Journal of Medical Sciences

ISSN 1682-4474

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Research Paper

J. Med. Sci., 8 (6): 547-552
15th September, 2008

Prevalence of Congenital Heart Disease in Iran: A Clinical Study

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This research was performed to study the prevalence of Congenital Heart Diseases (CHDs) in Iranian population. Data on the prevalence of CHDs were collected and analyzed from the major hospitals of Ahwaz, Khuzestan Province, Iran from the year 1998 to 2007. The present investigation in Ahwaz, from 1998 to 2007, revealed a mean prevalence of 12.30 per 1000 live births of the total 3061 inpatients and live births with a yearly prevalence varying from 7.93 to 17.51 per 1000 live births. The most frequent type of CHD was found to be Atrial Septal Defect (ASD) (19.54%) followed by Tetralogy of Fallot (TOF) (16.99%), Patent Ductus Arteriosus (PDA) (17.97%), Shunt (11.47%) and Ventricular Septal Defect (VSD) (11.07%). The prevalence of CHDs in Ahwaz is increasing from 1998 to 2007 which might be due to the improvement of diagnosis, attention or awareness among the medical authorities on the disease. The prevalence of CHDs in Ahwaz is not very high, however; it is an important disease which needs an immediate medical attention.

Key words: Congenital heart diseases, epidemiology, Ahwaz, prevalence

JMS (ISSN 1682-4474) is an International, peer-reviewed scientific journal that publishes original article in experimental & clinical medicine and related disciplines such as molecular biology, biochemistry, genetics, biophysics, bio-and medical technology. JMS is issued eight times per year on paper and in electronic format.

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INTRODUCTION

It has been suggested and it is probably correct, that virtually any form of heart disease can lead to the development of heart failure (Francis, 2001). The societal burden of symptomatic heart failure is considerable as it has been estimated that 0.5-2% of the adult population in the developed world is affected at any one time, the burden of disability is substantial and the prognosis poor (McMurray and Stewart, 2000). An equal number of people are thought to have asymptomatic left ventricular dysfunction (McDonagh, 2000) and as populations age the prevalence of both symptomatic and asymptomatic left ventricular dysfunction will increase yet further. Crucially, however, advances in the treatment of heart failure are paralleling these epidemiological trends. Congenital Heart Diseases (CHDs) are the malformation of the heart or the large blood vessels associated with the heart, affecting various parts or function. It is one of the leading causes of mortality in the first year of life (Noonan, 1994; Greenwood, 1985). CHDs are the common single group of abnormalities accounting for about 30% of the total congenital abnormalities (Noonan, 1994). In ~90% of the CHD cases, there is no identifiable cause that can be attributed as multifactorial defects. The majority of these structural abnormalities occur as isolated malformation in most patients, but about 33% have associated anomalies (Frias, 1993).

In the year 2000, the prevalence of CHD in the pediatric population was estimated at approximately 623,000 (320,000 with simple lesions, 165,000 with moderately complex disease and 138 000 with highly complex CHD) (Hoffman *et al*., 2004). Tremendous advances in medical and surgical care of children with CHD over the past decade have made survival into adulthood a reality. At the time of the Bethesda Conference in 2000, an estimated total of 787,000 adults were living with CHD (368 800 with simple disease, 302 500 with moderately complex disease and 117,000 with highly complex disease) (Webb and Williams, 2001; Williams *et al*., 2006). Iran, a country 1,648,000 km^2 wide, a Middle Eastern country with a population of 65 million, south of the Caspian Sea and north of the Persian Gulf, is three times the size of Arizona. It shares borders with Iraq, Turkey, Azerbaijan, Turkmenistan, Armenia, Afghanistan and Pakistan. Khuzestan is one of the 30 provinces of Iran. It is in the southwest of the country, bordering Iraq and the Persian Gulf. Its capital is Ahwaz and covers an area of 63,238 km^2 and population of 4.3 million.

Prevalence studies on CHDs have been done several times world wide. Although it is a common disease, a few studies on the prevalence of CHDs in Iran have been reported. In view of this, the study tries to show the prevalence of CHDs for 10 years among the patients in different hospitals of Southwest region of Iran, Ahwaz.

