Assessment of Risk Factors for Fetal Congenital Anomalies among Pregnant Women at Cairo University Hospitals.

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Abstract: Background, congenital anomaly is a defect that is present at birth, and can result from either genetic, environmental factors, or both. **Aim,** was to explore the risk factors which may lead to fetal congenital anomalies. **Design,** a descriptive research design was adopted. **Sample**, a total of 100 pregnant women was recruited according to the following criteria: pregnant in a fetus with a congenital anomaly; at any reproductive age; no specific gravidity or parity; single or multiple gestations. **Setting,** Fetal Medicine Unit at El-Manial Maternity Hospital. **Tools,** two tools were constructed and filled in by the researchers: 1) **Ultrasonographic** fetal assessment record 2) structured interview schedule. **Results,** age range of the pregnant women were 17-44 years with a mean of 26.52 ± 5.48 years old. Twelve percent of them cannot read and write while, 22% had university education. Renal anomalies, central nervous system (CNS), muscloskeletal, cardiovascular, and gastrointestinal anomalies were the most common congenital anomalies constituted 38%, 31%, 20%, 10%, 8% respectively of the total anomalies. Regarding to risk factors for congenital anomalies, 44% of the pregnant women had first degree consanguinity, 17% had a family history of a congenital anomalies, 19% had a previous child with a congenital anomalies, 33% gave a history of consuming drugs during present pregnancy, 21% of the pregnant women live near industrial source and 22% of them experienced infection during present pregnancy. **In conclusion**, renal, CNS and muscloskeletal anomalies were the most common type of congenital anomalies. Positive consanguinity, family history for congenital anomalies, previous child with a congenital anomaly, consuming drugs during pregnancy, living near industrial source and exposure to infections during pregnancy, were the most common risk factors associated with congenital anomalies. **Recommendations,** premarital examination for consanguineous marriages should be encouraged. Antenatal care is very important for suspecting and early detection of congenital anomalies.

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Key words: risk factors, fetal congenital anomalies.

1. Introduction

Human reproduction is a complex process, which can be affected in many phases by both host and environmental factors. The conception of an embryo involves the fertilization of the ovum by a spermatozoon. If the ovum and/or spermatozoon is defective, the fetus could present with stillbirth or congenital anomalies may be detected at birth or later in life. Another scenario is that, the embryo is conceived by a normal ovum and spermatozoon, but in the process of development in the uterus, it is exposed to agents that may be harmful to the different organ systems. Depending on the type of agents and at which stage of the developmental process of the organs' formation the exposure occurs, different congenital anomalies may result [(1)]. Congenital anomaly (birth defects) may be viewed as a physical, metabolic, or anatomic deviation from the normal pattern of development that is apparent at birth or detected during the first year of life [(2)].

Worldwide surveys shown that, the birth prevalence of congenital anomalies varies greatly from country to country [(3- 5).] It is reported to be as low as 1.07% in Japan and as high as 4.3% in Taiwan [(3)]. In the US, where most research has been conducted on this subject, a 2-3% birth prevalence of congenital anomalies has been reported. The birth prevalence of congenital anomalies in England is 2% and in South Africa it is 1.49% [(5)]. These variations may be explained by social, racial, ecological, and economical influences [(3, 5)]. **Temtamy *et al.,*** [(3)] on their study about a genetic epidemiological study of malformations at birth in Egypt, they reported that, the prevalence of malformation was 3.17%. Malformed neonates were classified into 13 groups according to the system affected using World Health Organization classification of congenital malformations. The most common anomalies were: central nervous system (29.5%), musculoskeletal system (20.0%) and genetic syndromes (13.7%).

In spite of the frequency of congenital anomalies, the underlying causes for most remain obscure. It has been estimated that, around 15%-25% are due to recognized genetic conditions; 10%-13% are due to

environmental factors, and 20%-25% are due to multi-factorial inheritance, meaning a complex interaction of multiple minor genetic anomalies with environmental risk factors. The majority, 40%-60% of congenital anomalies, have unexplained causes [6]. The control of genetic diseases should be based on an integrated and comprehensive strategy combining the best possible treatment and prevention through community education, population screening, genetic counseling, and the availability of early diagnosis [7]. **Abd el Aziz** [8] in his study about ultrasound screening of fetal congenital anomalies in Egypt reported that, nearly 80% of chromosomal abnormalities and 59% of anatomic abnormalities can be detected using ultrasonography screening between 11 and 14 weeks gestation. Moreover, an early diagnosis gives parents more time to adjust to the fact that, the baby will have special health needs and to prepare delivery and newborn period and for families who chose pregnancy termination [9].

