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PREVALÊNCIA E FATORES DE RISCO PARA OCORRÊNCIA DE ANOMALIAS CONGÊNITAS EM NEONATOS EM HOSPITAL PARA CRIANÇA E MATERNIDADE NA PROVÍNCIA DE MISAN

PREVALENCE AND RISK FACTORS FOR OCCURRENCE OF CONGENITAL ANOMALIES IN NEONATES AT HOSPITAL FOR CHILD AND MATERNITY IN MISAN PROVINCE

معدل انتشار وعوامل الخطر لحدوث التشوهات الخلقية عند الولدان في مستشفى الطفل والولادة في محافظة ميسان

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RESUMO

As anomalias congênitas afetam uma proporção notável de recém-nascidos e têm papel significativo na admissão hospitalar, morbidade e mortalidade em pediatria. Além disso, a morbidade e incapacidade a longo prazo causadas por defeitos congênitos podem ter um efeito significativo no desenvolvimento da criança, bem como nos sistemas de saúde e família. Em Misan, os defeitos congênitos são uma terceira causa comum de mortalidade neonatal. Este estudo teve como objetivo estimar a prevalência, tipos e fatores de risco de defeitos congênitos, a fim de ter um plano de ação para prevenir a ocorrência desses defeitos. Estudo transversal realizado na unidade de cuidados neonatais do Hospital Misan de Criança e Maternidade durante o período de dois anos (2018 e 2019). A província de Misan está localizada no sudeste do Iraque. As informações foram coletadas dos arquivos dos pacientes e dos registros cadastrais. Qualquer recém-nascido com defeito de nascença foi inscrito em nosso estudo. Esses casos foram diagnosticados dependendo da história, do exame clínico apoiado por outras investigações e de estudos radiográficos sempre que necessário. As taxas de prevalência de defeitos congênitos foram de 7,1/1000 e 6,6/1000 nascidos vivos em 2018 e 2019, respectivamente. O envolvimento do sistema nervoso central foi o padrão mais comum. Defeitos de nascimento foram mais frequentes em bebês masculinos, solteiros e a termo, com idade materna entre 18 e 35 anos, residentes em área urbana com histórico de consanguinidade. Assim, a taxa de prevalência de defeitos congênitos foi notavelmente alta em Misan. Esforços para a prevenção, bem como para melhorar o diagnóstico pré-natal, seriam essenciais.

Palavras-chave: *unidade neonatal, anomalias congênitas, Iraque.*

ABSTRACT

Congenital disabilities affect a remarkable proportion of neonates and have a significant role in hospital admission, morbidity, and pediatrics mortality. Besides, the long-term morbidity and disability caused by birth defects may have a considerable effect on the development of the child and family and health care systems. In Misan, congenital disabilities are considered a third common cause of neonatal mortality. This study aimed to estimate the prevalence, types, and risk factors of congenital disabilities to have an action plan toward preventing the occurrence of these defects. A cross-sectional study performed in the neonatal care unit in Misan Hospital for Child and Maternity during the period of two years (2018 and 2019). Misan province is located in the South East of Iraq. The information was collected from the files of patients and registration records. Any delivered a live neonate with birth defects was enrolled in this study. These cases were diagnosed depending on history, clinical examination supported by other investigations, and radiographic studies whenever needed. The prevalence rates of congenital disabilities were 7.1/1000 and 6.6/1000 live birth in 2018 and 2019, respectively. Central nervous system involvement was the most typical pattern. Congenital disabilities were more frequent in male, single, and term babies of maternal age 18-35 years living in an urban area with a consanguinity history. Thus, the prevalence rate of congenital disabilities was notably high in Misan. Efforts toward prevention, as well as improving the prenatal diagnosis, would be essential.

