

Association of folic Acid deficiency with Central Nervous System Anomalies, Anencephaly, Spina bifida and Hydrocephalous Diagnosed by Ultrasonography during Embryonic and Fetal period

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ABSTRACT

Aim: To see central nervous system anomaly during pregnancy (anencephaly, hydrocephalus and spina bifida) by ultrasonography associated with folic acid deficiency/ low intake.

Study design: cross sectional

Site and duration: one year from Jan 2021 to Dec 2021 at Pak Red Crescent Medical & Dental College and teaching Hospital Dina Nath Multan Road Kasur.

Method: There was convenient sampling. Written Consent was taken from mothers for participation in study. Pregnant mothers were examined by ultrasonography and color Doppler Machine. Designated proforma was filled by taking history of pregnant mother.

Results: The mean age of mothers was 25.00 + 5.00. Most of mothers were in 3rd trimester and Gravida 2. In eleven percent cases CNS anomalies were seen among these 6% were anencephaly and 5% were Spina bifida and hydrocephalus.

Conclusion: Central nervous system anomalies were found associated with folic acid low intake by mothers during pregnancy.

Keywords: Anencephaly, Hydrocephalus, Spina bifida, Folic acid intake, Ultrasonography.

INTRODUCTION

During pregnancy folic acid deficiency is most common cause of spina bifida, hydrocephalus and other central nervous system anomalies, in under developed countries¹.

Folic acid is an important vitamin which help to maintain nervous tissue cells formed during intra- uterine life², folding of embryo, brain and spinal cord formation. During embryonic period folic acid prevent CNS and other anomalies³, especially brain and spinal cord. During pregnancy 1mg daily or 300-400 mcg⁴ per day or up to 800 mcg daily during 1st trimester prevent many fetal anomalies⁵.

Food containing folic acid is green leafy vegetable, banana, strawberry, grape fruit, orange beans, liver kidney and sea foods⁶ are important but additional folic acid tablets are essential during pregnancy^{7,8}.

Anatomy of Cerebrospinal Fluid: Cerebrospinal fluid which bath the brain and spinal cord produce cushion for central nervous system, nutrition, remove waste products and act as neurotransmitter⁹.

It is produced in choroid plexuses of Lateral, 3rd and 4th ventricles of brain and circulate through cerebral aqueduct which connect 3rd ventricle to 4th ventricle and central canal of spinal cord. CSF comes out from 4th ventricle in subarachnoid space, after travelling through cisterns is absorbed in superior sagittal sinus by arachnoid villi¹⁰.

Normal CSF formation is 150-270 ml and continuous circulation of CSF is important for vitality of brain and its tissue¹¹.

Abnormal accumulation of CSF with in ventricle system is called hydrocephalus usually due to anatomically obstruction of cerebral aqueduct¹². Hydrocephalus may lead to large head, thinning of skull bones, widening of sutures and ultimately damage the brain cells¹³.

Neural Tube Folds During 3rd and 4th Week of Intrauterine Life:

Folic acid is important for proper folding of embryo¹⁴. If neural tube is not folded properly which due to folic acid deficiency or low intake of folic acid during pregnancy¹⁵. A flattened mass of nervous tissue is formed lead to spina bifida with myeloschisis. In case of spina bifida spinal cord is tied up with vertebral column. When vertebral column lengthened it pull the attached spinal cord along with cerebellum which is struck up into foramen magnum cutting the flow of CSF leads to hydrocephalus¹⁶. Neural tube folding

defect also lead to anencephaly which is common brain anomaly due to low intake of folic acid during pregnancy¹⁷. Ultrasonography is important¹⁸ noninvasive tool for early diagnosis of intrauterine anomalies¹⁹.

Benefits of study: Malnutrition and folic acid deficiency is most common in underdeveloped countries and Pakistan. Deficiency of folic acid or low intake of folic acid during pregnancy effect brain, spinal cord, cleft lip, other facial clefts and other anomalies²⁰. Newborn with anomaly is burden to family and society²¹. Prenatal diagnosis of spina bifida, hydrocele with ultrasound is very beneficial, as defect can be treated surgically and baby enjoy normal healthy life²². Motivation to general public to take folic acid and nutrition can prevent dire congenital abnormalities.

MATERIAL AND METHODS

This study was cross sectional and 200 pregnant mothers were included which visited the outpatient department of Pak Red Crescent Teaching Hospital for antenatal, checkup or ultrasonography. Study was from Jan 2021 to Dec 2021.

Technique was of convenient random sampling. Age group was 18- 45 year. Department of radiology & ultrasound and department of Obs & Gynae ward participated in this study. A proforma was designed and consent was taken from mothers who participated in this study. An ultrasound machine and color Doppler was used.

Data collected was statistically analyzed using SPSS 24. Data was presented in tables and graphs. To find the association between folic acid deficiency and CNS anomalies chi-square test was applied with significance value $p < 0.05$.

