

Evaluation of Risk Factors Related with Neonatal Patent Ductus Arteriosus in Hospitalized Neonates of Neonatal Intensive Care Unit

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Article information	Abstract
<p>Article history: Received: 8 Sep 2010 Accepted: 18 Nov 2010 Available online: 14 Dec 2010</p>	<p>Background: Patent ductus arteriosus or patent arterial duct (PDA) is a condition in which a structure called the ductus arteriosus, normal in fetal life, remains into infancy and onwards, when it should have disappeared. Thus, in this study we want to discuss about frequency of its symptoms and risk factors.</p> <p>Materials and Methods: It is a descriptive study which has been done among 100 newborns registered in Ghaem Hospital of Mashhad. Sampling was gathered easily.</p> <p>Results: The most prevalent symptom among newborn babies was systolic heart murmur (89%). According to the obtained risk factors, hypoxia (71%) and acidosis (70%) are followed by prematurity (41%). Out of all registered newborn babies 68% were suffering from associated disorders.</p> <p>Conclusion: For achieving an on-time diagnosis of PDA, clinical examination of heart and respiratory symptoms must be examined very precisely. Newborn babies must be examined in terms of two risk factors: prematurity and light weight.</p>
<p>Keywords: PDA Systolic Heart Murmur Low birth weight Prematurity</p>	
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Introduction

Patent Ductus Arteriosus (PDA) is a heart disease which occurs immediately after birth. In this disease, there is abnormal blood flow between two main arteries near the heart [1]. Before birth, two main arteries (aorta and pulmonary arteries) normally are connected to each other through a vascular duct called, arterial duct, which is the main component of the fetal circulatory system [1]. After birth, the duct should be closed in response to changes which are made across the fetal circulatory system [1]. Closure of the arterial duct is caused by the increased blood oxygenation which passes through the duct [2]. During the fetal period, the duct's blood oxygen pressure is only 15-20 mmHg, but only after several hours since birth, it will increase to 100 mmHg [2]. Several examinations have shown that there is a close relation between the contraction intensity of the smooth muscle of the duct wall and the oxygen amount available in the duct [2]. Probably, any failure in closing the duct would be due to excessive dilatation of the duct which is caused by the effect of vasodilator prostaglandins on the duct wall [2]. For some newborn babies, the arterial duct remains patent [3]. Risk factors which keep patent the arterial duct are: hypoxia, acidosis, respiratory distress, prostaglandin intake [2]. According to a report, 45% of 1750-gram babies, 80% of <1 kg babies and 60-70% of babies with the congenital rubella suffer from a patent arterial duct [3]. The patent duct let the blood flow to flow directly from the aorta to the

pulmonary artery which can increase either heart size or pulmonary blood pressure. Mani et al. showed that 2-7 percent of the cardiac abnormalities in the United States are PDA [4]. A study, conducted by the Texas Health Services, indicated that PDA more likely to develop in women than in men [5]. Likewise, Pourarian showed that in an Iranian hospital PDA constituted 15 percent of all cardiac abnormalities [6]. Kadivar et al. reported the prevalence rate of the disease 3% [7]. With regard to prevalence and importance of PDA and regarding the lack of sufficient information, this study tries to show how symptoms and the effective risk factors of PDA can be determined.

Materials and Methods

As a cross-sectional descriptive one, this study was conducted among 100 newborn babies with PDA who had been hospitalized in Neonatal Intensive Care Unit (NICU) of Ghaem Hospital of Mashhad in 2007. Some information including gender, age at diagnosis, diabetes, blood pressure and age of the mothers were collected through questionnaires. Critical signs and symptoms such as apnea, recurrent apnea, bounding pulse, precordial trauma, recurrent systolic murmur, respiratory distress and a number of risk factors such as prematurity, birth weight, hypoxia and acidosis were examined and recorded in patients cases. All hospitalized babies in NICU of the

Gheam Hospital who had been diagnosed with PDA based clinical and paraclinical signs, were included in the study after taking written consents from their mothers. Those newborn babies whose PDA disease based on the clinical signs had been posed as the primary differential diagnosis but had not been paraclinically confirmed were excluded. A number of 100 newborn babies with confidence level: 90% and power of test: 80% were considered and data were analyzed using SPSS-13 as well as χ^2 and correlation tests.

