DOI: 10.7860/IJNMR/2021/50408.2308

Original Article

Paediatrics Section

Prevalence of Birth Defects and Associated Risk Factors among Neonates in Tertiary Care Hospital, Shivamogga, Karnataka

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ABSTRACT

Introduction: Birth Defects (BD) account for a significant proportion of neonatal mortality. BD can result in long-term disability with a significant impact on individuals, families, societies and healthcare systems.

Aim: To estimate prevalence, types, clinical profile and perinatal profile of BD among neonates.

Materials and Methods: This was a prospective observational study conducted in the Neonatal Intensive Care Unit (NICU), Department of Paediatrics, from November 2018 to May 2019. A total of 71 cases were admitted to NICU with total 95 BD. All the demographic details, natal, antenatal, prenatal clinical data and family histories were collected with the help of a predesigned proforma, entered in Excel sheet and analysed using Statistical Package for Social Sciences (SPSS) software; version 25.0. The p-value was calculated using Chi-square test and p-value < 0.05 was taken as significant.

Results: Total number of neonates with BD was 71 (4.16% of total NICU admissions, 1.18% of total live births i.e., 6033). Neonates with single BD were 53 (74.65%) and multiple BDs were 18 (25.35%). Mean age was 3.89±5.29 days. Out of the 71 neonates, 37 (52.11%) were males while 28 (39.44%) were females, and the rest 6 (8.45%) had ambiguous genitalia. Prevalence of BD was more in Low Birth Weight (LBW) (6.27%, 34/542 cases) than normal birth weight babies (3.33%, 36/1080 babies). Prevalence of BD was highest in mothers of 26-30 years age group (28/433, 6.46%). The predominant system involved was cardiovascular system (29/95 BDs, 30.53%). The most common major BD was Ventricular Septal Defect (VSD) (13/95 BDs, 13.68%). The predominant type of BD found was malformation (83/95 BDs, 87.37%). Case fatality rate of BDs was 30.99% (22/71). Neonatal mortality rate of BDs was 0.35 per 1000 live births.

Conclusion: Prevalence of birth defects was 1.18% of the total live births. Cardiovascular system was the most common system involved, VSD being the most common defect. BDs were significantly associated with late twenties parity, LBW and pre-existing medical diseases in mothers. Single and major BDs were more common than their counterparts.

Keywords: Malformation, Mortality, Perinatal profile, Structural congenital anomalies

INTRODUCTION

According to World Health Organisation (WHO) congenital anomalies or BD can be defined as structural or functional anomalies (e.g., metabolic disorders) that occur during intrauterine life and can be identified prenatally, at birth or later in life [1]. According to the March of Dimes (MOD) global report on BD 7.9 million births (6% of total births) occur annually worldwide with serious BD and 94% of these births occur in the middle and low income countries [2]. According to a joint WHO and MOD meeting report, BD account for 7% of all neonatal mortality and 3.3 million under five deaths [1].

The world has made substantial progress in child survival since 1990. Globally, the number of neonatal deaths declined from 5 million in 1990 to 2.4 million in 2019 [3]. The majority of all neonatal deaths (75%) occur during the first week of life, and about 1 million newborns die within the first 24 hours. Preterm birth, intrapartum-related complications, infections and BD cause most neonatal deaths in 2017 [3]. The prevalence of BD in India is 6-7% which translates to around 1.7 million BD annually [1]. The common BD include congenital heart disease (8-10 per 1000 live births), congenital deafness (5.6-10 per 1000 live births), and neural tube defects (4-11.4 per 1000 live births) [1].

Some congenital anomalies can be prevented. Vaccination, adequate intake of folic acid or iodine through fortification of staple foods or supplementation, and adequate antenatal care are few examples of prevention methods [4]. Congenital anomalies can be caused by single gene defects, chromosomal

disorders, multifactorial inheritance, environmental teratogens and micronutrient deficiencies [1].

