International Journal of Contemporary Pediatrics
*Amroliwala R et al. Int J Contemp Pediatr. 2018 Jan;5(1):75-81*
http://www.ijpediatrics.com
pISSN 2349-3283 | eISSN 2349-3291

DOI: http://dx.doi.org/10.18203/2349-3291.ijcp20175541

**Original Research Article**

# Study of congenital heart diseases in neonates

**Rakesh Amroliwala, Manish Rasania*, Raish Memon, Avina Pokharna, Dixa Shah**

Department of Pediatrics, S.B.K.S. Medical Institute and Research Center, Sumandeep Vidyapeeth, Piparia, Vadodara, Gujarat, India

**Received:** 29 November 2017
**Accepted:** 11 December 2017

***Correspondence:**
Dr. Manish Rasania,
E-mail: mrasania@yahoo.co.in



## ABSTRACT

**Background:** Congenital heart disease defined as an abnormality in cardio circulatory structure or function that is mostly present at birth; even it is discovered much later. Recognition of congenital heart disease in newborn is important as this group abnormality constitutes a significant proportion of congenital malformation that present in the neonatal life, and their early detection is important for appropriate management and good outcome. Objectives of present study were to evaluate clinical profile and outcome of various CHDs identified during neonatal period and to study effect of paracetamol used for pharmacological closure of PDA in preterm neonates.
**Methods:** The study was conducted prospectively in NICU, Dhiraj hospital, Department of Pediatrics and Neonatology from January 2016 to June 2017 (1.5 years span). Echocardiography screening of all neonates suspected of having CHD was done. Details of all neonates having CHD diagnosed by echocardiography were noted in the prescribed Performa and their incidence, clinical profile and outcome was studied.
**Results:** Total 69 cases of CHD diagnosed by Echocardiography in neonatal period were studied. Incidence of CHD among neonates born at Dhiraj hospital was 8.48 per 1000 live birth. Male: female ratio of all CHD cases was 1.38:1. Risk of neonate with CHD is highest (18.18%) in extremely low birth weight neonates. Incidence of CHD was 4.08% in preterm < 34 weeks, 3.47% in late preterms and 0.51% in full term neonates. 86.95% were diagnosed within first week of life. 26.09% babies had associated anomalies. Presenting problem of neonates was breathing difficulty 42 (60.87%), feeding difficulty 36 (52.17%) and cyanosis 5 (7.25%). 8 (11.59%) neonates were asymptomatic. The most common presenting sign was murmur 46 (75.71%). 56 (81.16%) had Acyanotic CHD and 13 (18.84%) had Cyanotic CHD. Amongst 56 (81.16%) Acyanotic CHD cases, commonest was PDA in 44 (78.5%), followed by VSD in 18 (32.14%), ASD in 5 (12.5%) either in isolation or in combination with other lesions. Amongst Cyanotic Congenital Heart Disease, maximum incidence was of Tricuspid Atresia (TA) in 4 (30.76%) cases; followed by TGA in 3 (23.07%). 20 preterm neonates with PDA received paracetamol for PDA closure. 9 (45.0%) responded to paracetamol while 11 (55%) did not respond. 47(68.12%) were discharged, 10(14.49%) went left against medical advice, 7(10.14%) were referred to higher centre for surgery and 5(7.25%) babies expired.
**Conclusions:** Early recognition of congenital heart disease during neonatal life is important as its appropriate and timely management can result in good outcome.

**Keywords:** Acyanotic, Congenital heart disease, Cyanotic, Neonates

## INTRODUCTION

The congenital heart disease are not fixed anatomic defects that appear at birth, but are instead a dynamic group of anomalies that originates in fetal life and changes considerable during the postnatal development.[1] The incidence of moderate to severe structural congenital heart disease in live born infant is 6 to 8 per 1000 live births.[2-5] About 2-3 per 1000 newborn will be symptomatic with heart disease in 1st year of life.

