

ORIGINAL ARTICLE

## Pediatric Angiography: Single Center Experience

## Pedatrik Anjiolar: Tek Merkez Deneyimi

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### ABSTRACT

**Objective:** Congenital heart disease is the most common congenital anomaly. Early diagnosis and timely intervention are important in congenital heart disease. The aim of this study to share our experience and follow-up results of diagnostic and interventional angiography procedures performed in our center.

**Materials and Methods:** The retrospective study included patients who underwent catheter angiography in our clinic between July 2018 and October 2021.

**Results:** This study included 47 children with a mean age of 5.7 (SD, 2.9) years (0-17 years) who underwent catheter angiography. 47% of study population was girls. Diagnostic catheter angiography was performed in 29 patients. Successful interventional catheter angiography was performed in 18 patients. No significant complications were observed during or after diagnostic and interventional catheter angiography.

**Conclusion:** Diagnostic and interventional angiography procedures can be performed successfully in our clinic. In recent years, interventional angiography procedure has been preferred more because it shortens the hospital stay and does not create surgical scar tissue.

**Keywords:** children, congenital heart defects, angiography, cardiac catheterization

### ÖZ

**Amaç:** Doğuştan kalp hastalığı en sık görülen doğumsal anomalidir. Doğuştan kalp hastalıklarında erken tanı ve zamanında müdahale önemlidir. Bu çalışmanın amacı merkezimizde yapılan tanısal ve girişimsel anjiyografi işlemleri deneyimlerimizi ve takip sonuçlarını paylaşmaktır.

**Gereç ve Yöntem:** Retrospektif çalışmaya kliniğimizde Temmuz 2018-Ekim 2021 tarihleri arasında kateter anjiyografi yapılan hastalar dahil edildi.

**Bulgular:** Bu çalışmaya, ortalama yaşı 5.7 (SD, 2.9) yıl (0-17 yaş) olan ve kateter anjiyografisi yapılan 47 çocuk dahil edildi. Çalışma popülasyonunun %47'si kızlardan oluşuyordu. 29 hastaya tanısal kateter anjiyografisi yapıldı. Onsekiz hastaya başarılı girişimsel kateter anjiyografisi yapıldı. Tanısal ve girişimsel kateter anjiyografisi sırasında veya sonrasında önemli bir komplikasyon gözlenmedi.

**Sonuç:** Kliniğimizde tanısal ve girişimsel anjiyografi işlemleri başarı ile yapılabilmektedir. Son yıllarda hastanede kalış süresini kısaltması ve cerrahi skar dokusu oluşturmaması nedeniyle girişimsel anjiyografi işlemi daha çok tercih edilmektedir.

**Anahtar Kelimeler:** çocuklar, doğumsal kalp kusurları, anjiyografi, kardiyak kateterizasyon

### Introduction

Congenital heart disease (CHD) refers to structural, functional, or metabolic abnormalities of the heart or major blood vessels that occur during embryogenesis. CHD is the most common congenital anomaly in newborns (1). CHD rate is approximately 5-8 per 1.000 live births (2). Cardiovascular abnormalities are still the most common cause of infant mortality today (3). Therefore, early diagnosis and timely intervention are important in terms of reducing the morbidity, mortality rate and health care costs related to CHD.

Treatment of cardiovascular diseases in children with congenital heart disease has substantially advanced because to technological advancements. Interventional therapy has become an acceptable alternative treatment for many CHD, including closure of atrial septal defects (ASD), patent ductus arteriosus (PDA), dilation of stenotic valves (aortic and pulmonary), and dilation of stenotic vessels (coarctation of the aorta).

The specialty of pediatric interventional cardiology has grown significantly over the last three decades.

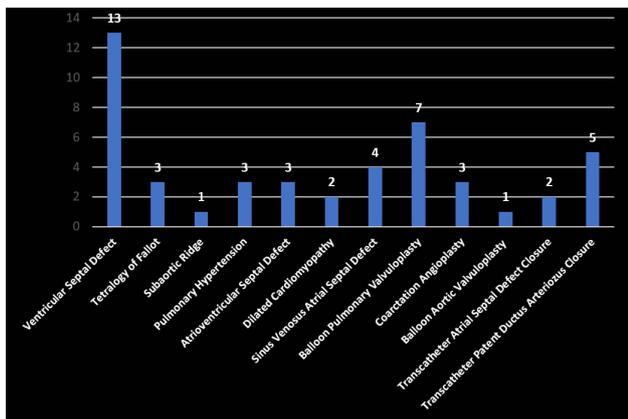
In this article, we planned to share our experience and follow-up results of diagnostic and interventional angiography procedures performed in our center.