Keywords: *neonatal care unit, congenital anomalies, Iraq.*

الملخص

تؤثر الإعاقات الخلقية على نسبة ملحوظة من الولدان ولها دور كبير في دخول المستشفى، وفي معدلات الاعتلال ووفيات الأطفال. إلى جانب ذلك، قد يكون للمرض والعجز طويل الأمد الناجمين عن العيوب الخلقية تأثير كبير على نمو الطفل والأسرة وأنظمة الرعاية الصحية. في ميسان، تعتبر العيوب الخلقية السبب الثالث الشائع لوفيات الأطفال حديثي الولادة. هدفت هذه الدراسة إلى تقدير مدى انتشار، أنواع، وعوامل الخطر للإعاقات الخلقية لوضع خطة عمل تجاه منع حدوث هذه العيوب. أجريت دراسة مقطعية في وحدة رعاية الأطفال حديثي الولادة في مستشفى ميسان للأطفال والأمومة خلال فترة سنتين (2018 و2019). تقع محافظة ميسان في جنوب شرق العراق. تم جمع المعلومات من ملفات المرضى وسجلات التسجيل. تم تسجيل أي مولود حي مصاب بعيوب خلقية في هذه الدراسة. تم تشخيص هذه الحالات اعتمادًا على التاريخ والفحص السريري المدعوم بالاستقصاءات الأخرى والدراسات الشعاعية عند الحاجة. كانت معدلات انتشار الإعاقات الخلقية 7.1 / 1000 و6.6 / 1000 ولادة حية في عامي 2018 و2019 على التوالي. كانت إصابة الجهاز العصبي المركزي هي النمط الأكثر شيوعًا. كانت الإعاقات الخلقية أكثر شيوعًا في الذكور، الوليد المفرد لأمهات تتراوح أعمارهن بين 18 و 35 عامًا والذين يعيشون في منطقة حضرية لها تاريخ زواج قرابة. وبالتالي، كان معدل انتشار العيوب الخلقية مرتفعًا بشكل ملحوظ في ميسان. وبالتالي سيكون من الضروري بذل الجهود للوقاية، وكذلك تحسين التشخيص ما قبل الولادة.

الكلمات المفتاحية: وحدة رعاية الاطفال حديثي الولادة، التشوهات الخلقية، العراق.

1. INTRODUCTION:

Congenital anomalies, also generally referred to as birth defects, congenital disorders, congenital malformations, congenital disabilities, or congenital abnormalities, are conditions of fetal origin present at birth affecting the health, growth, and/or survival of an infant (KHOURY, 1989). It affects a remarkable proportion of neonates and has a significant role in hospital admission, morbidity, and mortality in pediatrics (Dastgiri *et al*., 2011). The more severe congenital disabilities were reported to occur more in the low and middle-income countries in which more than 90% of these cases would die because of the serious defects (Sharma, 2013; Vatankhah *et al.,* 2017).

The entire family is affected by a child with a congenital disability. Parents whose children are affected by birth defects face notable struggles and want to make the lives of their children more comfortable. They also want to contribute to preventing potential congenital disabilities. Parents face obstacles such as contact with health practitioners, quality of life concerns, awareness-raising, and research activism (Lemacks *et al*., 2013). A global disease study burden reported approximately 510.400 deaths caused mainly by birth defects (Lozano *et al*., 2012). According to the World Health Organization report, about 3 million fetuses and infants are born with significant malformations every year. Many extensive population-based studies indicate that in 2–3 % of live births that significant malformations occur (Shawky and Sadik, 2011).

Congenital abnormalities contribute a large proportion of child morbidity and mortality, as well as fetal mortality. Birth defects can be classified into three main categories: structural/metabolic, congenital infections, and other conditions. The most common disorders include congenital heart defects, orofacial clefts, Down syndrome, craniofacial anomalies, and neural tube defects (Al-Alaiyan and AlFaleh, 2012; Irvine *et al.,* 2015; Farhan *et al*., 2020). The pattern and the prevalence of congenital disabilities vary in population according to the social (Consanguineous marriage), environmental, economic factors, and racial/ethnic disparities (Shawky and Sadik, 2011; Wang *et al.,* 2015).