The diagnosis is established by1 week of age in 40-50% of patients. Most congenital defects are well tolerated in the fetus because of the parallel nature of fetal circulation. It is only after when the fetal pathways are closed that the fully hemodynamic impact of an abnormality becomes apparent.[6] Depending upon the severity, CHD (Congenital Heart Disease) presenting at birth can be categorized into 3 groups – mild, moderate, severe. Severe CHD includes all cyanotic lesions as well as acyanotic lesions (Large VSD (Ventricular Septal Defect), Large PDA (Patent Ductus Arteriosus), Critical AS (Aortic Stenosis), Critical PS (Pulmonary Stenosis), Critical Coarctation and AVSD (Atrio Ventricular Septal Defect) which require intervention early in life. Moderate CHD [Mild-Moderate AS or PS, non-critical coarctation, Large ASD (Arterial Septal Defect)] are those that require expert care, but less intensive compared to severe CHD. Mild CHD (Small VSD, PDA, ASD, Mild AS or PS) are asymptomatic and often undergo spontaneous resolution.[7]

Signs and symptoms of severe heart disease in the new born period include cyanosis, discrepant pulses and blood pressures, congestive heart failure, and cardiogenic shock. Early recognition of congenital heart disease during neonatal life is important as its appropriate and timely management can result in good outcome.

Objectives of present study were to evaluate clinical profile and outcome of various CHDs identified during neonatal period and to study effect of paracetamol used for pharmacological closure of PDA in preterm neonates.

## METHODS

This study was done prospectively in NICU, Dhiraj hospital, Department of Pediatrics and Neonatology from January 2016 to June 2017 (1.5 years span). Study included neonates (birth to 28 days) diagnosed as having CHD by echocardiography and admitted in NICU (Neonatal Intensive Care Unit). Permission from institutional ethics committee was taken. Well informed parental consent was taken.

Data was recorded with respect to sex, birth weight, gestational age and presenting features. Detailed physical and general examination, including cardiovascular assessment was done. Chest x-ray (CXR) and Echocardiography were done in all the cases. Other relevant investigations were done in selected cases if required.

Echocardiography examination was done by pediatric cardiologist on GE HEALTH CARE VIVID S6 50/60 HZ. All the NICU admitted neonates were reviewed daily till discharge and early outcome of all neonates having CHD was noted. Their co- morbid conditions were also noted. Hemodynamically significant PDA cases in preterm neonates and PDA cases in VLBW (Very Low Birth Weight) neonates were treated with paracetamol (oral/iv - 15mg/kg/dose 6 hourly for maximum 5 days). To paracetamol non-responders, oral ibuprofen was given 10mg/kg stat, then 5 mg/kg/day for 2 days. Outcome was recorded as cured, leave against medical advice, transfer to other facilities, and expired.

## RESULTS

This study was conducted in NICU, Dhiraj Hospital, department of Paediatrics and Neonatology from January 2016 to June 2017. Total 69 cases of CHD diagnosed by Echocardiography in neonatal period are included in this study. 5 cases of PPHN (Persistent Pulmonary Hypertension of Newborn) with cardiac defects with Right to Left shunt, they were excluded from the study.

**Table 1: Incidence of congenital heart disease.**

| Subject | Inborn | Outborn |
|---|---|---|
| Total Live birth | 3301 | -- |
| NICU Admissions | 650 | 503 |
| Neonates with CHD | 28 | 41 |

Incidence of CHD among neonates born at Dhiraj hospital was 8.48 per 1000 live birth (28 out of 3301 live birth).

**Table 2: Gender distribution of CHD.**

| Sex | Inborn | Outborn | Total no. of cases | % |
|---|---|---|---|---|
| Male | 14 | 26 | 40 | 58.0 |
| Female | 14 | 15 | 29 | 42.0 |

Male:female ratio of all cases of CHD is 1.38:1. Male:female ratio of inborn neonates with CHD is 1:1.

