PATTERN OF BIRTH DEFECTS, ASSOCIATION AND THEIR OUTCOMES AMONG NEONATES IN A TERTIARY CARE HOSPITAL IN BANGLADESH

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Abstract:

Birth defects are one of the major cause of stillbirths and neonatal mortality in developed and developing countries. The prevalence of birth defects varies in different parts of the world. In many cases, the causes are unknown; however, several factors known to be associated are genetic factors, maternal age, health, dietary factors, maternal infections, geographical factors, drugs, smoking and irradiation.

Objectives: *To identify the pattern of birth defects, association and their outcomes among neonates*

Methodology: *This observational study was conducted in the department of neonatology, Dhaka Medical College Hospital, Dhaka from 1st July 2019 to 30th June 2021. Sample was collected by purposive sampling technique. Total 407 babies were enrolled. Out of them 207 babies were with birth defects in group-A and 200 babies had no birth defects in group-B. Detail demographic data were collected from the informant and recorded in structured case report form. Clinical examination and relevant investigations were done. Data processing work consist of registration schedules, editing computerization, preparation of dummy table, analyzing and matching of data.*

Results: *In this study the two study groups were almost similar with respect to their demographic characteristics like sex, residence, place of delivery, mode of delivery, gestational age, parity and maternal age. The total number of admission during this period was 3050 and total number of birth defects was 207 (6.78%). In this study on evaluation of maternal risk factors, group-A maternal high blood pressure were in 25.12% cases(OR=1.62;p=.002), maternal diabetes were in 15.46% cases (OR=1.12;p=.001), poor maternal nutritional status was 14.50%(p=.001), history of taking folic acid was 9.66%(OR=0.10;p=.001), 5.80% of the patient had history of exposure to antenatal radiation(OR=.06;p=.001), 4.43% had history of consanguinity(OR=.05;p=.001), 2.420% of women noticed that exposure to pesticides(OR=.025;p=.001), H/O of taking anticonvulsant was 2.420%(OR=.025;p=.001). Group-B was maternal high blood pressure in 7.25% cases(OR=.078;p=.001), maternal diabetes were in 6.28% cases(OR=.067;p=.001), poor maternal nutritional status was 5.80%(p=.001), history of taking folic acid was 4.83% (OR=.051;p=.001), 1.45% of the patient had history of exposure to antenatal radiation(OR=.015;p=.001) and 0.97% had history of consanguinity(OR=.01;p=.001). In this study pattern of birth defects summarized as the cardiovascular system defects was the most commonly affected(26.57%), followed by defects in the head, neck ear,- and eye(19.32%), Syndromes(14.50%), gastrointestinal defects(12.56%), musculoskeletal system defects(10.14%), central nervous system defects (8.70%) and genitourinary system(4.83%) of total defects. In group-A 78.26% of the patients recovered and 23 patients expired during hospital stay (p=.001). In group-B 85.99% of the patients recovered and 17 patients expired.*

Conclusion: *Congenital cardiac defects were the most prevalent anomaly detected. Maternal high blood pressure and diabetes are the risk factors of birth defects in neonates. Antenatal diagnosis and proper management can improve the outcome of these neonates.*

Keywords: *Birth defect, Neonates*

DOI: https://doi.org/10.3329/jdmc.v32i1.76423
J Dhaka Med Coll. 2023; 32(1) : 43-50

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Received: *29.11.2023* ***Revision:*** *02.01.2024* ***Accepted:*** 08.03.2024

Introduction:

Birth defects mean the defect or malformation that is present at birth. It is an abnormality of physical structure that is seen at birth or within few weeks after birth[1]. According WHO documents 1972, the term birth defects (BDs) should be confined to structural defects present at birth. Birth defects can be classified in to major and minor. Minor defects have structural abnormality present at birth with minimal effect on clinical function, but they may have a cosmetic effect e.g. preauricular tag in Goldenhar syndrome. But major malformation results in significant effect on function or on social acceptability e.g. ventricular septal defect (VSD) and cleft lip. A syndrome is a pattern of abnormalities that occur together and are associated with a set number of signs and symptoms. While dysmorphology is the study of abnormalities of human form and its mechanism that cause these abnormalities[2]. Almost 20-30% of infant mortality and 30% to 50% post-neonatal deaths are due to birth defects[2]. In developing countries food fortification with folic acid significantly reduced incidence of neural tube defects. First trimester is the crucial period for organogenesis of organs, especially between the 3rd and 8th weeks of gestation where any insult in any form to the fetus can cause congenital abnormality. So, this is the period for preventive intervention strategy especially for developing countries where prevalence of birth defects is very high. In south east Nigeria prevalence of birth defects is higher (29.4%) in low birth weight (LBW) babies than normal birth weight babies (35.3%)[3,4]. The cause of birth defects may be either genetic or environmental or sometime even unknown. Among genetic causes, 6% are due to chromosomal abnormality, 25% of single-gene disorders, and 20% of multifactorial[4]. Folate supplementation during peri-conception period is the most popular and proven preventive measure for neural tube defects[5]. Maternal age is also a risk factor for birth defects. Other risk factors include teratogenic drug intake particularly from anti-cancer and anti convulsant drugs, professional hazard like radiation exposure, maternal illnesses like hypothyroidism, smoking and alcohol consumption[6]. Modern antenatal screening methods like ultrasonography, maternal serum markers, chorionic villus sampling, amniocentesis etc. can be used to detect birth defects which can lead us for manual or therapeutic termination of pregnancy.

