

## Congenital malformations among newborns in Morocco: A retrospective study

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### Abstract

Congenital malformations are one of the leading causes of neonates and infants' mortality and morbidity. The frequency of these congenital malformations varies in different populations. The objective of this study was to find out the prevalence and pattern of congenital malformations in a tertiary teaching hospital in Rabat, Morocco. This four-year retrospective descriptive study was conducted from January 2011 to December 2014. All newborns with congenital malformations diagnosed at birth were included. Mothers and newborn characteristics were analyzed using SPSS 13.0. A total of 706 newborns were noted to have congenital malformation. The prevalence rate was 1.02%. The mean maternal age was 28.8±7.2 years. The mean maternal body mass index was 28.1±6.9 kg/m<sup>2</sup>. 13.3% of the mothers had a history of abortion. The nervous system was the most affected system (19.4%) followed by the musculoskeletal system (14.2%), the chromosomal abnormalities (12.3%) and the genito-urinary system (10.8%). Males newborns (57.9%) had more congenital malformations than females (40.5%). The rates for live-births, fetal asphyxia and stillbirths were 75.2%, 7.2% and 17.3%, respectively. This retrospective study provides recent and detailed data about congenital malformations in a Moroccan region. The result from this study will contribute to the knowledge of congenital malformations in this particular area and hence the supportive preventive policy.

### Introduction

A Congenital malformation is typically defined as any abnormality affecting the

structure or function of the body that is present from birth.<sup>1</sup> Congenital malformations are a global health problem. Every year an estimated of 7.9 million children are born with a serious birth defect, 3.3 million children (under five years) die from birth defects, and 3.2 million who survive may develop a disability later in life.<sup>2</sup> Furthermore, more than 7000 different congenital malformation have been identified to date. While some are clinically obvious at birth; others may only be diagnosed later in life.<sup>3</sup> Congenital malformations can be caused by single gene defects, chromosomal disorders, multifactorial inheritance, environmental teratogens and micronutrient deficiencies.

Maternal infections such as rubella, maternal illnesses like diabetes mellitus, iodine and folic acid deficiency, exposure to medicinal and recreational drugs including alcohol and tobacco, certain environmental chemicals, and doses of radiation are all other factors that cause congenital malformations.<sup>4</sup>

The prenatal diagnosis of congenital malformation consists of non-invasive techniques such as ultrasonography scan in first or second trimester and maternal serum alpha-fetoprotein measure. Invasive techniques consist of amniocentesis and chorionic villus sampling.

The treatment and rehabilitation of these children with congenital malformations is very costly, hence the need to identify causative and risk factors and prevent them early where possible is necessary.<sup>5</sup>

The prevention of these disorders is available in 60% of cases. This needs however epidemiological information.

Prevalence studies of congenital anomalies are useful to establish baseline rates, to document changes over time, and to identify clues to the etiology.<sup>6</sup> Many of the developed countries monitor the prevalence of congenital malformations through registration or surveillance system of fetuses and infants. In addition, international organizations have been established to conduct worldwide surveillance and research into the occurrence and possible causes of congenital anomalies and to establish prevention strategies.<sup>6</sup>

The prevalence of congenital malformations ranges from 1% to over 4% depending on the place and population studied. For instance; it ranges from an average of 1.07% in Japan to 4.3% in Taiwan.<sup>4,5,7</sup>

In the United States, where most research has been conducted on this subject, a 2-3% birth prevalence of congenital malformations has been reported. The birth prevalence of congenital malformations in England is 2% and in South Africa it is

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1.49%. These variations may be explained by social, racial, ecological, and economical influences.<sup>8</sup> The actual prevalence of congenital malformations in Africa may be different than in the developed world due to differences in genetics and differences in exposures such as infections, while the recognized prevalence may be different for reasons of underreporting, deficiencies in diagnostic capabilities, and poor follow-up for examination for anomalies in the post-

natal period. The rare studies on congenital malformations in Africa have reported an incidence between 1.5% and 2.5% in Egypt and East Africa (Kenya and Uganda) respectively.<sup>7</sup> In Morocco congenital malformations are an important cause of infant mortality and morbidity and the studies about the prevalence of fetal malformation are rare and about small samples.<sup>9</sup> This study was designed to determine the prevalence, pattern and factors associated with congenital malformations in a tertiary teaching hospital at Rabat, the capital of Morocco for a 4-year period from January 2011 to December 2014. The result from this study will contribute to the knowledge of congenital malformations in this particular area and hence the supportive preventive policy.

