

# TRANSCATHETER CLOSURE OF CORONARY ARTERY FISTULAS; SINGLE CENTER EXPERIENCE IN 6 YEARS PERIOD

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**Background:** Coronary artery fistulas (CAF), are abnormal direct vascular connections between the coronary arteries and cardiac chambers or great vessels bypassing the myocardial capillary network. CAF's in childhood are usually asymptomatic. In time potential complications may occur. Even though there is no consensus on the indications and timing of intervention, closure is recommended in the existence of symptoms and advocated electively in patients with moderate to large fistulas with significant shunting due to potential complications increasing with age. Recently, transcatheter closure is the treatment of choice for treatment of coronary artery fistulas. We present our 6years' experience with CAF's in 24 patients between 2007 and 2014 especially emphasizing on multiple openings, multiple feeding arteries and competitive flow after closure.

**Patients and Method:** 24 patients aged between 2 months - 67 years (median 7 years) who diagnosed with CAF by echocardiography underwent cardiac catheterization. Multiple hand-contrast injections in different projections was performed in order to define the anatomy, number of feeding arteries and distal opening of the fistula. Coils, plugs or devices that were used to close the fistula were placed to the most distal site that the fistula was opening and as far as to the normal coronary artery branches that are feeding the myocardium as possible. If the delivery system was easy to advance to a safe distance in the fistula and the femoral artery of the patient was large enough, the procedure was preferably performed with retrograde route. If however it was not feasible than an AV loop was created and the fistula was closed by antegrade approach through the venous route

**Results:** Coronary angiograms demonstrated 26 fistulas in 24 patients. Two patients had two separate fistulas. CAFs were originating from the right coronary artery (RCA) in 12, left anterior descending artery (LAD) in 8, left main coronary artery (LMCA) in 3, circumflex artery (CX) in 3 patients. CAFs were opening into the right ventricle in 12, right atrium in 9, pulmonary artery in 3, superior vena cava in 1 and bronchial artery in 1 patient. The opening orifices were single in 16 and multiple in 10 fistulas.

In 5 patients, the fistula was not closed since they were very small. In one pt the catheter couldn't be advanced to the distal then the procedure was abandoned. In another patient with two separate fistulas, one of them was moderate and had closed but the other was tiny and left untreated. Implantation was successful in 18 of 19 patients.

The implantations were done retrograde from the femoral artery in 15, antegrade from the femoral vein in 3 patients. 22 device-plug or coils were used in 18 pts, they were 4 detachable coils, 5 Amplatzer vascular plugs 1 (AVP1), 4 Amplatzer vascular plugs 4 (AVP4), 3 Amplatzer vascular plug 2, 4 duct occluder 1, 2 Gianturco coils,

**There were 4 fistulas with multiple feeding arteries (FA).** All closed by retrogradely. Three of them had multiple opening orifices also. In 2 of the four patients with multiple feeding arteries the vascular plug was placed just distally to the merging point before the multiple opening orifices. In a 7 year old patient with a dilated RCA and CX artery communicating with a dilated posterior descending coronary artery, the CAF opening into the RV was closed using an AVP1 distal to the opening orifice. Balloon occlusion angiography from RCA showed that the device was in a good position and the fistula was almost fully occluded and no interaction with the enlarged normal coronary lumen. There was no residual shunt after releasing the device on contrast injections both from RCA and Cx artery. However, very large Cx and RCA showed slow filling. The patient was heparinized for and Coumadin was started afterwards, experienced intractable ventricular fibrillation unresponsive to defibrillation and died on fourth day after intervention. In a 3 years old patient there was a CAF from LAD to RV with multiple FAs and multiple orifices. A AVP4 was placed where the FA merged before exiting with multiple orifices. And complete occlusion was achieved. After the first plug implantation, coronary angiogram revealed slow flow pattern in LAD due to competitive reciprocal flow through the FAs. And additional AVP4 was implanted by retrograde way to prevent competitive reciprocal flow.

