Incidence and Types of Congenital Anomalies in Newborns in Sulaimaniyah City in Iraq

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Abstract- Congenital anomalies or birth defects can be acquired during the fetal stages of development or from the genetic makeup of the parents. Congenital anomalies are important causes of infant and childhood illness and disability. Little is known about incidence and types of these anomalies in Iraqi Kurdistan. Therefore, this study was undertaken to estimate the incidence and types of congenital anomalies in Sulaimaniyah city. The study was carried out on the hospital's records of all newborns registered as having a congenital anomaly. The records of 586 neonates with congenital anomalies were analyzed from a total of 178,954 live broths that occurred during 4 years in the city. The data was obtained from the statistics section of maternal and a child unit of the Preventive Health Department. The overall incidence of all types of congenital anomalies over the four years was 3.3/1000 live births. There was a statistically significant difference in incidence between males and females over the four years, male to female risk ratio 1.2 (95% CI 1.02-1.42, *P*= 0.03). The commonest congenital anomalies affected the cardiovascular system accounting for 24% followed by those of the nervous system with 16%. Down syndrome accounted for 14% of all anomalies and cleft lip/palate for 11%. Types of anomalies were statistically associated with low birth weight and maternal age. The study indicates that the incidence of congenital anomalies is not high in the region; however, more extensive studies are required to give a more realistic incidence.

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Keywords: Congenital anomalies; Incidence; Sulaimaniyah; Iraq

Introduction

Congenital anomalies are also known as birth defects, congenital disorder or congenital malformation. Congenital anomalies can be defined as structural and functional abnormalities which are present from birth including metabolic disorders of the body that occur during intrauterine life and can be identified prenatally, at birth or sometimes may only be detected later in infancy, such as hearing defects (1). Congenital anomalies are a major cause of stillbirth and neonatal mortality in both developed and developing countries, but the burden is more severe in the low and middle-income countries (2). They can be life-threatening, result in long-term disability, and negatively affect individuals, families, health-care systems and societies (3). The occurrence and patterns of congenital malformation differ by geographical area (1,4). A range of factors has been reported to be associated with birth defects including genetics, environmental teratogenic factors, micronutrient deficiencies, and multifactorial inheritance. The common risk factors reported in the literature include consanguinous marriage, maternal age, medications, smoking, alcohol consumption and maternal illnesses (5,6). Although congenital anomalies may be the result of one or more genetic, infectious, nutritional or environmental factors, it is often difficult to identify the exact causes (7). About 60-70% of the causes of birth defects are unknown. The congenital anomalies occur in 2-3% of all births (8,9). Congenital disorders can be classified into minor and major defects. Minor malformations have a lesser effect on vital organs function, they do not cause any distress in the newborn, and usually, there is no need for urgent intervention. In contrast, major malformations have a greater effect on body function and may be life-threatening, thus require

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immediate intervention (6). Congenital anomalies can affect any system, but the commonest types are cleft lip/palate, Down syndrome, anencephaly, hypospadias, and congenital heart defects (10). Prevalence of congenital anomalies varies largely between countries and ranges from less than 1% to up to 8% (11). The variation in the prevalence of congenital anomalies other than geographical area may be due to socio-cultural, racial and ethnic variables (11). The incidence of congenital anomalies of the various system of the body is estimated to be 10-50/1000 of new live birth, and this incidence varies from one country to another country (12,13). The incidence of congenital malformation is much higher in children being born with low birth weight and in consanguineous marriage (6). Major anomalies have serious medical, surgical and cosmetic consequences and the method for decreasing this burden of the condition is by prevention, early treatment neonatal and surgical treatment (14). The objective of this study was to estimate the incidence of congenital anomalies and describe their types among neonates in Sulaimaniyah City.

