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Clinical case

The difficulty of interventional cardiology in routine everyday practice. Paying the price of a sigh

La dificultad de la cardiología intervencionista en el trabajo diario: el precio de un suspiro

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CASE PRESENTATION

We hereby present the case of a 73-year-old male with a past medical history of high blood pressure, diabetes mellitus type 2, dyslipidemia, and former smoker as cardiovascular risk factors. The patient showed chronic ischemic heart disease that started as unstable angina with coronary artery disease of the right and circumflex coronary arteries, undergoing complete percutaneous revascularization in 2008 with everolimus-coated stents.

Ten years later the patient suffered from a non-ST segment elevation acute coronary syndrome of inferior location with low blood pressure and need for vasoactive amines, which is why he was transferred to the cath. lab for an early invasive strategy.

The diagnostic coronary angiography performed using the right radial access showed the presence of a plaque complicated with a thrombus in the ostium of the right coronary artery with Thrombolysis in Myocardial Infarction grade flow 3 (figure 1).

A 6-Fr JR guiding catheter and a Sion guidewire (Asahi) were selected for the procedure. Predilatation was attempted with a 3.5 × 10 mm noncompliant balloon (figure 2) and a 3.5 × 18 mm Orsiro sirolimus-eluted stent was implanted covering the ostium (figure 3).

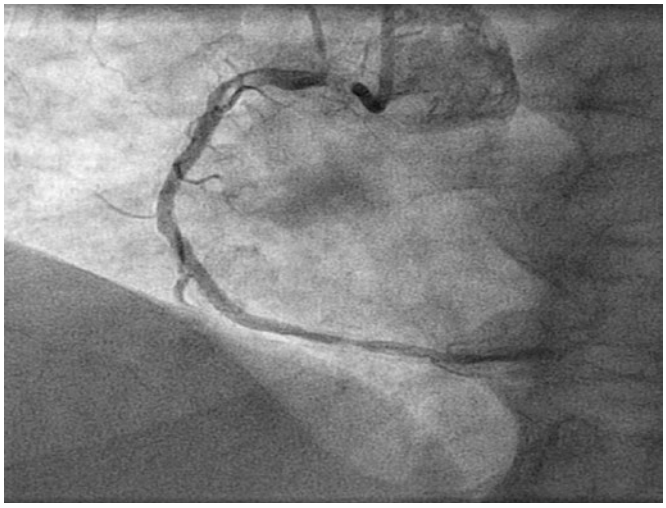

Figure 1. Acute complicated lesion in the ostium of the right coronary artery.

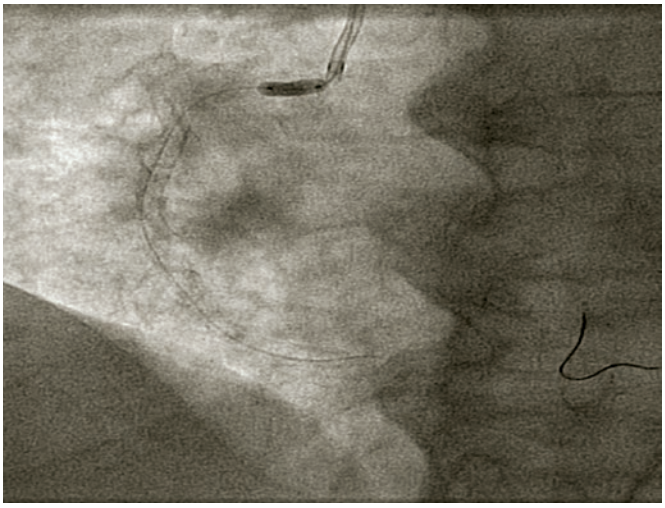

Figure 2. Predilatation with one 3.5 × 18 mm noncompliant balloon inflated at 14 atm, with adequate expansion.