Nurses are often the first health care providers to encounter women with preconception and prenatal issues. Nurse who provide prenatal care is often involved in initial client contact and assessment; identify families at risk for genetic problem; provide information about known risk factors for congenital anomalies and how to avoid these factors; assist families in acquiring accurate information about specific congenital anomaly; assist the family in understanding and dealing with information received; act as a liaison between the family and the genetic counselor; and aid families in dealing with the crisis of having child with congenital anomalies. Also the nurse must be aware and knowledgeable about predisposing factors, procedures and resources available for prenatal diagnosis [10, 11].

Significance

Congenital anomalies occur in 2-3% of all births worldwide. They are an important cause of perinatal morbidity and mortality and account for 20-30% of perinatal deaths all over the world. Moreover, survivors may have mental and physical disability[12]. Knowledge of the etiologic agent influences not only therapy, but also prevention in the case of future pregnancies for example, by fortifying the diet with folic acid to reduce the risk of neural tube defects [2]. In Egypt, few scattered researches were carried out to identify the risk factors which may lead to fetal congenital anomalies so, the researcher interested to carry out this research.

Aim of this research, was to explore the risk factors which may lead to fetal congenital anomalies.

Research Questions

1. What is the personal profile of pregnant women having fetus with congenital anomaly? ;
2. What is the most common type of fetal congenital anomalies?;
3. What are the risk factors which may lead to fetal congenital anomalies?

2. Subjects and Methods

Research Design. A descriptive research design was adopted in this research to reach the stated aim.

Setting.

The research was conducted at Fetal Medicine Unit at El-Manial Maternity Hospital. This hospital is a university affiliated hospital. The fetal medicine unit includes 4 rooms, each of them equipped with an ultrasound machine for the reason of obstetrical and gynecological examinations. This unit provides service for free through trained physicians and nurses.

Sample

A total of 100 pregnant women were recruited according to the following criteria: - pregnant in a fetus with a congenital anomaly; at any reproductive age; no specific gravidity or parity;

Tools

Two tools were constructed by the researchers after reviewing related literatures.

1) ***Ultrasonographic fetal assessment record*** which included data about the fetus such as, type of congenital anomaly, gestational age, gender, and amniotic fluid index; *2)* ***structured interview*** **schedule** which included four parts. The first part included data about sociodemographic characteristics for pregnant women and their husbands; the second part included data about medical history; the third part included data about past and present obstetric history and the fourth part included data about risk factors for congenital anomalies such as infectious diseases; physical agents such as radiation; drugs and chemical agents; maternal metabolic and genetic factors such as diabetes; and paternal factors.

Tools Validity

Tools were submitted to a panel of three experts in the field of neonatology, maternity nursing and fetal medicine to test the content validity. Modification was carried out according to the panel judgment on clarity of sentences and appropriateness of content.

Ethical consideration

An official permission was taken from ethical committee at faculty of nursing- Cairo University. Also an official permission was taken from hospital administrators. Each woman was informed about the purpose of the research and its importance. The researchers were emphasized that, participation in the research was entirely voluntary; anonymity and confidentiality were assured through coding the data. Informed written consent was taken from woman who meets the criteria and accepts to be included in the research.

Pilot Study

A pilot study was done on 10% of the total sample to assess the feasibility and clarity and objectivity of the tools and determine the needed time to fulfill. Modification was done according to the result of the pilot study. All pregnant women participated in the pilot study were excluded from the study sample.

