International Journal of Life Sciences, Biotechnology and Pharma Research Vol. 14, No. 2, February 2025 Online ISSN: 2250-3137
Print ISSN: 2977-0122

DOI: 10.69605/ijlbpr_14.2.2025.94

Original Research

Comparative Analysis of Erythrocyte Sedimentation Rate Measured by Micro ESR Method with Westergren method among Geriatric population

Kaur J[1], Dhuria S[2], Singh H[3], Narang S[4], Suri V[5], Singh K[5], Puri A[6]

[1]PG Resident, Pathology , AIMSR Bathinda.
[2]Assistant Professor, General Surgery, AIMSR Bathinda.
[3]Assistant Professor, Pediatric Medicine, GMC Hanumangarh.
[4]Associate Professor, Pathology, AIMSR Bathinda.
[5]Professor, Pathology, AIMSR Bathinda.
[6]Professor & Head, Pathology, AIMSR Bathinda.

Corresponding author:
Dr Shikha Narang
Associate Professor , Pathology, AIMSR Bathinda.
Email: shikhanarang003@gmail.com

Received:15 December, 2024 Accepted:23 January, 2025

Abstract
Background: Sedimentation Rate (ESR) is an important diagnostic tool used for diagnosing and monitoring various disease processes. The most important method of ESR estimation is gold standard Westergren method
Aims and objectives: To compared ESR values using Micro ESR Method with Westergren among Geriatric population
Methodology: Hospital and laboratory-based study was conducted for a period of 12 months Blood samples from 218 Geriatric patients (>60 years of age) were collected, and ESR was done using Micro ESR methods and Westergren method which is considered a gold standard.
Results: Sensitivity of Micro ESR was found to be 0.967 (95% CI = 0.964, 0.968), Specificity was 1.0 (95% CI = 1.0,1.0). The micro-ESR method had a correlation coefficient of 0.9885, with a p-value of less than 0.001. Thus, a good correlation can be seen between the ESR results of the Micro-ESR method and ESR results of the Westergren method.
Conclusion: A good correlation between the ESR results of the Micro-ESR method and ESR results of the Westergren method can be seen.
Keywords: Micro ESR Method, Westergren method, Sensitivity

INTRODUCTION

The erythrocyte sedimentation rate (ESR) is widely used in clinical practice as an indicator of inflammation, infection, trauma, or malignant disease.[1] Many methods can be used for measuring the ESR such as Westergren method, Wintrobe's method, manual method, Zeta sedimentation ratio, and micro-ESR. The most satisfactory method of performing the test was introduced by Westergren in 1921.[2] The Westergren method is recommended for measuring the ESR by the International Council for Standardization in Hematology (ICSH).[3,4] ESR ranges in adults from 2 to 20 mm/hour.[5]

ESR performed by the manual standard Westergren method is also affected by hematocrit, Fabry's formula (Westergren ESR X 15/55-HCT) can be used to correct ESR values obtained by the manual method.[6] Micro-ESR is another economical method to measure E.S.R. Micro-ESR uses a capillary tube to obtain a capillary blood sample; thus, venepuncture is not necessary here. The minimal blood requirement for Micro-ESR17 which is only 0.2 ml has several benefits, including preventing unwanted blood loss and decreasing rates of iatrogenic anemia. It can also be used in emergency set ups and remote areas. Thus, doctors working at settings with limited resources can benefit and contribute to patient's treatment.[7]

Westergren Method is the reference method because it is susceptible, inexpensive and easy to test. It requires 2ml of patient's venous blood, which, on repetition, can causes iatrogenic anemia. [8,9] With new advancements, many automatic machines have also been introduced to measure ESR. The automated instruments use EDTA as an anticoagulant. EDTA

DOI: 10.69605/ijlbpr_14.2.2025.94

gives better results than the earlier used trisodium citrate. These computerized machines use vacuum-controlled aspiration of blood samples from the test tube vials, which avoids exposure of patient's blood and help in decreasing the risk of bloodborne. Also, these automated analyzers give the final reading in much shorter time.[10,11]

Aims and Objectives: To compared ESR values using Micro ESR Method with Westergren among Geriatric population.

