

# Percutaneous Coronary Intervention in Different Anomalous Coronary Arteries - An Observational Study

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## Abstract:

*Anomalous coronary arteries are uncommon but clinically significant, depending upon its ostial origin, course & distribution such patient may be asymptomatic or may present with angina, acute myocardial infarction, arrhythmias, syncope & sudden cardiac death. Management of such cases may be medical, interventional & surgical as well. Some times it is difficult to cannulate such anomalous origin with conventional guiding catheters and requires different catheters unusual for such arteries. Between January 2002 to June 2012 a total of 3,110 elective PCI procedure were performed in NICVD & other cardiac centers in Dhaka, out of which twenty-one cases were in different varieties of anomalous coronary artery. We report here successful PCI in twenty-one cases having eight varieties of abnormal coronary artery with failure in one case. Percutaneous coronary intervention of anomalous coronary artery origins may be difficult, which require appropriate catheter selection and different tricks. Success depends on patience and careful decision of the operator.*

## Introduction:

Anomalous origin of coronary arteries are rare but well described cause of myocardial ischemia sudden cardiac death<sup>1,2,3,4</sup>. In adult referred for conventional coronary angiography, anomalous origin of coronary arteries are noted in 0.6 to 1.2% of patients<sup>3</sup>. The most common anomalous coronary artery is separate origin of left anterior descending artery (LAD) & Left circumflex artery (LCX) from left sinus of valsalva (LSV) (double barrel anatomy)<sup>5</sup>, LCX from right sinus of valsalva or proximal right coronary artery is also common<sup>5,6,7</sup>. There are almost no signs & symptoms in most cases of anomalous coronary arteries per se unless they are diseased<sup>8</sup>.

An anomalous coronary artery may present as both coronary arteries from LSV or both coronary arteries from RSV, LCX arising from RCA or RSV, LAD from RSV or RCA, LAD & LCX separately from LSV, conus & RV branch arising separately from RSV, coronary artery communicating with cardiac chambers or major thoracic vessel<sup>5</sup>. An anomalous LAD may originate from RSV or RCA<sup>9</sup> and pulmonary artery as well<sup>10</sup>. Anomalous RCA from LSV is uncommon & is found in about 0.003-0.9% for patient undergoing CAG<sup>11,12</sup>. RCA from LSV at its origin from aorta produces a slit like orifice and an acute angle, it courses between the great vessel-ascending aorta behind and pulmonary trunk anteriorly<sup>12</sup>. Such course makes the

artery to be compressed during exercise and increase demand. So patient may present with angina, acute myocardial infarction, arrhythmia, syncope and sudden cardiac death without any atheromatous lesion of coronary artery<sup>5,13</sup>. Incidence of anomalous left main coronary artery originating from proximal RCA is uncommon and have been reported 0.67-1.3%<sup>7</sup>. The course of such anomalous artery may be anterior when courses anterior of pulmonary artery which is benign in nature, through the septum, between the aorta & pulmonary trunk (Interarterial course) or behind the aorta (retro aortic course)<sup>5,7</sup>. In interarterial course, the artery may be compressed between the aorta & pulmonary trunk during exercise which may lead to sudden cardiac death in young patient<sup>5</sup>. Knowledge of different anomalous coronary arteries is important for doing catheter based treatment.

## Methods and Materials:

Because of unusual location, selective catheterization & guide stabilization is very difficult & time consuming. Here we report different methods used in PCI cases in eight varieties of anomalous coronary artery.

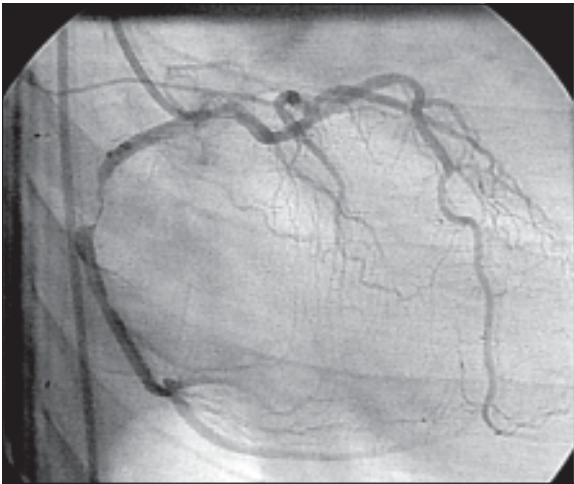
**Observation-1:** A 46 yrs old gentleman who was diabetic & hypertensive presented with chest pain on 25<sup>th</sup> October 2002, CAG revealed both RCA & LM arising from right sinus as single stem with 70% RCA mid lesion. PCI with stenting was done on the same day. A 6fJR 3.5 guiding

