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Procedures for the Collection of Arterial Blood Specimens; Approved Standard— Fourth Edition

This document provides principles for collecting, handling, and transporting arterial blood specimens to assist with reducing collection hazards and ensuring the integrity of the arterial specimen.

A standard for global application developed through the NCCLS consensus process.



NCCLS...

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Procedures for the Collection of Arterial Blood Specimens; Approved Standard—Fourth Edition

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Abstract

Collection of a blood specimen, as well as its handling and transport, are key factors in the clinical laboratory analysis and ultimately in delivering quality patient care. NCCLS document H11—*Procedures for the Collection of Arterial Blood Specimens* serves a dual purpose: to reduce the potential hazard to the patient and to maintain the integrity of the arterial blood specimen. Collecting arterial blood is not only technically difficult but also imposes a degree of risk for the patient. Arterial blood is also one of the specimens most sensitive to preanalytic effects. This standard will be particularly valuable to those involved in blood specimen collection, such as clinical laboratory directors, respiratory therapists, physicians, physicians in training, nurses, medical technologists, exercise physiologists, phlebotomists, and perfusionists.

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THE NCCLS consensus process, which is the mechanism for moving a document through two or more levels of review by the healthcare community, is an ongoing process. Users should expect revised editions of any given document. Because rapid changes in technology may affect the procedures, methods, and protocols in a standard or guideline, users should replace outdated editions with the current editions of NCCLS documents. Current editions are listed in the *NCCLS Catalog*, which is distributed to member organizations, and to nonmembers on request. If your organization is not a member and would like to become one, and to request a copy of the *NCCLS Catalog*, contact the NCCLS Executive Offices. Telephone: 610.688.0100; Fax: 610.688.0700; E-Mail: exoffice@nccls.org; Website: www.nccls.org



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Foreword

This standard has been written for use by clinical laboratory directors, respiratory therapists, medical technologists, physicians, physicians in training, nurses, exercise physiologists, phlebotomists, perfusionists, and any others who may collect or be involved with the collection of arterial blood specimens for clinical laboratory analysis. The preanalytical phase of the laboratory path of workflow includes the collection of blood specimens for clinical laboratory analysis. This is one of the initial critical steps in providing clinical laboratory services for quality patient care. Without the proper and efficient collection of specimens, laboratory results would have little value.

The collection of arterial blood is not only technically difficult, but can be painful and hazardous for the patient. Therefore, it is essential that individuals performing arterial puncture be familiar with the proper techniques, with the hazards/complications of the procedure, and with the necessary precautions.

Arterial blood is one of the specimens most sensitive to preanalytic effects. Improper patient assessment, test requisition, collection or transport of a specimen of arterial blood intended for pH, and blood gas analysis can alter the gas tensions, or pH, or both. In addition to pH/gases analysis, instruments are now available for the specific measurement of pH/gases and other critical care analytes (e.g., sodium, potassium, chloride, ionized calcium, glucose, hematocrit, hemoglobin) on the same arterial whole-blood specimens. Therefore, scrupulous attention to the principles outlined in this standard is mandatory to eliminate a major potential source of erroneous laboratory results.

This publication has been written for the primary purpose of reducing the potential hazards to the patient and increasing the integrity of the arterial blood specimen. The primary focus of this standard is arterial puncture with a discussion of arterial cannulation. While providing some specific guidelines, it is not intended to provide an exhaustive discussion of related subjects, such as pH/blood gas analysis and the technical implications of improper sampling.

NCCLS is dedicated to quality clinical laboratory services, and this standard covers one of the many areas in which standards are being developed to help achieve this end.

The revisions in this version of the H11 standard are intended principally to delineate between quality system essentials (QSEs) related to and the path of work flow for arterial blood collection. The previous edition (H11-A3) was published for wide and thorough review in the NCCLS consensus-review process. The objective of this review was to obtain specific input on the utility and applicability of the recommendations provided for arterial blood collection techniques. However, a "Summary of Consensus Comments" has not been included in this approved, fourth-edition document as all comments received as a result of the consensus review process were editorial in nature.

The Area Committee on Clinical Chemistry and Toxicology urges users to submit comments related to experience in using H11-A4 to assure future editions reflect the "state of the art."

Key Words

Arterial blood, arterial cannula/catheter, arterial puncture, blood collection, blood gas, blood gas analysis, oxygen tension, pH

Procedures for the Collection of Arterial Blood Specimens; Approved Standard—Fourth Edition

1 Scope

This standard has been written for the primary purpose of reducing the potential hazards to the patient and medical personnel and to increase the clinical usefulness of the arterial blood specimen. It has been written for use by clinical laboratory directors, respiratory therapists, physicians, physicians in training, nurses, exercise physiologists, perfusionists, and any others who may collect, or be involved with the collection of, arterial blood specimens.

It addresses collection of whole blood specimens from arterial sites with emphasis on reducing the potential hazards to the patient and to medical personnel. The specimen collection procedures are intended to provide appropriate whole blood samples for blood gas, electrolyte, and metabolite determinations.

2 Introduction

Arterial blood is the substance presented to all organs for their metabolic needs; its composition is uniform throughout the body. The composition of venous blood is conditioned by the metabolic activity of the tissue which it drains and therefore varies among different parts of the body and at different times (e.g., depending on muscular activity). The largest difference between arterial and venous blood is its oxygen content, but pH, carbon dioxide content, packed cell volume, and the concentrations of lactic acid, plasma chloride, glucose, ammonium and other metabolites also vary. All differences between arterial and venous blood are exaggerated when the general or local circulation is impaired. Arterial blood therefore is the preferred specimen for all these determinations and it is essential for evaluating respiratory and metabolic functions.

All individuals performing arterial puncture should be familiar with the hazards/complications of the procedure and with precautions designed to prevent hazards to the patient or to the laboratorian, or alteration of the results of the laboratory test. For example, anxiety or excitement of the patient alters the breathing pattern which will change the gas tensions within less than a minute. There must be attention to detail in the precollection and postcollection phases of arterial sampling to maintain the integrity of test results.

3 Standard Precautions

Because it is often impossible to know what might be infectious, all patient and laboratory specimens are treated as infectious and handled according to “standard precautions.” Standard precautions are guidelines that combine the major features of “universal precautions and body substance isolation” practices. Standard precautions cover the transmission of all infectious agents and thus are more comprehensive than universal precautions which are intended to apply only to transmission of blood-borne pathogens. Standard and universal precaution guidelines are available from the U.S. Centers for Disease Control and Prevention (*Guideline for Isolation Precautions in Hospitals*. Infection Control and Hospital Epidemiology. CDC. 1996;17(1):53-80 and *MMWR* 1988;37:377-388). For specific precautions for preventing the laboratory transmission of all infectious agents from laboratory instruments and materials and for recommendations for the management of exposure to all infectious disease, refer to the most current edition of NCCLS document M29—*Protection of Laboratory Workers from Occupationally Acquired Infections*.