MATERIALS AND METHODS

A Hospital and laboratory-based study was conducted for a period of 12 months.Blood samples from 218 Geriatric patients were collected, and a study was carried out.

Type of study: Study of diagnostic accuracy.

Study Subjects: Geriatric patients (age >60 years) were selected as and when they presented to Central Laboratory, Department of Pathology, AIMSR Bathinda following the application of inclusion and exclusion criteria and after obtaining their informed written consent.

 Inclusion criteria: Patients coming for E.S.R. evaluation who are in the age group >60 years.

 Exclusion criteria: The sample that was sent for a follow-up examination of E.S.R. within a week of the initial hospitalization or visit was not included in the research.

o Coagulated and hemolyzed blood samples were excluded.

Method for sample collection:

S.O.P.s (Standard Operational Procedures) was used to take blood samples from patients. Samples were collected in the sample collection area in the hematology section of the Central Laboratory. Venous blood samples were taken from the participants while following the recommended aseptic procedures. A vial containing EDTA (ethylenediamine tetra-acetic acid) was used to collect about 3 millilitres of blood, with K2EDTA acting as an anticoagulant. All three tests were carried out within 4 hours of collecting the blood. Blood that has been EDTA-anticoagulated may be used for up to 24 hours provided that it is stored at 4 °C. Blood samples received in hematology section for ESR evaluations are collected.

Micro-ESR Method:

Using a 3.2% tri-sodium citrate solution on a slide, 4 drops of EDTA vial blood were combined in a 4 to 1 ratio. After that, the sample was drawn into a 7.5-cm capillary tube at an angle of 45 degrees. The blood rises in the capillary tube because of its capillary properties. If the blood does not rise, the tube was lowered more while preventing air bubbles from entering the tube.Care was taken to avoid bubbles formation in the capillary. This method uses about 0.2ml of blood. The excess blood on the slides was wiped off. After 7 cm of blood rise in the capillary tube, it was then sealed with 2-3 millimeters of clay and stuck to the wall firmly perpendicularly with adhesive at the tube's base with the patients' names and time of blood collection stated. It was placed away from vibrations. The capillary tube can also be placed perpendicularly by slightly pressing into a plasticine tray with modeling clay or sealing wax plates to hold the tube straight.To make sure the one-hour sedimentation time was adhered to, alarm clocks were utilized. Following an hour, the distance was measured between meniscus of tubes containing red cell column and plasma column's highest point. The ratio of the plasma's height to the blood-filled capillary's total height was multiplied by 200.

Westergren method:

A 300-mm reusable straight colourless glass pipette with a 2.55 mm diameter and
open ends was used for the Westergren procedure. The glass pipette was used after proper cleaning by washing and drying the tube. The Westergren tube is calibrated in mm from 0-200 (top to bottom). Blood from the EDTA vial was diluted in 4 to 1 ratio in sodium citrate anticoagulant and then made to rise into the Westergren tube pipette. The Westergren pipette was placed in Westergren's stand, which held the tube in a motionless and vertical position.The stand was undisturbed for 1hour, away from direct sunlight, draughts, and vibrations. After an hour, the blood column's fall distance was measured in millimetres (mm) and reported.Bias was controlled by taking appropriate measures for confounding factors like lab temperature and wind effect.

OBSERVATION & RESULTS

Out of the 218 geriatric patients included in the present study, there were 99 males (45%) 119 female (55%) In each sample, the means of the results from the automated, manual, and micro-ESR methods were compared, and their p values were computed; a P-value of less than 0.05 was deemed statistically significant. Data was separated into two groups in accordance with ICSH standards in order to improve comparability of these methods with the
Westergren method.

- ESR value ≥ 61 mm - Group H (as high)
- ESR 21-60 mm - Group M (as medium)
- ESR ≤ 20 mm - Group L (as low)

E.S.R. measured by Micro E.S.R. method

- Varies from 03 mm/1st hour to 104 mm/ 1st hour
- with mean of 56.64 ± 25.63mm/1st hour ϖ

ESR by Westergren method

- ranged from 05mm/1st hour to 108 mm/1st hour
- with mean of 61.03 ± 25.65mm/1st hour.

