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ROUTINE PRENATAL ULTRASONOGRAPHY FOR FETAL ANOMALY DETECTION IN A SUBURBAN NIGERIAN SETTING

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ABSTRACT

Introduction: Fetal structural abnormalities significantly impact the health and well-being of the fetus and mother, ranking among the leading causes of perinatal mortality and morbidity worldwide. This study aimed to evaluate the effectiveness of routine prenatal ultrasound scans in detecting fetal anomalies in a suburban setting in Nigeria.

Methods: This retrospective study was conducted at a major diagnostic center in southwestern Nigeria from June 2022 to April 2023. Routine prenatal ultrasound scans were evaluated for pregnant women referred predominantly by Traditional Birth Attendants (TBAs).

Results: A total of 2,392 pregnant women, including 43 with twin pregnancies, underwent routine prenatal scans during the study period. Among these, 41 anomalies (1.7%) were detected in the scanned low-risk population. However, 45 fetuses were confirmed to have anomalies at delivery or termination, with 7 cases (15.5%) resulting in stillbirths. Most abnormalities (n=37) were identified before 24 weeks of gestation, yielding a sensitivity of 85.5%. The genitourinary tract was the most frequently affected system (39.1%), followed by the central nervous system (21.2%). The specificity of the scans was 99.1%, with one false positive reported. Six anomalies (13.3%) were classified as lethal.

Conclusion: Routine prenatal ultrasound scans in suburban settings are effective in detecting fetal anomalies but pose challenges in counseling. The establishment of standardized fetal anomaly detection protocols could help reduce perinatal mortality and morbidity in such settings. Lack of awareness and inadequate funding, particularly among TBAs, remain significant barriers to effective implementation.

Keywords: Ultrasound, Prenatal, Fetal Anomaly, Traditional Birth Attendants

Introduction

Fetal structural abnormalities are a significant concern during pregnancy due to their profound impact on the health and well-being of both the fetus and the expectant mother. These abnormalities rank among the leading causes of perinatal mortality and morbidity

globally, accounting for 20%–30% of neonatal deaths, with 95% of such deaths occurring in low- and middle-income countries (LMICs) (1–5). In Nigeria, prevalence rates for congenital malformations have been reported to range from 2.1% to 5.6% across different studies (6).

The psychological trauma and economic burden associated with fetal abnormalities are exacerbated by the associated morbidities (2). Prenatal ultrasound (US) has therefore become an essential tool for antenatal care, allowing for the early detection of structural anomalies. It is estimated that up to 90% of fetal anomalies occur in pregnancies without known risk factors, underscoring the importance of routine anomaly screening via ultrasound. (7). Obstetric ultrasound has gained wide acceptance in clinical practice in sub-Saharan Africa, including Nigeria, where it is now integral to antenatal care in hospitals, nursing homes, and even traditional settings (8, 9). However, the effectiveness of ultrasound in detecting fetal structural anomalies depends on several factors, including maternal and gestational age, the skill and experience of the sonographer, and the quality of the equipment used (1, 7).

Despite its widespread use, prenatal ultrasound in Nigeria is not primarily utilized for screening fetal anomalies. This limitation is particularly pronounced in suburban and rural areas, where access to modern healthcare services is restricted. Approximately 60%–70% of births in these communities occur outside formal healthcare facilities, often attended by Traditional Birth Attendants (TBAs) (11–13). According to the World Health Organization (WHO), a TBA is a person who assists mothers during childbirth and acquires their skills either through personal experience or apprenticeship (14). In Nigeria, TBAs play a significant role in maternal and reproductive health, especially in underserved communities, where they are respected and trusted for their expertise (12, 14). Some TBAs undergo formal training for three to six months and may receive periodic retraining under programs organized by the National Primary Health Care Development Agency (NPHCDA) or local government primary healthcare departments (LGPHCDs) (14–16). Despite these efforts, the reliance on TBAs and the lack of standardized prenatal care protocols contribute to undetected fetal anomalies and increased perinatal morbidity and mortality. While prenatal ultrasonography is commonly performed as part of antenatal care in Nigeria, the absence of established guidelines for fetal anomaly screening limits its effectiveness (1, 10). Consequently, many anomalies remain undetected in utero, contributing to adverse perinatal outcomes. Additionally, data on the prevalence and detection rates of fetal anomalies in Nigeria remain scarce, particularly in low-risk pregnancies.