MATERIALS AND METHODS

The present investigation was conducted in Ahwaz from the year 1998 to 2007. Data on the prevalence of CHDs were collected and analyzed from major private and governmental hospitals in Ahwaz. These hospitals receive major number of children as patients which also includes patients referred by other hospitals from in and around Ahwaz. These hospitals are easily accessible to all the city inmates as well as, to the inmates of neighboring districts and are affordable to the common man. Total 1365 patients were including in this study. The subjects in the present study included pediatric live births and inpatients that had been examined for various illnesses in the hospital by the pediatricians. The patients were divided into 7 groups according to age: (1) neonateo to 3 years; (2) 4 to 6 years; (3) 7 to 10 years; (4) 11 to 15 years; (5) 16 to 20 years, (6) 21 to 30 years and (7) 31 to 45 years and more.

The source of information was the medical and echocardiography records at these hospitals. The suspected CHD patients who showed symptoms like poor feeding, failure to thrive, respiratory problem, discrepancy in pulse, cyanosis, heart murmur, abnormal chest X-ray, or strong family history had been subjected by the researchers for further clinical diagnosis, extensive X-ray analysis, ECG and echocardiography examination for the conformation of the CHDs. Prevalence, age and sex specific frequency of all kinds of CHDs were computed.

Different types of CHDs considered for the present investigation are: Ventricular Septal Defect (VSD), Atrial Septal Defect (ASD), Tetralogy of Fallot (TOF), Patent Ductus Arteriosus (PDA), Pulmonary Stenosis (PS), Transposition of Great Arteries (TGA), Total Anomalous Pulmonary Venous Connection (TAPVC), Partial Anomalous Pulmonary Venous Connection (PAPVC), Pulmonary Artesia (PA), Single Ventricle (SV), Ebstein Anomaly (EA) and Complex CHDs (various types of CHDs existing together including rare type of CHDs). Exclusion criteria included CHDs with associated syndromes, since the present study was to know the prevalence of isolated CHDs in Ahwaz.

RESULTS

At the global level excluding Iran, population based epidemiological studies on CHDs have indicated a prevalence ranging from 1.01 (Egypt) to 17.5

Table 1: Prevalence of congenital heart diseases at global level as cited in the available literature and our study

Country/city	Frequency per 1000 live births	References
Thailand	3.30	Pongpanich *et al.* (1975)
UK	5.51	Dickinson *et al.* (1976)
USA	6.60	Fixler *et al.* (1981)
Hong Kong	6.35	Sung *et al.* (1990)
Norway	10.60	Meberg *et al.* (1991)
Austria	6.90	Stumpflen *et al.* (1994)
Karachi	4.00	Hassan *et al.* (1996)
Qatar	12.23	Robida *et al.* (1997)
Bohemia	6.16	Samanek *et al.* (1997)
Lebanon	11.50	Bitar *et al.* (1999)
Oman	7.10	Subramanyan *et al.* (1999)
Egypt	1.01	Bassili *et al.* (2000)
India	4.20	Chadha *et al.* (2001)
Saudi Arabia	10.70	Alabdulgader *et al.* (2001)
Bosnia-Herzegovina	6.12	Begic *et al.* (2003)
Australia	17.50	Bolisetty *et al.* (2004)
Isfahan	6.90	Saberi *et al.* (2006)
Present	12.30	2008

(Central Australia) per 1000 live births (Table 1) (Kenna *et al.*, 1975; Pongpanich *et al.*, 1976; Dickinson *et al.*, 1981; Fixler *et al.*, 1990; Sung *et al.*, 1991; Meberg *et al.*, 1994; Stumpflen *et al.*, 1996; Hassan *et al.*, 1997; Robida *et al.*, 1997; Samanek *et al.*, 1999; Bitar *et al.*, 1999; Subramanyan *et al.*, 2000; Bassili *et al.*, 2000; Chadha *et al.*, 2001; Alabdulgader, 2001; Begic *et al.*, 2003; Bolisetty *et al.*, 2004; Saberi *et al.*, 2006). Table 2 presents the prevalence of different types of CHDs in which ASD is found to be the most prevalent type of defect (19.54%). The present investigation in Ahwaz, from 1998 to 2007, revealed a mean prevalence of 12.30 per 1000 live births of the total 3061 in patients and live births with a yearly prevalence varying from 7.93 to 17.51 per 1000 live births (Table 3). The most frequent type of CHD was found to be ASD (598 patients) with a prevalence of 19.54% of the total CHDs recorded. The other frequent

