Anencephaly: Clinical Patterns, Associated Risk Factors and Maternal Awareness in Victoria Hospital, Bangalore

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ABSTRACT: Anencephaly accounts for one of the most common birth defects and are associated with a high mortality and morbidity. The main objective of this research was to determine maternal risk factors, the most common clinical presentations of anencephaly and assess maternal awareness on folic acid supplementation and its preventive role in occurrence of anencephaly. This was a hospital based case finding study that covered 60 patients with anencephaly and their respective mothers conducted in hospitals in Bangalore Medical College & Research Institute from 2014 to 2017. The results showed that experiencing any febrile illness, taking medications during pregnancy, consanguinity, have been associated with the birth of the fetus with anencephaly. Only 14% of mothers were aware of preventive role of folic acid in the development of anencephaly. The study emphasizes the complexity of the etiology behind anencephaly, variability of its presentation and yet unsatisfactory awareness among mothers about folic acid and its beneficial role in preventing anencephaly.

INTRODUCTION

By the end of 4th week of development the central nervous system forms a closed tubular structure detached from the overlying ectoderm, occasionally the neural groove fails to close because of faulty induction of surrounding mesodermal structure and the neural tube then remains exposed to the surface. Such a defect is localised in the cephalic region. Moreover the vault of the skull may be absent, giving the head the characteristic appearance, the eyes bulge forward, the neck is absent & the surface of the face and chest form a continuous plane. Anencephaly is a congenital anomaly characterised by gross defects of the head and often inability to swallow. Hydramnios (amniotic fluid > 2 litres) is frequently associated with it (Langman,'66). Over the years epidemiologic studies have tried to determine the etiology behind NTDs. Certain genetic and environmental factors have been found to affect the occurrence of NTDs. However, there is strong link between folic acid deficiency and occurrence of NTDs (Salvi, 2003). To date few, specific environmental causes of NTDs have been recognized, such as maternal diabetes (Becerra *et al.*,'90). Other factors, including fever and hyperthermia in early pregnancy (Graham,'98) and obesity (Shaw,'96) have been proposed.

The objectives of this study were, determining the clinical presentations of anencephaly, determining different maternal risk factors for occurrence of anencephaly (age, consanguinity, febrile illness, diabetes mellitus, medications) and assessing maternal awareness on folic acid supplementation and its preventive role in occurrence of anencephaly.

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MATERIALS & METHODS

The study design and data collection was a prospective, observational, hospital based study conducted in main hospitals of Victoria and Vani Vilas attached to Bangalore Medical College & Research Institute (BMCRI), Bangalore; during the period of August 2014 to June 2017. The study includes all the patients born with anencephaly and respective mothers, 60 anencephalic foetuses (23 males and 37 females) of 20-30 weeks; which were delivered in the Department of Obstetrics & Gynecology, Vani Vilas Hospital and Victoria Hospital, Bangalore. The dependent variable was anencephaly and independent variables were age of mother, febrile illness during pregnancy, medications taken during pregnancy, maternal diabetes, family history for NTDs and Folic acid supplementation. The need for the study and different procedures were explained to the parents, a written consent form was obtained from the parents. Data was obtained in the form of questionnaires, all mothers were met and personal interviews were conducted using specifically designed questionnaires for collecting the required data.

Simple descriptive statistics, frequency distributions and cross tabulation were performed on Statistical Package for Social Sciences (SPSS) software version 17. The results were tested for association using chi-square between maternal well-being and anencephaly. Level of significance was set on an alpha level at 0.05.

RESULTS

In this prospective study 60 anencephalic foetuses (23 males and 37 females) of 20-30 weeks were detected in main hospitals of Victoria & Vani Vilas attached to BMCRI, Bangalore; during the period of August 2014 to June 2017.

Classification of mothers according to age showed that maternal age in 83.4% were 21-35 years, in <20 years & >40 years were 1.6% and in 36-40 years were 13.4%. The mean of maternal age is 24.4 ±4. When mothers were classified according to their level of education, it was noticed that 91.6% were found to be <high school (illiteracy), 5% were high school and >high school were 3.4%. The study showed that majority of mothers were 76.7% unemployed (housewives) and 46% of the respondents were found to have regular visits to antenatal care centers. When respondents were inquired about experiencing any form of febrile illness during pregnancy (specifically the first trimester), 86.6% of mothers had no febrile illness during pregnancy; only 14.4% of them reported so. More details are shown in Table 1.