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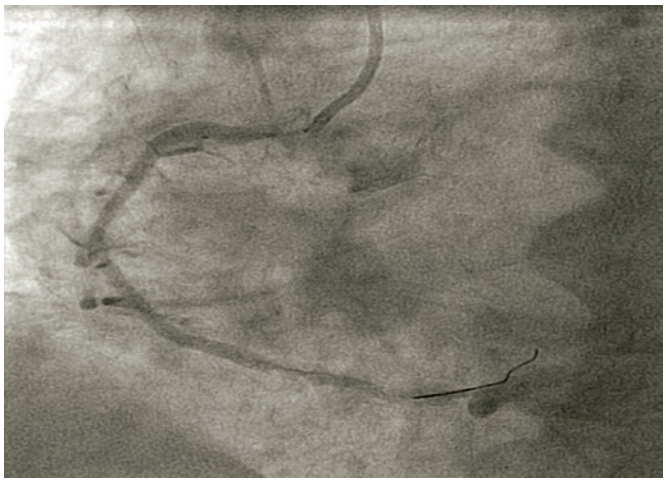

Figure 3. Angiography prior to the implantation of the stent adjusted to the ostium of the right coronary artery.

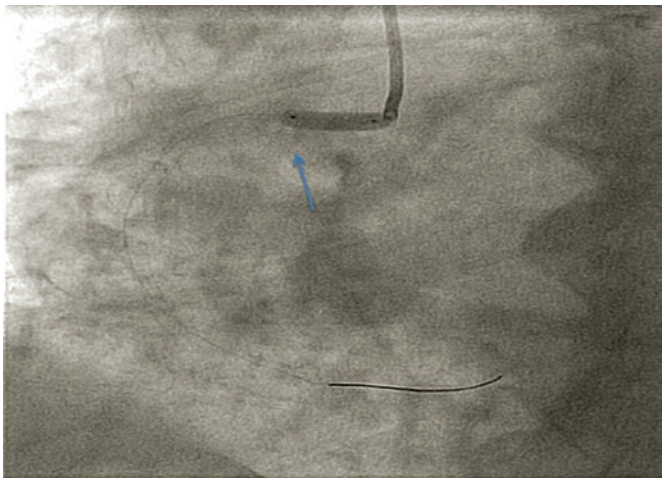

Figure 4. Stent displaced towards the aorta is observed. The arrow shows the mark of calcium in the sinus of Valsalva.

When the stent was deployed and inflated at 6 atm, with the patient in a state of agitation given his hemodynamic situation, he took a deep breath that caused the displacement of the stent towards the aorta (figure 4), that was deployed completely outside the ostium of the right coronary artery.

Therefore, we found ourselves with one under-expanded, displaced or loose stent inside the aorta that made maneuverability difficult with an uncovered thrombus in a complex ostial lesion and in the clinical context of an acute coronary syndrome.

The difficulty of interventional cardiology in routine everyday practice. Paying the price of a sigh. How would I approach it?

La dificultad de la cardiología intervencionista en el trabajo diario: el precio de un suspiro. ¿Cómo lo haría?

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HOW WOULD I APPROACH IT?

We are facing a challenging situation here both from the clinical–a patient with an acute coronary syndrome with hemodynamic impairment– and technical point of view –the procedure became complicated due to the accidental displacement of the stent from the coronary ostium towards the aorta–.

This is not something rare or due to any technical mistakes, we simply encountered a complication that can occur when treating ostial lesions in 15% of the cases. Even so the best thing to do here is to think about how it could have been prevented.

The management of ostial lesions is effective and safe but there are difficulties too. What we have here are plaques with more fibrosis and calcification that can lead to the infra-expansion and further restenosis or thrombosis of the stent.

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Also, it makes arterial catheterization more difficult, there is this possibility of blood pressure drops when inserting the catheter, issues with the positioning and release of the stent and, as it was the case here, even inadequate results.

In order to have some guarantees in the management of these lesions we need to choose a guiding catheter capable of providing good support, prepare the lesions with predilatation or use rotational atherectomy devices, and ultimately be very precise when positioning the stent. In this sense, it is advisable to implant it in the aorta with a 1 mm protrusion to make sure that the entire plaque has been covered.

This last step became complicated, yet different maneuvers have been described in the medical literature to avoid stent displacement. The first thing to do is to identify which is the ideal position here by using different views; then, we are supposed to keep firm and constant pressure over the stent during implantation. Leaving a second guidewire as a marker of the aorta can be helpful here. Also, the same intracoronary guidewire can be used to immobilize the stent in the position we want through ventricular pacing through the angioplasty guidewire.[1]

The use of guiding catheter extension devices has been suggested here to improve the positioning of the stent during implantation.