Table 2: Prevalence of major types of congenital heart diseases in Ahwaz hospitals during 1998-2007

	No. of patients in different age-groups (years)							
Lesions	0-3	4-6	7-10	11-15	16-20	21-30	31-45	Total (%)
PDA	20	30	136	129	154	25	56	550 (17.97)
COA	16	23	0	0	10	0	3	52 (1.70)
ASD	35	19	112	213	127	71	21	598 (19.54)
VSD	13	8	58	137	103	15	5	339 (11.07)
PA	7	4	18	55	0	14	17	3.76 (115)
Shunt	21	16	83	58	89	51	33	351 (11.47)
TOF	30	20	115	131	117	62	45	520 (16.99)
AVC	2	6	0	0	0	9	0	17 (0.56)
PAPVC	2	0	0	0	5	0	0	7 (0.23)
SAW	26	20	0	0	15	0	15	76 (2.48)
PS	4	6	15	55	0	13	17	110 (3.59)
TGV	0	0	1	0	0	0	0	1 (0.03)
TGA	0	0	0	3	0	0	0	3 (0.10)
Cashion defect	0	0	0	0	3	0	0	3 (0.10)
TAPVC	0	0	0	0	0	5	0	5 (0.16)
Fontan	0	14	0	1	5	0	4	24 (0.78)
Sinus venosus	0	0	0	0	0	0	1	1 (0.03)
Complex	47	35	33	57	63	27	27	289 (9.44)
Total (%)	223 (7.29)	201 (6.57)	571 (18.65)	839 (27.41)	691 (22.57)	292 (9.54)	244 (7.97)	3061

Patent Ductus Arteriosus (PDA), followed by Atrial Septal Defect (ASD), Tetralogy of Fallot (TOF), Ventricular Septal Defect (VSD), Atrioventricular Septal Defect (AVSD), Transposition of Arteries (TGA), Transposition of Ventricle (TGV), Pulmonary Stenosis (PS), Single Ventricle (SV), Total Anomalous Pulmonary Venous Connection (TAPVC), Partial Anomalous Pulmonary Venous Connection (PAPVC), Sub Aortic Web (SAW), Pulmonary Atresia (PA), Complex CHDs (ASD+PDA; VSD+PDA; ASD+PS; VSD+PS; VSD+AVC; VSD+PAB; TF+ASD+PDA; VSD+PS+PDA; ASD+SAW; COA+PDA; TF+PDA; ASD+MVR; VSD+AR; VSD+AI; PDA+PS; ASD+VSD; ASD+VSD+PS; TF+SAW)

Table 3: Data about congenital heart disease from major private and governmental hospitals, Ahwaz, Iran (from 1998-2007)

Year	No. of live birth	No. of CHDs	Prevalence per 1000 live births*
1998	18163	144	7.93
1999	10845	150	13.83
2000	21800	192	8.81
2001	23416	202	8.63
2002	20485	241	11.76
2003	13653	239	17.51
2004	25141	345	13.72
2005	31995	433	13.53
2006	33589	503	14.98
2007	18163	612	7.93

*The present data revealed a mean prevalence of 12.30 per 1000 live births of the total 3061 inpatients and live births with a yearly prevalence varying from 7.93-17.51 per 1000 live births

Table 4: The total number of individual CHD in percent recorded during 1998-2007 in Ahwaz comparing to CHD as cited in the available literature

