A Comparative Study of Blood Viscosity and Fibrinogen Concentration Between Non-Pregnant Women and Parturients with Uneventful Antenatal Period.

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ABSTRACT

Inflammation, an attendant corollary of parturition, expresses acute phase protein such as fibrinogen. Since pregnancy is contextually a hypercoagulable state, this additional expression of fibrinogen from the inflammation of parturition can be a risk for thromboembolism. This study is aimed at comparing blood viscosity and fibrinogen concentration between non-pregnant control and parturients who had an uneventful antenatal period. A total of 50 volunteers comprising 25 parturients and 25 non-pregnant control subjects from St. Philomena Catholic Hospital were studied. Informed consent from the subjects and ethical clearance from the St. Philomena catholic hospital were obtained for the study. The antenatal history was obtained from the case notes of the parturients while a pretested questionnaire was used to obtain biodata from the control subjects. The fibrinogen concentration, relative whole blood viscosity and relative plasma viscosity were measured using standard laboratory methods. Data obtained revealed that though relative whole blood viscosity and plasma viscosity were higher in parturients compared to the non-pregnant control, the difference was not statistically significant ($p>0.05$). However, fibrinogen concentration of the parturients (4.65±0.24g/dl) was significantly higher ($p<0.05$) than that of the non-pregnant control (2.19±0.13g/dl). The increase in fibrinogen concentration during the intrapartum period suggests that parturition might exacerbate the hypercoagulable state of pregnancy which is a potential risk for thromboembolism.

Keywords: Blood viscosity, Fibrinogen, Parturient, Non-pregnant, Antenatal

INTRODUCTION

A parturient is a woman who is in labour, Labour or the act or process of giving birth. Labour or parturition is usually associated with intermittent but regular uterine contractions which are characteristically painful. Pain is therefore a common denominator in inflammation and parturition. The process of parturition is associated with molecular events including the release of cytokines and prostaglandins (Kelly, 1996). Cytokines have major roles in the regulation of the biosynthesis of acute phase proteins such as fibrinogen in the liver (Castell *et al*., 1989; Marinkovic *et al*., 1989). Fibrinogen (factor1) is a blood protein produced by the liver that plays an important role in blood coagulation and inflammation management (Lang *et al*., 2009).

In pregnancy a procoagulable state is usually observed and this predisposes the pregnant women to thromboembolism, particularly those with additional risk factors (Duhlet *et al*., 2007). Furthermore, the aforementioned effect of parturition (pain) in increasing fibrinogen levels and a compensatory increase in platelet count post-delivery, serves as a potential for complications. However homeostasis is maintained by complex interactions between the cellular and protein component of coagulation (Hoffman and Monroe, 2001).

Postpartum hemorrhage is the leading cause of maternal mortality in low income countries and the primary cause of nearly one quarter of all maternal deaths globally and most of these deaths resulting from postpartum hemorrhage occur during the first24 hours after birth (WHO, 2012). Hence this research is aimed at studying some hemorheological indices such as fibrinogen concentration and blood viscosity of parturients with uneventful antenatal periods.

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MATERIALS AND METHODS

Subjects

A total of 50 women between the ages of 25 and 33 years at Saint Philomena Catholic Hospital, Benin city, Edo State, volunteered for the study. Twenty-five of the women were parturients who had given informed consent during the third trimester of their antenatal clinic, while the other twenty five women were the non- pregnant control.

Exclusion criteria

Any parturient with preeclampsia, chronic hypertension in pregnancy, diabetes in pregnancy, anemia in pregnancy, hemoglobin SS, smokers, alcohol use, vomiting, diarrhea, renal disease, chronic illnesses, chorioamnionitis, primary education, nulliparity, multiparity, preterm labour and was excluded.

Inclusion criteria

Booked patients with booking laboratory parameters that are within normal range. Parturients who are in active phase of labour but with cervical dilatation of not more 8cm.

Collection of blood samples

Seven (7) mls of venous blood samples were collected by standard aseptic methods into sample bottles containing Ethylenediaminetetraacetic acid (EDTA) and was subsequently used for the determination of fibrinogen concentration, relative plasma viscosity and relative whole blood viscosity.

