Comparative Study Between the Classical Westergren and the New Sealed Vacuum Extraction Methods for Erythrocyte Sedimentation Rate Determination

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Abstract

A comparative study between the classical Westergren and the new sealed vacuum extraction methods for erythrocyte sedimentation rate determination was performed on 80 individual subjects. The comparison-of-methods plot sealed vacuum extraction method (X) *vs* Westergren method (Y) gave a least square linear regression equation of $Y = 1.001\ X + 0.03$ ($r = 0.99$) and precision analysis gave a coefficient of variation below 3 per cent. Compared to the classical method, the sealed vacuum extraction method was easy to use, showed acceptable precision and reduced biohazard risk to the practitioner, therefore, it was suitable for a laboratory setting with a high rate of blood-borne infectious diseases such as Thailand.

Key word : Erythrocyte Sedimentation Rate, Comparative Study, Westergren *vs* New Sealed Vacuum Extraction

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Suitable and effective techniques of erythrocyte sedimentation rate determination have been necessary for the success of laboratory process. Several methods of erythrocyte sedimentation rate determination have been developed[1]. Among these techniques, the Westergren method is accepted as a standard method[1,2] and has been widely used in Thailand.

Although the Westergren method has been claimed for many advantages, the risk of the practitioner in contact with blood specimens, which can lead to blood-borne infection, is still high. In the present day, a new method for determination of erythrocyte sedimentation rate based on evacuated blood collection system has been developed[3]. With the basic principle of evacuated blood collec-

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tion system[4], erythrocyte sedimentation rate determination can be done using the same tube as the vacuum blood collection tube. Recently, this new method was introduced to Thailand, but there was no report about efficacy of this new method. Therefore, this study was set in order to be a pilot study to compare this new method to the Westergren method for determination of erythrocyte sedimentation rate.

MATERIAL AND METHOD

This study was set in the Laboratory Medicine Department, Faculty of Medicine, Chulalongkorn University in 1998. Eighty individual volunteer subjects were included. For each subject, two methods for erythrocyte sedimentation rate determination were performed. The first method was the Westergren method[1] as a standard method and the second was the sealed vacuum extraction method (SeditainerR).

The SeditainerR method was the new method making use of evacuated blood collection system, in which blood can be automatically drawn into the specific blood collection tube and this collection tube can be used as the erythrocyte sedimentation tube. The procedure of the system is described below:

1. Collect blood, using the accepted evacuated blood collection technique
2. Gently invert the SeditainerR tube at least 8 - 10 times
3. Repeat before inserting the tube into the specific stand
4. Insert the SeditainerR tube into the stand
5. Align the zero level of the scale to the bottom of the meniscus
6. Set the timer and read the erythrocyte level

The erythrocyte sedimentation rate for each sample was read and recorded at 1 hour. All recorded data were collected, analyzed and interpreted.

Linear regression was performed in order to assess the significant difference in the erythrocyte sedimentation rate obtained by the Westergren and SediatainerR methods.

RESULTS

All 80 samples were analyzed for erythrocyte sedimentation rate by the Westergren and SediatainerR methods. The data from this study are summarized in Table 1. The comparison-of-methods plot SeditainerR method (X) *vs* Westergren method (Y) gave a least square linear regression equation of $Y = 1.001 X + 0.03$ ($r = 0.99$) (Fig. 1). Precision analysis gave a coefficient of variation below 3 per cent.

Table 1. Characteristics of samples used in the study.

Assays	Values (millimeter/hour)
Westergren method	33.63 ± 23.55
SediatainerR method	33.26 ± 24.40

DISCUSSION

Erythrocyte sedimentation rate[1] is an important laboratory investigation in medicine. Although it is only a non-specific parameter, it can help physicians diagnose and follow-up many diseases. Therefore, a number of methods for erythrocyte sedimentation rate determination have been performed.

The Westergren method[1,2] is the method accepted as the standard method in the present day but there are some limitations to this technique. Firstly, it is an open method, therefore, practitioners have to contact the blood specimen directly. In the present day, there are a number of blood-borne pathogen caused – diseases, especially hepatitis and HIV infection. Furthermore, the classical Westergren erythrocyte sedimentation tube is made of glass and washing for reuse must be done. Not only hazards from possibly damaged glassware but also contaminated blood can be expected. Therefore, it is not applicable in a setting where blood borne infection is rather high and it does not match the concept of laboratory safety.

Therefore, a number of methods have been developed to overcome these problems. Sealed vacuum extraction (SeditainerR) method[3] is a new method based on the principle of evacuated blood collection system. A special black stopper-vacuum tube has been produced for used with both the vacuum blood collection tube and erythrocyte sedimentation tube at the same time. Due to the fact that blood for the test can directly flow into the collection tube then stopped when the proper quantity is reached and the test can be performed in the