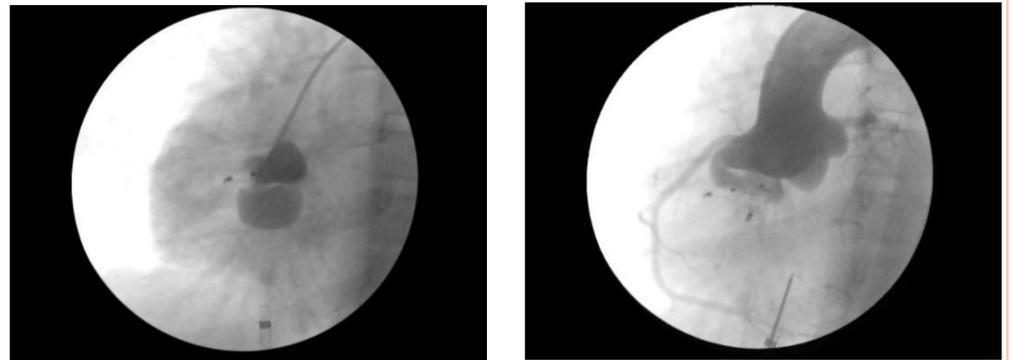
## Multiple orifices

In one patient the fistula was closed antegradely from the most distal part by ADO I device. After the device released a second opening was noticed and a second ADO I was placed in to that opening again by antegradely. The other CAFs with multiple orifices were retrogradely closed by coils and vascular plugs placing at the proximal parts of the fistulae

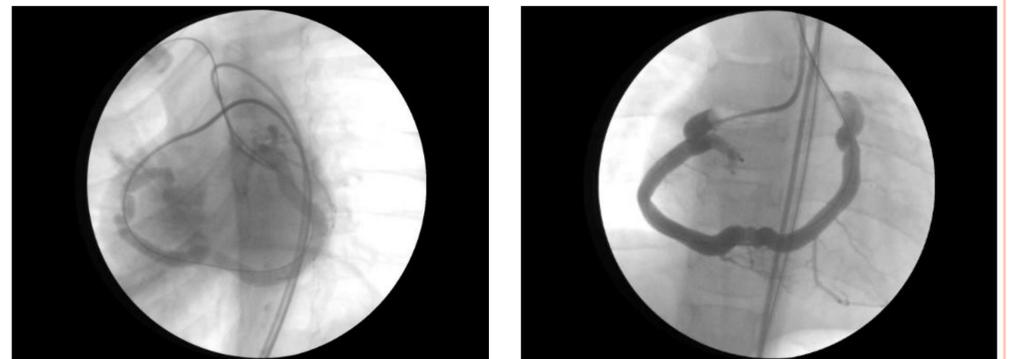
Complete occlusion was achieved immediate after the procedure in 15/18 patients. After 24 hours total occlusion was achieved 17 of 18 patients. There was only one residual shunt was one of the fistula was left untreated due to too small.

During a median 27 month (4 month – 6 years). There was no recanalization of the fistula was seen. All are well without symptoms, except one patient who died. In one patient with pulmonary atresia and VSD, ventricular dysfunction improved and there was complete recovery or decrease in severity of symptoms in the others.

**Conclusion;** Eventhough CAF's are rare they may present in a great variety in morphology. Effective and safe percutaneous transcatheter closure is possible in majority of cases with using different coils, plugs and devices. The age of the patient, the anatomy, length, number of feeding arteries, number of distal orificies and localization of the fistula should be taken into consideration. However it is not free of complications; not only during the procedure but also thereafter the procedure. The patient should be monitored closely not just during but after the procedure as well for possible late complications



A patient with dual opening orifices. After the first device released a second opening was noticed and a second ADO I was placed again by antegradely



In this patient coronary angiogram revealed a very large Cx artery communicating with RCA via posterior decendant artery. There was no residual shunt after releasing VP1 on contrast injections both from RCA and Cx artery. However, very large Cx and RCA showed slow filling after closing the fistula



3 years old patient with CAF from LAD to RV with multiple FAs and multiple orifices. A AVP4 was placed where the FA merged before exiting with multiple orifices. After the first plug implantation, coronary angiogram revealed slow flow pattern in LAD due to competitive reciprocal flow through the FAs



And additional AVP4 was implanted by retrograde way to the proximal part of the one of the fistula that did not give branches feeding myocardium. The last angiogram after releasing the device shows a good antegrade flow in the other feeding artery as acting real LAD and giving side branches to the myocardium.