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Procedures for the Erythrocyte Sedimentation Rate Test; Approved Standard—Fifth Edition

This document provides a description of the principle, materials, and procedure for a standardized erythrocyte sedimentation rate (ESR) method; a selected routine method, as well as a procedure to evaluate routine methods; and an outline of quality control programs for the ESR test.

A standard for global application developed through the Clinical and Laboratory Standards Institute consensus process.

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Abstract

Clinical and Laboratory Standards Institute document H02-A5—*Procedures for the Erythrocyte Sedimentation Rate Test; Approved Standard—Fifth Edition* is a revision of the fourth edition approved standard (H02-A4) published in December 2000. The document outlines the necessary details for the performance of a standardized (Westergren) method on diluted (1:4) blood specimens for the determination of the erythrocyte sedimentation rate (ESR). Quality assurance and evaluation of other methods to measure the ESR are also described, including procedures for the preparation of a fresh blood reference material for use in the laboratory or manufacturing of ESR devices. This standard provides guidance for the validation, verification, quality assurance, and quality control of ESR measurement devices or related controls. The intended audience includes manufacturers of such devices, end-user clinical laboratories, accrediting organizations, and regulatory bodies.

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Foreword

The erythrocyte sedimentation rate (ESR) test, first described about 70 years ago,¹⁻³ is one of the most widely performed laboratory tests. The Westergren method^{2,3} to measure the ESR has remained essentially unchanged since its inception and was recommended as the method of choice by the International Council (previously Committee) for Standardization in Haematology (ICSH) in 1973⁴ and 1977.⁵ Subsequently, in 1993, ICSH recommended the use of undiluted blood and adjustment of the hematocrit to 0.35 L/L or lower.⁶ Although over the years, other methods to measure the ESR were introduced for routine use (eg, the Wintrobe method⁷ and the zeta sedimentation ratio [ZSR] determination),⁸ the Westergren method remains the benchmark against which other methods can be, and are, evaluated.

This fifth edition reflects a unifying approach to optimal use of all the current ESR methods. Of particular note is that upon review of the current literature and available expert opinion this edition now recommends a standardized method using diluted blood, thus revising the standardization method for the ESR.

Over the last few years, a number of technical innovations and semiautomated instruments were introduced to eliminate or decrease the risk of exposure of laboratory workers to potentially infectious material, eg, blood. The newer procedures are considered less hazardous, primarily because they are either self-contained or use disposable materials, or both. There is a need to examine these innovations, both for comparability of results to previously employed methods and to ensure, on an ongoing basis, the quality assurance of the results. This document provides standardized methods to address these needs.

Erythrocyte sedimentation is a nonspecific reaction; it is a measure of the presence and severity of pathological processes. In general, the ESR is increased in acute, general infections and in localized, acute, inflammatory conditions. Variations in the ESR depend on the nature and severity of the disease process. The usefulness of ESR is in evaluating patients with unexplained symptoms when inflammation and infectious disease are suspected and a specific diagnosis is not available effectively using other tests. No evidence supports the use of ESR in asymptomatic individuals and the test should not be included in routine investigations aimed to monitor the health status. ESR provides useful information when used as a diagnostic criterion for temporal arteritis, polymyalgia rheumatica, monitoring the activity of giant cell arteritis, and inflammatory arthropathies, as well as following the course of patients with rheumatoid arthritis.⁹⁻¹⁷

On occasion, the ESR may increase where other clinical and laboratory evaluations yield negative results. This should nonetheless be regarded as a sign of disease until such time as the physician is fully satisfied that the patient is perfectly well. However, normal values for the ESR were found in patients with a neoplasm of the liver¹⁸ or with other serious conditions.¹⁹ The ESR was used to differentiate organic disease from functional disorders, or as a guide to the progress of diseases such as rheumatic carditis, rheumatoid arthritis, and certain malignancies, including Hodgkin's disease.