Results

54 boys and 46 girls constituted 100 newborn babies with PDA of our sample. 42, 82 and 95 babies have been diagnosed with PDA before reaching one week, two weeks and three weeks ages. Seven percent of babies were less than 28 weeks of gestational age, 20 percent of babies were 28-32 weeks of gestational age and 14 percent of babies were 32-37 weeks of gestational age. 21.1% of mothers were younger than 20 years old, 68.4% of mothers were 20-35 years old and 10.5 percent of mothers were older than 35 years old. Age at diagnosis was 3-28 days with the average rate of 10.4 ± 2.2 days. Out of 100 patients with PDA, two had mothers with diabetes and none of them had mothers with the high blood pressure.

Table 1. Frequency of signs and risk factors in the studied babies

Factors	(%)	Factors	(%)	Factors	(%)
Male	54	Continues Murmur	37	CPR	15
Female	46	Heart Thumb	16	Hypotension	31
Diabetic	2	Hypoxisa	71	Mortality	5
Mother Hypertensive	0.0	Acidois	70		
Mother Frequent Apnea	6	Associate Abnormalities	68		
Bonding Pulse	28	Apnea	21		
Systolic Murmur	89	respiratory distress	72		

About 68% of babies had another abnormality besides PDA. Hypotension was reported in 31 babies and 21 babies suffered from apnea and 72 patients were diagnosed with respiratory distress (Table 1). Among babies with PDA, 15 patients needed Cardiovascular and pulmonary rehabilitation. Gestational age and weight age were measured as 32-37 weeks and 1500-2500 gr, respectively. Seven percent of babies were less than 28 weeks of gestational age, 20 percent of babies were 28-32 weeks of gestational age and 14 percent of babies were 32-37 weeks of gestational age.

Seven babies were less than 1000 gr, 14 babies were between 1000-1500 gr, 19 babies were between 1500-2500 gr, 50 babies were between 2500-3500 gr, and 10 babies were between 3500-4500 gr. According to the result of the statistical tests, there was a direct meaningful relation between gestational age and weight of babies with PDA in birth time ($p=0.001$); similarly, there was a

converse meaningful relation between the associated abnormalities and weight of children in birth time ($p=0.012$), also, there was a meaningful relation between the gestational age and need to cardiovascular-pulmonary rehabilitation ($p=0.393$).

Discussion

In this study, systolic murmur was marked as the most prevalent symptom which was followed by respiratory distress, recurrent murmur and bounding pulse. According to the obtained risk factors, hypoxia, acidosis, then prematurity and low weight in birth time are ranked, respectively. 68 percent of patients suffered from the associate abnormalities.

The ratio of boys to girls in this study was 1.1:1. Texas Health Service study had specified that more girls suffer from the anomaly rather boys [5]. Ekici et al. in Ankara reported the prevalence rate of PDA 49% and 51% for girls and boys, respectively [8].

Pourarian et al. in Shiraz reported a high degree of the relationship between PDA occurrence and respiratory distress [9]. Siassi specified systolic murmur (89%), precordia trauma (47%), and bounding pulse (50%) as the most prevalent symptoms of PDA [10]. Brooks et al. announced the prevalence of respiratory distress during PDA as large as 80 percent [11]. Using echocardiography, Miyague in Brazil measured frequency of systolic murmur (18%), precordial trauma (13.1%), and bounding pulse (3.3%) [12].

Shann specified respiratory distress prevalence during PDA as large as 80% [13]. Ekici in Ankara measured prevalence of the respiratory distress (62%), systolic distress (62%) and precordial trauma (70.5%) and ranked precordial trauma, systolic murmur and respiratory distress as the first to third most common symptoms [8]. Pourarian in Shiraz measured frequency of the systolic murmur (100%), respiratory distress (70.6%), bounding pulse (30%) in PDA among which systolic distress and respiratory distress ranked as the first and second common symptoms in the patients [6].

