Management of Acute Coronary Syndrome Due to Massive Thrombosis

The occurrence of intracoronary thrombus is common in patients with acute coronary syndrome. However, massive thrombosis (thrombus grade 4-5) is rare and increases morbidity and mortality rates both during the procedure and in the first year. (1-3)

Mechanical thrombectomy devices are very useful for reducing thrombotic load and no-reflow after coronary stent implantation. (4) Also, aggressive therapy with aspirin, clopidogrel, abciximab (12 hours) and heparin sodium (15 days) has been effective in cases with persistent thrombus and TIMI flow ≥ 2. (1) Intracoronary fibrinolytic therapy is also described, (5) but no defined guidelines for implementation and doses are available.

After solving this acute problem, a thorough evaluation of the precipitating causes is needed as well as specific treatments if required. (3) For instance, the occurrence of nephrotic syndrome with severe hypoalbuminemia implies 40% risk of thrombosis, so these patients should receive oral anticoagulation. (3, 6)

We report the case of a 52-year-old black man, with no relevant medical history, who presented with chest pain in cardiogenic shock. The ECG showed ST-segment elevation in leads D2, D3, aVF and from V1 to V6, so loading dose of ASA (500 mg) and clopidogrel (600 mg) were administered, inotropic support was initiated, and the patient was referred for primary angioplasty. Cardiac catheterization was performed through the right radial artery. Coronary angiography showed balanced dominance [recurrent artery of highly developed anterior descending artery (ADA)] and a large thrombus from the distal left main coronary artery to the middle third of ADA (Figure 1). The first diagonal artery was occluded, with TIMI 2 distal ADA flow.

At the beginning of the interventional procedure, the patient received an intravenous bolus of heparin sodium adjusted for weight (70 IU/kg) and an intracoronary bolus of abciximab (0.25 mg/kg), followed by 12-hour continuous perfusion (0.125 mg/kg/min); activated coagulation time (ACT) was 225-250 sec throughout the procedure.

Two angioplasty guides (one into the circumflex artery and the other into the anterior descending artery) were advanced through an 8F EBU 3.5 guiding catheter. Then, manual removal of the thrombus was attempted using different mechanical thrombectomy devices, including a multipurpose catheter (mother-in-child technique), without success. Finally, the patient received intracoronary fibrinolytic therapy with tenecteplase (TNK) in 4 boluses of 500 IU each (total 2,000 IU) at 5 minute-intervals, until the thrombotic burden decreased significantly (thrombus disappearance from the main coronary artery and recanalization of the first diagonal branch; the thrombus persisted in the ADA, but distal flow improved significantly). Further thrombectomy was successfully performed, resulting in white thrombus (Figure 2) and TIMI 3 flow. At this point, it was decided to end the procedure without implanting coronary stent due to the residual thrombus, and to continue treatment with ASA, clopidogrel, heparin, and abciximab for 12 hours.

Throughout the procedure, hemodynamic status improved until withdrawal of the inotropic support was possible and ECG showed 75% resolution of ST-segment elevation.

Coronary angiography was repeated 18 hours later due to new chest pain with no changes in ECG. Only residual thrombus was found in the middle third of the ADA, and a self-expandable stent (Stentys® BMS; 3.5-4.5 x 27 mm) was implanted with good angiographic results.

The clinical outcome was good. The echocardiography showed preserved left ventricular function, without segmental alterations in contractility.

A deeper analytical study showed presence of nephrotic syndrome with hypoproteinemia as potential thrombogenic factor, and nephrologists recommended anticoagulation therapy with acenocoumarol in addition to the dual antiplatelet therapy.

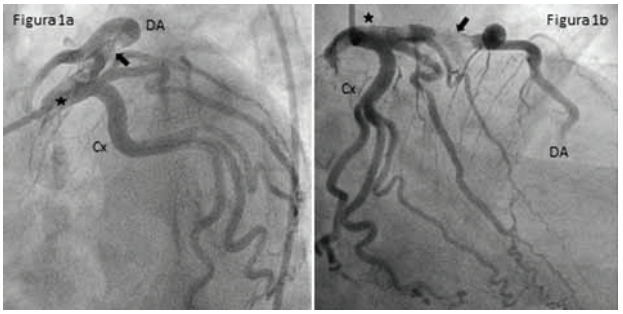

Fig. 1. 1 a & b. The ***star*** is on the main left main coronary artery and targets the thrombus extending to the anterior descending artery (ADA). Cx: Circumflex artery

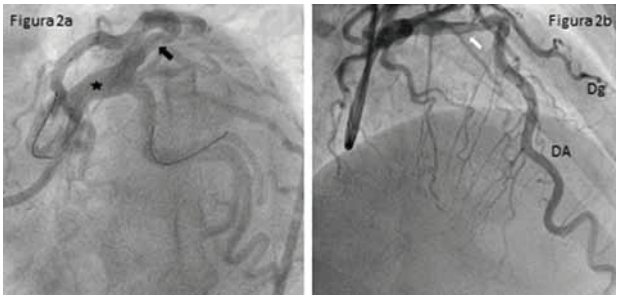

Fig. 2. a. The ***star*** is on the left main coronary artery, free of thrombus. The ***arrow*** targets the residual thrombus in the anterior descending artery (ADA). b. The first diagonal artery (Dg) is visualized. Flow improvement is observed, with complete filling of the ADA and the first diagonal artery.

