

DIFFERENCES IN INSTALLATION TECHNIQUE *TOURNIQUET* ON SERUM POTASSIUM RATE

THE DIFFERENCES APPLICATION TECHNIQUE OF *TOURNIQUET* TO POTASSIUM LEVEL IN SERUM

Bastian¹, FD Anindita Marson², Asmarani³, Pariyana⁴

¹STIKes Muhamadiyah Palembang,

²ATLM Charitas Hospital Bengkulu

³FK. Palembang Muhammadiyah University

⁴FK. Sriwijaya University

Email: bastiandarwin51@yahoo.com

Abstract

Potassium is an important analyte because if there is a deficiency or too much of potassium, it will lead to the death of a person, that is the reason why errors in potassium measurements can create serious conditions for patients if therapy is based on inaccurate laboratory results. The hemoconcentration state of the sample can influence the final results obtained. This research aims to determine application techniques *Tourniquet* against potassium levels, where use *Tourniquet* Inaccuracy can also cause hemoconcentration of the sample which can increase potassium levels in the serum. This research is a laboratory experiment that uses serum from subjects. All data was then processed statistically with paired T-Test. The results of the research are the average potassium levels using the technique *Tourniquet* released right after the vein became accessible was approximately 3.86 mmol/L, lower than the second intervention using application *Tourniquet* which is not released until the blood volume is sufficient, around 4.05 mmol/L. According to the results of the paired T Test, the p value is 0.003 with 2 tailed significance ($\alpha = 0.025$) which makes $p < \alpha$. These results indicate that there is a difference in potassium levels between the two tourniquet application techniques

Keywords: Serum Potassium, *Tourniquet*

Abstract

Potassium is an analyte that important because if there is a lack or too much potassium, it will causes someone is death, that is the reason why is the fault in measurement of potassium can make a serious condition to the patient if the therapy based on the laboratory result is not accurate. This

study aims to know the effect of application technique of Tourniquet to potassium level. This study was a laboratory experimental that using serum from the subject. All of the data then processed statistically with paired T- Test. The result of the study was the mean of potassium level with Tourniquet application that released right after the vein can be accessed was about 3,86 mmol/L, lower than the second intervention that using Tourniquet application that not released until the volume of blood was enough, about 4,05 mmol/L. According to paired T Test result, p value is 0.003 with significancy 2 tailed ($\alpha=0.025$) that makes $p < \alpha$. This result show that there are differences of potassium level between two application technique of Tourniquet.

Keywords: Potassium Serum, Tourniquet

INTRODUCTION

Electrolyte examination is one of the tests commonly carried out in clinical laboratories. Electrolytes play an important role in the human body, especially because almost all metabolic processes in the human body are influenced by electrolytes (Sacher and Pherson, 2004). The electrochemical potential of cell membranes is maintained by electrolytes, so that it will ultimately influence nerve function, muscles and cell activities such as secretion, contraction and various other metabolic processes (Sacher and Pherson, 2004).

Electrolyte tests that are often requested in the laboratory are Na, K and Cl tests. This is done to assess the balance of electrolyte levels in the body. Potassium is an important chemical analyte because its abnormalities can be immediately life threatening, so measurement errors can have serious consequences if therapy is based on inaccurate results (Sacher and Pherson, 2004).

The stages passed in various laboratory examinations include the pre-analytical stage, analytical stage and post-analytical stage. Errors that often occur in clinical laboratory examinations at the pre-analytical stage are 32-75%, analytical 13-32%, while post-analytical 9-31% (Wolcott et al, 2008). The pre-analytical stage includes patient preparation, specimen collection, specimen receipt, processing, storage and shipping. Specimen collection techniques also need to be considered when examining potassium.

Tourniquet is a flexible mechanical material that is usually made from synthetic rubber that can stretch. The purpose of using this dam is for fixation, strengthening the vein from which blood will be taken, as well as to increase the pressure of the vein that will be taken so that it will make the process of sucking blood into the syringe easier. Blocking of the veins will cause changes in several components in the blood if *tourniquet* Leave it for more than a minute, then install *tourniquet* It must be such that it can be easily removed with one hand when the needle has entered the vein wall (Kiswari, 2014).

