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Patterns of Routine Antenatal Laboratory Test Results at Booking in Enugu State University Teaching Hospital, Enugu, Southeast Nigeria

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Abstract: Objectives: To determine the patterns of routine antenatal care laboratory test results at booking in Enugu State University Teaching Hospital (ESUTH), Enugu, and to review the literature on the subject.

Methods: The registers for the results of routine laboratory tests at booking in ESUTH, Enugu were reviewed from April 1, 2014 to August 31, 2016. Data on age, blood group, rhesus status, hemoglobin genotype, packed cell volume; human immunodeficiency virus screening (HIV), venereal disease research laboratory (VDRL) and hepatitis B virus surface antigen (HBsAg) tests at booking were collected and analyzed with Excel 2007 software. The results were presented in tables, percentages and graphs.

Results: A total of 5293 mothers were tested; 2706 (51.12%) and 2500 (47.23%) of them were of ages <30 and 30-40 years respectively (Table 1). Table 2 showed the commonest blood group was 'O' 3062(57.85%). Most of the mothers 4811(90.89%) were Rhesus D positive while 482(9.11%) of them were negative. Hemoglobin genotype results were: AA 4066(76.82%), AS 1217(22.99%), and SS 8(0.15%). About 3819(72.15%) had packed cell volume of 31% and above. Table 3 revealed 232(4.83%) women tested positive to HIV, but 17(0.32%) only were new cases. Twenty eight (0.53%) women were reactive to VDRL while 166(3.14%) tested positive to HBsAg test. Many women 5061(95.62%) and 5127(96.86%) tested negative to HIV and HBsAg tests respectively.

Conclusion: Most women are young (<40 years), have blood group O rhesus D positive, hemoglobin AA genotype, and are not anemic at booking. Many women are non-reactive to VDRL, HIV and HBsAg tests; and are vulnerable to infections. The marked reductions on SS genotype, VDRL and HIV new cases in this study have justified the critical preventive role of routine ANC laboratory tests in our current obstetric practice and the need for the continuation of the practice.

Key words: *Patterns, Routine ANC Tests, Booking, ESUTH, Enugu, Literature Review.*

I. INTRODUCTION

Antenatal care (ANC) is an integral part of a continuum of evidence-based, preventive, cost-effective, and low-technology healthcare interventions during pregnancy, childbirth, and postnatal periods with the aim to ensure healthy maternal, fetal, newborn and infant outcomes [1]. Such quality ANC interventions should reduce or prevent approximately the 303 000 maternal deaths and 2.6 million stillbirths that occurred in 2015 [2, 3, 4]. Ninety nine percent of these preventable deaths occur in low-resource settings. The interventions and strategies to improve reproductive, maternal, newborn and child health are closely related and should be provided as a continuum of integrated service delivery that synergizes efficiency, and avoid duplication of resources [5]. What matters to women is that the ANC services they receive should ensure that the mother and the unborn baby are healthy; and that women have positive pregnancy experiences that transit to safe delivery of healthy babies without abuse and disrespect to them [6,7]. ANC also ensures that there are birth and emergency preparedness plans, and functional referral linkages to emergency obstetric care services [8]. These important plans are made in advance by every pregnant woman to avoid 'fatal' obstetric delays when life-threatening obstetric emergency occurs. The preventions of many prevalent health problems in developing countries such as malaria, tetanus,

syphilis, human immunodeficiency virus (HIV), hepatitis B virus, and anemia are integrated into routine ANC services. ANC has also become the entry points for many other interventions like health promotions, early healthcare-seeking behaviors, community mobilization for financial supports, discouragement of harmful traditional practices, and referral linkages to family planning, child immunization, genital cancer screening, infertility and other reproductive health problems. Routine laboratory tests at booking are part of this gamut of evidence-based interventions to ensure healthy mothers and infants. The prevailing health challenges and the available laboratory tests appear to be the determinants of what should be included in the routine antenatal laboratory tests. The tests should be cost effective. The usual recommended routine ANC laboratory tests in low resource countries include: Packed Cell Volume (PCV), Blood/Rhesus group, Hemoglobin genotype, Veneral Disease Research Laboratory (VDRL), Human Immunodeficiency Virus (HIV), Hepatitis B (HBsAg), and urinalysis. In developed world several other investigations like full blood count; rubella antibody test, urine culture, and ultrasonography are included in the booking investigations.

