Original Article

Pattern and Outcome of Prenatally Diagnosed Major Congenital Anomalies at a Nigerian Tertiary Hospital

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Abstract

Introduction: The prevalence of major congenital anomalies (CAs) shows wide variations depending on geographical location and may range from <1% to 8% and it causes between 20% and 30% of perinatal deaths. In Nigeria, the prevalence of CAs may be underestimated with the general reliance on mostly livebirths ranging between 0.5% and 2.8% exempting cases of miscarriage and abortions. The purpose of this study was to determine the epidemiologic pattern and outcome of major CAs detected prenatally at the University College Hospital, Ibadan, Nigeria, over a 4-year period. Methods: This hospital-based descriptive study highlights the prevalence and pattern of prenatally diagnosed fetal anomalies among the pregnant women who presented for routine prenatal ultrasound screening within the study period. Demographic details, associated risk factors, and fetal anomaly type in the fetuses were recorded using a prepared pro forma and were analyzed. **Results:** Prenatal ultrasound screening for fetal anomalies was performed on 989 fetuses (including 15 sets of twins and 1 set of triplets) during the study period, out of which 62 (6.3%) had CAs. Of the 62 with CAs, 37 (59.7%) were major and 25 (40.3%) were minor. Majority of the fetuses with major anomalies were found among women aged 30–34 years and most were detected during the routine 18–22 weeks' anomaly scan. The major anomalies were most common in central nervous system. Nine (14.5%) pregnancies were terminated before term and 8 (29.6%) babies had different postnatal surgical interventions. Eleven (17.7%) of the fetuses with anomalies died in the perinatal period. **Conclusion:** CAs remain a major contributor to perinatal morbidity and mortality in Nigeria. Since most are idiopathic, early prenatal detection with ultrasound may facilitate improved diagnosis and the reduction of overall perinatal morbidity and mortality in the Nigerian setting.

Keywords: *Congenital abnormalities, major, pattern, prevalence*

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Introduction

Congenital anomalies (CAs), otherwise known as birth defects, congenital disorders, or congenital malformations, are recognized as any structural abnormality determined by factors operating largely before conception or during gestation and can be identified prenatally, at birth or later in life.[1,2] They are usually subdivided into two groups: minor and major anomalies.[3,4] A minor anomaly is defined as structural abnormality present at birth, having minimal effect on clinical function, but may have a cosmetic effect, while major CAs are conditions that are severe enough to reduce life expectancy or compromise normal function.[4] Major malformations are said to be severe if the newborn infant cannot survive without medical or surgical intervention or lethal if it results in stillbirth/infant death.[3,4]

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Major CAs show considerable variation all over the world with prevalence ranging from <1% to 8% and it causes between 20% and 30% of perinatal deaths.[4-9] In Nigeria, prevalence of CAs was reported as ranging between 0.5% and 2.8%.[10-13] However, most of these figures are quoted for gross anomalies seen in livebirths, making the actual prevalence to be underestimated as many fetuses with major CAs may be aborted before delivery and even if the miscarriage occurs later, the anomaly may be undiagnosed.

The addition of prenatal ultrasound screening for anomalies to antenatal care in the developed countries has profoundly improved the detection rate of CAs prenatally.[1-4] This has helped in reducing perinatal morbidity and mortality by enabling the parents and clinicians to make informed decisions on the management of the pregnancy such as continuing with it, planning effectively for complications that may arise in labor and after birth, as well as in identifying potential risk factors for future pregnancies.

About 53% of CAs can now be detected as early as 14 weeks' gestational age (GA) by experienced sonologists and between 60% and 90% of anomalies, depending on the nature, can also be detected during the dedicated detailed anatomy scan between 18 and 22 weeks' GA.[14,15] With the addition of fetal echocardiography to prenatal ultrasound screening, cardiac anomalies are now being diagnosed *in utero* with high specificity and sensitivity.[16] Prenatal ultrasound screening for anomalies is a new development in Nigeria and this has only been introduced in our facility; the largest referral hospital in the country, in the last 4 years.[17]

The purpose of this study is to give an overview of major CAs detected prenatally at the University College Hospital (UCH), Ibadan, over the 4-year period and the subsequent outcomes in this group of patients.