**Table 3: Distribution of CHD by birth weight and gestational age.**

| | Total inborn live births | Inborn with CHD (28) | Outborn with CHD (41) | Total no. of cases (69) |
|---|---|---|---|---|
| **Birth weight (Gram)** | | | | |
| <1000 (ELBW) | 11 | 2 (18.18%) | 3 | 5 (7.25%) |
| 1000-1499 (VLBW) | 51 | 3 (3.92%) | 6 | 9 (13.05%) |
| 1500-2499 (LBW) | 1193 | 17 (1.25%) | 20 | 37 (53.62%) |
| ≥2500 | 2046 | 6 (0.44%) | 12 | 18 (26.08%) |
| **Gestational age** | | | | |
| <34 weeks | 98 | 04 (4.08%) | 08 | 12 (17.39%) |
| 34-<37 weeks | 259 | 09 (3.47%) | 14 | 23 (33.33%) |
| ≥37 weeks | 2944 | 15 (0.51%) | 19 | 34 (49.27%) |

Risk of neonate with CHD is 18.18% in extremely low birth weight neonates, 3.92% in very low birth weight neonates, 1.25% in low birth weight neonates, and 0.44% in normal weight neonates. Incidence of CHD was 4.08% in preterm < 34 weeks, 3.47% in late preterms and 0.51% in full term neonates.

52 (75.36%) neonates were AGA (Appropriate for gestational age), 13 (18.84%) were SGA (Small for gestational age), and 04 (5.79%) were LGA (Large for gestational age).

***Age at the time of diagnosis CHD***

During first week of life 60 (86.95%) cases were diagnosed, with mean day of life on diagnosis of 2.2 days. Between 8 to 28 days of life 9 (13.04%) patients were diagnosed with mean day of life on diagnosis of 13.44 days.

***Antenatal and family history***

Significant antenatal history was present in 14 (20.29%) cases. 4 (5.78%) mothers suffered from fever, of which 2 (2.9%) had associated rash. 5 (7.24%) mothers suffered from diabetes mellitus. 4 (5.78%) suffered from hypertension. 1 (1.45%) mother was on phenytoin medication.

Family history of CHD in siblings was present in 2 (2.90%).

**Table 4: Associated anomalies.**

| Associated anomalies and syndromes (n = 18) | Frequency (N) (out of 69) |
|---|---|
| Skeletal deformity | 7 (10.14%) |
| Organ deformity | 7 (10.14%) |
| Limb deformity | 5 (7.25%) |
| Down syndrome face | 1 (1.45%) |
| Cleft lip with palate | 1 (1.45%) |

18 (26.09%) babies had associated anomalies.

***Presenting symptoms and signs***

Presenting problem of neonates was breathing difficulty 42 (60.87%), feeding difficulty 36 (52.17%) and cyanosis 5 (7.25%). 8 (11.59%) neonates were asymptomatic.

The most common presenting sign was murmur 52 (75.36%), followed by tachycardia 31 (44.92%), tachypnea 31 (44.92%), chest retraction 23 (33.33%), bounding pulse 22 (31.88%), weak pulse 13 (18.84%), cyanosis 7 (10.14%), hypotension 7 (10.14%), CHF (Congestive Heart Failure) 4 (5.79%).

50 (72.46%) of CHD cases had other associated co morbid condition. So, the presenting symptoms and signs may be due to associated co morbid conditions, and may not be due to CHD.

***Associated co morbid conditions with CHD***

50 (72.46%) of neonates with CHD had associated co morbid condition. 19 (27.53%) were without any associated co morbid condition.

**Table 5: List of co morbid conditions.**

| Associated co-morbid condition | Inborn (out of 28) | % | Outborn (out of 41) | % |
|---|---|---|---|---|
| Sepsis | 3 | 10.71 | 10 | 24.39 |
| Pneumonia | 1 | 3.57 | 2 | 4.87 |
| Birth asphyxia | 7 | 25.0 | 4 | 9.75 |
| Prematurity (<34 week) | 4 | 14.28 | 8 | 19.51 |
| RDS | 0 | 0.0 | 5 | 12.19 |
| TTN (Transient Tachypnoea of Newborn) | 1 | 3.57 | 0 | 0.0 |
| MAS (Meconium Aspiration Syndrome) | 1 | 3.57 | 0 | |
| Apnea of prematurity | 1 | 3.57 | 7 | 17.07 |
| ARF (Acute Renal Failure) | 2 | 7.14 | 4 | 9.75 |
| Hypernatremic dehydration | 1 | 3.57 | 2 | 4.87 |
| Hyponatremic dehydration | 1 | 3.57 | 0 | 0.0 |
| Tracheo-esophageal fistula | 0 | 0.0 | 2 | 4.87 |
| Encephalocele | 1 | 3.57 | 1 | 2.43 |

***Investigations***

*Chest radiograph*

22 (31.88%) neonates had normal chest X ray. 47 (68.12%) had abnormal chest x ray findings.

