RESEARCH PAPER
INTERNATIONAL JOURNAL OF PURE MEDICAL RESEARCH

Pediatrics

KEYWORDS: Congenital Heart disease - Incidence - Outcome.

INCIDENCE AND OUTCOME OF CONGENITAL HEART DISEASE AMONG NEONATES WITH RESPIRATORY DISTRESS IN BENHA CHILDREN HOSPITAL NEONATAL INTENSIVE CARE UNIT

Volume-4, Issue-9, September - 2019
ISSN (O): 2618-0774 | ISSN (P): 2618-0766

Mona El Beshry	Professor of Pediatrics, Faculty of Medicine - Benha University
Rasha Shaker	Assistant Prof. of community, Faculty of Medicine-Benha University
Akram El Shafey	Assistant Prof. Pediatrics, Faculty Of Medicine-benha University
Effat H. Assar	Lecturer of Pediatrics, Faculty of Medicine-Benha University
Dina A. Sobhi*	M.B.B.Ch Faculty of Medicine - Benha University *Corresponding Author dr.dina.3ali@gmail.com

Article History
Received: 06.06.2019
Accepted: 18.08.2019
Published: 10.09.2019

ABSTRACT:

Background: Congenital Heart disease (CHD) is one of the most frequently occurring congenital defects which affect the newborn population. Congenital heart defects are very serious problem in current perinatology**.** The incidence of moderate to severe structural CHD in live born infants is 6 to 8 per 1000 live birth**.** Early CHD detection has definite effect on prognosis and the future implications of the disease on the patient and the family. The aim of this work was to determine the incidence and outcome of congenital heart diseases among neonates with respiratory distress in Benha Children Hospital Neonatal Intensive Care Unit (NICU).

Methods: This study was retrospective study which conducted on 1020 registered cases at Benha Children Hospital (BENCH) NICU during period from 2013 to 2015. This study was done in the period from first of October 2016 to March 2017. All subjects were subjected to history, clinical examination and Imaging (Echocardiography).

Results: Incidence of congenital heart disease among the studied groups was 47.1%. % of male was significantly higher among CHD patients than those without (70.8%, 59.3% respectively) p =0.000 **.**% of CS was significantly higher among CHD patients than those without (83.3%, 77.8% respectively) p =0.03 **.**% of improved outcome was significantly lower among CHD patients than those without (54.2%, 92.6% respectively) p =0.000

Conclusion: Incidence of congenital heart disease among the studied groups was 47.1%. % of improved outcome was significantly lower among CHD patients than those without (54.2%, 92.6% respectively) p =0.000

1-INTRODUCTION:

Congenital Heart disease (CHD) is one of the most frequently occurring congenital defects which affect the newborn population **(Yang et al., 2009).**

CHD by definition as proposed by Mitchell is "agross structural abnormality of heart or intrathoracic great vessels that is actually or potentially of functional significance". It has vast array of clinical presentation ranging from asymptomatic detection of the defects to symptomatic cardiac disease which may lead to death **(Farooqui et al., 2010).**

Congenital heart disease (CHD) has already been known as an important cause of significant morbidity and mortality in neonatal period. Neonatal unit is the best place for screening and diagnosis of CHD **(McCabe, 2002).**

A congenital heart defect that requires surgery or catheter intervention in the first year of life is termed critical CHD and comprises about 25% of those suffering from CHD (**Hussain et al., 2014)**

CHD has a multi-factorial etiology. Genetic and environmental factors play apart in the development **(Nikyar et al., 2011).**

Early CHD detection has definite effect on prognosis and the future implications of the disease on the patient and the family **(Farooqui et al., 2010).**

CHD accounts for significant mortality and morbidity in neonatal period and later on all over the world. However, reported incidence in literature varies in different countries, racial and ethnic groups. There are multiple factors for this variation, including lack of technical facilities and necessary skills. As a result, many defects remain undetected **(Fatema et al., 2008).** Such difficulties in identification of CHD have been described in details by (**Hoffman and Kaplan, 2002).**

