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RESEARCH ARTICLE

NEURAL TUBE CLOSURE ANOMALIES: EPIDEMIOLOGICAL STUDIES AND RISK FACTORS AT THE NEONATAL AND NEONATAL RESUSCITATION DEPARTMENT OF MOHAMMED VI UNIVERSITY HOSPITAL, OUJDA

Nour El Houda Benchaib, Anass Ayyad, Jihane El Mokhtari, Mohammed Ech-Chebab, Sahar Messaoudi and Rim Amrani

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Abstract

Objective: This study aims to identify the sociodemographic, maternal, and obstetric risk factors associated with neural tube defects (NTDs) and determine their prevalence among newborns hospitalized in the neonatology and neonatal intensive care unit at CHU Mohamed VI Oujda.

Methods: We conducted a descriptive retrospective study over an 18-month period, including all newborns hospitalized with isolated or associated NTDs. Incomplete records were excluded from the analysis.

Results: Out of 797 hospitalized newborns, 66 had congenital malformations, including 10 cases of NTDs (1.25%). The types of NTDs identified were anencephaly (1 case), spina bifida (6 cases), and encephalocele (3 cases). The majority of mothers had an average age of 34.3 years, with 80% coming from a low socioeconomic status and 60% having a history of consanguineous marriages. Additionally, fenugreek consumption during the first trimester of pregnancy was reported in 70% of cases, while only 20% of mothers had taken folic acid. Regarding the newborns, 70% presented with hypotonia, and 60% exhibited weak or absent primitive reflexes. The short-term postoperative mortality rate was 30%.

Discussion: The prevalence of neural tube defects (NTDs) observed in this study is significantly higher than the global average, which may be explained by unfavorable socioeconomic conditions and maternal nutritional deficiencies. Fenugreek consumption and low folic acid supplementation were identified as significant risk factors.

Conclusion: To reduce the incidence of NTDs, it is essential to strengthen prenatal care, encouraging folic acid supplementation, and advising against the consumption of fenugreek during pregnancy are essential. A preventive strategy tailored to local specificities could significantly improve newborn health and reduce complications associated with neural tube defects (NTDs).

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Introduction:

-Birth defects (congenital anomalies) are the leading cause of death in babies under one year old. Among these, neural tube defects (NTDs) are the second most common type of birth defect, following congenital heart defects, with a birth incidence of about 1 in 1,000 in American Caucasians [1]. Neural tube defects are a group of congenital malformations caused by a failure of the neural tube to close properly during the fourth week of embryonic development. There are two main types: Encephalic dysraphias (such as anencephaly and encephalocele) and medullary dysraphias (such as spina bifida) account for about 5% of birth defects. The most common presentations of neural tube defects (NTDs) are spina bifida and anencephaly [1,2]. Globally, it is estimated that approximately 300,000 babies are born each year with NTDs [3].

The origin of these malformations is multifactorial, resulting from the interaction between environmental and genetic factors. These defects in the formation of the nervous system often cause serious sequelae, both psychomotor and sphincteric. Progress has been made in the area of prevention and prenatal diagnosis. Genetic counseling and folic acid supplementation during the periconception period have reduced the prevalence of neural tube defects in several industrialized countries [4].

The objective of this study is to identify sociodemographic, maternal and obstetric risk factors associated with neural tube closure anomalies (NTD) in our local context. The study also aims to determine the prevalence of these malformations among patients hospitalized in our department.

Materials & Methods:-

We conducted a retrospective study with descriptive aims over an 18-month period. The study included newborns hospitalized in the neonatal and neonatal resuscitation departments due to neurological malformations. All neonates admitted with isolated or associated neural tube closure abnormalities were included, while incomplete files were excluded.

Results:-

In this study, which was conducted over an 18-month period, 797 newborns were hospitalized in our department. Among these patients, 66 had congenital malformations, a prevalence of 8.28% of hospitalizations. More specifically, 10 newborns (1.25% of the sample) were diagnosed with neural tube closure abnormalities. The malformations found were anencephaly (01cas), spina bifida (6 cases) and encephalocele (3 cases).

The average age of the mothers was 34.3 years. Eighty percent of the families had a low socioeconomic status, and 60% of the cases involved consanguineous marriages. Fenugreek consumption during the first trimester was noted in 70% of cases, while folic acid supplementation was low, with only 20% of mothers taking it (Table 1).

Maternal data	Numbers	Percentages
Parental consanguinity	6	60%
Age of the mother : over 30	7	70%
Low socio-economicstatus	8	80%
History of miscarriage	4	40%
Consumption of fenugreek during pregnancy	7	70%
Unattended or poorly managed pregnancy	7	70%
Folic acid intake during the first trimester of pregnancy	2	20%

Table 1:- Maternal and obstetric data.

Regarding neonatal characteristics, the sex ratio was 0.42, indicating a female predominance. The average gestational age was 36.55 weeks, with 70% of deliveries occurring via the vaginal route; one case involved an unmedicated delivery. Apgar scores at birth were less than 7/10 in 5 cases. The average birth weight was 3200 grams. Clinical examination revealed hypotonia in 70% of the cases, and archaic and sucking reflexes were weak or absent in 60% (Table 2).

