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Research Article

Period Prevalence of Antenatally Diagnosed Congenital abnormalities; Single Center Study

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Abstract:

Objective: To find out the period prevalence of congenital malformation diagnosed in security forces hospital – Riyadh –kingdom of Saudi Arabia, during the study period from Jan 2012 till Dec 2014 and the possible associated risk factors.

Method: This is a retrospective chart review of all pregnant ladies who were following at security forces hospital – Riyadh – in the period between Jan 2012 till Dec 2014 in whom congenital abnormalities were diagnosed by ultrasound.

Results: out of 18748 scans done for 9374 patients during the study period, 283 cases of congenital abnormalities were diagnosed, which gives a period prevalence of 3.02 %. The majority -around 70% of these anomalies- involved one body system; out of them 31% were renal anomalies.

Conclusion: The period prevalence of congenital abnormalities in our study group is similar to that seen in other population worldwide. Strikingly enough, consanguinity in our population appears to play a major associated risk factor.

Keywords: congenital; anomaly; abnormality; consanguinity; preconception

1. Introduction

Congenital anomalies are also known as birth defects, congenital disorders, or congenital malformations (CM). Congenital anomalies can be defined as structural or functional anomalies (e.g., metabolic disorders) that occur during intrauterine life and can be identified prenatally, at birth or later in life [1].

A congenital anomaly can be defined also as: any abnormality of physical structure found at birth or during the first few weeks of life; or any irreversible condition existing before birth in which there is sufficient deviation in the usual number, size, shape, location of any part or organ to warrant its designation as abnormal [2,3]. Because congenital anomalies are considered among the most common causes of disability in developed and developing countries [3], it began to emerge as one of the major childhood health problems [4,5].

CM may be minor or major. A minor malformation is defined as a structural abnormality presenting at birth which has minimal effects on clinical function, but may have cosmetic effect e.g., pre auricular tag. On the other hand, a major malformation has a significant effect on function or on social acceptability e.g., ventricular septal defect and cleft lip.

Malformation can be categorized into three groups; single malformation, multiple malformations with recognizable patterns (syndromes) that are related by pathophysiology and result from a common etiology [6, 7,8].

Most of the congenital anomalies are of multifactorial causation. Purely genetic factors (chromosomes, single gene mutations) are believed to account for 15-20% of all congenital anomalies leaving up to 80% due to multifactorial inheritance or environmental exposures [9,10]. Risks factors like infectious agents, chemical compounds, radiation, use of medication, maternal metabolic diseases, multiple births, maternal life event stress, prematurity and occupational exposure are associated with higher risk of congenital disorders [6]. Furthermore, low schooling and low socioeconomic status in the population are other factors which are highly relevant [11]. Environmental exposure can have a preconception mutagenic action or a post-conception teratogenic action [12]. Deficiency of folic acid and other

nutrients such as vitamin B1 in the periconceptional period are established risk factors for neural tube defects [13,14].

The danger of anomalies is increasing in old women pregnancies and in pregnancies which are not monitored. The abnormal intrauterine environment is regarded as another cause for impaired fetal development [14].

The role of environmental pollutants, drugs, and infectious agent in the causation of congenital defects is a major global concern. However, the underlying causes for most congenital anomalies remain obscure and multifactorial causation is believed to be the underlying cause for most congenital anomalies [15]. Among the most common preventable strategies is folate supplementation during periconceptional period and in the first trimester for the prevention of neural tube defects. In some developed countries food fortification with folic acid significantly reduced the incidence of neural tube defects. The incidence of congenital malformation is much higher in the low-birth-weight neonate and consanguineous than non-consanguineous marriages [16].

Consanguineous marriages are regarded an important factor contributing to increased congenital malformations, recessive gene may thus come to light for the first time in an in bred descendant after being hidden for generations. For this reason, consanguinity influences the incidence of some inherited diseases [17]. Because of high consanguinity rates within the Muslim population, the incidence of congenital abnormalities in some Islamic countries is between 10 -45 % [18]. The high rate of consanguinity marriages in Saudi Arabia compared to the developed countries necessitates recognition of the prevalence and pattern of these anomalies in order to take the appropriate steps in prevention and management, thereby reducing the disease in society [19].