catheter was hooked in RCA (fig-1a,b). A guide wire floppy run through (0.014<sup>//</sup> x 180cm) was used to cross the lesion. The lesion was predilated with ryujin plus balloon (2 x 15mm) @ 15 atms for 20 sec with 50% residual stenosis. We deployed a BMS 3.5 x 15mm @ 16 atms for 20 sec. The procedure was uneventful. Heparin, GTN were used during the procedure.

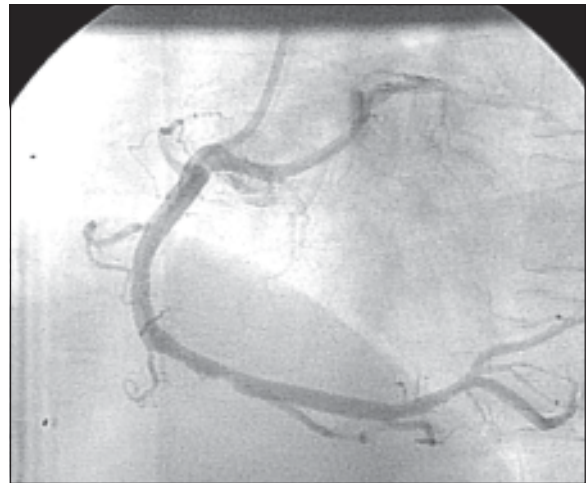
**Observation-2:** A 52 years old gentleman who was diabetic, hypertensive & smoker presented with post MI (Ant) angina on 15<sup>th</sup> June 2009. CAG revealed TVD with high take off origin of RCA having 70% mid lesion. PCI with stenting was done on the same day (Fig-2a,b). The RCA was hooked with 6f JR 3.5 after failing with AR, AL guide catheter.

The lesion was crossed with floppy run through (0.014<sup>//</sup> x 180cm) guide wire. We deployed a cobalt chromium stent 2.75 x 12mm @ 12 atms for 20 sec. The procedure was uneventful. Heparin & GTN were used during the procedure.

**Observation-3:** A 60 yrs. Old lady, diabetic, hypertensive presented with recent MI (Inf) on 16<sup>th</sup> August, 2008. CAG revealed abnormal origin of RCA from left sinus with 70-80% lesion. PCI with stenting was done on the same day. The RCA was hooked with tiger guide after failing with all types of guide catheter JL, JR, AL, AR (fig-3a,b). A guide wire floppy run through (0.014<sup>//</sup> x 180cm) was used to cross the lesion. The lesion was predilated with ryujin plus balloon (1.5x115mm) @ 16 atms for 20 seconds. Heparin GTN were used during the procedure.