Regarding the management of 10 newborns with neural tube closure anomalies, 90% of them received a surgical intervention. However, the short-term postoperative mortality rate was 30% for this population.

The remaining patients were transferred to the neurosurgery department for additional treatment.

Maternal data	Numbers	Percentages
Female sex	7	70%
Male sex	3	30%
Vaginal delivery	7	70%
High-birth	3	30%
Apgar score at birth less than 7/10	5	50%
Hypotonia	7	70%
Weak or absent archaic reflexes	6	60%

Table 2:- Neonatal data.

Discussion:-

International epidemiological data show a relatively low global average prevalence of neural tube defects (NTDs), approximately 1 in 1,000 births. However, this prevalence varies significantly between countries and is always reported relative to the total number of births. For example, the prevalence is estimated at 1 in 1,000 births in France and Germany, and 0.9 per 1,000 births in Japan [5].

In contrast, the prevalence observed in this study Within our hospital, the prevalence is significantly higher, reaching 12.5 per 1,000 hospitalizations. This increased hospital prevalence should be interpreted with caution, as it does not reflect the actual prevalence in the general population but rather the frequency of these malformations among newborns requiring hospitalization in our department.

Available epidemiological data indicate that neural tube defects (NTDs) are generally more frequent in female fetuses. This female predominance is especially pronounced for the subtype of anencephaly [6]. The results obtained in this study are consistent with those in the scientific literature. Thus, the sex distribution of newborns with NTDs observed in this case series aligns with internationally reported epidemiological trends.

This observed female predominance for NTDs, particularly in cases of anencephaly, raises questions about genetic factors. The risk of these complex congenital malformations is also influenced by hormonal or environmental factors.

Epidemiological data clearly show that low socio-economic status is one of the main risk factors associated with neural tube defects (NTDs). The results of our local study corroborates this trend observed nationally and internationally. The close association between low social and socio-economic Status may primarily be due to maternal nutritional deficiencies, particularly in folic acid. The number of unemployed individuals is higher in disadvantaged groups. Indeed, insufficient folate intake during the periconceptional period and early pregnancy is recognized as one of the main modifiable risk factors for these congenital malformations [7]. The first study linking periconceptional vitamin B9 supplementation to a decrease in NTD rates was published by Smithells et al. in 1980 [8], followed by other series [4,9,10,11].

The pathogenesis of neural tube defects (NTDs) is still the subject of debate and intense research. Many factors are suspected of playing an etiological role in the development of these congenital malformations, including hyperthermia, Exposure to valproic acid, consumption of fenugreek, hypervitaminosis A, deficiencies in folic acid and vitamin B12 during the periconceptional period, as well as genetic factors [7,12,13,14,15].

For instance, a study conducted in our region in 2017 highlighted a significant association between fenugreek consumption by pregnant women and the occurrence of neural tube defects in the newborn [12]. Our results corroborate these data from the literature by establishing a link between fenugreek consumption by mothers, lack of adequate prenatal care, and the subsequent development of NTDs in children.

Our study reveals that 80% of mothers have low socio-economic status and are uneducated. This indicates significant challenges in communication and access to information for implementing an effective preventive strategy in our local context.

However, the observed decrease in the incidence of neural tube defects can be explained by the implementation of the national folic acid fortification program for flour in 2008 [16]. This public health measure has likely improved the intake of this essential micronutrient among women of childbearing age. Nevertheless, to further strengthen this prevention, it would be important to specifically target high-risk populations by recommending folic acid supplementation during the periconceptual period. Additionally, avoiding fenugreek consumption, especially during the first trimester of pregnancy, should be strongly advised.

Finally, rigorous prenatal monitoring, especially for high-risk pregnancies, is crucial for early detection and appropriate management of potential neural tube defects.

Neural tube defects are associated with high mortality, generally ranging from 20% to 36% according to studies. These severe congenital malformations also lead to considerable morbidity. In cases of anencephaly, survival of the newborn is unfortunately impossible. The prognosis for spina bifida largely depends on early management. When the vertebral lesion is not quickly closed, the outcome is usually fatal within just a few days. However, if surgical closure is possible and associated hydrocephalus is treated with a shunt, the prognosis may be more favorable. In the long term, the fate of children with spina bifida is closely related to the degree of neurological and intellectual impairment, as well as the management of complications related to hydrocephalus. Medical follow-up and multidisciplinary care are essential to optimizing their quality of life [17].

Conclusions:-

In our context, neural tube malformations remain common birth defects, leading to substantial mortality and morbidity. In order to strengthen the prevention of these serious pathologies, several complementary approaches seem essential including a rigorous prenatal follow-up, especially for high-risk pregnancies, is essential to detect early any neural tube abnormalities and ensure appropriate management.

The avoidance of consumption of fenugreek during gestation, especially in the first trimester, should be emphasised because this plant could be associated with an increased risk of malformations. As well as folic acid supplementation of pregnant women with a high risk of recurrence of neural tube closure anomalies should be systematically recommended and reinforced, This is the first time that a woman has been pregnant.

The combination of these different preventive measures, combined with close monitoring of pregnancies, should significantly reduce the incidence of neural tube malformations in your local context.

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