The registration and monitoring of the type and number of congenital anomalies is vital to identify possible clusters and trends, and to address concerns about recognized environmental teratogens. Early prenatal diagnosis of congenital anomalies is crucial for early counseling, intervention and possible fetal therapy [20].

In dealing with such a concerning issue, some preventive measures are available which can be classified as primary and secondary. Primary prevention involves folic acid supplementation, maternal disease prevention by vaccination, especially against Rubella and chickenpox. Secondary prevention is targeted at early antenatal detection followed by termination of affected pregnancies, but this involves social, legal and religious issues [21]. Reported prevalence of major congenital malformation in different population around the world has shown considerable variation and ranges from less than 1% to up to 8 %. [22, 23, 24, 25, 26, 27, 28, 29, 30]. Among those, about 3% in Unites states, 2.4%in the India, and 2% to 3% United Kingdom [23]. The most prevalent conditions include congenital heart defects, orofacial defects, Down syndrome, and the neural tube defects. By routine prenatal ultrasound during the antenatal period, approximately half of the diagnosed fetal malformation were abnormalities related to the urinary system [24].

According to World health statistics 2008, about 260 000 neonatal deaths worldwide are caused by congenital anomalies. This figure represents about 7% of all neonatal deaths, but ranges from 5% in the South-East Asian region to more than 25% in the European region. Congenital anomalies are also considered a leading cause of fetal death and an increasing cause of neonatal mortality in countries undergoing the epidemiological transition (for example, China).

Although congenital anomalies account for a small percentage of deaths of neonates and infants aged 1–59 months in middle-income and low-income countries than in the wealthiest countries, more than 95% of all child deaths due to congenital anomalies occur in these settings, indicating that congenital anomalies affect all countries and represent a significant challenge to public health globally [31].

In Saudi Arabia, a study estimated the incidence of major and minor congenital malformation among live born infant to be 2.7%. And the highest incidence was for the cardiovascular (0.7%) and the musculoskeletal malformation (0.4%) (32). Another study found the incidence of congenital abnormalities to be 2.3 % [13], with the incidence of malformation of gastrointestinal tract of (0.13%), for the neural tube defects (NTD) (0.19%) and for Down syndrome (0.18%) [33]. According to another hospital-based study in 2008; the antenatal prevalence of congenital anomalies was 2.79% [34].

Although routine screening for fetal abnormalities is very successful, there are limitations to the abilities of both the technique and the operators to detect every anomaly.

There are several reasons for this: not all anomalies are evident at 20 weeks, when the routine ultrasound examination for anomalies is performed; there is wide variation in both expertise of staff and quality of equipment; and some fetuses are difficult to scan because of maternal body habitus, reduction in liquor volume or a persistent difficult fetal position. There are very few structural abnormalities for which the detection rate approaches 100%.

In our study, we tried to look at all structural congenital malformations in our sample which we think represents the community in Saudi Arabia. The primary outcome of interest was the point prevalence of congenital malformations in our hospital while the secondary outcomes were; the risk factors, the types of these anomalies distributed per body systems and the neonatal outcomes.

2. Materials and Methods

2.1. Subjects and Setting:

This is a retrospective chart review descriptive study conducted in the department of Obstetrics and Gynecology at Security Forces Hospital-Riyadh. This hospital serves all ministry of interior dependents all over the country of Saudi Arabia. The study was conducted over (36 months), from Jan 2012 till Dec 2014.

The total number of deliveries was (18,347) deliveries, and the total number of congenital malformations was (283) cases. Period prevalence is calculated as the proportion of a population that has the condition at some time during a given period.

All pregnant ladies who were followed during their pregnancies in the obstetrics and gynecology Department during the study period and had at least one ultrasound been included. All cases diagnosed to have any congenital malformation by the 1st scan done by the sonographers were referred to one of our perinatologists to confirm the diagnosis and to do full counseling. Some cases required invasive procedures where a specific genetic disease or aneuploidy is suspected. Fetal echocardiography was also done in some cases when indicated.

Major congenital anomalies were classified according to the systems involved (renal, cardiac, skeletal, etc.). The cases were also categorized according to the number of systems involved into: either isolated anomalies (only one system involved) or complex anomalies (two or more systems involved).

