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Angioplasty of Anomalous Coronaries Arising from the Opposite Sinus with an Interarterial Course, is it Safe?

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Abstract

Background: The coronary artery with an interarterial course CAIAC is the most threatening coronary anomaly, especially if it concerns the left coronary. Percutaneous coronary intervention PCI is scarcely described given its low prevalence and lack of long-term outcome data. Therefore, we assessed through this case series the feasibility and safety of PCI in this population.

Methods: This is an observational multicentric study including patients with CAIAC arising from the opposite sinus of Valsalva. The primary endpoints were immediate angiographic success and target lesion revascularization.

Results: During the period of the study, we performed 27235 PCI in six Cath labs, 26 procedures concerning abnormal coronaries including 12 with CAIAC. The median age was 57 years extremes: 43–78 with male predominance 1:11. Anomalous coronary artery was Right coronary artery RCA in eight patients, Left main LM in three patients, and left anterior descending LAD in one patient. The stenosis was located in all cases in proximal segments beyond the interarterial course proximal LAD, the superior genu of the RCA, or the proximal segment of mid-RCA. Five patients showed slit-like ostium and all have an angle take-off $<45^\circ$ on CT scan. After a median follow-up of 24 months, four subjects presented target lesion revascularization TLR, all were initially treated with either a bare-metal stent or with balloons.

Conclusions: PCI of patients with CAIAC is feasible and appears safe. The operator should carefully analyze the angiogram before PCI to choose the appropriate guiding catheter and should be acquainted with the different techniques for improving backup.

Keywords: Anomalous coronary artery, Inter-arterial course, Percutaneous coronary intervention, Target lesion revascularization, Angiographic success

1. Introduction

Abnormal coronary artery CAA is a rare congenital heart disease, with a prevalence

ratio between 0.6% and 1.3% in different series [1–4]. The abnormality could concern the origin, course, or termination, as well as intrinsic structure. Anomalous origin of the coronary artery from the

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opposite sinus ACAOS is the most frequent CAA according to the ANOCOR registry and represents 47% of all anomalies [5]. Some studies have shown that ACAOS causes abnormal intracoronary flow and a high risk of atherosclerosis [6]. In addition, patients with an abnormal course between the pulmonary artery and the aorta have the highest risk of sudden death compared to other CAAs [7]. In cases of obstructive coronary artery disease, the recommended treatment for these patients is surgery, especially if the abnormal vessel is the left coronary artery LCA. Consequently, few cases of percutaneous coronary intervention PCI of ACOAS with interarterial course have been reported in the literature. Many authors advise against percutaneous coronary intervention PCI of ACAOS, especially in young patients given the risk of stent compression and lack stent durability data [2]. The angioplasty of a coronary artery with an abnormal origin is also associated with concerns about backup and device deliverability; few papers have described the tricks of ACAOS management. Here we report a multicenter study of PCI in patients with ACOAS and interarterial course and we discuss technical features as well as long-term outcomes.

2. Methods

We conducted a retrospective observational Tunisian multicentric study over 9 years 2011–2019, approved by the ethics committee CPPSUD, enrolling all patients with atherosclerotic lesions in the ACAOS with an interarterial course and who underwent PCI of abnormal coronary. We examined the archive of reports of all PCI performed during the period, then we examined the medical record documents.

In all patients, we checked the abnormal trajectory by CT scan.

All Cath Labs that participated in this study perform between 400 and 900 PCI per year.

We excluded ACOAS with another course retro-aortic, subpulmonic, and pre-pulmonary course and patients undergoing coronary angioplasty with another than the abnormal vessel. We also excluded patients in whom we suspected interarterial coronary course and who did not undergo CT scan and were lost sight of Fig. 1.

Two expert interventional cardiologists, blind to the CT scan results, reviewed all procedures and sought slit-like orifices on angiography with specific attention to the coronary origin and course. Figure 2.

