International Journal of Medical Science and Clinical Inventions 4(10): 3264-3266, 2017
DOI:10.18535/ijmsci/v4i10.09 **ICV 2015: 52.82**
e-ISSN:2348-991X, p-ISSN: 2454-9576

Research Article

The Relationship Between the Duration of Cardiopulmonary Bypass (CPB) Use on Elevated Lactic Acid Post Operative of Open Heart Surgery at H. Adam Malik General Hospital Medan

Farhan Syarif, Marshal*, Doddy P. Pohan*
*Division of Cardiothoracic and Vascular Surgery, Department of Surgery, Faculty of Medicine University of Sumatera Utara, Haji Adam Malik General Hospital, Medan.

Abstract:
Introduction. Cardiopulmonary bypass (CPB) is widely used to regulate systemic perfusion and oxygenation during open heart surgery. During the use of CPB machines may be at risk of disrupting tissue perfusion and also after surgery is undertaken. The increase of lactic acid is a metabolic characteristic that results from the consequences of hypoxia, but this increase in lactic acid may also occur by a condition not caused by hypoxia. The purpose of this study was to investigate the relationship between CBP use and elevated lactic acid levels in patients with open heart surgery at RSUP H. Adam Malik Medan.
Methods. This study used a design of correlative test research with retrospective approach.. The implementation of the study was conducted in the Division of Cardiothoracic and Vascular Surgery, Department of Surgery, Faculty of Medicine USU/ RSUP H. Adam Malik Medan. We studied patients undergoing open cardiopulmonary surgery using the Cardiopulmonary Bypass (CBP) at RSUP H. Adam Malik Medan in 2016, the data of CPB use and lactic acid values that met the inclusion criteria.
Results. The number of research subjects was 30 people. Based on the results of the above study, any addition of CPB time more than 1 minute it will affect the increase in lactic acid 0.131 mg. The correlation between the duration of CPB and Lactic acid concentration with a large R value is 0.743. This indicated that there was a correlation between the duration of CPB and lactic acid concentration.
Conclusion. Bivariatally there was a relationship between duration of CPB use and elevated lactic acid levels in patients with open heart surgery with r = 0.743. In this investigation there were several confounding factors controlled by patient selection and the same surgical technique.

Keywords: Cardiopulmonary bypass, lactic acid.

Introduction

Cardiopulmonary bypass (CPB) is widely used to regulate systemic perfusion and oxygenation during open heart surgery. The concept of the Cardiopulmonary Bypass (CPB) machine emerges from a crosscirculation technique in which arterial and venous circulation is connected to a tube in the machine. John Gibbon discovered the development of the first CPB system, which was used when fixing Atrial Septal Defect (ASD). Initially, the technology was very complicated and unreliable because it was slow to develop. During the use of CPB machines may be at risk of disrupting tissue perfusion and also after surgery is undertaken. Duration of CPB use, degree of hypothermia, duration of cooling and heating, pH adjustment and the value of haematocrit are all factors that contribute to tissue hypoperfusion during CPB machine use.

Open heart surgery has been associated with impaired functioning of various organ systems, which started from the surgical process and persisted to postoperatively in various time spans. Damage to organs during cardiac surgery is primarily due to the use of CPB machines. Until then it was still difficult to determine precisely the causal factors that were the result of the use of CPB machines. The key mechanism that causes organ damage due to the use of CPB machines is the activation of the systemic inflammatory response. This is an unavoidable consequence, hemodilution and decreased blood viscosity appearing along with the onset of CPB machines, then causing changes in the distribution of blood flow to the organ and blood flow characteristics across the capillary tissue, ischemic injury / reperfusion of the heart, lungs, and organs supplied by the splanchnic circulation, as well as the laminar blood stream from the pulsatile, although still controversial.[1]

The increase of lactic acid is a metabolic characteristic that results from the consequences of hypoxia, but this increase in

lactic acid may also occur by a condition not caused by hypoxia. Hypoperfusion and hypothermia occurring during Coronery Artery Bypass Graft (CABG) surgery degrade liver function and therefore many patients show an increase in plasma lactate acid during CPB machine use.[2]

In Jabbari's study stated that there was a relationship between the duration of the use of CPB and the increase of lactic acid levels in patients with open heart surgery (r = 0.742, p = 0.03). At Haji Adam Malik Medan Central Hospital no studies have been made on the association between CBP use and elevated acid levels lactate in patients with open heart surgery. Based on these data then the researcher will conduct this research.

Methods

This study uses a correlative test design with retrospective approach. The research was conducted in Division of Cardiac and Vascular Surgery Division of Department of Surgery, Faculty of Medicine USU, RSUP H. Adam Malik Medan.