A miscarriage was considered if pregnancy loss occurred before 24 weeks of gestational age while still birth was defined as fetal loss at a gestational age of 24 weeks and above.

2.2. Data Collection:

The data was collected from the files of patients and presented in tables and figures using Microsoft Excel Software.

2.3. Ethical Approval:

The management of each pregnancy was not modified by the study, so it was exempted from IRB approval. Department Approval was obtained prior to data collection process.

3. Results

Out of 283 (3%) abnormal cases diagnosed in our hospital during the study period, 227 cases delivered in our hospital and 56 patients (24.6%), lost their fallow up. Among the 227 cases who were followed, 7 cases (3.08%) ended with spontaneous miscarriage , 34cases (14.97%) had termination of pregnancy due to the diagnosed anomalies , after discussion in multidisciplinary perinatal committee meetings, number of terminated cases to be 34 cases (12 cases before 24 week., 22 cases more than 24week.) , 16 (7.04%) pregnancies ended with intrauterine fetal death ,and 170 cases (74.88%) ended with delivery of live born, out of them 40 babies died in the early neonatal period ENND. Figure (1)

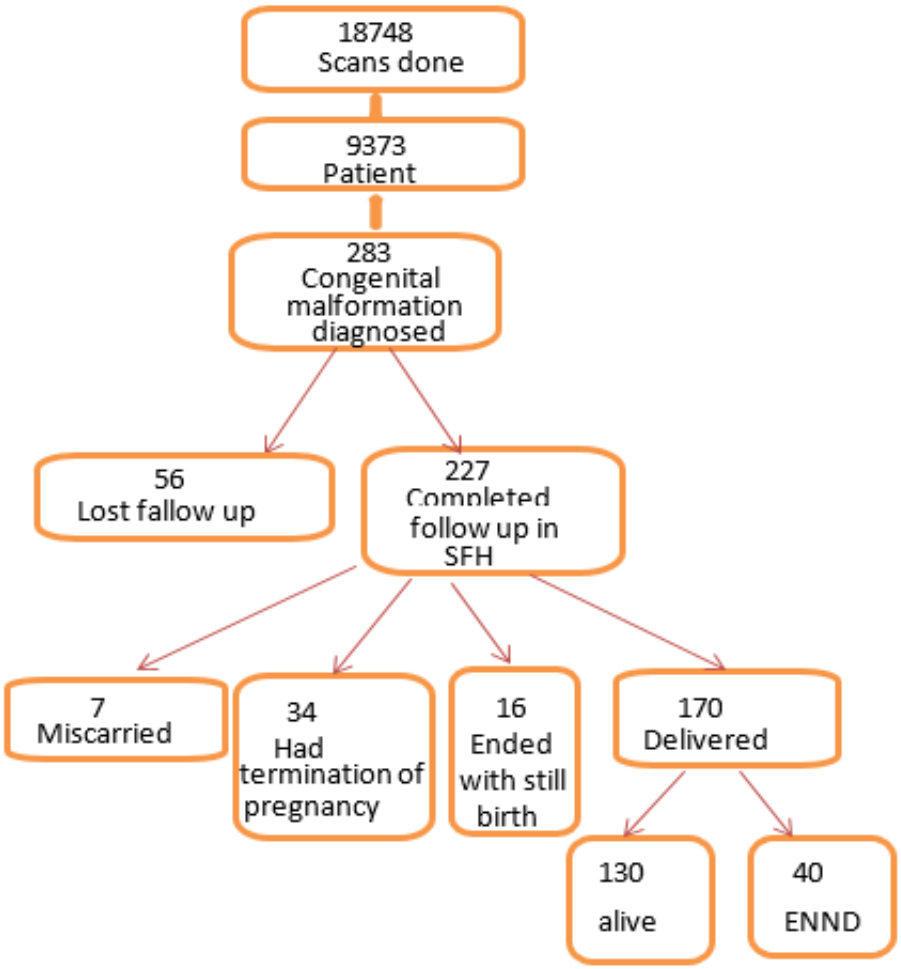

Figure 1: 40 babies died in the early neonatal period ENND.

