ORIGINAL ARTICLE

Role of angiography procedure for assessment of the type of patent ductus arteriosus in children under 18 years.

Shanzay Saeed¹, Danial Hanan Sheikh², Rimsha Badar³, Humaira Rauf⁴, Syed Zain-ul-Abidin⁵


ABSTRACT… Objective: To determine the role of angiography for the assessment of the type of patent ductus arteriosus in children under 18 years. Study Design: Observational Retrospective study. Setting: Children’s Hospital Lahore. Period: October 2021 to February 2022. Material & Methods: The sample size calculated was 245 but, at the end of the period of four months only 120 patients fulfilled the criteria and were included in this study convenient sampling technique was used to collect the data. Patients with patent ductus arteriosus were included in this study. Patients with other congenital heart diseases were excluded. Essential measurements included Types of Patent Ductus Arteriosus (PDA), (PDA) Size, Ampulla Size, Aortic and Pulmonary systolic and diastolic pressures. Results: In this study 120 patients with PDA were included. Out of 120, 38 (31.7%) patients were male and 82 (68.3%) patients were female. The age range of the patients was 8 months to 18 years (mean;5.44 ± 3.972 years). The weight range of the patients was 5.3 to 41 Kg (mean;16.05 ± 8.38Kg). The mean PDA size was 4.01 ± 1.80. The mean Ampulla size was 9.92 ± 3.13. The types of PDA detected by angiography were Type A 59(49%), Type B 15(12.5%), Type C 20(16.7%), Type D 20(16.7%), Type E 5(4%), Type F 1(0.8%). The mean Aortic systolic pressure was 105.5±18.99 and diastolic pressure was 57.2 ±14.4. The mean Pulmonary Artery systolic pressure was 47.4 ± 23.3 and diastolic pressure was 27.7 ±14.2. Conclusion: Angiography was found more accurate for the assessment of all the anatomical types of PDA especially TYPE B, C, D and F. More precise measurements of the ampulla and PDA sizes were obtained using angiography. We may conclude that Angiography is a much better modality than other modalities for the assessment of the types of PDA.

Key words: Ampulla Size, Angiography, Congenital Heart Disease, Patent Ductus Arteriosus, PDA Size.

INTRODUCTION

Ductus arteriosus in the fetus is a normal opening or vascular structure which connects the proximal left pulmonary artery with the proximal part of the descending aorta just distal to the left subclavian artery.¹ The fetal blood circulation is usually more complicated than the blood flow after the birth of the baby. During fetal life the lungs are non-functional and this ductus arteriosus provides a pathway to blood to bypass the lungs. Normally the functional closure of ductus arteriosus takes place within 12-24 hr after birth but, if it fails to do so it is called patent ductus arteriosus a congenital heart disease.²

The reported incidence of patent ductus arteriosus is around 1 in 2000 births.³,⁴,⁵ This is about 5% to 10% of all congenital heart diseases.²,³,⁶ The causes of PDA include Genetic syndrome e.g. Down’s syndrome, Maternal rubella infection, Diabetes during pregnancy, etc. Rapid breathing when baby is feeding, sweating, and poor weight gain are most common symptoms.

The morphology of the PDA can be defined by the changes that take place during fetal life in the shapes of the pulmonary artery and aorta. PDA was classified by Krichenko in 1989, on the basis of its angiographic appearance termed as Krichenko Classification.⁷ It has five types Type A-E. Type A (Conical), Type B (Window), Type C (Tubular), Type D (Complex) and Type

1. B.Sc (Hons) Medical Imaging Technology, FMH College of Medicine and Dentistry, Children’s Hospital Lahore.
2. B.Sc (Hons) MIT, MS-MIT, HCPC (UK), Certified in Obs/ Gyne USG, Assistant Professor HOD/MIT FMHCM, Lahore.
3. B.Sc (Hons) MIT, Certified in Obs/Gyne Ultrasound, Demonstrator MIT, FMHCMD, Lahore.
4. B.Sc (Hons) MIT, M.Phil MIT, Certified in Obs/Gyne USG (PAK), Assistant Professor HOD/MIT Chief Coordinator AHS.
5. B.Sc (Hons), MIT, Ms MIT, Senior Technologist Children’s Hospital.

