

# Prenatal and Postnatal Detection of Fetal Structural Defects by Abdominal Ultrasound and Physical Examination in Azadi Teaching Hospital in Kirkuk City

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## Abstract:

**Background:** The prevalence of birth defects increased abruptly in recent years especially in Iraq. The etiology may be related to either genetic or environmental factors.

**Material & Method:** In this cross sectional study that is conducted in Azadi Teaching Hospital in Kirkuk city in Sonographic unit & delivery room. A total of 1814 prenatal fetuses and postnatal newborns with their mothers were involved in this study. All the fetuses or newborns were examined for search of different fetal structural defects.

**The aim of the study:** Was to identify the prevalence of fetal structural defects among pregnant women who attending Azadi Teaching Hospital.

**Results:** Neurological defects were the most frequent detected anomaly (58.8%) followed by skeletal defects (15.4%), (10.3%) for hydropsfetalis, (7.7%) for urinary system defects, (7.7%) for cystic hygroma and only (5.1%) for facial defects. The anomaly detection rate by trans-abdominal ultrasound was (1.9%) during 2nd and 3rd trimesters, and postnatal diagnosis by physical examination was (2.5%).

**Conclusion:** The following factors were found to involve in the etiology of fetal structural defects; family history of congenital anomalies, maternal age, multigravidas mothers, taking tonics and supplements during pregnancy, smoking, living in rural areas finally socioeconomic status.

**Keywords:** Fetal structural defects, Abdominal ultrasound, Physical examination.

## Introduction:

Having a baby is the most joyous event in any family. Every parent wants their child to be healthy and to grow up and be successful in his or her life. For this to happen parents need to know how to create a healthy environment for their baby even before he or she is born.

Birth defects are major health problems. Primary prevention is at present emerging i.e. folate supplement<sup>(1,2)</sup>.

Broadly speaking, all pregnancy losses and birth defects are result either of genetic abnormalities in the fetus, environmental factors, or both of them<sup>(3)</sup>.

The environmental factors can be the result of suboptimal conditions for fetal growth and development as consequence of inadequacy or abnormality of the mother reproductive system, or the result of exposure of the fetus to an environmental insult such as infectious agent or drugs<sup>(4,5)</sup>.

Recently, it is well known that several kinds of structural defects of the fetus can be identified by ultrasonography examination performed using high-resolution equipment<sup>(6,7)</sup>.

Moreover, increasing evidence shows that early detailed ultrasonography is technically feasible as screening test for fetal structural defects in low risk pregnancies<sup>(8)</sup>. For example, for severe fetal structural malformation like anencephaly, the evaluation should be performed early in pregnancy (1st and 2nd trimesters) to allow pregnancy termination to be considered.

Since our country exposed to many wars during the last three decades, when different weapons had been used especially chemical weapons and Uranium. On the other hand, the pregnant who are using different drugs especially drugs which no adequate and well controlled studies during pregnancy, lead to increase in the number of cases of birth defects during this period, so this motivates us to such study.

### **Objectives of the study:**

- 1- To identify the prevalence of fetal structural malformations among pregnant women during 2nd & 3rd trimesters in Kirkuk city.
- 2- To recognize the common type of birth defects during 2nd trimester, 3rd trimester, and immediately or soon after birth.
- 3- To determine the common factors which cause the fetal structural defects.
- 4- To determine the gestational age in which the structural defects or malformations can be detected at time of scan.
- 5- To evaluate the prenatal and postnatal diagnosis of fetal structural defects by abdominal ultrasound scan and by physical examination.
- 6- To detect early any severe and uncorrectable malformations which may need termination of pregnancy.

### **Patients and Methods:**

This cross sectional study was conducted in sonography unit and delivery room at Azadi Teaching Hospital in Kirkuk city over 10 months period extended from October 2013 till July 2014.

A total of 1814 prenatal fetuses and postnatal newborns (preterm and full term) which their mothers randomly collected in this study; all fetuses or newborns were examined for search of different fetal structural defects. Only 39 cases (2.15%) out of 1814 which were diagnosed for different fetal structural defects were taken in consideration. The 1106 prenatal fetuses were evaluated during 2nd and 3rd trimesters by abdominal ultrasound scan. Postnatal babies (708) were evaluated by physical examination immediately or soon after birth the 1st 24 hours.

Information about infants' mothers: age, gestational age, gravidity, parity, abortion, occupation, location of living, level of education, level of socioeconomic status, using solvents and cosmetic chemicals, family history for birth defects, medical history, drug history, exposure to radiation, hot areas of war, tonics taken in the 1st trimester, smoking cigarettes, drinking alcohol, movement of the fetus, last menstrual period, and regularity of antenatal care visits were asked through well designed questionnaire.