The racial/ethnic was changed to more specific categories in 1981, from "White or Other", into six different types. The groups are now covered in the racial/ethnic classifier as white, black, Hispanic, American, Asian, and other. The racial/ethnic classification of the baby is derived from the medical records. Mixed race/ethnicity children are coded as "other," and unclear origin children are coded as "unknown." Chavez *et al.,* (1988) found that Americans had the highest overall scores, followed by whites, blacks, Asians, and Hispanics, for their study of 18 major birth defects by race /ethnic group (Chavez *et al.,* 1988). Low socioeconomic levels are at greater risk for congenital disabilities (Yu *et al*., 2014; Morales-Suárez Varela *et al*., 2009). Additionally, the pattern of birth defects may be affected by the geographical area (Liu *et al.,* 2020).

In comparison to non-consanguineous marriages, the occurrence of congenital anomalies was mainly seen in consanguineous marriages (Tayebi *et al.,* 2010). The geographic disparities in the prevalence of congenital anomalies in the region might be attributed to the highly polluted air and water or Polluted landfills, hazardous waste, and manufacturing facilities included in the vicinity of residential areas (Kihal-Talantikite *et al.,* 2017).

In the United States, about 3% of all births had congenital disabilities reported by the Center for Disease Control and Prevention (Martin *et al*., 2005). Moreover, EUROCAT, the European

Surveillance of Congenital Anomalies, is the European network of congenital anomaly population and recorded approximately 23.9 cases per 1000 births of significant congenital disabilities in 2003-2007 (Dolk *et al*., 2010). Birth defects causing early death or permanent lifelong disability can have a prevalence of up to 45 in 1000 live births in low-income countries, three times higher than in rich countries. (WHO, 1985).

It is estimated that around 7.9 million babies (6% of all global birth) are born with significant congenital disabilities every year. Although specific congenital abnormalities can be controlled and treated, about 3.2 million of these children are life-long disabled. Some congenital disabilities are hereditary. Others result from toxic environmental causes (toxic metal contamination), known as teratogens. There are also others that emerge from complex interactions between genes and environmental influences. These are known as multifactorial. However, the causes are unknown in about half of all cases of birth defects (Lobo and Zhaurova*,* 2008; Sahar *et al.*, 2008; Mihaileanu *et al.,* 2019). Notably, genetic disorders associated with congenital disabilities reached up to 5% of total live births in the developed countries (Dastgiri *et al*., 2010; Loughna, 2008).

There are various risk factors for birth defects such as hereditary, the gender of the baby, old-aged parents, complications during pregnancy, unprescribed drugs and excessive vitamin A intake during pregnancy, exposure to chemicals and pesticides during pregnancy, malnutrition, poverty, and living near mobile strengthening stations (Abdou *et al.,* 2019). The causes of only about 30% of congenital disabilities are relatively well known, and awareness even of those is often spotty. On the other hand, 70% still unknown and leaves open the possibility that environmental factors may play a significant role. So, recognizing and managing these risk factors would help reduce the rate of birth defects (Weinhold, 2009). Congenital disabilities can be classified based on their pathogenetic mechanism, severity, or whether they involve a single system or multiple systems (Tanteles and Suri, 2007). A cross-sectional retrospective study by (Obu *et al.,* 2012) was performed in which a four years (January 2007–April 2011) examination was conducted on the registries of all babies admitted to the Newborn Special Care Unit (NBSCU) at the Teaching Hospital of the University of Nigeria (UNTH), Ituku/Ozalla, Enugu. Mainly surgical congenital disabilities and cleft lip/cleft palate and neural tube defects were demonstrated as the commonest types.

In Misan province (South East Iraq), it is worth mentioning that birth defects were found to be the fourth one in the causes of neonatal respiratory distress and the third sequence in its mortality (6.6%) as reported by a study conducted in the same hospital of the current study (Aljawadi and Ali, 2019). Furthermore, another study in Misan considered birth defects, a third common cause of neonatal mortality (Ali, 2016). Additionally, the Iraqi annual statistical report in 2017 recorded that congenital anomalies were forming the second most typical cause of stillbirth in Iraq (Ministry of Health and Environment Iraq, 2017). Although different studies focused on congenital disabilities were conducted in some Iraq provinces, there was no similar study in Misan.

Therefore, this study aimed to estimate the prevalence, types, and risk factors of birth defects to have an action plan toward preventing the occurrence of these congenital anomalies.

