



Prenatal Ultrasonographic Management of Pregnancy: Is Routine Screening Necessary?

R. C. Onwuchekwa^{1*} and O. West¹

¹*Department of Radiology, Faculty of Clinical Sciences, College of Health Sciences, University of Port Harcourt, Rivers State, Nigeria.*

Authors' contributions

This work was carried out in collaboration between both authors. Author RCO designed the study, performed the statistical analysis, wrote the protocol, wrote the first draft of the manuscript, did the literature search and is the corresponding author for the manuscript. Author OW managed the analyses of the study and managed the literature search. Both authors read and approved the final manuscript.

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ABSTRACT

Objectives: The routine use of prenatal ultrasonography in all pregnancies had been of concern, especially in resource-limited developing countries. The study aims to evaluate the prenatal use of ultrasonography in our tertiary health institution to determine the cost-effectiveness and justification of routine prenatal scan in a resource-restricted environment.

Patients and Methods: This was a prospective study of all cases of obstetric ultrasonography seen in the radiology department of our health institution over a one year period from January to December 2017. The request forms and the duplicate copies of the obstetric scans were collected and stored on a safe shelf each day after work and were later analyzed to elicit information for the study. All cases of complete abortion and pseudo-cyesis were excluded. Also excluded were request forms without clear obstetric indication for example a request for pelvic or abdominopelvic

*Corresponding author: E-mail: ac_onwuchekwa@yahoo.com;

scan where the patient was found to be pregnant on ultrasonography.

The data was analyzed using the IBM SPSS Statistics for Windows, Version 20.

Results: A total of 550 cases were included in the study. The mean age was 32.08±4.96 years. More than 60% of the patients were within the age range of 26 years to 35 years. The most frequent indication for the prenatal scan was for routine assessment which is ultrasound scanning performed in the absence of any clinical condition. Routine scan constituted 392(71.3%) cases; this was followed by placenta localization 24 (4.4%) cases and gestational diabetes which constituted 18(3.3%) cases. Of the routine scans done 33(8.42%) were abnormal while 35 (22.15%) of the diagnostic scans were also abnormal. The commonest abnormality detected was oligohyramnios which constituted 20(29.41%) cases. Other abnormalities include uterine fibroid 14(20.59%), intrauterine fetal death 12(17.65%), abortion 10(14.71%) and placenta previa 6(8.82%). 290(52.73%) cases were done during the 3rd trimester, and of these, 38.62% were done during the 36th -38th weeks of gestation. During the first trimester, most of the scans 19(44.18%) were done at 9th and 10th weeks of gestation while second trimester scans 41(18.89%) were mainly during the 23rd and 24th weeks of gestation.

Conclusion: The study showed high rate of routine ultrasound scan without justifiable clinical indication. Majority of these scans were done during the second and third trimesters which lack the benefits associated with baseline prenatal ultrasonography usually carried out in the first trimester of gestation.

Keywords: Ultrasonography; prenatal; trimester; fetal anomalies; autonomy; obstetrics scan.

1. INTRODUCTION

Obstetric ultrasound is an integral part of antenatal care and in many centers it is performed routinely in all pregnancies [1]. The usefulness of ultrasound examinations in obstetric cases, in which there are clear reasons that the investigations might provide important information that compliments clinical assessment is not questionable. The controversy lies in the routine use of ultrasonography in all pregnancies. This had become a standard practice in many countries of the world, including Nigeria and other developing countries with limited resources. The autonomy of pregnant women is respected if obstetric ultrasonography is routinely offered and not offering routine obstetric scan systematically disrespects the autonomy of the pregnant woman [2]. However, it is the responsibility of the health professional to ensure that the screening procedures are cost effective as well as being clinically effective. The use of ultrasound had shown to reduce the risk of perinatal death and the use of obstetric interventions in high-risk pregnancies [3]. However, there is to date no supporting evidence that routine scans in early or late pregnancy confer benefits to mothers or babies if used in low-risk or unselected populations [4,5]. Ultrasonography is used clinically in obstetrics for a number of reasons including confirmation of fetal viability and gestational age [2], identification of multiple pregnancies, amniotic

fluid amount and screening for fetal anomalies [6]. Although the obstetricians described ultrasound as an invaluable tool for surveillance and management of pregnancy [7]. the routine use of prenatal ultrasonography should be monitored closely for possible abuse. Non clinically indicated overuse by healthcare professionals for their financial benefits [8] or by the patients for nonmedical reasons such as sex determination and selective abortion of normal female fetuses as practiced in some developing countries [9,10], especially in Asia where daughters are considered financial and cultural liabilities [8], should be discouraged.

