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CONGENITAL ANOMALIES IN ABORTED FETUS IN A TERTIARY CARE CENTER OF SOUTH GUJARAT, INDIA

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Abstract-
Background- Congenital anomalies or birth defects are among the main causes of mortality in children and if considered while planning the health policies in the developing countries can reduce mortality and morbidity. So the aim of our study was to identify common congenital anomalies and the linked maternal factors along with the evaluation of associated risk factors in affected mothers.
Methodology- Our study was a retrospective, analytical, cross-sectional, hospital based study conducted on 82 aborted fetuses with congenital anomalies at GMERS Medical College and Hospital, Valsad from Feb 2015 to May 2021. Relevant information regarding the diagnosed birth defect and the affected mother was collected from the hospital medical record using birth defect register on a predesigned excel proforma and then was analyzed using SPSS software version 26.
Result- In present study, male preponderance was seen and the highest congenital anomalies were observed in maternal age group from 21-30years, primigravida and mothers with no history of (h/o) abortion. Central nervous system (CNS) was most commonly affected followed by facial anomalies and the genito-urinary and cardiovascular systems were least involved in our study.
Conclusion- In our study, the main system affected was CNS with hydrocephalus as the commonest anomaly which can be effortlessly prevented by maternal nutrition. The data obtained from our study will help to spread awareness about congenital anomalies and their associations considerably influencing the prevention strategy & the treatment plan of birth defects.

Keywords- Congenital anomalies, birth defects, hydrocephalus, fetuses.

Introduction-

Congenital anomalies or birth defects are among top ten causes of mortality in children. According to the Global Burden of Disease study in 2015, birth defects were the fifth leading cause of death among children with age less than five years (1) and it was found to be responsible for 11% of neonatal mortality rate. The worldwide incidence of birth defects with clinical significance is estimated to be

around 2 to 3%. In India, perinatal and neonatal mortality rate due to congenital anomalies is about 8-15% and 13-16% respectively.(2-4)

A congenital anomaly is the structural and functional birth defect and is generally categorized as minor and major. Minor defects mainly effect cosmetically rather than any functional significance whereas major defects can be serious and causes significant functional disability.(5) Based on the morphology of the defect, congenital anomalies are referred as a sequence or malformation syndrome. If a single initiating defect are the basis of structural defect then the congenital anomalies are called to be a sequence, which further has four classes i.e. malformation, deformation, disruption and dysplasia sequence. Congenital anomalies are referred as malformation syndromes, if a single cause leads to multiple defects in one or more tissues causing multiple structural defects.(6) The factors associated with the congenital anomalies are consanguinity, maternal age, genetic constitution, environmental, drugs, radiations and various viral infections. Some other maternal conditions involved are nutritional status of mother, alcoholism, diabetes mellitus (DM), and endocrinopathies etc.(7)

Congenital anomalies are not considered as a health problem while planning the health policies(8) and are one of the ignored parts of the disease surveillance in many developing nations(9), where other causes like sepsis, low birth weight, prematurity etc are considered as the chief causes mortality in neonates. The main reasons for underprioritizing birth defects in developing and underdeveloped nations are that they consider them to be rare and they believe most of these conditions to be nonpreventable by low-cost primary care strategies. According to a study in 2018, the prevalence of birth defects in India is 184.48/10,000 births with anencephaly followed by talipes as the most common anomaly.(10) Encephaly and talipes both defects are avertable with folic acid supplements during preconception or with nominal orthopedic intrusion respectively. Other congenital anomalies can also be prevented by taking preventive actions like vaccination, genetic counseling adequate antenatal care, iodine and vitamin B12 intake etc.

In response to “World Health Assembly resolution”, “South East Asia Region (SEAR)” countries formulated a regional strategic framework to manage and prevent congenital anomalies. (11) A modified strategy was developed to deal with the tailback of individual countries. ‘Newborn Birth Defects Database (NBBD)’ was commenced to guarantee the uniformity and wholeness of the data.(12) To support data management, “WHO-SEARO” started an online system of “SEAR-NBBD” surveillance. Since 2014, 170 hospitals from 7 countries are providing congenital anomalies data and around 220 hospitals from 9 countries are a part of the “NBBD Surveillance network”. The plan was to set up a baseline estimation and observe the incidence of congenital anomalies in the region so that suitable measures can be taken.(13)

