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Maternal Age and Congenital Anomalies among Newborns in a Tertiary Health Facility in Benue State, North Central Nigeria

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Authors' contributions

This work was carried out in collaboration between all authors. Authors MOO, GIT and AM designed the study and wrote the protocol. Authors MOO, GIT, ROA, II, OD and OO drafted the manuscript. Authors MOO, AM and ROA managed the literature searches. Author GIT analyzed the data in the study. All authors read and approved the final manuscript.

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ABSTRACT

Background: Congenital anomalies occur due to structural or functional anomalies of the body that present at birth.
Aim and Objective: To determine the relationship between maternal age and congenital anomalies amongst newborns in a tertiary hospital in North Central Nigeria.
Materials and Methods: This descriptive retrospective study was carried out at the neonatal unit of the Benue State University Teaching Hospital over a three-year period. Data was collected from the medical records of patients with congenital anomalies and analyzed using the Chi-square test ($\chi 2$), significance level of 5%($p<0.05$).
Results: A total of 843 neonates were admitted and 72 were documented to have congenital anomalies giving a prevalence of 8.5%. Of the 72,43(59.7%) were males while 29(40.3%) females.

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The newborns with birth weight above 2500 g, 50(69.4%) presented more with congenital anomalies. Greater percentages 67(93.1%) were term. The mean maternal age of the mothers was 26.5 years, 95% CI 25.3, 27.7. Fifty-two (72.2%) of the mothers attended Antenatal care. Most of the congenital anomalies occurred amongst the primiparous. The major systems involved were the Central Nervous System, Gastrointestinal Tract and Musculoskeletal System. Among the systems involved the Central Nervous System (CNS) had the highest prevalence of 3.3% and occurred in the maternal age group 25-29 years giving a prevalence rate of 1.3%. Myelomeningocele was the leading cause of CNS manifestation with a prevalence rate of 2.5%. Anorectal malformation was the commonest GIT disorder with a prevalence rate of 1.7% and Gastroschisis (MSS) with a prevalence of 0.9%.

Conclusion: Neonates from mothers above 25 years are not more at risk of developing congenital anomalies than mothers below 24 years. The major systems involved were the CNS, GIT and MSS.

Keywords: Congenital anomalies; diagnosis; maternal age; newborns; prevalence rate.

1. INTRODUCTION

Congenital anomalies are structural or functional anomalies of the body that are present from birth [1-3]. Every year an estimated 7.9 million children worldwide are born with a birth defect [1]. At least 3.3 million children under five years of age die from birth defects each year while an estimated 3.2 million of those who survive may be disabled for life [1]. Birth defects are a global problem, but their impact is particularly severe in middle- and low-income countries where more than 94 percent of the births with serious birth defects and 95 percent of the deaths of these children occur [1]. In a hospital based study in Makurdi, North Central Nigeria the prevalence of Congenital anomalies was found to be 8.5% [4]. In Nigeria median age at first birth for women age of child -bearing age is 20.2 years. Women living in urban areas have their first birth three years later (22.0 years) than women living in rural areas (19.0 years) [5]. Maternal age profile of the general population has changed remarkably in Europe, with advanced maternal age rising each year. Previous studies have described the effect of the maternal age on the outcome of pregnancy as well as its relationship with newborn's birth defects. Both younger and advanced maternal age may pose increased risks for birth defects [6]. It is well known that older mothers have a higher risk of chromosomal anomalies such as Down syndrome, [7,8] but whether they are at higher risk of non-chromosomal anomalies is less clear. Hollier et al in a large prospective cohort study demonstrated an additional 1% age related risk of non-chromosomal abnormalities in women aged 35 years or older [8]. While Baird et al found no association between the incidence of congenital malformations and advanced maternal age [9]. Recent studies suggest that young maternal age maybe a stronger risk factor for certain congenital anomalies compared with advanced age [10,11]. Many of these studies were unable to obtain information on stillbirths and terminations, and the paucity of autopsy reports means that many congenital anomalies may not have been documented. The aim of this study was to describe the relationship between maternal characteristics and the pattern of congenital anomalies in their babies.