Year	Number	%
2012	92	32.50%
2013	89	31.44%
2014	102	36.04%
Total	283	100 %

Table 1: distribution of the cases by year.

Regarding the maternal characteristics, the mean maternal age was 30.6 years, 90 (31.8%) of the cases were detected in mothers between (25-39) years of age, followed by women in age group between (30-34) years. 59 cases accounting for (20.84 %)1, and the last 7 cases (2.47 %) were detected at maternal age of 44 years or more. Table (2)

Maternity age	Number	%
15 -19	12	4.24
20 – 24	44	15.54
25 -29	90	31.80
30 – 34	59	20.84
35 – 39	48	16.96
40 – 44	23	8.12
> 44	7	2.47
Total	283	100 %

Table 2: Maternal age.

As for parity, the mean parity was 4, where 82 cases (28.77%) were diagnosed in mothers who were Para 4 and more. Table (3). Among our study population, more than half and exactly (56.5 %) had consanguineous marriages, which was counted as a risk factor, while (30%) had no risk factors what so ever. Interestingly (22.6%) had history of a previous baby with an abnormality. Table (4)

Parity	Number	%
Para 0	75	26.50
Para 1	47	16.60
Para 2	49	17.31
Para 3	30	10.60
> Para 4	82	28.97
Total	283	100 %

Table 3: Parity.

Risk factors	Number	%
Consanguinity	160	56.5 %
Previous family history	64	22.6 %
No risks	85	30 %

Table 4: risk factors.

When we looked at preconception folic acid intake, only 35 cases (12.36%) were taking it. Table (5)

Use of folic acid	number	%
Yes	35	12.36
No	248	87.63
Total	283	100

Table 5: preconception use of folic acid.

As for the gestational age at which these abnormalities were detected, we found that 157 cases (55.47%) were diagnosed between (21-28 weeks) and the least were detected at gestational age of less than 20 weeks only 23 cases (8.12%). Table (6)

Gestational age at diagnosis	number	%
11 -20 wk.	23	8.12
21 – 28 wk.	157	55.47
> 28 wk.	103	36.39
Total	283	100

Table 6: Gestational age at diagnosis.

Regarding the nature of the abnormalities detected, whether isolated or multiple, most of them (70.3 %) were isolated. Table (7)

Type of anomalies	Number	%
isolated	199	70.31
multiple	84	29.8
Total	283	100

Table 7: type of anomalies.

By classifying the anomalies according to the system involved, we found that, renal anomalies were the most commonly detected ones, in 62 patient which accounts for (31.1%), followed by central nervous system (CNS) anomalies 41 cases (20.6%), while the facial anomalies were the least commonly detected, only 5 cases (2.51%). Table (8)

System involved	Number of cases	%
renal	62	31.15
CNS	41	20.6
cardiac	27	13.56
Gastrointestinal	20	10.05
skeletal	19	9.54
thoracic	13	6.53
hydrops	12	6.03
Facial	5	2.51
Total	199	100

Table 8: Isolated anomalies according to the system involved.

Looking at more details about the anomalies of these systems; in the renal system anomalies, we found the hydronephrosis accounting for the majority of the anomalies 21 cases (33.87%), followed with posterior urethral valve 20 cases (20.9%), while renal agenesis was found in 9 cases (9.67%). With regard to central nerve system anomalies; spina bifida was the most commonly diagnosed 13 cases (31.70%) through our study period, followed by isolated hydrocephalus 7 cases (17.07%). In cardiac system ventricular septum defect was found in most of the cases 10 cases (37.03%), followed by multiple cardiac anomalies 7 cases (25.92), 5 of our cases with cardiac abnormalities were confirmed to have hypo plastic left heart syndrome. As for the gastrointestinal system; the most commonly diagnosed anomaly was as follows: esophageal atresia, anorectal atresia, duodenal atresia accounting for 9 cases (45%), 7 cases (35%), and 4 cases (20%) respectively.