Primary angioplasty is –whenever possible– the treatment of choice for patients with ST-segment elevation acute coronary syndrome (STE-ACS). However, coronary stent implantation in patients with massive coronary thrombosis is associated with a very high risk of the no-reflow phenomenon. Although not very common, there are cases with significant thrombotic burden that not even a combined regimen of three antiplatelet drugs and anticoagulation can reduce effectively.

The risk of periprocedural complications and adverse events during follow-up for this population is extremely high. (2) The main mechanism responsible for these complications is the no-reflow phenomenon resulting from residual thrombus and distal embolization both in epicardial arteries and coronary microcirculation.

There are no randomized studies providing evidence on the best treatment in these cases, and current treatment guidelines are not explicit in this scenario. This case suggests the safety and efficacy of low-dose intracoronary fibrinolytic therapy in these specific situations, since we observed improvement in coronary perfusion with no major bleeding. We decided to follow a conservative approach of administration with small TNK boluses at 5-minute intervals, so as to administer the lowest effective dose possible.

In 2005, Kelly et al published a series of 34 patients (65% with STE-ACS) who developed intracoronary thrombosis during angioplasty. All the patients were treated with intracoronary TNK (mean dose 10 ± 5 mg), showing a significant improvement in TIMI flow. Thirty-two percent of patients died (3 due to cardiogenic shock and 1 due to infarction of the right ventricle), and 4 experienced bleeding complications at the puncture site (3 of them under concomitant glycoprotein IIb/IIIa inhibitor therapy). (5)

There are some cases in the literature in which intensive medical treatment was enough to remove the thrombus in one or two weeks without stent implantation, (1) but in our case, chest pain recurrence indicated the need for further catheterization within the first 24 hours. Therefore, stent implantation was decided to fix the thrombus to the arterial wall, and it was successful.

In addition to the initial treatment with intracoronary TNK, it is very important to elucidate and treat the causes of thrombogenicity in patients with no other atherosclerotic lesions. Our patient had a nephrotic syndrome with hypoalbuminemia (2.3 mg/dL), which presents itself a 40% risk of thrombosis. That was the reason why nephrologists recommended anticoagulation therapy with acenocoumarol in addition to dual antiplatelet therapy. The required length of treatment is unknown, but it seems logical to continue it until albumin levels are normal. (3, 6).

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Rev Argent Cardiol 2015;83:156-157 - http://dx.doi.org/10.7775/rac.v83.i2.5211

Primary Left Atrial Leiomyosarcoma

Primary cardiac tumors are rare. It affects an estimate of 0.001-0.03% of the general population. Seventy-five percent of cases are histologically benign, while primary malignant tumors represent only 25% of cases and are therefore considered exceptional. A leiomyosarcoma is a malignant tumor accounting for 0.019% of the total primary cardiac tumors. This case report analyses the presentation, diagnosis and treatment of a cardiac leiomyosarcoma.

We describe the case of a 39-year-old male patient without known medical history, who presented with a 2-month history of febrile syndrome, asthenia, 12-kilogram weight loss, and functional class II-III dyspnea with episodes of paroxysmal nocturnal dyspnea.

Physical examination revealed the patient was in good general condition, presenting with pale-earthy skin, hypopigmented conjunctiva, tachycardia, normotension, jugular ingurgitation, splitting R2 in apex, mitral regurgitation murmur of 2/6 intensity and mitral diastolic murmur that varied with changing positions. He also had bibasilar crepitant rales and painful hepatomegaly.

The ECG showed sinus rhythm at 100 beats per minute and signs of right chamber overload.

The chest X-ray revealed cardiac index of 0.50 with

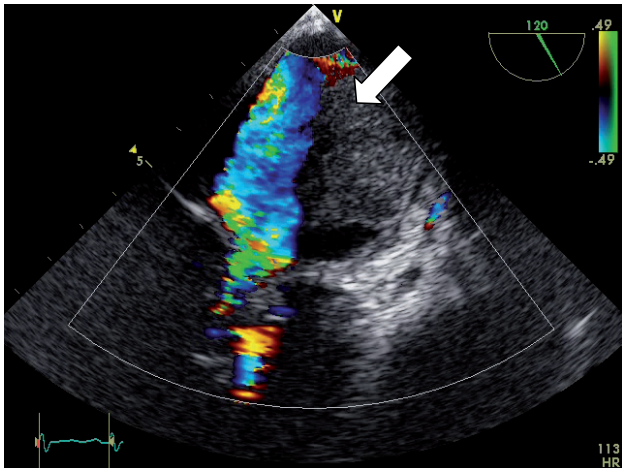

Fig. 1. Transesophageal echocardiography, mid-esophagus view at 120°. The arrow shows the tumoral mass. Doppler confirms transmitral flow acceleration, consistent with stenosis.

straight middle arch, and congestive lung fields with pulmonary venous capillary hypertension.

Lab tests on admission showed white blood cells: 8,500/mm3; RBC: 49 AU; Hemoglobin: 10.6 g/dl and HCT: 33%.

