

CONGENITAL ANOMALIES: A MAJOR PUBLIC HEALTH ISSUE IN INDIA

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ABSTRACT

Birth defects include abnormalities in the new born baby's structure, function or body metabolism which usually lead to physical and mental disabilities and can even be fatal sometimes. The aim of the review is to study the overall frequency of congenital malformations in India, to increase public awareness in saving new borns from birth defects; the topics discussed in the current review were prevalence of birth defects in India, mission of birth defects registry of India (BDRI) common type of birth defects. The literature was extensively reviewed concerning the causes of birth defects. Evidences indicate that India has the highest number of children with birth defects. Cleft lip, cleft palate, Down syndrome, autism, muscular dystrophy, neural tube defects, congenital heart disorders are the most prevalent congenital anomalies present in India. The most common aetiological factor for developing birth defects in India are advanced maternal age, low birth weight, consanguineous marriage low socio economic status, Maternal infections such as syphilis and rubella and multiple births are the major risks factor for developing congenital anomalies in India. The pharmacy profession has limited involvement in obstetric pharmacotherapy and patient counselling. We believe that such involvement in pregnancies with complicated conditions can result in significant improvement of pregnancy outcomes.

Keywords: Birth defects registry, Cleft lip, cleft palate, obstetric pharmacotherapy.

INTRODUCTION

Babies come into the world heralding the good news that the human species with all its diversities and complexities is still going good. Though a newborn brings in its wake untold happiness to those around, there are some unfortunate babies whose birth is clouded with sadness and worry for the parents because of the birth defects¹ in them that are manifest either immediately after birth or after a while, depending on the nature of the congenital abnormality. Birth defects include abnormalities in the new born baby's structure, function or body metabolism) which usually lead to physical and mental disabilities and can even be fatal sometimes. There are many causes for birth defects involving a wide range of factors –some due to hereditary abnormality, some caused by chromosomal disorders or genetic disorder and some others caused by environmental agents. There are commonly known birth defects like

cleft lip, cleft palate, Down syndrome, autism, muscular dystrophy, neural tube defects, congenital heart disorders to rare birth defects such as cleft foot and hand, club foot, aglossia and albinism, to name a few.

PREVALENCE AND INCIDENCE OF CONGENITAL ANOMALIES IN INDIA

The birth prevalence of congenital anomalies in the developing world is underestimated by deficiencies in diagnostic capabilities and lack of reliability² of medical records and health statistics. As a result, recorded diagnoses in vital statistics focus on overt acute illnesses, rather than on pre-existing congenital conditions that increase vulnerability to infections and malnutrition (WHO, 1985). More reliable estimates of the prevalence at birth of congenital anomalies come from registries of congenital malformations in newborns which show that the prevalence of recognizable malformations

among newborns is between 2-3% that is similar to that found in the industrialized world (ICBDMS, 1991). Congenital anomalies account³ for 8-15% of perinatal deaths and 13-16% of neonatal deaths in India. Patients with multiple congenital anomalies present a relatively infrequent but tremendously difficult challenge to the pediatrician. The proportion of perinatal deaths due to congenital malformations is increasing as a result of reduction of mortality due to other causes owing to the improvement in perinatal and neonatal care. In the coming decades, this is going to be a leading cause of morbidity and mortality^{4,5} in centers providing good neonatal care. The review revealed that higher incidence of anomalies in stillbirths⁶ and the incidence of congenital anomalies was significantly higher in preterm babies⁷, low birth weight infants⁸, mother's age⁹ above 35 years, increased maternal age¹⁰, and increased birth order. The factors that significantly increase the risk of congenital malformations to be presence of hydramnios, maternal febrile illness in the first trimester, past history of abortions, diabetic mother, eclampsia, previous abortion and history of congenital heart disease in previous child or malformed babies. Mother having diabetes mellitus, arterial hypertension, and hypothyroidism shows a positive association¹¹ with congenital malformations. The annual report of Indian Council of Medical Research¹² says that the commonest congenital malformations are cardiac in nature. Cardiovascular, musculoskeletal and genitourinary were the most commonly affected systems in a descending order of frequency. With special reference to the neural tube defect (NTD)¹³, the incidence of NTD has markedly reduced in the developed countries following mass promotion and mandatory prescription of folic acid for pregnant mothers. The incidence of congenital heart disease was the leading congenital malformation followed by musculoskeletal system.