Looking at skeletal system; the most serious anomalies were skeletal dysplasia 9 cases (47.30%), 2 cases only with limb reduction (10.52%). As for the 13 cases of thoracic anomalies, 7 case (53.84%) had CPAM (congenital pulmonary airway malformation) and 6 cases (46.15%) had diaphragmatic hernia. Lastly cleft lip with or without cleft palate was seen in only 5 cases. Table (9)

Congenital anomalies	Number	%
RENAL	**62**	
Hydronephrosis	21	**33.87**
Posterior urethral valve	13	**20.9**
Polycystic kidney	10	**16.12**
Renal agenesis	9	**9.67**
Pelvic kidney	5	**8.06**
Multicystic dysplastic kidney	4	**6.45**
CNS	**41**	
Spinal bifid	13	**31.70**
Hydrocephalus	9	**21.95**
Ancephaly	7	**17.07**
Encephalocel	5	**12.19**
Microcephaly	5	**12.19**
Sacrocogeaseal teratoma	2	**4.87**
CARDIAC	27	
Ventricular septum defect	10	**37.03**
Multiple congenital heart disease	7	**25.92**
Hypo plastic left heart	5	**18.51**
Atrial septum defect	4	**14.81**
Hypo plastic right heart	1	**3.70**
GASTRO INTESTINAL	20	
Esophageal atresia	9	**45**
Anorectal atresia	7	**35**
Duodenum atresia	4	**20**
SKELETAL	19	
Skeletal dysplasia	9	**47.36**
Club foot \talbis	5	**26.31**
Polydactyl	3	**15.78**
Limb reduction	2	**10.52**
THORACIC	13	
Cystic adenomatous malformation of lung	7	**53.84**
Diaphragmatic hernia	6	**46.15**
FACIAL	5	
Cleft lip with or without cleft palate	5	**100**

Table 9: distribution according to type of congenital anomalies.

Fetal echocardiography either to confirm a cardiac abnormality in cases of isolated cardio vascular system (CVS) anomalies or to rule out an associated cardiac abnormality as a part of multi system involvement was done for 68 of our cases and yielded 40 abnormal results (58.8%). Table (10)

Result of ECHO	number	%
Normal	28	41.1
Abnormal	40	58.82
TOTAL	68	100

Table 10: Fetal echocardiography result among 68 cases referred to ECHO.

Invasive procedures for possible prenatal diagnosis of chromosomal/ genetic abnormalities were done for 56 out of all cases and 20 of them (35.7%) were having abnormal results. Table (11).

Amniocentesis	Number	%
Normal	36	64.28
Abnormal	20	35.71
TOTAL	56	100

Table 11: Amniocentesis result among 56 cases requested invasive procedure exclude those refuse to do.

Regarding gestational age at delivery, 150 (72.1%) pregnancies ended by delivery at term. Table (12). Among the 34 cases who had termination of pregnancy, 12 cases were before viability, so a total of 208 cases carried their pregnancies beyond viability (24 week and above). As for the mode of delivery around two thirds 138 cases (66.45%) had vaginal delivery while (33.6%) had delivery by cesarean section. Table (13).

Gestational age of delivery	Number	%
24 – 36+6 wk.	58	27.9
>37 wk.	150	72.1
Total	208	100

Table 12: Gestational age of delivery

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(Excluding 7 case miscarriage, 12 case of termination of pregnancy before 24 weeks. among 227 cases delivered in our hospital)

Mode of delivery	Number		%
Vaginal delivery	138		66.45
Caesarian section	70		33.65
Total	208		100

Table 13: Mode of delivery.

(Exclude 7 case miscarriage, 12 case of termination of pregnancy before 24 weeks. among 227 cases delivered in our hospital)

The outcome according to the birth weight is as shown in table (14), where 148 (65%) of born babies were weighing more 2500 gm, followed by 32 (14.09%) cases with birth weight between 2000-2500 gm. 117 cases (51.5%) of the abnormalities detected were among males, and (44.05%) happened in females, and we had 10 cases which accounted for (4.4%) where the gender was not determined. Table (15).

Weight	Number	%
500 gm.	9	3.24
501-1000 gm.	6	2.64
1001- 1500 gm.	22	9.69
1501 -2000 gm.	10	4.40
2001 – 2500 gm.	32	14.09
>2500 gm.	148	65.19
Total	227	100

Table 14: Birth weight of the outcome among those delivered in the hospital.

Gender	Number	%
Boy	117	51.54
Girl	100	44.05
Undetermined	10	4.40
Total	227	100

Table 15: Outcome according to the gender among those completed fallow up in the hospital.

