

Environmental Pollution and Risk of Congenital Anomalies in Al-Diwaniya Governorate

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الخلاصة:

— أجريت دراسة تحليلية ، على 15 حالة من حالات التشوه الخلقي لأطفال حديثي الولادة في مستشفى الولادة والأطفال التعليمي في الديوانية للفترة من الأول من كانون الثاني حتى نهاية شهر كانون الأول لعام 2014 (6 ذكور و 9 إناث) وكانت الحالات المسجلة تشمل تشوهات القلب ' الجهاز البولي ' الجهاز العصبي ' تشوهات الشفة 'ومتلازمة داون....وكانت النسبة الأكبر هي التشوهات القلبية وتشوهات الجهاز البولي . كما كانت نسبة التشوهات بين الإناث أعلى مما هي في الذكور..أما بالنسبة لمكان السكن فكان الحي الجمهوري هو الأعلى من غيره ' أما بالنسبة لطبيعة البيئة فلم تكن هناك أي ظاهرة بيئية غريبة أو اختلاف عن بيئة المناطق الأخرى ' ماعدا منطقة الجمهوري شهدت نزاعات عسكرية عنيفة جدا .

Abstract :

Analytic study, conducted on 15 cases of congenital deformity of the newborn babies in the maternity and children's teaching hospital in Diwaniya for the period from the first of January until the end of December 2014 (6 males and 9 females) , were recorded cases include cardiac defects , urinary system anomalies , neural tube defects , cleft lip 'and Down syndrom.

The largest percentage is cardiac malformations and abnormalities of the urinary system, the proportion of malformations among females were more than in males , for the place of residence was a al- Jumhoory locality in the top of the other 'as to the nature of the environment there were no any strange environmental phenomenon or different from other regions environment' except al- Jumhoory locality had seen very violent military conflicts.

Key words:

Environmental pollution, Congenital defects .

Background:

Although environmental pollution suggested to play a great role in occurrence of certain bad outcome , evidence of health consequences to populations is sparse.

Aim of the study:

To investigate whether there is an association between risk of congenital anomaly and level of environmental pollution in Diwaniya during the last years .

Methodology:

Case series for each age-sex defected born baby in the region for 15 disorders represented births from January 2014 –December 2014 , were calculated, based on the estimates of cases by cause, type of disorder , incidence, age of the mother, duration, and disability severity.

Estimates of the burden and prevalence of exposure in different localities of disorders attributable to malnutrition, poor water supply, poor sanitation, personal and domestic hygiene , , tobacco use by mother, occupation, hypertension, physical inactivity, and use of illicit drugs during pregnancy .

We asked also about history of feeding , rash appearance , x-ray exposure , history of previous baby with congenital anomaly , also asking about antenatal care during the whole period of gestation and also about the duration of residence of mothers .

Results :

From the total 15 congenital anomalies recorded during the whole year , 6 males and 9 females , non-chromosomal anomalies combined, raised risks were found for Tetralogy of Fallot 5 cases (33.3%) , urinary system anomalies 4 cases (26.6%) , while those with cleft lip 2 cases and those with neural tube anomalies 2 cases represents only 13.3% for each , also cases with chromosomal anomalies (Down syndrome) 2 cases represents only 13.3% from the total cases .

According to the locality , it was found that al- Jumhoory locality is the highest (5) cases i.e. 33.3% of the total , followed by al-wihda locality (4) cases which represents 26.6% of the anomalies recorded . Other localities { al- asry , al-oroba , al- askary , al-hakim , al-taqia and al- sanniah } registered only one case for each .

According to other variables , age of the mother , smoking , presence of associated diseases like hypertension or D M , level of education , we don't find any significance .

Conclusions:

Although both environmental exposure and multiple genetic factors may plausibly explain some of the excess risks of birth defects observed, several alternative explanations, including exposure misclassification, ascertainment bias, and residual confounding cannot be excluded. Some of the effects observed, if real, might be therapeutic drugs , radioactive substance from weapons , cigarette smoking during pregnancy and maternal infection with rubella or cytomegalovirus .

Introduction :

Congenital anomalies , are also known as birth defects , congenital disorders , or congenital malformations ,which can be defined as structural or functional anomalies , including metabolic disorders , which are present at birth . (1)

Over the last years, concern for the possible influence of exposure to environmental pollutants in children during gestation has grown; exposure levels which may be reached nowadays in our dwellings and in our streets. In the present study evidence over the possible impact of ambient pollution on the fetus published during the last decade. (2)

Regarding damage in fetal health, although results are not always consistent, most studies show associations with exposure to environmental pollution during pregnancy. However, the precise mechanisms of action of pollutants on adverse reproductive results are still unknown, so is the period of exposure most relevant during pregnancy and the specific pollutant which may represent a higher risk.(3)