For patients with anomalous origin of the RCA R-ACAOS, we identified 3 common areas of origin according to a simplified classification scheme

Abbreviations

ACAOS	Anomalous origin of the coronary artery from the opposite sinus
CAA	Abnormal coronary artery
CAIAC	Coronary artery with an interarterial course
LM	Left main
LAD	Left anterior descending
LCA	Left coronary artery
MIMI	Minimalist immediate mechanical intervention
NSTEMI	Non ST elevation myocardial infarction
STEMI	ST elevation myocardial infarction
RCA	Right coronary artery
SCD	Sudden cardiac death
PCI	Percutaneous coronary intervention
TLR	Target lesion revascularization

described by Sakara et al. [8]. In the LAO view between 30 and 40°, the outflow tract of the left ventricle and aorta may schematically be regarded as a cylinder with a bulge in the middle owing to the presence of aortic sinuses. An imaginary line drawn at the upper edge of the bulge marks the plane dividing the aortic sinuses from the ascending aorta. Another vertical line is drawn along the long axis of the ascending aorta intersecting the aortic sinus and aorto-ventricular planes perpendicularly.

The origin of the anomalous vessel was described according to its location in relation to these landmarks: there are four classifications: A: Origin from the aorta above the sino-tubular plane. B: Origin just below the ostium of the left coronary artery LCA. C: Origin under the sino-tubular plane between the midline and the origin of the left coronary artery. D: Origin along the midline Fig. 3.

A radiologist ignoring the angiography results examined cardiac CT studies (see Fig. 4). He analyzed the takeoff, intramural segment, and the course of the anomalous coronary artery; he also sought to assess stent patency, and any evidence of stent fracture or anatomic distortion, if the CT scan was performed after PCI.

We have reported the devices used to perform PCI, in particular the guiding catheter, guidewires, and different techniques used to improve back-up during PCI.

The primary endpoints in our study were an immediate angiographic success, TLR, myocardial infarction, and death at any time of follow-up.

We defined angiographic success as a final TIMI flow = 3 and residual stenosis <30% without visible angiographic dissection.

Target Lesion Revascularization was defined as any repeat percutaneous intervention of the target lesion or bypass surgery of the target vessel

