

Clinical Efficacy of Retrograde Pulmonary Arteriography via Brachial Artery in Neonate with Ductus-Dependent Cyanotic Heart Diseases

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Retrograde pulmonary arteriography via brachial artery was used to clarify the anatomy of pulmonary artery and descending aorta in 4 neonates with ductus-dependent cyanotic heart diseases. The age ranged from 28 to 37 days (30.8 ± 3.7 days). The suspected diagnosis was pulmonary atresia with ventricular septal defect in 2 neonates, pulmonary atresia with intact ventricular septum in one, and tricuspid atresia with pulmonary atresia in the other patient. All cases had been infused with prostaglandin E1. A retrograde pulmonary arteriogram provided adequate diagnostic informations by visualizing the presence of ductus connected to pulmonary artery. There was no significant complication during the procedure.

Retrograde pulmonary arteriography is a minimally invasive, rapid, and safe procedure that can provide adequate angiographic information without the need for cardiac catheterization in neonates with ductus-dependent cyanotic heart disease who are hemodynamically compromised.

Key Word: Retrograde pulmonary arteriography

In recent years, the majority of congenital cardiac anomalies has usually been diagnosed by two-dimensional and doppler echocardiography. The use of these techniques has made cardiac catheterization unnecessary in many infants with congenital heart diseases. Nevertheless, in some cases it may be difficult to assess the presence of pulmonary artery anomalies and aortopulmonary collaterals from descending aorta in complex heart disease. Cardiac catheterization and angiography may thus be required in some patients before surgery. Very often these patients are too sick and cardiac catheterization may impose a great risk, particularly in the hemodynamically compromised¹. Retrograde pulmonary arteriography was proposed as an alternative to cardiac catheterization in critically ill patients, especially in whom the arterial ductus is patent.

This preliminary results with a small group of patients

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showed that retrograde pulmonary arteriography was a safe and effective technique. The purpose of this report is to present the anomalies of pulmonary artery and to assess the aortopulmonary collaterals from descending aorta, even in critically ill patients with ductus-dependent cyanotic heart disease as an alternative procedure to cardiac catheterization.

PATIENTS AND METHODS

Between May 1995 and July 1996, retrograde pulmonary arteriograms were performed in 4 patients (3 males and 1 female) with ductus-dependent cyanotic heart diseases. Pulmonary atresia with ventricular septal defect was suspected in 2 patients, pulmonary atresia with intact ventricular septum in one, and tricuspid atresia associated with pulmonary atresia in the other patient. All cases had been infused with prostaglandin E1 for maintaining the patency of arterial ductus. The age ranged from 28 days to 37 days (median 30.8 ± 3.7 days) at the time of arteriography just prior to palliative operation. The mean weight was 3.08 ± 0.25 kg, with a range

of 2.8~3.4 kg. The pulmonary arteriograms were performed in the cardiac catheterization laboratory, using standard bi-plane angiography after 4 hour fasting. Vascular access was achieved by direct arterial puncture at the left brachial artery with 24-gauge cannula (Angiocatheter), and dye line introducer was attached directly to the cannula. For each angiogram, a dose of 2 ml/kg of contrast material (Optray) was used. After confirming a free flow of arterial blood from cannula, the contrast was injected by dye injector (Angiomat6000, Liebel-Flarsheim company, Germany), with 400 atm pressure during 1.5 sec as rapidly as possible. In all cases, two angiograms were required to obtain diagnostic images. The first was aortopulmonary view - true lateral view, and the latter was 45° right anterior oblique - 45° left anterior oblique. The screening time ranged from 15 sec to 2 min. At the end of the procedure the cannula was removed and hemostasis was obtained by compression. Heparin was not administered.

RESULTS

Retrograde pulmonary arteriography provided the diagnostic details of the pulmonary artery anatomy and the patency of arterial ductus in all cases. It clarified the junctional stenosis of pulmonary artery in two cases and proximal narrowing of arterial ductus in one case, while prostaglandin E1 was continuously infused. It confirmed the collateral arteries originating from left subclavian artery. The informations for the anatomy of left subclavian artery, aortic arch, descending aorta, arterial ductus in all cases were obtained with this technique. There was no significant procedure-related complications. All patients had palliative operation, Blalock-Taussig shunt in three patients, and Glenn operation in the other patient without any more procedure.