Prevalence of birth defects is higher in black children than in white. In Nepal, 13% of neonatal deaths are due to congenital anomalies[11]. In Pakistan also, there is high Morbidity and mortality among children with birth defects[12]. Preventive measures like vaccination of mother prior to conception particularly against rubella and chickenpox can contribute to birth defects prevention[13]. Maternal factors associated with birth defects included the lack of peri-conceptional use of folic acid[14]. The commonest associated risk factors were consanguineous marriage. This may be reduced by creating awareness regarding the avoidance of consanguineous marriage[15]. Understanding and increased knowledge of the epidemiology of children with birth defects is a high priority due to the maternal and child health indicators in healthy people. The musculoskeletal system was the most commonly affected (23%), followed by the central nervous system (CNS) (20.3%), gastrointestinal system (GIT) (16.2%), genitourinary system (13.5%), craniofacial (10.8%), cardiovascular system (CVS) (9.5%), and chromosomal anomalies (6.8%)[16]. Congenital anomalies if overt can be picked up easily at birth by trained pediatricians, anomalies like congenital defects of the heart are apparent in seven to ten days even if not apparent at or soon after birth. Sometimes patient are informed beforehand about the anomalies on antenatal ultrasounds, most common of these include hydrocephalus renal anomalies, heart defects, and anomalies of the lungs so that antenatal counseling can be done and necessary management plans can be laid out[17].

Materials & Methods:

This observational cross-sectional study was conducted in the Neonatal Intensive Care Unit (NICU) of Dhaka Medical College Hospital from 1st July 2019 to 30th June 2021. All neonates

delivered with birth defects in DMCH, out born neonates with birth defects attained in OPD of Neonatology and admitted NICU in the Dhaka Medical College Hospital were included this study. Total 407 babies were enrolled. Out of them 207 babies were with birth defects in group-A and 200 babies had no birth defects in group-B. Before doing the study the thesis protocol was approved by the ethical committee in Dhaka Medical College with due procedure. Informed written consent from the parents for the involvement in the study were taken. Frequency and pattern of these birth defects were recorded. Variables studied include sex, residence, maternal age, parity, gestational age, place of delivery, mode of delivery, education and social status, were recorded. Maternal risk factors including high blood pressure, diabetes, family history of birth defects, cousin marriage, medical disorders, industrial exposure, and viral infections in early pregnancy were also recorded. Thorough neonatal examination and detection of any kind of birth defects was done by the medical officer at the time of admission in NICU or in the Neonatal OPD which than was followed by Neonatologist. Investigations like hematological and radiological study were done to detect and rule out multiple birth defects. Echocardiography and genetic studies were requested in standard lab center in Bangladesh. Post-mortem investigation of neonates was not done due to religious and social factors. Outcome was determined by patient condition within the seven days of hospital stay.

Data for socio-demographic and clinical variables were obtained from all participants by the use of a pre- designed and easily understandable questionnaire. After collection of all information, these data were checked, verified for consistency and edited for finalized result. After editing and coding, the coded data directly entered into the computer by using SPSS version 23(The Statistical Package for the Social Sciences version 23). Data cleaning validation and analysis was performed using the by MS excel, Chi-square test and Linear regression test. A "P" value <0.05 was considered as statistically significant.