Correspondence Address: Shanzay Saeed FMH College of Medicine and Dentistry, Children’s Hospital Lahore. shanzaysaeed18@gmail.com

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E (Elongated). Type F (Fetal Type) of PDA is not classified by Krichenko classification. Type F has a hockey stick like appearance.

Treatments available for PDA include medical management, transcatheter closure by occluder devices and surgical therapy. Many imaging modalities are used for the diagnosis of PDA like chest X-ray, echocardiography and cardiac catheterization, computed tomography, CT angiography, three dimensional rotational angiography and magnetic resonance imaging. Angiography is being used for the diagnosis as well as assessment of the Types of PDA and for the evaluation of ampulla and PDA sizes.

This research will help in the appropriate selection of suitable devices for duct occlusion on the basis of Krichenko angiographic classification of PDA prior to the duct closure. The angiographic findings of this study will lead to the timely and accurate treatment of PDA patients by transcatheter closure at the same place and at the same time.

The objective of this study was to determine the role of angiography procedure for assessment of the type of patent ductus arteriosus in children under 18 years.

The aim of the study was to evaluate the accuracy of angiography for the assessment of the types of PDA. This study will help physician to assess the Types of PDA with better modality. This will help in the treatment of patients.

MATERIAL & METHODS
This observational retrospective study was conducted at Children’s Hospital Lahore. The duration of this study was four months from October 2021 to February 2022.

Inclusion Criteria
Included Patent Ductus Arteriosus (PDA) patients.

Exclusion Criteria
Excluded patients with other congenital heart diseases e.g (VSD, ASD, TOF etc.).

METHODOLOGY
Angiography was performed using Siemens Biplane and Philips Hybrid Angiography machines.

Angiography is an ionizing imaging modality used to obtain detailed images of the heart and blood vessels. The angiography procedure is performed in catheterization lab or Cath Lab. A paediatric or adult catheterization procedure is longer than an adult coronary catheterization procedure. It takes around 2 to 3 hours. The patient is sedated before the procedure by giving sedative medications orally or intravenously. Seldinger technique is used to establish arterial or venous access. The access site is numbed by injecting a local anaesthetic called lidocaine subcutaneously. After gaining arterial access 50IU/Kg Heparin is administered. The femoral access site is used to position catheter in the descending aorta just below the expected location of PDA. Hemodynamic measurements are obtained during the procedure. A Physiologic recorder is used to display the Aortic systolic and diastolic pressure (PAP) waveforms as well as the Pulmonary artery systolic and diastolic pressure (SAP) waveforms. Once the catheter is properly positioned at the region of interest an iodinated low osmolar non-ionic contrast media e.g Ultravist is injected into the patient. The dose of contrast media is about 1-2ml/Kg. The lateral projection is used to obtain initial angiogram. Krichenko classification is used to determine the anatomical type of PDA. After viewing the shape of PDA adequately the software of the Cath Lab machine is used to measure PDA and Ampulla sizes in millimetre. Right anterior oblique RAO 35 to 40 using cranial angulation of 30 can be used for further evaluation in some patients.

RESULTS
In this study (120) patients were taken as a sample size out of which 38 (31.7%) were male and 82 (68.3%) were female who fulfilled the criteria, with patent ductus arteriosus PDA were included in this study. The mean age of the patients ranged from 8 months to 18 years with a mean of 5.44 ± 3.972. The mean weight of the patients ranged from 5.3 to 41 Kg with a mean of 16.05 ± 8.38. The mean PDA size was 4.01 ±
1.80. The mean Ampulla size was 9.92 ± 3.13. The mean Aortic systolic pressure was 105.5 ± 18.99 and diastolic pressure was 57.2 ± 14.4. The mean Pulmonary Artery systolic pressure was 47.4 ± 23.3 and diastolic pressure was 27.7 ± 14.2. The demographic characteristics are shown in Figure-1 and Table-I and angiographic measurements are given in Table-II below.