TABLE 1

Febrile illness during pregnancy

Febrile illness during pregnancy	Frequency	Percentage
Flu-like illness	3	5.0
Malaria	4	6.7
HBs Ag	1	1.6
Normal	52	86.6

The study showed that 8.3% of mothers had multiple abortions, 1.6% had abortion with asthma, diabetes with obesity and hypertension, 5% were diabetic and 81.6 % were normal. 10% of mothers reported taking medications during pregnancy, 1.6% mentioned antiemetic, 5% NSAID (paracetamol & aspirin), 1.6% mentioned herbal medications (Table 2). None of the respondents was found to have been exposed to any form of radiation during pregnancy. The study showed that 76.7% of mothers were taking folic acid during pregnancy. Regarding the timing of folic acid consumption during pregnancy, only 5% took folic acid preconception (see Fig. 1).

TABLE 2

Medications during pregnancy

Types of medications during pregnancy	Frequency	Percentage
NSAID*(Paracetamol/ aspirin)	3	5.0
Herbal	1	1.6
Anti –emetics	1	1.6
Mala D tablets	1	1.6
No medications	54	90.0

*NSAID; Steroidal anti-inflammatory drugs

When respondents were asked if they were aware that folic acid supplementation reduces the risks of developing NTDs, it was found that 14% of them were aware of that.15% of mothers reported consanguinity with their husbands & only 1.6% reported positive family history of NTDs and 1.6% had family history

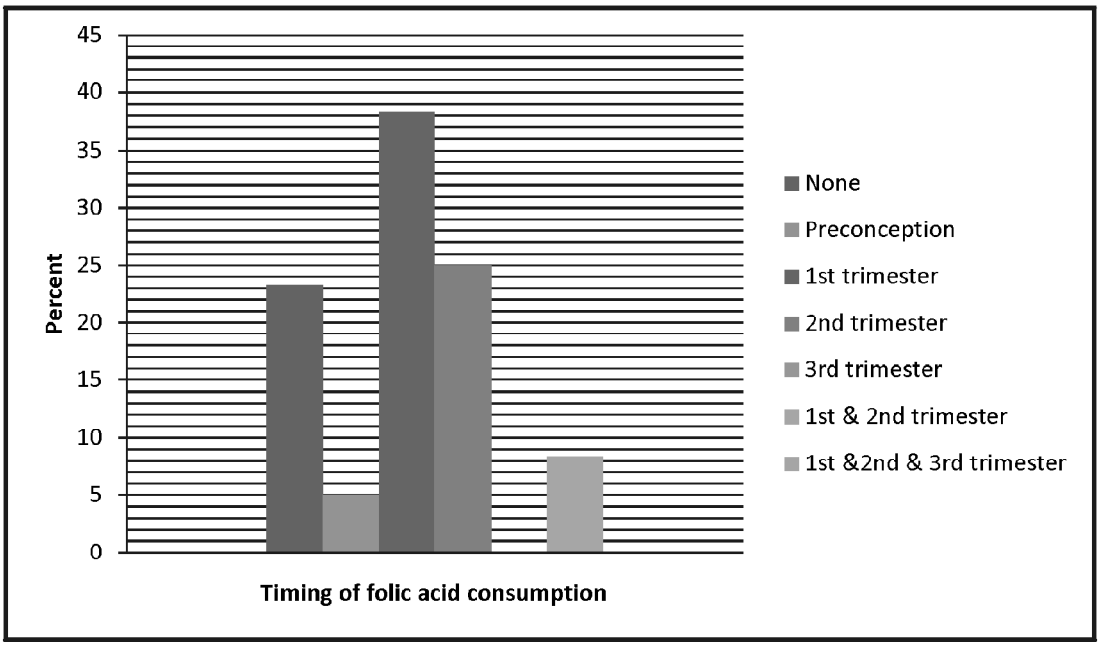

Figure 1: Timing of folic acid consumption

TABLE 3

Associated congenital anomalies

System	Anomalies present			
	Male	Female	Total	%
Skull & face	2	4	6	14.3
Vertebrae	10	9	19	45.3
Limbs	1	1	2	4.7
CVS	1	0	1	2.3
Respiratory system	0	4	4	9.5
GIT	0	2	2	4.7
Urinary system	1	1	2	4.7
Reproductive system	0	0	0	0
Hernia	2	0	2	4.7
Abdominal wall	0	1	1	2.3
Other anomalies	0	2	2	4.7
Total	17	25	42	100

of Down's syndrome. In 3.6% of subjects had occurrence of anencephaly. The study demonstrated that 61.6% of fetuses were females & 38.4% were males.

Examination of associated anomalies showed that 70% of total subjects had anomalies. Associated anomalies are shown in Table 3.