## Materials and Methods

Forty-seven patients who underwent catheter angiography in our clinic between July 2018 and October 2021 were reviewed retrospectively. All patients underwent detailed physical examination before catheter angiography. Electrocardiograms of the patients were taken and evaluated in terms of arrhythmia. Echocardiographic examinations of the patients were performed and their intracardiac morphologies were evaluated. The preoperative examinations of the patients were evaluated and consulted with the anesthesia department. Before catheter angiography, detailed information about the procedure was given to both parents. Signed consent forms were obtained from both parents before the procedure. The procedures were performed under general anesthesia. All patients underwent detailed physical examination and echocardiographic examinations 24 hours after the catheter angiography procedure. Angiography was performed on children using the femoral artery and femoral vein. Pressure recordings from the entered heart chambers, arteries and veins and blood samples were taken for oximetric study. Vasoreactivity test was performed on necessary patients.

## Results

We retrospectively analysed 47 children with a mean age of 5.7 (SD, 2.9) years (0-17 years) who underwent catheter angiography. Also, 47% of study population was girls. Diagnostic catheter angiography was performed in 29 patients. Graphic 1 shows that angiography distribution.



Graph 1: Angiography Distribution

Diagnostic catheter angiography was performed on 13 patients with ventricular septal defect (VSD). Hemodynamic parameters were measured. Contrast injections were performed as necessary for PDA, coarctation or any other additional defect. The patients were referred to Pediatric cardiac surgery in terms of operation. Catheter angiography was performed to evaluate the coronary arteries of 2

patients with a diagnosis of dilated cardiomyopathy. Coronary anatomy was found to be normal. Hemodynamic parameters were measured. The patients were referred to the heart transplant center. Catheter angiography was performed in 3 patients with tetralogy of Fallot (TOF) in order to visualize the pulmonary vascular bed and to detect the presence of coronary anomaly. Coronary anatomy of the patients was normal. One patient had a right arcus aorta. Because the pulmonary vessels of 1 patient were extremely narrow, Blalock-Taussig shunt was planned. Catheter angiography was performed in 1 patient with the diagnosis of subaortic ridge. Moderate aortic regurgitation and significant aortic stenosis were detected. The patient was referred to the surgical department for ridge resection. Catheter angiography was performed in 3 primary pulmonary hypertension patients and their hemodynamic parameters were measured. Appropriate pulmonary hypertension drugs were started for the patients whose vasoreactivity test was found to be negative. Catheter angiography was performed in the patient with a diagnosis of 4 sinus venosus ASD. It was observed that the right upper pulmonary vein drained into the right atrium in 3 of them. The patients whose hemodynamic parameters were studied were referred to the surgical department for operation. Catheter angiography was performed in 3 patients with atrioventricular septal defect (AVSD) diagnosis. Gooseneck deformity was observed in left ventricular contrast injection. Hemodynamic parameters were studied. Pulmonary hypertension was not detected. The patients were referred for surgery. Interventional catheter angiography was performed on a total of 18 (38%) patients. Seven patients with valvular pulmonary stenosis underwent pulmonary balloon valvuloplasty. Coarctation angioplasty was performed in 3 patients with aortic coarctation (figure 1).

Aortic balloon valvuloplasty was performed in 1 patient. After the balloon valvuloplasty procedure, there was a significant decrease in the gradient taken from the aortic valve level; In addition, minimal aortic regurgitation was detected. Transcatheter ASD closure was performed in 2 patients with a diagnosis of secundum ASD (figure 2). No residual migration through the device was observed. It was seen that the distance of the device to the anatomical structures in the heart was appropriate. No regurgitation was observed in the atrioventricular valves. There was no sign of compression on the aorta.

Transcatheter PDA closure was performed in 5 patients with a diagnosis of PDA (figure 3). No residual migration through the device was observed. No stenosis was found in the descending aorta and left pulmonary artery. No complications were observed during or after the procedure in any of our patients.