The methods involved in this study for investigation were:

- 1- Trans-abdominal ultrasound scan for pregnant ladies, for seeking of fetal life, fetal number, fetal activity, amniotic fluid volume, and assessment of gestational age.

Then systemic examination of the fetus was done by examination of every part of the fetus from top to bottom as possible, including:

- a- Cerebral ventricles
  - b- Cerebral hemispheres
  - c- The skull bone
  - d- Posterior fossa (including cerebellar hemispheres and cisterna magna)
  - e- Views of spines
  - f- The ribs and the lungs with pleurae
  - g- The peritoneum if fluid collected
  - h- Kidney and urinary bladder
  - i- Fetal umbilical cord insertion site
  - j- Determination of intactness of anterior abdominal wall
  - k- Four chamber view of the heart.
- 2- Physical examination: general examination was done for the newborns to find structural abnormalities.
- a- Inspection
  - b- Palpation
  - c- Percussion
  - d- Auscultation

In this study all the infants' mothers were informed about the purpose of study.

All the data was managed statistically using frequency distribution, cross tabulation and Chi square test.

P-value<0.05 was considered statistically significant.

### **Results:**

The total number of Median gestational age of the infants at the time of ultrasound scan was 32 weeks, whereas median gestational age for infants at time of birth was 36 weeks, table (1). The mean age of the mothers subjects of normal and abnormal babies were 28.2 and 34 years old respectively.

Most of the mothers of the abnormal babies were more than 36 years old (58.4%), figure (1).

The male to female ratio in the fetal structural defects was 1:1.17, but with no statistical relationship between the sex of the baby and developing fetal abnormalities, table (1).

The anomaly detection rate by abdominal ultrasound scan was (1.9%)

during 2nd and 3rd trimesters, and postnatal diagnosis by physical examination was (2.5%).

Neurological defects were the most frequently detected anomaly (53.8%), followed by detection of skeletal defects (15.4%), (10.3%) for hydropsfetalis, (7.7%) for urinary system defects, another (7.7%) for cystic hygroma, and only (5.1%) for facial defects, figure (2). Regarding family history of congenital anomalies and maternal illness in the congenital abnormal babies' families were noted in (41.02%) and (33.33%), respectively, figure (3).

Most of cases of fetal structural defects mothers were multigravidas, 5 pregnancies and more (53.8%) with statistical significance, figure (4).

The majority of the mothers of the cases of the structural defects were not taking tonics during the 1st trimester (76.9%). In total of 39 mothers of congenital abnormal babies only 6 cases (15.4%) were taking tonics in the first trimester regularly, 3 cases were taking it irregularly, while majority 30 cases (76.9%) were not taking it, figure (5). In normal babies' mothers (1775), 682 cases (38.4%) were taking tonics irregularly and 820 cases (46.2%) were not taking any tonics in the first trimester of pregnancy.

The number of fetal structural defects of women who were taking tonics during pregnancy were significantly and statistically lower than those who were not taking it (p value >0.001).

Regarding to maternal drug history during pregnancy, the frequency of taking drugs by mothers of congenital abnormal babies were recorded in 19 cases (48.7%), but in 20 (51.3%) of the abnormal babies were not, figure (6).

Regarding exposure to radiation only 6 cases of fetal anomalies mothers were

exposed to radiation (15.4%) but still there is statistical different, figure (7).

The majority of the cases of fetal anomalies mothers, their attending to the antenatal care units was irregularly (79.5%), with regard smoking, only (18%) of mothers of infants with birth defects were heavy smokers and (25.6%) were light smokers but still there is statistical significance, figure (8).

The majority of cases of fetal structural defects families were living in rural areas (61.5%).