Congenital heart defects are a very serious problem in current perinatology **(Kociszewska-Najman et al., 2010).** The incidence of moderate to severe structural congenital heart disease (CHD) in live born infants is 6 to 8 per 1000 live birth **(Hoffman and Kaplan, 2008).**

Clinical presentation and deterioration of CHD may be sudden and some treatable defects may even cause death before diagnosis **(Fernando and Arrigo, 2008).** Early detection of CHD and new possibilities of their treatment have decreased mortality rates in neonates **(Kociszewska-Najman et al., 2010).** Failure to identify pathological murmurs may delay necessary medical or surgical intervention and cause unwanted sequences **(Azhar and Habib, 2011).**

CHD has a multi-factorial etiology. Genetic and environmental factors play apart in the development **(Nikyar et al., 2011).**

Early CHD detection has definite effect on prognosis and the future implications of the disease on the patient and the family **(Farooqui et al., 2010).**

The aim of this work was to determine the incidence and outcome of congenital heart diseases among neonates with respiratory distress in Benha Children Hospital Neonatal Intensive Care Unit (NICU).

2- Subjects and Methods

I-Technical design:

This retrospective study was conducted on registered cases at

Benha Children Hospital (BENCH) NICU during period from 2013 to 2015. This study was done in the period from first of October 2016 to March 2017.

Site of study: Participants were recruited from Benha Children Hospital (BENCH) NICU.

Time of study: The field work (collection of data) started as soon as the protocol was accepted and approved (in the period from first of October 2016 to March 2017).

Subjects: The study group included 1020 cases having RD.

Sampling :
All patients fulfilling the inclusion criteria and accept to participate was included in the study.

Inclusion criteria:
- Both sexes were included.
- Post natal age from 1-28 days.
- Neonates with clinically suspected congenital heart disease.
- The signs of congenital heart disease may include:
- Tachypnea.
- Retraction.
- Cyanosis.
- Circulatory compromise.

Exclusion criteria:
- Post natal age more than 28 days.

II -Operational design:
Ethical consideration:
Informed consents were obtained. An approval from Research Ethics Committee in Benha faculty of medicine was obtained.

Tool of data collection:
All patients was subjected to the following
1 History taking regarding:
- Gestational age
- Consanginous marriage and method of delivery
- Maternal risk factor
- Hypoxic insults

2- Examination:
A General: Vital signs, general condition and presence of other congenital malformation.
B) Local:
Cardiac inspection: Tachypnea and retraction.
Palpation: Palpable pulsation or thrill.
Auscultation: Heart sounds and murmer.

3- investiogation:
Imaging:
Echocardiography: To detect specific pathology.

3-Statistical analysis:
The data were coded, entered and processed on computer using SPSS (version 18).The results were represented in tabular and diagrammatic forms then interpreted. Mean, standard deviation, range, frequency, and percentage were use as descriptive statistics. The following test was done: **Chi-Square test X^2** was used to test the association variables for categorical data. **Student's t-test** was used to assess the statistical significance of the difference between two population means in a study involving independent samples.

P value was considered significant as the following: * P > 0.05: Non significant.* P ≤ 0.05: Significant

4-RESULTS:
The study was conducted on 660 (64.7%) males and 360 (35.3%) females among all studied cases. Regarding to age among all studied cases ranged between 1 and 22 day with Mean ±SD of age (days) was 4.46±4.49 day in total studied cases. GA in all studied cases ranged between 26 and 42 week with Mean ±SD of GA (weeks) was 34.96±3.26 week in total studied cases. 820 (80.4%) were delivered by C.S and 200 (19.6%) were delivered by N.V.D. 680 (66.7%) had no MRF and 340 (33.3%) had MRF. (**Tab: 1**).

Incidence of congenital heart disease among the studied groups was 47.1%. (**Tab: 2**).

