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PREVALENCE OF CONGENITAL STRUCTURAL MALFORMATION IN NEONATES AND INFANT IN RURAL TERTIARY CARE TEACHING HOSPITAL

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ABSTRACT

Background: Congenital Anomalies (CA) can be defined as structural or functional anomalies (for example metabolic disorders) that occur during intrauterine life and can be identified prenatally, at birth or later in life. Congenital anomalies are also known as birth defects, congenital disorders or congenital malformations. Birth defects affect 2 to 3 % of births and as India has reported 27 million births in 2011, around 540000 to 810000 pregnancies may have been affected with major or minor congenital anomalies.

Aim and Objectives: To study prevalence of congenital structural malformation in neonates and infants reported in Pediatrics department of a tertiary care center. To identify possible risk factors associated with development of Congenital Malformation. To identify immediate outcome of enrolled participants.

Material and Method: The study was conducted in Dhiraj Hospital, Department of Paediatrics for period of 18 months (December 2019 to June 2021). This includes patients admitted in

Neonatal Intensive Care Unit, post-natal wards, paediatric intensive care unit and paediatric ward of paediatrics in Dhiraj Hospital upto 1 year age of patient within the duration of 18 months for data collection. General examination, radiological investigations were done for confirmation of Congenital Structural Malformation. Amongst these children who met inclusion criteria of the study were enrolled for the study. Each guardian of patient was given information sheet and proper instruction about the study in detail. Then written and informed consent was taken. Confidentiality was maintained about patient's details included in the study. A detailed bio-data of the patient including age, sex, caste, address, religion, socio-economic status were taken. A note of chief complaints along with relevant baby details, mother's details, natal history, post natal history were noted on predesigned proforma. A thorough head to toe examination of the child especially gross assessment for congenital structural anomalies were done.

Result: The incidence of congenital malformation in inborn babies (live + still birth) was 1.30 per 100 babies. Male to female ratio was 2.9: 1 in inborn babies. Internal congenital malformation 45.2%, External malformation 41.7% and Internal + External type was 13.1. Incidence in preterm babies was 2.62 per 100 babies, term babies was 1.10 per 100 babies, post term babies was 0.50 per 100 babies. 27.5 % babies maternal age were <= 20 years. 42 (50%) baby's birth weight were < 2.5 kg and 33 (39.3%) baby's birth weight were > 2.5 kg. In inborn babies incidence of congenital malformations per 100 babies was higher in baby born with consanguineous marriage about 2.85 %. 71 (84.5%) babies had major congenital structural malformation. 9 (10.7%) babies had minor congenital structural malformation.4 (4.8%) live babies had major + minor congenital structural malformation. The commonest system involved in present study was CVS 41 (48.80%), followed by Oro-facial groups 24 cases (28.6 %), GIT 12 cases (14.28%), CNS 12 cases (14.28%), Muscular skeletal 11 cases (13.09 %), etc. 3 babies had Down syndrome and Chiari II malformation each separately. Out of 84 babies, 54 (64.3%) were discharged, 13 (15.5%) went to DAMA, 10 (11.9%) were referred to higher centre, 3 (3.6%) babies were expired.

Conclusion: Congenital anomalies are one of the major causes of stillbirth and infant mortality. Preconceptional counseling, regular antenatal visits, vaccination and Supplementation of folic acid and prenatal diagnosis are recommended for prevention of congenital malformation.

Key words: Congenital malformation, Newborn, Infant

INTRODUCTION

Children are the greatest gift of God to humanity. In India children form nearly 40% of total population. The promotion of healthy child development has become major focus of world attention over the last 3 decades.

According to the World Health Organization (WHO) in 2010, an estimated 270 000 deaths during the first 28 days of life were reported due to congenital anomalies globally. [(1)]. According to March of Dimes (MOD) global report on birth defects 7.9 million births (6% of total births) occur annually worldwide. With serious birth defects and 94% of these births occur in the middle- and low-income countries. According to joint WHO and MOD meeting report, birth defects account for 7% of all neonatal mortality and 3.3 million under five deaths.[(2,3)] Birth defects affect 2 to 3 % of births and as India has reported 27 million births in 2011, around 540000 to 810000 pregnancies may have been affected with major or minor congenital anomalies. That this estimate may reflect the highest global burden of birth defects

is reflected in some other sources of global data.Congenital anomalies 76662 deaths in India. [4] India accounted for 28 % of the global neonatal mortality burden due to congenital anomalies.