Ekici showed 12.9 percent of immature newborn babies suffer from PDA. 56.9 percent of babies with PDA had the birth weight less than 1500 gr. while 43.1 percent of them were born with 1500-2500 gr weight [8]. In Pourarian et al. 17.6%, 47%, 23.5% and 11.5% of babies with PDA were 500-1000 gr, 1000-1500 gr, 1500-2000 gr, more than 2000 gr, respectively. 70.6% of babies were 27-31 weeks of gestational age, while 29.4% of babies were 32-36 weeks of gestational age. The average gestational age and average weight were 31.4 weeks and 1450 gr, respectively.

The highest weigh group was 1000-1500 gr. group and the most common gestational age was 27-31 weeks, which particular in terms of the gestational age is consistent with our study [6-8]. Siassi et al. showed prevalence of PDA in the premature babies (21%) which had an inverse relation with the increased gestational age and birth weight. They introduced embryo failure as the main cause of PDA. In the same direction, if hypoxia and acidosis are not considered in our study, then the embryo

failure will become the first factor to bring about PDA [10].

In this study, the associate abnormalities rate was 68% out which 15 percent of patients needed rehabilitation measures out which 5 percent were died. Therrien et al. reported mortality rate due to PDA 4 percent, out which 28-88% of babies suffered from cardiac and non-cardiac abnormalities and 8-11% of them had a chromosomal abnormalities. Pourarian et al. examined 114 premature babies in terms of having PDA, out which 3 one were died [5-6]. Kadivar et al. reported the prevalence rate of the disease 3% [7].

A number of limitations of the study were death probability of babies before finishing the study and discontent of families. With regard to high level of cardiac and respiratory abnormalities in children with PDA, precise clinical examination of heart and respiratory signs of them can be helpful in on timely diagnosis of

References

1. Douglas J. Schneider, John W Moore. Congenital heart disease for the adult cardiologist: Patent ductus arteriosus. *Circulation* 2006; 114(17): 1873-1882.
2. Guyton AC, Hall JE. *Textbook of Medical Physiology*. 12th ed. Philadelphia: mosbey Saunders; 2011: 384-9.
3. Behrman R, Kliegman R, Jenson H and Stanton B. *Nelson Textbook of Pediatrics*. 18th ed. Philadelphia: W.B Saunders; 2007: 112-114.
4. Mani AR, Meraji S, Houshyar R, et al. Finding genetic contributions to sporadic disease: A recessive locus at 12q24 commonly contributes to patent ductus arteriosus. *PNAS* 2002; 99(3): 15054-15059.
5. Therrien J, Connelly MS, Webb GD. Patent ductus arteriosus. *Curr Treat Options Cardiovasc Med* 1999; 1(4): 341-346.
6. Poorarian S. PDA frequency in neonates hospitalized in neonatal intensive care in Namazee Hospital. *Hakim Res J* 2003; 6(3): 77-81.
7. Kadivar M, Kiani A, Kocharian A, et al. Echocardiography and management of sick neonates in the intensive care unit. *Congenit Heart Dis* 2008; 3(5): 325-9 .
8. Ekici F, Atasay B, Gunlemez A, et al. Management of patent ductus arteriosus in preterm infants. *Anadolu Kardiyol Derg* 2006; 6(1): 28-33.
9. Bancalari E, Claure N, Gonzalez A. Patent Ductus Arteriosus and Respiratory Outcome in Premature Infants. *Biol Neonate* 2005; 88(3): 192-201.
10. Siassi B, Blanco C, Cabal LA and Coran AG. Incidence and Clinical Features of Patent Ductus Arteriosus in Low-Birthweight Infants: A Prospective Analysis of 150 Consecutively Born Infants. *Pediatrics* 1976; 57(3): 347-351.
11. Brooks J, Travadi J, Patole S, et al. Is surgical ligation of patent ductus arteriosus necessary? *Arch Dis Child Fetal Neonat* 2005; 90(3): F235-F239.
12. Miyague NI. Preterm neonate with Patent Ductus Arteriosus. *J Pediatr* 2005; 81(6): 429-430.
13. Shann F, Vince J. *Neonates-Patent Ductus Arteriosus*. 2nd ed. Australai: Australian agency for international development; 2003: 267-269.

such abnormalities. Since prematurity and low birth weight are two significant factors in this disease, hence they must be examined more precisely in newborn babies who are likely suffer from PDA.

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All authors contributed in all stages of the study.

Conflict of Interest

No conflict.

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