Major birth defects are abnormalities that lead to developmental or physical disabilities , or require medical or surgical intervention. There are more than 4000 different known birth defects , ranging from minor to serious , and although many can be treated or cured , they are still within the leading causes of death during the first year of life .(4)

According to the American College of Obstetrics and Gynecology (ACOG) , says

that 3 out of every 100 babies born in United States have some kind of major birth defect . (5)

Birth defects can be caused by genetic , environmental , or unknown factors . for most birth defects , the cause is believed to be an interaction of number of genetic and environmental factors .(6)

Environmental causes of birth defects have increasingly been recognized since the mid-20th century , by the early 1940 , the genetic causes of some birth defects were recognized and experimental studies in rats and other animals had demonstrate that some vitamins deficiencies and various chemicals could also cause birth defects .(7)

It was speculated that environmental agents might be teratogenic and viruses and other infective agents were known to cross the placenta , sometimes causing fetal infection . The teratogenic effect of rubella was first described in 1941 , but it was some years before this became widely known . (8)

When the Japanese Teratology Society was formed 50 years ago , relatively little was known about proven environmental causes of birth defects . The recognition that thalidomide was a potent human teratogen soon came in 1961 and maternal hyperthermia was first reported as a teratogen in animal species in 1963.(9)

Fifty years ago , the number of human chromosomal abnormalities in infants and children with specific patterns of multiple malformations were soon to be reported . (10)

According to the March of Dimes , more than half of all births defects have unknown causes , while about 40% of all birth defects are the result of genetic or environmental factors , or a combination of both .For most birth defects , the cause is believed to be an interaction of a number of genetic and environmental factors .(11)

Methods:

The study took place in al- Diwaniya region, during the period from January to December 2014 , which comprises eight administrative localities served by the same maternity hospital .

Since 1988, this region has been covered by a birth defects registry (primary health department) that is part of a national network of such registries reaching to the Ministry of Health in Baghdad . Malformations are ascertained by reporting Results :

from maternity wards in the region, combined with an active search of the medical records of the major local obstetric and pediatric units.

Malformations were first divided into two categories: chromosomal, and non chromosomal . The registry data enabled us to compute the rates of congenital anomalies, stratified by type of anomaly, sex , maternal age, previous mother's community of residence and mother's community of residence at time of birth . Further information like level of education of the mother ,any positive family history of malformations .

The local areas of defected children were visited to reveal any information which may have any possible relation with the defect noticed .

Table 1. Demographic characteristics of eligible children delivered between January and December 2014 in al-Diwaniya maternity hospital

	Cardiac defect	Urinary system anomalies	Cleft lip	Down syndrome	Neural tube defects	total
Infant's gender						
Male	4	2	-	-	-	6
Female	1	2	2	2	2	9
No prenatal care	2	2	2	6	3	15
Maternal age (years)						
20-29	1	1	-	-	-	2
30-39	1	2	1	-	1	5
≥40	3	1	1	2	1	8
Maternal education (years)						
≤ 6	3	3	1	2	2	11
7-12	1	-	-	-	1	2
≥12	1	1	-	-	-	2
Disease of mothers						
Yes	2	0	0	1	1	4
No	3	4	1	1	2	11
Relation of mothers and fathers						
Yes	3	2	1	2	2	10
No	2	2	0	0	1	5

Table (2):Distribution of congenital anomalies according to residence (locality)

Locality	Cardiac defect	Urinary system anomalies	Cleft lip	Down syndrome	Neural tube defects	total
al -asry	-	1	-	-	-	1
al-oroba	1	-	-	-	-	1
al-askary	-	-	-	1	-	1
Al-hakim	-	-	-	1	-	1
Al-Jumhoory	2	1	1	-	1	5
Al-sanniah	-	1	-	-	-	1
Al-taqia	-	-	-	-	1	1
Al-wihda	2	1	1	-	-	4
Total	5	4	2	2	2	15

Table (3) : Distribution of congenital anomalies according to date of birth.

Date	Cardiac defects	Urinary system anomalies	Cleft lip	Down syndrome	Neural tube defects	total
January 2014	-	1	-	-	-	1
February	1	-	-	-	-	1
March	-	-	-	1	-	1
April	1	-	-	-	-	1
May	-	1	-	-	-	1
June	-	1	-	-	-	1
July	-	1	-	1	-	2
August	-	-	-	-	-	0
September	1	-	-	-	-	1
October	-	-	-	-	1	1
November	1	-	2	-	1	4
December	1	-	-	-	-	1
Total	5	4	2	2	2	15

We found no consistent pattern of effects for any other pregnancy period (results not shown). Stratification according to maternal age did not suggest effect modification by these factors, yet the numbers of cases in most substrata were too small to be informative.

Table (2) shows the rate of congenital anomalies was higher in al-Jumhoory locality than other localities. This excess was explained mainly by anomalies of unknown or multifactorial aetiology (cardiac defects urinary defects , cleft lip , and neural tube defects).