Country/City	PDA	ASD	VSD	TOF	COA	PS	Complex and others	References
Ceylon	14.80	31.90*	17.60	7.50	0.7	12.60	14.90	Wallooppillai and Jayasinghe (1970)
Nigeria	18.00	14.20	27.00*	12.30	1.2	12.30	15.00	Antia (1974)
India	11.00	12.00	29.00*	17.00	2.0	7.00	22.00	Chadha *et al.* (2001)
UK	11.90	5.90	32.50*	5.90	6.3	7.60	29.90	Pongpanich *et al.* (1976)
USA	8.30	7.40	32.10*	3.80	6.7	8.60	33.10	Dickinson *et al.* (1981)
Qatar	5.10	7.20	40.60*	5.10	4.1	8.70	29.20	Hassan *et al.* (1997)
Oman	10.30	14.40	24.90*	9.60	3.7	8.80	28.30	Venugopalan and Agarwal (2002)
Saudi Arabia	8.60	11.50	39.50*	4.20	2.7	8.90	24.60	Alabdulgader (2001)
Kuwait	19.00	9.70	33.20*	4.10	4.8	7.60	21.60	Abushaban *et al.* (2004)
Present	17.97	19.54*	11.07	16.99	1.7	3.59	29.14	2008

Abbreviation: Patent Ductus Arteriosus (PDA) is the most frequent defect of all the recorded defects, followed by Atrial Septal Defect (ASD), Tetralogy of Fallot (TOF), Ventricular Septal Defect (VSD), Transposition of Arteries (TGA), Aortic Stenosis (AS), Pulmonary Stenosis (PS), Single ventricle (SV), Tricuspid Artesia (TA), Total Anomalous Pulmonary Venous Connection (TAPVC), Partial Anomalous Pulmonary Venous Connection (PAPVC), Complex CHDs. *Most frequent type of CHDs as cited in the available literature and results show in the present work

Table 5: Frequency of congenital heart diseases recorded from neonates to 45 years during 1998-2007 in Ahwaz hospitals

	1998		1999		2000		2001		2002		2003		2004		2005		2006		2007	
Age group (years)	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
0-3	11	14.58	20	13.33	42	21.88	35	17.33	49	20.33	51	21.34	97	28.12	73	16.86	73	14.51	115	18.79
4-6	15	20.14	36	24.00	51	26.56	41	20.30	33	13.69	43	17.99	69	20.00	81	18.71	115	22.86	163	26.63
7-10	21	30.56	45	30.00	29	15.10	19	9.41	31	12.86	31	12.97	47	13.62	42	9.70	41	8.15	25	4.08
11-15	12	15.97	19	12.67	19	9.90	53	26.24	57	23.65	29	12.13	35	10.14	113	26.10	95	18.89	175	28.59
16-20	4	6.25	16	10.67	25	13.02	19	9.41	43	17.84	61	25.52	19	5.51	29	6.70	78	15.51	49	8.01
21-30	6	9.03	5	3.33	14	7.29	11	5.45	17	7.05	17	7.11	26	7.54	38	8.78	52	10.34	36	5.88
31-45	3	3.47	9	6.00	12	6.25	24	11.88	11	4.56	7	2.93	52	15.07	57	13.16	49	9.74	49	8.01
Total	144		150		192		202		241		239		345		433		503		612	

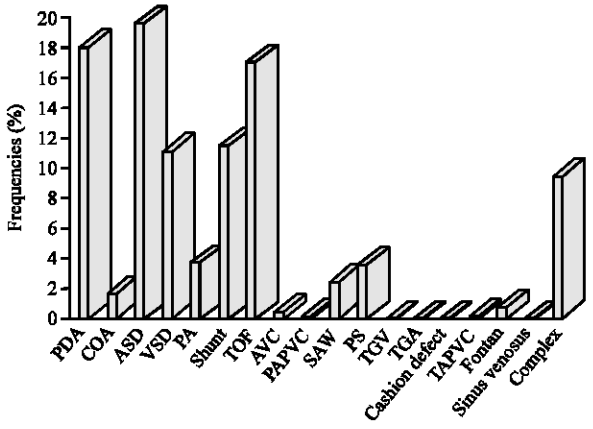

Fig. 1: Prevalence of major types of congenital heart diseases in Ahwaz Hospitals

