IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 15, Issue 1 Ver. III (Jan. 2016), PP 36-40
www.iosrjournals.org

Spinal Dysraphism in Rural India - Dietary Habits and Screening Techniques

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Abstract : *INTRODUCTION: Folic acid deficiency is a well known etiological factor for spinal dysrpahism. Still many regions of Rural India are not aware of the importance of folic acid supplementation and antenatal screening for congenital anomalies. OBJECTIVES: To study the folic acid supplementation and antenatal ultrasonography screening to rule out structural anomalies in mothers of spinal dysraphism children. MATERIALS AND METHODS: This is a retrospective study on the mothers of Spinal Dysraphism children from rural areas of North Costal Andhrapradesh. RESULTS AND CONCLUSION: None of them are aware of folic acid supplementation, its advantages, usage and effects of its deficiency. None of them started folic acid before planning for pregnancy. Only 16% of the cases are detected antenatally by ultra sonogram screening.*
Keywords -*Folic acid supplementation, Rural, Radiologist, Spinal dysraphism, TIFFA scan*

I. Introduction

Each year 3-4 lakh infants born are affected with spina bifida and anencephaly worldwide[1]. In India each year 1-3 of 1000 live births are affected with spinal dysraphism[2]. Children develop paraplegia, sphincter disturbances, CSF leaks, hydrocephalus due to ACM and learning disabilities and endocrine abnormalities. All these lead to significant physical disability, psychosocial maladjustments and increased financial burden to the family[3,4]. Folic acid deficiency is a well know etiological factor for NTD. Folic acid supplementation has proved beyond doubt as a preventive measure for spinal dysraphism[5]. Screening with TIFFA scan can detect NTD as early as 18-20 weeks[6]. When TIFFA scan is done by an experienced radiologist patients can elect for termination of pregnancy at the earliest.

II. Objectives

The following are the objectives of the study among mothers of spinal dysraphism children in the Rural areas of the three districts of Srikakulam, Visakhapatnam and Vizianagaram of North Costal Andhra Pradesh state.

1. To study the awareness of folic acid supplementation and the start of folic acid supplementation in relation to gestation of pregnancy.
2. To study antenatal ultrasonography screening - number of scans during pregnancy, gestational age at which first scan was done, scan done by radiologist or gynaecologist, cases identified by ultrasonography.

III. Materials and methods

It is a retrospective study done in Neurosurgery Department, King George Hospital, Visakhapatnam from the period between Jan 2014 and June 2015.

Thirty-six mothers of spinal dysraphism children, who belong to rural areas of three districts of Srikakulam, Visakhapatnam and Vizianagaram of North Costal Andhra Pradesh state are taken into the study.

The mothers were questioned and enquired about the awareness of folic acid supplementation and the gestational age at which they started the supplementation. They were also questioned about the antenatal ultrasonography screening done to rule out structural abnormalities.

IV. Results

In this study most cases of spinal dysraphism are products of non consanguineous marriage (72%) and 28% are products of consanguineous marriage(fig 1).

21 of 36 cases(58.3%) got manifested in first conception and 14 (38.9%) in their second conception and 1 in their third conception(2.8%)(Table 1). Most of the cases (about 95%) occur in the first pregnancy[7,8].

None of the mothers were aware of folic acid supplementation during pregnancy and its advantages in preventing neural tube defects and other anomalies.

8.3% of mothers did not take any supplementation and of the remaining 91.7% mothers non of them started folic acid before the conception. 25 of the mothers started supplementation from 3 months(69.4%). 3 mothers (8.3%) started in 4th month of pregnancy, 1 in 5th month(2.8%) and 3 in 6th month(8.3%)(Table 2)

10 of the 36 cases studied did not get any antenatal USG screening (27.8%) (fig 2). Of the remaining 26 cases TIFFA scan was done in only 3 cases by an experienced radiologist and the remaining 23 cases were screened by gynaecologist(88.5%).

Before conception 7 mothers(19.4%) could get only a single USG screening. among them four were screened at 5th month of gestation, 2 cases at 7 th month and one mother could not get USG examination till she attained 9th month of gestation.