Most previous studies on the subject centered on syphilis and whether the test (VDRL) should be continued as routine laboratory test in current obstetric practice [9, 10]. Few studies in this study area have reviewed holistically routine antenatal laboratory tests as we did in this work. The objectives of the study are to determine the patterns or results of the various routine ANC laboratory tests at booking in Enugu, and to review the literature on the subject.

II. SETTINGS AND METHODS

Enugu State University Teaching Hospital (ESUTH) Enugu is a state owned health institution that evolved from Nursing Home in 1930 for the colonial masters to a teaching hospital status in June 2006 [11]. It is located in the center of Enugu metropolis and most of the population are Christians and of the Igbo tribe [12]. The department of Obstetrics and Gynecology in ESUTH has two professors, a reader, 8 consultants, 9 senior registrars, 13 registers, house officers, and 45 staff nurse midwives. The obstetric unit has 42 beds with an average of 2000 ANC bookings and 1250 deliveries annually. The booking antenatal clinic is on Thursdays and is conducted by two registrars and five midwives. Health education, HIV group counseling and testing, and information on other routine laboratory tests are done. Prior to the laboratory testing, the women were counseled on the benefits of the tests, the implications of both a positive or negative result, and verbal consent (or decline) obtained. The results are carried out the same day by laboratory scientists attached to the departmental side laboratory, and the results are released to the mothers by the midwives after recording the results in the registers. The registers were reviewed from April 1, 2014 to August 31, 2016. Data on age, blood group, rhesus status, hemoglobin genotype, packed cell volume; retroviral screening (HIV), venereal disease research laboratory (VDRL) and hepatitis B virus surface antigen (HBsAg) tests at booking were collected and analyzed with Excel 2007 software. The results were presented in tables, percentages and graphs.

III. RESULTS

A total of 5293 mothers gave consent and were tested; 2706 (51.12%) and 2500 (47.23%) of them were of ages <30 and 30-40 years respectively as in Table 1. Only 82(1.55%) women were more than 40 years. Table 2 showed the commonest blood group was 'O' 3062(57.85%) while 'AB'114(2.15%) was rare. Most of the mothers 4811(90.89%) were Rhesus D positive while 482(9.11%) of them were negative. Hemoglobin genotype results were: AA 4066(76.82%), AS 1217(22.99%), and SS 8(0.15%). About 3819(72.15%) had packed cell volume of 31% and above. However, about 1474(27.85%) women booked with mild to moderate anemia. Table 3 revealed 232(4.83%) women tested positive to HIV, but 17(0.32%) only were new cases. Twenty eight (0.53%) women were reactive to VDRL while 166(3.14%) tested positive to HBsAg test. Many women 5061(95%) and 625127(96.86%) were non-reactive to HIV and HBsAg tests respectively, and are vulnerable to infections. The summaries of the results are presented graphically in Figures 1 and 2.

IV. DISCUSSION AND CONCISE LITERATURE REVIEW ON THE TESTS

Blood group and Rhesus types

Generally, it is very importance to know your blood group and rhesus status to prevent the risk of incompatible blood transfusions and reactions during emergencies; rhesus D sensitization and hemolytic disease of the new born in future rhesus- D positive baby pregnancies. The prevalence of blood groups among antenatal women in Enugu were: A (23.92%), O (57.85%), B (16.08%) and AB (2.15%). This study results were similar to the results of a prospective study in Port Harcourt, South-South, Nigeria that showed blood groups of: A (26.67%), O (52.78%), B (18.33%), and AB (2.22%) [13]. Our results vary widely when compared with values from Western Europe of blood groups: A (42%), O (46%),B(9%), and AB(3%), and South-Western Germany: A (43.26%), O (41.2%), B(10.71%), and AB(4.82%)[14,15]. Majority of the women in our obstetric population are of blood group O, and this knowledge is very important during dire obstetric emergencies and blood

transfusions. The common group O in this obstetric population provides an advantage in terms of availability of blood for transfusion as blood group O can be transfused to A, B and AB after cross matching.