2. MATERIALS AND METHODS

2.1 Study Site and Design

This was a descriptive retrospective study conducted at the Neonatal unit of the Benue State University Teaching hospital (BSUTH), Makurdi, Benue State over a three-year period from June 2013 to July, 2016.The teaching hospital which became operational in January 2012, has 350 bed spaces and provides primary, secondary and tertiary health care services to Benue and neighboring states of Nassarawa, Kogi, Taraba and Ebonyi; as well as Residency training program for doctors in various specialties and sub-specialties. The Neonatal unit of the hospital, which has eight cots, four incubators, six phototherapy units receives both in-born babies and out-born from home or referred from other centers. A Consultant Paediatrician, Resident doctors, trained Paediatric nurses and other support staff.

2.2 Data Collection and Definition of Variables

A self-designed structured questionnaire was used to collect data from participants. The diagnosis of congenital anomaly (CA) was based on clinical evaluation and ultrasound examination report. Genetic screening and

echocardiography was not included due to lack of equipment and trained manpower. The different characteristics of mothers and newborns were analyzed by the maternal age groups. Mothers were categorized by age group into 5 groups: ≤ 19 years, 20 to 24 years, 25-29 years, 30-34 years and 35 years above. Other variables analyzed included the parity and data on antenatal care, congenital anomalies were classified using the International Statistical Classification of Diseases and Related Health Problems 10th Revision (ICD-10) version for congenital malformations, deformations and chromosomal abnormalities [12]. For newborns sex, birth weight and gestational age were classified as term or preterm.

2.3 Data Analysis

The data was analyzed using Epi Info Version 7.2. Proportions and 95% confidence interval (CI) were determined.

3. RESULTS

3.1 Maternal and Neonatal General Characteristics

Table 1 summarizes maternal and neonatal general characteristics. A total of 843 neonates were admitted into the Special Care Baby Unit (SCBU) of Benue State University Teaching Hospital (BSUTH) over a three-year period from June 2013 to July 2016. There were 72 neonates with congenital anomalies, giving a prevalence rate of 8.5%. 43(59.7%) of the neonates were males while 29(40.3%) were females. Mothers in the age group less than 20 years had 8(11.1%), 20-24 years 19(26.4%), 25-29 years 23(31.9%), 30-34 years 17(23.6%) and 35 years and above 5(7.0%) respectively. 52 (72.2%) attended Antenatal Care (ANC). Most of the congenital anomalies occurred amongst the pimiparous mothers 24(33.3%). The newborns with birth weight above 2500 g 50(69.4%) presented more with CA. A greater percentage 67(93.1%) were term babies.

3.2 Prevalence Rates of Major Systems and Diagnoses Stratified By Maternal Age

Table 2: Among the systems involved the Central Nervous System (CNS) had the highest prevalence of 3.3% and occurred in the maternal age group 25-29 years giving a prevalence rate of 1.3%. Myelomeningocele was the leading cause of CNS manifestation with a prevalence rate of 2.5%. Gastrointestinal Tract (GIT) and Musculoskeletal System (MSS) both had a prevalence rate of 2.5% respectively. Anorectal malformation was the commonest GIT disorder with a prevalence rate of 1.7% and Gastroschisis (MSS) with a prevalence of 0.9%.

Table 1. Univariate analysis of maternal and neonatal characteristics

Maternal Age Group	N (%)
≤ 19	8 (11.1)
20-24	19 (26.4)
25-29	23 (31.9)
30-34	17 (23.6)
≥ 35	5 (7.0)
Mean Age	
26.5,95 % CI 25.3,27.7	
Parity	
1	24 (33.3)
2	17(23.6)
3	12 (16.7)
≥4	19(26.4)
Mean Parity	
2.7,95% CI 2.3,3.1	
ANC	
Yes	52 (72.2)
No	20 (27.8)
Neonate Characteristics	
Sex	
Male	43(59.7%)
Female	29(40.3)
Birth Weight	
•2500g	22(30.6%)
≥2500g	50(69.4%)
Nature of Gestation	
Singleton	72 (100.0

3.3 Birth Order Stratified by Maternal Age Group and Prevalence Rates of Congenital Anomalies

Table 3 showed the distribution of cases amongst the various maternal age groups with the highest proportion of 31.9% of CA occurring in the age group of 25-29 years. This is followed by 26.4% and 23.6% in 20-24 and 30-34 age groups respectively. Thus, the age groups 20-29 accounted for 68% of all congenital anomalies. Women giving birth for the first time had a higher number of cases of CA, 24 (33.3%) followed by second delivery, 17(23.6%) and third delivery 12(16.7%). No congenital defect was noted among babies of women who were ≥35 years.