**Table 6: Chest X ray finding.**

| Chest X ray findings | N (n =69) | % |
|---|---|---|
| Cardiomegaly | 25 | 36.23 |
| Right side aortic arch along with egg shaped | 3 | 4.35 |
| Oligemia | 6 | 8.70 |
| Plethora | 6 | 8.70 |
| Lung opacity | 4 | 5.80 |
| Boot shaped heart | 1 | 1.45 |
| Dextrocardia | 2 | 2.90 |
| Normal | 22 | 31.88 |

*Echocardiography*

Out of 69 babies, 56 (81.16%) were having Acyanotic CHD and 13 (18.84%) had Cyanotic CHD.

Amongst 56 Acyanotic CHD cases; commonest was PDA in 44 (78.5%), followed by VSD in 18 (32.14%), ASD in 5 (12.5%) and PAPVC (Partial Anomalous Pulmonary Venous Circulation) in 1 (1.78%) either in isolation or in combination with other lesions.

**Table 7: Type of CHD by Echocardiography findings (N = 69).**

| Type of CHD | | N | % |
|---|---|---|---|
| Acyanotic CHD | ASD | 2 | 2.90 |
| | ASD+PDA | 2 | 2.90 |
| | ASD+VSD | 1 | 1.45 |
| | ASD+VSD+PDA | 2 | 2.90 |
| | PAPVC | 1 | 1.45 |
| | PDA | 33 | 47.83 |
| | VSD | 8 | 11.59 |
| | VSD+PDA | 7 | 10.14 |
| | Total | 56 | 81.16 |
| Cyanotic CHD | Complete AV canal defect+PA | 1 | 1.45 |
| | Complex CHD | 1 | 1.45 |
| | DORV+VSD | 1 | 1.45 |
| | HLHS | 1 | 1.45 |
| | PA+Intact IVS+Large PDA | 1 | 1.45 |
| | TA+ASD+VSD | 2 | 2.90 |
| | TA+ASD+VSD+PDA | 1 | 1.45 |
| | TA+PA | 1 | 1.45 |
| | TGA (Transposition of Great Arteries) | 3 | 4.35 |
| | TOF+PS | 1 | 1.45 |
| | Total | 13 | 18.84 |

Amongst cyanotic 13 cases, commonest was Tricuspid atresia (TA) in 4 (30.76%) cases; followed by TGA in 3 (23.07%), Complex CHD in 1 (7.69%), DORV (Double Outlet Right Ventricle) in 1 (7.69%), TOF (Tetrology of Fallot) in 1 (7.69%), HLHS (Hypoplastic Left Heart Syndrome) in 1 (7.69%), Complete AV canal defect in 1 (7.69%), PA (Pulmonary Atresia) along with intact IVS (Intact Ventricular Septum) in 1 (7.69%)

***Treatment given***

Out of 69 babies 29 (41.43%) received inotropes, 24 (34.29%) received oxygen, 15 (21.43%) were ventilated, 13(18.57%) received furosemide, 5 (7.14%) received digoxin, 14 (20.00%) received paracetamol, 3 (4.29%) received ibuprofen. Preterm with PDA: 27 (38.6%) preterm neonates had PDA. 15 (55.5%) had hemodynamically significant PDA and 12 (44.4%) had hemodynamically non-significant PDA.

***Effect of Paracetamol /Ibuprofen for PDA closure***

20 preterm neonates received paracetamol for medical closure of PDA; of which 9(45%) responded whereas 11(55%) did not respond.

To the 11 paracetamol non-responders ibuprofen was given; of which 4 (36.3%) responded and 7 (63.63%) did not respond. Overall 13 cases (65%) responded to the medical management of PDA closure.

***Outcome***

Out of 69 babies 47 (68.12%) were discharged, 10 (14.49%) went left against medical advice (LAMA), 7 (10.14%) were referred to higher centre for surgery and 5 (7.25%) babies expired.