Results:

Table-I

Demographic characteristics of the newborn (n=407)

Variables	Group A(Case-207)	Group B(Controlled-200)	P value
Gender			
Male	116	110	.06
Female	91	90	
Residence			
Urban	136	120	.08
Rural	71	80	
Maternal age			
<35 years	77	80	.001
>35 years	130	120	
Parity			
Primi	75	80	.07
Multi	132	120	
Gestational age			
Term	120	110	.06
Preterm	87	90	
Place of delivery			
Home	52	60	.07
Hospital	155	140	
Mode of delivery			
NVD	125	130	.06
LUCS	82	70	

Table-II

Distribution of maternal risk factors contributing neonatal birth defects (n=407)

Variables	Group A (Case 207)	Group B (Controlled 200)	P value
Maternal high blood pressure	52	15	.001
Maternal diabetes	32	13	.000
Poor nutritional status	30	12	.001
H/O taking folic acid	20	10	.002
Family history of birth defects	15	2	.005
Exposed to antenatal radiation	12	3	.001
History of consanguinity	10	2	.002
Exposure to pesticides	5	1	.024
H/O taking anticonvulsant drug	5	1	.004
H/O maternal rash	4	0	.045

Table-III

Pattern and type of birth defects observed in neonates (n=207)

Clinical diagnosis	Number of patients	Percentage (%)
Congenital heart disease	55	26.57
Ventricular septal defect	37	67.27
Atrial septal defect	15	27.27
Patent ductus arteriosus	3	5.46
Head, Neck, Eye and Ear	40	19.32
Cleft palate & Lip	27	67.50
Pre auricular tag	4	10.00
Anotia	3	7.5
Microtia	3	7.5
Cystic hygroma	2	5.0
Congenital Cataract	1	2.5
Syndromes	30	14.50
Downs Syndromes	25	83.33
Prune belly Syndromes	3	10.00
Mermaid Syndromes	2	6.66
Gastrointestinal system	26	12.56
Congenital diaphragmatic hernia	5	19.22
Trachio Oesophageal fistula and atresia	5	19.22
Neonatal Intestinal obstruction	4	15.38
Omphalocele	4	15.38
Gastroschisis	3	8.33
Musculo skeletal system	21	10.14
Talipes equinovarus	14	66.66
Polydactyly	4	19.05
Syndactyly	3	14.28
Central Nervous system	18	8.70
Meningomyelocele	12	66.67
Anencephaly	2	11.11
Hydrocephalus	2	11.11
Microcephaly	2	11.11
Genitourinary system	10	4.83
Micropenis	3	30.00
Undescended testis	3	30.00
Bladder exstrophy	2	20.00
Hypospedias	2	22.00
Others Conjoined twin	72	3.38.97
Collodion baby Cyclopia	21	.97.48
Arthrogryposis Multiplex	1	.48
Cloacal Exstrophy	1	.48

Table-IV

Birth defects in association with maternal and others factors of Group A and Group B

Variables	Cardiovascular system defects	Head Ear, eye,	Syndromes	Gastrointestinal system defects	Musculo-skeletal system defects	Central nervous system defects	Genito-urinary system defects	Group A Odds ratio	Group A p value	Group B Controlled	Group B Oddsratio	Group B p value
Newborn sex												
Male	35	15	20	15	13	12	4	1.179	0.238	110	1.179	0.238
Female	20	25	10	11	8	6	6			90		
Residence												
Urban	39	27	20	12	15	12	8	1.915	0.003	120	1.524	0.003
Rural	16	13	12	14	6	6	2			80		
Maternal parity												
Primi	15	12	8	12	10	6	8	1.76	0.011	80	0.697	0.011
Multi	40	28	24	14	11	12	2			120		
Maternal high blood pressure												
Yes	11	6	20	6	4	3	2	1.62	0.002	15	0.078	0.001
No	44	34	12	20	17	15	8			185		
Diabetes Mellitus												
Yes	16	2	9	3	1	1	0	1.12	0.001	13	0.067	0.001
No	39	38	23	23	20	17	10			187		
History of taking folic acid												
Yes	5	3	5	5	2	0	0	0.107	0.001	10	0.051	0.001
No	50	37	27	21	19	18	10			190		
Family history of birth defects												
Yes	6	2	3	1	1	2	0	0.078	0.001	2	0.01	0.001
No	49	38	29	25	20	16	10			198		
Exposed to antenatal radiation												
Yes	1	1	3	1	1	4	1	0.062	0.001	3	0.015	0.001
No	54	39	29	25	20	14	9			197		
History of consanguinity												
Yes	1	1	2	0	2	3	1	0.051	0.001	2	0.01	0.001
No	54	29	30	26	19	15	9			198		
Exposure to pesticides												
Yes	0	1	2	0	1	1	0	0.025	0.001	1	0.005	0.001
No	55	39	30	26	20	17	10			199		
H/O taking anticonvulsant drug												
Yes	1	1	2	0	0	1	0	0.025	0.001	1	0.005	0.001
No	54	39	30	26	21	17	10			199		
H/O maternal rash												
Yes	2	0	1	1	0	0	0	0.02	0.001	0	0.005	0.001
No	53	40	31	25	21	18	10			200		