2. MATERIALS AND METHODS:

2.1. Study design

The present study is cross-sectional. It was conducted in the neonatal care unit in Misan Hospital for Child and Maternity during the period of 2018 and 2019. Misan province is located in the South East of Iraq. Data were collected from the files of patients (153 files) and records of the neonatal care and the obstetrical unit (22.406 total live births of two years were recorded).

2.2. Ethics

All procedures performed in this study involving data from human participants are per the ethical standards of the institutional and national research committee, the 1964 Helsinki Declaration, and its later amendments or comparable ethical standards. Ethical approval was obtained from the hospital (number 1879 of 1st of June 2020) to carry out this study, which allowed the researchers to have all the rights to check the records and files of patients.

2.3. Inclusion and exclusion criteria

Any delivered alive neonate with congenital disabilities was enrolled in this study. These cases were diagnosed depending on history, clinical examination supported by other investigations, and radiographic studies whenever needed. Stillbirth (dead fetus) was excluded.

2.4. Data analysis

The total number of birth defects and total live birth were recorded each year. Then the prevalence rate was calculated per 1000 live births. The types of congenital disabilities were classified according to the system involvement as (1) central nervous system (hydrocephaly, anencephaly, microcephaly, and neural tube defects); (2) gastrointestinal system (cleft lip and/or palate, trachea-esophageal fistula and/or esophageal atresia, duodenal atresia, diaphragmatic hernia, omphalocele, gastroschisis, and imperforated anus); (3) chromosomal (Down, Patau, Edward, Pierre Robin, and Russel Silver syndrome); (4) musculoskeletal system (polydactyly, syndactyly, chondrodysplasia, and limb deformities); (5) genitourinary system (polycystic kidney, ambiguous genitalia, Potter syndrome, and hypospadias); (6) cardiovascular system (ventricular septal defect, atrial septal defect, transposition of great arteries, and complex heart disease); (7) sensory (ichthyosis, and cutis aplasia); (8) respiratory system (pulmonary hypoplasia, and choanal atresia); and (9) unclassified birth defects (multiple systems involvement).

2.5. General information on the records of the patients

The collected information included gender, gestational age, maternal age, residence, parity, antenatal care, history of chronic maternal illness, type of pregnancy, history of intrauterine exposure (fever, drug, and radiation), consanguinity, and family history of birth defects.

2.6. Statistical Analysis

Data were analyzed using Microsoft Excel 2010 (Winston, 2011).

3. RESULTS AND DISCUSSION:

The total number of birth defects and the prevalence rate in 2018 were 80 cases and 7.1/1000 live births, respectively, while in 2019, there were 73 cases and 6.6/1000 live births, as shown in Table 1. The most typical pattern of congenital disabilities involved the central nervous system, followed by the gastrointestinal system. In contrast, the least pattern was involving the respiratory system, as shown in Table 2. In studying the association between birth defects and their different risk factors, congenital disabilities were more frequent in male, single, and term babies of maternal age 18-35 years living in urban areas. History of consanguinity was more predominant in babies with congenital disabilities, as shown in Table 3.

The prevalence rate of birth defects was 7.1, and 6.6 per 1000 live birth in two successive years. These results were much less than the total prevalence rate in Ramadi (West of Iraq), which recorded a prevalence rate of about 41/1000 live birth (Al-Ani *et al*., 2012), but this cannot be considered as low rates that should be neglected. Also, it was less than Saudi Arabia (27/1000 live birth) and Iran (165.5 per 10000 births) (Fida *et al*., 2007; Dastgiri *et al*., 2007). In the present study, the stillbirths were excluded, increasing the prevalence rate of birth defects in total birth. A study by (Penchaszadeh, 2002) clarified that the prevalence rate would be underestimated in developing countries. On the contrary, Misan rate was higher than Duhok (North of Iraq) (4.65/1000 live birth), Beijing Obstetrics and Gynecology Hospital, China (5/46), British Columbia (0.5/1000 live birth), and Egypt (2.5/1000 live birth) (Mohammed, 2015; Sun *et al.,* 2015 ;Trimble and Baird, 1978; El Koumi *et al*., 2013). These variations in the prevalence rates may be attributed to the different risk factors like social, environmental, and geographical distribution.