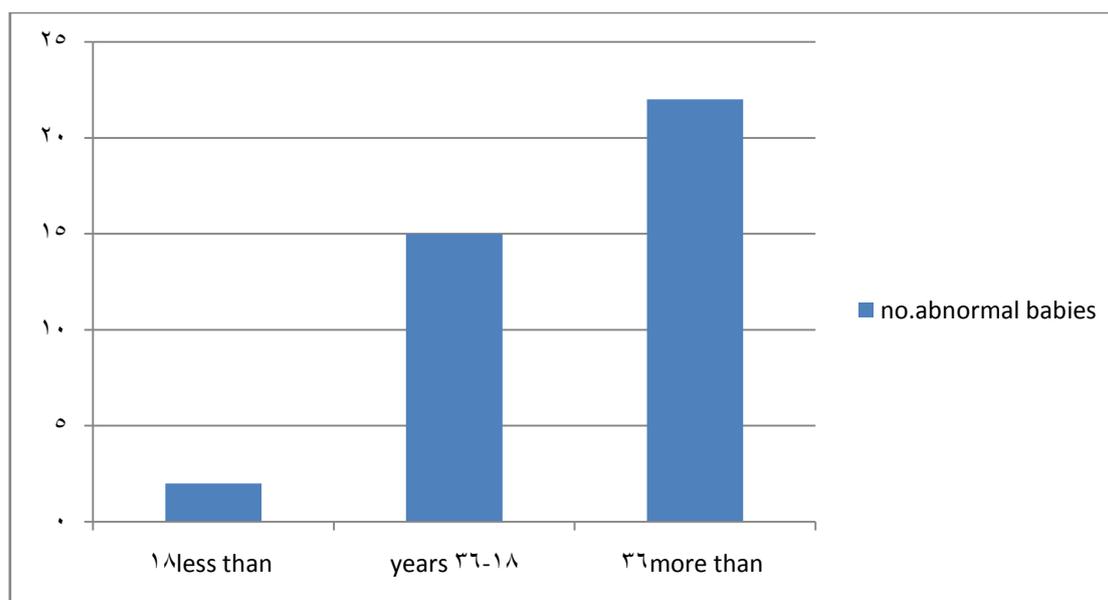
In this study most of abnormal defects' families were low socioeconomic status (56.4%), with a significant relationship between developing fetal structural defects and educational status and socioeconomic status of their mothers, figure (9).

There was no statistical relationship between developing fetal structural defects and their mothers' exposure to different kinds of daily used solvents in which (79.5%) of the structural defected babies were using different types of solvents, while (88.2%) of normal babies mothers were using solvents, statistically there is no significant difference between the two groups in relation to using solvents (p value is >0.05%).

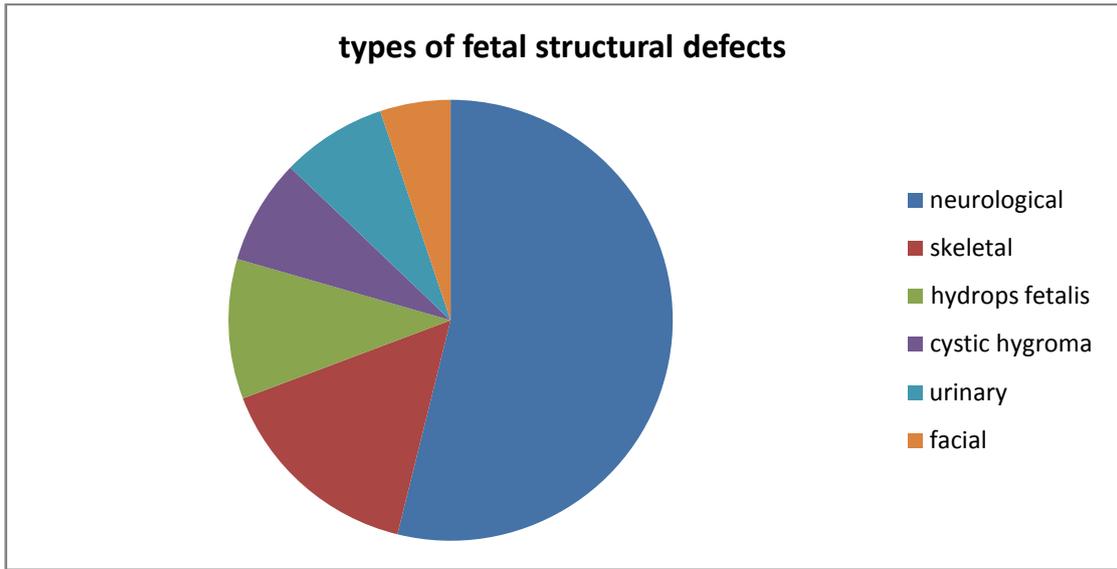
In this study, (66.7%) of cases of fetal structural defects mothers who were living in hot areas of war (according to recent military situation in Kirkuk governorate), and (53.7%) of normal babies mothers were living in hot areas of war, statistically there is no significant difference between the two groups in relation to their living in hot areas of war (p value >0.05%).

