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Prevalence and Pattern of Congenital Anomalies in a Tertiary Hospital in Central Vietnam

Hoang Thi Nam Giang, MBBS,[1,2] Susanne Bechtold-Dalla Pozza, PhD,[1,3] Sarah Ulrich, PhD,[1,4] Le Khac Linh, MBBS,[5] *and* Hoang Thi Tran, PhD[2,6,7]

[1]Center for International Health, Ludwig-Maximilians-University, Munich, Germany
[2]The Faculty of Medicine and Pharmacy, The University of Da Nang, Da Nang, Vietnam
[3]Pediatric Endocrinology and Diabetology, University Children's Hospital, Ludwig-Maximilians-University, Munich, Germany
[4]Department of Pediatric Cardiology and Intensive Care Medicine, Ludwig-Maximilians-University, Munich, Germany
[5]Residency Training Program, VinUniversity Project, 458 Minh Khai Street, Hai Ba Trung District, Ha Noi, 100 000, Vietnam
[6]Da Nang Hospital for Women and Children, Da Nang, Vietnam
[7]Da Nang University of Medical Technology and Pharmacy, Da Nang, Vietnam
Correspondence: Hoang Thi Nam Giang, The Faculty of Medicine and Pharmacy, The University of Da Nang, 41 Le Duan Street, Hai Chau District, Da Nang, Vietnam. Tel: +84934936571. E-mail<htngiang@ud.edu.vn>.

ABSTRACT

Background: Burden and pattern of congenital anomalies are insufficiently reported in Vietnam. This study aims to determine the prevalence and pattern of congenital anomalies in neonates in a tertiary hospital in central Vietnam.

Methods: A prospective cross-sectional study recruited all newborns with congenital anomalies in Da Nang Hospital for Women and Children—where nearly 60% neonates in the city are delivered.

Results: Over a 1-year period, 551 out of 14 335 registered live births were found to have congenital anomalies, equivalent to an overall prevalence of 384.4 per 10 000 live births. Congenital heart defects were the most common type (52.3%) with the prevalence of 200.9 per 10 000 live births, followed by anomalies of musculoskeletal system, digestive system.

Conclusions: This study revealed a high prevalence of congenital anomalies with the most common type being congenital heart defects in central Vietnam compared to both higher income countries and resource-limited settings.

KEYWORDS: birth defect, congenital anomalies, congenital malformation, congenital heart defect, Vietnam

INTRODUCTION

Congenital anomaly is a serious global public health problem because it is a major cause of child mortality and morbidity worldwide. Congenital anomaly causes lifelong disability and considerable impacts on the health care system. In 2015, congenital anomaly was responsible for nearly 276 000 neonatal deaths around the world; 95% of the deaths came from low-middle income countries [1, 2]. Prevalence and pattern of congenital anomalies have been reported in developed countries. However, there are surprisingly few data on this matter in countries with limited resources.

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KEY NOTE

- Little is known about the prevalence and pattern of congenital anomalies in Central Vietnam
- A high prevalence of congenital anomalies was documented in this study with the most common types of congenital anomalies are congenital heart defects, musculoskeletal anomalies, digest system anomalies, cleft lip and cleft palate.
- More studies on risk factors associated with congenital anomalies in Vietnamese context are needed

Vietnam is a low-middle income country with a population of approximately 90 million people and accurate birth prevalence of congenital anomalies is difficult to obtain because the health report system is being developed and the diagnostic capability is limited.

Central Vietnam was toxic contaminated from Agent Orange during the Vietnam War and Da Nang Airbase has been confirmed as a significant dioxin hotspot [3–5]. More than 50 years after the use of Agent Orange during Vietnam War, the concentration of dioxin remains elevated indicating extremely high contamination [3]. Agent Orange appears to be an increased risk factor of birth defects [6]. Data and information related to congenital anomalies in Vietnam are still insufficient. We hypothesized that the prevalence of congenital anomalies and subgroups are higher than in other parts of Vietnam.

The current study was conducted to determine the prevalence and patterns of congenital anomalies in newborn infants in Da Nang Hospital for Women and Children.

METHODS

Study design

This is a cross-sectional study over 1 year from April 2015 to March 2016, recruiting all newborns with congenital anomalies born in Da Nang Hospital for Women and Children.