In 10 cases twice USG was done, most of them in 5th & 7th month of gestation by gynaecologist. 3 times scan was done in four cases during pregnancy. In 5 cases scan was done more than 3 times (2 cases- 4 times scan, 2 cases - 5 times , 1 case - 6 times) due to high risk pregnancy (Table 3)

Among the 3 cases in which TIFFA scan was done radiologist could pick up neural tube defect in 2 cases. In one case it was identified at 5 months of gestation and in the other at 7 months of gestation. In one case radiologist missed when screened at 5 months but gynaecologist could pick up the abnormality at 8th month of gestation.

In the 36 cases taken into this study only 6 (16.7%) were detected by antenatal screening. Of these 3 are encephalocele and 3 are meningomyelocele. TIFFA by a radiologist identified 2 cases and 4 were by gynaecologist. Among the 23 cases screened by gynaecologist, only 17% were identified whereas those screened by radiologist 66.7% were identified.

5 pregnancies were home delivered by dai(13.9%). Normal Vaginal delivery was done in 21 (58.3%) mothers and LSCS in rest 10 cases (27.8%)

V. Discussion

Each year about 2,500 infants are born with the neural tube defects (NTDs) spina bifida and anencephaly. In addition, an unknown number of fetuses affected by these birth defects are aborted. All infants with anencephaly die shortly after birth, whereas the majority of babies born with spina bifida grow to adulthood with, in severe cases, paralysis and varying degrees of bowel and bladder incontinence. The evidence that consumption of folic acid, one of the B vitamins, before conception and during early pregnancy (the peri-conceptional period) can reduce the number of NTDs has been accumulating for several years.

The term 'folic acid' is derived from Latin, meaning leaves. The active form of folic acid is the reduced form called tetrahydrofolate (THF). Folic acid or pteroylmonoglutamic acid is a B group vitamin, first isolated from spinach leaf in 1941[9].Tetrahydrofolate will accept a carbon unit from serine or glycine to form 5,10-methylene-tetrahydrofolate. This is either used as such for the synthesis of thymidilate, which is incorporated into DNA, oxidized to formyl-THF, which is used for the synthesis of purines for incorporation into RNA and DNA, or reduced to 5-methyl-THF, which is used for the methylation of homocysteine to form methionine[10].

Cell processes depend largely on folate-mediated one-carbon metabolism, i.e. the transfer of one carbon unit. Folate acts as a donor as well as an acceptor of these groups. The cellular processes requiring one-carbon units are: nucleic acid biosynthesis, protein biosynthesis and methyl group biogenesis. The prime function of folate is to provide one-carbon moieties for the synthesis of three of the four bases of DNA, guanine, adenine and thymine[11]. This role of folate in the synthesis of nucleic acids and of methionine renders this vitamin vital to the development and normal function of the body. To quote Hibbard et al.''Folic acid and its derivates play a vital role in the synthesis of essential nucleic acids and are therefore important to cellular reproduction''.

Several dietary sources are rich in natural folate, such as fruits, green leafy vegetables, i.e. Spinach, Brussel sprouts and broccoli, oranges, beans, yeast and liver[12]. A considerable amount of folate, however, can be destroyed by cooking, processing and storage. The absorption of dietary folate comprises conversion of polyglutamates to monoglutamates by a conjugase in the jejunum. This monoglutamate enters the intestinal cells and is fully reduced to tetrahydrofolate (THF) by the enzyme tetrahydrofolate reductase. THF can be transported directly into the portal circulation or be converted to THF-polyglutamate stores or to 5-methyl THF monoglutamate, the predominant form of folate in serum and tissues. Storage locations are the liver, pancreas, kidneys, brain and red cells[13].

All women of childbearing age who are capable of becoming pregnant should consume 0.4 mg of folic acid per day for the purpose of reducing their risk of having a pregnancy affected with spina bifida or other NTDs[14]. Because the effects of higher intakes are not well known, care should be taken to keep total folate consumption at less than 1 mg per day, except under the supervision of a physician. Women who have had a prior NTD-affected pregnancy are at high risk of having a subsequent affected pregnancy. When these women are planning to become pregnant, they should consult their physicians for advice.

Sonographic diagnostic accuracy for open neural tube defects has improved dramatically in recent years. Enhanced image resolution has allowed localization of the origin of the echoes from the immature fetal spine and identification of significant cranial and intracranial anatomic changes in the presence of open spina bifida.

Recent investigations indicate that the sensitivity of sonography for open spina bifida is 95% when the examination is a targeted scan by an experienced radiologist.