RESULTS

Two hundred cases were taken from which 120 were in age group 18-25, 60 in age group 26-34 and twenty were in age group 35 and above with 60%, 30% and 10% respectively. Mean age was 25.01 with standard deviation 5.00, as mentioned in table 1 and graph 1.

Table 1: Age group of pregnant mothers with percentage.

| Serial No | Age Group | Frequency | Percentage |
|-----------|--------------|--------------|------------|
| 1 | 18-25 | 120 | 60% |
| 2 | 26-34 | 60 | 30% |
| 3 | 35 and above | 20 | 10% |
| Mean + | | 25.01 + 5.00 | |



Fig.1: Meningocephaly

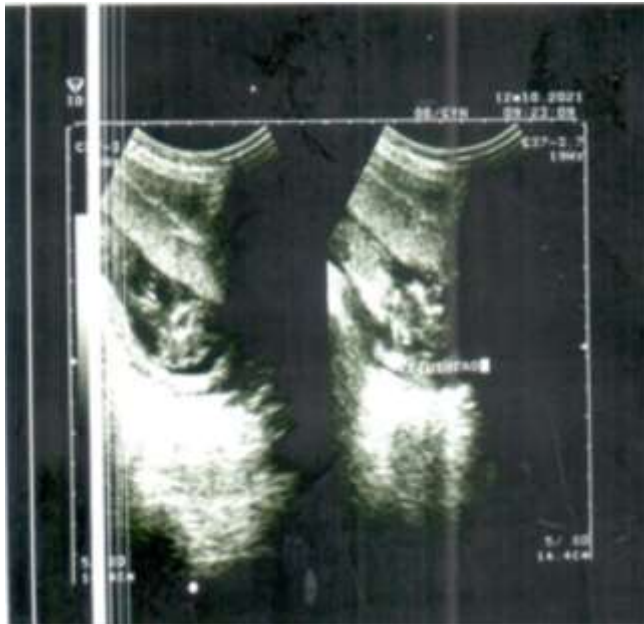


Fig.2: Petushead (Ancephlocele)

Table 2: Gestational age group of pregnant mothers with percentage.

| Serial No | Gestational age | Frequency | Percentage |
|-----------|-----------------|-----------|------------|
| 1 | 2-8 weeks | 06 | 3% |
| 2 | 8-12 weeks | 37 | 18.5% |
| 3 | 13-24 weeks | 44 | 22% |
| 4 | 25-37 weeks | 113 | 56.5% |

Table 3: Frequency of Gravida with percentage.

| Serial No | Gravid | Frequency | Percentage |
|-----------|--------|-----------|------------|
| 1 | G1 | 16 | 8% |
| 2 | G2 | 61 | 30.5% |
| 3 | G3 | 12 | 6% |
| 4 | G4 | 28 | 14% |
| 5 | G5 | 11 | 5.5% |
| 6 | G6 | 17 | 8.5% |
| 7 | G7 | 05 | 2.5% |
| 8 | Prime | 50 | 25% |

Table 4: Frequency of folic acid intake and not intake by pregnant mothers with percentage.

| Sr. No | History | Frequency | Percentage |
|--------|--|-----------|------------|
| 1 | Folic Acid intake during Pregnancy | 112 | 56% |
| 2 | Low Folic Acid intake/ No Folic Acid intake during Pregnancy | 88 | 44% |
| Total | | 200 | 100 |

Table 5: Frequency of central nervous system anomalies.

| Sr.No | Anomalies | No of Anomalies | Percentage |
|-------|------------------------------|-----------------|------------|
| 1 | Central Nervous System | 22 | 11% |
| 2 | Anencephaion | 12 | 6% |
| 3 | Spina Bifida & Hydrocephalus | 10 | 5% |

DISCUSSION

This study was done at Pak Red Crescent Medical & dental College and teaching hospital from 1 January to 31 December. Ultrasonography of 200 pregnant mothers were performed. Out of 200 cases 90% were in their best reproductive age (18-34yrs) and 10% were 35 years and above old.

Mothers were from prime to Gravid 7, majority were in G 2, (30.5%) and prime 25%. Most of the mothers visited in 3rd Trimester (56.5%). Average age was 25.01 years with SD+ 5.00.

In this study 56% cases gave history of folic acid intake and 44% pregnant mothers' not taken or low intake of folic acid during peri-conceptional period. In 11% cases central nervous system anomalies were observed out of which 6% were anencephaly and 5% showed spina bifida and hydrocephalus.. This study is compatible with Lynch SA²³, where 2%-16% neural tube defect were detected in fetus of mothers who have not taking folic acid during pregnancy. In another study, by Atiq R²⁴ 2018 where 72% peri- conceptional folic acid intake prevented neural tube defects and 10.9%% neural tube defects were observed.

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