This gap in knowledge and diagnostic capacity highlights the urgent need for studies that are specific to the context, and assess the real-world effectiveness of routine obstetric ultrasound in detecting fetal structural abnormalities. Understanding the diagnostic performance of ultrasonography is essential for guiding clinical practice and policy making, especially in rural settings where antenatal services are suboptimal and a significant proportion of deliveries still occur outside formal health facilities. Therefore, this study was undertaken to evaluate the diagnostic value of routine prenatal ultrasound in detecting fetal anomalies in a suburban Nigerian population. The study aims to inform healthcare practitioners, policymakers, and maternal health stakeholders on how best to optimize prenatal screening, particularly in resource-limited settings by providing evidence on detection rates and associated challenges. The findings could also support the development of localized protocols and training initiatives aimed at improving early detection and reducing perinatal morbidity and mortality.

Methods:

This retrospective study was conducted at a major suburban diagnostic facility, Ijora Scan Centre, located in Ijora, Lagos State, Southwestern Nigeria, between June 2022 and April 2023. It evaluated routine prenatal ultrasonography performed for pregnant women referred by Traditional Birth Attendants (TBAs).

Study Design and Setting

The study population comprised pregnant women in their second trimester (18–22 weeks of gestation) who were referred by TBAs for routine prenatal scans. All scans were performed by certified sonographers with 3–10 years of experience in obstetric ultrasonography. A mean examination time of 15 minutes per fetus was allocated per scan, during which the following parameters were assessed:

1. Fetal viability.
2. Number of fetuses.
3. Placenta location.
4. Detailed fetal anatomy, including:

a. Skull and intracranial anatomy.
b. Spine.
c. Thorax, including the four-chambered view of the heart.
d. Abdomen (stomach, kidneys, bladder, and anterior wall with cord insertion).
e. Four limbs.

For cases where the fetus was less than 18 weeks of gestational age or if the examination could not be satisfactorily completed, a follow-up scan was scheduled.

Protocol for Detecting and Managing Anomalies

When a fetal anomaly was detected:

1. Initial Discussion: The findings were thoroughly discussed with the referring TBA and the parents by a midwife counselor.
2. Referral: If required, the mother was referred to a tertiary center for further evaluation, confirmation of the anomaly, and additional investigations or management.
3. Follow-Up: Parents were contacted within 24 hours of the initial discussion to ensure understanding and to address any concerns.
4. Intervention:

a. For lethal anomalies, counseling was provided regarding termination of pregnancy.
b. For correctable anomalies, referrals were made to relevant specialists, and pregnancies were closely monitored until delivery to ensure prompt interventions.

Equipment

All examinations were performed transabdominally using a Siemens Acuson Sienna ultrasound machine.

Inclusion and Exclusion Criteria

- Inclusion: Pregnant women referred by TBAs for routine prenatal ultrasonography.
- Exclusion: Pregnant women referred from hospitals or primary health centers.

Data Analysis

The sensitivity, specificity, and predictive values of routine ultrasonography in detecting fetal structural abnormalities were calculated, along with their 95% confidence intervals. Statistical analysis was performed using standard diagnostic accuracy methods.

Results

A total of 2,392 pregnant women, including 43 with twin gestations, underwent routine prenatal ultrasound during the study period. The mean age of participants was 30.4 ± 4.63 years, ranging from 16 to 49 years.

Detection of Fetal Anomalies

Out of all pregnancies scanned, 41 fetal anomalies were detected, representing a prevalence of 1.7%. The genitourinary tract was the most affected system, accounting for 39% of all anomalies, followed by the central nervous system (CNS) with 22%. Less frequent anomalies involved gastrointestinal, respiratory, skeletal, cardiac, and other systems.

Timing of Detection

Most anomalies (90.2%) were identified before 24 weeks gestation. Four cases were diagnosed during third-trimester scans conducted for other clinical reasons, such as late booking or small-for-dates fetuses. An additional four anomalies were diagnosed postnatally in mothers who either booked late or missed routine second-trimester scans.

Pregnancy Outcomes

Of the 45 confirmed anomalies, seven (15.5%) resulted in stillbirths. Six cases (13.3%) were classified as lethal

anomalies while four pregnancies were terminated following counseling.

Sensitivity and Specificity

The sensitivity of routine ultrasonography for detecting fetal anomalies was 85.5% (95% CI: 77.7%–92.1%), while the specificity was 99.1% (95% CI: 98.9%–99.9%) (Table 3). The positive predictive value (PPV) of routine ultrasonography was 98.5% (95% CI: 94.6%–99.8%).

Correctable Anomalies and Interventions

Four anomalies were surgically correctable: Gastroschisis (1 case), Pleural effusion (1 case), and hydronephrosis (2 cases). However, both infants with hydronephrosis survived post-intervention, while those with gastroschisis and pleural effusion died within 24 hours and three weeks respectively due to prematurity.

