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Effect of Tourniquet Application on Serum Calcium Determination

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Abstract: ***The preanalytical process of sample collection establishes the validity of therapeutic interventions and the precision of laboratory results. Erroneous laboratory results can result from an inaccurate sample collection process, which can lead to an incorrect treatment plan. The most often used sample in laboratory analysis is blood, which is drawn using a tourniquet.A tourniquet is typically used during venous blood sampling procedures to assist in locating peripheral veins in order to facilitate a successful and secure venipuncture. However, one frequent cause of preanalytical errors has been the kind and timing of tourniquet application prior to blood collection. Applying a tourniquet prior to sampling may have an impact on certain lab parameters.As a result of the extended venous stasis caused by the tourniquet application during venipuncture, various biochemical analyte results may differ.The measurement of potassium and calcium may be impacted by prolonged tourniquet use, which may cause local hypoxia and acidosis.A localized acidotic environment causes the cells to release calcium, which raises the calcium content. Minerals that are most prevalent in the body are calcium and . In physiology, it plays a variety of vital functions. So inaccuracies in the result potentially affect patient safety.The purpose of this article is to provide an overview of how various tourniquet application times affect the overall concentration of calcium in the blood in healthy individuals.***

Keywords: Tourniquet application, Calcium estimation, Preanalytical Error, Hemoconcentration

1. Introduction

The first step in getting a high-quality lab test result for any patient is sample collection. The venipuncture process is intricate and demands expertise to execute. A quality collection would include the appropriate specimen being gathered at the appropriate time and being delivered to the appropriate laboratory.The most common type of specimen used in laboratory tests is venous blood[1].

A tourniquet is often used to help identify and locate peripheral veins in order to perform venous blood sampling in a successful and secure manner.The tourniquet facilitates the application of pressure to the arm, thereby slowing the flow of venous blood back to the heart. Blood pools in the veins, causing the walls of the blood vessels to momentarily obstruct and dilate. This allows veins to become more visible and easier to palpate. The tourniquet should not be applied to the patient's arm by the phlebotomist for more than a minute. Small molecules and plasma are able to pass through capillary walls and into the tissues because of the increased pressure exerted on the vessel walls [2]. We refer to this procedure as hemoconcentration. The interpretation of laboratory parameters is influenced by the subsequent hemoconcentration, which increases the concentration of various blood analytes at the punctured site. Extended tourniquet application and venous stasis-induced variations in serum total calcium and ionized calcium concentration [1].

The macro element calcium is highly significant.Two types of calcium can be found in plasma or serum: complexed or chelated calcium, and ionized or free calcium that is bound to proteins. The normal range for total calcium in healthy individuals is 8.8 to 10.4 mg/dL.4.6 to 5.3 mg/dL is the typical range of ionized calcium in healthy adults.In order to contract muscles, coagulate blood[3], activate enzymes, stimulate neurons, release hormones, and permeabilize membranes, calcium is essential. Maintaining health requires precise control of the calcium ion in extracellular fluids. Notwithstanding differences in intake and excretion, the interaction of three major hormones—calcitonin, vitamin D, and parathyroid hormone (PTH)—maintains a steady concentration of calcium.

Serum calcium measurements may contain errors.It involves applying a tourniquet for an extended period of time, which alters the serum's total calcium concentration. Hemoconcentration and hemodilution have an impact on the total calcium concentration because approximately 50% of circulating calcium is protein bound.Extended use of a tourniquet raises serum total calcium levels by 1.0 mg/dL[4]. The variations in the serum's total calcium concentration are caused by Hemoconcentration and hemodilution have an impact on the total calcium concentration because approximately 50% of circulating calcium is protein-bound.

The patient receives an incorrect report due to an elevated serum total calcium value resulting from extended tourniquet application [3]. Consequently, it is highly advised that extended tourniquet application be avoided when drawing blood in order to examine serum calcium levels.This article's goal is to give a general overview of how different tourniquet application times impact a healthy person's blood's total calcium concentration [5].

2. Method

The Department of Biochemistry at the Kottayam School of Medical Education conducted this study. A total of thirty participants, aged between twenty and thirty, were selected at

random for the study. Conditions that could affect blood calcium levels, such as thyroid disorders, kidney diseases, bone diseases, or defective intestinal absorption, were prohibited for study participants.

With each person's consent and in accordance with the protocols, 2 ml of venous blood was drawn from the anterior cubital vein at one, three, and six minutes following the application of the tourniquet in an aseptic setting. Following a centrifugation of the samples, the serum ca was analyzed by Arsenazo III Method

3. Result

3.I Graphical Representation of Mean Value of Calcium at Different Intervals

Group	*1 minute*	*3 minute*	*6 minute*
calcium	9.32	11	12.04

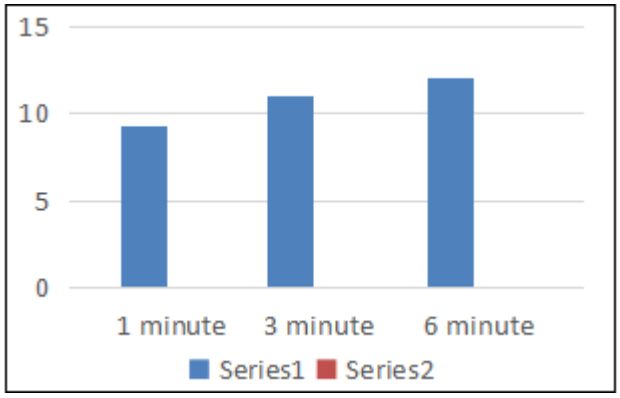

Figure 1: Graphical representation of mean value of calcium at different intervals

4. Conclusion

The purpose of this study was to investigate how the application of tourniquets at various intervals affected the overall concentration of calcium in the serum in healthy subjects. The results of this investigation showed a marked increase in serum calcium concentration. After one minute, the mean serum calcium level is 9.32 mg/dL, three minutes later it is 11 mg/dL, and six minutes later it is 12.04 mg/dL. According to the study, blood drawn three and six minutes after applying a tourniquet raises serum calcium levels.

The study's findings demonstrated that, within three minutes of applying a tourniquet, serum calcium concentrations can be measured more accurately. As a result, after a lengthy tourniquet application, total calcium does rise to clinically meaningful levels. Venous stasis, which results from a prolonged tourniquet application, is what causes the clinical changes. The result could be misleading due to the increase in plasma calcium and the additional risk of a significant laboratory error. As a result, it is suggested that the tourniquet be taken off during blood collection within a minute in order to examine hematological and biochemical parameters. Giving medical and laboratory personnel clear instructions on how and when to apply tourniquets is advised in order to reduce these kinds of mistakes.

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