**Table (1):** The median gestational age (pre& post) natal of the infants involved in this study.

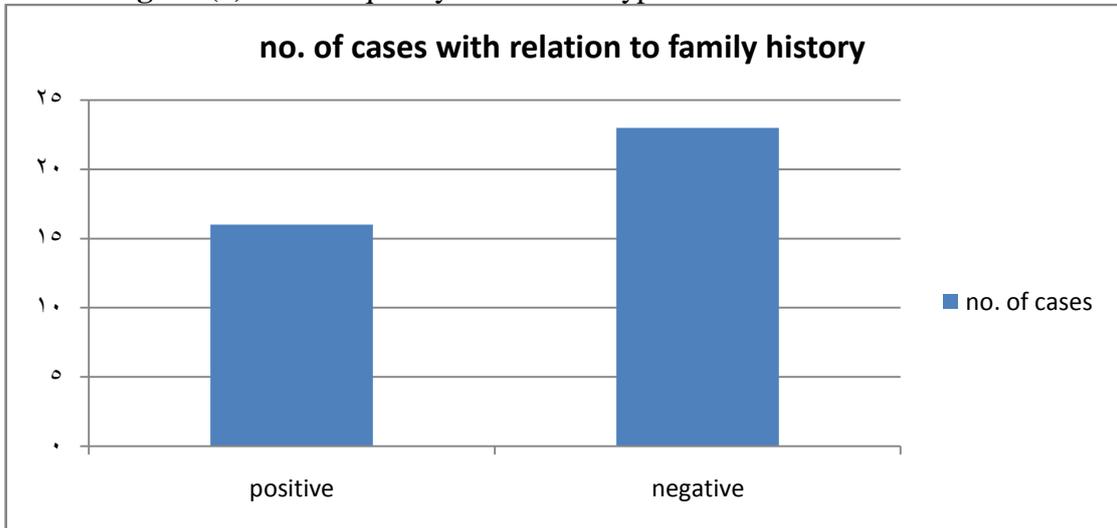
Type of scan	Number	Structural birth defects	Incidence regarding to sex Male female unknown	Median gestational age
prenatal	1106	21	9 10 2 42.9% 47.4% 9.5%	32 wks
postnatal	708	18	8 10 zero 44.4% 55.6% 0%	36 wks
Total	1814	39	17 20 2	



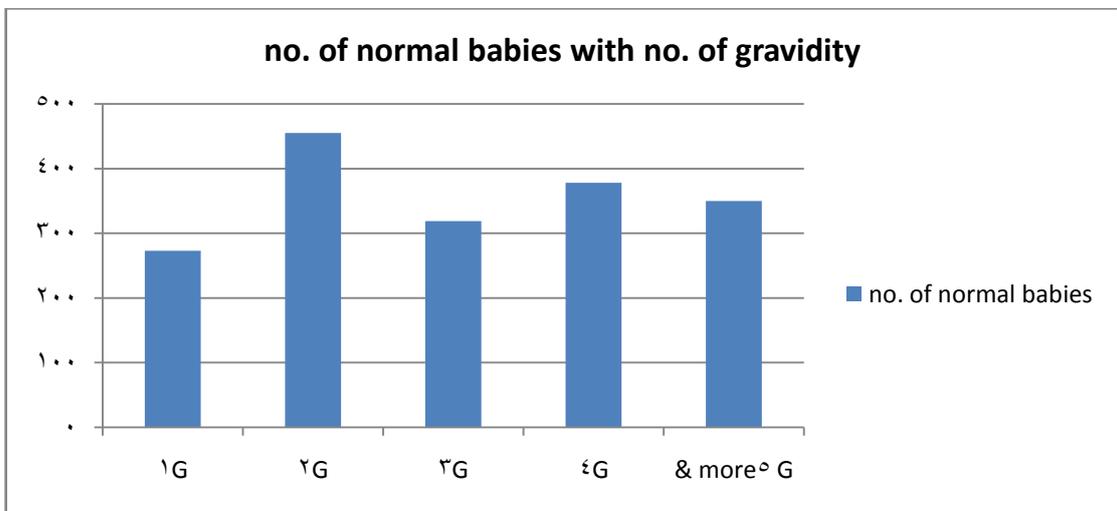
**Figure (1):** The number of abnormal babies in relation to their mothers' age.