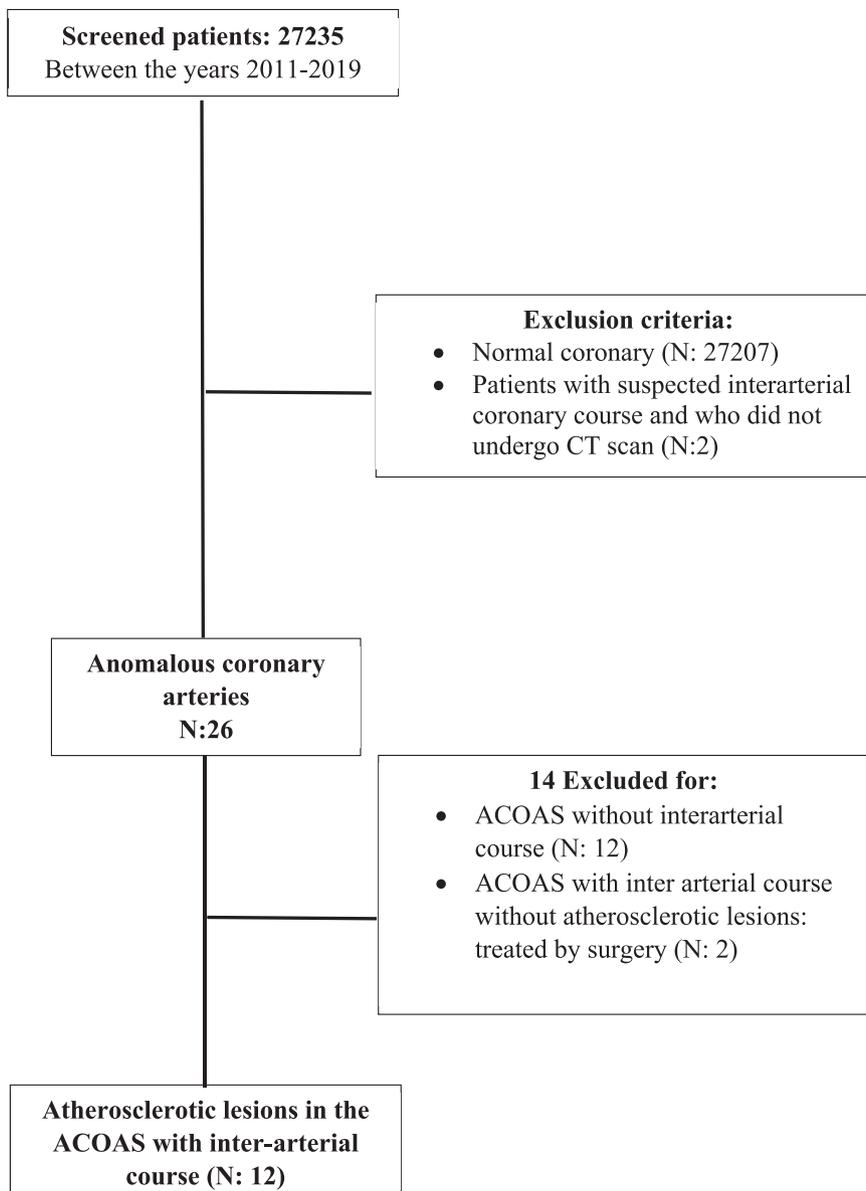


Fig. 1. Study flowchart.

performed for restenosis or other complications of the target lesion.

3. Results

During the period of the study, we performed 27235 PCI in 6 Cath Labs in our country. Twenty-six procedures concerned abnormal coronaries. Two patients with syncopal interarterial left main coronary artery were treated by surgery. Our study group includes 12 atherosclerotic lesions in the ACAOS with interarterial course. The median age of our patients was 57-year-old extremes: 43–78 with

male predominance Sex ratio = 11. Baseline characteristics of the patients are shown in [Table 1](#).

None of our patients had a history of resuscitated sudden death or syncope before admission. Diabetes was found in 8 patients 66%, hypertension in 6 patients 50%, and smoking in 5 patients 41.6%. All subjects have at least one cardiovascular factor. The most frequent clinical presentation was ST elevation myocardial infarction STEMI 8/12; 66%. One patient, who was admitted for anterior STEMI related to a 90% severe stenosis, underwent a staged PCI of the abnormal RCA, without performing an ischemia test.

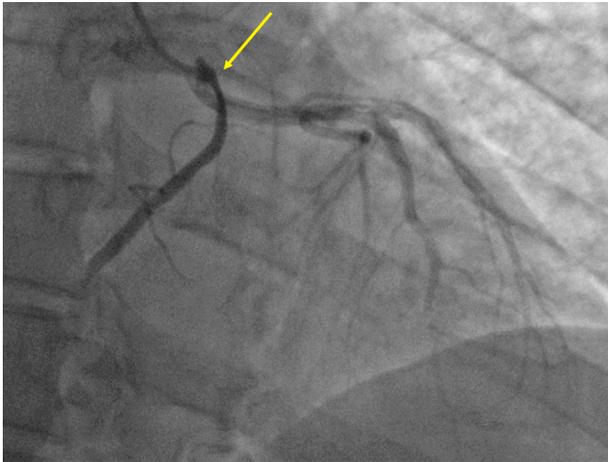


Fig. 2. Angiogram of patient number 2: On LAO view, slit-like ostium yellow arrow of the RCA which arises from the left sinus of Valsalva, close to the LAD Ostium classification: A, the mid-RCA was occluded.

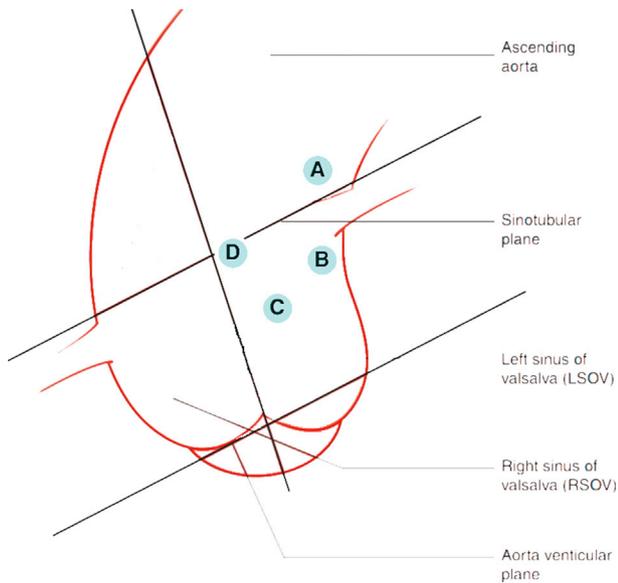


Fig. 3. Origin of anomalous RCA from LSOV. Representative diagram of aortic root and sinuses in LAO projection. The vertical axis indicates a hypothetical plane running through the midline. Sites A through D represents common sites for the origin of the anomalous artery.