The population in this study were patients who performed open heart surgery using Cardiopulmonary Bypass (CBP) at RSUP H. Adam Malik Medan in 2016. The study sample was part of the population with the old data of CPB and lactic acid values that met the inclusion criteria . The number of samples was taken based on the number of patients who entered the surgical division of Cardiovascular Toroma General Hospital H. Adam Malik Medan Center that meets the inclusion criteria.

Inclusion criteria:

- Patients performed open heart surgery by using cardiopulmonary bypass
- Patient is willing to follow the study after being given informed consent.
- All age

Exclusion criteria:

- Patients who died postoperatively before day 1
- Patients with congenital abnormalities

Results

The study involved patients who performed open heart surgery using CPB machines in hospitals. Haji Adam Malik Medan. The number of research subjects was 30 people. Based on table 4.1 it can be seen that the mean age of the study subjects was 52.0 + 14.3. In the table shows that the subject of research based on the most sex is male-lakit with 24 subjects (80%). For lactic acid yield, the mean elevation of postoperative lactic acid level was 7.03 + 3.04 mMol / L. In addition, the average duration of CPB use at open heart surgery was 132.3 ± 45.4 minutes in the RSUP. Haji Adam Malik terrain.

Characteristics of research subjects assessed in this study include two variables, namely the duration of CPB and lactic acid values. From the Data nirmality test, it has been found that the data is normally distributed.

Table 1. Test of Data Normality

One-Sample Kolmogorov-Smirnov Test

		Lama pemasangan CPB	Kenaikan kadar As. Laktat
N		30	30
Normal Parameters[a,b]	Mean	143.6333	6.1800
	Std. Deviation	34.48286	2.83955
Most Extreme Differences	Absolute	**.116**	**.141**
	Positive	.076	.141
	Negative	-.116	-.064
Test Statistic		.116	.141
Asymp. Sig. (2-tailed)		.200[c,d]	.131[c]

a. Test distribution is Normal.

\

Based on output above shows that the installation duration of CPB and increases in lactic acid levels meet the normal distribution. This is evident from the p-value values of both tests> 0.05 (0.2 and 0.131 each).

Based on the results of the above study, any addition of CPB time more than 1 minute it will affect the increase in lactic acid 0.131 mg

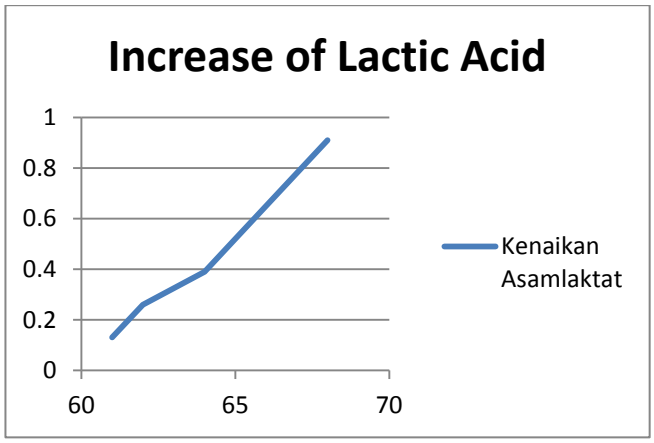

Figure 1. Graphic of Lactic acid increase

In the table below, a difference of lactic acid level can be seen post CPB use.

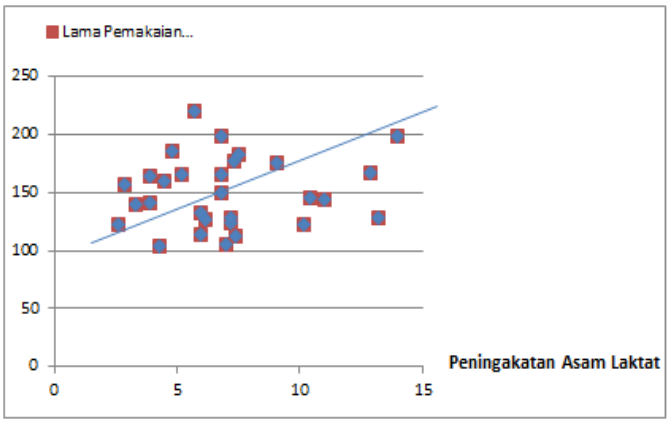

Figure 2. Graph of Length of CPB Usage Based on Lactic Acid Content

The table below illustrates the large correlation between the duration of CPB and Lactic acid concentration with a large R value of 0.743. This indicates that there is a correlation () between the duration of CPB and lactic acid concentration.

