ERYTHROCYTE SEDIMENTATION RATE IN PREGNANCY IN PORT HARCOURT, NIGERIA.

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Abstract

The erythrocyte sedimentation rate (ESR) is a simple, cheap and non-specific test employed in the assessment of the acute phase response to inflammation. Pregnancy is associated with haemodilution and an increase in plasma proteins especially fibrinogen and gamma globulins. These physiologic changes engender a remarkable increase in the ESR. Our study was aimed at assessing the physiologic change in ESR in the course of normal pregnancy compared to non-pregnant women using the Westergren method. We found a remarkable increase in ESR in pregnant women compared to non-pregnant controls, and it rose progressively with increasing gestational age. In addition, anaemic women had higher ESR values compared to non-anaemic women. Thus the ESR is not an appropriate marker of the acute phase response in pregnancy, rather alternative tests like plasma viscosity and C-reactive protein assay should be employed.

Key words: Erythrocyte, sedimentation, pregnancy, acute phase response.

Introduction

The erythrocyte sedimentation rate (ESR) is a measure of the sedimentation of red blood cells in autologous plasma. It is a non-specific test used in the assessment of the acute phase response to inflammatory disorders. Other tests of the acute phase response include C-reactive protein (CRP) assay and plasma viscosity.[1,2] In the evolution of the ESR for clinical use, Robin Fahraeus first evaluated it as a pregnancy test in 1918 before expanding it to diseases.[3] It was later refined by Alf Westergren and subsequently standardised and adopted by the International Committee for Standardization in Haematology in 1977.[2]

The ESR is remarkably increased in the presence of anaemia and the acute phase proteins especially fibrinogen, serum amyloid A protein and C-reactive protein.[1] Anaemia promotes rouleaux formation while the acute phase proteins coat the red cell membrane causing a reduction in the repulsive negative charge (zeta potential) thus enhancing aggregation and

sedimentation.[3] The ESR increases with age, probably due to a higher prevalence of diseases with increasing age. It is higher in females compared to males. This is attributed to the influence of female sex hormones.[1,3]

In pregnancy, levels of C-reactive protein and fibrinogen rise considerably while albumin level decreases.[4,5] Also the haemodilution of pregnancy results in anaemia. The cumulative effect of these physiologic changes is an increase in the ESR with increasing gestational age.[6]

As with many other laboratory tests, individual laboratories are advised to determine the reference ranges in their environment.[1] There are very few reports documenting the reference range of ESR in pregnancy especially in this environment. In this study we evaluated the effect of pregnancy on ESR values in apparently healthy pregnant women attending antenatal care in comparison with non-pregnant women as controls.

Materials and Methods

One hundred and eighty-three (183) apparently healthy pregnant women in their first antenatal visit to three health care facilities in Port Harcourt were recruited into the study. The health care facilities were: the University of Port Harcourt Teaching Hospital (UPTH), Alakahia; the Demonstration clinic of the Rivers State College of Health Science and Technology (RSCHST), Rumueme, and the Family support health centre, Orogbum. It was a cross-sectional study done between July and October, 2009. It was preceded by an approval from the Ethics Committee of the UPTH, Port Harcourt (UPTH/CS&T/118/VOLXII/405). Written informed consent was obtained from all the participants.

One hundred and twenty-four (124) apparently healthy age-matched non-pregnant women volunteered were evaluated as controls. They were drawn from staff of the UPTH, Port Harcourt and patient relatives in the hospital. Additional volunteers were recruited from three churches in Port Harcourt; Living Faith Church, Mgbuoba, Zion Baptist Church, Rumuepirikom, and Goodland Baptist Church, Rumuigbo.

Exclusion criteria included women who were ill, active bleeding from any site; blood pressure ≥ 140/90mmHg; major surgery or road traffic accident in the last one year, and women with known haemoglobinopathy.

Data were collected from the case files of the pregnant women and a structured user-administered questionnaire was used for both subjects and controls. Five milliliters (ml) of venous blood was then collected by venepuncture from each participant into potassium ethylene diamine tetra acetic acid (EDTA) bottles. The blood samples were analysed within 2-3 hours of collection in the Haematology laboratory at the University of the Port Harcourt Teaching Hospital (UPTH), for complete blood count (CBC) in an automated cell counter, PCE-210 (N), ERMA. ESR was measured in the subjects and controls using the Westergren method as described in Dacie and Lewis Practical Haematology.[1] Whole blood was diluted in sodium citrate solution in a ratio of 4:1 and left to sediment in a glass tube mounted vertically on a stand.

Statistical Analysis: The data generated was analysed using the Microsoft Excel, 2007 and EPI-INFO version 6.1softwares. Differences between the means in the groups were assessed using the student's t-test and p-values below 0.05 (5%) were considered significant.