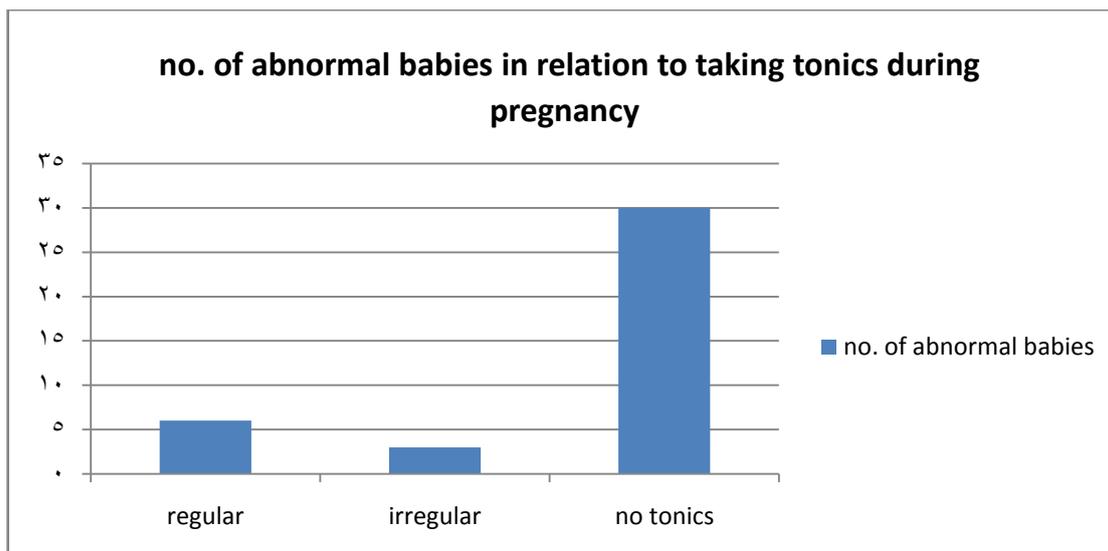
**Figure (2):** The frequency of different types of fetal structural defects.



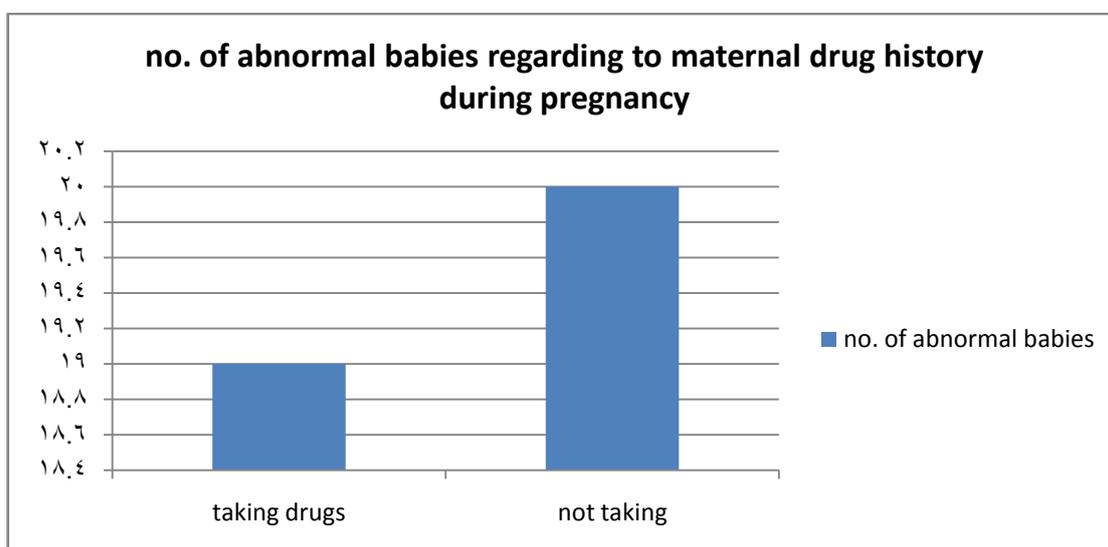
**Figure (3):** The relation between family history & birth defects.



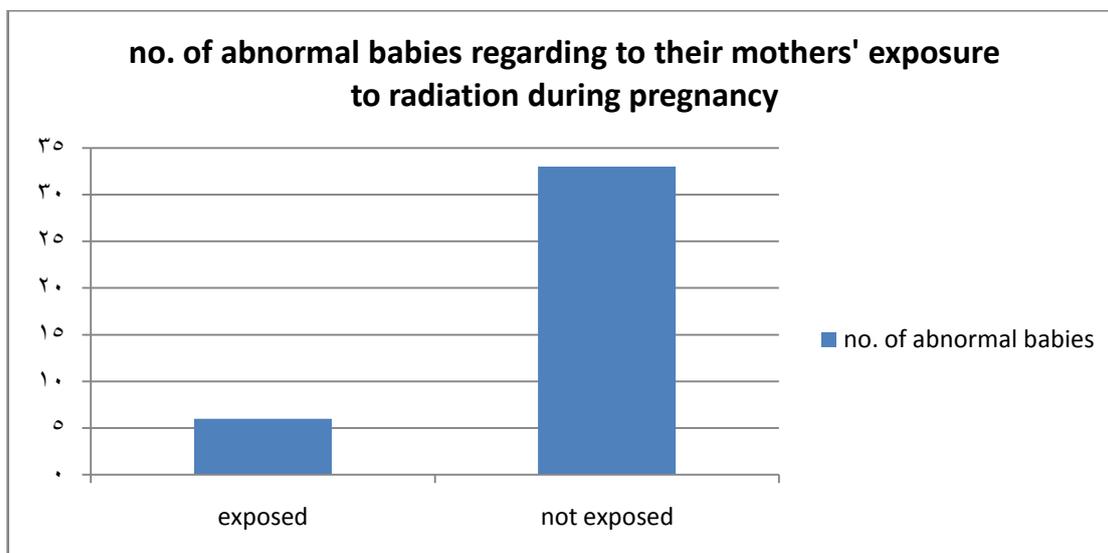
**Figure (4):** The relation between number of pregnancies (gravidity) & birth defects