% of male was significantly higher among CHD patients than those without (70.8%, 59.3% respectively) p =0.000 .% of CS was significantly higher among CHD patients than those without (83.3%, 77.8% respectively) p =0.03 .% of MRF was significantly lower among CHD patients than those without (25%, 40.7% respectively) p =0.000 .% of delayed 1st cry was significantly higher among CHD patients than those without (40%, 1.9% respectively) p =0.000 **(Tab: 3).**

Mean value of G.A was significantly higher among patients with CHD than those without (35.70, 34.31 respectively) p <0.001 .Mean value of age was not significantly among patients with CHD than those without (4.27, 4.63 respectively) p >0.05 .Mean value of weight was significantly higher among patients with CHD than those without (2423.54, 2072.96 respectively) p <0.00. **(Tab: 4).**

Of the congenital heart disease cases (150 (31.25%) had pulmonary hypertension,130 (27.08%)had patent ductus arteriosus (PDA),60(12.5%)had atrial septal defect (ASD),30(6.25)had transposition of great arteries (TGA) and 10(2.08%) had ventricular septal defect (VSD), Tetralogy of Fallot, dextrocardia, persistent truncus arteriosis, AS,PS and HCOM). **(Tab: 5).**

% of improved outcome was significantly lower among CHD patients than those without (54.2%, 92.6% respectively) p =0.000 **(Tab: 6).**

5-DISCUSSION:
Our study reported incidence of congenital heart disease among the studied groups was 47.1%.

This agrees with **(Moss et al., 2009)** in their prospective observational study based in a UK regional referral neonatal centre over an eight month period on 82 infants. Echocardiography identified 44 (53.6%) infants with a structural cardiac abnormality.

Our study reported an incidence of 471/1000 live births which is high when compared to 6.7/1000 shown by **(Yang et al., 2009).**

4/1000 live births in a review of different studies by **(Fernando and Arrigo, 2008)** and 8.6/1000 live births by **(Nikyar et al., 2011)**. It may be due to differences in size and nature of sample, place of study and methods employed to detect CHD. It may be due to a common factor that our study was conducted in a tertiary care setup. Our high reported incidence may be due to the reason that our unit is a tertiary care unit and a referral hospital. It may be due to all cases had respiratory distress . Moreover, we had a screening programme for all high-risk cases like positive family history for CHD, associated congenital malformations, history of drug intake and mothers suffering from diabetes mellitus and systemic lupus erythematosus (SLE). Many lesions likely to be closed in the first week of life were also picked up in this study, thus giving a high incidence. In addition to genetic factors affecting CHD incidence, racial differences and environmental factors like nutritional status may also be the reason for differences in incidence. A trained paediatrician/neonatologist in our study examined all cases within the first 24 hours of life so that even asymptomatic cases of CHD could also be picked up.

Sanatani and Smythe, (2003), studied all neonates in the NICU by echocardiography between 1 January 1992 and 31 December 1994. The incidence of structural heart disease was 2.8% (40 out of 1434).

Baltaxe and Zarante, (2011) estimated the prevalence of congenital heart defects in Colombia States. In a prospective case-control study on 44,985 infants born from June 1, 2001 to April 30, 2005.were reported (1.2 per 1,000) cases had CHD. They concluded that their study showed a similar prevalence of congenital heart disease to that found in Spain, Mexico, and South America.

In Central Australia reported 108 live births with CHD by echocardiography among 6156 live births with an incidence of 17.5 per 1000. However, the incidence of both major and minor types of CHD was significantly higher than previously reported from other regions of Australia. **(Bower et al., 2002**).

As regards Arab countries **(Samson and Kumar, 2010)** reported that, out of 11,085 live births, there were 83 neonates (who had a median age of 4.5 days) with a congenital cardiac defect, giving an incidence of 7.49 per 1000 live births. This incidence of congenital cardiac malformation in the United Arab Emirates is similar to that described in the gulf region and worldwide.

The high incidence of CHD may also reflect the high utilization of echocardiography for assessing minor lesions **(Bolisetty et al**., **2004)**.