With this idea in mind, we can try to stabilize it by using the buddy balloon anchor stent technique.

Szabo described one technique that used a second guidewire in the aorta to anchor the stent to the ostium by passing its proximal edge through the last cell of the stent. It is a relatively complex technique, success rate is between 78% and 90%, and there are risks involved (stent displacement, guidewire crossing, damage to the stent, etc.)

Several devices have been designed with this idea in mind such as the FLASH Ostial System, (Cardinal Health, California, United States) that uses one distal balloon angioplasty plus another proximal anchoring balloon for proximal stent edge apposition to the aorta or the Cappella system, (Cappella Medical Devices, Ireland), that includes a self-expandable stent to provide optimal ostial coverage, although in the case of hard fibrocalcific plaques it does not have enough radial power. The Ostial PRO system (Merit Medical Systems) helps in the ostial positioning of the stent by placing nitinol legs against the aortic wall to avoid implantations that may be too distal. However, none of these systems is used routinely for the management of ostial lesions and although these techniques can be used occasionally, the planning and careful performance of the procedure by an experienced interventional cardiologist should are still the treatment of choice as it was the case with our patient.

The fact of the matter is that, despite of everything, we found ourselves with an under-expanded stent that was displaced towards the aorta and implanted outside the coronary ostium. This excessive protrusion can originate thrombi, anticipate a future risk of embolization, and most assuredly complicate access to the coronary in new procedures.

Several options can help us to solve this problem:

- Stent removal:

By having a guidewire through the under-expanded stent and protruding into the aorta, the first maneuver here would be to advance the balloon through the stent in order to dilate the coronary artery proximal segment to guarantee its patency. Then the partially inflated balloon is smoothly removed up to the distal edge of the under-expanded stent, the stent is displaced towards the aorta and, if removed, it is advanced towards the guiding catheter. If the stent is partially implanted in the vessel wall, this maneuver won't probably by successful. Another option here would be to use the loop snare technique to capture the proximal edge of the stent that is protruding into the aorta. Some of the cases published[2,3] describe stent "explants" performed using this technique in ostial lesions with stents displaced towards the aorta. However, there is a risk of endothelial damage, dissection, and perforation with this maneuver. Also, after capturing the stent with the loop snare, the movement of traction to attempt the stent retrieval would probably lead to losing the intracoronary guidewire with the corresponding risk of vessel occlusion.

- Stent "modification":

In order to avoid the risks involved in this retrieval maneuver, we could also solve this complication by inserting a second intracoronary guidewire through the same guiding catheter or, if an alternative vascular access is possible, by using another guiding catheter to allow optimal coaxiality such as the Amplatz Right guidewire. We would have to orient the catheter to pass the new intracoronary guidewire through one cell of the stent segment that protrudes into the aorta and very close to the coronary ostium. Here we would need to advance a 1.5 or 2 mm balloon to open the struts in the stent and then proceed to dilate using gradually larger balloons until we would be able to open our way and deploy a new stent to cover the diseased area of the proximal coronary artery and the under-expanded distal segment of the first stent. Finally, we would have to over-dilate the proximal edge at a high pressure by using a long enough noncompliant balloon to guarantee the crushing of the stent that is protruding into the aorta and its apposition to the aortic wall. The very few cases published on this regard describing this maneuver for the management of stents with excessive aortic protrusion have shown favorable outcomes.

Although a good prior strategy and preparation of the lesion are essential to prevent complications from happening, unexpected sudden situations can trigger all sorts of complications. The interventional cardiologist's experience, expertise, and caution are crucial to solve these complications.

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The difficulty of interventional cardiology in routine everyday practice. Paying the price of a sigh. Case resolution

La dificultad de la cardiología intervencionista en el trabajo diario: el precio de un suspiro. Resolución

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CASE RESOLUTION

Given the partial opening of the stent, it was decided to proceed with an increased pressure and assess the stability of the stent.

The stent seemed to have been deployed totally outside the right coronary artery, which is why we tried to capture it using a semi-compliant balloon in order to try to drag it towards the radial artery for implantation purposes, but such a maneuver failed (figure 1). This is how we confirmed that the stent was anchored to the ostium by just a few millimeters. Initially the intravascular ultrasound was not used here to assess the location of the stent to avoid any possible moves and manipulations of the implanted stent.