The result of **rhesus D status** in this study showed that 90.89% of the mothers were rhesus D positive while 9.11% were negative. The 9.11% rhesus D negativity in this study is higher than 4.5% in University of Nigeria Teaching Hospital, Enugu and 7.1% in Sokoto Nigeria [16, 17]. In most Caucasian population, the incidence of rhesus D negativity is 15 - 16%, and less than 1% among Chinese and Japanese populations. In blacks, the incidence ranges from 4 to 8% [18].

Though, the risks of rhesus D iso-immunization and perinatal mortality are rare in the study population [19], health facilities managing rhesus D negative pregnancies should be able to demonstrate feto-maternal hemorrhage in the laboratories and give correct quantity of anti-D immunoglobin prophylaxis within 72 hours of any potentially sensitizing events during pregnancy and childbirth. Universal access to prophylactic anti-D should be provided for all rhesus D negative women after miscarriages,amniocentesis, cordocentesis, antepartum haemorrhage, vaginal bleeding during pregnancy, external cephalic version, abdominal trauma, intrauterine death and stillbirth, in utero therapeutic interventions, and therapeutic termination of pregnancy. The rhesus blood group of all babies delivered by rhesus D negative mothers should be determined at delivery and if found to be rhesus D positive; feto-maternal-hemorrhage testing (Kleihauer or flow cytometry test) should be carried out to estimate the quantity of fetal red cells that may have entered the maternal circulation to facilitate the administration of optimal quantity of anti-D immunoglobulin to prevent hemolytic disease of the new born.

Hemoglobin genotype

Hemoglobinopathies are common genetic disorders worldwide. They are inherited as autosomal recessive disorders from healthy-carriers. The distribution of hemoglobin genotype in this study revealed HbAA 78.82%, HbAS 22.99% and HbSS 0.15%. Umoh and coworkers [20] reported similar results in a mixed population of males and females as follow HbAA 78.7%, Hb AS 19.6%, and HbSS 1.5%. HbAC and HbSC accounted for 0.2% and 0.04% respectively in the study. In Port Harcourt the results of hemoglobin genotypes were also similar to findings in our study with 70.00% for HbAA, 29.44% for HbAS and 0.56% for HbSS. HbAC and HbSC did not occur in the Port Harcourt study as in our study population [13]. Geographic distribution of sickle cell disease revealed 1 – 10% HbSS [21]. The vigorous campaign for premarital hemoglobin genotype tests and the discouragement of AS/AS or SS/SS marriages appear to be the reason for the very low HbSS in our study. Pregnancy in HbSS patient is a high risk one that is associated with many adverse outcomes. Anemia in pregnancy (Hb<11 g/dl) was reported in 94.2% of such HbSS pregnancies [22]. The high risk HbSS pregnancies should ideally be managed by experts in tertiary health institutions to reduce adverse outcomes and prevent mortalities.

Packed cell volume and anemia

About 72.15% of the women in this study had packed cell volume of 31% and above while 27.85% of them had mild to moderate anemia. The rate anemia at booking in our work was less than 54.5% reported in Uyo Nigeria where the commonest cause was iron deficiency anemia [23]. Women need to be economically empowered, encouraged to book for antenatal care, be on intermittent prophylaxis for malaria, sleep under insecticide treated net and on hematinic supplementation to prevent anemia and its complications in pregnancy. The HbAS pregnant women should be screened and treated for urinary tract infections to avoid asymptomatic bacteria, preterm delivery and anemia in pregnancy.

Human immunodeficiency virus (HIV)