Thus birth defect prevalence and awareness can notably have an effect on the prevention and management strategy in decreasing subsequent perinatal, neonatal and infant mortality. So to take any preventive action at a definitive time, the need arises for the documented prevalence data. Further, to assist early detection and fast recovery, it’s decisive to focus on the associated maternal factors, antenatal detection, organs involved and distribution of the anomalies. Identification of the birth defect during antenatal period by screening with the noninvasive technique like targeted ultrasonography (USG) is one of the best tools. In addition to detection it also provides the information about severity of the anomaly and to decide for fetal therapy or medical termination of pregnancy.(13) Therefore in our study to see prevalence of birth defects, we enrolled cases clinically detected and identified by targeted ultrasonography at tertiary care center in South Gujarat of India. Further association of these birth defects was observed with presented maternal and fetal factors. Our study in this region will contribute the data in assessing the magnitude and various types of congenital anomalies which are common in this region. This will help health authorities to prioritize the measures to frame the policy to reduce the mortality and morbidity of children less than five years of age.

Methodology-

This was a retrospective, analytical, cross-sectional, hospital based study conducted on 82 aborted fetuses with congenital anomalies at GMERS Medical College and Hospital, Valsad from Feb 2015 to May 2021. A total of 8712 deliveries were done during this period. Study was approved and ethical

clearance with permission for waiver of consent was taken from institutional ethics committee. All the live and aborted fetuses in the hospital were examined for any birth defect shortly after delivery. The data of all the cases included in the study was collected from the hospital medical record using birth defect register maintaining the confidentiality of the data. The entry of the relevant data in the birth defect register had been directly done by the concerned clinicians or their juniors under their supervision. For efficiency and practicality we included fetuses with vaginal mode of delivery. The still birth, aborted fetus at any gestation period and live birth fetuses having survival rate of less than 2-3 hours were enrolled as study population. The fetuses with survival rate of more than 3hrs and the out born cases were excluded from the study. The final diagnosis of the congenital anomaly was based on considering consolidated analysis of antenatal, postnatal and systematic clinical examinations by pediatricians along with other significant investigations like echocardiography (ECG), targeted ultrasonography (USG), X-ray, radiographs, karyotyping etc. Birth defects were allocated 10th revision (ICD-10) codes by "International Statistical Classification of Diseases and Related Health Problems" to aid the system-based classification of the defects(14) The major defects were additionally categorized grounded on the developmental mechanism and clinical presentation as depicted in the "WHO birth defects surveillance manual".(12) In addition to the documented congenital anomalies, the significant information of the maternal factors like antenatal history, maternal age, other demographic data, gravida, history of abortions, mode of delivery, associated conditions in the affected mother e.g. consanguinity, maternal illness, anemia, preeclmpsia etc. were also noted on a predesigned excel proforma and then was analyzed using SPSS software version 26.

Result-

The study was conducted on 82 subjects. All the affected mothers delivered with congenital anomalies were by vaginal mode of delivery in our study. Table 1 shows that the study had male preponderance with 47(57.31%) males and 35(42.68%) females in our study. Age of the mothers was divided into three groups i.e. 18-20years, 21-30years and 31-35years. Table 1 depicts that the majority of the congenital anomalies in the delivered fetus were observed in maternal age group of 21-30 years with 51(62.19%) cases, followed by the age group 18 to 20years with 25 (30.48%) and age group 31-35 years with 6 (7.31%) cases. Further subjects were grouped on the basis of gravid status of the mother. Table 1 clearly illustrates that out of total birth defects, maximum were found in primigravida with 37(45.12%) cases trailed by second gravid, third gravida and ≥fourth gravida with 25(30.48%), 11(13.41%) and 9(10.97%) subjects. Majority of the births defects were observed in fetuses delivered by the mothers with history of no abortion i.e. 68 (82.92%) then in mothers with history of one abortion with 10(12.19%) followed by 4(4.87%) cases seen in mothers with history of two abortions as clearly visible from table 1.

Table 1- Distribution of congenital anomalies based on different variables.