**Table 8: Details of expired neonates.**

| Type of CHD | No of cases | % | Inborn/ Outborn | Echocardio-graphic finding | Associated co morbid condition | Duration of stay (days) |
|---|---|---|---|---|---|---|
| Cyanotic CHD | 1 | 1.45 | Outborn | TGA | NIL | 3 |
| | 1 | 1.45 | Inborn | Complex CHD | NIL | 2 |
| Acyanotic CHD | 1 | 1.45 | Outborn | Large PDA | Mild RDS (Rrespiratory Distress Syndrome) + LOS (Late onset sepsis) + Apnea of prematurity | 7 |
| | 1 | 1.45 | Inborn | Large PDA | Severe Birth asphyxia [HIE (Hypoxic Ischemic Encephalopathy) stage II] + MAS | 3 |
| | 1 | 1.45 | Outborn | PDA+VSD | Omphalocele + EOS (Early Onset Sepsis) | 4 |
| Total | 5 | 7.25 | | | | |

**Table 9: Details of LAMA Cases**

| Type of CHD | No. of cases | % | Echocardiographic finding | Associated co morbid condition |
|---|---|---|---|---|
| Cyanotic CHD | 1 | 1.44 | TGA | Severe birth asphyxia (No HIE) + sepsis + pneumonia |
| | 1 | 1.44 | Complete AV canal defect | NIL |
| | 1 | 1.44 | TOF | Oesophageal Atresia with tracheo-esophageal fistula |
| | 1 | 1.44 | HLHS | NIL |
| Acyanotic CHD | 1 | 1.44 | Large PDA | EOS |
| | 1 | 1.44 | Moderate PDA | B/L congenital dislocation of hip |
| | 1 | 1.44 | Large PDA | RDS Grade II + nasocomial pneumonia |
| | 1 | 1.44 | Large PDA | LOS |
| | 1 | 1.44 | ASD | LOS + Pneumonia |
| | 1 | 1.44 | VSD | Apnea of prematurity + suspected NEC (Necrotizing Enterocolitis) |
| Total | 10 | 14.49 | | |

70% of LAMA neonates were in moribund state with less chance of survival.

## DISCUSSION

The present study was conducted on 69 newborns, inborn (28) and out born (41) diagnosed as having CHD by Echocardiography and admitted in NICU from January 2016 to June 2017 at Dhiraj Hospital.

During the study period, there were 3301 live births at Dhiraj hospital, of which 28 were diagnosed with CHD. Incidence of CHD among neonates born at Dhiraj hospital was 8.48 per 1000 live birth which is similar to various national and international studies. According to different studies, incidence per live birth is: Chadha SL et al 6-8/1000, Saxena A et al 8-10/1000, Khalil A et al 5-10/1000, Humayun NK et al 8-10/1000.[4,5,8,9]

**Table 10: Cases referred for surgery.**

| Type of CHD | No. of cases | % | Echocardio-graphic finding | Associated co morbid condition |
|---|---|---|---|---|
| Cyanotic CHD | 1 | 1.45 | TA+ASD+VSD | LOS+Hypernatremic dehydration+pre-renal failure |
| | 1 | 1.45 | TA+ASD+VSD+PDA | NIL |
| | 1 | 1.45 | TA+ASD+VSD | NIL |
| | 1 | 1.45 | TA+PA | Bith asphyxia (No HIE) |
| | 1 | 1.45 | TGA | NIL |
| Acyanotic CHD | 1 | 1.45 | PA+INTACT IVS+Large PDA | NIL |
| | 1 | 1.44 | PDA+VSD | Persistent thrombocytopenia + suspected candida infection + refractory CCF (Congestive Cardiac Failure) |
| Total | 7 | 10.14 | | |

In the present study, the Male to Female ratio was 1.38:1. Study by Shah GS, et al in Nepal showed male to female ratio of 1.5:1 and study by Humuayun KN et al in Pakistan showed male to female ratio of 1.7:1.[9,10]