A systematic review and meta-analysis estimated that the pooled national birth prevalence of congenital anomalies in this country was 184.48 per 10,000 births [5]. The European Concerted Action on Congenital Anomalies and Twins (EUROCAT) is a collaborative network of 43 population-based congenital anomaly registers, based in 23 countries [6]. The registries collect data on congenital anomalies occurring in live births, late miscarriages (20-24 weeks gestation), stillbirths (>24 weeks gestation), and Termination of Pregnancy for Foetal Anomaly (TOPFAs, any gestation). EUROCAT reported that prevalence of congenital anomalies was 271.82 per 10,000 births in 2019 [7]. Population based cohort study in US has reported prevalence of BDs as 2.03% and the cause was established in only one in every five infants [8]. Anomalies of the musculoskeletal system were highest among live births while the prevalence of central nervous system defects was highest when stillbirths were included in the analysis. Anencephaly and talipes were the most commonly reported anomalies [5].

India is yet to put in place a system for surveillance of BD [9]. A little over half the deliveries (52%) occur at private hospitals but there is no system to document the number of affected births from these facilities [10]. The toll of BD might increase worldwide, with reduction in infectious diseases. New threats such as the Zika epidemic and Coronavirus Disease-2019 (COVID-19) pandemic are emerging. Unless progress is made in identifying and preventing the root causes of BD, these conditions will continue to have draining effects on the survival and quality of life of individuals and families. Surveillance system like EUROCAT has to be established.

As a first step, this study was conducted to look into the pattern of BD in Shivamogga (central Karnataka) and to find out the associated risk factors, helping to practice novel preventive measures. This study aimed to estimate the prevalence and type of structural BD among newborns and to enumerate the associated risk factors.

MATERIALS AND METHODS

This prospective observational study was conducted in NICU, Department of Paediatrics, SIMS, McGann District teaching hospital, Shivamogga, Karnataka, India. This study centre is a 950-bedded district teaching hospital. The study was done from November 2018 to May 2019. All neonates, who were admitted to NICU with BD, were included in this study. The study was approved by the Institutional Ethical Committee (letter number: SIMS/IEC/447/2018-19).

Inclusion criteria: The neonates admitted in the chosen study centre during the study time period with age less than 28 days and defects occurring and/or presenting at birth or recognised later in neonatal age and those with structural anomalies were included in the study.

Exclusion criteria: Those neonates born as stillbirths, those with defects secondary to complications and sequels of conditions such as prematurity (patent ductus arteriosus) or infections acquired in the postnatal period (hydrocephalus), neonates of those parents who did not give consent for the study and the ones with functional anomalies (e.g., metabolic disorders) were excluded from the study. Hence the sample of the study was formed by 71 neonates with birth defects amongst the 6033 live births in the selected study centre.

Data Collection Procedure

The study was conducted after obtaining verbal and written consent from the parent or guardian. The neonates were examined and assessed systematically for the presence of congenital anomalies. Diagnosis of congenital anomalies was based on clinical evaluation of new born babies by the Paediatrician and other appropriate investigations such as radiography, ultrasonography, echocardiography and chromosomal analysis etc. For each case, a detailed history related to mother including maternal age, parity, consanguinity, antenatal check-ups, and illnesses during pregnancy with other significant obstetric history was obtained by reviewing the maternal and labour ward records and by interviewing the parents. For all cases, family history was taken. Also, socio-economic history was sought according to the modified BG Prasad classification based on rural and urban areas [11].

The total number of BD were enumerated and classified as major or minor and isolated or multiple BD. Major congenital defects were defined as those abnormalities that, if uncorrected or uncorrectable, significantly impair normal body function or reduce normal life expectancy. Minor anomalies were defined as unusual morphologic features that were of no serious medical or cosmetic consequence to the patient [12].

