

Effects of Temperature and Storage Time on the Measurement of Lactate in Hospital Kuala Lumpur

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ABSTRACT

Lactate is known as an important indicator for patients with trauma or sepsis, where a high lactate concentration usually fatal (>5 mmol/L). Sample delaying and wrong sample handling were always the main factors for pre-analytical errors. The aim of this study is to find out if there were any changes to the lactate concentration at different temperature and storage time. Samples were collected (n=60), analysed and stored in different temperature and storage time, and lactate concentrations were analysed right after blood taking for Fresh Sample Lactate (FSL), after 1 hour, 2 hours, and 4 hours in 4°C and 24°C. All 6 results were compared to the initial lactate concentration. Our findings showed no statistical difference for FSL – 1Hour 4°C by using pairwise comparison (p=0.41) while other pairs showed statistical difference at p<0.05. In summary, results obtained within 1 hour from sampling is valid as long as it is kept within 4°C and samples rejection should be applied if criteria not met.

INTRODUCTION

Lactate has been known as a waste product of anaerobic but it was proven otherwise, where lactate is essential as one of the biomarker in medical emergency as well as critical care. It has been shown as initial high lactate levels as well as slow declining in lactate levels are affiliated with higher fatality rate. Lactate is considered an urgent sample and it should be sent in Sodium Fluoride / Potassium Oxalate tube (Grey Top) with ice to the laboratory as soon as possible.

Study Background

- Experimental Research Strategy

What will happen if:



Delayed sample



No Ice

OBJECTIVES

General:

To study the effects of temperature and storage time on the measurement of lactate in Hospital Kuala Lumpur

Specific:

- To measure lactate in cold temperature (4°C) at 1 hour, 2 hour, and 4 hour interval verified by using a thermometer
- To measure lactate in room temperature (24°C) at 1 hour, 2 hour, and 4 hour interval verified by using a thermometer

METHODOLOGY

Sample size calculation, n=60
Sample collection for each volunteer, 1n:
7 NaF / KOX tubes
[FSL (1), A (3) and B (3)]

Centrifuge FSL (3500RPM;5minutes) and analyse immediately for fresh sample lactate (Control Group)

Keep 3 Tubes A at room temperature (24°C)

Keep 3 Tubes B in polystyrene box containing ice (4°C)

Wait 1 Hour

Take one tube from A, centrifuge and analyze

Take one tube from B, centrifuge and analyze

Wait 1 Hour

Take one tube from A, centrifuge and analyze

Take one tube from B, centrifuge and analyze

Wait 2 hour

Take one tube from A, centrifuge and analyze

Take one tube from B, centrifuge and analyze

Data collection and analysis

Data Analysis by using Two-Way ANOVA and repeated measure ANOVA by comparing Fresh Sample Lactate (Control Group) to others. through SPSS. P-value of <0.05 was considered as significant and have statistical difference.

RESULTS

In Table 1, both multiple comparison between Fresh Sample Lactate with 4°C and 24°C groups are significant (p<0.05).

Table 1 Multiple Comparison by Temperature (Tukey HSD)

Temperature (I)	Temperature (J)	Mean Difference (I) – (J)	P-value	95% CI	
				LB	UB
[Fresh Sample Lactate]	[4°C]	-0.09	0.03	-0.15	-0.01
	[24°C]	-1.24	0.00	-0.20	-0.50

P-value significant at p<0.05

In Table 2, multiple comparison between Fresh Sample Lactate with 1 Hour groups is not significant (p>0.05). While Fresh Sample Lactate with 2 Hour groups and 4 Hour groups are significant (p<0.05).

Table 2 Multiple Comparison by Storage Time (Tukey HSD)

Storage Time (I)	Storage Time (J)	Mean Difference (I) – (J)	P-value	95% CI	
				LB	UB
[Fresh Sample Lactate]	[1 Hour]	-0.05	0.53	-0.13	0.42
	[2 Hour]	-0.11	0.01	-0.20	-0.02
	[4 Hour]	-0.15	0.00	-0.24	-0.06

P-value significant at p<0.05

Table 3 shows average mean of each sample sets

Table 3 Average means of each sample sets

Parameter	Mean	Standard Deviation
Fresh Sample Lactate	0.94	0.27
1 Hour 4°C	0.95	0.26
2 Hour 4°C	0.97	0.26
4 Hour 4°C	0.98	0.26
1 Hour 24°C	0.96	0.26
2 Hour 24°C	0.99	0.26
4 Hour 24°C	1.01	0.26

In Table 4, pairwise comparison between Fresh Sample Lactate with 1 Hour 4°C is not significant (p>0.05). While other sets are significant (p<0.05).

Table 4 Plasma lactate measurement on differences between pair

[Lactate Concentration] (I)	[Lactate Concentration] (J)	Mean Difference (I) – (J)	P-value	95% CI	
				LB	UB
[Fresh Sample Lactate]	[1 Hour 4°C]	0.00	0.41	-0.10	0.00
	[2 Hour 4°C]	-0.02	0.00	-0.03	-0.02
	[4 Hour 4°C]	-0.04	0.00	-0.05	-0.03
	[1 Hour 24°C]	-0.02	0.00	-0.03	-0.01
	[2 Hour 24°C]	-0.04	0.00	-0.05	-0.04
	[4 Hour 24°C]	-0.07	0.00	-0.07	-0.06

Test used is ANOVA repeated measure
P-value significant at p<0.05

DISCUSSION

- 1 Hour 4°C shows no statistical difference against Fresh Sample Lactate.
- Lactate results changes significantly along with temperature and storage time.
- From this study, it is proven that the lactate result is valid as long as it is kept in 4°C and analysed within an hour after blood taking.

CONCLUSION

In conclusion, when sample is received in 4°C and analysed within an hour from blood taking, there is no statistical difference. Therefore, the lactate result obtained is valid and can be accept. As for future studies and references, measurement of lactate concentration with separated plasma in different temperature and storage time can be done.

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