Materials and Methods

This study involved a retrospective analysis of records of congenital anomalies in Sulaimaniyah City. The records of 586 neonates with congenital anomalies were obtained out of a total of 178, 954 live births delivered in the Maternity Teaching Hospital and all private hospitals of the city between January 2013 and December 2016. The data was obtained from the statistics section of maternal and a child care unit of the Preventive Health Department (Ph.D.). The Ph.D. is the main body responsible for preventive health services, and collection of public health-related data from all hospital and health care centers of the city. Data used in the current study belongs to all live births reported with any congenital defects delivered in Sulaimaniyah hospitals. The records do not include stillbirth or terminated pregnancies. Number of total births during the same period was obtained from all hospitals with delivery facilities. The study was approved by the ethics committee of the Technical College of Health and permission was also taken from the Ph.D. The patterns of congenital anomalies were classified according to the International Statistical Classification of Diseases and Related Health Problems 10th Revision (ICD-10) for congenital malformations, deformations and chromosomal abnormalities (15). Records of neonates with multiple congenital anomalies were grouped depending on whether those anomalies qualified as a specific syndrome or not. The diagnosis was made by a pediatrician examining the neonate immediately or within a few days of delivery. If they qualified as a specific syndrome, they were then categorized into that syndrome. If no syndrome could be classified, then the anomaly is referred to the system affected and by the specific anomaly. When more than two systems were involved, it was recorded as multiple congenital anomalies. Birth weights ≥2.5 kg was considered to be normal weight, while birth weight <2.5 kg as low birth weight. Categorical variables were summarized as frequencies and percentages, while for numeric variables mean and the standard deviation was used if normally distributed variables. The Chi-square test used for determining the association between categorical variables. Incidence at birth was calculated per 100 live births, and incidence ratios and 95% CI were calculated for comparisons with *P* of 0.05 or less was considered to have a statistical significance.

Results

During the four years (2013-2016) a total of 178,954 live births were delivered in Sulaimaniyah hospitals and a total of 586 neonates with congenital anomalies were registered at the Ph.D. These included 328 (56%) males and 258(44%) females with congenital anomalies. Table 1 shows the main characteristic of these neonates. The birth weight of these children was normally distributed with a mean birth weight of 2.9 Kg (SD 0.78 Kg) and 25% of them having low birth weight while 75% had normal birth weight. Prevalence of parental consanguinity was 21.5%, and family history with congenital anomaly was found among 9% of the sample. Maternal age during the pregnancy in question was normally distributed, ranging from 14-48 years with a mean age of 30.4 years (SD 7.1 years). In addition, 29% of mothers were aged 14-25 while 26% were aged over 35 years. Age of the child at diagnosis was not normally distributed with a median age of 1 day, and 92% of them diagnosed at day 1 or two of their life.

Table 1. Characteristic of children with congenital anomalies (n=586)

Characteristics		Number (%)
Gender	**Male**	328(55.98)
	Female	258(44.03)
Birth weight	**Low birth weight (<2.5 Kg)**	145(24.7)
	Normal birth weight (≤2.5 Kg)	441(75.3)
Consanguineous marriage	**Yes**	126(21.5)
	No	460(78.5)
Child relative with a congenital anomaly	**Yes**	52(8.9)
	No	534(91.1)
Mother' s occupation	**Employed**	71(12.1)
	Unemployed(housewife)	515(78.9)
Mother's age	**≤25**	171(29.2)
	26-35	260(44.4)
	≥36	155(26.4)
Pregnancy Pattern	**Singleton**	582(99.3)
	Twin	4(0.7)
Mother's age in years, mean (SD)		30.4 (7.1)
Child age at diagnosis in days, median (IQR)		1(IQR 1,1)
Birth weight in Kg, mean (SD)		2.90 (0.78)

Incidence and types

The overall incidence of congenital anomalies at birth and incidence by year is shown in table 2. The overall incidence of all types of congenital anomalies over the 4 year period was 3.3/1000 live births. There was a statically significant difference in incidence between males and females with a risk ratio of 1.2 (95% CI 1.02-1.4, *P*=0.03). Incidence and male/female incidence ratios for each year are shown in table 2. Incidence in males was consistently higher than the incidence in females.

Table 2. The incidence and risk ratios of congenital anomalies by sex and year 2013-2016

Years	Types	Number of neonates with CM	Total live births	Incidence /1000	Risk ratio	95% CI	*P*
2013	Male	112	23819	4.7	1.7	1.24-2.37	0.0003
	Female	63	22919	2.7	Reference		
	Total	175	46738	3.7			
2014	Male	101	25939	3.9	1.2	0.91-1.69	0.07
	Female	78	24828	3.1	Reference		
	Total	179	50767	3.5			
2015	Male	88	22326	3.8	1.3	0.94-1.84	0.05
	Female	63	21957	2.9	Reference		
	Total	151	44283	3.3			
2016	Male	52	23125	2.2	1.7	1.03-2.73	0.01
	Female	29	21514	1.3	Reference		
	Total	81	44639	1.8			
2013-2016	Male	328	92086	3.6	1.2	1.02-1.41	0.03
	Female	258	86868	3.0	Reference		
	Total	586	178954	3.3			