**Figure 1:** Coarctation angioplasty



**Figure 2:** Transcatheter ASD closure



**Figure 3:** Transcatheter PDA closure

## Discussion

The most common cardiac anomalies in children are VSD, which account for about 30% of all CHD (4). Large VSDs are unlikely to close, and patients with VSD will experience symptoms of congestive heart failure. We plan to perform catheter angiography to detect the presence of pulmonary hypertension, the presence of additional congenital heart diseases such as PDA, aortic coarctation, and to measure the amount of shunt after VSD closure indication is established. Catheter angiography was performed on 13 patients with a diagnosis of VSD, and there were no complications during or after the procedure.

All patients who underwent diagnostic angiography were discussed in the cardiac surgery council, and it was decided to perform surgical procedure (AVSD, TOF, Subaortic ridge, Sinus venosus ASD) on patients with indications.

Approximately 19% of all CHDs are caused by ASD (4). When compared to previous reports, the incidence of several of the abnormalities has increased due to developments in diagnostic techniques for CHD (5). If ASD is not closed, in later ages development of right ventricular volume overload and later dysfunction, progressive pulmonary vascular disease carries the risk of developing atrial arrhythmias and paradoxical embolism. Transcatheter ASD closure compared to surgical ASD closure, it has advantages such as shortening the hospital stay, no cardiac bypass and no scarring of thoracotomy. For these reasons, we used the ASD closure device to close the hemodynamically significant ASDs of our patients who were diagnosed with ASD and whose rims were judged to be adequate by transoesophageal echocardiography. Although it is a safe and effective treatment method, air embolism of device closure, device embolization, device dislocation, arrhythmia, cardiac perforation, and tamponade has complications. No complications developed during or after ASD closure.

The presence of the normal fetal structure frequently connecting the left pulmonary artery and the descending aorta beyond 2 to 3 weeks of life is known as PDA, and it accounts for 5% to 10% of all CHD, excluding those in premature newborns (6). PDAs that are large and cause significant shunting are left untreated, Eisenmenger syndrome may develop. Hemodynamically important and significant duct surgery or should be closed by interventional methods. In our clinic, we closed PDAs with systole-diastolic murmur, hemodynamically significant, and heart failure findings, with the appropriate device selection. No device embolization, protrusion into the aorta or pulmonary artery was observed.

Pulmonary balloon valvuloplasty is used safely in the treatment of pulmonary stenosis. In children the results of balloon pulmonary valvuloplasty are successful. It was observed that these patients did not have residual stenosis after the procedure and in the controls. Moderate to severe pulmonary regurgitation did not develop in any of the patients.

Coarctation of the aorta is the common anomaly among all congenital heart lesions (7). The clinical picture is mostly dependent on left ventricular systolic load. Angiography is the gold standard for the evaluation of coarctation. Percutaneous balloon angioplasty is an alternative treatment method to surgery in the treatment of coarctation. It can be applied at any age. Complications such as bleeding in the femoral artery, loss of femoral pulse, hematoma, hemiparesis, aneurysm, and arrhythmia may develop (8). No complications were observed during and after balloon angioplasty for aortic coarctation. Re-coarctation did not develop in the follow-up of the patients.

Valvular aortic valve stenosis (AS) occurs in approximately 3% to 6% of patients with CHD (9). Aortic valvuloplasty for congenital AS is a safe technique with a reported incidence of complications of 3% (10,11). The initial balloon chosen for the valvuloplasty should be 85% to 90% of the aortic valve annulus measured via aortic angiography. Our patient underwent valvuloplasty with a balloon with a length of 85% of the aortic valve annulus measured in angiography. Significant decrease in gradient was detected; however, mild moderate aortic regurgitation was detected.

In conclusion diagnostic and interventional angiography procedures can be performed successfully in our clinic. In recent years, interventional angiography procedure has been preferred more because it shortens the hospital stay and does not create surgical scar tissue.

#### **Ethics Committee Approval**

Approval for this study was obtained from the Local Ethics Committee of Selçuk Medical Faculty Ethics Committee (2022/352).

#### **Conflict of Interest**

The authors certify that there is no conflict of interest with any financial organization regarding the material discussed in the manuscript.

#### **Declaration of Interest**

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

#### **Funding Source Declaration**

The authors report no involvement in the research by the sponsor that could have influenced the outcome of this work.

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