Study setting

The study was conducted in the neonatal unit and delivery room at Da Nang Hospital for Women and Children. The hospital was established in 2011 to offer health care for children and women. Every year there are around 14 000 pregnant women from different parts of Da Nang and surrounding provinces including Quang Nam and Quang Ngai. There are approximately 4000 admissions to the neonatal unit, mainly neonates with different diseases, among those congenital anomalies playing a big part. Da Nang has a population of about one million people. The surrounding provinces of Quang Ngai and Quang Nam have a population of approximately three million people. During the Vietnam War, in central Vietnam, Da Nang, Quang Nam and Quang Ngai were heavily contaminated from Agent Orange [4, 5, 7, 8].

Study procedure

Data was collected prospectively after birth using a structured form designed for this study (Supplementary Table 1). Information collected includes sex, type of congenital anomalies, maternal and perinatal history and parents' demographic information, like highest educational qualification, occupation of mother and father, smoking, alcohol consumption, pesticide exposure and chronic diseases. Information on newborns with congenital anomalies was extracted from medical records at the time of discharge by two research nurses. If the newborn had visible congenital anomalies and severe health problems, they were transferred to the neonatal unit and information was recorded in the neonatal unit. If the newborn had minor congenital anomalies and no need to admit to the neonatal unit, information was recorded in the delivery room. Data were checked to avoid duplicated cases between neonatal unit and delivery room.

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For those babies that were obviously healthy, they were examined at least one time by health professionals (doctor, nurse,or midwife) before leaving the hospital. Only newborns with suspected problems were checked by a pediatrician. Newborns stayed three days in hospital if they were vaginally born and five days if they were born with caesarean section.

Measurement of endpoints

Congenital anomalies were diagnosed based on clinical evaluation, imaging examination and blood tests, information was documented in the medical records by doctors. Categories of congenital anomalies were described according to the International Classification of Disease, version 10 (ICD-10) [9]. Isolated or single congenital anomaly or multiple anomalies within the same body system was counted as one anomaly. Multiple congenital anomalies are two or more unrelated structural anomalies [10].

For congenital heart diseases, if the baby was suspected to have congenital anomaly after clinical examination, Doppler ultrasound was performed to confirmed diagnosis. Repeated ultrasound before discharge was performed in infants with atrial septal defect or patent ductus arteriosus to confirm the final diagnosis.

Data analysis

Data were rechecked and entered into Microsoft Excel sheet. Statistical analysis was conducted using R Statistical Language (R Foundation for Statistical Computing, Vienna, Austria).

Primary outcome is the presence of congenital anomalies. As congenital anomalies occur during intrauterine life, total births should be denominator in congenital anomaly statistics [10]. However, it is difficult to obtain accurate data on congenital anomalies in stillbirth in hospitals in Vietnam background. Therefore, in the descriptive analyses, the prevalence of congenital anomalies, defined as the number of congenital anomalies per 10 000 live births, was calculated as the total number of infants with congenital anomalies per total number of live births who were born in the hospital during the research period. The independent variables included parental demographic factors and neonatal factors. Categorical variables were described as proportion and chi-squared or Fisher exact test were performed to compare proportion between individual items. Poisson distribution was used to calculate 95% confident interval (CI) of congenital anomalies and their subgroups prevalence. The alpha level was set at $\alpha = 0.05$. For analyzing congenital anomaly characteristics, a newborn with multiple congenital anomalies was counted as one unit. For specific analysis of a particular defect or system defect, each anomaly was counted as one unit.

Ethical approval

The study was approved by the Scientific and Ethics Board of Da Nang Hospital for Women and Children and the Ethics Board of the Medical Center of Ludwig Maximilian University. Individual informed consent was not required. Our research complies with the World Medical Association Declaration of Helsinki regarding ethical conduct of research involving human subjects.

RESULTS

General characteristics

Among 551 newborns with congenital anomalies, there were 241 (43.7%) male. Multiple births accounted for 16 (2.9%) of the deliveries. There was 458 (83.1%) newborns had a single congenital anomaly and 93 (16.9%) had multiple anomalies. Thus, there were a total of 796 anomalies among 551 newborn babies. Mother's abortion history was presented in 122 cases (22.1%) and maternal history of giving preterm birth was presented in 19 cases (3.4%).

Prevalence of congenital anomalies of inborn newborns

Over a full calendar year, 551 inborn newborns were found to have congenital anomalies out of 14 335 live births registered at Da Nang Hospital for Women and Children within the study period. This corresponds to an overall prevalence of 384.4 per 10 000 live births (95% CI 353.8–417.5). Prevalence of all main categories of congenital anomalies is presented in Table 1.