## Materials and Methods

### Study area

The study was conducted at the Maternite Souissi, the obstetrical department of a tertiary teaching hospital of Rabat, Morocco. This is the first teaching unit in the country. It caters to an average 70-80 new antenatal registration per day and 16000 deliveries per year. It includes a region called Rabat sale Zemmour Zear. This region covers approximately 9580 square kilometers. Situated in North-Western Morocco, the region has a population of more than 2.3 million people, with both, rural and urban background.

### Study population

To describe the study population, we analyzed the different characteristics of the mother and the newborn. Congenital malformations were defined as obvious anomalies of structure or form and present at

birth. All the newborns with congenital malformations were examined by a pediatrician at the delivery room.

The study covers births with gestational age of 22 weeks or greater. Mothers' age was categorized. Mothers body mass index was categorized into 3 groups, normal (18,5-25 kg/m<sup>2</sup>), overweight (25-30 kg/m<sup>2</sup>), and obese (>30 kg/m<sup>2</sup>). Other variables include parity status and history of abortion. For the newborn, birth weight was categorized into 3 groups: low birth weight (<2499 g), normal birth weight (2500-4199g) and macrosomia (>4200g).

The gestational age was divided into 3 age groups: preterm (22-36 weeks), at term (37-42 weeks) and post term (>42 weeks).

Other variables include life status with Apgar score, gender, fetal presentation and type of delivery. Congenital malformations were categorized according to the International Statistical Classification of Diseases and Related Health Problems 10th Revision (ICD-10) Version for congenital malformations, deformations and chromosomal abnormalities. When two systems were involved, it was recorded as multiple congenital anomalies.

## Data analysis

Data was analyzed using SPSS 13.0. Rates and proportions were calculated with 95% confidence intervals.

## Results

During this 4-year period, there were 68704 birth delivered at Maternite Souissi, the obstetrical department of a Tertiary teaching hospital of Rabat, the capital of Morocco. Out of this birth number, 706 showed congenital malformations. The prevalence rate of congenital malformations was 1.02%. The mean age of the mothers whose newborn have congenital malformations was 29.8 ± 7.2 years. The mean Boy Mass index was 28.1 ± 6.9 kg/m<sup>2</sup>. In this study, 40.2% of mothers had overweight and 30% were obese. Also, 13.3% of the women had a history of abortion. Table 1 shows maternal characteristics. The nervous system was the most affected system (19.4%) followed by the musculoskeletal system (14.2%), the chromosomal abnormalities (12.3%) and the genito-urinary system (10.8%). Table 2 shows the frequency and

**Table 1. Mother's characteristics.**

Parameter		Frequency	Percentage
Maternal age	≤19	43	6.7
	19-24	136	21.3
	25-30	145	22.7
	30-35	133	20.8
	35-40	113	17.7
	>40	68	10.7
BMI kg/m <sup>2</sup>	Normal <25	151	29.8
	Overweight 25-30	204	40.2
	Obese >30	152	30
Gravida	1	310	44.7
	2	163	23.5
	≥3	221	31.8
History of abortion	Yes	94	13.3
	No	612	86.7