DISCUSSION

Two-dimensional echocardiography has been a reliable technique for the diagnosis of cardiac anomalies in the majority of congenital heart disease. However, in small neonates it is difficult to make a diagnosis with confidence by echocardiography alone, particularly in critically ill patients, because of a poor echo window or incomplete clinical information for urgent decision-making needed for operation. Even

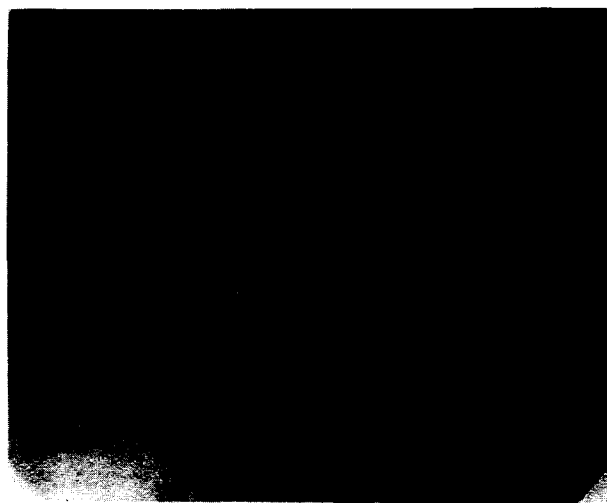


Fig. 1. A retrograde dye injection via left brachial artery in 28 day-old neonate shows left subclavian artery and aortopulmonary collateral arteries from left subclavian artery.



Fig. 2. In left antero-oblique 45° view, main and bilateral pulmonary artery demonstrated by retrograde injection.

Color Doppler echocardiography may also provide useful additional information, however, it is often inadequate for the structural details of branch stenosis of pulmonary artery, aortopulmonary collateral arteries, patency and anatomy of the arterial ductus. Therefore, it may be necessary for other procedure such as cardiac catheterization or magnetic resonance imaging². Magnetic resonance imaging is undoubtedly an excellent noninvasive technique for imaging peripheral pulmonary artery, but it is not always available. The standard



Fig. 3. Anteroposterior view. The contrast fills the main pulmonary artery and descending aorta without aortopulmonary collaterals.



Fig. 4. This 45° right anterior oblique view revealed marked stenotic ductus and pulmonary artery opacification via arterial ductus.

technique for the detailed evaluation of anomalies of pulmonary artery has been cardiac catheterization. The venous approach may be used, however, in ductus-dependent cyanotic heart diseases, the image quality may be affected by asso-

ciated anomalies in which the pulmonary artery cannot be visualized by direct right ventricular approach, due to pulmonary atresia in the majority of the cases. Therefore, arterial approach is usually preferred in most cases, despite of its potential risks particularly in the neonatal period, when the patients are often too ill and the situation may become worse after arterial catheterization with complication. The most frequent complication is arterial thrombosis, which can occur in up to 7% of small children, the incidence being higher in low-weight infants¹. Therefore, retrograde pulmonary arteriography is an attractive alternative method in such a situation. This can be performed through a small-gauge cannula, and the risks of complications are reduced by the short time of cannulation.

Retrograde angiography was first described 50 years ago in countercurrent aortography of aortic arch anomaly³. Ueda et al. changed the technique of aortography by using the radial arterial approach⁴, and the technique was further modified by Qureshi who performed the studies during cardiac catheterization in patients with obstructive lesions of aortic arch. He recorded the aortograms on cine film and used brachial artery, which has larger caliber and closer to aortic arch. In the last few years the image quality has been improved substantially by digital subtraction angiography⁵. Anjos et al. preferred the right brachial artery because the contrast from left subclavian artery opacified the duct and the descending aorta, thus providing inadequate information on the aortic arch anatomy².

In present study, all the patients with ductus-dependent lesion had their access route via left brachial artery and, therefore, arterial ductus and pulmonary artery was opacified via left subclavian artery. Retrograde pulmonary arteriography via a peripheral arterial injection is a minimally invasive procedure providing high quality images of pulmonary artery anomalies, anatomy of arterial ductus, collateral arteries from left subclavian artery or descending aorta even in critically ill patients without any significant complications⁶, particularly in neonates with ductus-dependent cyanotic heart diseases. Retrograde pulmonary arteriography is a preferable alternative to cardiac catheterization in neonates with ductus-dependent cyanotic lesions because of safety and efficacy.

We cannot find any previous report on retrograde pulmonary arteriography in our present study. Nevertheless, these

informations and the techniques of retrograde aortography for aortic arch anomalies were applied to pulmonary arteriography in neonates with ductus-dependent cyanotic heart diseases, and good images of pulmonary artery and arterial ductus were obtained. Since our study was limited to only a small number of neonates, which needs an extension to a larger scale of study is in needed.

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