Transthoracic echocardiography revealed large tumor formation in the left atrium. The implantation base or area could not be exactly determined; it seemed to be attached to the anterior leaflet of the mitral valve, generating an area reduction estimated in 1.2 cm2, with mitral peak transvalvular gradient of 21 mm Hg. Dilated right chambers with mild tricuspid regurgitation were seen, and pulmonary hypertension with right ventricular systolic pressure of 70 mm Hg was verified.

Transesophageal echocardiography (TEE) showed a 5.5 cm × 5 cm heterogeneous tumoral mass in the left atrium, with slight motility, implanted in the atrial septum with anterior mitral leaflet infiltration (Figure 1).

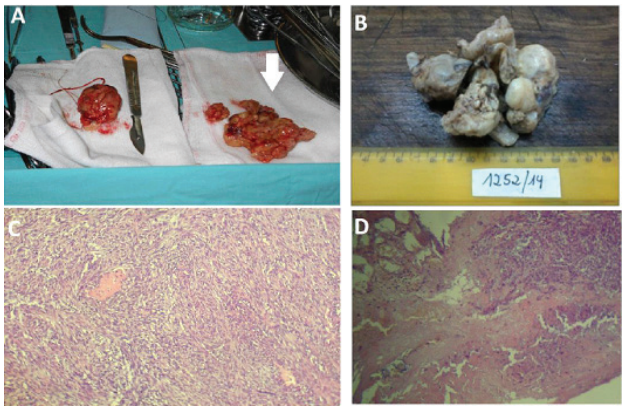

Fig. 2. A. Surgical piece. Two tumor formations are shown: the tissue within the right pulmonary vein (arrow) and the formation located at the atrial level. B. Macroscopic image. Multilobed mass with congestive areas, necrosis and hemorrhages. C. Histological section with hematoxylin-eosin stain. Fusocellular proliferation with necrotic areas inside can be observed. D. Histological section showing the tumor infiltrating the mitral valve.

Surgery revealed a 6 cm × 5 cm diameter multilobed mass of hard-elastic consistency, prolapsing into the right inferior pulmonary vein, with apparent pedicle in the atrial septum, multiple implantations in the ostium of the left atrial appendage and infiltration of the anterior mitral leaflet (Figure 2). Tumor resection and mitral valve replacement with mechanical prosthesis and reconstruction of the atrial septum with pericardial fragments were performed.

Macroscopic pathological examination revealed tumor lesion with irregular surface in several fragments, with congestive and hemorrhagic areas. Microscopic pathological examination showed atypical fusocellular proliferation with low mitotic index and necrotic areas. Immunohistochemistry was negative for cytokeratin AE1-AE3 and positive for 1-4 actin (Figure 2 B-D).

Leiomyosarcoma is a cancer of smooth muscle cells characterized by its highly invasive capacity. It comprises 8% of all sarcomas and can largely occur in the uterus, retroperitoneum, and intra-abdominal region. (1) Its occurrence in the heart is extremely rare, representing 0.019% of all primary cardiac tumors. (1) Leiomyosarcomas arise from smooth muscle fibers located in the subendocardium or within major thoracic vessels. Seventy-six percent of these tumors are implanted in the left atrium, 16% in the right atrium and 8% in the ventricles. (2) They usually occur in the fourth decade of life, and their clinical presentation is late and diverse. Symptoms are usually the result of valve, cardiac chamber or great vessel obliteration. (3, 4)

Transesophageal and surface electrocardiograms, as well as CT scan, are proper methods of diagnosis. While distinction between a myxoma and a malignancy is difficult with these methods, the occurrence of infiltration at the level of the anterior mitral leaflet increases the likelihood of malignancy, as in the case presented here. Positive diagnosis is made with pathology and immunohistochemistry. (4) Transesophageal echocardiography-guided biopsy allows pathologic diagnosis prior to surgery. It is a rather risky procedure and, in our case, we chose tumor excision without previous biopsy, which is the therapeutic approach adopted in our Department for all resectable cardiac tumors. (5)

Leiomyosarcoma is a tumor with a high recurrence rate. (3) Radiotherapy and chemotherapy are adjuvant treatments, particularly when radical resection of the tumor is not achieved. In our patient, tumor was excised without adequate safety margins due to its location and wide implantation sites. Subsequent radiotherapy was ruled out due to the cardiac complications it causes, such as myocarditis and actinic pericarditis. We chose chemotherapy with docetaxel and gemcitabine as adjuvant treatment in cycles every 21 days.

When radical resection is not possible, leiomyosar-

coma presents a high recurrence rate. In our patient, a follow-up transesophageal echocardiography 45 days after surgery and before chemotherapy showed recurrence of the leiomyosarcoma, causing severe mitral prosthesis stenosis. A significant reduction of the tumor was observed after three chemotherapy cycles.

Patients with cardiac leiomyosarcoma have an ominous prognosis. Surgical resection shows a mean survival rate of 12 to 16 months after surgery, (6) while adjuvant chemotherapy may extend the mean survival rate to approximately 24 months. (6) In some cases, recurrence of the tumor requires further operation, (3) but in the case of our patient this intervention is ruled out due to the impossibility of radical resection.