**Table 2. Classifications of congenital malformations according to ICD10.**

Systeme	Frequency	Percentage	ICD10	95% Confidence Interval
Congenital malformations of the nervous system	137	19.4	Q00-Q07	16.6-22.4
Cleft lip and cleft palate	43	6.1	Q35-Q37	4.4-7.9
Congenital malformations of the urinary system	76	10.8	Q60-Q64	8.4-13.0
Congenital malformations and deformations of the musculoskeletal system	100	14.2	Q65-Q78	11.6-16.7
Congenital malformation syndromes predominantly affecting facial appearance	29	4.1	Q87.0	2.7-5.7
Gastroschisis and other congenital malformations of abdominal wall	30	4.2	Q79.3 Q79.5	2.7-5.8
Congenital absence, atresia and stenosis of anus without fistula Imperforate anus	12	1.7	Q42.3	0.8-2.8
Atresia of esophagus without fistula	14	2.0	Q39.0	1.0-3.1
Chromosomal abnormalities	87	12.3	Q90-Q91	9.8-14.9
Multiple Congenital malformation,	111	15.7		13.2-18.6
Other congenital anomalies	67	9.5		7.4-11.8

percentage of congenital malformations according to the ICD 10. This study shows also that males newborns (57.9%) had more congenital malformations than females (40.5%). Concerning life status at time of delivery, 512 (75.2%) were alive with an Apgar Score >7, 51 (7.2%) had fetal asphyxia, and 118 (17.3%) were still birth. Table 3 summarizes the characteristics of the congenital malformations.

## Discussion

Congenital malformations are one of the major causes of pregnancy loss, stillbirth, neonatal death, and physical defects and disabilities around the world.<sup>1</sup>

The prevalence rate of congenital malformations of 1.02% obtained in our study is similar to the findings of Swardekar in Oman (1.2%),<sup>10</sup> Madi in Kuwait who reported an incidence of 1.25%,<sup>11</sup> and Mashhadi Hussein who reported in Iran a prevalence rate of 1.12%.<sup>5</sup> Our prevalence rate was low compared to the results of the European network of population-based registers for the epidemiological surveillance of congenital malformations (EUROCAT) (2.4%).<sup>4</sup> Prevalence from Nigeria has been reported as 2.7%, Taiwan 16 4.3%, Bahrain 2.7% and Saudi Arabia 2.79%.<sup>6,12</sup> Table 4 resumes a comparison of prevalence of congenital malformations in different Arab and African countries. However, any two studies are never comparable in the strict sense of the term because the true prevalence of congenital malformations depends upon

many factors like place of study, nature of sample, ethnicity, geographical distribution and socioeconomic status. The mean maternal age (in years) of those with congenital malformations is  $29,8 \pm 7.2$ . It corresponds to the results of other publications.<sup>1,6</sup> High incidence of congenital malformations among primi-gravida was reported by our study. In other studies, the incidence of congenital malformations was higher in multiparous.<sup>13-15</sup> Chromosomal anomalies are known to be the single most common cause of spontaneous abortion. Historically, 50% of spontaneously expelled aborts have been

thought to be chromosomally abnormal.<sup>16</sup>

An increased risk of karyotypic abnormality identified at the time of prenatal diagnosis is demonstrated in patients with an increasing number of spontaneous miscarriages.<sup>17</sup> 13.3% of women in our study had a history of miscarriage. In this study the most common anomaly was nervous system which is consistent with reports from some African countries, Saudi Arabia, Pakistan and India.<sup>7,13</sup> The lack of folic acid supplementation, may explain the increased occurrence of these disorders in our series. Some studies, however, recorded a higher

**Table 3. Newborn's characteristics.**

Parameter		Frequency	Percentage
Gender	Male	395	57.9
	Female	276	40.5
	Genital ambiguity	11	1.6
Gestational age	Preterm	119	17.4
	At term	549	80.4
	Post term	15	2.2
Birthweight	2.5-4kg	435	64.6
	<2.5 kg	175	26.0
	>4 kg	63	9.4
Fetal presentation	Cephalic	534	85.3
	Breech	75	12
	Transverse	10	1.6
	Other	7	1.2
Mode of delivery	Vaginal delivery	450	64.7
	Caesarean delivery	245	35.3
Life status	Alive	512	75.2
	Stillbirth	118	17.3
	Fetal asphyxia	51	7.5