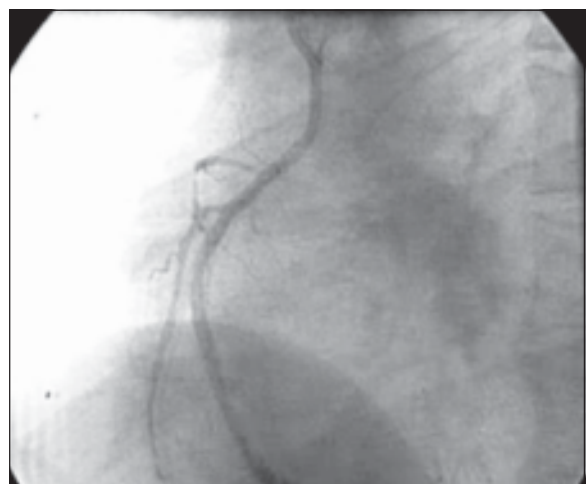
**Figure-1(a) :** Before PCI



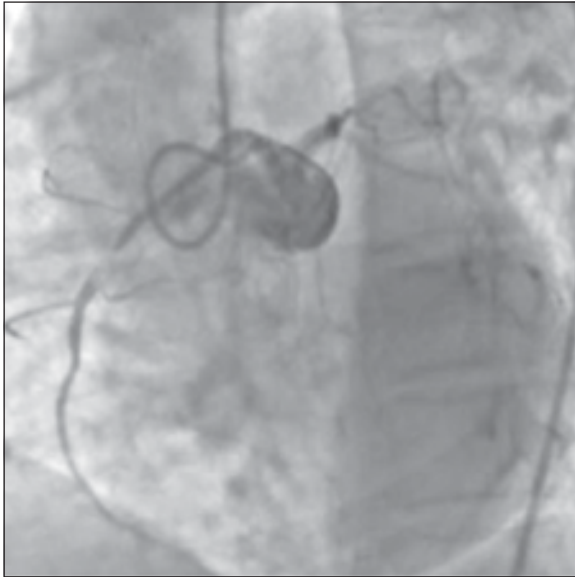
**Figure-1(b) :** After PCI



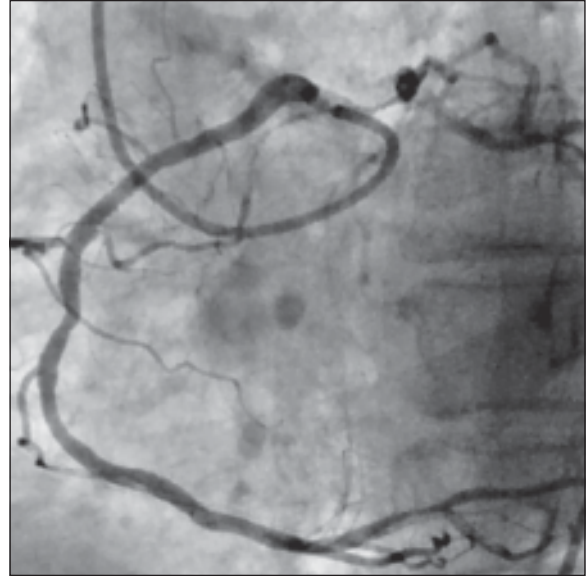
**Figure-2(a) :** Before PCI



**Figure-2(b) :** After PCI



**Figure-3(a) :** *Before PCI*



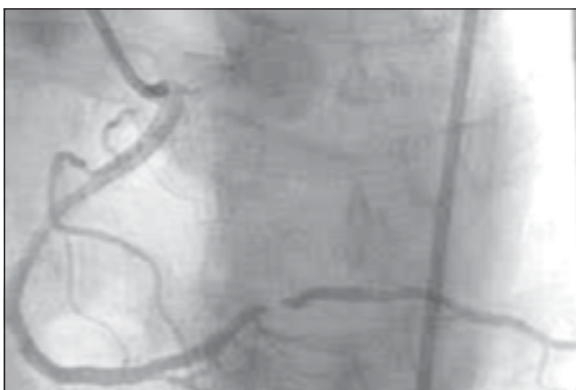
**Figure-3(b) :** *After PCI*

**Observation-4:** A 63 years old gentleman, smoker, diabetic, normotensive presented with chest pain on 18<sup>th</sup> August, 2007, CAG revealed SVD, posterior origin of RCA with 70-80% distal lesion. PCI with stenting was done on the same day. The RCA was hooked with 6f JL 3.5 after failing with AR, AL, JR guide catheter (fig-4a,b). The lesion was crossed with extra support (0.14//x180cm) guide wire. The lesion was predilated with a balloon 1.5x 10mm @ 10atms for 20 sec. Finally a DES 2.5 x 120mm @ 16atms for 20 sec was deployed. Heparin & GTN were used during the procedure.

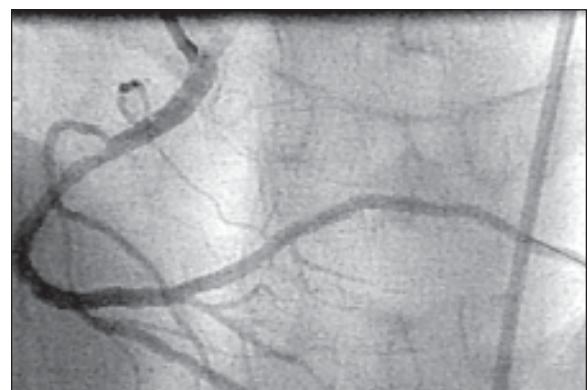
**Observation-5:** A 56 years old lady who was diabetic, hypertensive presented with recent MI (int) & post MI angina. CAG revealed abnormal LCX arising from right coronary sinus with distal 80% stenosis. PCI with stenting was done on the same day. The LCX was hooked with 6f

JR 3.5 guide catheter(fig-5a,b). The lesion was crossed with a 0.14//x180cm floppy guide wire. Lesion was predilated with a ryujin plus 1.5x10mm balloon for 20 sec @ 16atms. We deployed a DES 2.5x15mm @ 16atms for 20 sec. The procedure was uneventful. Heparin and GTN were used during the procedure.

