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Capillary Blood Sampling in Adults

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Summary

Capillary blood sampling is a medical procedure used for early detection of some diseases before their symptoms appear or serious complications arise and for routine checking the health status of patients.

In adult patients, a blood sample is obtained by simple pricking of a finger. The technique has been used for decades and it is progressively used worldwide because it is a quick, easy, cheap, and widely available method to check and control a patient's status of health.

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Mini Review

Capillary blood sampling in adults

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Abstract

Capillary blood sampling is a medical procedure used for early detection of some diseases before their symptoms appear or serious complications arise and for routine checking the health status of patients. In adult patients, a blood sample is obtained by simple pricking of a finger. The technique has been used for decades and it is progressively used worldwide because it is a quick, easy, cheap, and widely available method to check and control a patient's status of health.

Keywords: Capillary blood, Sampling procedure, Safety lancet, Single-use medical device, Blade, Needle.

Abbreviations: CRP: C Reactive Protein; HIV: Human Immunodeficiency Virus; HBV: Hepatitis B Virus; HCV: Hepatitis C Virus; 2019-nCoV - Coronavirus Disease 2019

Introduction

Most widely available diagnostic tests utilize a small amount of blood to quickly check the health status of a patient. In adult population, capillary blood samples are usually used for running rapid tests to check the level of e.g. cholesterol, bilirubin, glycated haemoglobin, lipids (total cholesterol, triglycerides and high-density lipoprotein cholesterol), international normalised ratio or electrolytes [1-3]. The rapid tests are used in public health-care settings such as nursing homes, physicians' offices, outpatient clinics, and in home healthcare where a physician or a nurse is able to run a quick test to decide if a patient should be diagnosed further in a hospital or whether the result is negative and a disease is excluded [4]. Checking of glucose and C-reactive protein levels are the most common tests run at outpatient sites and physicians' offices [5-7]. A small amount of blood lets physicians to take decision if a patient needs to be prescribed an antibiotic (CRP level) or his/her blood sugar level should be further diagnosed. Utilisation of small quantities of biological samples is rapidly expanding, especially in the poorest parts of the world with the highest burden of mortal viral infections. Capillary blood samples are used in the early and rapid screening test for viruses, such as HIV [8], HBV, HCV [9], 2019-nCoV [10], and other infectious diseases such as malaria or tuberculosis [11]. All the rapid tests use a small amount of blood obtained during the capillary blood sampling procedure. The most important features of capillary blood sampling procedures are speed, simplicity and cost-effectiveness. Test results are instantly available, allowing quick treatment initiation to prevent development of diseases and improve a patient's health status [12].

Capillary Blood Sampling Procedure

According to the World Health Organisation (WHO) the capillary blood sampling procedure conducted by health-care professionals consists of several steps that could be grouped into four phases:

1) Preparing for the procedure,
2) Pre-lancing,
3) Lancing
4) Post-lancing.

The preparation phase includes collection of necessary supplies to conduct the procedure, hand washing by a nurse, patient's identification, labeling a device for capillary blood collection, positioning the patient and putting on the gloves. According to recommendations, it is important to position the patient so that the hand is easily accessible, and the finger is lower than the heart [13]. When the patient, equipment and the place are ready, the second phase - pre-lancing - can be introduced. In adults, the preferred site for puncturing is the fingertip side of the middle or ring finger

where tissue depth is enough to prevent accidental bone injury. The skin must be cleaned with an applicable disinfecting agent. As far as adult patients are concerned, ethanol and 70% isopropyl alcohol are the preferable agents for disinfection. Other products used for cleaning the puncture sites are alcoholic or aqueous solutions of chlorhexidine gluconate or povidone-iodine [14]. Whatever agent is used, each of them requires taking time to let it evaporate off the skin.

The next step is selection of the safety lancet to make a puncture. To obtain the required amount of blood with minimal pain perception, the proper version of safety lancet should be chosen by the health-care professional. During safety lancet selection, the user should take into account the required volume of blood necessary to run a test and also the patient's characteristics, such as age or skin type which may impact the amount of blood obtained [15]. Users are usually individuals experienced in the use of similar medical devices (trained personnel of hospitals and other health care facilities). Additionally, there are also safety lancets which are intended for lay users, too.

Safety lancets are sterile, single use micro-collection devices used to carry out skin punctures for the purpose of collecting capillary blood samples. They have an ergonomically designed housing for grip and ease of handling. Safety lancets available on the market differ in such parameters as: puncturing element (needle or blade), type of the needle or blade size and penetration depth, the method of activation (push-button activation or contact activation), and body design, shape and colour. All of them are disposable products. After activation the needle or blade retracts into the housing and the device cannot be triggered again which prevents reuse and accidental finger sticks of third parties. The activation method should not have any significant influence on the obtained capillary blood volume or pain perception [15].

Safety lancets of different types (needle or blade) and sizes (gauge and penetration depth) are used to obtain different blood volumes [15,16]. Safety lancets equipped with blades allow to obtain a significantly higher volume of capillary blood and cause more pain than those equipped with a needle [16]. As far as the safety lancets equipped with a needle are concerned, their diameter impacts blood volume and pain perception. The lowest capillary blood volumes are observed when we use safety lancets with the thinnest needle (higher gauge numbers), while the highest blood volumes are reported for the group of the thickest safety lancets (lower gauge numbers). Penetration depth in the range of 1,0 mm to 2,4 mm does not have a significant impact on the obtained capillary blood volume, however, it does on the pain perception [15].

The lancing procedure starts with making a puncture that should be performed across the fingerprint, not parallel to it [13]. It highly recommended to eliminate the first drop of capillary blood before collecting the sample [17]. If higher volumes of capillary blood are necessary, gently pressing the fingertip during blood collection is recommended. Additionally, we can significantly increase volumes of obtained capillary blood when we collect a blood sample for 2 minutes rather than 20 seconds [15]. Application of excessive pressure to the puncture area to obtain a higher blood volume should be avoided. It can lead to hemolysis and fluid contamination of the sample. When the procedure is finished, the medical device should be discarded into an appropriate sharps container and the puncture site ought to be protected with a sterile gauze pad.

Conclusion

Compared to venous blood sampling, capillary blood sampling is less invasive, simpler and relatively painless. It is recommended for all patients, but especially for those with huge burns, being afraid of sampling, with thrombosis or fragile and inaccessible veins. Any errors that may occur during each of the procedure phases influence on the quality of blood sample. Proper technique and well-educated personnel are responsible for sample quality as well as test results. Moreover, if the procedure is conducted according to recommendations, adequate blood samples are obtained and pain perception during and after lancing for patients is minimal. Therefore, the capillary blood sampling procedure should be conducted according to the global standards and recommendations.

Conflict of Interest

The author is an employee of HTL-Strefa S.A.

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