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Rev Argent Cardiol 2015;83:157-158 - http://dx.doi.org/10.7775/rac.v83.i2.4880

Oral Anticoagulation with Vitamin K Antagonists in the Era of New Anticoagulants

Cardioembolism due to atrial fibrillation (AF) accounts for 1 in 6 ischemic strokes, and is a potentially preventable cause. (1) Several studies have demonstrated the efficacy of oral anticoagulation to prevent strokes in patients with AF. (2) New oral anticoagulant agents have been approved, demonstrating that they are not inferior to treatment with vitamin K antagonists. (3-5) The purpose of this study was to describe the rate of ischemic strokes and bleeding complications in a group of patients with AF anticoagulated with warfarin.

All patients with AF were retrospectively assessed from October 2004 to November 2008 through a computer-assisted anticoagulation control system developed in our institution. Only patients treated for nonvalvular AF with warfarin, followed up for at least 60 days and with regular INR checks (no more than 60 days between two consecutive checks) were included. The time in therapeutic range (TTR) was measured in each patient according to the methodology proposed by Rosendaal et al. (6)

The endpoints were death from any cause, ischemic event (ischemic stroke, transient ischemic attack or systemic embolism) and major bleeding event (requiring at least 2 units of packed red cells or its equivalent in whole blood, bleeding related to death, fall in hemoglobin level > 5 g/dL, hypotension requiring inotropic agents, intraocular bleeding with significant vision loss, bleeding requiring surgery or intracranial hemorrhage).

Categorical variables were expressed as percentage, and continuous variables as mean and standard deviation. InfoStat/P 2014 (Universidad Nacional de Córdoba) was the statistical program used.

Among 341 patients assessed, 118 met the proposed inclusion criteria. Mean age was 76.5 ± 8.6 years, 42.7% were women, and the CHADS2 score was 1.9 ± 1.2. Follow-up was 28.2 ± 17.5 months, and average TTR was 59.6 ± 17.5%. Table 1 shows the remaining characteristics of the study population. During follow-up, there were 6 deaths (5.08% or 2.16% per year), 5 ischemic events (4.23% or 1.8% per year) and 19 bleeding events (16.1%), 5 of which were major bleedings (4.23% or 1.8% per year).

Oral anticoagulation with vitamin K antagonists reduces the risk of ischemic stroke and death by 64% and 25%, respectively, compared with placebo, and by

Table 1. Characteristics of population

	% (n) (n total = 118)
More than 75 years	44.4 (52)
High blood pressure	83.7 (98)
Diabetes mellitus	15.3 (18)
Dyslipidemia	48.7 (57)
Heart failure	23.9 (28)
Stroke/TIA	16.2 (19)
Coronary heart disease	22.2 (26)
Aspirin	39.3 (46)
Clopidogrel	5.1 (6)

n = Number of patients ACV: Accidente cerebrovascular. TIA: Transient ischemic attack.

Table 2. Comparison of clinical events with the warfarin arm in the three studies on new anticoagulant agents

	TTR (%)	Ischemia (%)	Hemorrhage (%)	Death (%)
RELY (3)	64	1.69	3.36	4.13
ROCKET AF (4)	55	2.2	3.4	2.21
ARISTOTLE (5)	66	1.60	3.09	3.94
Local	59.6	1.8	1.8	2.16

TTR: Time in therapeutic range. Ischemia includes stroke or systemic embolism. Hemorrhage corresponds to major hemorrhages.

39% compared with aspirin. (2)

In our experience with a selected group of anticoagulated non-valvular AF patients with regular INR checks and similar anticoagulation effectiveness, we have found rates of death, ischemic and bleeding events consistent with the warfarin arm in the 3 current studies with new anticoagulants (Table 2). Our study is retrospective, mostly with low-risk patients. In the RELY and ARISTOTLE studies, patients had average CHADS2 of 2.1, with a history of previous stroke in about 20% and heart failure in 30%. In the ROCKET AF trial, the average CHADS2 score was 3.46 with a history of previous stroke in 54% and heart failure in 30% of patients. The mean age of warfarin patients was 70-73 years in the three studies. (3-5)

Finally, we believe that the information obtained highlights the fact that –in a local experience– the data on warfarin anticoagulation from three contemporary large randomized studies can be extrapolated to our population, provided that an adequate TTR (about 60%) is maintained.

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Rev Argent Cardiol 2015;83:158-159 - http://dx.doi.org/10.7775/rac.v83.i2.4790

Postpartum Multivessel Spontaneous Coronary Artery Dissection

Spontaneous coronary artery dissection is a rare cause of acute coronary syndrome (ACS) that accounts for about 1 - 2.4 ‰ of cases. It typically affects young women, mainly in the anterior descending artery (ADA). Its etiology is associated with atherosclerotic disease, pregnancy and postpartum, vasculitis, and other less frequent causes. The most appropriate therapy for this condition has not been yet established. (1) We report a new clinical case to help improve the management of this severe process.