Mean difference between values of Westergren and Micro-ESR for

DOI: 10.69605/ijlbpr_14.2.2025.94

Low (≤ 20 mm/hr)- 11.75 ± 3.88 mm/hr High values (≥61 mm/hr)- 78.05 ±13.95 mm/h
Intermediate (21-60 mm/hr)- 39.05 ± 11.52 mm/hr

Table No-1: Calculation of Mean and standard deviation:

Groups	Mean /SD	P value	Coefficient of variation
Westergern	61.03±25.65	0.00	42.03
Micro ESR	56.64±25.63	0.07	45.25
Group L			
Westergern	15.16±4.82	0/51	31.78
Micro ESR	11.75±3.88	0.07	33.08
Group M			
Westergern	43.23±10.99		25.43
Micro ESR	39.09±11.52	0.000	29.51
Group H			
Westergern	82.69±13.57		16.41
Micro ESR	78..05±13.95	0.001	17.87

Accuracy, Sensitivity and Specificity calculations:

In order to assess accuracy and compare methods, every sample underwent parallel analyses using the Westergren technique and Micro-ESR.

Table 2

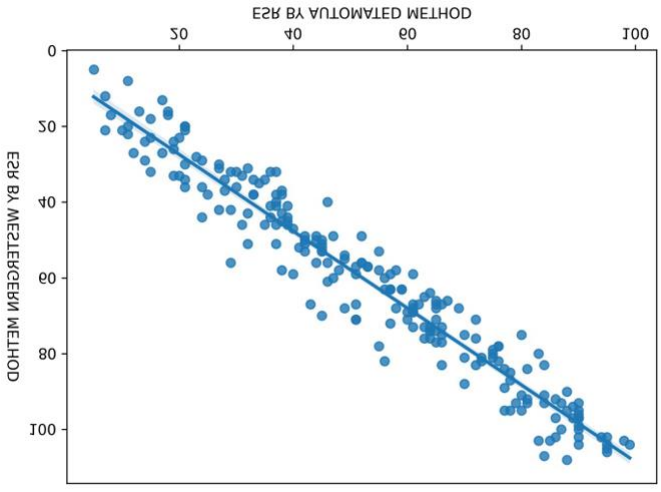
	MICRO ESR
Sensitivity	0.967 (95% CI = 0.964, 0.968)
Specificity	1.0 (95% CI = 1.0,1.0)
Accuracy	0.969 (95% CI = 0.966, 0.971)

With Pearson's Correlation test, the micro-ESR method had a correlation coefficient of 0.9885, with a p-value of less than 0.001. Thus, a good correlation can be seen between the ESR results of the Micro-ESR method and ESR results of the Westergren method.

Table 3. Correlation of Micro ESR versus Westergern

	Correlation value	P value
Micro ESR vs Westergern	0.9885	<0.0001

Graph No.1:
Scatter diagram illustrating the connection between Micro- ESR method and Westergren Method (Comparison by Regression Analysis)



DOI: 10.69605/ijlbpr_14.2.2025.94

DISCUSSION

ESR is one of the non-specific tests with many limitations, which is used by every doctor. The sedimentation rate and plasma proteins are impacted by a number of factors, which are screened and tracked using E.S.R. It is of great use for diagnoses of diseases like giant cell arteritis in the emergency room, its outcome is crucial. Additionally, it is also essential for the clinical decision-making process of many different types of diseases. The classic Westergren Method is affordable and simple to use. It was chosen as the reference method because the test is sensitive, repeatable, and dependable.