The structural defects were divided into four categories; malformation, deformation, disruption and dysplasia. A malformation was defined as a morphologic defect of an organ, part of an organ, or larger region of the body resulting from an intrinsically abnormal developmental process. A disruption was defined as a morphologic defect of an organ, part of an organ or larger region of the body resulting from the extrinsic breakdown of, or an interference with, originally normal developmental process e.g., amnion disruption process. A deformation was defined as an abnormal form, shape, or position of a part of a body caused by mechanical forces (e.g., club foot). A dysplasia was defined as abnormal organisation of cells into tissue(s) and its morphologic result(s) (e.g., achondroplasia) [13]. System wise distribution of the anomalies was performed. Follow-up was made through telephonic conversation.

STATISTICAL ANALYSIS

The data was collected in person with the help of a predesigned proforma. The data collected was then transferred into Excel

format and analysed using SPSS software, version 25.0. The p-value was calculated using Chi-square test and p-value <0.05 was taken as significant.

RESULTS

The statistical data of NICU and total deliveries during the study period are shown in [Table/Fig-1]. Out of the 71 neonates with BD, 37 (52.11%) were males and 28 (39.44%) were females while the rest 6 (8.45%) had ambiguous genitalia. Mean age was 3.89±5.29 days. Majority of the babies (80.28%) were of term gestation. Majority of the neonates (36 cases, 50.70%) had normal birth weight. Only one baby (1.41%) was Large for Gestational Age (LGA) [Table/Fig-2]. Prevalence of BD was more in LBW (6.27%, 34/542 cases) than normal birth weight babies (3.33%, 36/1080 babies).

Details of the demographic data and the antenatal profile are enlisted in [Table/Fig-3]. Majority (39, 54.93%) of the mothers were from rural areas, and 43 (60.56%) belonged to class III socio-economic status. With respect to maternal age, 32 mothers (45.07%) belonged to the age group of 21-25 years. Mean maternal age was 25.15±3.65 years. Prevalence of BD was highest in mothers of 26-30 years age group (28/433, 6.46%).

Parameter	Number of newborns
Total deliveries	6092
Live births	6033
Intrauterine deaths	59
NICU admissions	1708
Babies with BDs	71
NICU deaths	175
Deaths with BDs	22*

[Table/Fig-1]: NICU and labour room statistics.
*1 case died at 11 months of age

Para meter	Classification	Frequency (Percentage)	Ratio/Mean	Neonates with no BD (n=1637)	Chi-square test and p-value
Sex	Male	37 (52.11%)	M:F-1.32:1	908	0.82
	Female	28 (39.44%)		729	
	Others (ambiguous genitalia)	6 (8.45%)	-	-	-
Gestation	Term	57 (80.28%)	-	1171	0.108
	Preterm	14 (19.72%)		466	
Birth weight	Normal	36 (50.70%)	2508.31±729 grams	1080	**0.03#**
	LGA*	1 (1.41%)		15	
	LBW*	34 (47.89%)		542	
Age at admission	-	-	3.89±5.29 days	-	-

[Table/Fig-2]: Details of neonates with Birth Defects (BD) (n=71).
*LGA: Large for gestational age; LBW: Low birth weight; #Prevalence of BDs was statistically more significant in LBW babies

Demographic parameters	Classification	Frequency (Percentage) (n=71)	Mothers of neonates with no BD (n=1637)	Chi-square test and p-value
Residence	Urban	32 (45.07%)	-	-
	Rural	39 (54.93%)	-	
Socio-economic class	II	8 (11.27%)	-	-
	III	43 (60.56%)	-	
	IV	14 (19.72%)	-	
	V	6 (8.45%)	-	
Mother's age	≤ 20 years	7 (9.86%)	439	**0.007#**
	21-25 years	32 (45.07%)	663	
	26-30 years	28 (39.44%)	433	
	> 30 years	4 (5.63%)	102	
Medical disease in mothers	GDM* on insulin (7) Hypothyroidism on thyroxine (8) Psychosis, depression, PCOD* (1) Epilepsy (1)	17(23.94%)	232	**0.02#**
Gravida	Primi	31 (43.66%)	834	0.26
	2	27 (38.03%)	623	
	3	11 (15.49%)	148	
	4	2 (2.82%)	-	
Abortions		21 (29.57%)	-	-
Death of previous siblings	Neonatal	7 (9.86%)	-	-
	Infants	4 (5.63%)	-	
Consanguinity	No consanguinity	56 (78.87%)	1264	0.74
	Second degree	3 (4.23%)	373	
	Third degree	12 (16.9%)		
Triple marker test	Not done	58 (81.69%)	-	
	Done, normal	13 (18.31%)	-	
Liquor	Normal	43 (60.56%)	-	
	Oligohydramnios	17 (23.95%)	-	
	Polyhydramnios	11 (15.49%)	-	
Antenatal USG*	BD detected	34 (47.89%)	-	
	BD not detected	37 (52.11%)	-	
Mode of delivery	Vaginal	43 (60.56%)	926	0.5
	LSCS*	28 (39.44%)	711	