<table>
<thead>
<tr>
<th>Demographic Parameters</th>
<th>Mean ±SD</th>
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<tr>
<td>Age (years)</td>
<td>5.44 ± 3.972</td>
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<tr>
<td>Weight (Kg)</td>
<td>16.05 ± 8.38</td>
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**Table-I. Demographic characteristics (n=120)**

<table>
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<tr>
<th>Angiographic Measurements</th>
<th>Mean ±SD</th>
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<tr>
<td>PDA Size</td>
<td>4.01 ± 1.80</td>
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<tr>
<td>Ampulla Size</td>
<td>9.92 ± 3.13</td>
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**Table-II. Angiographic measurements (n=120)**

Out of 120 patients who were selected for the assessment of the type of PDA using angiography 59 were TYPE A (49%), 15 were TYPE B (12.5%), 20 were TYPE C (16.7%), 20 were TYPE D (16.7%), 5 were Type E (4%), 1 was Type F (0.8%). The details of the Types of PDA are given in Figure-2 below.

Krichenko angiographic classification of the Types of PDA shown in Figure-3 below.

**DISCUSSION**

According to this study, (120) patients were taken as a sample size out of which 38 (31.7%) were male and 82 (68.3%) were female who fulfilled the criteria, with patent ductus arteriosus PDA. All the patients underwent angiography procedure for the assessment of the types of PDA.

In this study Type A of PDA was found in a large number of patients whereas, TYPE F was least among the all. Out of 120 patients who were included in this study 59 were TYPE A (49%), 15
were TYPE B (12.5%), 20 were TYPE C (16.7%),
20 were TYPE D (16.7%), 5 were Type E (4%),
was Type F (0.8%). The mean PDA size measured was 4.01 ± 1.80 and the mean Ampulla size measured was 9.92 ± 3.13.

Alaa Roushdy et al.\(^\text{11}\), concluded that out of 42 patients Type A was the most common Type of PDA and Type B was least common Type of PDA. The anatomical types of PDA assessed by angiography were Type A 20(47.6%), Type B 1(2.3%), Type C 2(4.7%), Type D 2(4.7%), Type E 17(40.4%). The pulmonary end measured by angiography had a mean of 1.8 ± 0.5mm. The aortic end measured by angiography had a mean of 7.4 ± 1.4mm.

Raghda Ghonimy Elsheikh et al.\(^\text{12}\), concluded that out of 25 patients Type A was the most common Type of PDA whereas, no patient had Type D of PDA using angiography. The anatomical types of PDA assessed by angiography were Type A 14(56%), Type B 1(4%), Type C 2(8%), Type D 0(0.00%), Type E 8(32%). The pulmonary end of the duct measured by angiography had a mean of 2.64 ± 0.87mm. The aortic end measured by angiography had a mean of 5.98 ± 1.92mm. The length of the PDA had a mean of 7.79 ± 2.31mm.

Now, if we compare this study results with the international studies angiography was found more accurate for the assessment of all the anatomical types of PDA especially TYPE B, C, D and F. As well as more precise measurements of the ampulla and PDA sizes were obtained using angiography. We may conclude that Angiography is a much better modality than other modalities for the assessment of the types of PDA.

CONCLUSION

Angiography was found more accurate for the assessment of all the anatomical types of PDA especially TYPE B, C, D and F. As well as more precise measurements of the ampulla and PDA sizes were obtained using angiography. We may conclude that Angiography is a much better modality than other modalities for the assessment of the types of PDA.

REFERENCES


Limitations of this study include the following:

- The sample size was small.

CONCLUSION

Angiography was found more accurate for the assessment of all the anatomical types of PDA especially TYPE B, C, D and F. As well as more precise measurements of the ampulla and PDA sizes were obtained using angiography. We may conclude that Angiography is a much better modality than other modalities for the assessment of the types of PDA.

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**AUTHORSHIP AND CONTRIBUTION DECLARATION**

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<th>No.</th>
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<tr>
<td>1</td>
<td>Shanzay Saeed</td>
<td>Research contribution, Design of the work, Drafting the article. Conception of the work, Methodology design, Final approval, Clinical supervisor.</td>
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<tr>
<td>2</td>
<td>Danial Hanan Sheikh</td>
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<tr>
<td>3</td>
<td>Rimsha Badar</td>
<td>Approval of the version published.</td>
<td><img src="image3" alt="Signature" /></td>
</tr>
<tr>
<td>4</td>
<td>Humaira Rauf</td>
<td>Data collection and Provider Clinical assessment.</td>
<td><img src="image4" alt="Signature" /></td>
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<td>5</td>
<td>Syed Zain-ul-Abidin</td>
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