HIV prevalence among pregnant women attending ANC has remained the principal data source to inform trends in generalized HIV epidemics in developing countries [24]. In Abuja, Nigeria HIV prevalence among pregnant women attending ANC ranged from 4.5% in 2005 to 11.2% in 2006 and peaked at 15.4% in 2009 [24]. A pooled study on recent HIV prevalence trends among pregnant women and all women in sub-Saharan Africa countries revealed that HIV prevalence declined among pregnant women from 6.5% between 2003--2008 to 5.3% between 2009-2012; but remained unchanged among all women aged 15-49 years at 8.4% over 10 years [25]. The HIV prevalence in ESUTH, Enugu was 4.38%, and this is within the 4-6% HIV prevalence for Enugu state as at 2013 [26]. The routine HIV testing of antenatal women and the freely available highly active antiretroviral therapy (HAART) for all HIV positive mothers on WHO option B+ basis [27] may be responsible for this decline. The fact that only 0.53% cases of new HIV occurred during this study period showed the critical role of ANC can play in preventing prevalent health problems like HIV. In Option B+ all HIV-positive pregnant women are commenced on a single-pill fixed-dose HAART regimen containing tenofovir, lamivudine and efavirenz from diagnosis and continued for life. Option B+ regimen is a simplified first-line antiretroviral treatment regimen that paved the way for public health approach in global scale-up of the

use of HAART in prevention of mother-to-child transmission of HIV and elimination of paediatric HIV, and in the 'treatment as prevention of HIV' (TasP) in the prevention of new HIV infections. The crucial role of ANC in virtual elimination of mother-to-child transmission of HIV has been documented by Okafor et al [28].

Venereal Disease Research Laboratory (VDRL) test

Syphilis is systemic disease caused by Treponemapallidum. The first epidemic occurred in the 15th century in Western Europe. It is transmitted through sexual activity from muco-cutaneous lesions. In pregnancy, mother-to-child transmission can occur through the placenta and during childbirth. Syphilis in pregnancy is an important cause of adverse feto-maternal outcomes [29]. It can cause spontaneous abortion, stillbirth, non-immune hydrops, intrauterine growth restriction, perinatal death, and serious sequel in live born infected children. Complications in the surviving newborns include deafness, multiple skin, bone, and joint deformities and haematological disorders. World health organization (WHO) recommended serological test for syphilis in pregnancy, and the treatments with injectable penicillin for the infected mothers and their partner/s to interrupt further transmission of the disease [30]. Venereal Disease Research Laboratory (VDRL) test is the most widely used screening test for syphilis, but it has a high false-positive rate of 73.3% [10]. Ideally, positive VDRL results should be confirmed with other specific tests like Treponemapallidumhaemagglutination and Fluorescent Treponemal Antibody Absorbed (FTA-ABS) test before treatment. The low prevalence of 0.53% sero-positivity in this work showed how effective ANC intervention can help in prevention of reproductive health problems. Our result is within 0.6%-2.3% reported rates in Nigeria for over 40 years [31-33]. However, the seropositive rates in otherAfrica countries range from 3%–18%, and thus syphilis has remained a major problem in many countries of sub-Saharan Africa [34-36]. It is still necessary to continue the antenatal VDRL test in the developing countries until the disease is eradicated.

Hepatitis B surface antigen (HBsAg)

Hepatitis B virus (HBV) is a blood borne and sexually transmitted hepadnavirus that causes acute and chronic hepatitis, cirrhosis and hepatocellular carcinoma. It was first described in the 5th century, but the earliest recognized outbreak occurred in Germany in 1883 after small pox vaccines prepared from human lymph were administered in 1289 shipyard workers, and 191 (15%) developed jaundice after several weeks; but jaundice did not occur among unvaccinated workers [37] The virus is transmitted through contact with the HBV infected blood or other body fluids like serum, semen, vaginal secretion and saliva. It is stable and infectious at room temperature environment even after 7 days. An estimated 240 million people are chronically infected with hepatitis B (HBsAg positive > 6 months), and more than 686 000 people die annually due to its complications [38].Perinatal transmission, infants, and children under 5 infections with immature immune systems account for 90% of chronic HBV infections while 95% of adult infections recover fully [39-41]. Chronic hepatits B also occur also in immunosuppressed persons [42]. Horizontal transmission occurs when susceptible individuals and households come in contact to infected blood, and body fluids. Unimmunized individuals, children, injection drug users, people practicing unsafe sex, and health workers are at risk of infection. The progression of chronic HBV infection to cirrhosis and hepatocellular carcinoma can be prevented with antiviral drugs, and new infections are also preventable with safe and effective vaccine.