**Observation-6:** A 46 years old smoker gentleman presented with UA on 20<sup>th</sup> February 2005. CAG revealed LCX as proximal branch of RCA with 70% lesion. PCI with stenting to LCX was done on the same day. RCA was hooked with 6f JR 3.5 guide catheter(fig-6a,b). The lesion was crossed with a floppy run through 0.14//x180cm guide wire. The lesion was predilated with a Ryujin plus balloon 1.5x15mm @ 16atms for 20 sec. Finally we deployed a DES 2.5x20mm @ 16atms for 20 sec. The total procedure was uneventful. Heparin & GTN were used during the procedure.



**Figure-4(a) :** *Before PCI*



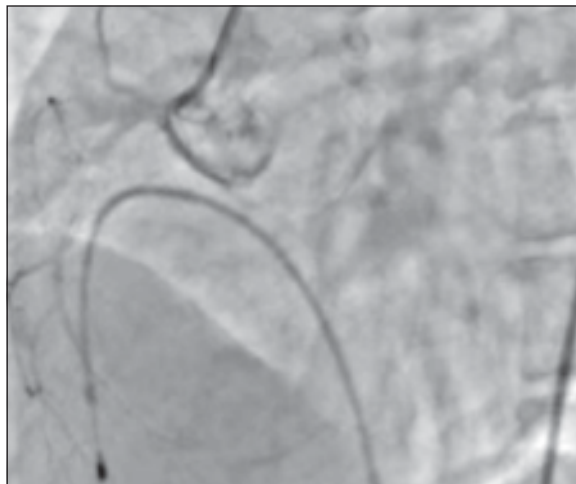
**Figure-4(b) :** *After PCI*



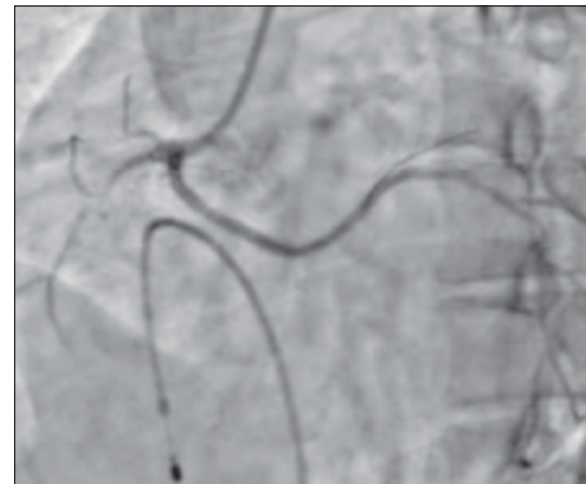
**Figure-5(a) :** *Before PCI*



**Figure-5(b) :** *After PCI*



**Figure-6(a) :** *Before PCI*

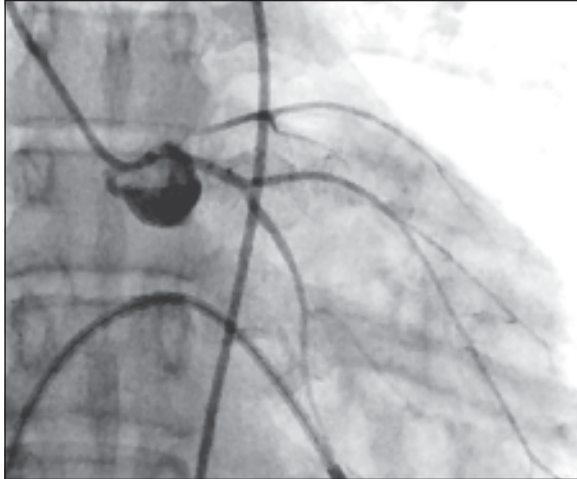


**Figure-6(b) :** *After PCI*

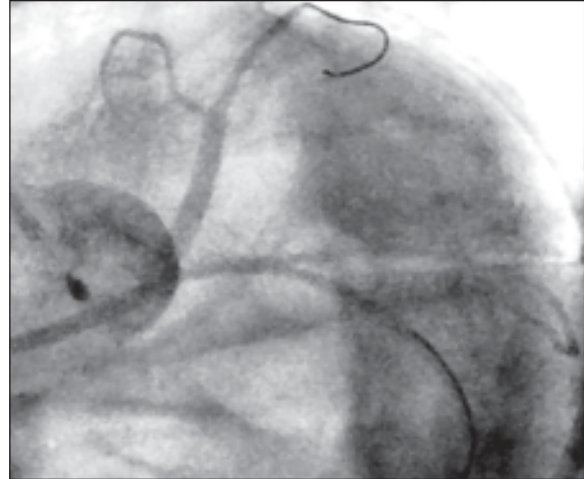
**Observation-7:** A 42 years old diabetic gentleman presented with UA on 17<sup>th</sup> December, 2009. CAG revealed separate origin of LAD with ostio-proximal 90% lesion. PCI with stenting was done on the same day. LAD was hooked with 6f EBU 3.5 guide catheter (fig-7a,b). The lesion was crossed with floppy run through (0.014//x 180cm) guide wire. The lesion was predilated with a PTCA balloon 1.5x20mm@ 16atms for 20 sec with 50% residual stenosis. We deployed a cyper stent 3.0x24mm @ 16 atms for 20 secs. The procedure

was uneventful. Heparin & GTN were used during the procedure.