A potential cause for the difference in prevalence might be racial differences. In our study all the neonates were Egyptian, Caucasians race. A study performed in the United States showed either no difference or a slightly increased prevalence of CHD in the white population compared with the non-white population **(Botto et al., 2007).** In contrast, in Western Australia, CHD was 30% more common in Aboriginal compared with non-Aboriginal total births **(Bower et al., 2002).**

This study showed that, % of male was significantly higher among CHD patients than those without (70.8%, 59.3% respectively) p =0.000

This agrees with **(Hussain et al., 2014)** who made prospective study which conducted in the neonatal unit of Combined Military Hospital (CMH), Rawalpindi, from September 2008 to August 2011. It is a tertiary care referral hospital catering to patients from peripheral military hospitals as well as serious civilian patients. All the newborn babies of this hospital admitted in the neonatal unit for any reason from the operation theatre, labour rooms and post-natal wards were included in the study. Moreover, neonates admitted from outdoor and referred from other armed forces hospitals/civil hospitals were also included. Data was collected on a predesigned proforma that included information regarding gender, weight, gestational age and family history of CHD and associated malformations. He aimed to estimate the incidence of CHD, the pattern of the malformations, he found there was a male preponderance 50(57.47%) versus 37(42.52%) female babies.

This study showed that there is a male preponderance which is consistent with (**Farooqui et al., 2010)** i.e. male 61.72% to female 42.52% and **(Nikyar et al., 2011).** However, it is in contrast with studies conducted in Saudi Arabia **(Alabdulgader, 2006)** and Iceland **(Stephensen et al., 2004)** where they showed equal incidence in males and females. Our result is entirely opposite to a study conducted in Nigeria **(Correa-Villansenor and McCarter, 1991)** where female patients outnumbered the males. These differences can be explained on the basis of ethnic and racial factors. **Reller et al., (2008)** also has shown association of certain CHD lesions with gender of neonate.

This study showed that mean value of G.A was significantly higher among patients with CHD than those without (35.70, 34.31 respectively) p <0.001

This agrees with **(Fatema et al., 2008)** which found mean value of G.A was significantly higher among patients with CHD than those without.

This study showed that % of family history of consanguinity was significantly higher among CHD patients than those without (14.6%, 3.7% respectively) p =0.000

This agrees with **Hussain et al., 2014)** who found history of consanguinity to be a significant etiological factor of congenital heart diseases

Positive consanguinity was encountered in 14.6% of our cases. This in line with the study done by **Settin et al., (2008)** in Mansoura Locality, Egypt, where positive parental consanguinity was found in 18.8% of CHD cases. Also, **Bassili et al., (2000)** reported high rate of positive parental consanguinity as a risk factor for CHD. In addition, in a study done in Iran, parental consanguinity was found in 39.6% of cases with CHD (**Nikyar et al., 2011).**

Our finding are similar to those reported by **(Gucer et al., 2011),** in their study on 305 cases with CHD found that there was parental consanguinity in 22% of cases.However other studies detected higher percentages; **(Nabulsi et al., 2009)** who studied 759 Lebanese patients with different types of congenital heart malformations from the Children's Cardiac Registry Center (CCRC) at the American University of Beirut Medical Center. Their study showed a rate of consanguinity as high as 34.7%.

This study showed that, mean value of weight was significantly higher among patients with CHD than those without (2423.54, 2072.96 respectively) p <0.001

This agrees with **(Fatema et al., 2008)** which found mean value of weight was significantly higher among patients with CHD than those without. This may be explained on the contery, **Reller et al., (2008)** has suggested that CHD may impair the growth of the foetus.

This study showed that of the congenital heart disease cases (150 (31.25%) had pulmonary hypertension,130 (27.08%)had patent ductus arteriosus (PDA),60(12.5%)had atrial septal defect (ASD),30(6.25)had transposition of great arteries (TGA) and 10(2.08%) had ventricular septal defect (VSD), Tetralogy of Fallot, dextrocardia, persistent truncus arteriosis, AS,PS and HCOM).