Table 1. Baseline demographics and angiographic data.

Median age (years)	54 (43–78)
Sex repartition	11 Male/1Female
Cardiovascular risk factors	Hypertension: 6/12 Diabetes: 8/12 Smoking: 6/12 Dyslipidemia: 3/12
History of coronary artery disease	1 patient (History of stenting of proximal LAD (anterior STEMI))
Clinical presentation	Stable chronic syndrome: 1/12 NSTEMI: 3/12 STEMI: 8/12
Number of vessel disease	1 VD: 7/12 2 VD:2/12 3 VD:3/12
Time of PCI	Primary PCI: 8/12 Staged PCI: 1/12 Urgent PCI (NSTEMI): 3
Median Follow up (months)	24.5
Target lesions revascularization	4/12
Target vessel revascularization	3/12

We used a right radial approach in 50% of cases and a right femoral approach in the other cases. All procedures were performed with 6 Fr catheters.

The PCI performed included balloon angioplasty in one patient and stent deployment in 10 patients. We failed to cross the lesion in one patient. The coronary angiogram showed one-vessel disease in 7/12 subjects 58.3%, two-vessel disease in 2 patients, and three-vessel disease in the remaining patients. The anomalous vessel was the right coronary artery R-ACAOS in 8 patients 66.6% and the left coronary artery L-ACAOS in 4 patients 3 LM, 1 LAD.

In all patients, we noted that the treated lesion was located just following the interarterial course. In the case of R-ACAOS, it was located just beyond the abnormal course in the proximal RCA in the superior genu or the proximal segment of Mid RCA. In the case of L-ACAOS, the stenosis was located in the proximal LAD.

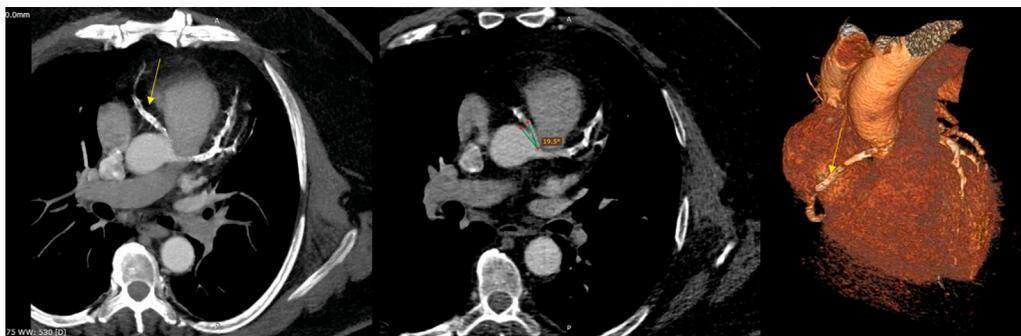


Fig. 4. CT scan: RCA which arises from the left sinus of Valsalva, we see the stent in the mid-RCA yellow arrow, the Take-off angle of R-ACOAS was calculated = 19°, we observe an intramural segment, and the LAD was heavy calcified.

Table 2. Angiographic findings based on Angiography and CT scan.

Patient Number	VD number	Dominance	Abnormal coronary	Slit like ostium on angiogram	Location of atherosclerotic lesion	CT scan- Angiogram interval	Angle take off On CT scan	Intramural segment On CT scan
1	3VD	Right	RCA	yes	Proximal RCA, in the Superior Genus	After PCI 1 month	<45°	Yes
2	3VD	Right	RCA	Yes	Proximal RCA, in the Superior Genus	After PCI 28 months	<45°	Yes
3	1 VD	Right	RCA	Yes	Proximal RCA, in the superior genus	After PCI 11 months	<45°	No
4	3 VD	Right	RCA	No	Mid RCA, following the superior genus	After PCI 13 months	≥45°	No
5	1 VD	Right	RCA	No	Proximal RCA, in the superior genus	After PCI 16 months	>45°	No
6	1 VD	Right	RCA	Yes	Proximal RCA, the superior genus	After PCI 19 months	<45°	Yes
7	2 VD	Right	RCA	Yes	Proximal RCA, beyond the abnormal intercourse	After PCI 20 months	<45°	Yes
8	2 VD	Right	RCA	No	Mid RCA beyond the superior genus	After PCI 24 months	>45°	No
9	1 VD	Right	LM	No	Proximal LAD	after PCI 67 months	<45°	No
10	1 VD	Right	LAD	No	Proximal LAD beyond the inter-arterial course	After PCI 18 months	≥45°	No
11	1VD	Left	LM	No	Proximal RCA, beyond the abnormal intercourse	Before PCI	>45°	No
12	1 VD	Left	LM	No	Proximal LAD	After PCI 51 months	≥45°	No