The distribution of demographic factors and potential risk factors for malformations is presented in table (1). As expected, chromosomal defects were associated with advanced maternal age (>40 years) and somewhat with low maternal educational level and lack of prenatal care; cardiac deformities affected a higher proportion of males.

Table (3) shows the distribution of congenital anomalies throughout the year ,with no significant findings .

Discussion :

Although environmental pollution has recently been linked to several adverse pregnancy outcomes, our results substantially extend the epidemiologic data on the potential relation between increases in

environmental pollutants during vulnerable pregnancy periods and congenital malformations. (1)

Compared with the few previous studies on this topic globally, our investigation was limited to small area with too little number of cases in comparison with those done abroad. (2)

Also we have no facilities to measure the environmental pollution, this lead us to depend on what we see by necked eyes with little information by history taken from the families of cases, enabled nearly incomplete ascertainment of cause and effect. (3)

To our knowledge, the only previous epidemiologic information on this topic comes from ecologic studies conducted in Poland, the Czech Republic, and Russia, where communities with high versus low levels of ambient air toxics were found to have increased rates of heart defects (4)

Active maternal smoking during pregnancy has been associated with a number of birth defects including ventricular septal defects and or facial clefts. Prenatal exposure of the human fetus to tobacco smoke through maternal passive smoking has been linked to low birth weight (5).

We observed an increased risk of several cardiac defects during the period of study, no real explanations can be reached, but multifactorial factors can be the answer, where both genetic and environmental factors work together to yield these malformations, and this agree with the report of (The Children's Hospital Of Philadelphia) at 1996 (6).

Some of environmental causes of many congenital malformations include prenatal infections with Rubella virus or using of certain drugs like Lithium and Thalidomide or consumption of alcohol especially during the first trimester of pregnancy, these findings was mentioned by the report of Lucile Packard Children's Hospital in Stanford at 30th July 2010. (8)

Maternal illnesses like Diabetes Mellitus, Phenylketonurea, Systemic Lupus Erythematosus can also considered as environmental factors that lead to many

congenital abnormalities in the offspring. (9)

Central nervous system defects might be caused by chromosomal abnormalities and single gene defects that alter the blueprint of the brain, or by imbalance of factors that control gene expression during development. (10)

Disruption of CNS result from destruction of the normally developed (or developing) brain are caused by environmental or intrinsic factors such as inutero feta infection, exposure of the pregnant women to harmful chemicals, radiation, or feta hypoxia. For instance, Holoprosencephaly, a condition in which the forebrain is not divided into two hemispheres, is a malformation. Hydranencephaly, in which massive destruction reduces the hemispheres into fluid-filled sacs, is a disruption. The line between malformation and disruption is sometimes blurred because an extrinsic factor (e.g. radiation) may cause direct physical injury, but also damage genes that are important for development. (11)

Infection with cytomegalovirus (CMV) before mid gestation can cause Microcephaly and polymicrogyria. CMV infection in the third trimester causes an encephalitis, similar to post natal CMV encephalitis. (12)

Cleft lip (Cheiloschisis) and cleft palate (palatoschisis), which can also occur together as cleft lip and palate can be caused by environmental and genetic factors rationalizing the high incidence of facial malformations. During the first six to eight weeks of pregnancy, the shape of the embryo's head is formed, this agrees with Dudas M et al., 2007. (13)

In conclusion, our results suggest that, in Diwaniya city, exposure to increased levels of environmental pollution during pregnancy may contribute to the occurrence of many fetal defects and exposure to increased levels pollution may elevate the risk of these defects, these initial

findings need to be confirmed by further studies.

Limitations of the study :

1. lack of baseline information concerning the relation between environmental pollution and fetal birth defects .
2. unable to evaluate several risk factors for birth defects , like maternal smoking , vitamin supplement use , diet and obesity because they are not adequately reported.
3. The number of birth defects recorded are only those who are born in the hospital , i .e. many cases who are born by midwives are lost .

Conclusions:

1. Many birth defects appear to be caused by multiple genes and environmental exposures .
2. Using of certain drugs by pregnant can be consider as an important environmental factor that cause birth defects .
3. Exposure to electromagnetic fields materials from weapons and explosions can cause genetic some genetic manipulations.
4. Cigarette smoking by pregnant may increase the risk of cleft lip or palate .
5. Maternal rubella , Phenylketonurea , gestational diabetes , and exposure to thalidomide, are factors that cause congenital defects .

Recommendations:

1. Monitoring of all pregnant women during the whole period of pregnancy especially in areas suspected to have environmental pollution .
2. Health education for pregnant to avoid smoking , taking drugs , or exposed to radiation during pregnancy , especially in the first trimester .
3. Urgent treatment of any viral or parasitic infections of pregnant mothers .

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