Congenital anomalies can be caused by genetic, single gene defects, chromosomal disorders, multifactorial inheritance, environmental teratogens (An agent, which can cause a birth defect) and micronutrient deficiencies.[5]Although congenital anomalies(CA) may be the result of one or more genetic, infectious, nutritional or environmental factors, it is often difficult to identify the exact causes. Approximately 40% to 60% of CA is of unknown origin. Although there are some known risk factors which can be linked with the causation of malformation. Consanguineous marriages have been described as an important factor contributing to increased CA. Studies have shown a significantly higher incidence of malformations in offspring of consanguineous parents. [2]

Congenital malformations are major contributors of neonatal mortality or lifelong disability in developed and developing countries. Early diagnosis and early surgical treatment when required can prevent neonatal deaths and help for better survival. Serious birth defects are life-threatening or have the potential to result in disability (physical, intellectual, visual, hearing impairment).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 just 3 examples of prevention methods. [6]

The most common serious congenital disorders are congenital heart defects [2].The birth defects include congenital heart disease (8-10 per 1000 live births), Neural tube defects (4-11.4 per 1000 live births)[4] , Gastrointestinal system (13%) include Cleft lip and palate, Imperforate anus , Exomphalos , Tracheoesophageal fistula, Mal-rotation of gut, Congenital diaphragmatic hernia, Laryngomalacia, Urogenital system Hypospadias, Hydronephrosis , Posterior urethral valve, Micro-penis, Congenital hydrocele Ear and Neck anomalies Chromosomal anomalies, Pierre Robin syndrome ,Cardiovascular system Patent ductus arteriosus , Cyanotic Congenital Heart Disease (CHD) , Single umbilical artery , Pre-auricular skin, Congenital Talipes Equino Varus (CTEV), Polydactyly.

Congenital anomalies can contribute to long-term disability, which may have significant impacts on individuals, families, health-care systems, and societies. As we know majority of congenital anomalies in our set up are detected postnatal because of lack of high degree of suspicion and limited availability of resources. Keeping all these facts in mind present study was planned to identify prevalence of structural congenital malformation inpatients reported to tertiary rural teaching hospital. Generated data might be helpful in identifying prevalence of particular subset of diseases.

MATERIALS AND METHODS

The study was carried out in the department of Pediatrics, Smt. B.K.Shah Medical Institute and Research Center, Dhiraj Hospital, Sumandeep Vidyapeeth, Pipariya for a period of 18 months from December 2019 to May 2021. Interview and allocation of subjects, collection of samples and administration of medication were done in indoor wards, Paediatrics. This includes patients admitted in Neonatal Intensive Care Unit, Post-natal wards, Paediatric intensive care unit and Paediatric ward of Paediatrics Department in Dhiraj Hospital upto 1 year age of patient within the duration of 18 months for data collection.

Study design: single center, propective observational study

Sample size: prevalence of congenital malformations in the department from the available data was 3.1 per 1000 live births. Hence, considering formula of 4 PQ/L2 taking the prevalence and allowable error of 5%, sample size was calculated to 75.

Inclusion criteria: all children (neonate and infants) born or admitted in Pediatrics Department with congenital heart disease

Exclusion criteria: patients who were already treated or corrective treatment already taken outside.

All the neonates and children upto age 1 year, fulfilling the inclusion criteria were included in the study after obtaining informed consent from their parents. Parents were provided with patient information sheet explaining regarding study. Babies who were already diagnosed outside and had taken corrective treatment as well as parents not willing to participate were excluded from the study. Anatomy for features varying from usual or normal standards was performed. Measurements height, weight, and head circumference were taken in comparison with standard charts. Radiographs, Ultrasonography, and echocardiogram were done in babies for selective cases. The anomalies were grouped and categorized as syndrome, sequence, association, or field defect. They were also classified as major, minor, or normal variant. All these data were tabulated and analysed statistically. All data were collected and entered in the excel sheet and descriptive data were presented as percentages. P value< 0.05 was considered significant. P <0.05 will be considered significant. The data was analyzed using SPSS program.

RESULTS

This study was conducted in Dhiraj Hospital department of paediatrics, 84 patients fulfilling our inclusion criteria were enrolled in our study during the study period (18 months from the day of permission).