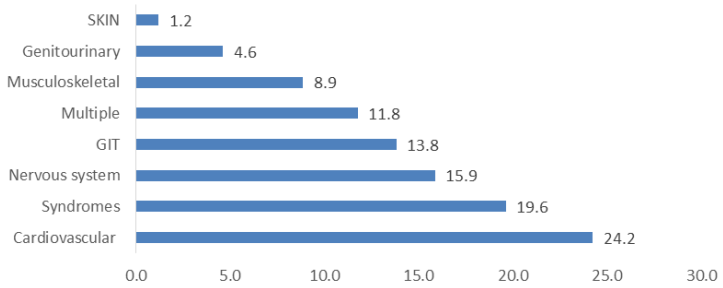

Figure 1. Percentage distribution of congenital anomalies by system affected

Figure 1 shows distributions of the congenital anomalies according to body systems affected. The commonest affected body system was the cardiovascular system accounting for 24% of all anomalies followed by the central nervous system (16%) and the genitourinary system with 14% of all anomalies.

Table 3 shows the incidence of body systems with congenital anomalies. In terms of incidence of these anomalies as shown in table 2, there were 79 cardiovascular anomalies per 100,000 live births, 52 nervous system anomalies followed by 45 gastrointestinal anomalies.

Table 3. The incidence of congenital anomalies by systems affected per 100,000 live births

System affected	Number	% of total	Incidence per 100,000
Cardiovascular	142	24.2	79
Syndromes	115	19.6	64
Nervous system	93	15.9	52
GIT	83	14.2	45
Multiple	69	11.8	39
Musculoskeletal	52	8.9	29
Genitourinary	27	4.6	15
SKIN	7	1.2	4
All	586	100.0	327

Distributions and percentages of different anomalies are shown in table 4. Congenital heart defects were recorded as one category and remained the most common with 24% of all anomalies followed by Down's syndrome with 14%, multiple anomalies with 12% and cleft lip/palate with 11% of anomalies. Spina bifida was the most common nervous system anomaly with 8% of all congenital anomalies followed by hydrocephalus. Clubfoot and hypospadias were the commonest anomalies of the musculoskeletal and genitourinary systems, respectively.

Table 4. Types of congenital anomalies

Type	Freq.	Percent
Congenital heart defect	142	24.2
Down's Syndrome	83	14.2
Multiple congenital anomalies	69	11.8
Cleft lip/palate	65	11.1
Spina bifida	46	7.8
Hydrocephalus	31	5.3
Club foot	30	5.1
Hypospadias	15	2.6
Edward syndrome	12	2.0
Limb deformity	11	1.9
Pierre Robin syndrome	11	1.9
Imperforate anus	8	1.4
Tracheoesophageal fistula	8	1.4
Ichthyosis Vulgaris	7	1.2
Renal Agenesis	7	1.2
Anencephaly	6	1.0
Polydactyly	6	1.0
Omphalocele	5	0.9
Potter syndrome	5	0.9
Dandy-Walker syndrome	4	0.7
Microcephaly	4	0.7
Patau syndrome	4	0.7
Blader extrophy	3	0.5
Encephalocele	2	0.3
Undescended Testes	2	0.3
Total	586	100.0

We analyzed the types of congenital anomalies by gender, consanguinity and family history. Overall there was no association between these and the types of congenital anomalies (Table 5). However, anomalies which were more common in males included polydactyly (83% were in males), renal agenesis (85%), cleft lip/palate (64%) and congenital heart defects (61%). Anomalies which were more common in females were encephalocele (100%), Patau syndrome (75%) and limb deformities (64%). Overall, 21.5% of neonates with congenital anomalies had parental consanguinity. Congenital anomalies with higher consanguinity included multiple anomalies (35% were to consanguineous marriages), polydactyly (33%) and hydrocephalus (29%). Overall, 8.9% of the neonates had a family history of congenital anomalies. Congenital anomalies with higher family history included polydactyly (33% had a family history), microcephaly (25%), spina bifida (20%) and some of the syndromes.