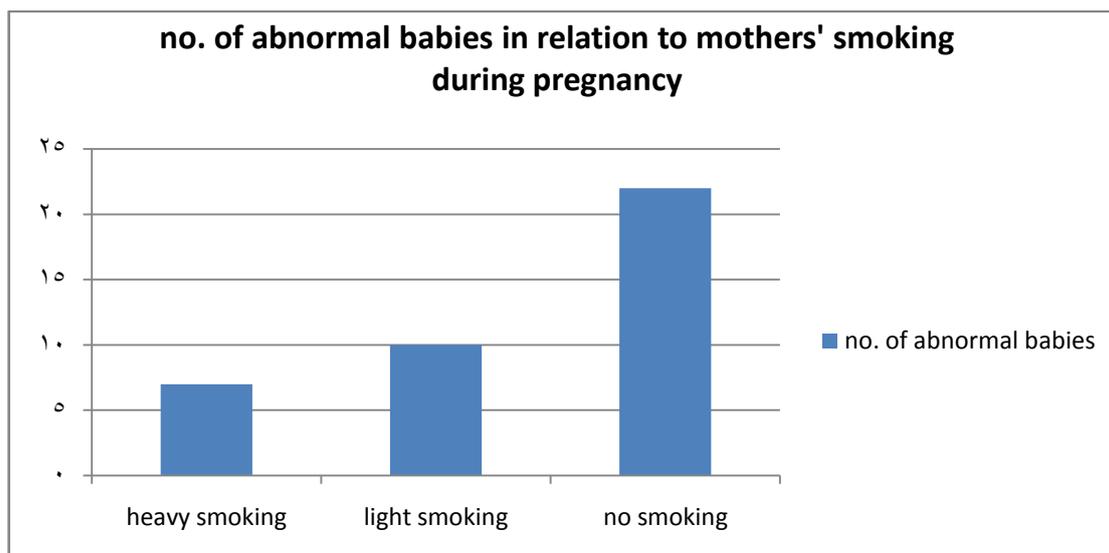
**Figure (5):** The effect of taking tonics on having abnormal babies.



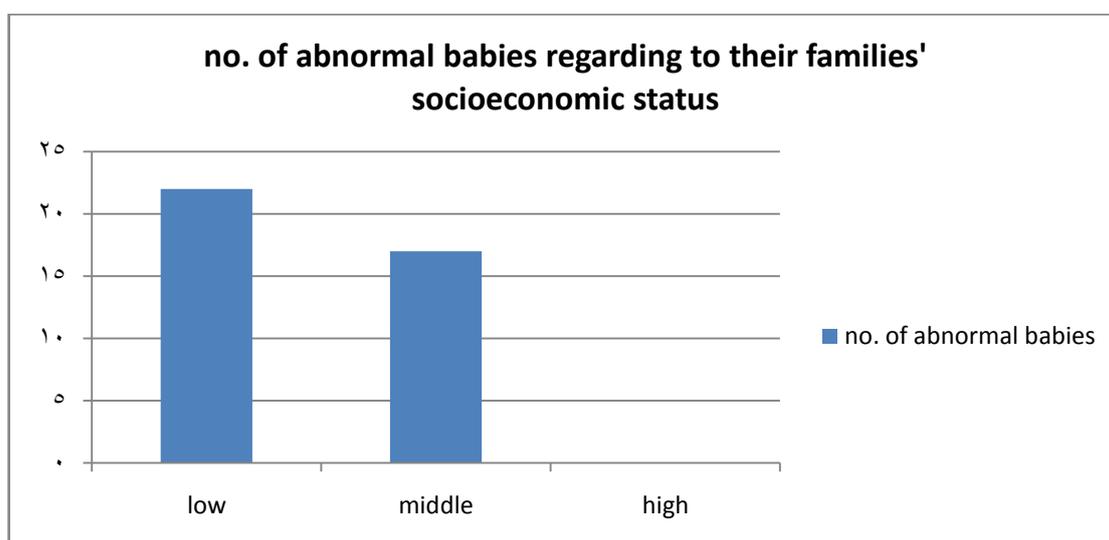
**Figure (6):** The number of birth defects in mothers that were taking drugs during pregnancy.