Variable		**No. of Cases**	**Percentage**
Gender of the fetus	Males	47	57.31%
	Females	35	42.68%
Maternal age in years	18-20	25	30.48%
	21-30	51	62.19%
	31-35	6	7.31%
Gravida status of the affected mother	Primigravida	37	45.12%
	2^{nd} gravid	25	30.48%
	3^{rd} gravid	11	13.41%
	$\geq 4^{th}$ gravida	9	10.97%
No. of abortions in the affected mothers	One time	10	12.19%
	Two times	4	4.87%
	No h/o Abortion	68	82.92%

The congenital anomalies of the fetuses were additionally categorized on the basis of the affected system of the fetuses. Defects in our study were distributed into central nervous system defects, facial defects, limb defects, gastrointestinal (GIT) defects, genitourinary defects and cardiovascular system (CVS) defects with 40(48.78%), 15(18.29%), 10(12.19%), 7(8.53%), 5(6.09%) and 5(6.09%) subjects. Central nervous system (CNS) was affected most among all the system of the aborted fetuses. In CNS defects, out of total congenital anomalies (82), hydrocephalus occurred in 14(17.07%) followed by anencephaly and spinabifida with each having 8(9.75%) cases trailed by menigomyelocele with 6(7.31%) subjects and then one(1.21%) case each of holoprosencephaly, microcephaly, thinning of parenchyma & dandy walker malformation was observed in current study. Facial abnormalities seen were mostly cleft palate and cleft lip with 7(8.53%) and 6(7.31%) subjects respectively. One(1.21%) case each of pierre robin sequence and hypoplastic nasal bone were also noted on facial examination. When limbs of the fetuses were scanned then it was observed that majority of the fetuses had club foot i.e. 9(10.97%) and one (1.21%) case of absence of thumb was noted in limb defects. Among all congenital anomalies of GIT, tracheo-esophageal fistula was seen in 2(2.43%) subjects and one(1.21%) case each of imperforate anus, anal atresia, duodenal atresia, umbilical hernia and diaphragmatic hernia was noted. Further on genito-urinary examination, 2(1.21%) subjects each of hypospadiasis and unilateral agenesis of kidney was observed and one(1.21%) case of absence of urethral opening was also documented. Whereas on examination, among all the CVS defects, 2(4.87%) subjects each of cardiomegaly and patent ductus arteriosus (PDA) were observed in our study along with one(1.21%) subject of left ventricular hypertrophy (LVH).

Table 2- System wise distribution of congenital defects in aborted fetuses

System n(%)	Defect	Number	Percentage
Central nervous system defects- 40(48.78%)	Menigomyelocele	6	7.31%
	Spina bifida & Anencephaly	16	19.51%
	Holoprosencephaly, Microcephaly, Thinning of parenchyma & Dandy Walker malformation	4	4.87%
	Hydrocephalus	14	17.07%
Facial Defects- 15(18.29%)	Cleft lip	6	7.31%
	Cleft palate	7	8.53%
	Pierre Robin sequence & Hypoplastic nasal bone	2	2.43%
Limb defects- 10(12.19%)	Clubfoot	9	10.97%
	Absence of thumb	1	1.21%
GIT defects 7(8.53%)	Imperforate anus, Anal Artesia, Duodenal Artesia, Umbilical hernia & Diaphragmatic hernia	5	6.09%
	Tracheo-esophageal fistula	2	2.43%
Genitourinary defects- 5(6.09%)	Hypospadiasis, Unilateral agenesis of kidney	4	4.87%
	Absence of external urethral opening	1	1.21%
Cardiovascular defects- 5(6.09%)	LVH	1	1.21%
	Cardiomegaly & PDA	4	4.87%

Figure 1 illustrates the associated risk factors observed in affected mothers. In our study, main associated condition in affected mothers was assessed to be consanguinity in 17 (20.73%) cases followed by anemia in 9(10.97%) and polyhydramnios in 7(8.53%) subjects. Further 3(3.65%) cases

each of intra-uterine growth retardation (IUGR) and breech presentation were observed in our study whereas 2(2.43%) subjects of oligohydramnios and one(1.21%) subject each of preeclampsia and twin pregnancy was documented in current study.