BIRTH DEFECTS STATISTICS

- 2-3 per 100 children are born with birth defects around the world
- 2.5/1000 babies are born with Neural Tube Defects
- 2.7/1000 babies are born with Club foot, Gastrointestinal tract abnormalities and defective diaphragm
- 1.9/1000 babies are born with Cleft lip, Cleft palate and Congenital Heart Defects
- Birth defects incidence in India has not reduced over the last 8 years

BIRTH DEFECTS REGISTRY OF INDIA AND FETAL CARE RESEARCH FOUNDATION

Birth Defects Registry of India (BDRI) was instituted in 2001 by Foetal Care Research Foundation²¹, a not-for-profit charity trust based in Chennai, to document incidences of congenital abnormalities in the Indian population. From a modest beginning, BDRI has now enrolled nearly 700 hospitals across 26 states and 3 Union territories and has so far analyzed over 0.7 million births of which the most common anomaly has been Neural Tube Defects (NTD). Besides ascertaining a baseline prevalence of birth defects throughout India, BDRI is working to reduce the birth defects and enable families and carers to form Support Groups for various congenital disorders. The Federation of Obstetric and Gynaecological Societies of India (FOGSI) has joined hands with BDRI since 2008 and both work in unison, adopting the same model. FOGSIBDR seeks to explore the frequency and pattern in which various birth defects occur across India

MAGNITUDE OF THE PROBLEM

- Congenital anomalies (also referred as birth defects) affect approximately 1 in 33 infants and result in approximately 3.2 million birth defect-related disabilities every year²².
- An estimated 270 000 newborns die during the first 28 days of life every year from congenital anomalies.
- Congenital anomalies may result in long-term disability, which may have significant impacts on individuals, families, health-care systems and societies.
- The most common serious congenital disorders are heart defects, neural tube defects and Down syndrome.
- Congenital anomalies may have a genetic, infectious or environmental origin; although in most of the cases it is difficult identify their cause.
- About 110 000 cases of babies born with congenital rubella syndrome can be prevented through timely vaccination of the mothers during childhood and the reproductive years.
- Many birth anomalies can be prevented and treated. An adequate intake of folic acid, iodine, vaccination, and adequate antenatal care are key.
- India included in the list of countries account for the two-thirds of the world's preterm births.

CONDITIONS THAT MAY CONTRIBUTE HIGHER INCIDENCE OF BIRTH DEFECTS IN DEVELOPING COUNTRIES

1. Inadequate periconceptional intake of folic acid
2. Iodine deficiency in mothers diet
3. Lack of vaccination against Rubella
4. Women giving birth after 35 years of age
5. Consanguineous marriage
6. Alcohol consumption during pregnancy
7. The use of teratogenic medications and oral contraceptives
8. Low birth weight

INTERVENTIONS TO REDUCE THE IMPACT OF BIRTH DEFECTS IN INDIA

Evidences indicate that India has the highest number²⁴ of children with birth defects. The lack of public health support for treatment often means lifelong suffering. Many of the tools to prevent birth defects are inherent in the existing reproductive and child health programme. With some additions, a prevention programme could be initiated in order to address this invisible public health problem. Prevention of birth defects depends on risk identification and management through community and health service personnel education, population screening, genetic counselling and the availability of appropriate services. Elements of effective preventive services include basic reproductive health services and medical genetic screening.

RECOMMENDATIONS

Phase -1: Educate the Public About Congenital Anomalies.