[Table/Fig-3]: Demographic data and antenatal profile of mothers.
*GDM: Gestational diabetes mellitus; PCOD: Polycystic ovarian disease; USG: Ultrasonography; LSCS: Lower segment caesarean section; #p-value less than 0.05 was considered significant

Seventeen (23.94%) mothers had history of medical disease in antenatal period, out of which 8 (11.27%) had hypothyroidism

(treated with thyroxine) and 7 (9.86%) had Gestational Diabetes Mellitus (GDM) (treated with insulin). In the present study, prevalence of BDs in mothers with pre-existing medical conditions (17/232, 7.33%) was statistically significant than in mothers without medical conditions (54/1405, 3.84%).

In the present study, only 15 (21.12%) mothers had history of consanguineous marriage. A total of 43 mothers (60.56%) had normal liquor, 17 (23.95%) of them had oligohydramnios and 11 (15.49%) had polyhydramnios. 43 (60.56%) babies were born by vaginal delivery and rest by Lower Segment Caesarean Sections (LSCS). In this study, majority (43.66%) of babies with BD were born to primi-mothers. In this study, 2 babies had Down's syndrome and the Triple marker test was not done in them. Only 13 (18.31%) mothers had received this test and all of them had normal reports. All the mothers had antenatal scans done including anomaly scan but congenital anomalies were detected only in 34 (47.89%) mothers [Table/Fig-3].

A total of 95 BDs were identified in 71 neonates. Major BDs constituted 90.53% (86 BDs) and minor BDs 9.47% (9 BDs). [Table/Fig-4] depicts the spectrum of BD. The predominant system involved was cardiovascular system (29 BDs, 30.53%, n=95), followed by musculoskeletal system (27 BDs, 28.42%). VSD was the most common major anomaly found in the cardiovascular system likewise cleft lip and cleft palate was found to be the most common major anomaly in musculoskeletal system. The three most common major BD were VSD (13 BDs, 13.68%), cleft lip and cleft palate (7 BDs, 7.37%) and ambiguous genitalia (6 BDs, 6.32%).

Birth Defects (BD)	N=95	Percentage
Central nervous system	6	6.31
Occipital encephalocele	2	
Hydrocephalus, aqueductal stenosis	1	
Anophthalmia	1	
Meningomyelocele	1	
Anencephaly	1	
Cardiovascular system	29	30.53
TGA*	9	
VSD*	4	
ASD*, VSD	2	
ASD, PDA*	1	
TGA, PDA	3	
ASD	2	
Complex CHD*	1	
PDA	1	
TAPVC*	2	
Haemangioma	1	
Hypoplastic left heart syndrome	1	
Ebstein's anomaly	2	
Musculoskeletal system	27	28.42
Limb reduction defect	2	
Rhizomelia	1	
Mesomelia	2	
Developmental dysplasia of Hip	1	
Facial dysmorphism	6	
Polydactyly	3	
CTEV*	6	
Cleft lip and cleft palate	1	
Cleft lip	1	
Anotia	1	
Microtia	1	
Preauricular skin tags	1	
Sacrococcygeal teratoma	1	
Gastrointestinal system	12	12.63
Congenital diaphragmatic hernia	2	
Hirschsprung's disease	2	
Ileal atresia	4	
Imperforate anus	2	
Tracheo esophageal fistula	1	
Malrotation of gut	1	
Genitourinary system	15	15.79
Ureterocele	6	
Ambiguous genitalia	1	
Multicystic dysplastic kidney	3	
Hypospadias	1	
Bilateral polycystic kidney disease	1	
Bilateral Hydronephrosis	1	
Vestibulo rectal fistula	1	
Bladder exstrophy	1	
Respiratory system	4	4.21
CCAM*	1	
lung hypoplasia	1	
Pulmonary hypoplasia	2	
Syndromes/Others	2	2.1
Down's syndrome	2	