Table 2. Prevalence rates of major systems and diagnosis stratified by maternal age groups

Systems/diagnosis	N	Prevalence	Age group and prevalence rates					Total
			15-19	20-24	25-29	30-34	≥35	
Systems			**N(prev)**	**N(prev)**	**N(prev)**	**N(prve)**	**N(prev)**	
CNS	28	3.3	3 (0.4)	4 (0.5)	11(1.3)	9 (1.0)	1(0.1)	3.3
GIT	21	2.5	0(0)	07(0.8)	6(0.7)	5(0.6)	3(0.4)	2.5
MSS	21	2.5	3(04)	07(0.8)	6(0.7)	3(0.4)	2(0.2)	2.5
Total	70	8.3	0.8	2.1	2.7	2	0.7	8.3
Diagnosis								
Myelomeningocele	21	2.5	3(0.4)	2(0.2)	8(0.9)	7(0.8)	1(0.1)	2.5
Anorectal Malformation	14	1.7	0(0)	5(0.6)	3(0.4)	2(0.2)	1(0.1)	1.7
Gastroschisis	8	0.9	0(0)	2(0.2)	3(0.4)	3(0.4)	0(0)	1
Omphalocele	7	0.8	3(0.35)	3(0.35)	0(0)	0(0)	1(0.1)	0.8
Total	50	5.9	0.75	1.35	1.9	1.6	0.3	6

Total prevalence is 8.5%; 72 congenital anomalies and 843 total neonates in this study.
Omphalocele major and minor combined to give the total and maternal age related prevalence rates

Table 3. Birth order stratified by maternal age group and prevalence rates of congenital anomalies

	Maternal age group						
Parity/Birth order	**15-19**	**20-24**	**25-29**	**30-34**	**≥ 35**	**Total**	**Prevalence**
1	6 (25)	10 (41.6)	4 (16.7)	4 (16.7)	0	24	2.83
2	2 (11.8)	7 (41.2)	4 (23.5)	4 (23.5)	0	17	2.01
3	0	2	7 (30)	1 (60)	2 (10)	12	1.42
≥4	0	0	8 (42.1)	8 (42.1)	3 (5.8)	19	2.24
Total	**8**	**19**	**23**	**17**	**57**	**72**	

3.4 Bivariate Analysis on Neonatal Characteristics and Maternal Factors

Table 4 ANC attendance, birthweight and gestational age had a reduced risk of association with maternal age group of 25 years and above with odds ratios of (OR) 0.4,0.6 and 0.1 respectively. However, only birth weight was weakly associated with maternal age, ≥25 years, P-value = 0.05. ANC attendance and gestational age at birth was not statistically significantly associated with maternal age, ε 25 years as shown by P-value = 0.41 and 0.06 respectively. The latter two insignificant P-values were associated with overlap of confidence intervals of reduced and increased risk (OR < 1 and OR > 1) of 0.003 and 1.5 for gestational age at birth. Similarly, the CNS, GIT and MSS that were the major systems involved showed that maternal age 25 years and above was a risk factor for all of them to develop, OR of 2.5, 1.3 and 1.8 respectively but with insignificant P-values of 0.08, 0.6 and 0.3. The confidence interval for each of them overlapped.