Procedure

Data were collected from October 2009 to December 2010. Two days/week from 9 Am to 3 pm. Data collected through ultrasonography fetal assessment and structure interview with pregnant women. **1) *Ultrasonographic fetal assessment,*** that was done by trained fetal medicine specialist. This assessment includes examination of all fetal body systems, to screen for the presence of any congenital anomaly, fetal biometry such as head circumference, abdominal circumference, and femur length to identify gestational age, measuring amniotic fluid index, and identifying the gender of the fetus. Then these data were recorded in the record of ultrasonographic fetal assessment. Ultrasonographic fetal assessment takes about 15- 20 minutes, ***2) structure interview,*** each pregnant woman having a fetus with a congenital anomaly was interviewed after ultrasound examination to collect data related to: 1) sociodemographic characteristics for the woman and her husband; medical history; past and present obstetric history; and risk factors for congenital anomalies such as family history and hereditary factors; infectious diseases and agents; physical agents; drugs and chemical agents; maternal metabolic and genetic factors; and paternal factors. The researchers faced the pregnant woman, asked her the questions in Arabic and recorded her answers in the tool. Structure interview consumed about 15 minutes for each one. These data were recorded in structure interview schedule.

Statistical analysis

Collected data were coded and tabulated using personal computer. Statistical package for social science (SPSS) version 11 was used. Descriptive statistics was used to identify the frequency and percentage of the variables. Mean and standard deviation also used.

3. Results

Findings of this descriptive research presented in three main parts: Personal profile of pregnant women having fetus with congenital anomaly; the most common type of fetal congenital anomalies and the risk factors which may lead to fetal congenital anomalies.

I-Personal Profile of Pregnant Women Having Fetus with Congenital Anomaly

Concerning sociodemographic characteristics of the pregnant women, age range of the pregnant women was 17-44years with a mean of 26.52 $\pm$ 5.48 years old. In this research, 12% of the pregnant women cannot read and write, while 22% had university education. Concerning residence before pregnancy, 61% of them lived in urban areas, while, during pregnancy 72% lived in urban areas. Ninety three percent of pregnant women were housewives (Table 1). Regarding body mass index, 31% of the pregnant women had ideal body mass index (BMI 18.5-24.9 kg/m^2), 49% of them had class I obesity (BMI 30-34.9 kg/m^2), and 20% had class II obesity(BMI 35-39.9 kg/m^2). Concerning pregnant women special habits, 46% of them were passive smoker. ***In relation to sociodemographic characteristics of the husband,*** the age range was 21-55years with a mean of 32.31$\pm$ 7.28 years old. In this research, 16% of the husbands cannot read and write, while 51% had secondary school education (Table 1). Regarding to their habits, 54% of the husbands were active smokers.

Regarding medical disorder, 14% of pregnant women suffered from medical disorders. Fifty seven point fourteen percent of them had cardiac disorder (Figure, 1).concerning ***Obstetrical history***, 27% of them were primigravida and only 2% were gravida eleven. Thirty five percent were nulliparous. Concerning complications occurred during previous pregnancy, 51% experienced complications during previous pregnancy. Fifty eight point eighty two percent of these complications were abortion, and only 3.92% were preeclampsia. Considering the mode of previous delivery, 38% delivered vaginally with episiotomy, 16% delivered by cesarean section, and 11% delivered vaginally without episiotomy. Regarding contraceptive methods, 49% used to use contraceptive methods. Sixty five point three percent of them used IUD, 24.5% used oral contraceptive pills, and only 10.2% used injectables. Only 7% of pregnant women were suffering from infertility.

Focusing on current pregnancy, 57% of the pregnant women were at the second trimester and 43% were at the third trimester with a mean of 27.48 $\pm$ 6.01 weeks gestation. Ninety four percent of the pregnant women had a singleton fetus. Thirty nine percent of the fetuses were males. Considering the amniotic fluid volume, 66% were average liquor, 22% were oligohydraminos, and 12% were polyhydraminos. In relation to complications occurred during the current pregnancy, 11% of pregnant women experienced complications. Eighty one point eighty one percent of them experienced bleeding in early pregnancy, 9.09% preeclampsia, and 9.09% gestational diabetes (Table, 2).

II-The Most Common Types of Fetal Congenital Anomalies

Regarding to type of congenital anomalies, 69%

of the fetuses had single congenital anomaly, and 31% of them had multiple congenital anomalies. Classification of congenital anomalies according to affected body system, 38% of congenital anomalies were renal anomaly, 31% were CNS, 22% were muscloskeletal anomaly, 11% were cardiovascular system, gastrointestinal tract and genital anomaly 3% each, 7% facial anomalies, and 2% respiratory system anomaly, and other anomalies constitute 18% of total anomalies (Figure 2 & Table 3).