In present study, 73.92% were low birth weight, and 26.08% were with normal birth weight. Risk of CHD is highest (18.18%) in extremely low birth neonates, and least (0.44%) in normal weight neonates. 75.36% neonates were AGA, 18.84% were SGA, and 5.79% were LGA. Yerushalmy A et al.[11] reported higher incidence of CHD in LBW (Low Birth Weight) full term babies. Study by Humayun KN et al reported that 31% babies were low birth weight and 69% were appropriate for gestational age.[9]

In present study, association of gestational diabetes mellitus in mother was found 7.24%, with cardiac defect such as complete AV canal defect, tricuspid atresia (ASD+VSD), complex CHD and PDA. In 5.8% cases, there is history of fever during antenatal period. In 5.8% cases, mother had history of hypertension during pregnanacy.

Mother took teratogenic drug (phenytoin) in 1.50%. 2.90% of neonates had a history of siblings having a congenital heart disease. A study in India by Vaidhyanathan B et al reported that gestational diabetes mellitus was present in 10%, pregnancy induced hypertension in 10.6%, fever in 4.9% and teratogenic drug was in 0.3%.[12] Humuayn KN et al noted that 10% of

neonates had a history of sibling having a congenital heart defect.[9]

In the present study extra, cardiac malformation were found in 26%. Kasturi L et al noted 20% of CHD cases with extra cardiac anomalies.[13] Khalil A et al noted an incidence of 17.9% of somatic anomalies in patient with congenital heart disease.[8] Humayun KN et al noted that 31% had extra cardiac anomalies in a form of imperforated anus, polydactyly, VATER syndrome, tracheoesophageal fistula and cleft palate.[9]

Majority of neonates presented with breathing difficulty (61%), followed by feeding difficulty (52%), cyanosis (bluish discoloration) (7%). Commonest sign was murmur (75.71%), followed by tachycardia (45.71%), tachypnea (44.30%), chest retraction (34.28%), cyanosis (10.00%), hypotension (10.00%), CHF (5.71%). Study by Molaei A et al in Iran observed that respiratory distress (70%) was the most common complaint and cyanosis (24.4%) was the second most common complain.[14]

In present study, Chest X-ray was abnormal in 68% of cases, while normal in 32% cases. Echocardiographic confirmation showed 18.8% neonates with CHD were of cyanotic type, while 81.2% constituted to Acyanotic type. In cyanotic type of CHD, TA along with ASD, VSD, PDA (5.8%) was the commonest cyanotic heart disease followed by TGA (4.3%), complex CHD (1.45%), TOF (1.45%), DORV (1.45%), HLHS (1.45%), Complete AV canal defect (1.45%), PA along with IVS (1.45%). Amongst acyanotic CHD cases, PDA along with other cardiac lesion accounted (63.76%), followed by VSD (26%), ASD (10.1%), PAPVC (1.45%) respectively. Kasturi L et al.[15] noted 19% belonged to cyanotic group where as 81% belonged to Acyanotic group. Khalil A et al noted VSD and PDA were the commonest lesions found in 34.8% and 18.6% respectively.[8] Higher rates of PDA in present study can be explained by location of study (NICU) and higher number of preterm neonates in present study.

72.46% had associated co morbid condition. Associated co morbid conditions were birth asphyxia 7 (25.0%), prematurity 4 (14.28%), sepsis 3 (10.71%), ARF 2 (7.14%), pneumonia 1 (3.57%), followed by TTN 1 (3.57%), encephalocele 1 (3.57%) and apnea of prematurity 1 (3.57%). In out born cases, associated co morbid condition were sepsis 10 (24.39%), prematurity 8 (19.51%), apnea of prematurity 7(17.07%), RDS 5 (12.19%), birth asphyxia 4 (9.75%), ARF 4(9.75%), tracheo-esophageal fistula 2 (4.87%), pneumonia 2 (4.87%), hypernatremic dehydration 2 (4.87%), and encephalocele 1 (2.43%). Khalil A et al noted that the neonatal mortality is not only influenced by available facilities for early detection and surgical correction, but also is dependent on the level of perinatal care because of associated presence of prematurity, low birth weight, infections, asphyxia etc.[8] All these factors were responsible for 60% neonatal death among infants with CHD.