Methods

This was a prospective, hospital-based study conducted at the Ultrasound Unit of the Antenatal Clinic of the UCH, Ibadan, between September 2012 and August 2016. UCH is a tertiary hospital located in Ibadan, Southwest Nigeria, established for training of health professionals and serves as a major referral center for hospitals in the South-West Nigeria.

Detailed prenatal (18–22 weeks of gestation) ultrasound scan was performed transabdominally, by an experienced radiologist with specialist training in fetal anomaly scan, for antenatal clinic attendees either on referral by their consultants or as screening after due detailed counseling. The mid-trimester ultrasound screening guidelines of the International Society of Ultrasound in Obstetrics and Gynaecology were used. The detected anomalies were classified into minor and major categories. Major anomalies were further categorized into severe and lethal anomalies. Fetuses with only soft markers such as echogenic bowel or intracardiac echogenic focus without an identifiable anomaly were excluded from the study.

Statistical analysis was performed using the IBM-SPSS version 20 spreadsheet (IBM version 20.0., IBM Corp., Armonk, NY, USA).

All the participants gave informed consent. The data collection was part of routine clinical service and screening of all eligible pregnant women at the UCH Ibadan, Oyo State, Nigeria.

Results

Over the 4-year period, 989 fetuses (15 sets of twin gestations and 1 triplet gestation) were evaluated for fetal anomalies. The mothers were aged between 18 and 51 years with a mean age of 31.7 ± 4.5 years. Anomalies were detected in 62 fetuses, giving a hospital

Table 1: Age group and gestational age distribution of mothers according to categories of major anomalies

Variable	Severe (%)	Lethal (%)	Total (%)
Age group (years)			
20-24	1 (33.3)	2 (66.7)	3 (8.1)
25-29	6 (66.7)	3 (33.3)	9 (24.3)
30-34	11 (84.6)	2 (15.4)	13 (35.1)
35-39	4 (57.1)	3 (42.9)	7 (18.9)
>40	5 (100.0)	0	5 (13.5)
Total	27 (73.0)	10 (27.0)	37 (100.0)
GA at detection (weeks)			
18-22	16 (72.7)	6 (27.3)	22 (59.5)
22-28	6 (66.7)	3 (33.3)	9 (24.3)
>28	5 (83.3)	1 (16.7)	6 (16.2)
Total	27 (73.0)	10 (27.0)	37 (100.0)

GA=Gestational age

Table 2: Classifications of anomalies based on risk factors

Indication	Severe (%)	Lethal (%)	Total (%)
Routine (no known risk factor)	11 (73.3)	4 (22.7)	15 (40.5)
Advanced age	8 (72.7)	3 (27.3)	11 (29.7)
Chronic hypertension in pregnancy	1 (100.0)	0	1 (2.7)
Previous baby with anomaly	1 (50.0)	1 (50.0)	2 (5.4)
Twin gestation	2 (100.0)	0	2 (5.4)
Suspected anomaly in index pregnancy	4 (66.7)	2 (33.3)	6 (16.3)
Total	27 (73.0)	10 (27.0)	37 (100.0)

prevalence of 6.3%. Twenty-five (40.3%) of the fetuses had minor anomalies, while 37 (59.7%) were categorized as major anomalies, giving a prevalence of 2.5% and 3.7%, respectively. In addition, 27 (73%) of the major anomalies were classified as severe, while 10 (27%) were considered to be lethal [Table 1].

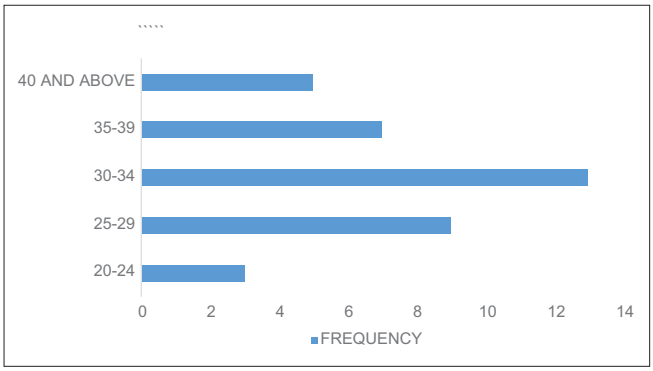

Figure 1: Age distribution of the mothers having fetuses with major congenital anomalies