Congenital heart defects were the most common congenital anomaly with a prevalence of 200.9 per

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Table 1. Prevalence (per 10,000 live births) of main congenital anomalies categories in Da Nang, 2015–2016 (n = 14 335)

Congenital anomalies category	No. of case	Prevalence (95 % CI)	Proportion (%)
Total	551	384.4 (353.8–417.5)	100
Multiple congenital anomalies	93	64.9 (52.7–79.8)	16.9
Single congenital anomalies	458	319.5 (291.6–349.9)	83.1
Congenital heart defect	288	200.9 (178.9–225.6)	52.3
Musculoskeletal system	42	29.3 (21.4–40)	7.6
Digestive system	32	22.3 (15.5–31.9)	5.8
Cleft lip and palate	15	10.5 (6.0–17.7)	2.7
Genital organs	12	8.4 (4.5–15.0)	2.2
Nervous system	11	7.7 (4.0–14.2)	2.0
Chromosomal anomaly	10	7.0 (3.5–13.3)	1.8
Urinary system	5	3.5 (1.3–8.6)	0.9
Eye, ear, face and neck	5	3.5 (1.3–8.6)	0.9
Respiratory system	3	2.0 (0.5–6.7)	0.5
Congenital tumor	10	7.0 (3.5–13.3)	1.8
Congenital adrenal hyperplasia	1	0.7 (0.04–0.5)	0.2
Congenital hypothyroidism	1	0.7 (0.04–0.5)	0.2
Other congenital anomalies	15	10.5 (6.0–17.7)	2.7

10 000 live births (95% CI 178.9–225.6) and accounting for 52.3% of all congenital anomalies. The second most common anomaly allotted to musculoskeletal system anomalies with 29.3 per 10 000 live births (95% CI 21.4–40.0), digestive system anomalies 22.3 per 10 000 live births (95% CI 15.5–31.9) and cleft lip and cleft palate 10.5 per 10 000 live births (95% CI 6.6–17.7). The prevalence of anomalies of respiratory and urinary system were less than five per 10, 000 live births.

Prevalence of single congenital anomaly was 319.5 per 10 000 live births (95% CI 353.8–417.5), accounting for 83.1% of all congenital anomalies. The prevalence of multiple congenital anomalies was 64.9 per 10 000 live births (95% CI 52.7–79.8).

Among newborn infants with congenital heart defect, atrial septal defect was the most common with 251 (48.5%) cases. Among those with musculoskeletal system anomalies, polydactyly, syndactyly and clubfoot were the most commonly defects with 50 (74.6%) cases. Hirschsprung disease accounted for 18 (38.3%) and ano-rectal atresia/stenosis accounted for 16 (34%) of all digestive system anomalies.

Indeterminate sex, anencephaly, congenital cystic adenomatoid malformation of lung and congenital posterior urethral valves were found to be the most common anomalies of genital anomalies, nervous system anomalies, respiratory system anomalies and urinary system anomalies with 37.5%, 27.7%, 50% and 42.9% respectively.

The prevalence of chromosomal anomalies was 7 per 10 000 live births. Down syndrome was the most common chromosomal anomaly and it accounted for 83.3% of chromosomal anomalies.

The 15 major anomalies were presented in Table 2.

DISCUSSION

Congenital anomalies cause both early mortality and long-term disability. Their impact in low-middle income countries is much higher than in high income countries [11]. Recognizing the burden of congenital anomalies and associated disabilities is essential to identify priorities for care and prevention of congenital anomalies. In this hospital-based prospective study, we investigated the prevalence and pattern of congenital anomalies in Da Nang.

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Table 2. Prevalence of the selected congenital anomalies in Da Nang (per 10 000 live births)

Congenital anomalies subtypes	Da Nang (Prevalence per 10 000 live birth)
Atrial septal defect	175.09
Patent ductus arteriosus	119.98
Ventricle septal defect	41.15
Cleft lip and palate	23.02
Down's syndrome	13.95
Hirchsprung disease	12.6
Polydactyly	11.9
Syndactyly	11.9
Clubfoot	11.2
Ano-rectal atresia and stenosis	11.2
Pulmonary atresia/stenosis	8.4
Gastroschisis	4.9
d-Transposition of great arteries	3.5
Diaphragmatic hernia	3.5
Anencephaly	3.5

Vietnam is a low-middle income country. At present, there is no data on perinatal mortality rate in Da Nang. Perinatal mortality rate of 23 per 1000 live births in Vietnam was estimated based on data from seven provinces represent seven regions of Vietnam from 1997 to 1999 [12]. The prevalence of congenital anomalies in Vietnam has been estimated 1–3% [13, 14]. The high prevalence of congenital anomalies of 384.4 per 10, 000 live births is higher than the report from the EUROCAT (261.5 per 10 000 births) and Korea (286.9 per 1000 live births) [15], and higher than recent reports from more resource-rich setting in the region such as Thailand (261.2 per 10 000 live births) and Singapore (239.9 per 10 000 live birth) [16]. The high prevalence of this recent study may be explained by the fact that Da Nang hospital for Women and Children is a referral hospital for high risk pregnancy and sick children.