Educate the community, health professionals and workers, policymakers, the media, and other stakeholders about the term birth defects or congenital anomalies and understanding them how serious it is, give information's about various types congenital anomalies, how it is occur, who is at risk stage, what are things to know about pregnancy and care, healthy pregnancy, infant's health, providing access to educational pamphlets and brochures that address common health concerns, including birth defect prevention.

Phase -2: Conduct Population Based Studies/Surveys

Monitor trends of birth defects to detect emerging health concerns and identify affected populations through the population-based studies/surveys. And Stimulate research on risk factors, treatment, prevention, and the cure of birth defects. It include

- a) **Surveillance:** To collect and analyze our birth defects data on all children under the age of three years old for the frequency and distribution of birth defects in the state.
- b) **Referrals:** To provide information to affected families on locally available medical, social and educational services.
- c) **Prevention:** To use the results of data analysis to plan and target birth defects education and prevention efforts.
- d) **Collaboration:** To be active partners in birth defects education and prevention efforts throughout the state.

Phase -3: Prevention.

Optimizing women's diet during Pregnancy

The recognition of the role of maternal nutrition in the prevention of birth defects such as neural tube defects and iodine deficiency disorder has confirmed the need for adequate women's periconception nutrition. Means of optimizing women's nutritional status include improving their general nutrition; ensuring they have adequate intake of specific micronutrients including folic acid, iodine and iron; and removing harmful substances from the diet, especially alcohol, which may damage the developing embryo or fetus. The periconception period (three months before and after conception) can be targeted by specific interventions such as folic acid supplementation^{25,26} for those planning a pregnancy. Unplanned pregnancies are the one of the risk factor for developing congenital anomalies. The studies related to neural tube defects reveals that, 70%^{27, 28} of neural tube defects can be prevented by the intake of daily dose of 400 µg synthetic folic acid for women of childbearing age.

Pre-conception

- Use of family history as a screening tool for birth defects and genetic conditions^[29].
- Carrier risk identification using family pedigrees and DNA analysis of identified individuals (cascade screening).
- Population carrier screening for common recessive disorders, the haemoglobin disorders (FBC and indices, electrophoresis, DNA), and cystic fibrosis (DNA).

Antenatal

- Rhesus negativity.
- Down syndrome (advanced maternal age, maternal serum and ultrasound).

- Neural tube defects (maternal serum and ultrasound).
- Major malformations (fetal anomaly scanning).
- Carrier screening for common recessive disorders, the haemoglobin disorders (FBC and indices, electrophoresis, DNA), and cystic fibrosis (DNA).

Postnatal

- Neonatal screening (using Guthrie cards). The following conditions should be considered when feasible. Additional screening tools and conditions may be added as needed and feasible.
- Congenital hypothyroidism.
- Sickle cell disorders.
- Neonatal jaundice /G6PD deficiency.
- Common inborn errors of metabolism.

PREVENTION STRATEGIES

Prevention strategies³⁰ include primary secondary and tertiary levels of prevention. These strategies can be applicable various stages of pregnancy that is Pre-conception, Antenatal and Postnatal period.

CONCLUSION

The present review reveals that there is lack of Population based Health information survey on birth defects. Constrained diagnostic capability, poor health-related statistics, lack of birth defect surveillance and registries and reliance on hospital-based rather than population-based studies have contributed to this situation, which has led to a systematic underestimation of the toll of birth defects in these regions. India included in the list of countries account for two-thirds of the world's preterm births. There is fewer number of birth defects related studies are conducted in India, most of them are hospital based studies and they reveals that advanced maternal age, low birth weight, consanguineous marriage low socio economic status and multiple births are the major risks factor for developing congenital anomalies in India. Musculoskeletal, central nervous system, cleft lip, cleft palate, Genitourinary malformations more prevalent in India.