Table-V

Outcome of the neonates of the birth defects (n=407)

Outcome	Group A	Group B	P Value
Discharged	139	150	.001
DOR	30	25	
DORB	15	08	
Death	23	17	

Table-VI

Distribution of death among the neonates with birth defects

Birth defects	Number of death(%) n=23
Congenital heart disease	5 (21.70)
Anencephaly	2 (8.70)
Collodion baby	2 (8.70)
Omphalocele	2 (8.70)
Gastroschisis	2 (8.70)
Downs syndrome	2 (8.70)
Tracheo-esophageal fistula	2 (8.70)
Mermaid syndrome	2 (8.70)
Duodenal atresia	1 (4.35)
Conjoined Twin CyclopiaCloacal Exstrophy	1 (4.35) 1 (4.35)1 (4.35)

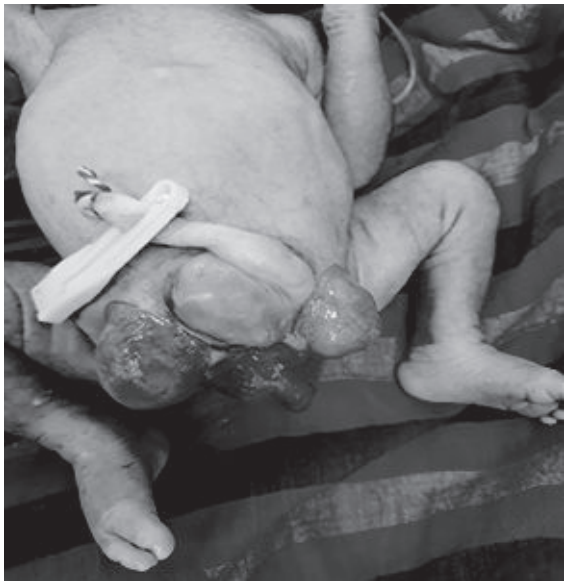

Figure 1: *Cloacal Exstrophy*

Figure 2: *collodion baby*

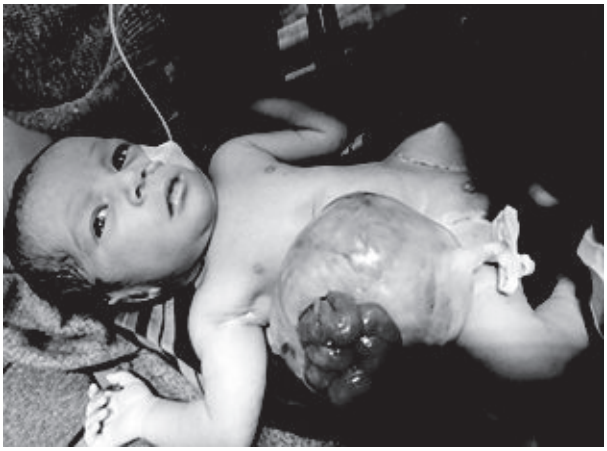

Figure 3: *Omphalocele*

Discussion:

Four hundred and seven newborn were taken as sample for study according to inclusion, exclusion criteria. Demographic characteristics revealed that, in group-A out of 207 cases 56.03% patients were male and 44.97% were female. Male – female ratio was 1.27:1. In group-B out of 200 cases 55% were male and 45% were female. Total numbers of admission were 3050, total numbers of birth defects were 207(6.78%), out of them total death were 23(11.11%). Large numbers of respondents in group-A came from urban area, e.g., 65.70%, followed by rural area 40.0%. In group-A, 74.88% had history of hospital delivery, majority of the patient had history of normal vaginal delivery (e.g. 60.39%), Term baby were 57.97%, Multipara were 63.77% and maternal age >35 years were 62.80%. In group-B, 70.05% had history of hospital delivery, majority of the patient had history of normal vaginal delivery (e.g. 62.80%), Term baby were 53.14%, Multipara were 58.94% and maternal age >35 years were 57.98%.

Hussain S et al study shows out of 3,210 total admissions, 226 (7%) neonates were congenitally malformed. Of them, 130 (57.52 %) were male and 96 (42.47 %) females[18]. In a study the prevalence rate of congenital malformation was found to be of 8.39%; 52 (54.10%) were males and 44 (45.83%) females[19].

EI Koumi M et al study shows the maternal and fetal factors association with birth defects

at birth. Maternal age (<20 years or >35 years) was associated with increased incidence of congenital malformation although this was not significant. The incidence of congenital malformation was significantly higher amongst the LBW (<2500 g) babies than among normal birth weight babies. Congenital malformation were observed significantly more in preterm babies than full term (P<0.05)[16].