The cost of each prenatal ultrasonography in our tertiary health institution and in private diagnostic centers in the area of this study ranges from three thousand to five thousand naira (approximately \$9- \$15). This may appear very cheap in high income developed countries where each scan costs about \$200 [11]; but not in a country with limited resources like ours where the minimum wage is eighteen thousand naira per month. Paying such amount for obstetric scan alone is expensive and capable of draining limited personal income.

The aim of the study is to evaluate the prenatal use of ultrasonography in our tertiary health institution to determine the cost- effectiveness, and justification of routine prenatal scan in a resource restricted environment.

2. PATIENTS AND METHODS

This was a prospective study of all cases of obstetric ultrasonography seen in the radiology department of University of Port Harcourt Teaching Hospital over a one year period from January to December 2017. The request forms and the duplicate copies of the obstetric scans were collected and stored on a safe shelf each day after work and were later analyzed to elicit information on patients age, indication for the scan, ultrasound estimated gestational age, fetal lie and presenting part, amniotic fluid volume, placenta location, fetal heart rate and summary. Presence of coexisting leiomyoma was also recorded.

All cases of complete abortion and pseudocyesis were excluded. Also excluded were request forms without clear obstetric indication for example, where a request was made for pelvic or abdominopelvic scan, but patient was found to be pregnant on ultrasonography.

The scan was done using MINDRAY DC-8 (2013, China) ultrasound machine fitted with 2.5-5MHz curvilinear transducer.

The study was approved by the medical ethics committee of the University of Port Harcourt Teaching hospital.

The data was analyzed using the IBM SPSS Statistics for Windows, Version 20.0 (IBM, 2011, Armonk, NY); statistical significance was set at $P < 0.05$. The data were analyzed using descriptive statistics of tables and percentages. Scattered plot was used to show the linear regression between fetal heart rate and gestational age.

3. RESULTS

A total of 550 cases were included in the study. The mean age was 32.08 ± 4.96 years. The age range was from 17 years to 52 years, and the mode was 36 years. More than 60% of the patients were within the age range of 26 years to 35 years (Table 1).

The commonest indication for the prenatal scan was routine assessment which is ultrasound scanning performed in the absence of any clinical condition and during which estimation of gestational age, fetal heart rate, placenta location, fetal lie, presenting part and liquor amni volume were evaluated. Routine scan constituted 392(71.3%) cases; this was followed by placenta localization 24 (4.4%) cases and gestational

diabetes which constituted 18(3.3%) cases (Table 2).

Table 1. Age distribution of the patients

| Age | Frequency | Percentage |
|-------|-----------|------------|
| 15-20 | 7 | 1.27 |
| 21-25 | 35 | 6.36 |
| 26-30 | 169 | 30.73 |
| 31-35 | 214 | 38.91 |
| 36-40 | 107 | 19.45 |
| 41-45 | 9 | 1.64 |
| >45 | 9 | 1.64 |
| Total | 550 | 100 |

Table 3 shows the various abnormalities found on ultrasound scan in relation to the type of request.

33 (8.42%) of the routine scans were abnormal while 35 (22.15%) of the diagnostic scans were also abnormal. The commonest abnormality detected was oligohyramnios which constituted 20(29.41%) cases. Other abnormalities include uterine fibroid 14(20.59%) cases, intrauterine fetal death 12(17.65%) cases, abortion 10(14.71%) cases and placenta previa 6(8.82%) cases.