Table 3: Distribution of anomalies based on body systems

Body system	Severe (%)	Lethal (%)	Total (%)
CNS	5 (55.6)	4 (44.4)	9 (24.3)
GUS	5 (83.3)	1 (16.7)	6 (16.2)
Gastrointestinal system/body wall	5 (83.3)	1 (16.7)	6 (16.2)
CVS	4 (80.0)	1 (20.0)	5 (13.5)
MSS	0	2 (100.0)	2 (5.4)
Facial	1 (100.0)	0	1 (2.7)
Multiple	7 (87.5)	1 (22.5)	8 (21.6)
Total	27 (73.0)	10 (27.0)	37 (100.0)

CNS=Central nervous system; MSS=Musculoskeletal system; GUS=Genitourinary system; CVS=Cardiovascular system

Only 26.5% of the mothers with fetuses with CAs were at the extreme of age (262 were above 34 years and 1 was below 18 years). Majority of the fetuses with major CAs were found among women aged 30–34 years [Figure 1], with 15 (40.5%) of these fetuses being from mothers with no known risk factors and 11 (29.7%) were from mothers with advanced age (>34 years). Two (5.4%) of the anomalies were found in two fetuses from two different twin gestations [Tables 1 and 2].

With respect to timing of anomaly screening and detection, majority of the fetuses with anomalies (22 [59.5%]) were detected during the 18–22 weeks' mid-trimester anomaly scan, 24.3% between 22 and 28 weeks, while only 6 (16.2%) were detected after 28 weeks' gestation [Table 1].

For major CAs, the central nervous system (CNS) was the most commonly affected system with 9 (24.3%) having anencephaly and severe ventriculomegaly [Tables 3 and 4]. This was followed by the genitourinary and the gastrointestinal systems with 6 (16.2%) each.

At the time of scanning, multiple systems were affected in only 8 (21.6%) of the fetuses [Table 4].

Of the 62 pregnancies with various anomalies, 9 (14.5%) were terminated before term and of these, 6 were lethal, while 3 were recognized as severe. For the newborns with severe anomalies, eight (29.6%) underwent different types of surgical interventions, out of which two were postoperative deaths. Only 3 (8.1%) of the identified mothers whose fetuses had major CAs were lost to follow-up, while 29 (78.4%) of the fetuses with major anomalies were confirmed after either delivery or following termination of the pregnancy. The

Table 4: Pattern of anomalies according to system with their gestational age at detection and clinical outcome

System	Diagnosis/frequency	GA at detection	Category	Outcome	Confirmation
CVS	Anencephaly/3	22 weeks	Lethal	Terminated at 23 weeks	Yes
		20 weeks	Lethal	Terminated at 22 weeks	Yes
		30 weeks	Lethal	Terminated at 33 weeks	Yes
	Dandy-Walker syndrome with severe ventriculomegaly/1	27 weeks	Severe	Delivered at term	Yes
	Huge occipital encephalocele/1	20 weeks	Lethal	Terminated at 21 weeks	Yes
	Severe ventriculomegaly with aqueductal stenosis/1	34 weeks	Severe	Delivered at term	Yes
	Severe ventriculomegaly + lumbar meningomyelocele/1	36 weeks	Severe	Delivered at term	Yes
	Severe ventriculomegaly/2	24 weeks	Severe	Delivered at term	Yes
		34 weeks	Severe	Delivered at term	No
GUS	Bilateral multicystic dysplastic kidney/1	22 weeks	Lethal	IUFD at 36 weeks	No
	Bilateral multicystic dysplastic kidney/1	22 weeks	Lethal	IUFD at 36 weeks	No
	Bladder extrophy + PCKD/1	18 weeks	Severe	Delivered at term NND	Yes
	Bilateral PCKD echogenic kidneys/1	20 weeks	Severe	Early NND	No

Contd...