The state of hemoconcentration can affect the final results obtained. Use *tourniquet* Inaccuracy can also cause hemoconcentration of the sample. In practice, laboratory staff often use assistance *tourniquet* for sampling. Use *tourniquet* also varies between laboratory personnel. Some people use it *tourniquet* just got to the beginning

process recruitment blood, There is Which use *tourniquet* until the blood collection process has been completed.

RESEARCH METHODOLOGY

a. Subjects and Methods

This type of research is laboratory experimental research using serum obtained from research subjects. The research population consisted of 53 people, with complete inclusion criteria *informed consent* and not currently taking diuretic drugs (thiazide, furosemide). From the total population, the sample was selected using simple random sampling techniques and a total of 20 research subjects were obtained. The research location is at the Clinical Chemistry Laboratory, Faculty of Health Sciences, Musi Charitas Catholic University, Palembang and the Clinical Laboratory at Myria Hospital, Palembang. Blood samples are taken using assistance *sphygmomanometer* as a replacement *tourniquet* with the following pressure calculation:

$$\text{Sphygmomanometer pressure} = \frac{\text{Systolic pressure} + \text{Diastolic pressure}}{2}$$

The first treatment is to draw blood using the mounting technique *tourniquet* which is released after the vein can be accessed, and the second treatment is blood collection using the installation technique *tourniquet* which is not released until the desired blood volume is reached.

b. Tools and materials

The tools used in this research are: a) 3 cc syringe; b) *tourniquet*/ sphygmomanometer; c) Cotton; d) Vacutainer tube; e) 500 µl micro pipette; f) Blue tip; g) Rack/tube holder; h) Centrifuge; i) serum cup; j) EasyLyte Na/K/Cl Analyzer. The examination material used in this study was venous blood, which was allowed to clot completely (15-30 minutes) then the serum was taken and immediately examined using an analyzer.

c. Way of work

Selected research subjects had their blood pressure measured to determine the amount of holding pressure when blood was drawn. The subjects then had their blood taken twice from each arm with two different treatments. In the first arm, when the blood has entered the syringe, the pressure *sphygmomanometer* released, and blood collection continues until the volume reaches 3 cc. On the second arm, pressure *sphygmomanometer* maintained to volume

reaches 3cc. Pay attention to the timing of these two treatments for installations *sphygmomanometer* does not exceed 1 minute. The blood that has been obtained is then centrifuged to obtain serum which is then checked for potassium levels.

RESULTS AND DISCUSSION

a. Results

A total of 20 data obtained in the first treatment (*tourniquet* released) had an average of 3.86 mmol/L with the lowest value at 3.36 mmol/L and the highest potassium value at 4.19 mmol/L. Second treatment (*tourniquet* which is not released) has an average potassium level of 4.05 mmol/L with the lowest value at 3.64 mmol/L and the highest value at 4.54 mmol/L

Sample code	Potassium levels with <i>Tourniquet with release (A)</i>	Potassium levels with <i>Tourniquet not released (B)</i>
1	3,66 mmol/L	3,80 mmol/L
2	3,58 mmol/L	4,09 mmol/L
3	3,73 mmol/L	4,17 mmol/L
4	3,97 mmol/L	3,87 mmol/L
5	3,99 mmol/L	3,99 mmol/L
6	4,19 mmol/L	4,14 mmol/L
7	3,74 mmol/L	3,96 mmol/L
8	3,68 mmol/L	4,33 mmol/L
9	3,36 mmol/L	3,74 mmol/L
10	4,19 mmol/L	4,22 mmol/L
11	4,11 mmol/L	4,01 mmol/L
12	3,89 mmol/L	4,09 mmol/L
13	4,07 mmol/L	4,32 mmol/L
14	3,90 mmol/L	4,21 mmol/L
15	3,94 mmol/L	3,79 mmol/L
16	3,87 mmol/L	4,07 mmol/L
17	3,97 mmol/L	4,30 mmol/L
18	4,00 mmol/L	4,54 mmol/L
19	3,91 mmol/L	3,75 mmol/L
20	3,61 mmol/L	3,64 mmol/L

MEAN	3,86 mmol/L	4,05 mmol/L
MIN	3,36 mmol/L	3,64 mmol/L
MAX	4,19 mmol/L	4,54 mmol/L
S	0,2164	0,2367

Table 1: Examination Results

The examination results table shows that 70% of the sample data experienced an increase in potassium levels whose samples were taken using the mounting technique *tourniquet* (14 data). As many as 25% of samples experienced a decrease in potassium levels whose samples were taken using the mounting technique *tourniquet* which is not released (5 data). 5% of samples did not experience changes in potassium levels even though they were taken using two mounting techniques *tourniquet* different (1 data).