III-Risk Factors which may lead to Fetal Congenital Anomalies

Regarding to hereditary factors, 44% of the pregnant women had first degree consanguinity; 17% of them had a family history of congenital anomaly; 16% had a family history of mental retardation; and 19% had a previous child with congenital anomaly. ***Concerning drugs and chemicals***, 33% of the pregnant women consumed drugs during current pregnancy and 17% of them complaining of unsafe water consumption. ***Regarding to Physical factors,*** 21% of the pregnant women lived near industrial source. ***Concerning Infectious factors,*** 22% had a history of exposure to infections during the current pregnancy (Table 4).

Table (1) Distribution of the Pregnant Women and their Husbands According to their Sociodemographic Characteristics

Characteristics	Frequency (n=100)	%
Level of education		
Illiterate	12	12
Reads and writes	4	4
Preliminary education	8	8
Preparatory education	13	13
Secondary school	41	41
University education	22	22
Occupation		
Housewife	93	93
Professional	6	6
Written work	1	2
Husband's level of education		
Illiterate	16	16
Reads and writes	4	4
Preliminary education	1	1
Preparatory education	7	7
Secondary school	51	51
University education	21	21
Husband's occupation		
Laborer	76	76
Professional	15	15
Written work	9	9

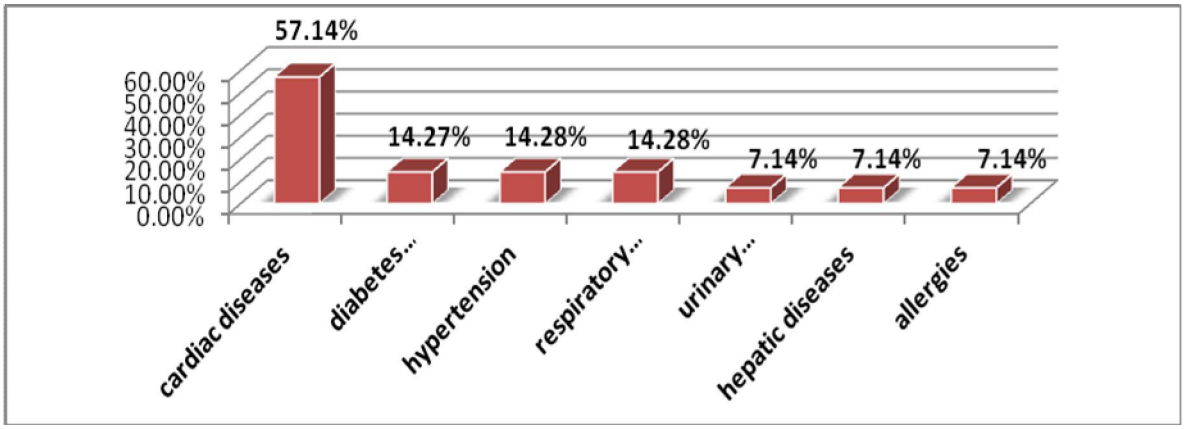

Figure (1) Distribution of the Pregnant women According to Medical Disorders (n=14)
N.B. Number is not mutually exclusive because of some pregnant women had multiple Medical Disorders

Table (2) Distribution of the Pregnant Women According to their Obstetrical History

Characteristics	Freq.	%
Complications occurred during previous pregnancy (n=51)		
Abortion	30	58.82
Child with CA	16	31.37
Stillbirth	15	29.41
Preterm labor	10	19.6
Preeclampsia	2	3.92
IUFD	2	3.92
Using Contraceptive methods (n=100)		
Yes	49	49
No	51	51
Type of contraceptive methodes (n=49)		
IUD	32	65.30
Oral contraceptive pills	12	24.48
Injectables	5	10.2
Types of infertility (n=7)		
Primary infertility	4	57.14
Secondary infertility	2	28.56
Primary and secondary	1	14.3
Complications occurred during current pregnancy(n=11)		
Bleeding in early pregnancy	9	81.81
Preeclampsia	1	9.09
Gestational diabetes	1	9.09