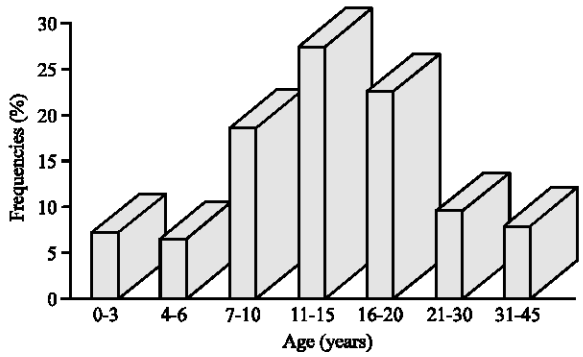

Fig. 2: Congenital heart diseases recorded at different age groups in Ahwaz Hospitals

defects were found to be TOF with a prevalence of 16.99% (520 patients) followed by PDA (550 patients) with 17.97%, Shunt (351 patients) with 12.53% and VSD with 11.07 % (339 patients) (Table 4). The Fig. 2 shows the total number of individual CHD in percent recorded during 1998-2007. PDA is the most frequent defect of all the recorded defects, followed by ASD, TOF, VSD, AVSD, TGA, AS, PS, SV, PA, TAPVC, PAPVC, Complex CHDs. The CHDs which were not been confirmed as to what type of defect, has been excluded while calculating the percentage of individual CHDs Less frequent types of CHDs were COA, AS, PS, TGA, TGV, SV, TAPVC, PAPVC, PA and complex CHDs (Fig. 1). Table 5 reveals the age when the CHDs were detected in the patients. The Fig. 2 presents the total number in percent of diagnosed patients at different age range during the year 1998-2007. Congenital heart diseases recorded at different age groups in males and females in Ahwaz hospitals during the year 1998-2007 also have been presented here (Fig. 3).

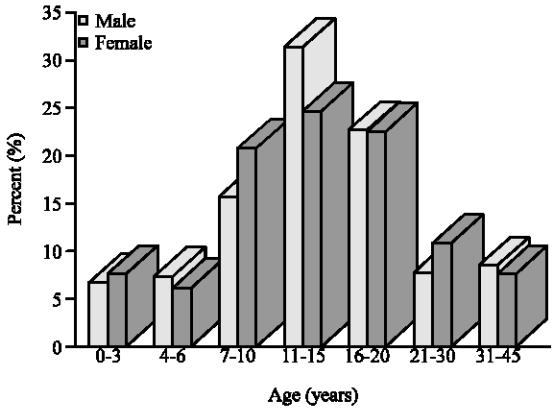

Fig. 3: Congenital heart diseases recorded at different age groups in males and females in Ahwaz Hospitals

DISCUSSION

The recent exponential increase in the knowledge of genetics has revolutionized the understanding of CHDs during the past few decades (Srivastava, 2001; Mani *et al*., 2002). The present study has been undertaken to understand the prevalence of CHDs in Ahwaz from the year 1998-2007. The most frequent type of CHD was found to be PDA which is in accordance with other studies. The frequency of the rare and more frequent types of CHDs like COA, PS, ASD, VSD, PDA, TOF were less when compared to the western data (Pongpanich *et al*., 1976; Dickinson *et al*., 1981; Hassan *et al*., 1997; Chadha *et al*., 2001; Venugopalan and Agarwal, 2002; Antia, 1974; Wallooppillai and Jayasinghe, 1970; Bidwai *et al*., 1971; Abushaban *et al*., 2004) (Table 4). This could be due to the severity of the defects which might have lead to the death of the patients before accessing the medical facilities. This might also be due to racial and genetic factors in different populations. Of the total CHDs a few cases which were clinically diagnosed as CHDs could not be categorized into their respective types due to lack of echocardiography report.

The prevalence of CHDs in Ahwaz is increasing from 1998 to 2007 (Table 3) which might be due to the improvement of diagnosis, attention or awareness among the medical authorities on the disease. Missing of the CHD patients was avoided to the maximum as these three hospitals are the major and the largest hospitals which are easily reached by the common man. However, inevitably some cases would have escaped detection and referral which includes neonates, especially born at home who die without medical attention which can be considered as negligible.

The present findings indicate that (a) prevalence of CHDs in Ahwaz is not as high as the prevalence reported by other studies around the world, (b) however; it is a serious problem, which requires immediate attention for the improvement of diagnostic and therapeutic facilities which is accessible to the common man.

ACKNOWLEDGMENTS

This study (grant No. PRC13) has been conducted in Physiology Research Center (PRC) of Ahwaz Joundi-Shapour University of Medical Sciences. We would like to thanks the patients and their family. We thank Ahwaz Joundishapour University of Medical Sciences for giving us an opportunity to carry out present research.

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