[Table/Fig-4]: Spectrum of Birth defects (BD) (n=95).
*TGA: Transposition of great arteries; VSD: Ventricular septal defect; ASD: Atrial septal defect; PDA: Patent ductus arteriosus; CHD: Congenital heart disease; TAPVC: Total anomalous pulmonary venous return; CTEV: Congenital talipes equinovarus; CCAM: Congenital cystic adenomatoid malformation

Systems involved in individual neonates with BDs are mentioned in [Table/Fig-5]. Most common system involved was cardiovascular system (28.16%, n=71). Different types of BDs based on severity and aetiopathogenesis is shown in [Table/Fig-6]. The predominant type of BD found was malformation (83 BDs, 87.37%) followed by dysplasia (6 BDs, 6.36%).

Systems involved	Neonates with birth defects n (%)
CVS*	20 (28.16%)
MSS*	12 (16.90%)
GUS*	11 (15.49%)
MSS, CVS	7 (9.86%)
CNS*	6 (8.45%)
GIT*	5 (7.04%)
GIT, CVS	3 (4.22%)
RS*	2 (2.81%)
GIT, MSS	2 (2.81%)
CVS, GUS	1 (1.41%)
GUS, MSS	1 (1.41%)
GIT, CVS, GUS	1 (1.41%)

[Table/Fig-5]: System involved in individual neonate with BD (n=71).
*CVS: Cardiovascular system; MSS: Musculoskeletal system; GUS: Genitourinary system; CNS: Central nervous system; GIT: Gastrointestinal system; RS: Respiratory system

Type of Birth Defects (BD)	N (percentage)
Major	86 (90.53%)
Minor	9 (9.47%)
Malformation	83 (87.37%)
Disruption	1 (1.05%)
Dysplasia	6 (6.36%)
Deformation	3 (3.15%)
Syndrome	2 (2.11%)

[Table/Fig-6]: Different types of BDs based on severity and aetiopathogenesis (n=95).

Outcome

Total 27 neonates (38.03%) were referred immediately to tertiary care centres for neurosurgical, cardiovascular and Paediatric surgical interventions; 8 cases (11.27%) died in this institute before any interventions. Outcome of neonates along with referrals is shown in [Table/Fig-7]. Total number of deaths was 22. Case fatality rate of BDs was 30.99% (22/71). Neonatal mortality rate of BDs was 0.35 per 1000 live births.

DISCUSSION

Globally, surveys have reflected that the frequency of BD varies greatly from region to region and depends on time of observation after birth, type of malformation, differences in reporting and statistical procedures [14]. Data from meta-analysis done by Bhide P and Kar A, suggested that there may be as many as

Parameter	Result	Number	Percentage
Died in the hospital	-	8	11.27
Referrals*	Died with intervention	11	15.49
	Died without intervention	2	2.82
	Alive with intervention	24	33.80
	Alive without intervention	13	18.31
	Died at >1 month of age	1	1.41
	Lost for follow-up	10	14.08
No intervention done	-	2	2.82

[Table/Fig-7]: Outcome of neonates with Birth Defects (BD) (n=71).
*Inhouse referrals included

472,177 (421,652 to 522,676) congenital anomaly affected births in India each year [5]. National neonatal perinatal database with a network of 17 hospitals in India reported prevalence of congenital malformation as 17/1000 live births [15]. Comparison of prevalence and associated parameters of BDs has been done in [Table/Fig-8] [16-20].