There were 26(4.7%) cases of multiple pregnancies, 21(3.8%) were twins while 5(0.95) were triplets.

Majority of the scans were done during the 3rd trimester, constituting 290(52.73%) cases (Table 4), and of these, 38.62% were done during the 36-38weeks gestational age. During the first trimester, most of the scans 19(44.18%) were done at 9th and 10th weeks gestational age, second trimester scans 41(18.89%) were mainly during the 23rd and 24th weeks of gestation (Table 4).

The scatter plot (Fig. 1) shows that fetal heart rate reduces with increasing gestational age ($r = 0.038$).

4. DISCUSSION

Ultrasound is very attractive to women and their partners, because it provides early visual confirmation of pregnancy and contact with their babies; it reassures them about the fetal well-being [5]. As a result of this, some women initiate the request for the scan from their obstetricians, and there had been cases of self referral, where the patient go directly to the sonologist or sonographer for routine prenatal ultrasound

evaluation without referral from the obstetrician [12,13,14]. For the respect of the patients' autonomy this could be accepted, however, the respect for patients' autonomy should not devalue the obstetricians' role for clinical judgments and experiences, as well as any recommendation he or she thinks is in the patients' interest.

Table 2. Clinical indication for the prenatal scan

| Indications | Frequency | Percentage |
|---------------------------------|-----------|------------|
| Routine scan | 392 | 71.3 |
| Placenta localization | 24 | 4.4 |
| Gestational diabetes mellitus | 18 | 3.3 |
| Premature rupture of membrane | 12 | 2.2 |
| Antepartum heamorrhage | 9 | 1.6 |
| Previous cesarean section | 8 | 1.5 |
| Fibroid | 7 | 1.3 |
| Fetal anomaly | 7 | 1.3 |
| Fetal viability | 7 | 1.3 |
| Intrauterine growth restriction | 7 | 1.3 |
| Fetal dating | 6 | 1.1 |
| Pre-eclampsia | 6 | 1.1 |
| Threatening abortion | 6 | 1.1 |
| Fetal lie and presentation | 5 | 0.9 |
| Expected fetal weight | 4 | 0.7 |
| Post date | 4 | 0.7 |
| Malaria in pregnancy | 3 | 0.5 |
| Multiple pregnancy | 3 | 0.5 |
| Polyhyrarnnios | 3 | 0.5 |
| Preterm labour | 3 | 0.5 |
| Reduced fetal movement | 3 | 0.5 |
| Sickle cell disease | 3 | 0.5 |
| Hyperemesis gravidarum | 2 | 0.4 |
| Hypertension in pregnancy | 2 | 0.4 |
| Intrauterine fetal death | 2 | 0.4 |
| Fever | 1 | 0.2 |
| Graves disease | 1 | 0.2 |
| Retroviral disease | 1 | 0.2 |
| Urinary tract infection | 1 | 0.2 |
| Total | 550 | 100 |

Table 3. Distribution of abnormalities found on ultrasonography

| Abnormal scan findings | Routine scan | Diagnostic scan | Total | Percentage |
|---------------------------------------|--------------|-----------------|-------|------------|
| Fibroid | 8 | 6 | 14 | 20.59 |
| Intrauterine fetal death | 7 | 5 | 12 | 17.65 |
| Intrauterine fetal growth restriction | 1 | 0 | 1 | 1.47 |
| Poly hydraminos | 1 | 1 | 2 | 2.94 |
| Oligohydramino | 8 | 12 | 20 | 29.41 |
| Fetal anomaly | 1 | 2 | 3 | 4.41 |
| Abortions | 3 | 7 | 10 | 14.71 |
| Placenta previa | 4 | 2 | 6 | 8.82 |
| TOTAL | 33 | 35 | 68 | 100 |

Table 4. Gestational age (trimester) distribution of scans

| Trimester | Frequency | Percentage |
|---------------------------|-----------|------------|
| 1 st trimester | 43 | 7.82 |
| 2 nd trimester | 217 | 39.45 |
| 3 rd trimester | 290 | 52.73 |
| Total | 550 | 100 |