N.B. Number is not mutually exclusive because of some pregnant women had multiple complications

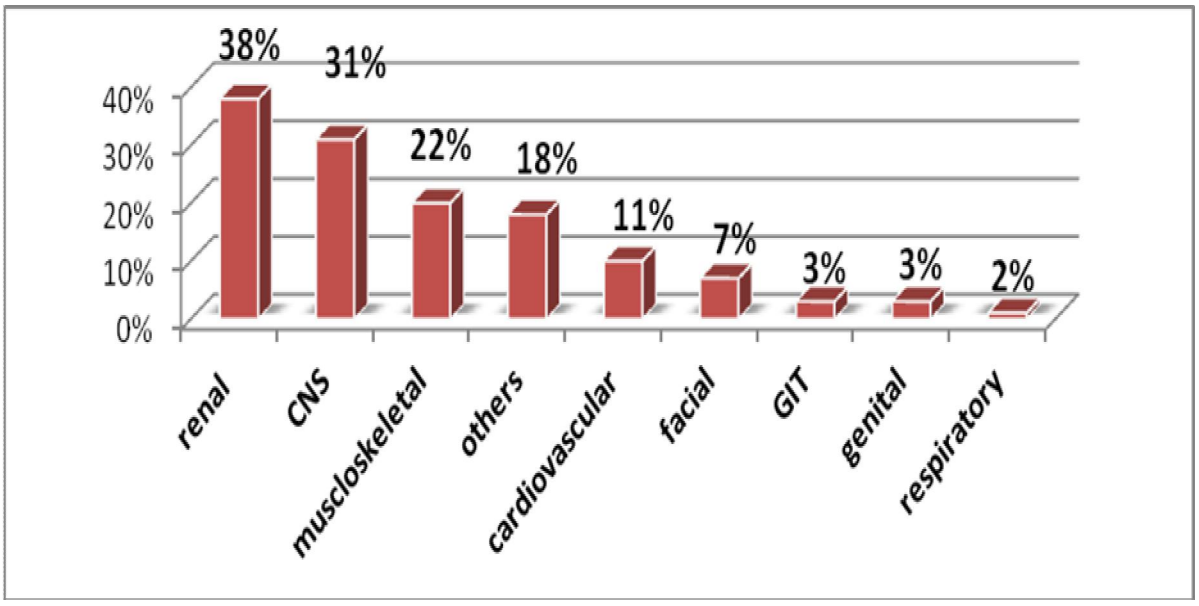

Figure (2) Distribution of the Congenital Anomalies of Fetuses According to the Affected System
N.B. Number is not mutually exclusive because of some fetuses had multiple congenital anomalies.

Table (3) Distribution of the Congenital Anomalies of Fetuses According to the Affected System