Moss et al., (2009) in their previously mentioned study, reported 44 infants with congenital heart disease; 26 neonates (59%) had PDA (14 were significant and 12 were not), 8 neonates (18.1%) had isolated VSD, 7 neonates (15.9%) had isolated ASD, 3 (6.8%)had Atrioventricular septal defect, 3 (6.8%) had Hypoplastic left heart syndrome/hypoplastic aortic arch, One (2.2%) had Coarctation of Aorta, One (2.2%) had Transposition of the great arteries and One (2.2%) had Complex congenital cyanotic heart defects

.

On the other hand in Western Galilee Hospital, Israel, **(Roguin et al., 2003)** reported muscular VSD in 56 (25 male, 31 female) of 1,053 neonates 6 to 170 h old, a prevalence of 53.2/1,000 live births. All these neonates were asymptomatic. Similarly **(Samson and Kumar, 2010 , Bolisetty et al. 2004 and Dorfman et al., 2011),** all found VSD to be the most commonly encountered CHD.

Botto et al., (2007) suggested that the rapid increase in the rates of minor defects, such as small VSDs and small ASDs, was due to active case ascertainment and the widespread use of echocardiography.

Early diagnosis and treatment of hemodynamically significant PDA are crucial in preventing complications, such as intraventricular hemorrhage, pulmonary hemorrhage, and necrotizing enterocolitis

Echocardiogram is required for early diagnosis of PDA in preterm infants, as clinical signs are not reliable in the first few days of life **(Alagarsamy et al., 2011).**

The present study detected PDA in 60 (12.5 %)of studied neonates. **(Alenick et al., 2006)** stated that ductus arteriosus was patent in 11% of 45 studied fullterm neonates 4 days of age**.**

This study showed that, % of improved outcome was significantly lower among CHD patients than those without (54.2%, 92.6% respectively) p =0.000

(45.8%) died among CHD patients is more than that reported in other studies where **Shah (et al., 2008)** in Nepal, reported 20% mortality rate among patients with CHD and also, **Jacobs et al., (2000)** in a study from Hong Kong reported 20% mortality in cyanotic heart disease patients. However, the mortality rate is higher in the study by **Humayun and Atiq, (2008)**where mortality rate was 36.4%. The difference may be due to difference in the study population and the availability of cardiac facilities.

6-CONCLUSION:

This study concluded that Incidence of congenital heart disease among the studied groups was 47.1%. % of male was significantly higher among CHD patients than those without (70.8%, 59.3% respectively) p =0.000 **.**% of CS was significantly higher among CHD patients than those without (83.3%, 77.8% respectively) p =0.03 **.**% of improved outcome was significantly lower among CHD patients than those without (54.2%, 92.6% respectively) p =0.000

Table (1): Perinatal history among the studied sample.

		Patients	
		(n=1020)	%
Gender	Male	660	64.7
	Female	360	35.3
Mode of delivery	C.S	820	80.4
	N.V.D	200	19.6
MRF	No	680	66.7
	Yes	340	33.3
Hypoxic Insult	No	970	95.1
	Yes	50	4.9
Diagnosis	CHD	480	47%
	Without CHD	540	53%
Age(days)	Range	1-22	
	Mean +SD	4.46± 4.49	
GA(weeks)	Range	26-42	
	Mean +SD	34.96± 3.26	

Table (2): Incidence of congenital heart disease among the studied groups.

Echocardiography		
	Frequency	Percent
Patients with cong. heart disease	480	47.1
Patients without cong. heart disease	540	52.9

Table (3): Comparing patients with cong. heart and without cong. heart regarding perinatal history.

		Patients without cong. heart disease (No.=540)		Patients with cong. heart disease (No.=480)		X^2	P. value
		No.	%	No.	%		
Gender	Male	320	59.3	340	70.8	14.9	.000*
	Female	220	40.7	140	29.2		
Mode of delivery	CS	420	77.8	400	83.3	4.9	.03*
	NVD	120	22.2	80	16.7		
MRF	No	320	59.3	360	75.0	28.3	.000*
	Yes	220	40.7	120	25.0		
Hypoxic insult	No	530	98.1	440	91.7	22.9	.000*
	delayed 1st cry	10	1.9	40	8.3		

Table (4): Comparing patients with cong. heart and without cong. heart regarding perinatal history.