Out of 84 babies, 71% babies were inborn. The incidence of congenital structural malformation in inborn babies was 1.30 per 100 babies. 60 (71%) were males 24 (29%) were females. The incidence of male to female ratio in inborn babies was 2.9:1. P value - 0.006, which was statistically significant. The odds ratio was 2.42 (CI 1.28-4.55) which showed that males have 2.57 times more risk compared to females. Most of the cases had internal type of congenital structural malformations 38 (45.2%) followed by external type of congenital structural malformation 35 (41.7 %) and mixed type was found only in 11 (13.1 %) of the cases assessed. In present study; 64 (72.2 %) of the babies were term babies, 19 (22.6 %) were found to be preterm and 1 (1.2%) was post term. The incidence of congenital structural malformation was 2.62% in inborn preterm babies. Table 5 showed that the incidence of congenital malformation in inborn babies (per 100 babies) was progressively increases as the maternal age advances from 20 years onwards. Highest incidence 2.94 % was found when the maternal age is > 35 years. On other hand one can observe that the incidence in babies of mothers of age < 20 years was also higher that those between age 20-30 years. However the differences were not found to be statistically significant when it was compared between < 30 years and > 30 years. (P value = 0.11). 42 (50%) babies had weight <2.50 kg and 1(1.2%) baby weight >= 3.50 kg. Out of 51 inborn babies 40 (78.4%) babies weight were <2.50 kg. Congenital anomalies based on consanguinity were assessed and it was seen 3.6% in present study out of 84 cases. P-value was 0.43, not proving any association of consanguinity with congenital malformations. There were only 5 cases in which a known risk factor was present. Most cases however did not demonstrate presence of any such known risk factor.

The data in table 9 shows that maternal anaemia was the commonest maternal complication amongst patients of congenital structural malformation. As many as 14 patients with CHD had maternal anaemia. Oligohydraminos was present in 1 case with Hypospadias; however the patient did not have any other complication like hydronephrosis of obstructive uropathy .One mother with Gestational DM had CHD in the form of a VSD in baby. A mother with bicornuate uterus had a baby with CTEV, an expected complication. The various congenital structural malformations overall were assessed in 84 babies and some of babies had multiple anomalies as shown in table 10. It was found that majority of the babies had congenital heart disease 41 (48.8 %) followed by Cleft lip + Palate 13(15.5%) babies. Also The prevalence of various syndrome were assessed and Down syndrome and Chiari II malformation were found to be common which were 3(3.6 %) both. 54 (64.3%) out of 80 babies who were born alive with congenital structural malformation were successfully discharged. 10 babies required referral for surgical management of 5 cases of CHD, 2 cases of Trecheo-oesophageal fistula and 1 case of Duodenal Atresia, Imperforte anus and Mid gut Volvulus each. On other hand 3 babies died during hospitalization.

TABLE 1: Birth of baby (Inborn vs. Outborn)

Delivery	Cases (%)	Total babies	Incidence per 100 babies
Outborn	33 (39.3%)	596	5.53
Inborn	51 (60.7%)	3894	1.30
Total	84 (100%)	4490	1.87

TABLE 2: Sex wise congenital structural malformation distribution

Sex	No. of malformed Babies (84) (%)	No. of malformed Babies (Inborn)(51)	No. of normal Babies (Inborn)	No. of malformed per 100 inborn babies
Male	60 (71.4 %)	38 (74.5%)*	2102	1.77
Female	24 (28.6%)	13 (25.5%)	1741	0.74

TABLE 3: Types of Congenital Structural Malformation

Congenital Structural Malformation Type	Number of cases	Percentage
External	35	41.7 %
External + Internal	11	13.1 %
Internal	38	45.2 %

TABLE 4: Gestational Maturity

Gestational Maturity	Cases (84) (Inborn + Outborn)	Total cases in inborn (51)	Total babies (Inborn)	Incidence Per inborn 100 babies
Preterm (< 37 weeks)	19 (22.6%)	16 (31.8%)	610	2.62
Term (37-42 weeks)	64 (72.2%)	34 (66.6%)	3085	1.10
Post term (> 42 weeks)	1 (1.2 %)	1 (1.6%)	199	0.50

TABLE 5: Maternal age and congenital structural malformation

Mother age at time of delivery (Years)	Total Babies (Inborn) (3894)	Malformed babies (Inborn)(51)	Cases (Inborn) (%)	Incidence of congenital structural malformation per 100 inborn babies
=<20	946	14	27.5%	1.47
21-25	1647	18	35.3 %	1.09
26-30	943	11	21.6%	1.16
31-35	256	5	9.8%	1.95
>35	102	3	5.8 %	2.94

TABLE 6: Birth weight of the baby

Birth Weight	Cases(Percentage) (84)	Cases in inborn babies (51)
Extremely LBW (<1 kg)	1 (1.2 %)	1 (1.2%)
Very LBW (1-1.49 kg)	9 (10.7 %)	8 (15.7%)
LBW (1.5-2.49 kg)	32 (38.1 %)	21 (41.8%)
2.50 kg – 3.49 kg	32 (38.1 %)	20 (39.2%)
>= 3.50 kg	1 (1.2%)	1 (1.2%)
Not Known	9 (10.7 %)	0 (0.0%)

