

Frequency of Etiological Factors Leading to Patent Ductus Arteriosus

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Abstract

Background: Patent Ductus Arteriosus (PDA) is developing as major problem in our society. Many studies in Pakistan has been done to analyze the efficacy of surgical procedures but no one tried to find the frequency of factors leading to this problem.

Objective: The purpose of this study was to find out the frequency of factors leading to patent ductus arteriosus in children presented at Punjab Institute of Cardiology.

Method: A cross sectional study was conducted on 242 patients of PDA who already have been treated during the year 2006 – 2007. They were interviewed on their regular follow up visits. Their operative information was gathered from their files.

Results: Mean age of children at time of treatment was 6.12 + 5.203 years. Out of 242 children, there were more female (62.8%) as compared to male (37.2%). In this study, 17.8% children inherited the disease from their close relatives and 105 (43.4%) mothers had some infectious problems during pregnancy. 103 (42.6%) mothers used antibiotics or other drugs during pregnancy. 11 (4.5%) children had Down syndrome. One hundred and thirty seven (56.61%) children had premature birth.

Conclusion: Female gender, preterm birth, infection during pregnancy, mother's exposure to drugs and smoking, low birth weight may be etiological factors for development of PDA.

Key Words: Etiological factors, Patent Ductus Arteriosus, surgical ligation, catheter based procedure.

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Introduction

Patent ductus arteriosus (PDA) is a problem in which a blood vessel called the ductus arteriosus fails to close normally soon after birth of an infant.¹ PDA is the persistence of a normal structure between the left pulmonary artery and the descending aorta. The ductus normally undergoes closure at birth. Persistence of this structure after 10 days of birth is considered abnormal. A PDA is variable in its presentation. It may be varying in size from small to large and some time it cannot be picked up during physical examination at birth. Spontaneous ductal closure can occur without treatment. Complications may include growth failure, bac-

terial endocarditis, congestive heart failure (CHF), and the development of pulmonary vascular disease. It can complicate other cardiorespiratory conditions.²

PDA is a common congenital heart defect in the United States. The condition occurs more often in premature infants, occurring in about 8 of every 1,000 births. However, it also occurs in full-term infants (about 2/1,000 births).² The available retrospective data on the natural history of untreated patent ductus arteriosus are poor; however, complications can arise.¹ According to a survey was conducted in KPK in 2002, frequency of PDA was found in 9.7% cases.³ But in 2006 another study conducted in Peshawar, the frequency was increased (12.8%).⁴ Therefore, we conduct this study to find out the etiological factors leading to this problem in our set-up.

Methodology

Cross Sectional survey was conducted to collect the data. There were 242 patients who had been treated at Punjab Institute of Cardiology during the year 2006 – 2007. They were called for recheck-up and also interviewed. Their operative information, including their age at time of presentation, size of PDA and procedure, was gathered from their files. Quantitative variables like child’s age, mother’s age, size of PDA, and height of the children were calculated as mean ± standard deviation. Frequency and percentages were calculated for qualitative variables like gender, residential area, Down’s syndrome, inheritance, smoking status of parents and any infection to mother during labor of the affected child. There were no ethical issues as it was just an observational study and after taking informed consent from parents data was collected.

Results

There were total 242 patients included in the study with the mean current age of children was 7.441 ± 5.313 years but mean age at time of treatment was 6.12 ± 5.203 years with minimum age of 1 year and maximum age of 16 years. At time of treatment 52.1% children belong to age group 1 – 4 (Figure 1). There were 90 (37.2%) male children and 152 (62.8%) female children included in the study (Figure 2). There were more children who belong to urban areas (72.7%) while 27.3% of children belong to rural areas. Mean height of children at time of treatment was 3.509 ±

1.181 feet and mean weight was 24.90 ± 11.33 kg. Minimum weight of 8 kg and maximum weight was 56 kg. Current mean age of mothers was 34.64 ± 7.48 years but age of mother at time of birth of the child was 27.17 ± 4.42 years and minimum age was 19 years and maximum age was 40 years. Mean PDA size of children at time of treatment was 6.87 ± 3.58 mm. There were 17.8% children who inherited the disease from their 1st relatives like grand father, grand mother, mother, father and siblings also had this defect. Only 4.5% of children reported with Down’s syndrome. But 56.6% of children had premature birth. There were 43.4% females who reported about the rubella and other severe infection during pregnancy and 42.6% of them used antibiotics for the cure of that infection while they were pregnant. It was observed that 66.1% of children were given medical treatment to manage the

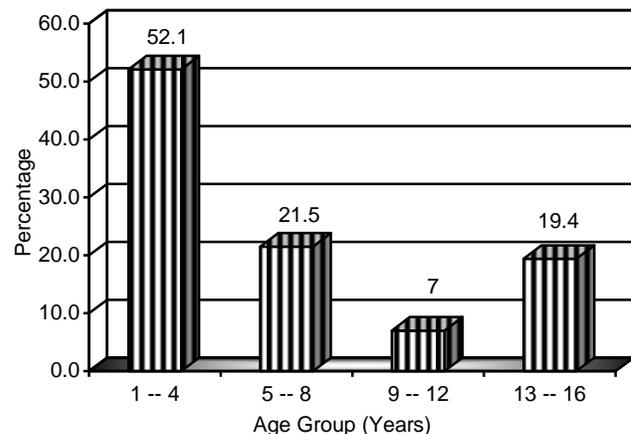


Figure 1: Distribution of affected children with respect to age groups (years).