4. DISCUSSION

Congenital anomalies are not uncommon in our center, with a prevalence of 8.5%, predominantly CNS and GIT where meningomyelocele and anorectal malformations accounted for the majority. Women aged between 20-29 years and primiparous were more likely to have babies with CA. The lower birth order has much higher prevalence of CA than the higher birth order, meaning that, lower parity was more affected. Previous studies have observed an association between nulliparity and an increased risk of many different defects [13]. Maternal age, 25 years and above were at higher risk of giving birth to cases of CA but not statistically associated with the major systems involved as shown in the bivariate analysis where CNS, GIT and MSS where the major systems involved and are implicated by odds ratios greater than 1. However, the P-values (> 0.05) in the analysis showed that none of them was statistically significantly associated with maternal age 25 years and above. The mean maternal age in our study was 26.5 years SD (± 5.3)95% CI 25.3-27.7. Our findings suggest that women between the ages of 24-29 years at delivery had a significant risk of having babies with non-chromosomal anomalies when compared with women aged less than 24 years this is similar to what has been reported by other researchers [8,14]. Women giving birth at an early age have increased risk of adverse pregnancy outcomes.

Table 4. Bivariate analysis for effect of maternal factors on neonatal characteristics

Maternal age	Characteristics		OR	95% CI	X^2	p-value
	Yes	No				
	Birth Weight					
	< 2500 g	≥ 2500 g				
≥ 25	10	35	0.4	0.1, 1.0	3.93	0.05
≤ 24	12	15				
	ANC					
≥ 25	31	14	0.6	0.2, 1.9	0.66	0.41
≤ 24	21	6				
	Gestational age					
	Preterm	Term				
≥ 25	1	44	0.1	0.003, 1.5	4.14	0.06**
≤ 24	4	23				
	CNS					
≥ 25	21	24	2.5	0.9, 7.1	3.05	0.08
≤ 24	7	20				
	GIT					
≥ 25	14	31	1.3	0.4, 3.8	0.22	0.6
≤ 24	7	20				
	MSS					
≥ 25	11	34	1.8	0.2, 1.5	1.3	0.3
≥24	10	17				

*** Fisher's exact*

Early prenatal care less likely in teenage mothers and these mothers are less likely to be educated and come from lower socioeconomic group [15]. 72.2 % of the mothers in our study attended ANC which is a predictor of a favorable outcome of childbirth, including a reduced risk of premature births, low birth weight and infant mortality as described in literature [16-18]. Association of low birth weight (LBW) with increased risk of congenital malformations is very well documented [18] our findings is at variance with this because we found more babies with CA at birth weight above 2500g.There was no significant association of the birth weight with CA. In this study a significantly higher prevalence of malformation were seen among babies of primiparous mothers in contrast with what had been reported from other studies which found out that higher incidences of CA occurred in babies of the multiparas [19].

In the present study the malformations of the central nervous system (CNS), gastrointestinal tract (GIT) and musculoskeletal system (MSS) were the major systems involved and occurred in maternal age 25 years and above with OR of 2.5,1.3 and 1.8 respectively but with insignificant p-values of 0.08,0.6 and 0.3 respectively. The confidence interval for each of them overlapped. Fontoura and colleague documented similar findings [20]. While Neelu Desai [21] found MSS as ranking first and Shamim et al. [22] have shown GIT anomalies topping the list.

Our study is not without limitations, the small size maybe associated with power to infer significant association between maternal age and the various systems involved. This is a secondary data that lacked other descriptive information about the mothers like socioeconomic and environmental factors. This is a retrospective design with its potential for misclassification bias.

5. CONCLUSION

The present study gave us important information regarding the frequency of distribution of congenital anomalies and its relationship with

maternal age. Neonates from older mothers are not more at risk of developing congenital anomalies than young mothers. The major systems involved were the CNS,GIT and MSS.

6. RECOMMENDATION

A Statewide or population based study of CA to increase sample size and power to draw inference should be carried out in our country. More diagnostic facilities should be made available to tertiary facilities .Regular antenatal visits and prenatal diagnosis is recommended for prevention.

CONSENT

It is not applicable.

ETHICAL APPROVAL

The analyses presented in this report consisted only of secondary unlimited data analysis, no contact with subjects occurred. However, the protocol for this study was reviewed, approved and monitored by the ethical committees of Benue State University Teaching Hospital Makurdi.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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