The micro-ESR method uses a capillary tube to obtain only 0.2ml capillary blood sample; thus, venepuncture is unnecessary. Therefore, it can be used for geriatric 48 patients with difficulty collecting blood due to difficult venous accessibility, age-induced skin integrity changes, venous vasculature, and valves. With passing years, our skin becomes thin and loose. Veins roll easier as a result of smaller muscles mass. Moreover, after a venepuncture, veins lose some of their elasticity and are more prone to injury or collapse. Thus, blood collection is complex in geriatric patients and capillary blood sample can be used. 0.2 ml of blood is the smallest amount needed for Micro-ESR, and this provides various advantages, such as lower incidence of iatrogenic anemia and higher satisfaction of patient. The micro-ESR, which is a cheap, simple, and readily available bedside test, compares favorably with other hematological parameters, which are expensive, require skilled technicians and laboratory services for the detection of E.S.R. It is economical and can be used in emergency setups and remote areas.

Micro E.S.R. method ranged from 03 mm/1st hour to 104 mm/ 1st hour with a mean of 56.64 ± 25.63 mm/1st hour; and E.S.R. by Westergren method ranged from 05 mm/1st hour to 108 mm/1st hour with a mean of 61.03 ± 25.65 mm/1st hour. Also a perfect correlation (r=0.9885) of Micro-ESr with the conventional Westergren method is observed. Some authors discovered a strong agreement and correlation between these techniques in earlier research. Kamal Preet et al. have also obtained similar results.[12]

The results of this study could have a number of practical applications, especially in the treatment of elderly patients. The strong correlation between the Micro-ESR method and the Westergren method suggests that Micro-ESR could be a viable alternative in geriatric settings.

CONCLUSION

A good correlation between the ESR results of the Micro-ESR method and ESR results of the Westergren method can be seen.

Conflict of interest: NO

REFERENCES

1. Plebani M, Piva E. Erythrocyte sedimentation rate: use of fresh blood for quality control. Am J Clin Pathol 2002;117(4):621–626
2. Westergren A. Studies of the suspension stability of the blood in pulmonary tuberculosis. Acta Med Scand 1921;54:247–282
3. Bull BS, Brecher G. An evaluation of the relative merits of the Wintrobe and Westergren sedimentation methods, including hematocrit correction. Am J Clin Pathol 1974;62(4):502–510
4. Moseley DL, Bull BS. A comparison of the Wintrobe, the Westergren and the ZSR erythrocyte sedimentation rate (ESR) methods to a candidate reference method. Clin Lab Haematol 1982;4(2):169–178
5. Bain BJ, et al. Supplementary techniques including blood par-asite diagnosis. In: Bimpong AO, ed. Dacie and Lewis Practical Haematology. 12th ed. China: Elsevier; 2017:93–111
6. Agrawal A, Hammond DJ Jr., and Singh SK. Atherosclerosis-related functions of C reactive protein. Cardiovasc Haematol Disorders Drug Targets 2010;10:235-40.
7. . B.A Barrett and P.I Hill. A micromethod for the erythrocyte sedimentation rate suitable for use on venous or capillary blood. Journal of Clinical Pathology 1980;33:1118-9.
8. Asmita Pathak and Alok Agrawal.Evolution of C-Reactive Protein. Frontiers in Immunology 2019;10:1-12.
9. J.M.Jou, S.M.Lewis, C.Brigg, S.-H.Lee, B.Delasalle and S.Mcfadden. ICSH review of the measurement of the erythrocyte sedimentation rate. International journal of laboratory hematology 2011;33:125-32.
10. Feza Hashemi, Alireza Majidi , Hassan Motamed, Afshin Amini, Fares Najari and Ali Tabatabaey. Erythrocyte Sedimentation Rate Measurement Using as a Rapid Alternative to the Westergren Method. Emergency 2015;3:50-3.
11. Mario Plebani, Stefania De Toni, Mariam Colomba Sanzari, Daniela Bernardi and Elisabebeth Stockreiter. The TEST 1 Automated System: A New Method for Measuring the Erythrocyte Sedimentation Rate. American Journal of Clinical Pathology 1998;110:334-40.
12. Kamal Preet, Vyankatesh T. Anchinmane and Shilpa Sankhe. Evaluation of micro ESR method with Westergren method for determination of erythrocyte sedimentation rate. IJRMS 2018;6:628-31.