Table 4: Contd...

System	Diagnosis/frequency	GA at detection	Category	Outcome	Confirmation
	Prune baby syndrome/1	24 weeks	Severe	Delivered at term-early NND	Yes
	Severe unilateral hydronephrosis and hydroureters/1	18 weeks	Severe	Delivered at term-early neonatal surgery	Yes
	Posterior urethral valve/1	20 weeks	Severe	Absconded	No
GIT/body wall	Gastroschisis/1	25 weeks	Severe	Surgery/early NND	Yes
	Exomphalos/2	22 weeks	Severe	Staged surgeries	Yes
		22 weeks	Severe	Staged surgeries	Yes
	Limb body wall complex/1	18 weeks	Lethal	Absconded	No
	Duodenal atresia/1	35 weeks	Severe	Surgery at birth	Yes
	Small bowel obstruction/1	21 weeks	Severe	Surgery at birth	Yes
CVS	VSD+pericardial effusion/1	22 weeks	Severe	IUFD at 32 weeks	No
	Isolated VSD/1	22 weeks	Severe	Delivered at term	Yes
	Cardiomegaly + pericardial effusion + arrhythmias/1	21 weeks	Severe	IUFD at 28 weeks	No
	Tricuspid atresia/1	24 weeks	Lethal	Absconded	No
	VSD + 2 vessel cord/1	22 weeks	Severe	Delivered at term (FTT)	Yes
MSS	Thanatophoric dysplasia/1	33 weeks	Lethal	Terminated at 34 weeks	Yes
	Osteogenesis imperfect/1	23 weeks	Lethal	Terminated at 23 weeks	Yes
Facial	Congenital cataract/1	20 weeks	Severe	Early neonatal surgery	Yes
Multiple systems	Dandy-Walker syndrome+bilateral severe hydronephrosis/1	29 weeks	Severe	Early NND	Yes
	VSD + pleural effusion/1	20 weeks	Severe	Thoracocentesis at birth + NND	Yes
	Hydrops fetalis + cystic hygroma/1	22 weeks	Severe	Terminated at 22 weeks	Yes
	Major omphalocele + fetal ascites + bilateral PUJ obstruction/1	22 weeks	Severe	Terminated at 22 weeks	Yes
	VSD + choroid plexus cyst + echogenic bowel/1	20 weeks	Severe	Delivered at 36 weeks + FTT	Yes
	Tracheoesophageal fistula + huge abdominal cyst + hydronephrosis + ambiguous genitalia/1	20 weeks	Severe	Surgery at birth: Early NND	Yes
	Hydrops fetalis with pericardial and pleural effusion + fetal ascites/1	24 weeks	Lethal	IUFD at 30 weeks	Yes
	Severe ventriculomegaly + bilateral clubbed feet/1	20 weeks	Severe	Terminated at 21 weeks	Yes

GA=Gestational age; CVS=Cardiovascular system; GUS=Genitourinary system; NND=Neonatal death; IUFD=Intrauterine fetal death; GIT=Gastointestinal system; VSD=Ventricular septal defect; FTT=Failure to thrive; MSS=Musculoskeletal system; PCKD=Polycystic kidney disease; PUJ=Pelvi-ureteric junction Obstruction

remaining five (13.5%) fetuses with major anomalies were unconfirmed postnatally because they were either delivered as stillborn with no obvious physical deformities or were delivered at outside facilities. Overall, 11 of the fetuses with anomalies died in the perinatal period, giving a perinatal rate of 17.7%. Four were intrauterine fetal death (IUFD), while the other seven had early neonatal deaths (NNDs) [Table 4].

Discussion

The prevalence of 6.2% for CAs in this study was higher than previous reports from other regions of Nigeria.[10-13] This difference may be a reflection of the study designs in which most of the studies were done on livebirths, without taking cognizance of aborted fetuses and stillbirths which we did by screening them prenatally. It is important to note however that there is paucity of information on prenatally diagnosed CAs, while the only available similar study conducted by Butt *et al*.[18] reported a prevalence of 2.15% which is lower than our findings. This significant difference may be due to geographical or environmental factors.