The Prevalence of Birth Defects in India (per 1,000 Live Births) are 64.3%. The Contribution of birth defects to neonatal mortality rate is 9.6%, Contribution of birth defects to perinatal mortality rate is 19.5%, Contribution of birth defects to stillbirths 9.9%. Most common birth defects reported in India are Neural tube defects, Down syndrome, metabolic disorders, thalassemia and pathological haemoglobin

disorders, congenital heart defects and Duchene muscular dystrophy. And there is no Periconceptional intake of folic acid and only some states prefer Rubella vaccination as part of prepregnancy care. There is no educational and awareness programs about Avoidance Pregnancy > 35 year and about avoid teratogens during pregnancy. There is no public new born screening for birth defects and No ban on Use of alcohol among women also. Consanguineous marriages are uncommon in most countries except for India where it is common in some populations such as Muslims (22%) and South Indians (20%) as presented by countries. All these factors contribute to increase in prevalence of congenital anomalies in India.

There is a paucity of observational data on the birth prevalence of birth defects in middle- and low-income countries. Traditionally, health initiatives in developing countries have focused on the control of infectious disease and malnutrition to reduce infant and child mortality the next step to reduce infant mortality and mitigate the importance of severe lifelong disability can involve low cost strategies to prevent severe birth defects. A minimal cost, countries can discourage woman from reproducing after they reach 35 years of age. A second step of proven and cost effective interventions involves improved treatments to reduce disabilities caused by birth defects. A third set interventions includes preconceptional and prenatal screening to prevent genetic birth defects.

Congenital malformation of neural tube defects like anencephaly, spina bifida, facial defects (cleft lip, palate) can be detected in an early stage by ultrasonography; aminocentesis and various genetic or chromosomal abnormalities can be diagnosed by chorionic villi sampling (CVS) and reduced maternal serum (RDS) screening. Early detection of major malformation during early pregnancy can indicate for medical termination of pregnancy to reduce the high morbidity and mortality of neonates due to congenital malformations. So proper and timely counselling, regular antenatal care with folate supplementation especially during the most sensitive period of embryogenesis is essential to avoid major congenital malformation for future pregnancy. The pharmacy profession has limited involvement in obstetric pharmacotherapy and patient counselling. We believe that such involvement in pregnancies with complicated conditions can result in significant improvement of pregnancy outcomes and the clinical pharmacist can recognize the need for genetic testing in a particular patient. Moreover, we

believe this involvement would be welcomed by the physicians caring for these patients. This commentary documents current obstetrical

pharmacy practices and proposes changes for the profession of pharmacy to consider.