Baruch Samuel Blumberg in 1964, discovered hepatitis B surface antigen (HBsAg) in the blood of an Australian hemophiliac who had multiply blood transfusions that is used as screening test for the virus during ANC [43,44]. HBV infection is hyperendemic (> 8% HBsAg chronic carriers in the general population) in some sub-Saharan countries such as Nigeria, Namibia, Gabon, Cameroon, Burkina Faso. Kenya, Zambia, Ivory Coast, Liberia, Sierra Leone and Senegal are considered areas of intermediate endemicity (2%-8%), while Egypt, Tunisia, Algeria and Morocco, located in the north of the continent, show a low endemicity level (< 2%) [45]. Pooled prevalence results of HBV in Nigeria from 2000-2013 studies showed: 14.0% for blood donors; 14.1% for pregnant women attending antenatal clinics; and 11.5% for children [46]. Other studies in Niger Delta and Benin reported seroprevalence of HBsAg among pregnant women of 5.3% and 6.6% respectively [47, 48]. The seroprevalence of 3.14% in our study is lower than other studies in Nigeria. May be increase in awareness, acceptance of universal HBV vaccine at birth and in susceptible individuals may explain the low seroprevalence in this study.

V. **CONCLUSION**

Most women are young (<40 years), have blood group O rhesus D positive, hemoglobin AA genotype, and are not anemic at booking. Many women are non-reactive to VDRL, HIV and HBsAg tests; and are vulnerable to infections. The marked reductions on the prevalence of SS genotype, VDRL and HIV new cases in this study have justified the critical preventive role of routine ANC laboratory tests in our current obstetric practice and the need for the continuation of the practice. The inclusions of the laboratory diagnoses of other

common health problems like malaria and diabetes mellitus in routine ANC services in Nigeria are recommended.

Table 1: Ages of mothers at booking antenatal clinic in ESUTH*, Enugu

Age in years	Number	Percentage (%)
<30	2706	51.12
30-40	2500	47.23
>40	82	1.55
Not states	0	0
Total	5293	99.9

ESUTH* =Enugu State University Teaching Hospital

Table 2: Results of hematological tests at booking antenatal clinic in ESUTH*, Enugu

Blood group	Number	Percentage (%)
A	1266	23.92
O	3062	57.85
B	851	16.08
AB	114	2.15
Not stated	0	0
Total	5293	100
Rhesus status		
Positive	4811	90.89
Negative	482	9.11
Not stated	0	0
Total	5293	100
Haemoglobin genotype		
AA	4066	76.82
AS	1217	22.99
SS	8	0.15
Others	0	0
Not stated	2	0.04
Total	5293	100
Packed cell volume (%)		
<25	84	1.59
25-27	297	5.61
28-30	1093	20.65
31-33	1818	34.35
>33	2001	37.8
Not stated	0	0
Total	5293	100

*ESUTH =Enugu State University Teaching Hospital

Table 3: Results of HIV, VDRLandHBsAg tests in Enugu.

Retroviral screening (HIV)	Number	Percentage (%)
Positive	232(New 17)	4.83% (New 0.32%)
Negative	5124	96.80
Not stated	0	0
Total	5293	100
Veneral Disease Research Laboratory (VDRL)		
Reactive	28	0.53
Non-Reactive	5265	99.47
Not stated	0	0
Total	5293	100
Hepatitis B Surface Antigen (HBsAg)		
Reactive	166	3.14
Non-Reactive	5127	96.86
Not stated	0	0