LAD: left artery descending, LM: Left Main, M: male, F: Female, NSTEMI: non ST elevation Myocardial Infarction, RCA: Right Coronary artery, STEMI: ST elevation myocardial infarction, PCI: percutaneous coronary Intervention, VD: vessel disease, yo: year old.

On angiogram, we relieved a slit-like orifice in 5 patients with R-ACAOS. All these patients showed an angle takeoff <45° on CT scan Fig. 3. The ostium of the left coronary artery was normal in all patients with L-ACAOS. The sensibility and specificity of slit-like ostium to detect the intramural segment were, respectively, 100% and 80%. However, we opted for conservative treatment in patients with intramural segment, especially that it concerns the RCA.

We obtained immediate angiographic success in 11 patients 91,6%. The angiographic data as well as long-term outcomes are shown in Tables 2 and 3.

In a patient who was admitted for STEMI, 11 h after the onset of chest pain, the RCA was occluded in the superior genus. We failed to introduce even a small balloon due to poor backup. We changed the guiding catheter and the guidewire several times; we used a buddy wire technique, but we failed to cross the occlusion even with a small balloon. As the patient was pain-free and had three-vessel disease with a Rentrop 3 collateral in the RCA, we decided to stop the procedure and to discuss surgery. The patient underwent CABG two months later after a viability test.

In a second patient hospitalized for anterior STEMI and TIMI 2 initial flow in the proximal LAD, we opted for a minimalist immediate mechanical intervention MIMI attitude. We restored a TIMI 3 flow using a small balloon and then we failed to deliver the stent although we used deep cannulation, buddy wire, and anchoring balloon. Therefore, we decided to treat the patient with CABG. The operator opted for this strategy, as the patient was diabetic and had three-vessel diseases in addition to the interarterial course of the left main.

In another patient with R-ACAOS and slit-like ostium, the stent was partially deserted just in the ostium. The operator decided to complete the deployment of this first stent and treat the lesion of the mid-RCA using a second stent overlapping with the first stent.

To improve back-up, we used the buddy wire technique in 8 patients and an anchoring balloon in two patients. We needed to change the guiding catheter at least one time in 7 patients.

Although the median experience of the operators was 6 years extremes 2–17 years, the median time of fluoroscopy was 45 min extremes: 18–59 and the median volume of Contrast was 210 ml extremes: 160–300 ml.

There were no major bleeding or vascular complications reported in any of our patients. However, the PCI was complicated with contrast nephropathy in one of the patients with angiographic failure. He

Table 3. Procedural data.

Patient Number	Operator Experience (years)	Vascular access	Initial Timi Flow	Ostium Classification	Guiding Catheter	Wire	Predilatation	Back up	Stent	Angiographic success	Fluoroscopy (min)	Contrast Volume (ml)	Complications
1	12	Right Radial	0	A	MB1 - AL 1- JR 4 - JL 4 - AR 2	Whisper ES Pilot 150	yes	Buddy wire Deep cannulation	no	No	59	300	Contrast Nephropathy
2	6	Right femoral	0	A	JR 4	BMW	yes	no	2 BMS 3/23 3.5/18	Yes	45	220	The first stent was Partially deserted in the proximal RCA and so deployed and we add another stent
3	2	Right Radial	0	B	JR 4	BMW	yes	No	DES 3.5/28	yes	18	160	-
4	2	Right Radial	2	C	JR 4- AL1	Runghrough Intermediate	yes	No	BMS 3/24	yes	25	180	-
5	3	Right Radial	2	A	JR 4-EBU 3.5	BMW 0.014	yes	Deep cannulation	DES 3/24 mm	yes	35	200	-
6	4	Right radial	0	A	JR 4-EBU 3.5	Choice PT BMW	yes	Buddy wire	DES 3/28 mm	Yes	28	140	Distal embolization in the PDA
7	4	Right Radial	3	D	EBU3.5- JR4,-JL4 - AL1	2 Runghrough Hypercoat and Intermediate	predilatation	Buddy wire	DES 3/33	Yes	53	300	-
8	8	Right femoral	3	C	JR4- AL1	2 BMW	predilatation	Buddy wire	DES 3.5/12	Yes	45	200	-
9	17	Right femoral	2	-	AL1	2 Runghrough hypercoat	no	Buddy wire	DES 2.75/14	Yes	45	200	-
10	12	Right femoral	0	-	JL 4	2 BMW	Yes	Buddy wire	DES 2.5/24	Yes	52	220	-
11	6	Right femoral	0	-	AL1	2 BMW	predilatation	Buddy wire Anchoring Balloon	Balloon	Yes (MIMI attitude)	48	290	We could not deliver the stent
12	12	Right Femoral	3	-	EBU3.5- AL1-JR 4	2 BMW	yes	Buddy wire Anchoring balloon	DES 3/38 mm	Yes	52	260	-