We describe the case of a 39-year-old woman without cardiovascular risk factors who was admitted in our coronary care unit with high-risk non-ST segment elevation acute coronary syndrome. The patient was on day 15 postpartum and in the previous days had had intermittent episodes of chest pain that subsided spontaneously. A coronary angiography was performed within the first 24 hours, which showed a suspicious image in the left main coronary artery (LMCA) with diffuse and long narrowing of all the ADA.

A spiral dissection of the proximal, mid and distal segment of the right coronary artery (RCA) extending to the crux cordis was detected. An intracoronary ultrasonography revealed a large circumferential hematoma between the intima and media, in the mid and proximal ADA segments, extending to the LMCA (Figure 1 A). The circumflex artery was not affected. The patient was stable and asymptomatic, so a conservative approach with dual antiplatelet therapy and low-molecular-weight heparin was the treatment of choice. Ten days later, the patient presented a new episode of

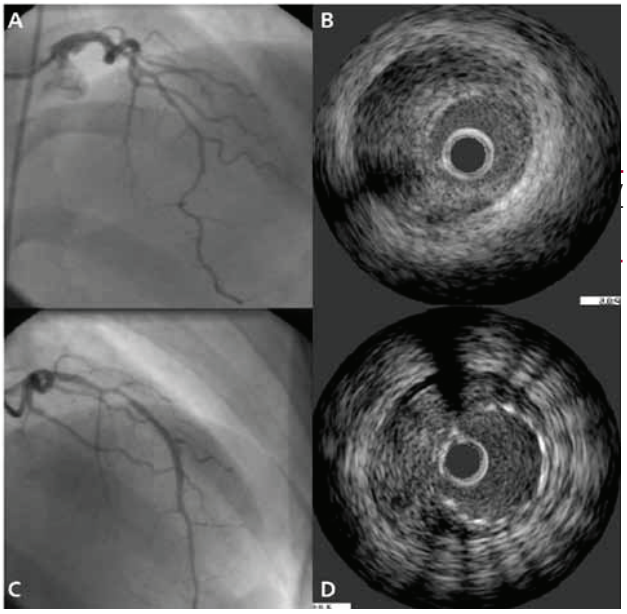

Fig. 1. Coronary angiography of the left coronary tree (A) in AP cranial projection; image of aneurysm in the left coronary tree and diffuse and long narrowing of all the anterior descending coronary artery. Normal circumflex artery. Intracoronary ultrasound (B) targeting image of dissection and associated hematoma in left coronary tree. Circumferential medial adventitial dissection in the anterior descending artery, with large intramural hematoma from ostium to distal segment, but without intimal flap. After stent implantation in proximal and medial ADA due to flow involvement, coronary angiography (C) shows good caliber and flow in that vessel. Intracoronary ultrasound (D) showing correctly placed stent with residual hematoma between the stent and the adventitia.

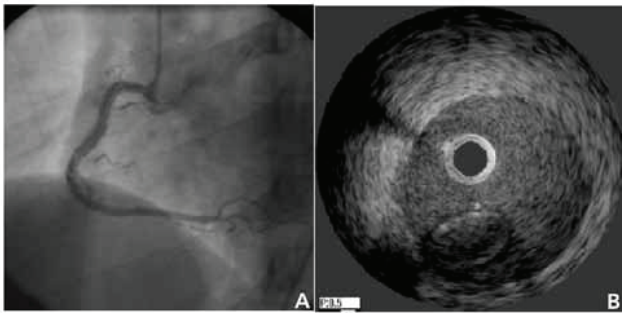

Fig. 2. A. Right coronary angiography in left anterior oblique projection: image of an helical dissection reaching the distal segment before the crux cordis. B. Intracoronary ultrasound showing complete dissection of the vessel, with the ultrasound catheter in the false lumen, and the true lumen retracted.

chest pain with ST segment elevation in the anterior wall. An urgent coronary angiography was performed. Occlusion of the mid ADA was detected. Two drug-eluting stents were implanted in medial and proximal segments, resulting in an artery with TIMI 3 flow. The LMCA image remained stable without complications. The left ventricular ejection fraction was moderately depressed due to hypokinesis in apical and anterior segments. Percutaneous coronary intervention on the RCA was scheduled for the following week. Intracoronary ultrasound of RCA showed complete dissection originating in the ostium with the ultrasound catheter remaining in the false lumen and the true lumen retracted in the proximal segment of the vessel (Figure 2). Communication between the true and false lumens was observed in the medial segment without flow involvement. Since the patient was asymptomatic, a conservative approach was decided. Six months later, a follow-up ICUS targeted a reduction of hematoma in the ADA, and an echodense image suggesting hematoma thrombosis with lack of stent apposition. Balloon angioplasty was then performed with good results (Figure 1 B). In the LMCA, the dissection was sealed without hematoma. The angiographic image of the RCA was a chronic spiral dissection, with good flow in the vessel. At one-year follow-up, the patient was asymptomatic with normal left ventricular ejection fraction.