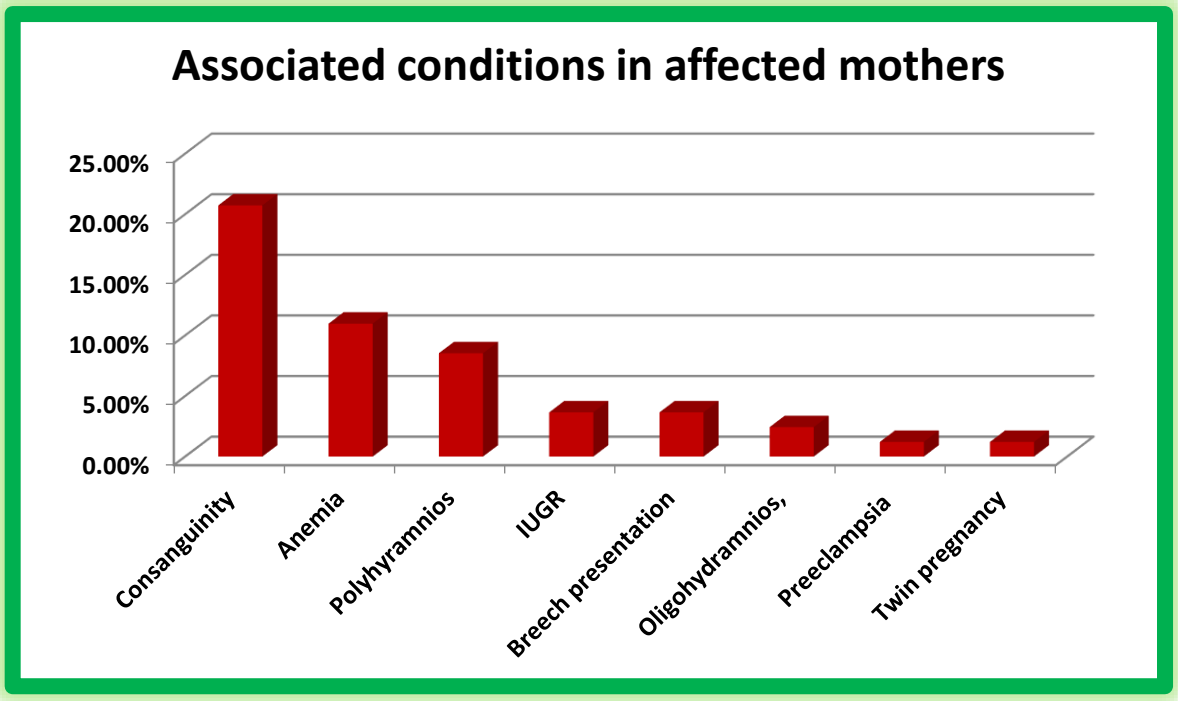

Figure 1- Associated conditions in affected mothers

Discussion-

The present study was a retrospective hospital based study conducted on 82 aborted fetuses with congenital anomalies at GMERS Medical College and Hospital, Valsad. to see prevalence of birth defects and their association with maternal and fetal factors. The WHO & March of Dimes which is is a nonprofit organization of United States working to improve the health of mothers and babies have documented the occurrence of 3.3million deaths in <5years children and 7% mortality rate in neonates due to congenital anomalies.(13) In our study we found incidence of the congenital anomalies to be 0.941% which is strongly supported by the study of Vineeta Paliwal et al.(15) done in the different area of the same state as they found incidence of the anomalies as 0.97%. Studies from other states are also in support of our study. A study done by Sandhya rani et al.(16) in Andhra Pradesh also found nearby incidence i.e. 0.90%. Other study nearly in agreement with the present study was conducted by Parmar A et al.(17) as they noted the incidence to be 0.88%. Although findings of the present study are notably higher than other two studies (0.42% and 0.58%) (18,19) conducted in different hospitals of Nepal. The difference in findings could be due to variable clinically significant inclusion criteria of our study. Other studies done by Desai N et al.(13) and Saifullah et al.(20) found significantly higher incidence of congenital anomalies than our study i.e. 3.6%. According to a study conducted by Bhatt BV, the incidence is 3.7%. In our study it could be low because of lack of awareness about antenatal visit in our area. Though incidences are variable, but it forms significant number causing mortality and morbidity in the children below five years of age. The world wide incidence is 3-7%(20) as the prevalence of birth defects varies from nation to nation due to consanguineous marriages, different survey tools, racial, biological, environmental, geographical and other factors.

The congenital anomalies in the present study showed preponderance of males (57:31%) compared to females (42:68%). This finding is in agreement with the study by Jogender K et al.(21) as they also observed similar results of male dominance. In contrast to our study, Parmer et al. (17), Kanhere AV et al.(22) and Sachdeva et al.(23) reported female predominance. The current study observed majority of the congenital anomalies in the maternal age group of 21-30years, which is in harmony with the

results reported by Kokate et al(24) and Kanhere AV et al.(22) Study by Taksande A. et al.(25), and Desai N et al. (13) are in disagreement with our findings as they observed significantly raised congenital anomalies in increased maternal age group.