BMS: Bare metal stent, DES: drug Eluting stent.

was 78-year-old, diabetic and he was admitted because of STEMI. In this procedure, we used 4 types of guiding catheters and 220 ml of Ultravist.

The median follow-up was 24 months extremes: 13–79. We noted TLR in 4/12 patients 30%, because of restenosis of BMS in two patients, failure of placing a stent in one patient, and a MIMI strategy in one patient [Table 3](#). There was no sign of stent deformation or fracture in patients who underwent CT scan.

4. Discussion

Anomalous coronary connection to the opposite Valsalva sinus is the most common coronary anomaly, representing 40%–47% of all abnormal coronary arteries ACA [5,9]. Recently, Angelini et al. showed that ACAOS is not rare as previously assumed and affects about 1.2 million persons in the United States [10]. Among this group, the interarterial course is the most frequent abnormal trajectory 39% and it could be associated with intramural intercourse [11].

The interarterial course, particularly if it concerns the LCA, it predisposes the patient to a high risk of life-threatening cardiovascular events, such as sudden cardiac death SCD or myocardial infarction MI. This anomaly was also shown to be associated with an increased predisposition to develop significant epicardial atherosclerosis disease [6]. The pathological mechanism is unclear. Jim et al. compared two groups of patients examined by CTA. The prevalence of atherosclerosis was significantly higher in patients with RCA arising from the opposite Valsalva sinus 69% compared with normal RCA 52% [6]. In our study, seven patients 58% of 12 had one vessel disease which is the abnormal vessel, and this could mean that the risk of atherosclerosis is higher in abnormal coronaries than the other coronaries of our patients.

Many mechanisms have been proposed to explain the predisposition to atherosclerosis in ACAOS: the slit-like configuration of the ostium, acute proximal angulation, the oblique route of the vessel as well as the possible compression on the coronary artery wall in addition to the intramural course could in some cases lead a change in intracoronary flow and higher shear stress [11–15]. The consequence would be endothelial dysfunction and new atherosclerotic plaque formation. Hutchins et al. suggested that all these mechanisms could accelerate the rate of atherosclerosis, especially in the proximal segments of abnormal coronaries [12]. In our study, we noted that the elective site of atheroma was the segment following the interarterial course of RCA superior

genus or mid-RCA and the proximal LAD for abnormal LM. These findings are in agreement with those of Darki et al. who reported the outcomes of PCI in 11 patients with R-ACOAS, the site of stenosis was the proximal segment or the ostium of RCA [13]. Cheezum et al. reported also a series of 103 patients with ACOAS, diagnosed by CT scan [11]. They found that coronaries with interarterial course 43 patients were concerned more frequently the RCA $n = 40$ patients, 93%. The slit-like ostium was observed in 21% of patients with ACA and obstructive CAD was noted in only 14%. All patients were revascularized by CABG; no one had undergone PCI.

Angioplasty of these arteries can be difficult due to the course and structure of the vessels as well as to the location and nature of the atherosclerotic lesions. To date, data are sparse on angioplasty in patients with anomalous coronary arteries.