In the present study, the prevalence of congenital malformations in the newborns was 1.18%, which is comparable with the earlier studies from India [17,21,22]. There are other reports from different parts of the world representing different frequency of congenital malformations [18,19]. The prevalence of BDs would have been more than the present rate, if we could have included the abortions, intrauterine deaths and stillbirths. Tertiary care hospitals usually do not have definite catchment areas and complicated cases are more likely to be encountered. Hence, prevalence calculated in this type of hospital-based study cannot be projected to the total population.

Male babies had a higher prevalence of congenital anomalies than female babies in the present study similar to other studies where male preponderance was noted [21,23]. A population based study by Sokal R et al., found that the prevalence of congenital anomalies (CAs) was 26% higher in males compared with females. This study confirmed the greater risk for males to be born with major CAs and additionally highlighted substantial variation in this risk by system-specific subgroup and specific diagnosis [24].

Prevalence of BD was statistically more significant in LBW babies than normal birth weight babies in this study. Association of LBW with increased risk of congenital malformations is very well documented [20,23]. A hospital-based study by Grandi C et al., found an approximate two fold association between BD and preterm birth [25]. In a population based study by Honien MA et al.,

Parameter	Sarkar S et al., [16] (n=286)	Taksande A et al., [17] (n=179)	Mir NA et al., [18] (n=770)	Tomatır AG et al., [19] (n=183)	Baruah J et al., [20] (n=206)	Present study (n=71)
Total deliveries	12896	9386	33332	63,159	18,192	6092
Prevalence	2.22%	1.91%	2.38%	0.29%	1.2%	1.18%
M:F	1.93:1	1.63:1	1.1:1	1.2:1	1.6:1	1.32:1
Predominant system involved	MSS	CVS	MSS	CNS	MSS	CVS
Most common anomaly	CTEV	VSD	CTEV	-	-	VSD
Single: Multiple	-		1:1	-	-	2.94:1
Prematurity	Significant 4.4%	Significant 5.14%	Not significant	-	Significant	Not significant (p-0.108)
LBW	Significant 3.8%	Significant 4.1%-5.8%	Not significant	-	Significant	Significant (p-0.03)
Predominant Mothers' Age Group (Years)	20-30 Not Significant	>30 3.6%	>40 Significant	20-34	>30 2.2%	26-30 (Significant p-007)
Consanguinity	Significant 40%	8.5%	-	14.3%	-	Not significant (p-0.74)
Predominant Mode of Delivery	Vaginal-significant 2.5%	-	-	Vaginal	-	Vaginal (p -0.5 Not significant)
Multiparity	Significant 3.3%	Significant 1.78%-5.95%	Significant	-	-	Not significant (p-0.26)
Mortality Rate	-	-	7.5%	14%	-	30.99%

[Table/Fig-8]: Comparison of prevalence and associated parameters of Birth Defects (BD) with other studies [16-20].
M:F: Male:Female; CVS: Cardiovascular system; MSS: Musculoskeletal system; CNS: Central nervous system; VSD: Ventricular septal defect; CTEV: Congenital talipes equinovarus; LBW: Low birth weight

in the United States, there was a strong correlation between BD and preterm birth, with the strongest association between preterm births and BD observed at the earliest gestational ages [26]. A significantly higher incidence of congenital anomalies in preterm babies as compared with the full term babies had been confirmed in the previous studies reported from this country [27,28]. In this study, association of prematurity and prevalence of BDs was not statistically significant. High proportion of CVS anomalies, which tend to get detected only after birth but less lethal intrauterine might be the reason behind the above findings.