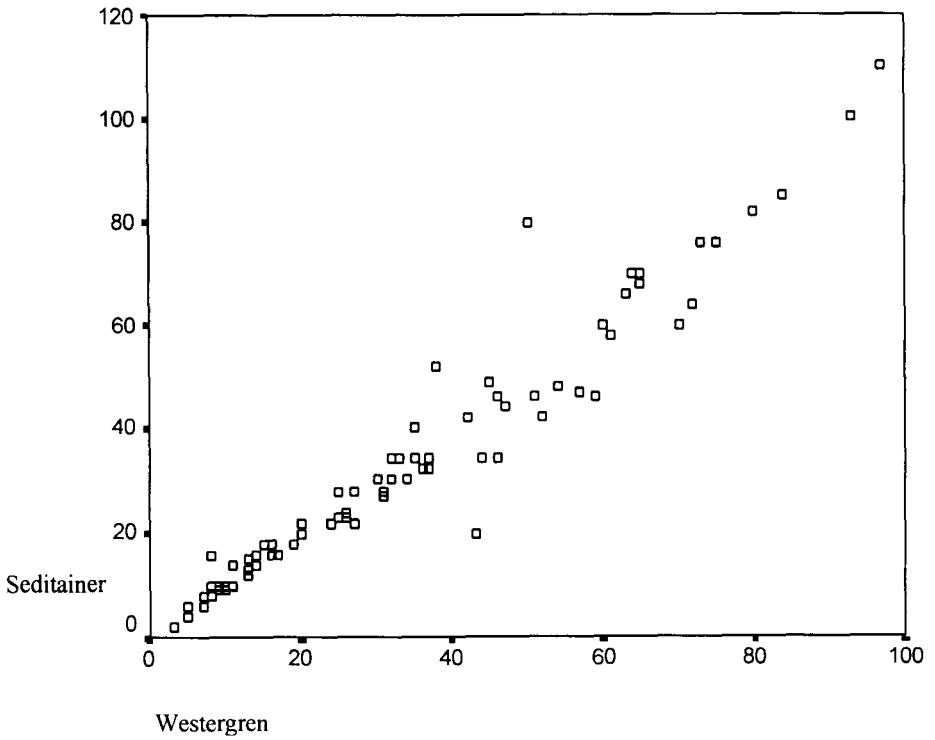

Fig. 1. Comparison of standard Westergren and sealed vacuum extraction (Seditainer^{R}) method for erythrocyte sedimentation rate determination.

same tube. Therefore, there is no problem with improper ratio of blood to anticoagulant and infectious blood particle contact can be avoided. Furthermore, it can save cost and time for venipuncture and performing the test.

This study revealed that usage with this new technique can provide very good correlation ($r = 0.99$). Therefore, the sealed vacuum extraction method answers the problem of the safety limitation of the present standard method. It can be a potentially useful tool in performing erythrocyte sedimentation rate determination especially in a setting where the rate of blood –borne infectious diseases is rather high such as in Thailand[5].

However, there are still some limitations with this new method. Firstly, because the size of the erythrocyte sedimentation tube for the new method is shorter than the standard method, a specific reader must be used in reading the result. A newly designed tube the same size as the classical Westergren tube has been produced[6], therefore, this problem has been solved.

Another problem that can be expected is that the practitioner of the new method has to be the same as the phelebotomist, therefore, only trained medical personnel can perform this test due to the legal aspect. Furthermore, the evacuated blood collection technique is rather a new method for Thai medical personnel so training for this technique is necessary.

This study is only a pilot type in one specific laboratory setting. Some variables of the test due to the setting can be expected. Therefore, further studies in multi centers should be performed.

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การศึกษาเปรียบเทียบการหาอัตราการตกตะกอนของเม็ดเลือดแดงด้วยวิธีมาตรฐานเวสเทอร์เกร็นและวิธีใหม่ที่ใช้การเก็บตัวอย่างจากหลอดเลือดดำด้วยระบบสูญญากาศ

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ได้ทำการศึกษาเปรียบเทียบการตรวจหาอัตราการตกตะกอนของเม็ดเลือดแดงด้วยวิธีมาตรฐานเวสเทอร์เกร็นกับวิธีใหม่ที่ใช้การเก็บตัวอย่างจากหลอดเลือดดำด้วยระบบสูญญากาศ โดยได้ทำการศึกษาในกลุ่มตัวอย่างจำนวน 80 ราย พบว่าค่าอัตราการตกตะกอนของเม็ดเลือดแดงด้วยวิธีใหม่ (X) เข้ากันได้ดีมากกับวิธีมาตรฐาน (Y) โดยแสดงได้ด้วยสมการถดถอยเชิงเส้น $Y = 1.001 X + 0.03$ ($r = 0.99$) และได้สัมประสิทธิ์ของความแปรปรวนน้อยกว่าร้อยละ 3 เมื่อเปรียบเทียบกับวิธีมาตรฐานดั้งเดิมแล้วการหาอัตราการตกตะกอนของเม็ดเลือดแดงด้วยวิธีใหม่เป็นวิธีที่ใช้ได้ง่าย มีความแม่นยำและลดความเสี่ยงของผู้ทำหัตถการต่อการสัมผัสสิ่งติดเชื้อที่ปนเปื้อนในเลือดดังนั้นวิธีการใหม่นี้จึงมีความเหมาะสมที่จะนำมาใช้งานโดยเฉพาะในสถานที่ที่มีความเสี่ยงของโรคติดเชื้อจากเลือด เช่น ในประเทศไทย

คำสำคัญ : อัตราการตกตะกอนของเม็ดเลือดแดง, การศึกษาเปรียบเทียบ, วิธีเวสเทอร์เกร็นและวิธีเก็บตัวอย่างด้วยสูญญากาศ

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