TABLE 7: Congenital Anomalies associated with consanguineous marriage

Marriage	Normal babies (Inborn)	Malformed cases (Inborn) (51)	Total cases (Out of 84) (%)	Incidence per 100 babies (Inborn)
Consanguineous	34	1*	3(3.6%)	2.85

Non consanguineous	3809	50	81(96.4 %)	1.29

***p value -0.43*

TABLE 8: Known Risk Factors and associated with Congenital Structural Malformation

Known Risk factor for Congenital Structural Malformation	Congenital Structural Malformation	No of Case
Tobacco chewing mother	Cleft lip + palate	1
Consanguineous marriage	CHD	2
GDM	CHD (VSD)	1
PIH	CHD	1

TABLE 9: Maternal complication in case of congenital structural malformation

Medical / Surgical / Gynaec	Congenital structural malformation	Cases
Anaemia (3rd Trimester)	CHD	14
	Cleft Palate	1
	Cleft Lip	1
	Cleft Lip + Palate	3
	Duodenal Atresia	1
	Diastemetomyelia	1
	Imperforate Anus	3
	Tracheo-Oesophageal Fistula	3
	CTEV (Club foot)	1
	Sacro-coccygeal Teratomas	1
	PUJ Obstruction	1
Sickle cell Disease	CHD	1
Fever without Rash	Cleft Lip + Palate	1
	CHD	2
Oligohydraminos	CHD	1
	Hypospadias	1
Polyhydraminos	Cleft Lip + Palate	1
	CHD	3
Gestational Diabetes	CHD	1
PIH	CHD	2
Diabetes Insipidus	CHD	1
Mother has Bicornuate uterus	CTEV	1
Type I DM	Hypospadias	1

Multiple gestations(Twins)	Tracheo-oesophageal fistula	1
	CHD	2
	Imperforate anus	1
Multiple gestations (Triplets)	CHD	1

TABLE 10: Congenital Malformations

Congenital structural Malformation	Cases	Percentage *
Congenital Heart Disease	41	48.8 %
Cleft lip + Palate	13	15.5 %
Cleft Palate	2	2.4 %
Cleft lip	2	2.4 %
Congenital cataract	1	1.2 %
B/L PUJ obstruction	3	3.6 %
Polydactyly	4	4.8 %
Clinodactyly	1	1.2 %
B/L absent testis	1	1.2 %
Myelomeningocele	4	4.8 %
Diastematomyelia	1	1.2 %
Micrognathia	1	1.2 %
Imperforate Anus	5	6.0 %
Tracheo- oesophageal fistula	4	4.8 %
Duodenal atresia	1	1.2 %
CTEV (Club foot)	4	4.8 %
Hypospadias	2	2.4 %
Mid Gut Volvulus	2	2.4 %
Absent Pinna	1	1.2 %
Anencephaly	1	1.2 %
Encephalocele	1	1.2 %
Sacrococcygeal Teratoma	1	1.2 %
Clover Leaf Skull	1	1.2 %
Protruding Eyeball	1	1.2 %
Phocomelia	1	1.2 %
U/L Absent Kidney	1	1.2 %
U/L Ectopic Kidney	1	1.2 %
Absent Thumb	1	1.2 %
Rudimentary Thumb	1	1.2 %
Pre Auricular Tag	1	1.2 %
Ear Pit	1	1.2 %
Microtia	1	1.2 %
Dolicocephaly	2	2.4 %
Microcephaly	1	1.2%

Congenital Hydrocephalus	1	1.2%
Sacral dimple	1	1.2%

TABLE 11: Syndrome associated with congenital structural malformation

Syndrome	Cases	Percentages
Binder's syndrome	1	1.2 %
Chiari II malformation	3	3.6 %
Down syndrome	3	3.6 %
Heterotaxy syndrome	1	1.2 %
Congenital Rubella syndrome	1	1.2 %
Pfeiffer's syndrome	1	1.2 %

TABLE 12: Immediate outcome of congenital structural malformation babies

Outcome	Cases	Percentages
Discharged	54	64.4%
DAMA (Nonmoribond)	4	4.8 %
DAMA (Moribond)	9	10.7%
Death	3	3.7 %
Referred	10	11.9 %
Still Birth	4	4.8 %

DISCUSSION

Congenital anomalies (CA) are also known as birth defects, congenital disorders or congenital malformations. They also can be defined that can occur during intrauterine life and can be identified prenatally, at birth or later in life. The pattern and prevalence of congenital malformation may vary over time or with geographical location. It depends upon the environmental and genetic factors including socio-cultural, racial and ethnic variables.