Determination of fibrinogen concentration, relative plasma viscosity and relative whole blood viscosity

Fibrinogen concentration was determined using the STA-R Evolution instrument (STA® Fibrinogen 5, Diagnostic Stago, Asnieressur Seine, France); non-pregnant range 2.0-4.5g/l. The modified needle and syringe method of Reids and Ugwu (1987) was used for the determination of relative plasma viscosity and relative whole blood viscosity. The ratio of transit time for 1 ml of plasma to 1 ml of distllled water through a 1 ml syringe is the relative plasma viscosity, while the ratio of 1 ml of bloo to 1 ml of distilled water through a 1 ml syringe is the relative whole blood viscosity.

Statistical analysis

Data were presented as the mean± standard error of mean, using the Microsoft excel 2010. The students' t- test was used for analyses of data and a p value < 0.05 was considered statistically significant.

Ethics

Ethical clearance (SRECC/16) was obtained from the Ethics and Collaboration Committee of the St Philomena Catholic Hospital, Benin, where the study was done. Informed consent was also obtained from the subjects.

RESULTS

A total of fifty subjects were studied with 25 parturients and 25 non-pregnant control subjects. The age for the control subjects was 29.3±2.63 years, while that for the parturients was 30.1±1.71 years. The packed cell volume of the parturients ranged between 33% and 37%. During the antenatal period the parturients maintained a weight gain which ranged between 9 kg and 12kg; their systolic blood pressure ranged from 100 to 110mmHg, while the diastolic pressure ranged from 60 to 70 mmHg. The urine analyses during the course of the ante-natal clinic in the subjects studied were devoid of protein and glucose.

The relative whole blood viscosity in the non-pregnant control and parturients is shown in figure 1. The relative whole blood viscosity for the control was 1.14±0.02 while that for the parturients was 1.18±0.03. There was no statistical significant difference (p>0.05) in viscosity when the test values were compared with the control.

Similarly the relative plasma viscosity in the non-pregnant control and parturients is shown in figure 2. The relative plasma viscosity for the control was 0.93±0.02 while that for the parturients was 0.97±0.02. There was no statistical significant difference (p > 0.05) between both values. The fibrinogen concentration in the non-pregnant control and parturients is shown in figure 3. The fibrinogen concentration for the control was 2.19±0.13 while that for the parturients was 4.65±0.24. The fibrinogen concentration for the parturients was higher than that of the control subjects (p < 0.05).

DISCUSSION

Uncomplicated pregnancy is accompanied by changes in the coagulation and fibrinolytic system which consequently creates a state of hypercoagulability (Domenico *et al*., 2005; Stirling *et al*., 1984; Bonnar, 1987). The overall aim of this physiologic adaptation is to prevent post-partum hemorrhage. In this study, the relative whole blood viscosity was only empirically increased in the parturients when compared to the non-pregnant control. This finding is similar to previous reports of a non-significant transient increase in blood viscosity during fetal delivery with a rapid return to the baseline values during delivery of the placenta (Brun *et al*., 1995; Kleiner *et al*., 1970). Nevertheless, the stress of labour can alter osmolality and pH in such a way that the size and shape of red blood cells are affected in favour of increased blood viscosity.

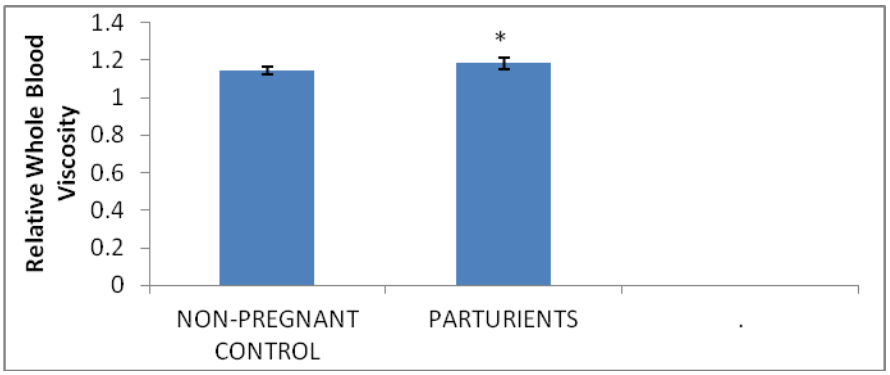

Figure1: Relative Whole Blood Viscosity (RWBV) in non- pregnant women and parturients. Data are expressed as the mean ± SEM. * $p > 0.05$ compared to parturients, n=25 per group.