In order to protect the stent from the deformation by the tip of guiding catheter, the Guideliner guiding catheter extension device was used (Vascular Solutions, Inc., Minneapolis, Minnesota, United States). One semi-compliant balloon of 2.5 mm in diameter was advanced towards the proximal segment of the right coronary artery where it was inflated. It was then that the Guideliner device was advanced and the inflated balloon was slightly pulled (anchoring) by placing the tip of the guiding catheter extension device into the proximal segment inside the displaced stent (figure 2).

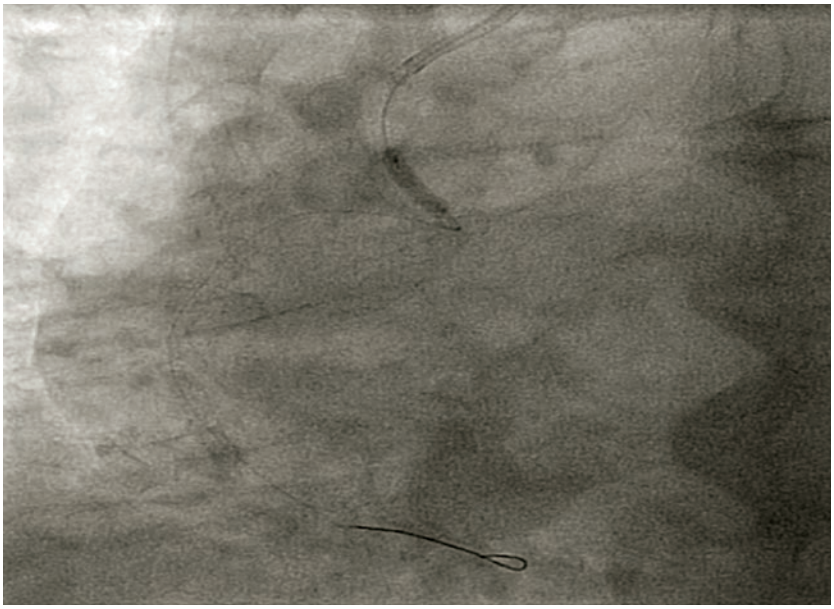

Figure 1. Attempt to drag the stent out of the coronary artery with a semi-compliant balloon.

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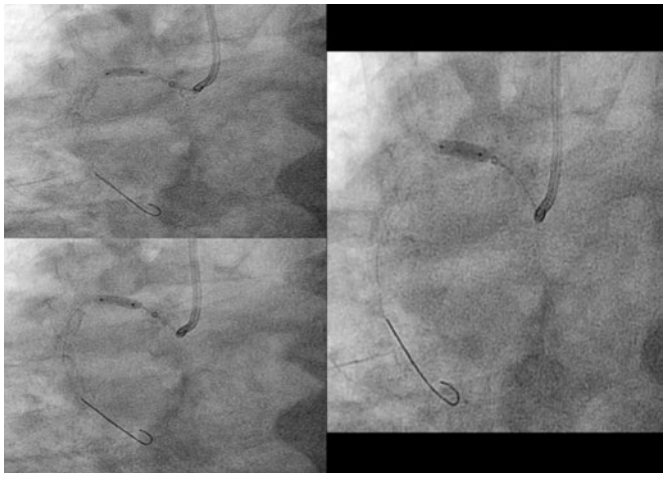

Figure 2. Advancement of the guiding catheter extension device towards the proximal segment of the right coronary artery.

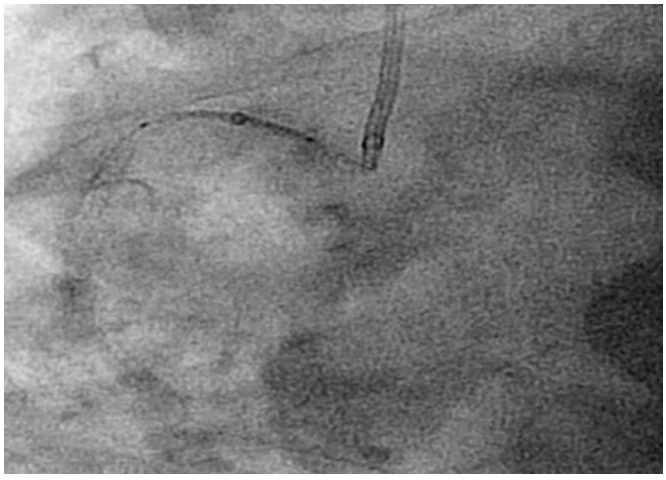

Figure 3. Implantation of zotarolimus-coated stent in the proximal segment of right coronary artery.