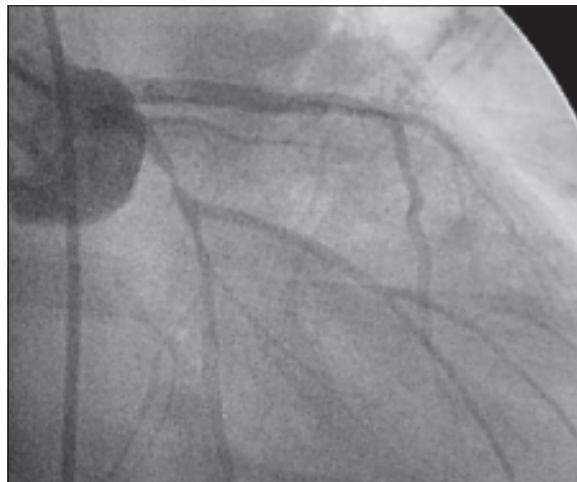
**Observation-8:** A 55 years old diabetic, hypertensive gentleman presented with UA on 10<sup>th</sup> March 2010. CAG revealed separate origin of LCX with proximal 80% lesion. PCI with stenting was done on the same day. LCX was hooked with 5f JL 3.5 guide catheter(fig-8a,b). The lesion was not predilated. A BMS 3x112mm @ 12atms was deployed for 20 secs. The procedure was uneventful. Heparin & GTN were used during the procedure.



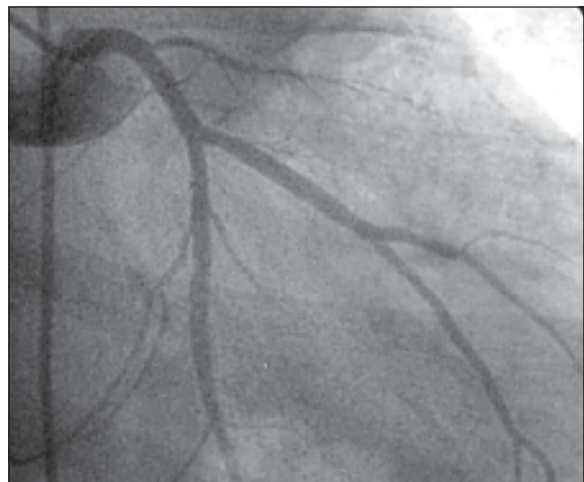
**Figure-7(a) :** *Before PCI*



**Figure-7(b) :** *After PCI*



**Figure-8(a) :** *Before PCI*



**Figure-8(b) :** *After PCI*

### **Discussion:**

Since January 2002 we have done 3110 PCI cases in NICVD and other cardiac centers in Dhaka. Out of which total twenty-one cases were performed in different varieties of anomalous coronary artery. Among those twenty-one cases, seven cases were PCI to high take off origin of RCA, six cases were PCI to RCA of posterior origin, three cases were PCI to RCA arising from left sinus of valsalva, single case each for PCI to LCX as proximal branch of RCA. PCI to LCX arises from right sinus of valsalva, PCI to LAD arising separately from LSV, PCI to LCX arising separately from LSV, PCI to RCA where RCA & LM arising from RSV as a single stem.

