Clinical utility of the erythrocyte sedimentation rate test and haemoglobin electrophoretic patterns among premarital couples in Port Harcourt, Nigeria

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ABSTRACT

Background: The erythrocyte sedimentation rate (ESR) is a relatively non-specific test that is often ignored during the diagnosis and monitoring of disease. However, in recent times, the test is often requested alongside haemoglobin electrophoretic pattern as pre marital test. This study was aimed at determining the ESR values among these apparently healthy populations, correlate this parameter with Hb electrophoretic pattern and evaluate its usefulness in modern medicine.

Materials and Methods: Standard haemoglobin electrophoresis run with cellulose acetate paper at pH 8.9 and Westergren method for ESR were used in the determinations.

Results: The mean ESR value for the males was 12.48±10.0mm/hr while 20.77 ± 18.8 was obtained for the females. There was significant difference between the male and female values (t = 3.94; p < 0.01). Mild elevation of ESR (20–50 mm/hr) occurred in 6.67% of males, 11.1% of the females and 8.85% in the study population A moderately elevated value (ESR 51–99mm/hr) was observed in 2.2% males, 5.56% females and 3.38% in the study population. No extreme elevation (ESR >100mm/hr) was observed in the study population. ESR was found to correlate negatively with gender (r = -0.248; p <0.01). Amongst the premarital couples, 83.3% had HbAA while 16.7% had HbAS. No relationship was found to exist between ESR and haemoglobin electrophoretic patterns.

Conclusion: There are no sufficient scientific reasons to support the inclusion of ESR as a premarital test so, this practice should be discouraged.

Keywords: *Erythrocyte sedimentation rate, haemoglobin electrophoretic pattern, premarital couples*

INTRODUCTION

The erythrocyte sedimentation rate (ESR) is the rate at which erythrocyte settles in a vertical column of anticoagulated blood in 60minutes. It is a simple and inexpensive laboratory test that is frequently requested for, in clinical medicine.[1-3]

Historically, Edmund Biernacki (1866-1912), a Polish physician, first noted the increased sedimentation rate of blood from ill individuals and realized that it was due to the presence of fibrinogen.[4] In 1918, Robin Fahraeus (1888-1968) furthered Biernacki's work.[5] His initial motivation to study the ESR was as a pregnancy test but his interest expanded to the study of ESR in disease states. Alf Westergren (1881-1968) refined the technique of performing the ESR and reported its usefulness in determining the prognosis of patients with tuberculosis.[6] A variation of the methodology of the ESR was published by Wintrobe in 1935 and was at one time in wide use.[7] In 1977, the International Committee for Standardization in Hematology recommended the adoption of the Westergren method worldwide.[6-8]

The ESR is a relatively non-specific test that is frequently requested for during the diagnosis and monitoring of disease. A variety of factors influence the sedimentation rates. Disease related factors that may affect the ESR include the plasma immunoglobulin and fibrinogen concentrations and the presence and degree of anaemia.[9] Factors unrelated to

disease that may affect the ESR values include age, sex and drug therapy.[3, 10]

The rationale for the inclusion of ESR among other tests in premarital test screening as is becoming the practice in this part of the world is not known, as its relevance in premarital screening has not been reported. This study examines how relevant the ESR test is to premarital screening when compared with other tests. The question is, should this practice be encouraged or not?

The seroprevalence of HIV, blood groups and haemoglobin genotypes among premarital couples in Port Harcourt has been reported. [11] In this study, the ESR values and haemoglobin electrophoretic pattern are further evaluated and compared to evaluate the extent of correlation between these factors. Haemoglobin electrophoretic pattern among premarital couples is often done for the purpose of screening for carriers of abnormal haemoglobin and provide counseling to intending couples with a view to preventing hereditary blood disease.[12]

SUBJECTS AND METHODS

The study population consisted of one hundred and eighty (180) premarital men and women (i.e. 90 premarital couples) who attended the mandatory premarital counseling of a faith based organization and who were referred to the Medical Laboratory for premarital testing. All the subjects were offered pre-test genetic counseling by the Marriage Committee headed by a medical officer and thereafter, an informed consent was obtained for each blood sample collection. Results of the tests were returned directly to the marriage committee. The Committee then disclosed the results of the tests to the intending couples during their counseling sessions. The stages involved in the counseling process fall beyond the scope of this study. All the participants were apparently healthy individuals with no clinical evidence of any disease. The mean age of the males was 31.5±10.7 while that of the females was 24.5±5.74. Three milliliters of venous blood were collected into potassium ethylenediamine tetracetic acid (EDTA) salt and used for both ESR and haemoglobin electrophoresis.

The Westergren method was used for ESR determination. This employed a 200mm, 2.5mm diameter tube vertically aligned column. The column was filled with blood anticoagulated with K_3 EDTA. The distance that the column of blood falls in one hour is recorded and reported in millilitre at the end of the 1st hour. Haemoglobin electroporetic pattern was performed on each sample with cellulose acetate paper at pH 8.9 with AA and SS controls. Data were analyzed using the SPSS software (version 11). Significant level was set at alpha 0.05 ($p \leq 0.05$).

RESULTS

A total of 90 intending couples with requests for premarital tests constituted the study population. Their ages ranged from 18 to 40 years. The mean age of the females (24.57±5.74 years) differ significantly from their male counterparts (31.5±10.7 years) ($p < 0.01$). The ESR values of the females (20.77±18.8 mm/hr) were significantly higher than those for males (12.48±12. 0 mm/hr) ($p < 0.01$) (Table 1).