Hagen A et al., stated that older maternal age is strongly associated with chromosomal BD such as trisomies 13, 18, and 21 [29]. Several studies have also observed an association between older maternal age and non chromosomal BD such as neural tube defects, cleft lip or palate, congenital inguinal hernia, and cardiac defects [30,31]. This study has depicted that the prevalence of BD was more in mothers aged between 25-30 years. This could be due to the thorough screening of the elderly mothers by obstetricians. Increased awareness among mothers about the higher chances of pregnancy related complications and occurrence of BD as the age progresses had led them to go for early marriage and early conception.

In the present study, prevalence of BDs in mothers with pre-existing medical conditions like GDM and hypothyroidism was significantly more than others without medical conditions. Marwah S et al., had proved the same in their study [32]. A population-based study by Chou HH et al, stated that several maternal chronic diseases like diabetes mellitus, hypertension, anaemia, epilepsy, connective tissue disorders and mood disorders were associated with a significantly higher prevalence of CHDs in newborn [33].

Incidence of congenital anomalies were found to decline with increasing birth order in this study but study by Swain S et al., observed more in multigravida [34]. Taksande A et al., and Anand JS et al., found no significant difference with the parity of the mother and the incidence of anomalies [17,35]. In the present study, only 47.89% BDs have been detected in antenatal scans. It has been documented that routine ultrasound screening during the antenatal period can detect 60-80% of major and 35% of minor congenital malformations [36].

In the present study, the predominant system involved was cardiovascular system and VSD was the most common major anomaly found. This is in accordance with the annual report of ICMR and Taksande A et al., [17,37]. In most parts of India abnormalities of the musculoskeletal system are the commonest malformations as reported by many workers [27,38]. The incidence in different studies can vary depending upon the population sampled, selection of study material,

and astuteness of clinician and availability of laboratory aids. Kalra A et al., reported that the CNS defects have the highest incidence, whereas Sugunabi NS et al., reported gastrointestinal malformations to rank the highest [39,40]. In the present study, multiple BD was found in 25.35% of the babies comparable to the study by Charlotte TN et al., in which it was 18.2% [41]. Major BDs constituted 90.53% which was comparable to a study by Mir NA et al., [18].

Case fatality rate of BDs was 30.99%, higher compared to Mir NA et al., and Tomatir AG et al., [18,19]. Neonatal mortality rate of BDs was 0.35 per 1000 live births.

Limitation(s)

As it is a tertiary care hospital and referral centre, prevalence calculated may be higher than the general population in this hospital-based study. This study did not include the abortions, intrauterine deaths, functional BD and stillbirths. As 14% of cases have been lost to follow-up, mortality and morbidity might be higher than stated.

CONCLUSION(S)

Prevalence of BDs was 1.18% of the total live births and 4.16% of total NICU admissions. Cardiovascular system was the most common system involved, VSD being the most common defect. Prevalence of BDs was significantly associated with late twenties parity, LBW and pre-existing medical diseases in mothers. Male gender, prematurity, consanguinity and multiparity were not significantly associated with BDs. Single and major BD was commoner than their counterparts. Regular antenatal visits and prenatal diagnosis including foetal echocardiogram are recommended for prevention, early intervention and even planned termination, when needed. Evaluation of the cardiovascular system by means of foetal echocardiography to rule out congenital heart disease in a high risk mother is the important factor to be considered. An extensive collaborative population-based study using case-control design to identify specific risk factors of BDs in this sub region has to be planned and executed.

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PLAGIARISM CHECKING METHODS: [Jain H et al.]
- Plagiarism X-checker: Jun 01, 2021
- Manual Googling: Jul 24, 2021
- iThenticate Software: Aug 24, 2021 (21%)

ETYMOLOGY: Author Origin

AUTHOR DECLARATION:
- Financial or Other Competing Interests: None
- Was Ethics Committee Approval obtained for this study? Yes
- Was informed consent obtained from the subjects involved in the study? Yes
- For any images presented appropriate consent has been obtained from the subjects. NA

Date of Submission: **May 18, 2021**
Date of Peer Review: **Jul 05, 2021**
Date of Acceptance: **Aug 17, 2021**
Date of Publishing: **Sep 30, 2021**