Discussion: The study conducted in main hospitals of Bangalore with the main objective of determining maternal risk factors associated with anencephaly. Incidence of anencephaly is reported to be 1:1000 to 1:20000. In the present study the incidence of anencephaly in Victoria and Vani Vilas hospital was 1.04 in 1000 births. In the present study 23(38.4%) were males and 37(61.6%) were females. The majority were females in the present study, the review of literature also showed that anencephaly is more common in females (Gupta, 2016; Kheir, 2015). The birth was of 1st order in 40% of cases, 35% cases were 2nd order, 21.6% were 3rd order & 3.4% cases were 4th order.

Age of mother in 1.6% cases were <20, 83.4% were 21-35, 13.4% cases 36-40 and in 1.6%, >40. Maternal occupation: 76.7% cases mothers were house wives, 10% cases farmers, 1.6% were tailor & teacher and 3.4 % were group D. Family history of both the mother and father was taken in which 1.6% cases had Down's syndrome for 1st cousin & in 1.6% father of the fetus had hyperthyroidism.15% mothers got consanguinity, all were first cousins and 85% were unrelated which was similar in few studies (Mukhtiar, 2015; Kaur *et al.*, 2017; Reddy and Ramanappa, 2016).

In a study on uptake of folic acid supplementation in nearly half a million women, 466,860 women

screened provided details on folic acid supplementation. The proportion of women taking folic acid supplements before pregnancy declined from 35%. They concluded that policy of folic acid supplementation is failing and has led to health inequalities. This study demonstrates the need of fortified flour and other cereal grains with folic acid in all the countries of the world (Jonathan, 2014).

Table 4 present the maternal risk factors that were compared in some studies (Kheir *et al*., 2015; Singh *et al*., 2015; Kar *et al*., 2015).

TABLE 4

Percentage frequency of anencephaly in relation to mother (Kuppuswamy's socio-economic status scale, Dudala, 2013)

Qualification	Kheir *et al*., 2015	Singh *et al*., 2015	Present study
<High school	26.7	17.4	91.6
High school	23.1	23.2	5.0
>High school	25.3	42.0	3.4
Graduate	20.9	17.4	–

Socio-economic status	Singh *et al*., 2015	Present study
Low	13.0	86.6
Medium low	49.2	13.4
Medium	33.0	–
High	4.3	–

Febrile illness during pregnancy	Kheir *et al*., 2015	Present study
Flu-like illness	37.0	5.0
Malaria	18.5	6.7
Fever & skin rashes	11.1	1.6
Gastroenteritis	3.7	–
Others	29.6	–

Maternal risk factors	Kar *et al*., 2015	Present study
Abortion & asthma	NRD	1.6
Abortion	4.0	8.3
Diabetes	8.0	5.0
Diabetes & obesity	10.0	1.6
Hypertension	NRD	1.6
Folic acid intake	35.0	23.3

NRD: no risk factor detected

Associated anomalies (Table 5) were found in 42 cases (70%) in the present study & it is compared with the other studies. Out of 42 cases 25 females (41.7%) and 17 males (28.3%) showed associated anomalies; majority of anomalies were in female anencephalic fetuses which was similar to some studies. Cleft lip and palate were the most common defect (84.3%) and 19 (45.3%) had spina bifida. There were no reproductive system anomalies in the present study.

TABLE 5

Percentage comparison of associated anomalies with anencephaly

System	Tan *et al*., (1984)	Vare *et al*., (1971)	Neilson *et al*., (2006)	Pandurang *et al*., (2012)	Singh *et al*., (2015)	Present study
Total incidences	9.4	–	43.0	73.0	58.0	70.0
Head & Neck	NAD	7.5	14.0	2.5	13.0	15.0
CVS	3.0	7.5	4.75	14.5	13.0	2.3
Respiratory system	3.0	NAD	NAD	2.5	17.3	9.5
GIT	29.0	32.0	NAD	14.5	13.0	4.7
Renal	3.0	27.0	12.0	NAD	11.5	4.7
Musculoskeletal	20.0	14.5	16.5	14.5	10.1	2.3
Genital	NAD	5.0	NAD	12.0	1.4	NAD
Diaphragm hernia	NAD	5.0	2.3	1.0	5.7	NAD
Umbilical hernia	1.0	NAD	NAD	NAD	NAD	4.7

NAD: no anomaly detected

CONCLUSION

Anencephaly accounts for one of the most common birth defects. Experiencing any febrile illness, taking medications during pregnancy and consanguinity have been associated with increased risk of birth of a fetus with anencephaly. The study emphasizes the complexity of the etiology behind anencephaly, variability of its presentation and yet unsatisfactory awareness among mothers about folic acid & its beneficial role in preventing anencephaly.

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