We also analyzed the types of congenital anomalies by mother's age (up to 35 and over 35 years of age) and birthweight of the child (low birth weight at <2.5 Kg). Distribution of the congenital anomalies was statistically different within each of these factors (Table 6). Overall 26% of anomalies were to mothers aged over 35 years, but this was more in relation to Down's Syndrome (54% were to older mothers). Certain anomalies occurred exclusively in young mothers including polydactyly, renal agenesis, undescended testes, anencephaly, omphalocele, and Dandy-Waker syndrome. Overall, 24.7% of neonates with congenital anomalies had low birth weight. Congenital anomalies which were more common with low birth weight included anencephaly, Dandy-Waker syndrome, Patau syndrome, Potter syndrome, and Edward syndrome.

Table 5. Different congenital anomalies by gender, parental consanguinity and family history of any congenital anomalies

Congenital anomaly	Child Gender		Parental Consanguinity	Family history
	Male	Female		
Anencephaly	3 (50.0)	3 (50.0)	0 (0.0)	1 (16.7)
Bladder extrophy	2 (66.7)	1(33.3)	1 (33.3)	0 (0.0)
Cleft lip/palate	42 (64.6)	23 (35.4)	13 (20.0)	5 (7.7)
Club foot	16 (53.3)	14 (46.7)	6 (20.0)	1 (3.3)
Congenital heart defect	87 (61.3)	55 (38.7)	32 (22.5)	7 (4.9)
Dandy-Walker syndrome	3 (75.0)	1 (25.0)	0 (0.0)	0 (0.0)
Down's Syndrome	39(47.0)	44 (53.0)	14 (16.9)	7 (8.4)
Edward syndrome	5 (41.7)	7 (58.3))	3 (25.0)	2 (16.7)
Encephalocele	0 (0.0)	2 (100.0)	0 (0.0)	0 (0.0)
Hydrocephalus	19 (61.3)	12 (38.7)	9 (29.0)	3 (9.7)
Hypospadias	10 (66.7)	5 (33.3)	2 (13.3)	1 (6.7)
Ichthyosis vulgaris	3 (42.9)	4(57.1)	3 (42.9)	0 (0.0)
Imperforate anus	4 (50.0)	4 (5.0)	1 (12.5)	2 (25.0)
Limb deformity	4 (36.4)	7 (63.6)	1 (9.1)	0 (0.0)
Microcephaly	2 (50.0)	2 (50.0)	2 (5.0)	1 (25.0)
Multiple congenital anomalies	32 (46.4)	37 (53.6)	24 (34.8)	8 (11.6)
Omphalocele	3 (60.0)	2 (40.0)	0 (0.0)	0 (0.0)
Patau syndrome	1 (25.0)	3 (75.0)	0 (0.0)	0 (0.0)
Pierre Robin syndrome	7 (63.6)	4 (36.4)	2 (18.2)	2 (18.2)
Polydactyly	5 (83.3)	1 (16.7)	2 (33.3)	2 (33.3)
Potter syndrome	4 (80.0)	1 (20.0)	0 (0.0)	0 (0.0)
Renal agenesis	6 (85.7)	1(14.3)	1 (14.3)	0 (0.0)
Spina bifida	24 (52.2)	22 (47.8)	7 (15.2)	9 (19.6)
Tracheoesophageal fistula	5 (62.5)	3 (37.5)	3 (37.5)	1 (12.5)
Undescended testes	2(100.0)	0 (0.0)	0 (0.0)	0 (0.0)
All			126 (21.5)	52 (8.9)
Statistical test results	χ^2=26.1, *P*=0.35		χ^2=26.4, *P*=0.33	χ^2=27.1, *P*=0.3