In this study, there were only a few more major anomalies (59.6%) than minor anomalies, which is at variance with the findings by Fida *et al*.[19] in their study conducted in Saudi Arabia. They found major anomalies in 95.9% of their patients. This may have been due to their focus on newborns; a postnatal evaluation, compared to our study where we evaluated our participants prenatally *in utero*, thereby removing any form of selection bias. In addition, the prevalence of major CAs in our study population was 3.7%, which was higher

than the prevalence of <1% obtained in a similar study in Barbados.[2] The lower prevalence in Barbados could be because of the retrospective nature of the study in which some of the data could have been lost. It may also be due to the large population studied (64,479 births), which was much higher than our population of less than a thousand.

Much of the variations in the reported prevalence may result from differences in the study designs vis-à-vis the source of data, the length of observation, and the methodology for definition and categorization of the malformations.[2]

Most of the major anomalies in this study were detected in mothers between the ages of 26 and 34 years. This is contrary to the general belief that most anomalies are found at the extremes of age. Sighn *et al* and Khan *et al*., in separate studies, also reported that most anomalies were found in the 26–30 and 25–34 years' age groups, respectively,[13,20] although this was contrary to the findings of Onankpa and Adamu and El Kunim, who found most of the anomalies in mothers below 20 and above 35 years of age.[10,21]

The known risk factors for CAs are environmental and genetic causes, but it has been noted from previous studies that 40%–60% of CAs have no known risk factors,[22] and this was corroborated in our study with 46% of the anomalies being reported in fetuses of mothers with no known risk factors. Risk factors for anomalies could also be linked to religion and ethnicity, but none of these was ruled out in our study.

The etiology of CAs is genetic (30%–40%) and environmental (5% to 10%). Among the genetic etiology, chromosomal abnormality constitutes 6%, single gene disorders 25%, and multifactorial 20%–30%; however, for nearly 50% of CAs, the causes are yet to be known.[22]

Many previous studies found the CNS to be the most commonly affected system by CAs,[4,11,13,23,24] and this is corroborated in this study unlike studies by Muktar Yola *et al*. and Koumi *et al*. who reported the most common affected systems to be the gastrointestinal and musculoskeletal systems, respectively.[12,21]

CAs contribute immensely to perinatal and neonatal mortality worldwide.[23,25,26] Lawn *et al*.[27] in a major study on the estimation of causes of NNDs concluded that between 20% and 30% of NNDs could be attributed to major CAs. Findings from this study revealed a perinatal mortality rate of 17.7% among the fetuses with CAs and these included those with IUFDs and early NNDs. Al Bu Ali *et al*.[25] in a study conducted in Saudi Arabia found a higher perinatal mortality rate of 34.9%, while studies from Nigeria by Muktar-Yola *et al*.[12] and Onankpa and Adamu[10] reported a rate of 6.0% and 25%, respectively, among the neonates with anomalies. This also implied a possible geographical or environmental variation as potential contributory factor.

There are lots of psychological and emotional stress associated with having babies with major anomalies[11] and this is particularly worse in low-resource countries where the management of such babies could be very expensive and unaffordable by most parents.[11] One major benefit of early prenatal diagnosis of fetal anomalies is the possibility of making an informed decision of continuation or termination of the pregnancy as was done by almost a quarter of affected mothers in this study. In a similar study by Butt *et al*.,[18] termination of pregnancy was performed for all fetuses with severe and fatal anomalies. Termination of pregnancies with major anomalies has been reported to contribute significantly to the reduction in the overall perinatal morbidity and mortality from CAs.[28]

A significant number of fetal anomalies are surgically correctable, thus necessitating a need for an accurate and reliable prenatal diagnosis such that a multidisciplinary approach to care is maximally adopted and *in utero* surgical correction is offered where feasible.[28,29]

Conclusion

CAs play a vital role in contributing to perinatal morbidity and mortality in many clinical settings. Since the causes of these anomalies are not known in majority of cases, early detection and management may aid in planning appropriate care and possibly reduce perinatal morbidity and mortality from CAs in low-resource settings like Nigeria.

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Conflicts of interest

There are no conflicts of interest.

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