Sonographic evaluation of the fetal spine depends on visualisation of the ossification centres within the fetal vertebrae. Each fatal vertebra has three ossification centres: one in the body (centrum) and one at the base of each transverse process. Three planes of imaging are commonly used to assess the fatal spine from the cervical region through the coccyx: coronal, parasagittal, and transverse. In the transverse plane, all three ossification centres should be visualised, and the centres of the neural arches should be parallel or converging. the parallel configuration is particularly noticeable when the foetus is in decubitus position with respect to the transducer[15]. In the longitudinal plane, the spine has a "rail-road track" appearance, with gradual widening toward the fetal head and gradual tapering in the sacrum[16].

The distal part of the spine may not be ossified in healthy foetuses before 22 weeks of gestation, and in such cases imaging may be repeated if the foetus is at high risk for a neural tube defect. Transvaginal or transperineal imaging in the second trimester can be extremely helpful in visualising the distal spine of the fetus in a persistent breech presentation.

Recent advances in three- dimensional sonography allow a diagnostician to obtain a true three-dimensional image of the fatal spine rather than requiring multiple two-dimensional images to be integrated into a mental impression of the fatal anatomy.

Prenatal detection of spina bifida has become very important, as termination of pregnancy before fetal viability is elected by upto 80% of families. If the pregnancy is continued, detection may affect the delivery location and method. The degree of handicap and the survival rate depend on the level of the spinal segments involved, the severity of the lesion, the treatment program and the associated abnormalities.

VI. Figures and Tables

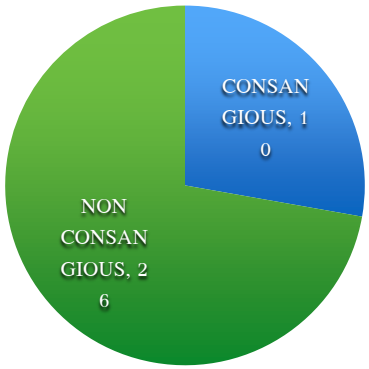

Figure 1: pie chart showing the consanguinity among the mothers of children with neural tube defects

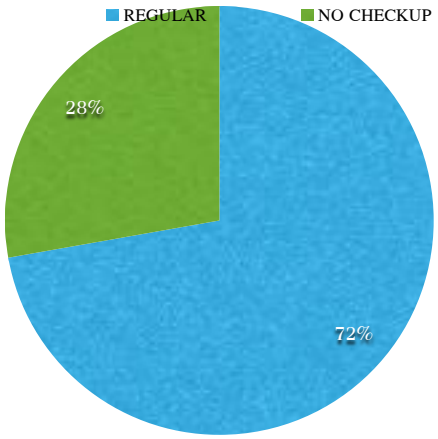

Figure 2 : pie chart showing the percentage of mothers who got regular antenatal ultrasonographic screening

NO OF THE CHILD	TOTAL CASES
1ST CHILD	21
2ND CHILD	14
3RD CHILD	1

Table 1: The frequency of NTD in relation to the order of child birth

STARTED FROM	NO OF CASES
NO SUPPLEMENTATION	3
FROM 1 MONTH	1
2 MONTH	0
3 MONTH	25
4 MONTH	3
5 MONTH	1
6 MONTH	3

Table 2: start of usage of folic acid supplementation in relation to gestation of pregnancy

NO OF ANTENATAL SCANS	NO OF CASES
NO SCAN	10
SINGLE SCAN	7
TWO SCANS	18
THREE SCANS	4
FOUR SCANS	2
FIVE SCANS	2
SIX SCANS	1

Table 3: Screening ultrasonography done by obstetrician

VII. Conclusion

Even though folic acid supplementation is the primordial prevention measure for spinal dysraphism still we could not get into rural india. It is started as a primary preventive measure in rural india only after conception. Lack of awareness of folate was the most common reason for not taking folic acid supplementation[17]. General population, health care professionals, nurses and pharmacists are not well aware of the beneficial effects of folic acid supplementation. Vitamin supplementation, food fortification and dietary

supplementation must be made to prevent Neural tube defects. Awareness must be created among the people of rural areas.

The detailed knowledge of fetal spinal anatomy afforded by sonography permits early and accurate diagnosis of defects. TIFFA scan should be made compulsory for every mother for an earlier diagnosis of Neural tube defects and termination of pregnancy if necessary.

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