33 (47.83%) neonates had PDA, of which 27 (38.6%) were preterm neonates. Most of these neonates presented with respiratory distress and more than 50% babies had murmur. Out of 27 preterm babies, 15 (55.5%) had hemodynamically significant PDA. 20 preterm neonates with PDA received medication for PDA closure (paracetamol/ibuprofen). 9 (45%) responded to paracetamol, 4 (20%) babies responded to ibuprofen whereas 7 (35%) neonates neither responded to paracetamol nor ibuprofen. Dang D et al in his controlled trials comparing the effectiveness of oral paracetamol to oral ibuprofen showed that PDA closure occurred in 81% in paracetamol and 78% in ibuprofen group.[16]

Out of 69 babies, 47 (67.14%) were discharged, 10 (14.49%) went left against medical advice (LAMA), 7 (10.0%) were referred to higher centre for surgery, 5 (7.14%) babies expired. Khalil A et al noted survival rate of 76.75%, while mortality rate of 23.25%.[8]

## CONCLUSION

Early recognition of congenital heart disease during neonatal life is important as its appropriate and timely management can result in good outcome.

*Funding: No funding sources*
*Conflict of interest: None declared*
*Ethical approval: The study was approved by the Institutional Ethics Committee*

## REFERENCES

1. Perloff JK. The clinical recognition of congenital heart diseases. 4th ed. Philadelhpia: Saunders; 1998. P. 1-3.
2. Hoffman JIE, Kaplan S. The incidence of Congenital heart disease. J Am Coll Cardiol. 2002;39:1890-1900.
3. Wechsler SB, Wernovsky G. Cardiac disorders. In: Cloherty JP, Eichenwald EC, Stark AR. Editors. Manual of neonatal care. 5th ed. Philadelphia: Lippincott Williams and Wilkins; 2004:407.
4. Chadha SL, Singh N, Shukla DK. Epidemiological study of congenital heart disease. Indian J Pediatr. 2001;68:507-10.
5. Working group on management of congenital heart disease in India. Consensus in timing of intervention for common congenital heart disease. Indian Pediatr. 2008;45:117.
6. Bernstein D. Congenital heart disease. In: Kliegman RM, Behrman RE, Jenson HB, Stanton BF. Editors. Nelson text book of pediatrics. 18th ed. Philadelphia: Saunders; 2007:1878-81.
7. Vaidyanathan B, Kumar RK. The global burden of congenital heart disease. Congenital Cardiol Today. 1990;37:25-43.
8. Khalil A, Aggarwal R, Thirupuram S, Arora R. Incidence of congenital heart disease among hospital live births in India. Indian Pediatr. 1994;31:519-24.

9. Humayun KN, Atiq M. Clinical profile and outcome of cyanotic congenital heart disease in neonates. J Coll Physician Surg Pak. 2008;18:290-3.
10. Shah GS, Singh MK, Pandy TR, Kalkheti BK, Bhandari GP. Incidence of congenital heart disease in tertiary care hospital. Kathmandu Univ Med J. 2008;6:33-36.
11. Laursen HB. Some epidemiological aspects of congenital heart disease in Denmark. Acta Peditr Scand. 1980;69:619-24.
12. Vaidyanathan B, Kumar RK. Clinical screening for congenital heart disease at birth. Indian Pediatr. 2011;48:25-29.
13. Tank S, Malik S, Joshi S. Epidemiology of congenital heart disease among hospitalized patients. Bombay Hosp J. 2008;11(8):12-15.
14. Molaei A, Asadi G, khoshbakht M. Prognosis of the newborns with congenital heart diseases. Auatralian International Academic Center. 2015;3:49-55.
15. Kasturi L, Kulkarni AV, Anin A, Mahashankar VA. Congenital heart disease: Clinical spectrum. Indian Pediatr. 1999;36:953.
16. Dang D, Wang D, Zhang C. Comparision of oral paracetamol versus ibuprofen in prematures infants with PDA. Plos One. 2013;8:7788.

**Cite this article as:** Amroliwala R, Rasania M, Memon R, Pokharna A, Shah D. Study of congenital heart diseases in neonates. Int J Contemp Pediatr 2018;5:75-81.