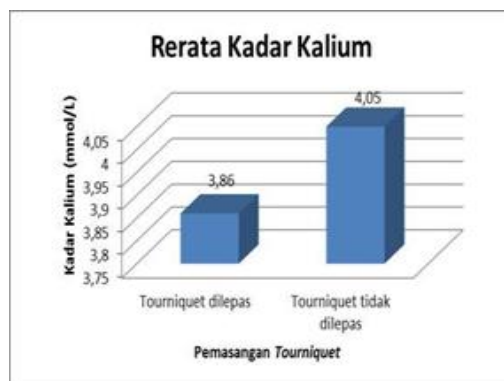


Figure 1: Average Potassium Levels

b. Discussion

The results of examining potassium levels in research subjects, as many as 70% of samples experienced an increase in potassium levels in the second treatment, namely by taking samples using the mounting technique *tourniquet* which is not released. The paired T test (paired T-test) is carried out on data that is normally distributed, and on data that is related to each other. The confidence level used in the paired T test is 95% with a risk of error of 0.05 if the p value < 0.05 then there is a difference in potassium levels taken using the two fitting techniques *tourniquet* different.

Installation Techniques <i>Tourniquet</i>	Mean	SD	<i>P Value</i>	Conclusion
Released	3,86	0,216		
Not released	4,05	0,236	0,003	There is a difference

Table 2 Paired T Test

This can be caused by an extension of the holding time which increases intravenous pressure and as a result hypoxia occurs in the vascular tissue which causes infiltration of small molecules and fluid from the lumen into the peripheral tissue (Serdar Muhittin et al., 2008). Hypoxia due to extended stasis times can also cause intracellular elements to infiltrate inward

plasma. As a result, the potassium levels in the samples experienced a statistically significant increase.

These results are in accordance with previous research, according to Lippi G et al (2005), this research states that the use of *tourniquet* at a pressure of 60 mmHg for 1 and 3 minutes will cause significant changes in serum potassium levels. In this study there were slight differences in which treatment *tourniquet* maintained for one and three minutes, while in this study *tourniquet* maintained only until the vein is accessible and until the blood draw reaches the desired volume.

The Clinical and Laboratory Standards Institute (CLSI) in Strasinger (2011) states that *tourniquet* should be released as soon as the vein is accessible. Increased yield as a result of extended containment time with *tourniquet*. This shows that the installation technique *tourniquet* quite influential in the final results of serum potassium examination. From this it can be concluded that the first retrieval technique is by directly releasing the pressure *phygmomanometer*. As soon as the vein is accessible, it is best to obtain a blood sample for potassium testing.

CONCLUSION

From research that has been carried out on "Differences in Installation Techniques *tourniquet* on Serum Potassium Levels" it can be concluded that there are differences in potassium levels taken using the mounting technique *tourniquet* which is released and uses installation technique *tourniquet* which is not removed, and it is best to use a barrier in the blood collection process as quickly as possible so as not to affect the results of the examination.

In the future, similar research can be carried out to see the effect of using barrier (*Tourniquet*) to other analytes, and by paying attention to the time of use of the barrier. Based on this research, it is better for sampling officers to use *tourniquet* as minimal as possible so as not to affect the results of the examination.

BIBLIOGRAPHY

- Arneson IN, Brickell J (2007). *Clinical Chemistry: A Laboratory Perspective*. Philadelphia: F.A Davis Company.
- Burtis C, Ashwood ER, Burns DE (eds) (2008). *Tietz Fundamentals of Clinical Chemistry*. Sixth editon. Missouri: Saunders Elsvier.