In this study on evaluation of maternal risk factors, group-A was maternal high blood pressure in 25.12% cases, maternal diabetes were in 15.46% cases, poor maternal nutritional status was 14.50%, history of taking folic acid was 9.66%, 5.80% of the patient had history of exposure to antenatal radiation, 4.43% had history of consanguinity, 2.420% of women noticed that exposure to pesticides, H/O of taking anticonvulsant was 2.420%. Group-B was maternal high blood pressure in 7.25% cases, maternal diabetes were in 6.28% cases, poor maternal nutritional status was 5.80% history of taking folic acid was 4.83%, 1.45% of the patient had history of exposure to antenatal radiation and 0.97% had history of consanguinity.

Ahwaz et al shows there was a statistically significant association between having a child with congenital anomalies and a maternal history of previous congenital anomalies, parental consanguinity, and history of medical disorders. Maternal occupation and smoking did not have any influence to develop congenital anomalies[1].

In this study among of birth defects the cardiovascular system defects was the most common birth defects(26.57%), followed by defects in the head, neck ear,- and eye(19.32%), Syndromes(14.50%), gastrointestinal defects(12.56%), musculoskeletal system defects(10.14%), central nervous system defects (8.70%) and genitourinary system(4.83%) of total defects.

Bastola R et al studies shows that birth defects being one of the main cause of neonatal mortality, are very common and most commonly affected system include ear, eye, face and neck anomalies and with syndromes followed by digestive, genitourinary, musculoskeletal, CVS, and skin in descending order of frequency[19]. As far as involvement of different systems of the body is concerned, brain has the highest incidence of congenital malformation. 10/1000 followed by heart 8/1000, kidney 4/1000, limb 1/1000 and miscellaneous 6/1000 live births[10].

Ameen SK et al study shows the most common central nervous system anomalies were hydrocephalus (12.3%) and meningocele (12.3%), followed by anencephaly (11.5%) and spina bifida (2.3%). The most common musculoskeletal anomalies were clubfoot (7.7%), omphalocele (3.8%), and gastroschisis (3.1%). The most common gastrointestinal tract anomalies were cleft lip (18.5), cleft palate (16.2), Pierre Robin syndrome (4.6%) and esophageal atresia (3.8%)[35]. In a study the most common system involved was circulatory followed by nervous and musculoskeletal system[20]. Another study shows neural tube defect was the commonest. Three cases of congenital heart disease were seen with two cases each of Down's syndrome and facial malformation[20].

Amir A k et al study shows the most common area for anomalies was the central nervous system (37.7%) followed by the musculoskeletal (23.1%) and gastrointestinal systems (20.8%). In another study among different body systems affected, anomalies related to the central nervous system were 46(20.35%) musculoskeletal 42(18.58%), genitourinary 34 (15.04%), cardiovascular system 30 (13.27%), ear, eye,ace, neck 27(11.94%), digestive system 19 (8.40%), syndromes and skin 14 (6.19%) each[21].

In group-A 78.26% of the patients recovered and 23 patients expired during hospital stay (p=.001). In group-B 85.99% of the patients recovered and 17 patients expired.

Neonatal adverse outcomes were extremely common in all birth defects groups. Hospitalization time was the increased for all of them as a result of preterm delivery, low birth weight, Apgar score <7 at the 5th minute. Neonatal infection were more common among the birth defects with preterm low birth weight, cardiovascular defects and gastrointestinal anomaly[22].

Conclusions:

Congenital cardiac defects were the most prevalent anomaly detected. Maternal high blood pressure and diabetes are the risk factors of birth defects in neonates. Antenatal diagnosis and proper perinatal management can improve the outcome of these neonates.

Recommendations:

In the light of analysis and interpretation of the present study findings following recommendations can be made:

1) All newborn babies should be examined thoroughly for any evidence of birth defects.
2) Fetal anomaly scanning is the most effective method of identifying the prevalence of serious birth defects. So anomaly scanning should be routinely performed.

Limitations of the study

This study was not without limitation. The limitations of the studies were as follows:

1. It was a single centre study, only patients admitted in Dhaka medical college hospital was enrolled. So this will not reflect the overall picture of the country. A large scale study needs to be conducted to reach to a definitive conclusion
2. This study sought to detect mostly external (overt) birth defects among neonates, relying only on clinical examinations to make a diagnosis. Neither cytogenetic analysis nor autopsies for stillbirths were performed, because these procedures are expensive and have limited availability in our locality.

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