Characteristics	Freq.	%
Renal anomalies	**(n=38)**	
Hydronephrosis	**13**	**34.21**
Multicystic dysplastic kidney	**9**	**23.68**
Megacystis	**6**	**15.78**
Hydroureter	**6**	**15.78**
Renal agenesis	**4**	**10.52**
Polycystic kidney	**2**	**5.26**
CNS anomalies	**(n=31)**	
Ventriculomegaly	**7**	**25.58**
Hydrocephaly	**7**	**22.58**
Dandy walker malformation	**4**	**12.90**
Anencephaly	**3**	**9.67**
Acrania	**3**	**9.67**
Encephalocele	**3**	**9.67**
Microcephaly	**2**	**6.45**
Arnold Chiari syndrome	**1**	**3.22**
Inferior vermal agenesis	**1**	**3.22**
Holoprosencephaly	**1**	**3.22**
Muscloskeletal anomalies	**(n=22)**	
Talipes	**8**	**36.36**
Omphalocele	**4**	**18.18**
Micromelia	**4**	**18.18**
Kyphoscoliosis	**3**	**13.63**
Diaphragmatic hernia	**3**	**13.63**
Pierre Robin syndrome	**1**	**4.54**
Amelia	**1**	**4.54**
Gastrochiasis	**1**	**4.54**
Hand and leg anomaly	**1**	**4.54**
Clinched hands	**1**	**4.54**
Cardiovascular anomalies	**(n=11)**	
Single umblical artery	**3**	**27.27**
Cardiomegaly	**2**	**18.18**
Congenital heart block	**2**	**18.18**
AVSD	**1**	**9.09**
ASD	**1**	**9.09**
Left ventricle hypoplasia	**1**	**9.09**
Truncus arteriosis	**1**	**9.09**
Tetralogy of fallot	**1**	**9.09**
GIT anomalies	**(n=3)**	
Illial obstruction	**1**	**33.33**
Esophageal atresia	**1**	**33.33**
Choledochal cyst	**1**	**33.33**
Genital anomalies	**(n=3)**	
Cloacal malformation	**2**	**66,67**
Hydrocele	**1**	**33.33**
Facial anomalies	**(n=7)**	
Unilateral cleft lip	**4**	**57.14**
Cleft palate	**3**	**42.85**
Bilateral cleft lip	**2**	**28.57**
Small low set ear	**1**	**14.28**
Anophthalmia	**1**	**14.28**
Proboscis	**1**	**14.28**
Respiratory anomalies		
Congenital adenomatiod malformation	**1**	**50.00**
Hydrothorax	**1**	**50.00**
Others	**(n=18)**	
Hydrops	**12**	**66.66**
Cystic hygroma	**3**	**16.66**
Ascites	**2**	**11.11**
Situs inversus fetalis	**1**	**5.55**
Scalp edema	**1**	**5.55**

N.B. Number is not mutually exclusive because that some fetuses had multiple congenital anomalies.

Table (4) Distribution of Pregnant Women According to Risk Factors for Congenital Anomalies

Characteristics	Freq	%
Hereditary factors		
Consanguinity (n=100)		
Positive consanguinity	44	44
Negative consanguinity	56	56
Family history of congenital anomalies (n=100)		
Yes	17	17
No	83	83
Family history of mental retardation (n=100)		
Yes	16	16
No	84	84
Previous fetus with congenital anomalies (n=100)		
Yes	19	19
No	81	81
Drugs and chemicals		
Consuming drugs during pregnancy (other than vitamins and calcium (n=100)		
Yes	33	33
No	67	67
Types of drugs (n=33)		
Antibiotics	12	36.36
Progesterone	8	24.24
Unknown	5	15.15
Marivan	2	6.06
Aspocid	2	6.06
Analgesics	8	3.03
Inderal	5	3.03
Insulin	2	3.03
Calheparin	12	3.03
Time of drug intake (n=33)		
1st trimester	27	81.81
2nd trimester	6	18.18
Physical factors		
Live near industrial source (n=100)		
Yes	21	21
No	79	79
Type of industrial source (n=21)		
Mobile network	15	71.42
Cement factory	4	19.04
Aluminum factory	1	4.76
textile factory	1	4.76
Infectious agent		
Exposure to infection during pregnancy (n=100)		
Yes	22	22
No	78	78
Common cold	16	72.72
Unknown	3	13.63
CMV	1	4.54
UTI	1	4.54
Vaginal infection	1	4.54

4. Discussion

Congenital anomalies are an important cause of perinatal morbidity and mortality and account for 20-30% of perinatal deaths all over the world. This research explores the risk factors which may lead to fetal congenital anomalies. Results of this research will be discussed in two parts: - risk factors which may lead to fetal congenital anomalies and the most common type of congenital anomalies

Risk Factors Which may Lead to Fetal Congenital Anomalies

Findings of this research revealed that, the pregnant women's age ranged between 17-44years with a mean of 26.52 ± 5.48 years. Similarly, **Tootoonchi** (2003) [13], who studied the prevalence and risk factors in Tehran, reported that, maternal age range was 14-44years with a mean of 25.69 ± 5.54 years. Less than one fourth of the pregnant women's were less than 20 years, and less than one fourth of the pregnant women's were above 30 years. In congruent with our study, **Croen and Shaw** (1995) [14] stated that, the overall prevalence of all congenital anomalies across the age distribution was shown as a J shape, with pregnant women aged 20–29 years having the lowest prevalence, teenage pregnant women having an intermediate prevalence and pregnant women more than 40 years old having the highest prevalence. Moreover, **Tomatir *et al.,*** (2008) [15] who studied major congenital anomalies in Turkey found that, less than one tenth of the mothers were adolescence and also less than one tenth were older mothers.

