

Significance of lactate and its clearance within 6 hours of admission in children with sepsis and septic shock admitted to PICU

Roopa B Mangshetty^{1*}, Aishwarya Patil², Sharanagouda Patil³

¹Associate Professor, ²Resident, ³Professor and HOD, Department of Paediatrics, Mahadevappa Rampure Medical College, Gulbarga, Karnataka, INDIA.

Email: rmangshetty@gmail.com, sunny07nov@gmail.com

Abstract

Aims and Objective: To measure the serum lactate levels in patient with sepsis and septic shock. To determine and correlate lactate clearance within 6 hours of admission with sepsis and septic shock, with PICU mortality. **Methods:** Admission to PICU (aged >2months and <18yrs) were studied between 2015-2016 after obtaining written informed consent from parents. Serum lactate estimation was done at admission and 6 hours after admission, lactate clearance (lactate level at admission – lactate level after 6 hours of admission/ lactate level at admission * 100) in first 6 hours of hospitalization was correlated with PICU mortality. **Results:** 27 out of 55 patients admitted to PICU died due to sepsis and septic shock, 69% died among those with delayed/ poor clearance(clearance <30%) compared to 30% in those with good lactate clearance and 0.1% died despite good lactate clearance and 9.2% improved despite poor lactate clearance. **Conclusion:** Lactate levels and its clearance within 6hours of admission predicts significantly the mortality in PICU in patients admitted with sepsis and septic shock

Key Words: Lactate clearance; Lactate levels; sepsis; septic shock.

*Address for Correspondence:

Dr. Roopa B. Mangshetty, Department of Paediatrics, Mahadevappa Rampure Medical College, Gulbarga-585105, Karnataka, INDIA.

Email: rmangshetty@gmail.com

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predicting mortality in patients with sepsis¹⁰ Nguyen reported that 'lactate clearance', defined as the percentage decrease in lactate from emergency department presentation to 6 hours, was an independent predictor of mortality¹. They concluded that 'lactate clearance in the early hospital course may indicate a resolution of global tissue hypoxia and that this is associated with decreased mortality rates.' We studied the significance of lactate and its clearance within 6 hours of admission could help predict the mortality in patients with sepsis.

INTRODUCTION

Hyperlactemia indicates inadequate tissue perfusion and reflects the severity of illness particularly in septicemia and shock due to sepsis^{1,2}. Lactate is a product of anaerobic cellular metabolism³ that occurs due to poor oxygen delivery to tissues due to septic shock, various studies have established the use of lactate as a prognostic marker of global tissue hypoxia in circulatory shock⁴⁻⁹. Lactate clearance is the rate of fall in lactate after resuscitation is started and has shown promising results in

MATERIALS AND METHODS

Admissions to the PICU (aged >2 month and <18 years) were studied between June 2015 and June 2016 after obtaining informed written consent from parent. Children with inborn error of metabolism, trauma, cardiogenic, oligemic, anaphylactic, neurogenic, endocrinological, and dengue shock, patients with known malignancies and immunosuppressive treatment, patients with serious underlying neurological disease, and major congenital malformations, postoperative cases HIV positive patients

with known end stage processes were excluded. The study was approved by the hospital ethics committee. A convenience sample of 55 patients admitted consecutively was enrolled. Heparinized syringe was used to collect venous blood. Lactate estimation was done by Radiometer Copenhagen ABL 555 blood gas analyzer. Lactate levels were estimated at admission and after six hours of admission and clearance was calculated as follows: Lactate clearance = (lactate level at admission – lactate level after 6hours of admission/ lactate level at admission * 100).

Statistical Methods

Statistical analysis was performed using the windows SPSS 20.0. The continuous variables with normal distributions were expressed as mean standard deviation

and were compared using Student’s t-test. The continuous variables with an asymmetrical distribution were expressed as median and respective range interval were compared using the non parametric Mann-Whitney test

RESULTS

Out of 55 children, (mean age 27.33 ± 35.38, range 2 months to 144 months, male female ratio 1.5:1, table 1),33 died. Initial lactate was significantly different between those who died and those who survived (2.86 ± 0.74 vs 4.52 ± 1.71, P=0.001, table 2), and lactate level clearance after 6 hours of admission was significantly lower in those who died (20.23 ± 9.77) than those who survived (38.29 ± 10.56) (P=0.001), table 2).

Table 1: Characteristics of patients admitted in PICU with septic shock

Characteristics		Values	%
Number of patients included in the study		55	--
Male : Female		1.5 : 1	--
Age in Months	Mean ± SD	27.33 ± 35.38	--
	1-6 Months	21	38.1
	6-12 Months	12	21.9
Age Groups	12-156 Months	22	40.0
	Total	55	100.0
Underlying infective pathology	Pneumonia	20	36.36
	Viral encephalitis	8	14.54
	Meningitis	5	9.10
	Acute GE with Sepsis	22	40
	Total	55	100.0

Table 2: Various clinical parameters and lactate level among survivor and non-survivor

Variables (N=55)	Survivor (n=22)	Non-survivor (n=33)	Test-value	P-value and significant
Age	21.61 ± 24. 52	32.84 ± 42. 5	T=1.137	P=0.261, NS
Median [months (IQC)	7(5.7)	8(5.8)	U=0.0012	P=0.832 NS
Male: Female	14:9	19:13	X2=0.006	P=0.881, NS
Lactate at 0 hrs	2.86 ± 0.74	4. 52 ± 1.71	T= 4.45	P=0.001, NS
Lactate at 6 hrs	1.81 ± 0.62	3. 53 ± 1.36	T= 5.46	P=0.001, NS
Lactate clearance	38.29 ± 10. 56	20.23 ± 9.77	T= 5.79	P=0.001, NS

DISCUSSION

In our study lactate levels were significantly higher among nonsurvivors in comparison to survivors. In previous studies by Duke *et al* and Kloski *et al* a lactate level of > 3 mmol/l significantly predicted mortality.¹¹ Hatheril *et al* showed that persistent hyperlactemia >2mM after 24h was associated with 93% mortality as compared to 30% in children whose lactate level had normalized¹², however single measurement of lactate serves as a biomarker of risk, hence the significance of lactate clearance after 6 hours of admission to predict the mortality was explored in this study. In our study we have observed the mortality in non/poor lactate clearance group (20.23 ± 9.77, P=0.001), which is similar to the study by Arnold *et al* (60% versus 19% at lactate

clearance cut f of 10% after 6 hours of admission, P=<0.001) Munde *et al*¹³ studied the lactate clearance at 6 hours and observed that mortality was high in poor/delayed lactate clearance group when compared to clearance group(75% versus 25% with a p value 0.000).⁷ A study by Nguyen *et al*¹⁴ compared the lactate clearance in survivors (LC 38.1%± 34.6%) versus non survivors (LC 12.0%± 51.6 %), (P=0.005).⁸ and stated that there was 11% decrease in the likelihood of mortality for 10% increase in lactate clearance⁹.

CONCLUSION

Lactate levels and its clearance within 6hours of admission predicts significantly the mortality in PICU in patients admitted with sepsis and septic shock

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