Table 6. Different congenital anomalies by mother's age and birth weight

Congenital anomaly	Mother's age		Low birth weight (<2.5Kg)
	≤ 35 years	Over 35 years	
Anencephaly	6 (100.0)	0 (0.0)	3 (50.0)
Bladder extrophy	3 (100.0)	0 (0.0)	0 (0.0)
Cleft lip/palate	55 (84.6)	10(15.4)	9 (13.9)
Club foot	27 (90.0)	3 (10.0)	6 (20.0)
Congenital heart defect	103 (72.5)	39 (27.5)	45 (31.7)
Dandy-Walker syndrome	4 (100.0)	0 (0.0)	3 (75.0)
Down's Syndrome	38 (45.8)	54 (54.2)	18 (21.7)
Edward syndrome	10 (83.3)	2 (16.7)	7 (58.3)
Encephalocele	1(50.0)	1 (50.0)	0 (0.0)
Hydrocephalus	22 (71.0)	9 (29.0)	7 (22.6)
Hypospadias	11(73.3)	4 (26.7)	1 (6.7)
Ichthyosis vulgaris	5(71.4)	2 (28.6)	1 (14.3)
Imperforate anus	6 (75.0)	2 (25.0)	0 (0.0)
Limb deformity	10 (89.9)	1 (9.1)	2 (18.2)
Microcephaly	3 (75.0)	1 (25.0)	0 (0.0)
Multiple congenital anomalies	54 (78.3)	15 (21.7)	22 (31.9)
Omphalocele	5 (100.0)	0 (0.0)	0 (0.0)
Patau syndrome	3 (75.0)	1 (25.0)	3 (75.0)
Pierre Robin syndrome	8 (72.7)	3 (27.3)	3 (27.3)
Polydactyly	6 (100.0)	1(0.0)	0 (0.0)
Potter syndrome	3 (60.0)	2 (40.0)	2 (40.0)
Renal agenesis	7 (100.0)	0 (0.0)	2 (28.6)
Spina bifida	32 (69.6)	30.4)	10 (21.74)
Tracheoesophageal fistula	7 (87.5)	1(12.5)	1 (12.5)
Undescended testes	2 (100.0)	0 (0.0)	0 (0.0)
All	431 (73.6)	155 (26.4)	145 (24.7)
Statistical test results	χ^2=58.5, *P*<0.001		χ^2=45.5, *P*= 0.005

Discussion

Congenital anomalies are among the important causes of infant mortality and childhood morbidity. The overall incidence of all types of congenital anomalies for the 4 years was 3.3 per 1000 live births with a male to female risk ratio was 1.2. This is in accordance with studies carried out in Nigeria (16) and is similar to a study was done in Turkey and South Africa (17,18). While in Al-Ramadi western Iraq which reported the higher overall incidence 40.5/ 1000 live births (2) and the earlier studies in Sarajevo region 28.6/1000 live births (19). A study done in the United States reported the incidence of 28.9 per 1000 live births is in contrary to our results (20). In our study male had a 20% increased risk of congenital anomalies which corresponds to a study from India (21) and two studies from England (22,23). However, a study from China reports a higher risk in females (24). The lower incidence in our study could be due to differences in inclusion criteria and variabilities in the diagnosis of the condition. The incidence in our study could be an underestimation because some minor cases might have been missed during the first few days of delivery especially in private hospital were the neonates might have not been properly checked or referred for followed-up. Although 92% of the children were diagnosed in the first 2 days, the presence of 8% late diagnosis is an indication that there was no standard procedure followed unanimously for checking the children.

The most common anomalies were CVS anomalies, nervous system, Down's syndrome, and cleft lip/plate. Our results are corresponding with the study was done in London and the United State (11,20).

The current study demonstrated no significant differences between gender and types of congenital anomalies in children similar to the studies from Iran and Pakistan (5,6) while a study from the UK reports such a difference (23). Parental consanguinity was also similarly distributed among various types of congenital anomalies similar to the Iranian study (5). In respect to family history, also there was no difference between family histories with the types of congenital anomalies. The results are corresponding with the study was done in Tanzania (25). The difference between low birth weight

and the types of congenital malformations was found statistically significant. The result is similar to studies performed in India (1) and the United State (26). Our study also revealed the statistical difference between older maternal age with types of congenital anomalies which is similar to studies from Mongolia, China (27) and studies done in the United States (28,29).

The study is not without limitations. The study depended on routine data which has the inherent limitations of inconsistency and incompleteness. Estimation of incidence is especially prone to underestimation because of the possibility of missed cases, missed data and late diagnosis. However, it is the best estimate that could be obtained with this data. The sample was sufficiently large and any undiagnosed and missed cases would have been probably at random making the analysis of the types of the congenital anomalies important and probably representative to the condition in the study population .

In conclusion, the study was able to provide a rough estimate of the incidence of congenital anomalies in Sulaimaniyah city and identify their main types which could be important for informing public policy and clinical practice. Further research, especially prospective, is required to provide a more accurate estimate of incidence at birth. It is important to strengthen early detection of the congenital anomalies immediately or as soon as possible after delivery. Strengthening of registration and records of all deliveries and congenital anomalies is also required .

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