Table 1: List of some birth defects related studies conducted in India

Study location	No. Of Malformed Babies	Risk Factors	Most Predominant Anomalies
Congenital malformations at birth in Central India: A rural medical college hospital based data. (Maharashtra January 2005 and 31 July 2007)	179	<ul style="list-style-type: none"> • Prematurity • Increased maternal age • Increasing birth order • Low birth weight 	<ul style="list-style-type: none"> • Cardiovascular malformations • Musculoskeletal • Genitourinary anomalies.
A community-based survey ¹⁴ of visible congenital anomalies in rural Tamil Nadu (Rural Areas of Tamil Nadu (2004-2005)	166,833	<ul style="list-style-type: none"> • Family history • Consanguinity • Medication (anti-convulsants) 	<ul style="list-style-type: none"> • Cleft palate
Birth defects surveillance ¹⁵ study. (Genetic Research Centre, National Institute for Research in Reproductive Health, Parel, Mumbai, India)	1694	<ul style="list-style-type: none"> • Low birth weight • Mothers having anaemia • Genetic, Consanguinity • Maternal age 	<ul style="list-style-type: none"> • Central nervous system anomalies • Polygenic malformation • Genetic disorders <ul style="list-style-type: none"> • Chromosomal abnormalities
Chromosomal abnormalities: genetic disease burden in India ¹⁶ (Guru Nanak Dev University, Amritsar, India, March 1991 - March 2005)	1950	<ul style="list-style-type: none"> • Consanguineous marriage • Maternal age greater than 35 years 	<ul style="list-style-type: none"> • Down syndrome • Microcephaly • Mental retardation • Ambiguous genitalia/
Congenital Malformations at Birth - A Prospective Study From South ¹⁷ India. (Department of Pediatrics, Jawaharlal Institute of Post-Graduate Medical Education and Research, Pondicherry (September 1989 to December 1992)	469	<ul style="list-style-type: none"> • Consanguineous marriage • Low birth weight 	<ul style="list-style-type: none"> • Musculoskeletal malformations • Cutaneous malformations • Genitourinary malformations • Central nervous system defects • Gastrointestinal defects
Pattern of distribution of congenital anomalies in stillborn ¹⁸ : a hospital based prospective study. (Gandhi Medical College, Hyderabad (July 2007 to December 2009)	28	<ul style="list-style-type: none"> • Consanguinity • Previous history of abortion • Previous child with congenital anomalies • Low socio economic Group, Maternal age 	<ul style="list-style-type: none"> • Anencephaly • Astomia • Agnathia • Polycystic Kidney • Dextrocardia.
The incidence of major ¹⁹ congenital malformations in Mysore (1967 through 1969)	46	<ul style="list-style-type: none"> • Maternal age 	<ul style="list-style-type: none"> • Cleft palate • Anencephaly • Spina bifida
Congenital Malformations at Birth (Department of Obstetrics and Gynecology, Banaras Hindu University, Varanasi, January 1988 to December 1989) ²⁰	48	<ul style="list-style-type: none"> • Multi Gravida • Low birth weight 	<ul style="list-style-type: none"> • Anencephaly • Hydrocephalus • Talipes • Hypospadias

SOURCE OF DATA / INFORMATION ON BIRTH DEFECTS IN INDIA²³

Table 2: Demographic characteristics

1. Percentage of births registered	National: 68% 7 states: 100%
2. Percentage of deaths registered	63%
3. Percentage of stillbirths registered	NA
4. Percentage of women older than 35 years at delivery	Negligible
5. Percentage of population who marry consanguineously	South Indian: 20% Muslims: 22%

Table 3: Contribution of birth defects to select mortalities

1.	Contribution of birth defects to neonatal mortality rate	9.6%
2.	Contribution of birth defects to perinatal mortality rate	19.5%
3.	Contribution of birth defects to stillbirths	9.9%
4.	Contribution of birth defects to medical termination of pregnancy	NA
5.	Most common birth defects	NTD, Down, MD, Thal, CH, DMD

Table 4: Information on birth defects surveys

1.	Registry: National or sub national	Sub-national
2.	Hospital based Health information survey	Yes
3.	Population based Health information survey	No
4.	Special surveys	Disability:
5.	Surveillance system	No

Table 5: Folic acid supplementation and fortification

1.	Adolescents	Yes
2.	Pregnancy And lactation	60% coverage
3.	Periconceptional	No
4.	Composition of tablets	Iron: 100 mg Folic acid: 0.5 mg
5.	Food fortification: national/sub national	Yes: folic acid, iron, iodine

Table 6: Pre-Pregnancy care

1.	Rubella vaccine	Yes: Some states
2.	Use of alcohol among women	No: national Ban in one state
3.	Harmful use of tobacco and exposure during pregnancy	Yes
4.	Education and awareness programmes	
a)	Avoid Pregnancy > 35 years	No
b)	Avoid teratogens	No
c)	Detection of Type 2 diabetes	Yes: secondary & tertiary care

Table 7: Screening for birth defects

1.	Antenatal Screening	Yes (Some states for Hb pathies)
2.	Ultrasonography screening	Yes
3.	Newborn screening	No: Public Yes: Private
4.	Population screening for thalassaemia, etc.	Yes
5.	Prenatal diagnosis	Yes
6.	Medical termination Of pregnancy	Yes