Total	5293	100

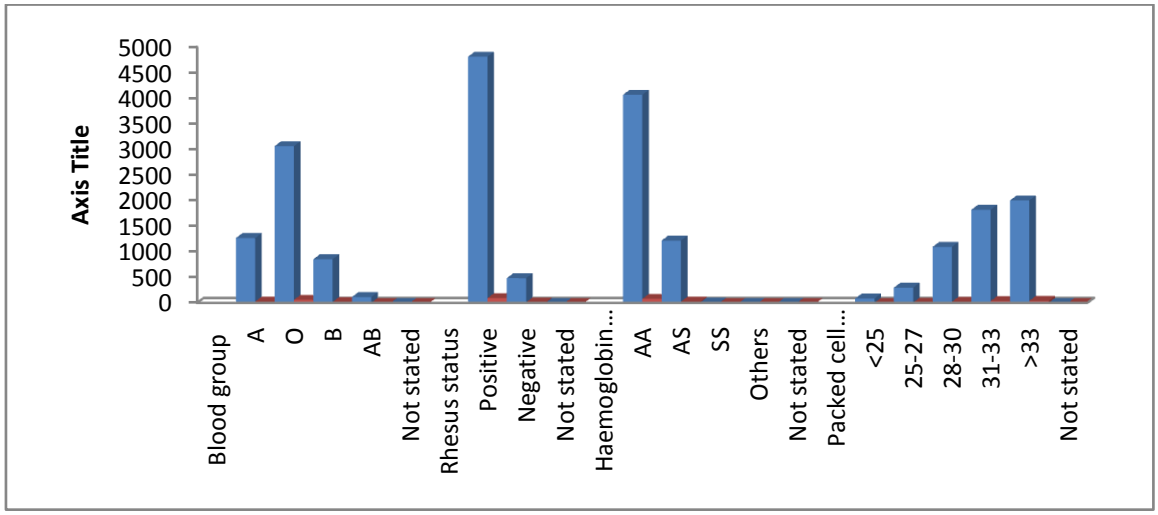

Figure 1: Results of hematological tests at booking antenatal clinic in ESUTH*, Enugu
*ESUTH =Enugu State University Teaching Hospital

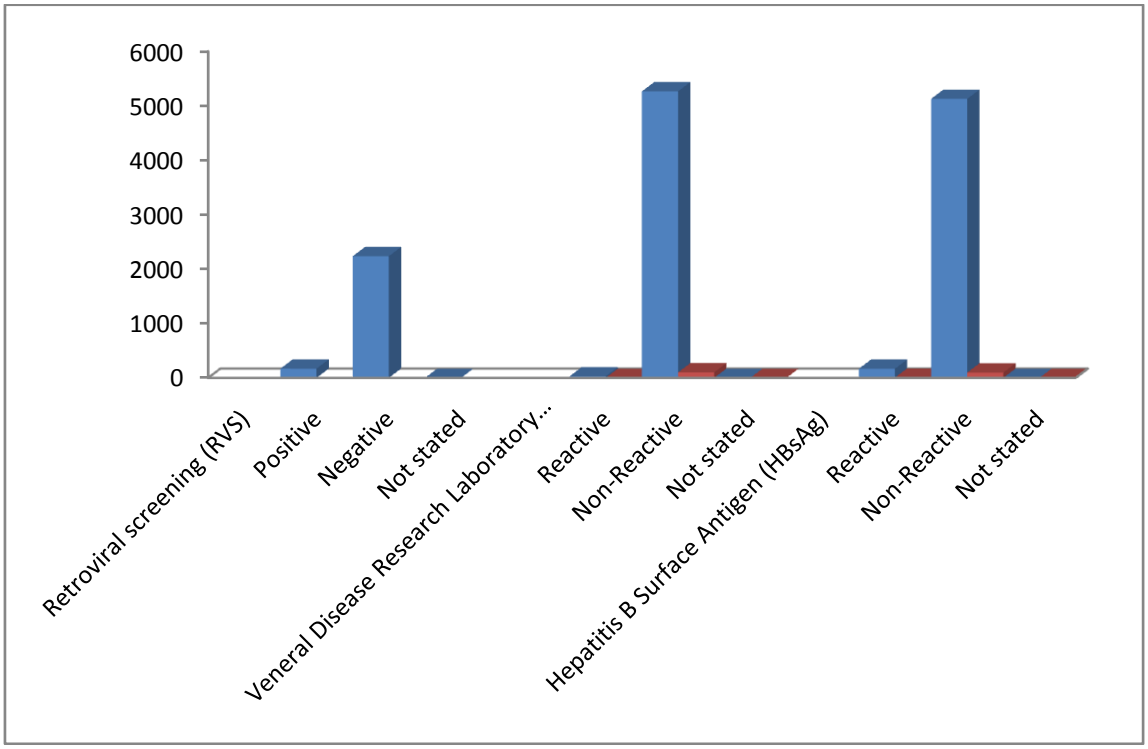

Figure 2: Results of HIV, VDRL and HBsAg tests in ESUTH, Enugu.

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