Primary spontaneous coronary artery dissection is a rare condition. Its etiology, clinical course and treatment have not been well defined. It usually affects young women, and 25% of cases are associated with the first trimester of pregnancy, delivery and postpartum, since hormonal changes that weaken the middle layer of the artery contribute to dissection. The hemodynamic stress of delivery could cause disruption of the arterial intima. The anterior descending artery is most commonly affected, followed by the RCA and the distal LMCA. The most common clinical presentation is sudden death or acute myocardial infarction followed by death. Prolonged unstable angina is a rare form. In most cases, diagnosis is made with coronary angiography, which shows a radiotransparent line corresponding to the intimal flap. In doubtful cases in which dissection and diffuse narrowing of the artery are suspected, intracoronary ultrasonography shows the associated dissection and hematoma and differentiates true and false lumen. (2) Treatment for spontaneous coronary dissection has not been established and should be tailored for each patient depending on the territory affected and the clinical impact of the dissection. (3) Medical treatment has been successful in asymptomatic patients with non-occlusive dissection and good distal flow. The use of thrombolytic agents for acute myocardial infarction can induce a progression of the dissection due to expansion of the intramural hematoma. The purpose of coronary angioplasty with primary stent placement is to seal the dissection and control the intramural hematoma. Outcomes are usually successful, with low rate of complications.

Coronary artery bypass surgery is a therapeutic option in patients with multivessel involvement and large territory at risk. (4) Our patient, with LMCA and multivessel involvement, received conservative treatment in one of the arteries and primary percutaneous coronary intervention with stent implantation in the flow-affected artery, with good outcome.

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Rev Argent Cardiol 2015;83:159-161 - http://dx.doi.org/10.7775/rac.v83.i2.4847

Aortic Valve Replacement in Failed Post-TAVI Patients Due to Severe Paravalvular Leak

The efficacy and safety of transcatheter aortic valve implantation (TAVI) have been demonstrated in patients with severe aortic valve stenosis whose surgical risk is high or who cannot undergo surgery. (1, 2) However, there are cases in which it is necessary to perform immediate or short-term conventional aortic valve replacement (AVR) due to complications during the procedure. The occurrence of paravalvular leak (PVL) is a common finding reported in approximately 70% of cases. (3) The degree of calcification of the aor-

tic annulus is closely related to PVL and other complications, such as dissection and obstruction of the coronary artery ostium. Preoperative evaluation by the Heart Team is of vital importance.

The purpose of this study was to analyze the inoperability criteria for AVR and its application in daily practice using as starting point two cases initially considered as high risk patients who required surgical treatment after complicated TAVI.

Between March 2009 and August 2013, 50 TAVIs were operated, 10 of which were transapical (TAP-TAVI). In all cases, the procedure was carried out in a hybrid operating room with interventional cardiologists, anesthesiologists, diagnostic imaging specialists, gerontologists, and cardiovascular surgeons (Heart Team). The patients evaluated by this team fulfilled high-risk surgical criteria based on the PARTNER study and the 2012 ACCF/AATS/SCAI/STS Consensus. Two patients (4%) underwent AVR; one of them was an urgent case and the other was an emergency intervention due to severe complications during TAVI.

CASE #1

The first case was an 86-year-old female patient with a history of hypertension, dyslipidemia, chronic obstructive pulmonary disease, non-Q AMI, and chronic renal failure. Her predictive surgical risk was 11.9% (STS score). The echocardiography revealed severe aortic stenosis (SSAS) resulting in aortic valve replacements, preserved left ventricular function, and mild mitral regurgitation (MR). Transfemoral TAVI (TF-TAVI) with the CoreValve bioprosthesis™ (Medtronic, USA) was performed. Immediate post-procedural control showed severe PVL due to calcium nodule on the left coronary leaflet, involving 30% of the prosthetic circumference. Redilations with 25 × 45 mm BALT balloon were performed. Moderate to severe mitral regurgitation and deterioration of ventricular function were also observed. During the immediate postoperative course, the patient experienced hemodynamic instability and atrial fibrillation with rapid ventricular response. Orotracheal intubation and subsequent emergency electrical cardioversion were required. A new echocardiography revealed severe MR, severe periprosthetic aortic regurgitation, severe tricuspid regurgitation, pulmonary artery systolic pressure of 63 mm Hg, and moderate deterioration of left ventricular systolic function. Emergency AVR was decided. Percutaneous valve was replaced by a biological prosthesis #21, and the calcium nodule on the left coronary sinus was targeted and resected (Figure 1). The patient was referred to a tertiary care center 27 days after surgery. She died 15 months later due to an abdominal condition associated with urothelial carcinoma.

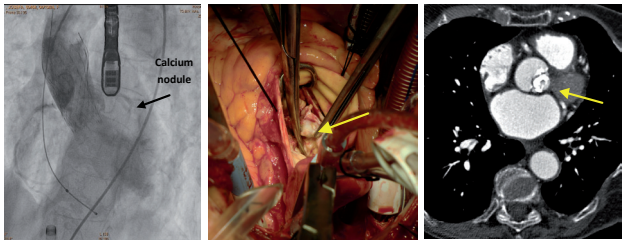

Fig. 1. Left: Calcium nodule is evidenced, causing extrinsic compression on the CoreValve prosthesisÒ. Center: Correlation with the surgical finding. Right: CT scan image of the nodule on the left coronary sinus.