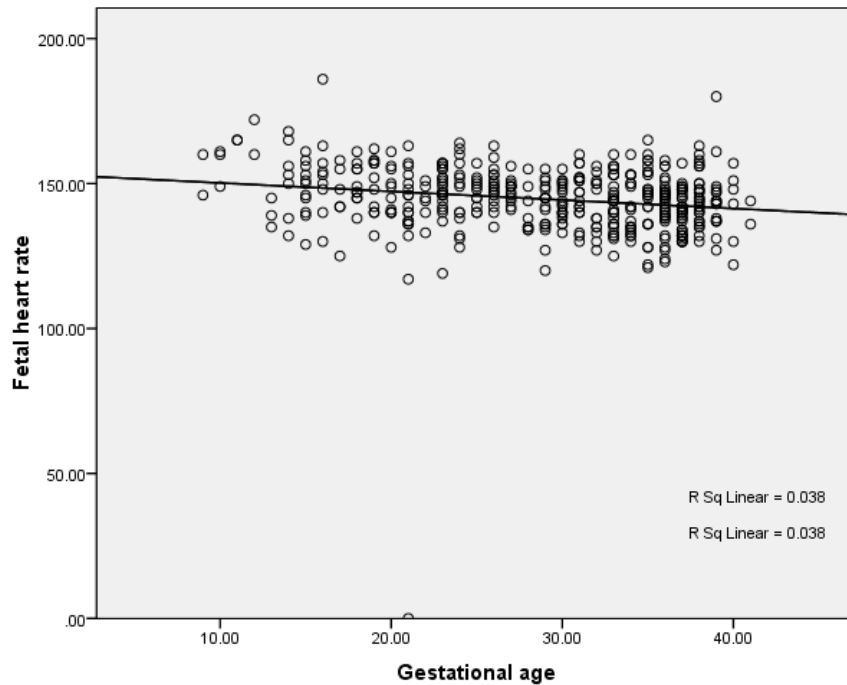


Fig. 1. The scatter plot (Fig. 1) shows that fetal heart rate reduces with increasing gestational age

Each prenatal ultrasound scan in our centre costs between three to five thousand naira (₦3000 to ₦5000) on the average. This is equivalent to \$9 to \$15. This amount may appear negligible in a high income society but considering a developing country with low income such as Nigeria, where the minimum wage is eighteen thousand naira (\$51.43) per month, it may be considered expensive. Majority of these women are unemployed, hence depend on their husbands for all the expenses for antenatal care, ultrasound scan and transportation to the hospital. The estimated cost to the National Health Service (NHS) of routine antenatal ultrasound scan at Liverpool women’s hospital was between £14- £16 each [15].

Considering cost effectiveness of routine prenatal scan, the cost of detecting an abnormality in pregnancy which was considered low-risk may be regarded as clinically beneficial if prenatal or perinatal interventions were possible and could lead to reduction in maternal and fetal mortality.[2] In this study only 8.42% of those who had routine scan were found to have abnormalities on the ultrasound scan findings. There were no major cases of fetal malformation

that would necessitate termination of pregnancy or amniocentesis.

Previous studies had shown that in some centers some of the pregnant women undergo 3-6 prenatal scans for each pregnancy [6,16,17] though we did not evaluate the number of scans per pregnancy, some of the patients we evaluated have had previous scans within and outside our institutional health facility. A survey carried out in Vietnam showed that 400 women had an average of 6.6 scans during their pregnancy and one- fifth had 10 or more scans. The study suggested the need for guidance regarding the appropriate use of obstetric ultrasound in antenatal care [17], A study on maternal perspective of prenatal sonogram in North-Eastern population in Nigeria reported that 61% of the women had previous ultrasonography and that women do seek prenatal ultrasonography on their own without referral by obstetricians [12]; similar assertions had been made by other researchers [13,18].