The current research reported maximum birth defects associated with primigravida and least with ≥ 4 gravida status, which is not in harmony with the study by Kanhere AV et al.(22) as they found higher birth defects in multigravida status. Majority of the births defects were observed in fetuses delivered by the mothers with history of no abortion.

Further in our study, predominantly central nervous system was more affected in congenital anomalies. This outcome is strongly supported by Kokate P et al.(24) as they reported the incidence of central nervous system being affected in birth defects as 44%. In contrast to our study, Parmar A et al. documented much higher incidence of 64.56%.(17) Though there is variation in the incidences of involvement of the CNS in all the studies, it is observed that the central nervous system is predominantly affected as far as the congenital malformation are concerned. It could be because of folic acid deficiency in mothers during preconception period. In disparity to our findings, study by Jogender Kumar et al.(21) and other studies(26-28) found cardiovascular defects as the commonest malformation, which was least observed in our study. Facial anomalies with cleft palate & cleft lip as the most common malformation hold second rank in our study with 18.29%, which is nearly in concurrence with the findings by Bastola R et al. with 20.83% occurrence. Shakya H et al.(9), Taksande A et al. and others(25) also reported orofacial defects as the second common birth defects. As far as limb defects are concerned, it was seen in 12.19% in our study and club foot deformity which is compatible with the life, dominated the group of limb anomalies. Additionally, GIT defects contributed 8.53% in the congenital anomalies of our study including tracheoesophageal fistula, omphalocele, imperforate anus, anal atresia, umbilical hernia and diaphragmatic hernia. In this regard, it is in dissimilarity with the Shakya H et al.(9) as they found much lesser and Bastola R et al. who found much higher GIT defects than our study. A study conducted in North India(29) by a tertiary paediatric surgery centre noted GIT defects as the most communal defect.

In present study genito-urinary and cardiovascular system defects shared the incidence of 6.09%. In current study, each PDA and cardiomegaly has 2.43% occurrence. In respect to genitor-urinary defects, each anomaly Hypospadiasis and unilateral agenesis of kidney has 2.43% incidence whereas study conducted by Taksande A et al.(25) and Basavanthappa et al.(30) showed much higher incidence of these defects. As far as CVS defects are concerned, they are in congruity with the study by Basavanthappa et al.(30) with 5.83% incidence. On the other hand, Taksande A et al.(25), Shakya H et al.(9), Vineeta Paliwal et al.(15) and many other studies documented much raised incidence of CVS defects. Overall low prevalence of CVS defects in our study could be because CVS abnormalities become prevalent during age of 2-4months which were excluded in our study. Reason for overall cardiac anomalies may be materanal smoking during pregnancy, familily history of CHD and genetic abnormalities.

The present study noted, various associated conditions in the congenital anomalies i.e. consanguity 20.73%, anaemia 10.97%, polyhydramnios 8.53%, Breech 3.65%, IUGR 3.65%, oligohydramnios 2.43%, preeclampsia and twins 1,23%. This outcome is strongly supported by Kanhere AV et al.(22) and Gupta S.(31) as they observed similar range of associated risk factors with congenital anomalies.

Conclusions-

Congenital anomalies are one of the budding causes of morbidity & mortality in infants with noteworthy impact on families, society, infants and medical systems. This present study was done to detect the prevalence and pattern of birth defects along with its association with various maternal factors. Our study reported the male prepondance of birth defects and their association with maternal factors like maternal age of 21-30 years, primigravida, consanguinity, anemia and no history of previous abortion. The main system involved was CNS with hydrocephalus as the commonest anomaly which could be effortlessly prevented by pre-conceptional folic acid and vit-B12 therapy. Hence more focus on awareness of premarital counseling, maternal nutrition, maternal care, antenatal testing, early diagnosis and genetic counseling during pregnancy can easily tackle this deadly

pregnancy complication. Early diagnosis and timely preventive measures help in preventing morbidity, mortality and also emotional trauma to parents. Awareness about congenital anomalies and their associations can considerably influence the prevention strategy & the treatment plan of birth defects. So our study will help in future prevention and enhanced management of the affected infants and the parents by offering them the baseline information related to congenital anomalies.

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Conflict of interest- None

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