In terms of environmental agents, central Vietnam including Da Nang was highly contaminated by Agent Orange, Da Nang airbase was determined as a 'dioxin hotspot'. In addition, the high prevalence calculated could also be attributed to the classification of congenital anomalies using ICD-10 which does not differentiate major and minor anomalies. However, the prevalence of congenital anomalies found in this study was lower than the prevalence estimated to the South-East Asia Region by the World Health Organization 510 per 10 000 live births (congenital anomalies: 310 per 10 000 live births and chromosomal disorders: 39 per 10 000 live births, single-gene disorders: 14.7 per 10 000 live births) [11], Indonesia 593 per 10 000 live births, Bangladesh 586 per 10 000 live birth. Limited diagnostic capability might attribute to underestimate the prevalence of congenital anomalies in the current study. Although most of the births were attended by medical staffs, only suspected cases were examined by pediatricians, therefore less severe anomalies could be missed.

Among all congenital anomalies, congenital heart defect was the most common defect, followed by anomalies of musculoskeletal system and digestive system.

Studies in Korea [15] and UK [17] reported similar data. However, a study from India [18] reported mainly musculoskeletal anomalies, followed by gastro-intestinal and central nervous, while Mashuda *et al.* [19] reported in Tanzania the highest number of congenital anomalies was related to nervous system and musculoskeletal system. The prevalence of atrial septal defect was particularly high in Da Nang, approximately 10 times higher than in USA and 2.5 times higher than in Korea. The prevalence of cleft lip and cleft palate was also three times higher than that in United States and two times higher than in Korea. When considering the overall prevalence of congenital heart defects, the prevalence of 200.9 per 10 000 live births represents the prevalence of isolated congenital heart defects only. The birth prevalence of congenital heart defect in Da Nang reported in our study was particularly higher than that in the EUROCAT (82.16 per 10 000 births) [20], Korea (124.5 per 10 000 live births) [15], USA (108 per 10 000 live births) [21] and China (52.41 per 10 000 live births) [22]. Other regions in Vietnam also reported a prevalence of congenital heart defect significantly lower than in Da Nang, 1.6 per 10 000 live births in Ho Chi Minh (six cases with congenital heart defects out of 37 530 births) [14], 17.6 per

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10 000 live births in Binh Dinh (29 cases with congenital heart disease out of 16 444 live births), and 3.1 per 10 000 live births in Ha Noi (six cases with congenital heart disease out of 18 834 live births) [23]. The difference in frequency may be due to difference in environmental and genetic factors, time and method of collecting data, difference in diagnostic ability and diagnostic criteria [24]. Agent Orange during the War might further be a possible cause of high prevalence in congenital anomaly. Regarding fetal number, the finding in our study is similar with previous study, that congenital heart defect in twins is more common than in singletons (63% increase in the odds for congenital heart defect for twins) [25].

The limitation of the study

An important limitation of hospital-based studies such as our study is that they will not represent the full spectrum of congenital anomalies of general population. Another limitation was that the study could not record the prevalence of congenital anomalies among perinatal deaths therefore the current prevalence might underestimate the true situation. Furthermore, we only collected data of cases that present in neonatal period during the hospitalization, congenital anomalies presented later in life might be missed.

CONCLUSION

In conclusion, this study highlighted the prevalence of congenital anomalies within 1 year in the largest hospital for women and children in central Vietnam. It revealed a high birth prevalence of congenital anomalies in central Vietnam compared to high income countries, resource-limited setting and high risk countries. Among those, congenital heart defect is the most common anomalies. These findings have informed and raised awareness about the high prevalence of congenital anomalies including congenital heart defect in a population in central Vietnam possible due to late effects of environmental contamination two to three generations ago.

SUPPLEMENTARY DATA

Supplementary data are available at *Journal of Tropical Pediatrics* online.

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