In as much as we presumed routine prenatal ultrasonography an over utilization of limited resources, there are reasonable advantages accrued from routine prenatal ultrasound

evaluation of the pregnant women. This usefulness is seen in those clinical situations in which there are clear reasons that such an investigation may provide important information which would complement clinical assessment and may lead to reduction in maternal mortality and perinatal death. In this study routine prenatal scan revealed some cases of intrauterine fetal death, abortion and placenta previa. These are life threatening to the pregnant woman and the fetus. Unsafe abortion is known to account for 13% of maternal mortality [19]. If an incomplete abortion is not adequately managed, there may be excessive haemorrhage, shock and death. Ultrasound detection of abortion cases early before much blood is lost will enhance patients' management. It will help in determining when the abortion is complete and detect retention of product of conception that may lead to haemorrhage. It is useful in determining which pregnancies are viable and which are most likely to miscarry [20].

There had been evidence that routine ultrasound in early pregnancy provides: better gestational age assessment, early detection of multiple pregnancies, diagnosis of non viable pregnancies, and detection of clinically unsuspected fetal malformation at a time when termination of pregnancy is possible. Gestational age has emerged as one of the most important predictors of perinatal mortality [21]. Accurate gestational age enables future detection of intrauterine growth restriction (IUGR), large for gestational age and also essential in decision making for delivery and determination of premature rupture of membrane (PROM), post dates, placenta previa [20]. Gestational age estimation is more accurate in the first trimester (7-13 weeks gestation) using crown –rump length (CRL). Also multiple pregnancy detection and reliable distinction between dichorionic and monochorionic pregnancies are more accurate with ultrasonography in the first trimester. This definitive diagnosis of chorionicity may not be possible with second and third trimester scan. In this study, only 7.83% of the prenatal scans were done in the first trimester, while majority of the scans were done in the second trimester (39.45%) and third trimester (52.73%). Similar higher rate of third trimester prenatal scan was reported by Eze et al. [22] in the South east part of Nigeria.

The second trimester routine ultrasonography is useful for prenatal diagnosis especially between 18 and 24 weeks to rule out any fetal anomaly,

while the third trimester scan has the benefit of determining fetal lie, presentation, estimated weight, localization of placenta, amniotic fluid volume estimation and to guide fetal cord sampling and intrauterine transfusion [23].

The rationale behind high rate of scans in the second trimester is not understood, though fetal malformations which are detected during this period are the major contributor to perinatal mortality, this ultrasound detection may be followed by induced abortion which may decrease the number of perinatal deaths without improving the eventual outcome of pregnancy [24]. It has also been reported that majority of the women do object to termination of the pregnancy even when obvious fetal malformation is detected on ultrasound [7].

Ultrasonography may play a role in high risk late pregnancy by guiding management decisions, especially where an intervention could be carried out to improve maternal health and reduce perinatal mortality. However, based on existing evidence, routine late pregnancy ultrasound in low risk or unselected populations does not confer benefits on mother or baby [15]. The high rate of third trimester routine prenatal scans shows the reluctance of the clinician to apply their clinical expertise in evaluating the patients. Most of the third trimester prenatal scan benefits could be elicited from good clinical history and physical examination. This showed gradual detachment of the obstetricians from close contact with the patients and support the assertion by Guyer et al that ultrasonography runs the risk of becoming the *de Facto* standard of care without supportive clinical evidence.[25] In keeping with this assertion, health care provider in Botswana reported that, since the introduction of ultrasound, they are tempted to take history and carry out physical examination less thoroughly than before [8].

5. CONCLUSION

The study showed high rate of routine ultrasound scan without justifiable clinical indication. Majority of these scans were done during the second and third trimesters which lack the benefits associated with baseline prenatal ultrasonography usually carried out in the first trimester of gestation. The late trimester ultrasonography practiced in our centre does not only drain the limited resource but are also not cost effective as it does not improve the pregnancy outcome. We recommend that a

routine base line ultrasonography should be encouraged in the first trimester for the benefits of accurate dating, and late trimester ultrasonography reserved for high- risk pregnancies.

CONSENT

As per international standard or university standard written patient consent has been collected and preserved by the authors.

ETHICAL APPROVAL

As per international standard or university standard, written approval of Ethics committee has been collected and preserved by the authors.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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