	Patients without cong. heart disease (No.=540)		Patients with cong. heart disease (No.=480)		t. test	p value
	X+SD	Range	X+SD	Range		
G.A(weeks)	34.31± 3.23	26-40	35.70± 3.17	29-42	6.97	.0001
age(days)	4.63± 4.41	1-22	4.27± 4.62	1-22	1.2	0.05
weight (grams)	2072.96± 822.311	900-4300	2423.54± 861.899	880-4500	6.7	.000*

Table (5): Echocardiography among the studied neonates had congenital heart disease.

Echocardiography		
	Frequency (Total number=480)	Percent
VSD	10	2.08
PDA	130	27.8
ASD	60	12.5
TGA	30	6.25
pulmonary hypertension	150	31.25
AV CANAL	10	2.08
Tetralogy of Fallot	10	2.08
DEXTROCARDIA	10	2.08
MITRAL REGURGE	30	6.25
persistent truncus arteriosis	10	2.08
AS	10	2.08
PS	10	2.08
HOCM	10	2.08

Table (6): Outcome among the studied groups.

		Patients without cong. heart disease (No.=540)		Patients with cong. heart disease (No.=480)		X^2	P.value
		No.	%	No.	%		
Outcome	Improved	500	92.6	260	54.2	197.5	.000*
	Died	40	7.4	220	45.8		

7-REFERENCES:

1. Alabdulgader AA. Congenital heart disease in Saudia Arabia: current epidemiology and future projections. East Mediter Health J 2006; 12: 157-67.
2. Alagarsamy S, Chhabra M, Gudavalli M, Nadroo AM, Sutija VG et al., (2011): Comparison of clinical criteria with echocardiographic findings in diagnosing PDA in preterm infants. JPerinat Med;33:161-4.
3. Alenick DS, Holzman IR and Ritter SB, (2006): The neonatal transitional circulation: A combined non invasive assessment. Echocardiography, 9: 1197- 205.