Total numbers (4490) of babies were examined. Out of them, 84 babies fulfilling inclusion criteria were enrolled in our study. Out of these 3894 babies (86.72%) were delivered in our hospital. The incidence of congenital structural malformation of inborn babies including still births was 1.30 per 100 babies. Total number of babies with congenital structural malformation (including inborn and outborn) constituted 1.87% of total admission in Neonatal Intensive Care Unit, Post-natal wards, Paediatrics Intensive Care Unit and Paediatric ward of upto 1 year age. Gandhi MK et al from South Gujarat has reported incidence of congenital malformation was1.23 per 100 babies. [7], which was closer to our incidence. The reported incidence from various places varies significantly [8,9,10]. This may be dependent on the local demographic factors as well as whether the sample was drawn from the community or was hospital based.

Reports of gender based incidence of congenital malformations are somewhat conflicting. Sarkar et al [11], Taksande et al [9], Neelambari YC et al [12] and Golalipour MJ et al [13] noted that incidence of congenital malformation more in male compared to female. However; Anand

et al [14] noted that incidence of congenital malformations to be more in female. Amel-Shahbaz S etal [15] noted that CHDs were more common in females than males. He also noted that VSD, PS, PDA and ASD were more common in female than male. However TOF, AS, COA and D-TGA, VSD were more common in male than female. [15] One must remember that congenital malformation is not a homogenous group but a collection of various individual malformations. Each malformation has a different sex ratio of its own. For example, Hypertrophic pyloric stenosis is more common in male babies while Congenital Dislocation of Hip (CDH) is more common in females. [16] PUJ obstruction, Hypospadias and Congenital hydrocephalus are more common in male. NTDs are more common in females than in males. [17] The overall incidence therefore will depend on the distribution of particular malformations in the given study.

Congenital malformations are more common in male. One of the reasons the females were afflicted with more lethal congenital malformations and could not survive to be born with signs of life. [11]

In the present study, incidence of congenital structural malformation in preterm inborn babies was 2.62 and in term babies was 1.10 per 100 babies. Sarkar et al [11] noted that incidence of congenital malformations were 5.14 per 100 in pre term babies. On other hand incidence of congenital malformations was 1.79 per 100 in term babies. Taksande et al [9] also noted that incidence of congenital malformation were 4.40 per 100 in pre term babies. On other hand incidence of congenital malformations was 1.00 per 100 in term babies.

The current study noted that incidence of congenital structural malformation below 30 years of maternal age was 1.21 per 100 inborn babies as compared to above 30 of maternal age was 2.23 per 100 inborn babies. These results correlate with Saguna Bai et al [18] and Kokate P et al [13] . It is widely recognised that a mother's lifestyle may predispose her children to developing CA later in life. Known teratogenic causes are including the consumption of alcoholic beverages, smoking cigarettes, and taking certain drugs.[10] In present study 1 mother had history of tobacco chewing, which baby was birth with cleft lip + cleft palate. Several studies have also documented incidence of consanguinity with malformations[12,13]. In present study total 3 cases were found with consanguinity. Out of those, 2 cases of consanguinity had CHD while 1 case had Phocomelia. It is also established that in 40-60% of congenital malformations genetic factors are responsible. Environmental factors too affect the incidence in several cases (for example folic acid deficiency or maternal rubella infection). In many cases the causes are multifactorial. Most cases of cleft lip/palate, oesophageal atresia and congenital heart disease are multifactorial. [19]

Common system involved was cardiovascular system 41 (48.80%), followed by Oro-facial groups 24 cases (28.6 %), GIT 12 cases (14.28%), CNS 12 cases (14.28%), Muscular skeletal 11 cases (13.09 %) etc. Taksande etal[9] and NeelambariYC et al[12]had major involvement of cardiovascular system whilst Gandhi MK et al 43 and Tomatir et al[20] had majority of patients involved from central nervous system. Anand et al [14] noted out of 40 congenital malformed 30% live babies had minor congenital structural malformation and 57.5% live babies had Major + Minor congenital structural malformation.

CONCLUSIONS

Congenital anomalies are one of the major causes of stillbirths and infant mortality. This study has highlighted the incidence and types of congenital structural malformation. Several

risk factors like consanguinity, GDM, PIH, history of tobacco chewing during pregnancy, bad obstetric history were identified.

Preconceptional counseling, regular antenatal visits, vaccination and Supplementation of folic acid and prenatal diagnosis are recommended for prevention of congenital malformation. By thorough clinical and radiological examination life-threatening congenital structural malformation must be identified, as early diagnosis and surgical correction of the malformed babies offer the best chance for survival.

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