CASE #2

The second case was a 71-year-old male patient with a STS score of 11%, history of hypertension, dyslipidemia, and hydatid disease with resection of pulmonary cysts. The patient was hospitalized for chronic atrial fibrillation and acute pulmonary edema during the course of one year. He presented SSAS symptomatic for dyspnea. Echocardiography revealed preserved LV function, aortic valve disease with severe stenosis and mild to moderate MR. A TF-TAVI with CoreValve® #29 (Medtronic, USA) was scheduled. Immediate echocardiography revealed PVL and central leak, exceeding the anterior leaflet tip of the mitral valve, and occupying the entire left ventricular outflow tract, associated with severe mitral regurgitation. It also showed complete atrioventricular block with atrial fibrillation rhythm and His bundle escape. A temporary pacemaker was placed. A permanent VVI pacemaker was inserted prior to patient discharge. Twenty days later, the patient experienced clinical worsening, PVL and severe aortic regurgitation associated with severe MR. Echocardiography showed the proximal end of the prosthesis 2.17 cm above the plane of the mitral valve annulus (low prosthesis), and consequently emergency surgery was decided. AVR with biological prosthesis #25 was performed (Figure 2). Follow-up echocardiography did not reveal PVL, and LV function was preserved, with mild to moderate MR. The patient was discharged 5 days after surgery.

Greason (4) reviewed 194 patients who underwent TAVI. These included 119 who received transfemoral procedure, 5 of whom (2.8%) experienced complications during the procedure -4 of them requiring standard aortic valve replacement. Seventy-five percent of patients survived the procedure. Similar outcomes were obtained by Seiffert, (5) with 4/6 surviving patients.

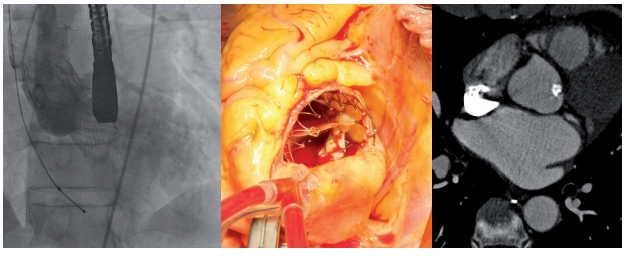

Fig. 2. *Left:* Fluoroscopic image of the CoreValve prosthesis® with low aortic annulus implantation relative to the aortic annulus. *Center:* Image showing surgical explantation of the prosthesis. *Right:* CT angiography showing the degree of calcification of the aortic annulus.

Immediate conversion to AVR is rare; the PARTNER 1A study (1) refers 9 cases over 348 patients (2.6%). Mortality rate in patients with moderate or severe MR who are candidates to TAVI is higher than in those without MR. (6) Fifteen to 35% of post-TAVI patients require permanent pacemaker, especially with CoreValve prosthesis. The degree of calcification of the aortic annulus with the presence of calcium nodules is the most common cause of residual PVL in 70% of cases. (3) The occurrence of PVL determines a negative impact on mid- and long-term survival rate. Scores to categorize patients have shown to be suboptimal for predicting mortality at 30 days. There are patients at real high surgical risk for whom score calculation is low because certain comorbidities are not taken into account (porcelain aorta, thoracic deformities, radiation, affected pulmonary function, fragility, cirrhosis). That is why consensus by a Heart Team is essential, although replacing the lack of a "TAVI Score" by expert decisions is not enough. Despite the above, the STS score proved to be superior to the EuroSCORE as predictor of mortality at 30 days in high-risk groups.

The experience of surgical treatment in patients considered "inoperable" leads us to reflect on the criteria to consider them as not eligible for surgery. We think it is necessary to reconsider the indication of TAVI for those patients with calcium nodules on the aortic annulus evidenced in pre-surgical testing. The lack of a TAVI Score to assess clinical comorbidities, degree of calcification of the aortic annulus and presence of calcium nodules, determines patient outcome and prognosis, since failure of prosthesis expansion or any other complication associated to calcium nodules, can immediately turn patients into candidates for surgery. Risk predictors currently available have not been designed for this intervention, and therefore categorization as high-risk or "inoperable" patients is suboptimal. Further long-term studies will be necessary to define the indication of TAVI in patients with severe calcification of the aortic annulus. Denying the conversion to conventional surgery in failed post-TAVI should not be a knee-jerk response. The cases presented could be the starting point for debate on the inoperability and mortality criteria, and on the scores used for this population.

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Rev Argent Cardiol 2015;83:161-163 - http://dx.doi.org/10.7775/rac.v83.i2.4524

A New Option in Aortic Stenosis and Porcelain Aorta: Sutureless Bioprosthesis

Calcification of the ascending aorta is an important intraoperative surgical concern because perioperative embolization of atheromatous material caused by manipulation of the aorta is responsible for a high percentage of strokes during cardiac surgery. Also, the existence of severe aortoiliac occlusive disease or prior treatment with aorto-bifemoral bypass turn particularly difficult the femoral approach in transcatheter aortic valve implantation (TAVI) in patients with aortic stenosis. Other options are transapical and transaortic TAVI, although these options have a higher mortality than the transfemoral approach.