- Cengiz M, Ulker P, Meiselman HJ, Baskurt OK (2009). Influence of Tourniquet Application on Venous Blood Sampling for Serum Chemistry, Hematological Parameters, Leukocyte Activation and Erythrocyte Mechanical Properties. *Clin Chem Lab Med*, 47 (6):769-776.
- Clinical Laboratory Improvement Amandement (2013). Dalam ASVCP TEa Guideline (Biochemistry).USA
- Dahlan M.S. (2012). *Steps Make Proposal Study Medical and Health Sector*. Edition 2. Jakarta: Sagung Seto
- Guyton AM (2012). *Human Physiology and Disease Mechanisms*. Edition 3. Jakarta: EGC.
- Kee JL (2007). *Laboratory & Diagnostic Examination Guidelines*. Edition 9. Jakarta: EGC Medical Book Publishers.
- Decision Minister Health Republic Indonesia number 1792/MENKES/SK/XII/2010 concerning Guidelines for Clinical Chemistry Examination
- Kiswari R (2014). *Hematology and Transfusion*. Jakarta: Erlangga Publishers
- Lippi G, Salvagno GL, Montagnana M, Brocco G, Guidi GC (2005). Influence of Short Term Venous Stasis on Clinical Chemistry Testing. *Clin Chem Lab Med*, 43 (8), 869- 875.
- Marlinda Novi PSH (2015). *Differences in Fasting Blood Glucose Levels 1 Hour and 2 Hours After Candy Intake in Medical Laboratory Technology DIV Students, Faculty of Health Sciences, Musi Charitas Catholic University, Palembang*. Palembang, Musi Charitas Catholic University Palembang. Thesis
- Medica Corp. (2014). *Medica Easy Lyte Operator's Manual*. USA: Bedford
- Mulyono H (2010). *Strengthening the Quality of the Clinical Chemistry Laboratory*. In: Sukorini U, Dwi KN, Mohammad R, Bambang H.PJ (eds). Strengthening Internal Quality of Clinical Laboratories. Jogjakarta: Alfabedia. pp. 85-89
- Notoatmodjo S. (2012). *Health Research Methodology*. Jakarta: Rineka Cipta.
- Regulation of the Minister of Health of the Republic of Indonesia No. 43 of 2013 concerning How to Organize a Good Clinical Laboratory
- Indonesian Association of Clinical Pathology Specialists (2012). Basic Phlebotomy National Training Module for Health Analysts. Edition 2.
- Sacher RA, Mc Pherson RA (2004). *Acid-base and Electrolyte Regulation*. In: *Clinical Review of Laboratory Examination Results*. Translation: Pendit, BU and Wulandari B, Edition 11. Jakarta: EGC, pp: 327-330
- Serdar MA, et al (2008). Tourniquet Application Time during Phlebotomy and The Influence on Clinical Chemistry Testing; Is It Negligible?. *Turkish Journal of Biochemistry*. 33 (3), 85-88.
- Sinaga H. (2011). *Urinalysis*. Palembang: Multi Sarana
- Sunyoto D. (2012). *Health Statistics*. Jogjakarta: Nuha Medika
- Sutoro (2014). *Deviation Results of examination of blood electrolyte levels (Na⁺, K⁺, Cl⁻) collected in new and used vacuum tubes*. Semarang, Muhammadiyah University of Semarang. Thesis.
- Strasinger SK, Marjorie S. (2011). *The Phlebotomy Textbook*. Third Edition. Philadelphia: F.A. Davis Company. pp:178; 194; 226

- Wilson L.M. (2006). *Fluid Volume, Osmolality, and Electrolyte Disorders*. In: Price S.A, Wilson L.M (eds). *Pathophysiology: Clinical Concepts of Disease Processes*. Jakarta: EGC Medical Book Publishers.
- Wolcott J, Schwartz A, Goodman C (2008). *Laboratory Medicine: A National Status Report*. The Lewin Group, 150.
- Yaswir R, Ira F (2012). Physiology and Disorders of Sodium, Potassium and Chloride Balance and Laboratory Examination. *Andalas Health Journal*, 1(2), 80-85