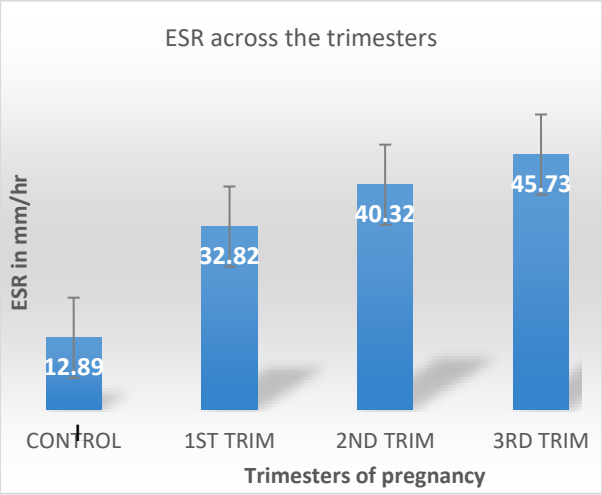
Results

The pregnant women were aged between 19 and 41 years, mean ± SD (29.82 ± 4.72)

their ESR values ranged between 10 and 130 mm/hr. The ESR values are not normally distributed, so the median values were calculated. The overall median ESR in pregnant women were 35.5mm/hr (mean, 41.95mm/hr), standard deviation was 26.44 mm/hr. Thirty-eight (38) of the pregnant women were in their first trimester, 106 in the second trimester and 39 in the third trimester. The non-pregnant women were aged between 19 and 47 years, mean ± SD (27.64 ± 5.78) and their ESR values ranged between 2 and 35 mm/hr. Their median ESR were 11.0mm/hr, (mean ± SD: 12.89 ± SD 7.52 mm/hr).

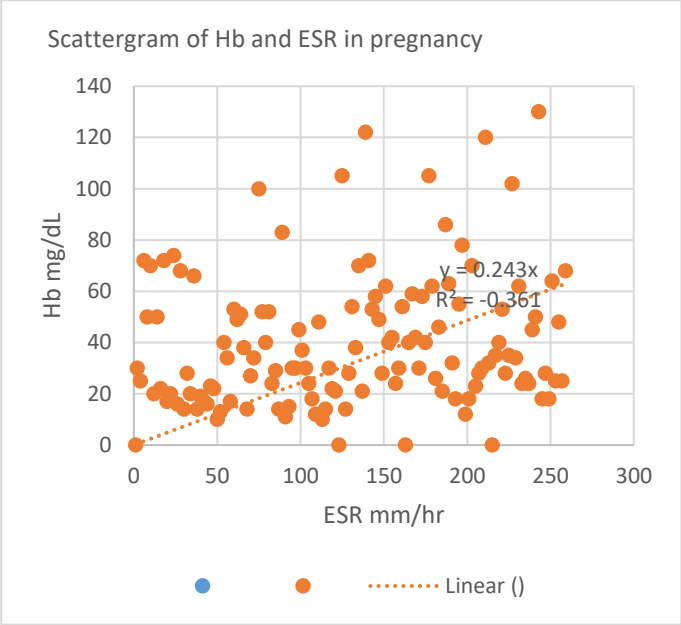
Figure 1 shows the distribution of mean ESR across the trimesters compared with non-pregnant controls. The ESR was much higher in pregnant women compared to non-pregnant women (p-value, 0.001) and there was a progressive increase from the first to the third trimester, though the differences were only significant between the first and the third trimester (p-value, 0.03).

Figure 1: Distribution of ESR across the trimesters



The effect of haemoglobin concentration (Hb) on ESR was assessed in both sujects and controls. The WHO/UNICEF[7] definition of anaemia in pregnancy is haemoglobin concentration (Hb) less than 110g/L while that for menstruating non-pregnant women is Hb less than 120g/L. Applying these definition, the median ESR in anaemic and non-anaemic pregnant women were 40mm/hr and 28mm/hr respectively. The corresponding values for non-pregnant women were 12mm/hr and 10mm/hr respectively. The ESR was significantly higher (p-value, 0.02) in anaemic pregnant women compared to non-anaemic pregnant women. There is a negative correlation between Hb and ESR in pregnancy (R^2 = -0.351). See figure 2.

Figure 2: Scatter plot showing the relationship between Hb and ESR in pregnancy.



Discussion

The ESR is useful in the monitoring of inflammatory disorders like lymphomas, polymyalgia rheumatica, rheumatoid arthritis, and temporal arteritis. In recent times, better alternatives have been found in plasma viscosity and C-reactive protein assay.[1,8] In pregnancy, the ESR is particularly inappropriate as a marker of inflammation because of its reported increase with gestational age.[1,5] Thus C-reactive protein (CRP) assay is preferred in the assessment of inflammatory changes in pregnancy.[9] In this study, median ESR values were much higher in pregnant

women (35.5mm/hr) compared to non-pregnant controls (11.0mm/hr), and there was a progressive increase with gestational age (Figure 1). This corroborates the findings of van den Broek and Letsky,[5] in pregnant women in the UK.

Our study also revealed higher ESR values in anaemic women compared to non-anaemic women. The effect of anaemia on ESR was significant in pregnant women unlike their non-pregnant controls (Figure 2). This is in agreement with the reports of studies in the UK.[1,5] Overall, the ESR values in our study were higher than those reported in Caucasians,[1,5] This is probably due to a higher prevalence of anaemia and infectious diseases like malaria in our environment. The effect of age on ESR was not evaluated in this study.

The ESR is a simple, cheap, and non-specific marker of inflammatory conditions, but its utility in pregnancy is limited by the associated physiologic changes (increase in fibrinogen and haemodilution). Thus, ESR results in pregnancy should be interpreted with caution and more sensitive tests of the acute phase response like plasma viscosity and CRP[10] assay should be employed in the precise assessment of inflammatory changes in pregnant women.

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