Before performing the procedure, the interventional cardiologist should carefully analyze the abnormal coronary ostium and the aortic connection site to choose the appropriate guiding catheter and to avoid deep cannulation in case of a slit-like ostium. There will certainly be a risk of dissection. Oblique LAO and oblique RAO views are required in every patient with ACAOS to examine the coronary ostium. An elliptical form in one of the views indicates an intramural route. In our study, all patients who presented this anomaly on angiography had an intramural course on CT scan and a take-off angle $< 45^\circ$. These findings were similar to those of Darki et al. [13], they found that the observation of a slit-like lesion on the angiogram is associated with excellent sensitivity 100% and reasonably high accuracy for the diagnosis of interatrial course specificity of 86% of the anomalous vessel observed on subsequent CT scan. However, there is no data on the significant hemodynamic effect of this anomaly, and there is no scientific evidence of systematic stenting of this lesion, especially when it concerns RCA in adults. Darki et al. [13] treated these lesions by PCI with immediate angiographic success.

Intracoronary imaging would be particularly useful to assess the RCA ostium to differentiate extrinsic compression from atherosclerotic plaque burden. In the case of R-ACOAS reported by Jin et al. [14], the operator performed an IVUS study, showing atherosclerotic plaque burden on the proximal RCA with a spindle-shaped arterial lumen a slit-like lumen caused by extrinsic compression. They place a stent in this lesion, with an uneventful one-year follow-up (see [Table 4](#)).

Appropriate guiding catheter selection is considered essential to ensure successful PCI in such

Table 4. Long follow up of patients.

Patient number	Follow up (months)	TLR	Management
1	69	yes	CABG 3 months later after a viability test
2	79	Yes	Instant restenosis, treated by a long DES (3.5/48)
3	12	No	
4	24	yes	Instant restenosis CABG, 16 months later
5	25	No	–
6	58	No	–
7	51	No	–
8	20	No	–
9	24	No	–
10	67	No	–
11	18	No	–
12	13	yes	CABG after one Month

TLR: target lesion revascularization, CABG: coronary artery bridging graft, DES: drug eluting stent.

cases. We also need to accurately analyze the coronary aortic connection site in the LAO view. Few studies have addressed the choice of the guiding catheter according to the classification adopted in our study. Sarkar et al. and Ulthayakumar et al. analyzed the angiography of, respectively, 24 and 17 patients [8,15]. Our findings are in agreement with those of the two previous studies; we demonstrated that in the case of type “A or B”, especially in the case of type “C or D” the Amplatz left seems to be the most appropriate guiding to selectively cannulate the abnormal RCA Table 5. In a series of 11 patients with R-ACOAS, Darki et al. used the Amplatz guiding catheter in 9 patients but did not specify the anomalous coronary classification.

If the operator is struggling to deliver the device into a coronary artery due to poor support, he may use some tricks as follows: 1 size up or change the shape of the guiding catheter offering greater backup support to get coaxial alignment 2 Anchoring balloon technique 3 buddy wire technique and 4 child-in-mother technique or the use of an extension guiding catheter, and finally the deep

cannulation. However, this last technique will not be possible if there is an intramural course and slit-like ostium, the pressure will be damped. In our study, we used these techniques in many patients, especially buddy wire and anchoring balloon. However, we were unable to place the stent in one patient.

In a series including 11 patients with R-ACOAS and who underwent elective PCI, the operators used 217.7 ± 50 ml of Contrast and 17.4 ± 4.7 min of fluoroscopy. In our study, we used a median volume of 210 ml of contrast and 45 min of fluoroscopy. This is because most of our procedures were emerging procedures STEMI or NSTEMI, there was only one elective procedure. We perform ad hoc PCI, so we use a greater amount of contrast and fluoroscopy.

Our study showed the safety of stenting of coronary arteries with interarterial course. After a median follow-up of 24 months 13–79, all patients treated with DES were asymptomatic, we noted 4 TLRs in patients treated initially with BMS or Balloon. Darki showed that in between eleven patients with RAOCAS treated with DES, only one

Table 5. The guiding catheter used to cannulate RCA arising from the opposite Valsalva sinus.