Table 2. Correlation Between the duration of CPB use and Lactic Acid Uptake Correlations

		peningkatan asam laktat	lama 50
lactic acid increase	Pearson Correlation	1	.743
	Sig. (2-tailed)		.141
	N	30	30
Duration of CPB use	Pearson Correlation	.743	1
	Sig. (2-tailed)	.141	
	N	30	30

* Pearson Correlation Test, r = 0,743

Discussion

The study involved patients who performed open heart surgery using CPB machines in hospitals. Haji Adam Malik Medan. The total number of subjects was 30 people. Based on table 4.1 it can be seen that the mean age of subjects who undergo open heart surgery is 52.0 + 14.32 years. Similarly, the study by Jabbari A mentioned the mean age is 62+ 14 years (> 50 years)[2]

In the table shows that the subject of research based on the most gender is male 24 subjects (80.0%). In another study it was mentioned that men had more open heart surgery with a ratio of 4: 1 to women.

The results of this study explain that the use of longer use of CPB is more risky to increase lactic acid with r = 0.743. In line with previous studies which suggested that the use of CPB> 60 minutes increased the risk of increased lactic acid in 23.1% of patients undergoing open heart surgery.

In a Santosh study, the mean lactate levels at 15 and 45 minutes in CPB increased to 7.01 mmol / L and 9.92 mmol / L respectively. The reasons for this increase have been raised earlier. The progressive decrease in lactate levels during rewarming (at 35 ° C), off bypass, 24 hours and 48 hours postoperatively with mean lactate concentration to 7.01 mmol / L, 4.75 mmol / L, 3.06 mmol / L and 2 , 10 mmol / L respectively. Significant increase in mean lactate levels (P <0.001) in patients in NYHA class IV at 15 minutes and 45 minutes of CPB, during rewarming and 24 and 48 hours post-CPB. The ratio of lactate levels to the relationship for duration of CPB revealed higher levels in CPB lasting more than 1 hour (p <0.05).[3]

Network perfusion risks damage during the CPB. Potential factors that contribute to tissue hypoperfusion during CPB use include CPB duration, hypothermia, coolant duration and warming, pH and hematocrit levels. In addition, other factors such as venous flow disruption characterized by reduced excessive splanchnic flow may limit perfusion leading to systemic inflammation. Hypoperfusion of tissue is associated with secondary lactic acidosis resulting from anaerobic metabolism. Measurement of lactate levels can be used as a marker to assess the adequacy of tissue perfusion.[2]

Increased lactate levels commonly encountered in patients after cardiac surgery. Production of lactic acid or lactic acidosis occurs due to tissue hypoperfusion and hypoxia during surgery. This provides important prognostic markers in critically ill patients. Jabbari A's research aims to utilize the determination of serial lactate levels in predicting side effects, especially in children after open heart surgery. Lactic acidosis is an extensive anion gap in metabolic acidosis caused by either overproduction or underutilization of lactate. "If the body produces adenosine triphosphate (ATP) without the use of oxygen it will increase lactate production.On the other hand, the inadequate reduction of lactic acid by oxidation or gluconeogenesis allows an understanding of the utilization of lactate.[2,4]

Glycolysis is the first stage of glucose metabolism and occurs in the cytoplasm of almost all cells. The end product of this pathway is pyruvate, which can then diffuse into the mitochondria and be metabolized into carbon dioxide by the Kreb Cycle. Elevated blood lactate may occur with or without metabolic acidosis. Hyperlactatemia is induced stress, due to catecholamine process or due to alkalosis where the buffer system is able to mitigate the pH decrease.[5]

Conclusion

Bivariately there is a relationship between the long use of CPB and elevated lactic acid levels in patients with open heart surgery with r = 0.743 In this study there are several confounding factors that are controlled by patient selection and the same surgical technique.

REFRENCES

1. Snell, A., Parizkova, B. Organ damage during cardiopulmonary bypass In: Ghosh, S., Falter, F., Cook, DJ. 2009. Cardiopulmonary Bypass. Cambridge University Press: Cambridge
2. Jabbari Aet Al. 2013. Serum Lactate As A Prognostic Factor In Coronary Artery Bypass Graft Operation By On Pump Method. Caspian J Intern Med; 4(2):662-666
3. Santosh B S, Kumud K G, Pawan K, Neela D P. 2005. Blood Lactate Levels during CPB 39 Blood Lactate Levels During Cardiopulmonary Bypass for Valvular Heart Surgery. Annals of Cardiac Anaesthesia; 8: 39–44)
4. Bulow NH, et al.2014. Inflammatory Response in Patients under Coronary Artery Bypass
5. Suzette M. Perfecto MD; Lourdes SR. Casas, MD; Juliet J B; Azcueta MB, 2012. Pediatric