4. Azhar AS, and Habib HS, (2011): Accuracy of the initial evaluation of heart murmurs in neonates: do we need an echocardiogram ?. Pediatr Cardiol; 27: 234-7.
5. Baltaxe E, Zarante I, (2011): Prevalence of congenital heart disease in 44,985 newborns in Colombia. Arch Cardiol Mex.;76:263-8.
6. Bassili A, Mokhtar SA, Dabous NI, Zaher SR, Mokhtar MM, Zaki A. Risk factors for congenital heart diseases in Alexandria, Egypt. Eur J Epidemiol 2000;16:805–14. http://dx.doi.org/ 10.1023/A:1007601919164.
7. Bolisetty S, Daftary A, Ewald D, Knight B, Wheaton G (2004): Congenital heart defects in Central Australia. Med J; 180: 614-617
8. Botto LD, Correa A, Erickson JD, (2007):Racial and temporal variations in the prevalence of heart defects. Pediatrics; 107: 1-8
9. Bower C, Ramsay JM, (2002): Congenital heart disease: a 10 year cohort. J Paediatr Child Health; 30: 414-8.
10. Correa-Villansenor A, McCarter J. White-black differences in cardiovascular malformations in infancy and socioeconomic factors. Am J Epidemiol 1991; 134: 393-402.
11. Dorfman AL, Levine JC, Colan SD, Geva T, (2011). Accuracy of Echocardiography in Low Birth Weight Infants With Congenital heart Disease. Pediatrics; 115; 102-7.
12. Farooqui R, Haroon UF, Niazi A, Rehan N, Butt TK, Niazi M. Congenital heart diseases in neonates. J Rawal Med Coll 2010; 14: 31-2.
13. Fatema NN, Chowdhury RB, Chowdhury L. Incidence of congenital heart disease among hospital live births in a tertiary hospital of Bangladesh. Cadiovasc J 2008; 1: 14-20.
14. Fernando V L and Arrigo G B, (2008): Cardiopatlas congenitas. Prenatal incidence. Rev Chil Obstet Ginecol; 67: 203-6.
15. Gücer S, Ince T, Kale G, Akcoren Z, Ozkultu S , Talim B et al., (2011): Noncardiac malformations in congenital heart disease: A retrospective analysis of 305 pediatric autopsies. Turk J Pediatr; 47:159-66.
16. Hoffman JI, Kaplan S. The incidence of congenital heart disease. J Am Coll Cardiol 2002; 39: 1890-900.
17. Humayun KN, Atiq M. Clinical profile and outcome of cyanotic congenital heart disease in neonates. J Coll Physicians Surg Pak 2008;18:290–3, http://dx.doi.org/05.2008/JCPSP.290293.
18. Hussain S, Sabir M, Afzal M, Asghar I. Incidence of congenital heart disease among neonates in a neonatal unit of a tertiary care hospital J Pak Med Assoc. Vol. 64, No. 2, February 2014.
19. Jacobs EGJ, Leung MP, Karlberg J. Distribution of symptomatic congenital heart disease in Hong Kong. Pediatr Cardiol2000;21:148–57. http://dx.doi.org/10.1007/s002469910025
20. Kociszwska-Najman B, Zacharska-Kokot E, Kulikowska-Matloz J and Marianowski L, (2010): Echocardiographic abnormalities in infants with heart murmur. Ginekol Pol Jan; 75: 445-50.
21. McCabe LL Newborn screening as a model for population screening. Mol Genet Metab 2002;75:299–307. http:// dx.doi.org/10.1016/S1096-7192(02)00005-7.
22. Moss S, Kitchiner DJ, Yoxall CW, Subhedar NV, (2009): Evaluation of echocardiography on the neonatal unit. Arch Dis Child Fetal Neonatal Ed; 88: 287-9.
23. Nablusi M M, Tamim H, Sabbagh M, Obeid M Y, Yunis K A and Bitar F F, (2009): Parental consanguinity and congenital heart malformations in a developing country. Am J Med Genet; 116A: 342-47.
24. Nikyar B, Sedehi M, Mirfazeli A, Qorbani M, Golalipour MJ. Prevalence and pattern of CHD among neonates in Gorgan, Northern Iran. Iran J Pediatr 2011; 21: 307-12.
25. Reller MD, Stricland MJ, Riehle-Colarausso T, Mahle WT, Correa A. Prevalence of congenital heart disease in metropolitan Atlanta. J Pediatr 2008; 153: 807-13.
26. Roguin N, Du ZD, Barak M, Nasser N, Hershkowitz S, Milgram E, (2003): High prevalence of muscular ventricular septal defect in neonates. J Am Coll Cardiol.; 26:1545-8.
27. Samson G R and Kumar S R, (2010): A study of congenital cardiac disease in a neonatal population- the validity of echocardiography undertaken by a neonatologist. Cardiol Young. ;14: 585-93.
28. Sanatani S, and Smythe JF, (2003): Use of echocardiography in the neonatal intensive care unit. Paediatr Child Health;2 : 187-92.
29. Settin A, Almarsafawy H, Alhussieny A, Dowaidar M. Dysmorphic features, consanguinity and cytogenetic pattern of congenital heart diseases: a pilot study from Mansoura Locality, Egypt. Int J Health Sci (Qassim) 2008;2:101–11.
30. Shah GS, Singh MK, Pandey TR, Kalakheti BK, Bhandari GP. Incidence of congenital heart disease in tertiary care hospital. Kathmandu Univ Med J (KUMJ) 2008;6:33–6.
31. Stephensen SS, Sigfusson G, Eiriksson H, Sverrisson JT, Torfason B, Haraldsson A, et al. Congenital cardiac malformations in Iceland from 1990. Cardiol Young 2004; 14: 396-401.
32. Yang XY, Li XF, Lu XD, Liu YL. Incidence of congenital heart disease in Beijing, China. Chin Med J 2009; 122: 1128-32.