Table 8: Things to be done and avoided during pregnancy

THINGS TO BE DONE DURING PREGNANCY	THINGS TO BE AVOIDED DURING PREGNANCY
Schedule a Preconception Doctor's Visit	Avoid alcohol, tobacco and street drugs
Consume Enough RDA for Folic Acid	Avoid stress
Check Your Immunity to German Measles (Rubella)	Avoid OTC Medication, including Aspirin
Take Prenatal Vitamins	Avoid Caffeine
Eat Plenty of Protein	Avoid Vitamin A Supplements
Eat Well, Get Plenty of Exercise and Maintain a Healthy Weight	Avoid Pesticides, including Paint
Do Kegal Exercises	Avoid Sauna, Jacuzzis, and Tanning Beds
Control Chronic Conditions and Manage Medications	Avoid Fish Containing Mercury
Focus on Your Child and Avoid Negative Thoughts and Actions	Avoid contacts with the x-rays,VDTs and Microwaves
Learn About Genetics and Talk to Your Doctor about Existing Conditions and Your Family History	Avoid Drinking Tap Water if Possible
See a Doctor Regularly	Avoid Raising Your Body Temperature

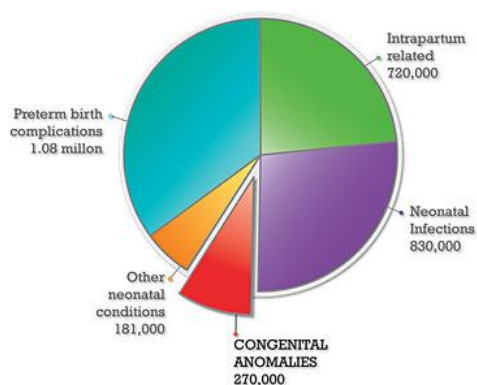


Fig. 1: Causes of 3.1 million neonatal deaths in 193 countries in 2010
 Source: Adapted from WHO. Born too soon. The global action report on preterm birth. Geneva, World Health Organization, 2012

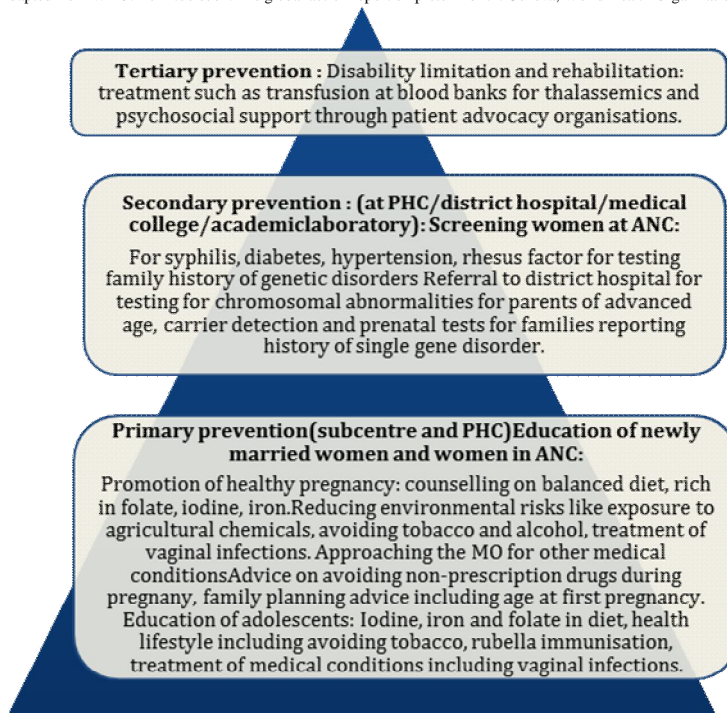


Fig. 2: Levels of Services for Prevention of Birth Defects

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