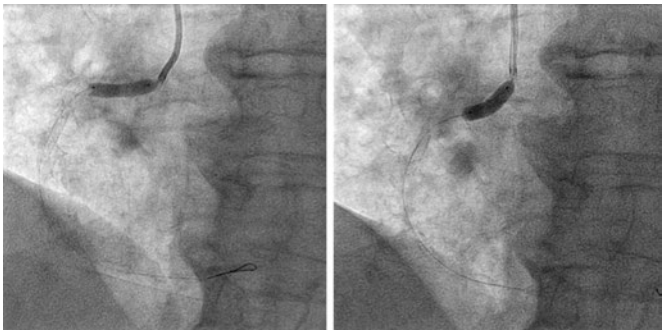

Figure 4. Post-dilatation with balloon of the previous implanted stents especially of the portion protruding into the aorta in order to achieve the greatest possible longitudinal shortening.

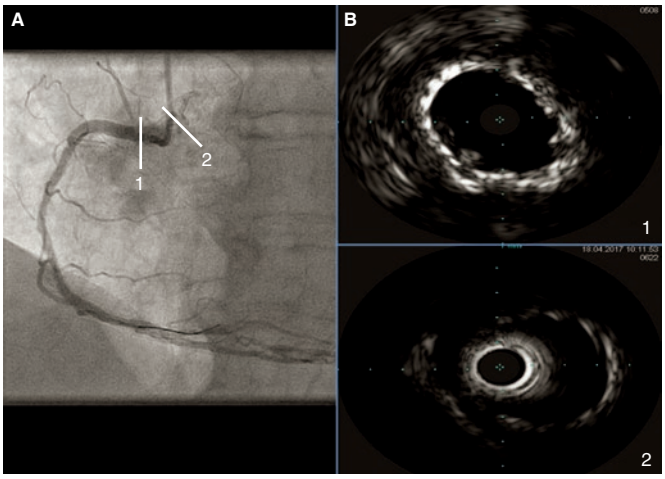

Figure 5. A: final angiographic result. **B1:** intracoronary ultrasound image showing the double layer of stents at ostium level with good stent apposition and expansion. **B2:** intracoronary ultrasound image showing the stent implanted in the first place, protruding into the aorta, and showing wide overexpansion.

Afterwards we proceeded with the eventless advancement of a new zotarolimus-coated stent (Medtronic Resolute Onyx, 4 × 22 mm) towards the proximal segment by navigating inside the guiding catheter extension device (figure 3). This second stent was implanted and anchored to the previous one and adjusted to the ostium. It was dilated with high pressure with the delivery balloon including the visible segment protruding into the aorta in order to achieve the longitudinal shortening of the stent by overexpansion (figure 4).

The angiographic results were good (figure 5A) and the intravascular ultrasound examination conducted showed the double layer of stents at ostium level with good stent apposition and expansion (figure 5B1) and the stent deployed protruding into the aorta showed wide overexpansion (figure 5B2).

We learned that the monorail extension of the guiding catheter helped us maneuver the intracoronary devices and protect the devices already implanted, which in the case of ostial lesions can prevent the deformity and the possible longitudinal shortening of the stent induced by guiding catheters.

The most radio-opaque stents can be a good option for the management of ostial lesions because of their better angiographic visualization. In this sense, chrome-cobalt alloys and, especially, chrome-platinum alloys have higher density and radiopacity. However, the chrome-platinum platform was not selected here due to its association with longitudinal deformity, especially in ostial lesions, where repeated proximal traumas are possible with the guiding catheter.

Finally, in order to avoid stent displacements with respiration we could have asked the patient to hold his breath for a few seconds, just long enough to be able to deploy the stent. However, in the presence of agitation preventing the patient's collaboration, as it was the case here, it is advisable to use powerful sedation or analgesia, or both, to avoid complications such as stent displacement during stent deployment or issues derived from the loss of the angioplasty guidewire.