Table 1: Mean age and ESR values of the study population

Parameters	Males Mean ±SD	Females Mean ±SD	Overall Mean ± SD	Range Min-Max
Age (years)	31.5 ± 10.7	24.5 ± 5.74	29.28 ± 5.38	18 – 40
ESR (mm/hr)	2.48± 10.0	20.77 ± 18.8	17.03 ±15.45	1 – 75
t-test for ESR = 3.9**				

** = Significant at p <0.01

Table 2 shows the distribution of the electrophoretic patterns among the study participants. Of the study population, 88.3% had AA while, 16.7% had AS. The four variables used in this study were correlated

using Pearson's correlation tests. Significant relationship was found to exist between gender and ESR (Table 3).

Table 2: Distribution of Hb electrophoretic patterns among the study population

Gender	Hb Electrophoretic Pattern	
	AA *n (%)*	**AS** *n (%)*
Females *(n = 90)*	74 (82.2)	16 (17.8)
Males *(n = 90)*	76 (84.4)	14 (15.6)
Total	**150 (83.3)**	**30 (16.7)**

Table 3: Pearson correlation of the four variables used in this study

	Age	Sex	ESR	Hb Electrophoretic pattern
Age	1.000			
Sex	-0.705**	1.000		
ESR	0.064	0.248*	1.000	
Hb Electrophoretic pattern	-0.027	0.065	0.144	1.000

** = Correlation is significant at p <0.01 (2-tailed)
* = Correlation is significant at p <0.05 (2-tailed)

ESR cut-off values in this study population shows that none of them had an extreme elevation of ESR values. Of the females, 5.55% and the males 2.2% had moderately elevated ESR values, respectively (Table 4).

***Table 4: The cut-off values for ESR in the study population

	Cut-off values	Males	Females	Total
Mildly elevated	20 – 50mm/hr	12 (6.67%)	20(11.1%)	32(8.83%)
Moderately elevated	1– 99 mm/hr	4 (2.2%)	(5.56%)	14(3.38%)
Extreme elevation	≥100 mm/hr	0 (0%)	0 (0%)	0(0%)

DISCUSSION

Erythrocyte sedimentation rate (ESR) is called an acute phase reactant test because it reacts to acute conditions in the body such as infection and trauma. The rate increase follows a rise in temperature and white blood cells count, peaks after several days and usually lasts longer than the elevated temperature or white blood cell count.[14]

As with other laboratory tests, it is necessary for the actual range of ESR to be established among normal healthy subjects which at the same time may serve the purposes of screening the population for occult diseases. In this study, the mean ESR values varied significantly according to sex alone, being higher in females than males. This observation is in consonance with earlier published data by Katz, *et al*.[15] The ESR values in women may be attributed to their low haematocrit or haemoglobin concentration occasioned by menstrual blood loss. In anaemia, with the haematocrit reduced, the velocity of the upward flow of plasma is altered so that red blood cell aggregates fall faster.[16]

Other conditions that can raise the ESR value by elevating fibrinogen include, pregnancy, diabetes mellitus, end-stage renal failure, heart disease, collagen vascular diseases and malignancy. Though the participants in this study were apparently healthy premarital couples, 5.56% of the females had their ESR moderately elevated (ESR 51–99mm/hr) while 2.2% of the males were affected at the same level. Notwithstanding that the use of the ESR as a screening test in asymptomatic persons is limited by its low sensitivity and specificity, the elevated ESR is key diagnostic criterion for polymyalgia rheumatica and temporal arteritis, thus, further investigation may need to be instituted to rule out or confirm the presence of these conditions.

The normal values of ESR for men are 15 mm/hr or less and 20 mm/hr or less for women,[3,17] hence in this study, the ESR values for both males and females were within the normal range. No significant relationship was found to exist between ESR and age of participants, however, the ages of the participants ranged between 18 and 40. A study by Caswell, *et al;*[18] showed that the

highest normal ESR values are among those aged 65–74years. The lack of correlation between age and ESR in this study may be attributed to the fact that the participants are in their middle ages. The probability of disease at any age increases with increased ESR and becomes more significant when the ESR exceeds 50mm/hr.[19] It appears that age alone has only a marginal effect, if any, on the ESR. In blacks, normal values of the ESR are at least 2mm/hr to 13mm/hr higher even after correcting for age, haemoglobin concentration and certain chronic diseases.[19,20]

The ESR did not show any correlation with haemoglobin electrophoretic pattern when compared with Pearson correlation test, thus its inclusion as one of the premarital tests may be as a "sickness index" which may warrant further investigation. The frequencies of HbAA was higher (83.3%) in this study than the previous study earlier reported[11], however, the prevalence of HbAS in this study is reduced (16.7%) as against 26% in the earlier study. No sickle cell diseases (HbSS, HbSC etc.) were detected in this study.

Potential new applications of the ESR test have emerged in recent times, proving that the ESR was not only useful in ancient Greek times but is still relevant in modern medicine. Some of the current literature data on the relevance of the ESR in some clinical condition are thus summarized. The ESR has been shown to be elevated in 92% of 48 children with acute hematogenous oesteomyelitis.[21] In sickle cell disease (SCD) the ESR has been found to be usually low in the absence of a painful crisis.[22] The ESR determination in a prospective study of 447 human immunodeficiency virus (HIV) infected patients was a predictor of AIDS but only when coupled with a CD4 count of <500 x 10^6/ml and an elevated b2–microglobuln.[23] Similarly, the ESR has been shown to be elevated in pelvic inflammatory disease, prostate cancer, coronary artery disease and early prediction of stroke severity.[23-25]

The ESR is an old, yet, important test in modern medicine, but its usefulness as a premarital test has not been scientifically proven so its inclusion as one of the premarital test should be revisited.

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