ICU was done. The exclusion criteria included:

- Patients with other causes of shock not due to sepsis itself,
- Patients with presence of any malignancies
- Patients on any form of immunosuppressive treatment
- Patients with presence of conditions known to cause elevated lactate

A total of 50 sepsis patients were enrolled. Complete demographic and clinical details were obtained. Lactate levels were measured in arterial blood using a blood gas analyser at different time intervals. Outcome was recorded. All the results were summered and were subjected to statistical analysis.

### Results

A total of 50 subjects with mean age of 52.1 months were enrolled. Among them, 60 percent were males while the remaining were females. Pneumonia, Encephalitis, Meningitis, Dengue, Burn and Abscess were the underlying pathology in 36 %, 30 %, 20 %, 6 %, 4 %, and 4 % of the patients respectively. Mortality rate was 30

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percent. Lactate clearance was found to be significant predictor of mortality.

**Table 1: Demographic data**

Variable		Number
Mean age (months)		52.1
Gender	Males (%)	60
	Females (%)	40
Underlying pathology	Pneumonia	36
	Encephalitis	30
	Meningitis	20
	Dengue	6
	Burn	4
	Abscess	4

**Table 2: Outcome**

Outcome	Number	Percentage
Survived	35	70
Mortality	15	30

**Table 3: Comparison of lactate levels among survivors and non-survivors**

Lactate clearance (%)	Survivors	Non-survives
Mean	19.5	-25.4
SD	20.3	43.2
p- value	0.0000 (Significant)	

## Discussion

Sepsis in children has been defined as presence of organ dysfunction in a child with systemic inflammatory response syndrome (SIRS) with suspected infection and the prevalence has been reported between 8–15%. Sepsis remains one of the leading causes of mortality accounting for nearly 7% of deaths among children. Early diagnosis and effective management of sepsis is critical to successful treatment. The “Sepsis bundles” were introduced with a view to facilitate early recognition and timely management of sepsis. These were modified in 2016 to include blood lactate as an indicator of global organ hypoperfusion and shock associated with sepsis in assessment of septic patients in 2016 by International Surviving Sepsis Campaign. It is believed that lactate is an anaerobic metabolite, which may be increased in sepsis due to tissue hypoxia, excess adrenergic stimulation, or decreased hepatic clearance. Hyperlactaemia is a cardinal finding of sepsis and blood lactate level of up to 2 mmol/L is usually defined to be normal for critically ill patients[7-10]. Hence; the present study was undertaken for assessing the role of early lactate clearance for predicting in hospital mortality children with sepsis.

A total of 50 subjects with mean age of 52.1 months were enrolled. Among them, 60 percent were males while the remaining were females. Pneumonia, Encephalitis, Meningitis, Dengue, Burn and Abscess were the underlying pathology in 36 %, 30 %, 20 %, 6 %, 4 %, and 4 % of the patients respectively. Jaiswal P et al compared the performance of plasma lactate with high-sensitivity C-reactive protein (hs-CRP), and paediatric sepsis-related organ failure assessment (pSOFA) score for predicting mortality in septic children. Serial plasma lactate and hs-CRP levels and pSOFA score was assessed during early hospital stay in septic children. Out of 149 participants, 45 died. Plasma lactate at 0 h and 6 h was significantly higher, and lactate clearance was significantly lower in non-survivors. The optimal cut-off of plasma lactate at 6h for identifying mortality was 2.5 mmol/L (sensitivity 85% and specificity 74%). pSOFA score had the best predictive ability for mortality (AUC 0.89) followed by hs-CRP at 0 h (AUC 0.86), hs-CRP at 48 h (AUC 0.83), plasma lactate levels at 6 h (AUC 0.83), and plasma lactate at 0 h (AUC 0.67). pSOFA score, hs-CRP and hyperlactemia at 6 h can identify septic children at risk of dying[11].

In the present study, mortality rate was 30 percent. Lactate clearance was found to be significant predictor of mortality. Choudhary R et al evaluated the predictive value of lactate clearance and to determine the optimal cut-off value for predicting outcome in children with

septic shock. Serial lactate levels were measured at PICU admission, 24 and 48 h later. Lactate clearance, percent decrease in lactate level in 24 h, was calculated. The mean lactate levels at admission were significantly higher in the nonsurvivors than survivors,  $5.12 \pm 3.51$  versus  $3.13 \pm 1.71$  mmol/L ( $P = 0.0001$ ). The cut-off for lactate level at admission for the best prediction of mortality was determined as  $\geq 4$  mmol/L (odds ratio 5.4; 95% confidence interval [CI] = 2.45–12.09). Mean lactate clearance was significantly higher in survivors than nonsurvivors ( $17.9 \pm 39.9$  vs.  $-23.2 \pm 62.7$ ;  $P < 0.0001$ ). A lactate clearance rate of  $<10\%$  at 24 h had a sensitivity and specificity of 78.7% and 72.2%, respectively and a positive predictive value of 83.1% for death. Failure to achieve a lactate clearance of more than 10% was associated with greater risk of mortality (likelihood ratio + 2.83; 95% CI = 1.82–4.41). Serial lactate levels can be used to predict outcome in pediatric septic shock. A 24 h lactate clearance cut-off of  $<10\%$  is a predictor of in-hospital mortality in such patients[12].

## Conclusion

From the above results, the authors conclude that persistently high lactate levels are a predictor of mortality in pediatric patients with sepsis.

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