Focusing on Medical disorder, less than one fourth of the pregnant women had medical disorders, about one half of them had cardiac disease, less than one fourth had diabetes mellitus, and less than one fifth of them had hypertension. Similarly, **Tootoonchi,** (2003) [13] in his study reported that, among chronic maternal illnesses, about one fourth had heart diseases, hypertension accounted for about one fourth and diabetes were the most frequent illnesses and constituted about two third. Some of these disorders are known to be risk factors of congenital anomalies such as diabetes as mentioned by Martina et al., (2009)[16] in their study about obstetric and perinatal outcome in type 1 diabetic pregnancies reported that, in the diabetic group, there was a twofold increase in the incidence of major malformations.

Regarding complications during previous pregnancies, the result of this research revealed that, about half of the pregnant women experienced complications during previous pregnancies, more than one half of them experienced abortion. In congruent with our research **Tootoonchi,** (2003) [13] and **Tomatir *et al.,*** (2008) [15] found that, about one fourth of their samples has positive history of abortion. About one third of the pregnant women were gravida one and one third were gravida two. In the same line, **Neelu and Avinash,** (2006) [17] found that, in their study more than one third of the pregnant women were gravida one and one third were gravida two. This result means that, congenital anomalies occurred more frequently in first and second pregnancies. ***Regarding to complications occurred during the present pregnancy***, more than one tenth of the pregnant women experienced complications during current pregnancy, a high percentage of them were suffering from bleeding in early pregnancy, and this result is matched with the study of **Tootoonchi,** (2003) [13] . He reported that, diabetes, preeclampsia and vaginal bleeding emerged as the commonest maternal gestational illnesses.

Concerning hereditary factors, our research found that, less than one half of the malformed fetuses were born of consanguineous marriages, this illustrating the deleterious effects of consanguinity because it favors the reemergence of recessive deleterious alleles that run in families. Similarly, **Neelu and Avinash,** (2006) [17], reported that, slightly less than one fourth of malformed babies were born of consanguineous marriages. Also, **Tomatır *et al.,*** (2008) [15] who studied major congenital anomalies in Turkey reported that, among the infants with major anomalies, less than one fourth were from consanguineous marriages. This difference in percentage may be explained by the sample size and cultural background. In our research less than one fourth of the pregnant women had a family history of congenital anomalies, and less than one fourth of the pregnant women had a previous child with a congenital anomaly. This may be explained as autosomal recessive anomalies that run in families. Similarly, **Temtamy *et al.,*** (1998) [3] in their study reported that, less than one tenth of his sample had a history of affected relatives of the same or different condition. Moreover, **Tootoonchi,** (2003) [13] found that, less than one tenth of his sample had a positive history of congenital anomalies in siblings.

Regarding chemical factors, about one third of the pregnant women took medications during the present pregnancy; large percentage took the medications during the first trimester. In contrast, **Tootoonchi,** (2003) [13] found that, 2.75% had positive history of drug ingestion during pregnancy. *Focusing on maternal smoking*, slightly less than half of the pregnant women were passive smokers. Smoking is considered a risk factor for CA as mentioned by Scott, et al., (2009). [18] In their study they compare the infants of a smoker and a non smoker mothers in relation to congenital anomalies and they found that, the offspring of smokers had a 56 percent increase in the frequency of cardiovascular anomalies when

compared with those born to nonsmokers. *Regarding to paternal smoking*, more than one half of husbands were active smokers. In congruent with our study, **Zhang *et al.,*** (2009) [19] carried out a case-control study of paternal smoking and birth defects. They reported that, paternal smoking was associated with a 2.1- fold increase of anencephaly; 3.3 times to have pigmentary anomalies of the skin, and 2.3 times to have a diaphragmatic hernia. Increasing risk among the heavier smokers was apparent for spina bifida, nasal bone absence, varus or valgus deformities of the feet, and diaphragmatic hernia.