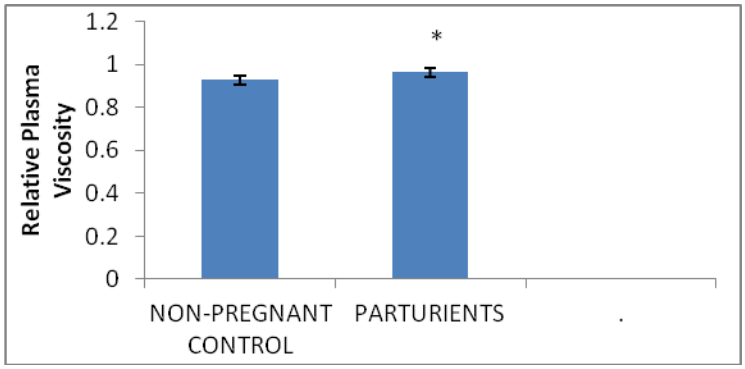

Figure 2: Relative Plasma Viscosity (RPV) in non- pregnant womenand parturients. Data are expressed as the mean ± SEM. *$p > 0.05$ compared to parturients, n=25 per group.

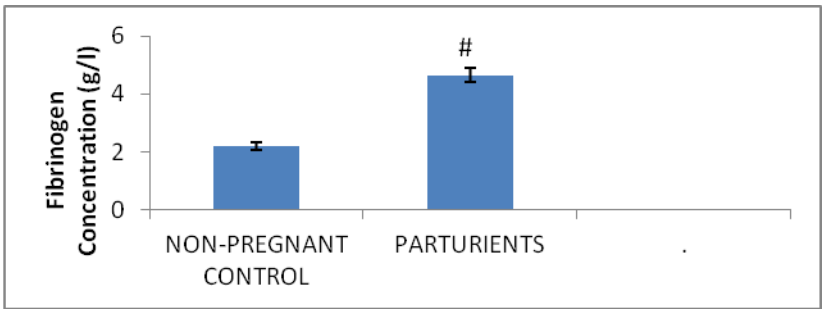

Figure 3: Fibrinogen concentration in non- pregnant women and parturients. Data are expressed as the mean ± SEM. #$p > 0.05$ compared to parturients, n=25 per group.

Normal red cell suspension increases viscosity with increase in osmolality at high shear rate (Yamoto and Niimi, 1983). Thus, the maintenance of normal blood viscosity during parturition in this study is probably due to the hospital's management protocol for labour, which includes analgesia, adequate rehydration and calories. The adequate rehydration ultimately maintains the plasma viscosity and the internal viscosity of red cells. It has been hypothesized that hypoxia and lactic acidosis and other hormonal processes may cause a short term rigidification of erythrocytes resulting in increased blood viscosity

(Brun *et al*.,1995) as observed in the empirical increase in this study. Albeit, the adequate rehydration and glucose infusion received in labour may counteract the erythrocyte rigididification effect of hypoxia and lactic acidosis.

Fibrinogen concentration showed a significant increase in the parturients which correlates with a pioneer work that demonstrated an increase in fibrinogen concentration and a decrease in fibrinolytic activity during parturition (Bonnar *et al*., 1970). However, their research was a sequential study of the blood cogulation and fibrinolytic systems in the uterus of parturients delivered by caesarean section. The physiology of parturition favours a reactionary increase in coagulation indices as compensation for the increased platelet consumption at birthing (Sharma *et al*., 1997). Parturition being a pro-inflammatory process may increase the production of cytokines which have major roles in regulating the synthesis of acute- phase protein like fibrinogen in the liver (Castell *et al*., 1989; Marinkovic *et al*., 1989). The increase fibrinogen concentration during intrapartum period which favours hypercoagulation may predispose to thromboembolic complications.

The hypercoagulable state of pregnancy can be worsened by the increase in fibrinogen levels associated with parturition. This synergy increases the potential for postpartum thromboembolic complications. Therefore, astute labour management protocol which ensures adequate hydration, use of analgesia and early postpartum ambulation is expedient

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