ESR procedures cannot be calibrated. The procedures used to determine the ESR are susceptible to a variety of errors. An inadequately performed ESR that produces an incorrect result may not be detected unless some reference material is available in the laboratory where the ESR procedure is performed. Because the phenomenon of erythrocyte sedimentation is confined to fresh blood and is transient, presently, the only feasible way of providing a control material is for the manufacturer or test developer to specify a method for the production of such material in the laboratory where it will be used. Because of the nature of the human erythrocyte sedimentation reaction, reference or control materials of the usual type are not available for the ESR test.

Foreword (Continued)

This document describes a standardized procedure for the ESR test, as well as a selected procedure. This standardized method is based on the original methodology of Fåhræus¹ and Westergren,³ which used diluted blood in open-ended, Westergren-type glass pipettes of 300-mm length, mounted vertically in a rack or stand. The standardized procedure was verified in studies based on an ICSH procedure.⁶ The procedures described in this document are an attempt to measure the ESR in a fashion that is not misleadingly influenced by variations in relative erythrocyte volume. The procedures also permit the preparation of a standardized material for test validation within the laboratory. Such a material, of necessity fresh whole blood, can then be used in the laboratory to ensure the quality of the method(s) routinely in use to determine the ESR.

The document outlines the necessary details for the performance of a standardized (Westergren) method on diluted (1:4) blood specimens for the determination of the ESR. Quality assurance and evaluation of other methods to measure the ESR are also described, including procedures for the preparation of a fresh blood reference material for use in the laboratory. This standard will enable the user of commercial, disposable ESR equipment to ensure that both the test equipment and test procedures are performing adequately.

Key Words

Erythrocyte sedimentation, erythrocyte sedimentation rate (ESR) test, quality control, selected procedure, standardized procedure, Westergren pipette

Procedures for the Erythrocyte Sedimentation Rate Test; Approved Standard—Fifth Edition

1 Scope

This document addresses the methodology and devices for the measurement of the erythrocyte sedimentation rate (ESR) phenomenon. It also provides guidance for validation, verification, quality assurance (QA), and quality control (QC) through standardized approaches to ensure good laboratory science and clinical relevance. The intended audience includes manufacturers of such devices, end-user clinical laboratories, accrediting organizations, and regulatory bodies.

End-user clinical laboratories will also find guidance for establishment of working methods for ESR test validation and for QA of their ESR testing method(s).

2 Standard Precautions

Because it is often impossible to know what isolates or specimens 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 known 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 Centers for Disease Control and Prevention.²⁰ For specific precautions for preventing the laboratory transmission of all known infectious agents from laboratory instruments and materials and for recommendations for the management of exposure to all known infectious diseases, refer to CLSI document M29.²¹

3 Terminology

3.1 A Note on Terminology

CLSI, as a global leader in standardization, is firmly committed to achieving global harmonization wherever possible. Harmonization is a process of recognizing, understanding, and explaining differences while taking steps to achieve worldwide uniformity. CLSI recognizes that medical conventions in the global metrological community have evolved differently in the United States, Europe, and elsewhere; that these differences are reflected in CLSI, International Organization for Standardization (ISO), and European Committee for Standardization (CEN) documents, as well as in World Health Organization (WHO) publications; and that legally required use of terms, regional usage, and different consensus timelines are all important considerations in the harmonization process. In light of this, CLSI’s consensus process for development and revision of standards and guidelines focuses on harmonization of terms to facilitate global application of standards and guidelines.

Specifically, in H02, *accuracy* was changed to *trueness* (where appropriate) for consistency with accepted international usage.

3.2 Definitions

accuracy (measurement) – closeness of agreement between a measured quantity value and a true quantity value of a measurand (ISO/IEC Guide 99)²²; **NOTE 1:** The concept ‘measurement accuracy’ is not a quantity and is not given a numerical quantity value. A measurement is said to be more accurate when it offers a smaller measurement error (ISO/IEC Guide 99)²²; **NOTE 2:** The term “measurement accuracy” should not be used for measurement trueness and the term measurement precision should not