**Figure (7):** The number of birth defects in radiation exposed mothers.



**Figure (8):** The number of abnormal babies in smokers & non smoker's mothers.



**Figure (9):** The relation between socioeconomic status & having abnormal babies.

### **Discussion:**

In this study, out of 1814 pregnant ladies, only 39 cases of fetal structural defects were diagnosed with a detection rate of (2.15%) using two types of scan: the first was prenatal by using trans-abdominal ultrasound scan for pregnant ladies at 2nd and 3rd trimesters during antenatal care visits and 2nd was postnatal by physical examination at time of birth. The detection rate for the prenatal was (1.9%) (21 cases out of 1106) and detection rate for postnatal was (2.5%) (18 cases out of 708) where there was no statistical difference

between the two scans (P- value=0.35 which is  $>0.05$ ), this means that the ultrasound scan is affective as physical examination in detecting fetal structural disorders.

The results of this study are compatible with other investigators, Fong et al, Liao Y et al, and Malhotra N et al. <sup>(9, 10, 11)</sup> suggested that ultrasound is sensitive in detecting fetal structural defects. Bethune M et al., Verroti C et al. and Carvalho et al. <sup>(12, 13, 14)</sup>; in their studies reported that a 2nd trimester

ultrasonography examination has a major role in prenatal detection of fetal anomalies and should not be abandoned. The detection rate in our study was (2.15%) which is lower than that of (Wargowski D<sup>(15)</sup>), who gave detection rate of (3.7%), and much lower than that of Dunn et al.<sup>(16)</sup> where detection rate over all birth defects was ranged from (5.49-5.75%) over the 5 years of their study, and also lower than that of Carvalho et al<sup>(14)</sup> whose detection rate of congenital anomalies during pregnancy was (4.6%). But our detection rate was higher than a study done in Mosul by Taboo Z A<sup>(17)</sup> which was only (0.69%) of births.

These variable findings indicate that there is a wide range of detection rate of fetal structural defects many factors such as the area of diagnosis, skill of the examiner, due to differences in the gestational ages of the time of scanning, incidences of particular abnormal findings in study population, and on the knowledge of sonographers to recognize the structural abnormalities<sup>(18)</sup>.

The mean age of the fetal structural defect fetuses' mothers was 34 years, while the mean age of normal fetuses was 28.2 years old. The finding of this study disagrees with the result of Lennon CA and Gray DL<sup>(19)</sup>, they reported that the mean maternal age was 28.1 years for congenital disordered fetuses, also disagree with that of the study done by Guariglia L and Rosati P<sup>(20)</sup> in which their mean maternal age of the abnormal fetuses was 29.5 years old. These differences between studies may be due to that some countries have a national policy and regular center of birth defects to all pregnant women.

The maternal age of abnormal babies in this study was (5.1%) of the mothers of less than 18 years old, (38.5%) of these

of 18-36 years old, and (56.4%) for the mothers of more than 36 years old, the study showed that there is a significant relationship between maternal age and fetal congenital anomalies, this result is go on line with Reichmann NE and Pagnini DL<sup>(21)</sup> who suggest that the oldest mother >40 years being at high risk than younger age group, the same results of Goetzinger K et al.<sup>(22)</sup>.

Dallaire L<sup>(23)</sup> reported that women who are 35 years old and more have a high risk of giving birth to an infant with congenital anomalies especially chromosomal disorders as 1/2000 women at 20 years have a risk of having birth defect, 1/1200 at 25 years old, 1/400 35 years old and 1/100 at 40 years old, this is due to part of ovum aging. Taboo Z A<sup>(17)</sup> in Mosul reported that the percentage of abnormalities increased significantly at age (20-40) years (34.98%) but there was a non-significant decrease in the remaining group ages. While Dunn R et al.<sup>(16)</sup> & Marwah A<sup>(24)</sup> suggested that the overall risk of birth defects is increased at both ends of the maternal age spectrum, highest for infants of mothers aged 40 plus, but also elevated for mothers less than 25 years old.

In this study we found that there is a significant relationship between family history of congenital anomalies and having a baby with congenital anomalies. This finding also approved by Dallaire L, Brent RL, Romitti PA & Dupepe E et al.<sup>(23, 25, 26, 27)</sup> who found that the risk of having a baby with birth defects increased by having a family history of such diseases especially, for neural tube defects. However, the result of this study was less than that reported by Guariglia and Rosati<sup>(20)</sup> in which family history was positive in only (1.2%).