The Perceval S (Sorin Biomedica Cardio SRL, Saluggia, Italy) is a bovine pericardium bioprosthesis mounted on a structure of nitinol that allows a sutureless implantation, shortening the cardiac ischemic time. It also facilitates complex surgical cases in which it is difficult to place sutures in the aortic annulus, as in the case of severely calcified aortic root. (1)

We report the case of a patient with aortic valve stenosis, porcelain aorta and severe aortoiliac occlusive disease who underwent aortic valve replacement with sutureless bioprosthesis as a therapeutic option to conventional surgery. Permission to conduct the implantation was obtained from the patient and the local ethics medical committee.

A 69-year-old man with clinical history of hypertension, diabetes mellitus, hyperlipidemia, chronic renal failure and an aorto-bifemoral bypass performed 11 years before, was referred to our department with diagnosis of aortic stenosis. He had a 3-month history of angina and dyspnea on mild exertion.

Transesophageal echocardiography revealed severe aortic stenosis (mean systolic gradient: 71 mm Hg; peak gradient: 119 mm Hg; aortic valve area: 0.8 cm2; valve annulus: 24 mm), moderate aortic regurgitation,

and normal left ventricular function (ejection fraction: 74%), without others significant findings. Coronary angiography showed a nonrevascularizable proximal occlusion of the right coronary artery, and multislice computed tomography indicated that maximum aortic annulus diameter was 25 mm and minimum diameter 20 mm, with a diagnosis of porcelain ascending aorta.

Preoperative evaluation showed transfemoral TAVI was not possible due to previous vascular surgery. The patient presented a 9.92% logistic EuroScore mortality risk, and since the aortic reconstructions from the multislice computed tomography showed a segment of the aorta free of calcification (Figure 1 A), conventional surgery with a sutureless prosthesis was decided, instead of transapical TAVI. Median sternotomy was the approach followed. Cardiopulmonary bypass was established with right axillary artery cannulation using an 8 mm Dacron conduit and standard right atrial venous cannulation. A calcium-free aortic segment was confirmed on palpation. The aorta was cross-clamped, and retrograde cardioplegia was administered. A small aortotomy was performed, the native aortic valve was excised without removing the annular calcification and a size S Perceval sutureless prosthesis was implanted. Extracorporeal circulation and ischemic times were 80 and 42 minutes, respectively (Figure 1 B). Control intraoperative transesophageal echocardiography confirmed the absence of aortic regurgitation and a peak transvalvular gradient of 23 mm Hg. The patient made good progress, without any neurological complication, and was discharged on the 7th postoperative day.

The term "porcelain aorta" is defined differently depending on the publications. Cardiac surgeons consider that an aorta is unsuitable for conventional surgery in cases of circumferential calcification of the ascending aorta which preclude cross-clamping. (2) Additionally, the distribution of calcium in cases defined as porcelain aorta in the TAVI series is not homogeneous. On many occasions the upper outer quadrant of the ascending aorta is calcium-free, as in the case we have presented. (3) Severe calcification of the ascending aorta is considered a risk factor for atheroembolism and uncontrollable bleeding in cardiac surgery. There are several surgical options to replace the aortic valve with or without the ascending aorta using deep hypothermic circulatory arrest or antegrade cerebral perfusion. These techniques increase the morbidity and mortality of the valve replacement procedure in patients who are often elderly and have multiple comorbidities. Other alternatives are the apical aortic conduit and the use of an endovascular aortic occluder to avoid external clamping of the calcified aorta. Some publications have considered TAVI as the technique of choice for aortic stenosis and porcelain aorta. (4) Today, open valve replacement remains the gold standard in aortic stenosis, especially as the series of transcatheter prostheses show a significant rate of periprosthetic leaks, influencing patient mortality. (5) Sutureless prosthesis minimizes the risk of periprosthetic leaks by resecting the calcified leaflets, resulting in a homogeneous annulus for implantation. Outcomes are similar to those of conventional valve surgery. (1)

In patients with severe calcification of the ascending aorta, preoperative planning must be made, with particular attention to the type of procedure, presence of comorbidities, and extent of calcification, reducing surgical complications, and leading to overall better survival rate and quality of life.

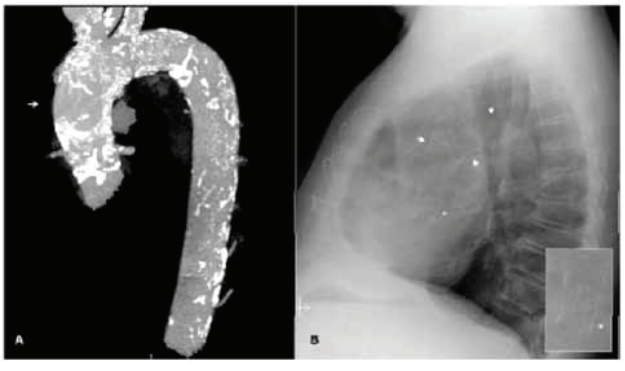

Fig. 1. A. Computed tomography reconstruction showing the severely calcified thoracic aorta and the approach point (*arrow*). Lateral chest x-ray showing the implanted prosthesis (*) and the calcified aorta (*arrows*).

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Rev Argent Cardiol 2015;83:163-164 - http://dx.doi.org/10.7775/rac.v83.i2.4751