Table (16) is showing the number and percentages of babies who required NICU admission, and as expected most of them required so, 106 cases (62.36%). Among the outcome 40 babies (23.52%) ended with early neonatal death. Table (17).

NICU admission	Number	%
Yes	106	62.36
No	64	37.64
Total	170	100

Table 16: NICU admission among 170 delivered alive.

The outcome	Number	%
Alive baby	130	76.47
Early neonatal death	40	23.52
Total	170	100

Table 17: the outcome among birth.

4. Discussion

Most children, born with congenital anomalies and survive infancy are affected physically, mentally or socially and can be at increased risk of morbidity due to various health disorders [36].

Prevalence studies of congenital anomalies are useful to establish baseline rates, to document changes over time, and to identify clues to etiology. They are also important for planning and evaluating antenatal screening for congenital anomalies, particularly in high-risk populations [37]. The overall prevalence of major congenital malformation in this study during the study period was 3.01%, accounting for perinatal mortality rate of (47/10,000) live births [22].

In this study, congenital anomalies of the renal system were the most commonly encountered and accounted for 31% of all isolated anomalies. This was followed by malformation of central nerves system CNS (20.6%) and cardio vascular system CVS (13.56%). A similar study from Saudi Arabia reported that major congenital anomalies among all live births were mostly observed in the cardiovascular system (CVS), followed by musculoskeletal [32].

Maternal age is an important parameter in the birth of a congenitally malformed fetus. For this reason, females who are older than 35 years of age need to be examined more carefully since the risk of having a congenitally malformed fetus is increased [2]. In the present study, the median maternal age at diagnosis was 30 years which is close to the age reported by other authors as Sellout [5], who indicated that the median maternal age was 27.5 years. Also, they observed direct relation between advancing maternal age and the increasing incidence of congenital anomalies -lower incidence with age of <20 years and higher with age between 20-35 years- which is similarly found in found in our study too. Another study showed that advanced maternal age (> 35 years) to be the most frequent risk factor for birth defects in Brazil [25].

In this study, most of the congenital anomalies detected were seen in women who were para four or more 82 case (28.97%) followed by primai gravidas 75 case (26.50%).

An additional observation in this study was that the mean gestational age at delivery was 37 weeks and the time of diagnosis by ultrasound was 21-28 week. This outcome was similar to the observations of Khaskheli and Michels [38, 39].

Among the other risk factors studies, we found that consanguinity and having a positive previous history of congenital malformation were associated with higher risk. We also found that the mode of delivery was not influenced by having some of the abnormalities diagnosed, where the percentage of cesarean deliveries was very close to the rate for the general population in our unit. The late gestational age at diagnosis is a major factor affecting proper antenatal diagnosis and outcome. Only 56 cases had invasive prenatal diagnosis done, this can be explained by the late gestational age at diagnosis duo to late booking or late referral, in addition, some refused invasive testing.

A major limitation of this study was the retrospective nature of it, as we depended on data collected from patient medical records, and sometimes some information was missing, so we needed to make telephone calls to try to get as much of the information as possible. Also, the prevalence may have been underreported in this study as we only looked at cases with structural abnormalities.

Another factor that may have also resulted in lower rate of detection of malformation among the stillbirths in general is the lack of routine autopsy in these cases. Also, we included those malformation diagnosed by antenatal ultrasound, while still there are some others which were detected postnatally, or the mothers were un booked during their pregnancies and we had no records of their follow up.

5. Conclusion

The period prevalence of congenital abnormalities in our study is similar to that reported in other population worldwide. Strikingly enough, consanguinity in our population appears to play a major associated risk factor. Still, we think that the prevalence is under reported as only cases of structural anomalies were included, so we recommend a larger study to address this issue.

Conflict of interests and funding sources statement

None

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None

Authors' contributions

AlMardawi drafted the manuscript. All Authors contributed to study conception and studydesign. Almardawi and Bajabaa contributed to literature review and data collection. All

Authors contributed to data analysis and data presentation in tables and figures. All

Authors reviewed manuscript for editorial and intellectual contents. All authors have read

and approved the final draft of manuscript.

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