**Table 4. Congenital malformations in other countries.**

Author	Country (city)	Prevalence rate	N. congenital anomalies (deliveries)	Study period
Juliet Ndibazza [2]	Entebbe, Uganda	2.03	180 (2365)	2003-2005
Herbert A Obu [6]	Enugu, South-East Nigeria	2.8	17/706	January 2007 and April 2011
Sandeep Sachdeva [3]	Haryana, India	1.64	47	Randomly selected 4 months of a calendar year (2010)
Mohamed A. El Koumi [4]	Zagazig Governorate, Egypt	2.5	63/2517	January 2011 to December 2011
Hossein Mashhadi Abdolahi [5]	Tabriz, northwest of Iran	1.12	254/22500	2004-2012
A.G. Tomatr [8]	Denizli, Turkey	0.29	183/63159	2000-2004
Shabbir Hussain [13]	Kharian, Pakistan	7	226/3210	September 2011 to February 2013
Isa Abdi-Rad [19]	Urmia, Northwestern Iran	1.87	264/14121	January 2001 through June 2005
Sallout [12]	King Fahad Medical City, Saudi Arabia	2.7	217/5379	March 2005 to February 2007
Sawardekar [10]	Nizwa, Oman	2.46	541/21 988	January 1993 through December 2002
Madi SA [11]	Al Jahra , Kuwait	12.5	97/7739	January 2000 to December 2001
Al Hosani H*	National Congenital Anomalies Register, United Arab Emirates	0.79		1999-2001
Our study	Rabat, Morocco	1.02	706/68704	January 2011 to December 2014

\*Al Hosani H, Salah M, Abu-Zeid H, Farag HM, Saade D. The National Congenital Anomalies Register in the United Arab Emirates. East Mediterr Health J. 2005;11:690-9.

incidence of musculoskeletal system.<sup>2,4</sup>

There was no case of cyanotic congenital heart defect at birth noted in this study. Under diagnosis is especially right for congenital heart diseases at birth even in developed countries, as it usually gets detected later after discharge from institution.<sup>3</sup>

The incidence of congenital malformations in our study was higher in male than in female. This is consistent with most studies made around the world.<sup>11,18</sup> Although, some rare studies have shown a difference with a higher prevalence of congenital malformations among female than male.<sup>19</sup> We also found that the rate of congenital malformations in full-term neonates was higher than in preterm neonates. This was in contrast with studies from Nigeria and Pakistan.<sup>3,11</sup>

In this study, the incidence of congenital malformations was higher among normal weight babies in comparison to the low birth weight babies. Nevertheless, the association of low birth weight and malformations has been well documented in other studies.<sup>4</sup> In our study, the rate of stillbirth was 17,3% which is compatible with the studies carried in Iran.<sup>11</sup> To date, there are no such large epidemiological studies done on major congenital anomalies in Morocco.

In terms of limitations, the current study was based on a hospital delivery unit and, as such, is not representative of the situation in the community at large. A lack of post-mortem examination of stillborn infants, and those delivered at home who died in the neonatal period, incomplete follow-up to age one year, and lack of genetic studies; all of these may have resulted in an underestimation of the overall prevalence of congenital anomalies. Moreover, the introduction of advanced techniques such as fetal visualization using ultrasound screening and chromosome microarray testing at birth, would greatly improve the early detection of anomalies in many developing countries.<sup>2</sup> It is necessary to establish a registry system for congenital anomalies.

A prospective, community-based study is thus desirable.

## Conclusions

The results from this 4-year period

study shows that the prevalence of congenital malformations in Maternite Souissi, the obstetrical department of a tertiary teaching hospital of Rabat, the capital of Morocco is 1.02%. This study gives also a view of the pattern of congenital malformations in our country. All results appear to be consistent with similar ones from the studies in other countries. This would give a stimulus for further studies in the subject and a health-care plan for prevention strategies.

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