This study showed the prevalence of congenital anomalies in the central nervous system was the first as the most commonly affected organ system which agreed with studies in Duhok, British Columbia, and Sarajevo (Mohammed, 2015; Trimble and Baird, 1978; Hadžagić-Ćatibušić *et al*., 2008) followed by the gastrointestinal system to be the second sequence as seen in Karbala (Hussein, 2017). This sequence differs from Ramadi and Saudi Arabia, in which the cardiovascular system was the first most standard involved system (Al-Ani *et al*., 2012; Fida *et al*., 2007). These discordant data may be attributed to the early or severe clinical presentation at birth if the central nervous system or gastrointestinal system was involved and the urgent need for interference. Hence, a definite recording of these cases would be applied. Meanwhile, the folic acid role in central nervous anomalies should be studied in future research. The involvement of the cardiovascular system is the seventh congenital disabilities in this study. It might be related to the delayed echocardiographic appointment, especially in asymptomatic cases. Thus, further prospective research is recommended.

In studying the characteristics and risk factors of congenital disabilities, there was more predominance in male babies, agreed by Karbala

(Hussein, 2017), and neonatal outcome in the Netherlands for type 1 diabetic pregnancy (Evers *et al.,* 2009). Moreover, in Ramadi, a significant role of the male gender in congenital disabilities was observed (Al-Ani *et al*., 2012). Until now there is no definitive cause for male predominance but the genetic or X-linked roles may partially explain this. Besides, more frequent birth defects in term than preterm neonates were detected in the current study. On the contrary, different studies in Egypt and Iran found a significant association between prematurity and congenital disabilities (El Koumi *et al*., 2013; Woday *et al*., 2019). A larger sample size and a longer period may be needed to explain this discordance.

The current study revealed more congenital disabilities in multiparous mothers age 18-35 years. These findings were compatible with Karbala (Hussein, 2017) and Alexandria in Egypt (Shawky and Sadik, 2011). Another study in Egypt disagree with these results and found that mothers age more than 35 years were more prone to have babies with congenital anomalies(Abdou *et al.,* 2019). In Misan province, the social, cultural, and tribal attitudes encourage early marriages and large families. So most of the childbearing women are in the twentieth of age and vulnerable to have more kids.

The present study showed that urban residence and regular antenatal care were more frequent in birth defects than in Karbala (Hussein, 2017), which may be due to the lack of education and family planning awareness. This would need a further study about maternal and health provider partnership status in preventing congenital disabilities. More consanguinity association with congenital disabilities was seen in this study. This is in agreement with other research in Ramadi, Erbil (North of Iraq), Egypt, and Iran, which recorded a significant increase in birth defects when it is linked with consanguinity (Al-Ani *et al*., 2012; Ameen *et al*. 2018; El Koumi *et al*., 2013; Kaviany *et al.,* 2016). Misan people belong to tribes that prefer consanguineous marriage.

Furthermore, different studies in Ramadi, Erbil, and Egypt revealed a significant relationship between recurrence of congenital disability and previous birth defects (Al-Ani *et al*., 2012; Ameen *et al*., 2018; El Koumi *et al*., 2013). Nevertheless, this study did not find any relationship between congenital disability and the family history of previous congenital disabilities. This might be addressed to the small sample size.

In the current study, congenital disability occurred less frequently in mothers with a chronic disease that disagrees with Erbil study (Ameen *et al.,* 2018). Mothers aged 18-35 were more frequent in this study; hence, they were less likely to have a chronic disease like hypertension and diabetes mellitus. Birth defects were less frequent in the multiple types of pregnancy, and this needs expanded study in this issue.

Recent studies in Fallujah city (west of Baghdad, Iraq) by (Alaani *et al.,* 2011) have drawn attention to rises in congenital birth abnormalities and cancer blamed on teratogenic, genetic, and genomic stress thought to result from depleted Uranium contamination following the battles in the town in 2004. Their results indicate the enriched uranium exposure is either a primary cause or linked to the cause of the congenital anomaly and cancer increases. This might cause a congenital anomaly in Misan province because the concentration of Uranium in the soil (Al-Ani et al., 2011) reached 2.158±0.631 ppm in some areas. According to the world health organization (WHO), the tolerable intake (TI) for Uranium is 0.0006 mg per kg (ppm) of body weight per day (WHO, 2001).