Considering the possible technical difficulties of angioplasty of an abnormal vessel, several aspects merit attention—the orifice configuration, the exit angulation from the aorta, the route the artery takes & the location of atherosclerotic lesion. The major factor determining successful PCI in these vessels is guiding catheter selection, since stable guiding

catheter position is the key to success of PCI in abnormally arising coronaries. The choice of guide wire can also affect the final outcome. With occasional exceptions, the guides used successfully are those matched to the sinus of Valsalva from which the anomalous artery arises rather than to the eventual distribution of the artery<sup>12</sup>. Coronary arteries arising from the left sinus of valsalva, be they normal or anomalous, are likely to be successfully cannulated with a left Judkins, a left Amplatz, or a left Voda<sup>12</sup>. Like normal arteries arising from the right sinus of Valsalva, anomalous arteries arising there are likely to be catheterized without difficulty using a right Judkins, a right or left Amplatz, or a multipurpose catheter<sup>12</sup>. Theoretically, performing PCI of a single coronary artery increases the procedural risk since a complication leading to dissection (e.g., guiding-catheter induced) of the single ostium may be catastrophic. The risk of guiding catheter damage is low. The double guide wire technique provides excellent back-up support for the guiding catheter<sup>12</sup>.

Selective cannulation of an anomalous RCA with guiding catheter is difficult and sometimes challenging one. Its anomalous origin from aorta makes an acute angle and slit like orifice which prevents selective cannulation coaxial alignment and adequate guide catheter support, which are essential for PCI<sup>13</sup>. When Judkin Right (JR) and Judkin Left (JL) guide catheter of different sizes fail to cannulate, then successful selective cannulation and PCI with stenting were done with 7F multipurpose Hockey Stick guiding catheter<sup>13</sup>. Primary PCI and elective PCI after thrombolytic therapy in acute MI of anomalous RCA from LSV have been reported<sup>14</sup>. Patients with anomalous RCA presented usually with inferior wall MI but with true posterior wall MI as well<sup>14</sup>. Selective cannulation of anomalous RCA and successful PCI were done by 7F MPA1, 7F XB3.0, 6F JL4.0, 6F AL1 guiding catheter<sup>13,14,15</sup>. For better guiding catheter support a balloon on guide wire with guiding catheter AL1 was also used in a few cases for successful PCI of anomalous RCA<sup>13</sup>. In our cases, PCI to RCA with high take off origin, naturally AR guide catheter should be hooked but here both AR & AL guide were failed to negotiate the coronary ostium, JR 6F 3.5 catheter was used successfully in this case. In case of PCI to RCA arising from left sinus, all types of guide JL, JR, AL, AR were tried but failed, finally tiger guide was apposed to ostium of RCA. In another case of same anomalous origin of RCA, PCI was successful with 6F AL-2 guide catheter. In case of PCI to RCA of posterior origin we tried AR, AL, JR guide catheter but failed, finally success came with JL 6F 3.5 guide catheter. In our other cases of PCI to LCX arising from RCA JR 6F 3.5 catheter was used & PCI to LCX arising from RSV, vessel was able to cannulate with conventional JR 6F 3.5 guide catheter. In case of PCI to LAD of separate origin from LSV, LAD was cannulated with EBU 6F 3.5 guide catheter but in case of separate origin of LCX from LSV PCI was done with 5F JL 3.5 curve guide catheter.

Our observation is that PCI in anomalous coronary arteries is a challenging job. Selective cannulation of the vessel may not be easy. It is very important to have proper selection of hard ware as well as good guide support for doing successful PCI in anomalous coronary arteries. No guide catheter is specific for specific type anomalous coronary artery. Trial & error is the rule to achieve the final goal.

### Conclusion:

PCI in anomalous coronary arteries is a feasible therapeutic strategy with excellent clinical results. Selection of appropriate guiding catheter and other equipment is essential to the technical success of the procedure. Since these cases are rare, the reported experience of other practitioners may provide helpful tips.

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