Regarding to physical factors, less than one fourth of the pregnant women live near industrial sources, a higher percentage of them were living near mobile network and textile industry. In the same line, **Baldo *et al.,*** (2008) [20] conduct a matched case-control approach to assess the risk for anencephaly after the maternal environmental exposure to organic solvents released by textile industries in five counties of Argentina, reported that, a low and non significant risk for anencephaly when the maternal place of residence is closed to textile industries. We suggest that, find a significant association between environmental exposure and risk for congenital anomalies is quite difficult due to multiple confounders such as unspecific contaminants exposure, unspecific dose and time of exposure during pregnancy.

Concerning infectious factors, around one fourth of the pregnant women had a history of exposure to infections during the current pregnancy. Regarding to the types of infection more than two third of them had common cold, and small percentage of them had cytomegalovirus and urinary tract infection. CMV is known to be a cause of some types of congenital anomalies. This result supported byGolalipour, et al., (2009), [21] they carried out cross-sectional study to explore the frequency of contamination with TORCH agents in neonates with congenital malformations in a referral centre in Gorgan city, Islamic Republic of Iran. They found that, about two third of neonates with congenital malformations and two third of mothers were positive for CMV IgG antibody. In congruent with our results, **Czeizel *et al.,*** (2007) [22] they conducted a case control study about high fever–related maternal diseases as possible causes of multiple congenital abnormalities reported that, an association was found between a higher risk for congenital anomalies and high fever–related influenza, common cold with secondary complications, tonsillitis, and recurrent orofacial herpes. Also, **Bánhidy *et al.,*** (2006) [23] carried out a case control study about maternal urinary tract infection and related drug treatments during pregnancy and risk of congenital abnormalities in the offspring. They reported that, there is no any association between UTI and related drug treatments in the second and/or third month of gestation and any congenital anomaly group including atrial septal defect. On the other hand, **Wilson *et al.,*** (1998) [24] evaluated the attributable fractions for eight different cardiovascular anomalies in the Baltimore-Washington and reported that, there is a relation between maternal urinary tract infection and atrial septal defect. Also, **Tootoonchi,** (2003) [13] found that, urinary tract infection account about two third of maternal gestational illnesses.

II- The most common type of congenital anomalies

In our research single congenital anomaly constituted about two third of the total anomalies, and one third were multiple anomalies. These results are similar to those of **Tootoonchi,** (2003) [13] that carried out in Iran and revealed that, about two third of the fetuses had single congenital anomaly and one third had multiple congenital anomalies. In contrast, **Al-Gazali *et al.,*** (2009)[25] who studied the profile of major congenital abnormalities in the United Arab Emirates found that, slightly more than one half of the sample had multiple malformations, and slightly less than one half had involvement of a single system.

In our research the most common congenital anomalies incountred were renal anomalies constituting more than one third of the fetuses, followed by central nervous system anomalies constituting about one third of the sample, and muscloskeletal anomalies constituted one fifth of the sample. In contrast of our study Malta congenital anomalies registry, (2002) [12] reported that, the most commonly encountered group of anomalies was congenital heart defects constituted slightly more than one third. The next most frequently encountered group of anomalies were limb defects and defects of the external genital system together accounted for one third of all anomalies registered. Moreover, **Jehangir *et al.,*** (2009) [26] studied the prevalence of congenital anomalies, they reported that, the most common anomalies were central nervous system, cleft lip and cleft palate, musculoskeletal system, and gastrointestinal tract. This discrepancy between our result and result of other studies may be explained by the difference of samples size, geographic location, associated risk factors, availability and variability of diagnostic procedure and equipment and availability of trained obstetricians.

In conclusion, the most common congenital anomalies were renal system, central nervous system, and musculoskeletal system anomalies. Positive consanguinity, family history for congenital anomalies, consuming drugs during pregnancy, and living near industrial source were the most common risk factors for congenital anomalies.

Recommendations

Based on the findings of this research the following recommendations are suggested:

1- Premarital examination for consanguineous marriages should be encouraged.

2- Antenatal care is very important for suspecting and early detection of congenital anomalies.

3-Educational programs should be established in order improve the nurses' knowledge about the prevalence and risk factors for congenital anomalies.

4-Further studies are needed to investigate the risk factors for each system anomaly.

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