High rates of mortalities in Maysan province for Neonatal (age: 0-28 day), infants (age: less 1 year), and under 5 years (10.4, 12.6 and 17 per 1000 live births, respectively) were recorded by the Iraqi annual statistical report in 2017 (Ministry of Health and Environment Iraq, 2017). So it is necessary to consider these factors (age and parity of the mother and consanguinity) to correct or act whenever possible, such as more focus on antenatal care, education, and pre-marriage counseling. Subsequently decline in congenital disability would be achieved, leading to more reduction in neonatal and infant mortality rate.

4. CONCLUSIONS:

The prevalence rate of congenital disorders was notably high in Misan. Central nervous system involvement was the most typical pattern followed by the gastrointestinal system. More concentration about the role of folic acid supplements before conception is required. Congenital disabilities were more frequent in male, single, and term babies of maternal age of 18-35 years living in urban areas and a history of consanguinity. Social education using different media types focusing on family planning, consanguineous marriage, and genetic counseling is important.

Furthermore, improvement in the primary health care system leads to the early detection of high-risk pregnancies. So, efforts toward

prevention, as well as improving the prenatal diagnosis, would be essential.

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Table 1. *Frequency and prevalence rate of congenital disorders*

Year	Number of congenital disorders	Total live birth	Prevalence of congenital disorders per 1000 live birth
2018	80	11343	7.1
2019	73	11063	6.6

Table 2. *Types of congenital disorders according to the system involvement*

System involvement	Number and percent of congenital disorders	
	2018	2019
Central nervous system	25 (31.2%)	26 (35.6%)
Gastrointestinal system	19 (23.8%)	14 (19.2%)
Chromosomal	8 (10.0%)	12 (16.5%)
Musculoskeletal system	7 (8.8%)	7 (9.6%)
Unclassified (multiple system involvement)	6 (7.5%)	5 (6.8%)
Genitourinary system	5 (6.2%)	0 (0.0%)
Cardiovascular system	4 (5.0%)	5 (6.8%)
Sensory	4 (5.0%)	4 (5.5%)
Respiratory system	2 (2.5%)	0 (0.0%)
Total	80 (100%)	73 (100%)

Table 3. *General characteristics and risk factors of congenital disorders*

Characteristics and risk factors	2018	2019
Gender:		
Male	44 (55.0%)	41 (56.2%)
Female	36 (45.0%)	32 (43.8%)
Gestational age:		
Term	59 (73.8%)	53 (72.6%)
Preterm	21 (26.2%)	20 (27.4%)
Maternal age:		
< 18 years	5 (6.2%)	13 (17.8%)
18-35 years	60 (75.0%)	52 (71.2%)
> 35 years	15 (18.8%)	8 (11.0%)
Residence:		
Urban	55 (68.8%)	44 (60.3%)
Rural	25 (31.2%)	29 (39.7%)
Parity:		
Primiparous	26 (32.5%)	15 (20.5%)
Multiparous	54 (67.5%)	58 (79.5%)
Antenatal care:		
Regular	40 (50.0%)	45 (61.6%)
Irregular	40 (50.0%)	28 (38.4%)
History of maternal chronic illness:		
Present	8 (10.0%)	12 (16.4%)
Absent	72 (90.0%)	61 (83.6%)
Type of pregnancy:		
Single	75 (93.8%)	69 (94.5%)
Twin	5 (6.2%)	4 (5.5%)
History of intrauterine exposure to (fever, drug, radiation):		
Yes	14 (17.5%)	11 (15.1%)
No	66 (82.5%)	62 (84.9%)
Consanguinity:		
Related	45 (56.2%)	56 (76.7%)
Not related	35 (43.8%)	17 (23.3%)
History of birth defects:		
Yes	20 (25.0%)	20 (27.4%)
No	60 (75.0%)	53 (72.6%)