	Sarkar et al. [8] N = 24	Ulthayakumar et al. [15] N = 17	Our study N = 8
Type A	N = 4 FL3 (3 patients) FCL3(1 patient)	N = 8 JL 5 (6 patients) JL4 (2 patients)	N = 4 AR2 (1 patient) EBU3.5 (1 patient) JR4 (2 patients)
Type B	N = 5 FCL (2 patients) FCL 3.5 (2 patients)	N = 3 EBU3.5 (1 patient) JL4 (2 patients)	N = 1 JR 4 (1 patient)
Type C	N = 9 VL 3.5 (5 patients) VL3 (3 patients) FCL3.5 (1 patient)	N = 6 AL1 (4 patients) AL2 (1 patient) JL4 (1 patient)	N = 2 AL1 (2 patients)
Type D	N = 6 AL1 (3 patients) AL2 (1 patient) AL3 (1 patient)	–	N = 1 AL1 (1 patient)

patient showed intrastent restenosis. There were no cases of sudden death in our series as well as the series of Darki et al. [13].

Some Case reports indicated that the incidence of stent restenosis may be higher in patients with ACA when compared with patients without this anomaly [16]. Alghorani et al. reported a case of ACA revealed by STEMI and treated with drug coated balloon DCB instead of implanting a drug-eluting stent [17]. The use of DCB is associated with a trend toward lower mortality when compared with stent implantation. Furthermore, there is emerging evidence that DCB-treatment in de-novo vessel disease is safe and feasible [18].

Indeed, after the age of 50, the risk of sudden death is very low and seems to be not higher than in the general population [19]. Autopsy series show that most cases of sudden death are young <35-year-old and die during, or shortly after exercise. Nagashima et al. demonstrated through a registry of patients with a course between great vessels 65 patients, that predictors of sudden cardiac death were age ≤ 40 years, male sex, sport activity, absence of prodromal symptoms, acutely angulated take-off $\leq 30^\circ$ in the aorta and absence of luminal narrowing of the IAC segment [20]. Considering the stiffness of the aorta in middle age, the risk of coronary artery compression seems to be very low. To our knowledge, our cases are the first cases of PCI of L-ACOAS. We have shown the safety of PCI in middle-aged patients with this anomaly.

According to the recent ESC guidelines on adult congenital heart diseases [21], risk stratification should also include age <35 years and there is no evidence of survival benefits of surgery in asymptomatic patients with coronary arteries presenting an interarterial course. In our study, we treated patients with L-ACOAS and an interarterial course with PCI. Normally the choice treatment in this patient is surgery, but since all of these patients had STEMI or NSTEMI, we performed an emergent procedure. We succeed to place a stent in three patients, and we failed in the fourth one because of backup difficulties. Moreover, given that the patient had a three-vessel disease and that we had obtained TIMI 3 flow after balloon pre-dilatation, we preferred surgery rather than PCI.

5. Limitations of the study

Our conclusions must be interpreted in light of our study limitations. Its retrospective methodology and the relatively small number limited the study. Given the low prevalence of ACOAS, a prospective

study would require a long time to include sufficient numbers of patients.

Another limitation was that we did not use intracoronary imaging nor FFR to assess the interarterial segment during PCI.

Overall, the identification of optimal management strategies warrants a larger study, ideally a prospective multicenter study in many countries, with a sufficiently long follow-up period.

6. Conclusions

This study demonstrated the feasibility and long-term safety of PCI in patients with coronary arteries originating from the opposite Valsalva sinus and an interarterial course, whether RCA or LCA. We have also shown that most of the time, atherosclerosis concerns the segment following the interarterial course. The operator should be familiar with tips for improving back-up and the most appropriate guiding catheter. Drug-eluting stents must be the stent of choice. Large studies with intracoronary imaging are needed to best analyze the intervascular segment and long-term durability of scaffolds in these patients.

Author contributions

Conception and design of Study, Acquisition of data: Rania Hammami, Imtinene Ben Mrad. Literature review, Research investigation and analysis, Data collection, Revising and editing the manuscript critically for important intellectual contents: Rania Hammami, Imtinene Ben Mrad, Amine Bahloul, Salma Charfeddine, Rym Gribaa, Houssein thabet, Emna Allouche, Aymen Ben Abdesslem, Majed Hassine, Leila Abid, Samir Kammoun, Hassen Ibn Hadj Amor. Analysis and interpretation of data: Amine Bahloul, Salma Charfeddine, Rym Gribaa. Drafting of manuscript, Data preparation and presentation, Supervision of the research, Research coordination and management: Rania Hammami.

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Conflicts of interest

None.

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No.

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