Taking drugs by mothers during pregnancy have been proven by this study to have effect on developing fetal structural defects, this phenomena also showed by other studies <sup>(16, 25, 28)</sup>. Drugs can cause fetal death or damage at any stage of pregnancy. Anticancer drugs, for example can cause inhibition of cell replication. B Blockers may cause general retardation of growth <sup>(29)</sup>. Another example, drugs related to vitamin A produce physical and mental defects (2), and drugs that interfere with folate metabolism are teratogenic, with folate supplement reducing the incidence of abnormalities like antiepileptic drugs such as phenytoin and valproate when taking during pregnancy may lead to folate deficiency because it interferes with folate metabolism pathway <sup>(1,30)</sup>.

In this study, most of the abnormal fetuses are from mothers who didn't take supplements like folic acid during pregnancy. Recently many studies investigate the effectiveness of taking folic acid before and during the 1st trimesters of pregnancy and its preventive effect in developing neural tube defects. Czeizel A and Dudas I <sup>(31)</sup> & Imbard A et al. <sup>(32)</sup> showed that (50-70%) of neural tube defects can be prevented by taking adequate folic acid intake before and during pregnancy. Hernandez-Diaz S <sup>(33)</sup> and Al whaibi M et al. <sup>(34)</sup> indicated that adequate folic acid intake may also reduce the risk of other birth defects, including oral cleft lip and palate, and congenital heart and urinary tract defects. Dunn et al. <sup>(16)</sup> and Chitayat D et al. <sup>(35)</sup> found a significant decline in birth prevalence rate of spina bifida and hydrocephalus, but not anencephalus, when pregnant women were taking folic acid associated with fortification of grain products. Bourouba R et al. <sup>(36)</sup> shows the majority of their

cases about (86%) of neural tube defects' mothers didn't take pre-conception supplements with folic acid.

Cigarettes smoke contains a number of potential teratogens which are fetotoxic, in this study, the heavy smoking mothers was noted in (18%) of congenital abnormal babies mothers, (25.6%) of them were light smokers and (56.4%) of them were not smokers while among the normal infants' mothers only (5.1%) of them were heavy smokers, the same result noted by Stoll et al. <sup>(37)</sup> who suggests that smoking during pregnancy contribute to different birth defects mainly cleft lip and cleft palate, there are many studies around the world that have the same point of view Mund M et al. <sup>(38)</sup> & Nicoletti D et L. <sup>(39)</sup> also shows the relationship between maternal smoking during pregnancy & having abnormal babies and this association is dose dependent.

Accommodation have a great role in the maintenance of healthy pregnancy, most of the cases of abnormal fetuses in this study were from families from rural areas, the same finding was noted by Dunn et al. <sup>(16)</sup>, who demonstrate a higher detection of congenital anomalies in rural areas than urban areas, these differences may be due to geographical features, water supply and background radiation.

Most pregnant women with fetal anomalies were those with low socio-economic status Reichman NE & Pagnini DL <sup>(21)</sup> also reported the same view, it has been proposed that increase fetal defects for example of central nervous system related to socio-economic status such as vitamin D deficiency associated with enamel hypoplasia, folate and vitamin C deficiency are associated with increased incidence of neural tube defects <sup>(32, 40, 41)</sup>.

## **Conclusion:**

- 1- The prevalence of fetal structural defects in Kirkuk study in this study was (2.15%) which is relative high and most of risk factors exist.
- 2- Since there are no risks in having an ultrasound scan therefore it appears to be an effective way to identify many congenital anomalies during pregnancy (2nd and 3rd trimesters), especially neurological defects.
- 3- An early detection of sever and uncorrectable fetal structural defects is important to decide about termination of pregnancy such as anencephaly in which in this study 7 of neurological defects were anencephaly diagnosed and 5 of them were diagnosed prenatally .
- 4- There is significant association between fetal structural defects and many factors such as maternal age, maternal illnesses, taking drugs during pregnancy, smoking during pregnancy.....etc.
- 4- Having a family history of congenital anomalies is a risk factor of having another baby with congenital anomalies.
- 5- Multigravidas (having 5 pregnancies and more), mothers with an age of more than 35 years and illiterate mothers have a higher detection rate among the others.
- 6- Taking tonics in the 1st trimester may play an important role in preventing the incidence of fetal structural defects.
- 7- The cause of most birth defects remains unknown, and most cannot be prevented, at this time.
- 8- Regular attending to the antenatal care for pregnant ladies is important to detect fetal abnormalities and furthermore for preventing its occurrence by giving supplements and tonics like folic acid and others.
- 9- There is no significant relationship between using solvents and living in hot

areas of wars with incidence of fetal structural defects.

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