Table 1: Pattern of distribution of fetal anomalies

Detection of abnormalities	Frequency (%)
Central Nervous System	9 (21.9%)
Hydrocephalus	2
Anencephaly	2
Encephalocele	1
Choroid Plexus Cyst	1
Iniencephaly	1
Dandy-Walker malformations Cerebellar Vermis defect	1
Cardiac	1(2.4%)
Ventricular Septa defect	1
Neural tube defects	1(2.4%)
Cervical meningocele	1
Genito-Urinary Tract	16(39.0%)
Hydronephrosis	6
hydronephrosis and hydroureter	2
Renal agenesis	3
Bladder ureterocele	1
Bilateral enlarged extrarenal pelvis	2
Unilateral Megaureter	2
Gastro-Intestinal Tract	2(4.9%)
Gastroschisis	1
Omphalocele	1
Respiratory	2(4.9%)
Pleural Effusion	2
Skeletal	2(4.9%)
Disorganised spine	1
Limb shortening	1
Others	8(19.5%)
Hydrops	1
Umbilical hernia	1
Cystic hygroma	1
Multiple abnormalities	5
Total	41

Table 1: Fetal abnormalities identified after second trimester

	Diagnosis	Indication	Outcome
By ultrasonography: in 3rd trimester:	Two (2) Hydrocephalus	Late booker	Neonatal death Live birth, shunt inserted postnatally
	One (1) Multicystic Kidney (unilateral)	Late booker	Live birth
	One (1) Bilateral Hydronephrosis and Hydroureter	Small for dates	Neonatal death
After birth:	Two (2) Minor deformity of the nose and face	Late booker	Live birth
	1 Undescended testes	Late booker	Live birth, management follow
	1 Cleft lip and palate	Late booker	Live birth

Table 3: Sensitivity and specificity of routine ultrasonography

	All abnormalities	Abnormality before 24weeks	Lethal
Sensitivity (%)	85.5 (83.1 to 89.4)	90.2(87.6 to 92.7)	89.6 (87.1 to 92.3)
Specificity (%)	99.1 (96.6 to 99.9)	99.8(97.3 to 99.9)	99.6 (99.9 to 99.9)
Positive predictive value (%)	95.5 (92.6 to 99 8)	97.8(92.6 to 99 8)	98.2 (96-0 to 99-8)
Negative predictivevalue (%)	99.4 (99.2 to 99-7)	99.5 (99.4 to 99-7)	99.7 (99.6 to 99-9)

Discussion:

This study demonstrates that routine ultrasonography performed by trained sonographers is an effective tool for detecting structural fetal anomalies in a low-risk, suburban Nigerian population. The detection rate of 1.7% aligns with global findings, particularly the Eurofetus study, which reported prevalence rates between 0.3% and 3.4% (18,19). This supports the

utility of prenatal anomaly scans in improving perinatal outcomes, even in resource-constrained settings.

The most frequently identified anomalies involved the genitourinary system (39.1%), followed by the central nervous system (21.9%)—a pattern consistent with prior Nigerian and international studies (2,17,19,20). Hydronephrosis emerged as the most common anomaly, echoing similar observations by Agunloye and Shirley (19,20). Routine ultrasound showed a high sensitivity (85.5%) and specificity (99.1%) for anomaly detection—well above older reports of 22–41% (8,20,21), and comparable to more recent estimates of 74–85%(22–24). This performance reflects the impact of examiner training, gestational age at scan, and structured postnatal verification. The low false-positive rate (one case) further confirms its reliability, reinforcing the importance of follow-up and second-opinion scans in ambiguous cases.

Out of the six lethal anomalies identified, four pregnancies were terminated following counseling. This is consistent with Chitty et al., who reported a 72% termination rate for similar cases (22). These findings demonstrates the critical role of prenatal counseling, where cultural and religious beliefs may influence parental choices (25). Additionally, early detection helps in critical clinical plannings, such as improving delivery timing and postnatal interventions.

Several operational challenges were observed. These include:

a. Technical Limitations: Maternal obesity, suboptimal fetal positioning, and difficulties in evaluating multiple pregnancies.

b. Late Presentation: Over 75% of pregnant women in the study population presented for antenatal care after 22 weeks of gestation, limiting opportunities for early anomaly detection.

c. Uncertain Outcomes: Mild anomalies such as ventriculomegaly and late-diagnosed conditions like pleural effusion posed diagnostic challenges.

Conclusion

Routine prenatal ultrasonography in a low-risk population is effective in detecting fetal structural anomalies, with a sensitivity of 85.5% and specificity of 99.1%. The study highlights the prevalence of genitourinary and central nervous system anomalies and underscores the importance of second-trimester anomaly scans. Early detection facilitated informed parental decision-making, appropriate counseling, and timely perinatal interventions, improving maternal and fetal outcomes.

Despite challenges such as late antenatal presentation and technical limitations, the study emphasizes the need for enhanced training for sonographers and increased awareness among pregnant women. Integrating routine anomaly scans into antenatal care protocols, particularly in resource-limited settings, can significantly reduce perinatal morbidity and mortality, warranting further research and policy action.

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