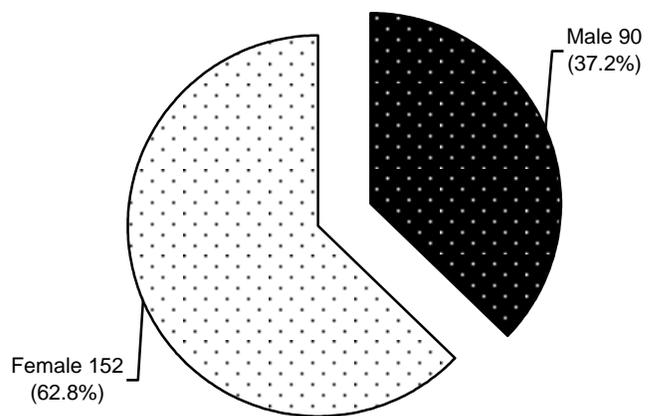


Figure 2: Distribution of gender of the patients.

PDA but later on when hole was not closed then surgical intervention was adopted to save the child, 45.5% undergone catheter based procedure while 54.5% undergone surgical ligation depending upon the condition of the child. We also observed that 63.6% mothers were exposed to smoking; directly (mother was a smoker) or indirectly (father of child was smoker).

Table 1: Distribution of males and females in different age groups.

Age Groups at Time of Treatment	Gender		Total
	Male	Female	
1 – 4	53 (42.1%)	73 (57.9%)	126
5 – 8	19 (36.5%)	33 (63.5%)	52
9 – 12	10 (58.8%)	7 (41.2%)	17
13 – 16	8 (17.0%)	39 (83.0%)	47
Total	90 (37.2%)	152(62.8%)	242

Discussion

There were total 242 patients included in the study with the mean current age of children was 7.441 ± 5.313 years but mean age at time of treatment was 6.12 ± 5.203 years with minimum age of 1 year and maximum age of 16 years. At time of treatment 52.1% children belong to age group 1 – 4, 21.5% belong to age group 5 – 8, 7.0% belong to age group 9 – 12 and 19.4% belong to age group 13 – 16. Females are 2 – 3 times more likely than males to develop PDA.² PDA is more common among females than among males,⁵⁻⁹ although one investigation reported 53% of the PDA cases to be among males.¹⁰ Same pattern was seen in our study. There were 62.8% females as compared to males. In our study it was also proved as male to female ration was 1:2. Thus gender female is itself a factor that may lead to PDA.

PDA is a common problem in premature infants and is less likely to be noted as gestational age increases to full term. Incidence ranges from 20% in premature infants older than 32 weeks’ gestation up to 60% in those younger than 28 weeks’ gestation. Up to 30% of low birth weight infants (< 2500 g) develop a patent ductus arteriosus.² According to our study 56.6% of children born premature. But we could not gather the information about the gestational age of child i.e. at

which gestational age he/she was born. Thus mothers should be very careful during pregnancy so that they may complete the gestational age and risk of developing PDA may be reduced. The incidence of PDA is inversely related to gestational age and birth weight. A hemodynamically significant shunt due to PDA has been reported in 40% of infants less than 1000 grams and 20% of infants between 1000 – 1500 grams.¹¹ According to our study mean height of children at time of treatment was 3.509 ± 1.181 feet and mean weight was 24.90 ± 11.33 kg. Minimum weight of 8 kg and maximum weight was 56 kg. These results were because there were children of age more than 10 were also in the study group.

PDA risk increases with maternal diabetes.^{5,12-14} PDA has been reported among the offspring of mothers with phenylketonuria.¹⁵ There is no association between PDA and maternal hypothyroidism or hyperthyroidism¹⁶ or influenza.⁵ In a study that examined the relationship between PDA and maternal hyperthermia, PDA risk was associated with fever and upper respiratory infection but not with workplace temperature or sauna bathing.¹⁷ But according to our study 43.4% mothers reported about infection that was severe and 42.6% of mother took antibiotics during pregnancy and most of them took antibiotics over the counter or without any physicians recommendations. There is also a thought that PDA has not been associated with maternal ampicillin use.¹⁸

We also observed that 63.6% mothers were exposed to smoking; directly (mother was a smoker) or indirectly (father of child was smoker). Although one investigation reported increased risk of PDA with maternal smoking,¹⁹ several other studies found no such association.^{4,20,21}

Conclusion

We conclude that female gender, preterm birth, infection during pregnancy, mother’s exposure to drugs and smoking, low birth weight may be etiological factors for development of PDA.

Recommendations

These are modifiable factors that can be controlled. If these factors are controlled, then the incidence of PDA can be reduced. This study was conducted only in a small set-up with a small sample size. If this would be

done at district or provincial level, this could help in finding the extent of the problem in our population.

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