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Coronary rotational aterectomy in an injury with unexpanded stent restenosis

Aterectomía rotacional coronaria en una lesión con reestenosis de stent subexpandido

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ABSTRACT

High calcium content lesions are probably the most challenging and more likely to negatively impact both acute and long-term results in a percutaneous coronary intervention. The rotational atherectomy technique has shown to be safe and effective in treatment when labeled as a removal technique of the subsets of calcified coronary lesions. Several studies show an increase in the procedure's success with a relatively low rate of complications of dissection or perforation. However, there is a margin of error in which we found ourselves with cases where atypical situations occurred that carry a risk of dissection, perforation, and slow/no reflux, among other complications. Therefore, this work shows a patient with complications after undergoing rotational atherectomy, the corrective procedure for eliminating the presented problem, and displays a precedent on the procedure in case of complications with rotational atherectomy.

RESUMEN

Las lesiones con alto contenido de calcio, son probablemente las más desafiantes y tienen más probabilidades de impactar negativamente tanto en los resultados agudos como a largo plazo en la intervención coronaria percutánea. La técnica aterectomía rotacional se muestra segura y efectiva en el tratamiento donde se ha etiquetado como una técnica de eliminación de subconjuntos de lesiones coronarias calcificadas. Diversos estudios muestran un éxito del procedimiento fue muy alto con una tasa relativamente baja de complicaciones de disección o perforación. La información apunta a ser un método efectivo, sin embargo, hay un margen de error por lo cual nos vemos con la particularidad de encontrarnos con casos donde se presentan situaciones atípicas que conllevan un riesgo de disección, perforación y reflujo lento/nulo entre otras complicaciones. Por tal razón, el presente trabajo muestra el caso de un paciente con complicaciones tras ser sometido a una aterectomía rotacional, mostrando el procedimiento correctivo para la eliminación de la problemática presente, mostrando un precedente sobre el método de actuar en caso de complicaciones de la aterectomía rotacional.

INTRODUCTION

High calcium content lesions (HCCL), specifically the coronary artery calcification (CAC), are defined as the angiographic presence of radiodensities within the vascular wall at the site of the stenosis; these types of lesions are probably the most challenging and are more likely to negatively impact both acute and long-term outcomes in the percutaneous coronary intervention (PCI), considered a predictor of poor prognosis in patients undergoing PCI,[1-3] associated with immediate complications plus late failure due to sub-expansion and poor stent placement.[4] However the development of technologically more advanced devices and methods, such as support catheters, cutting balloons, high pressure and low-

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profile balloons, orbital, laser atherectomy, or lithoplasty, rotational atherectomy (RA), these methods continue to be the most widely used techniques worldwide to modify plaque calcifications.[2]

The RA technique, introduced in 1990, is safe and effective in treatment where it has been labeled as a technique for removing subsets of calcified coronary lesions. Its primary mechanism of action involves a high-speed rotational plate ablation (140,000-160,000 revolutions per minute, rpm) and grinding by the diamond-coated abrasive bur.[5,6]

RA is considered the standard technique for preparing highly calcified lesions before stent implantation, mainly when the lesions cannot be passed through with a balloon device. The success of the procedure was remarkably high (99.1%), with a relatively low rate of complications from dissection (7%), perforation (1%), or slow/no flow (1.1%). On the other hand, there is the J-PCI study, which included 13,355 RA cases, also reported low rates of death in the hospital (0.6%), tamponade (0.64%), and the need for emergency surgery (0.18%).[3]

The information points to RA as an effective method. However, there is a margin of error in which we found ourselves with cases where atypical situations occurred that carry a risk of dissection, perforation, and slow/no reflux, among other complications.[3]

Therefore, the present work shows the case of a patient with complications after undergoing RA, and showcases the corrective procedure to eliminate the presented problem, displaying a precedent on the method of acting in case of complications of RA.

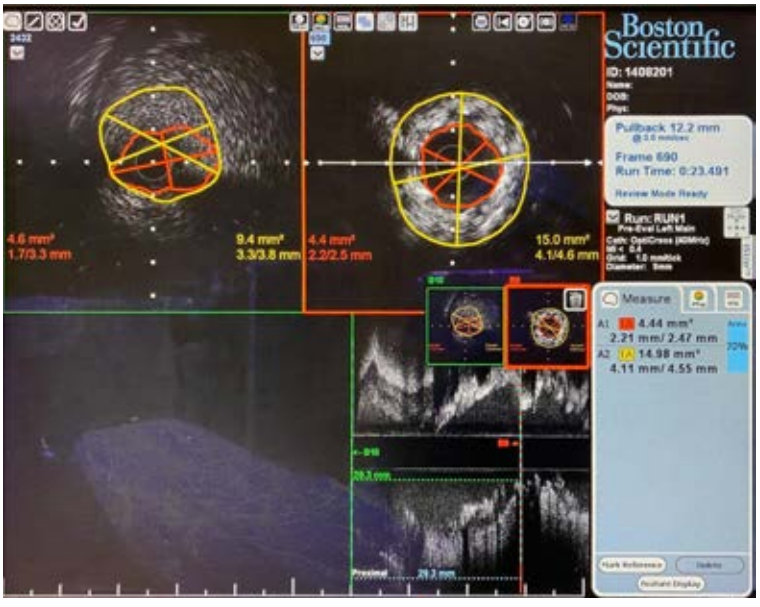

Figure 1: Left anterior descending artery (LAD) distal segment 70% in-stent restenosis.

CASE PRESENTATION

The patient is a 79-year-old male with a history of systemic arterial hypertension, type 2 diabetes mellitus, ischemic heart disease with angioplasty and stent (PTCA) in the medial and distal segment of the diagonal branch of the left anterior descending artery (LAD) on 2016; placement of a double chamber pacemaker on May 2019, and a previous cardiac catheterization on May 2019 where two stents were placed in the right coronary artery and the diagonal branch of the LAD, and cardiac catheterization on August 2019 where the LAD artery with severe calcification is shown. Presence of two overlapping stents involving the proximal and middle segment with sub expansion in a residual lesion with maximum stenosis of 70% as seen in *Figure 1*, a distal segment of a vessel smaller than 2 mm with total chronic occlusion which receives RENTROP I homocoronary collateral circulation, and in the second diagonal branch with a diffuse disease with maximum stenosis of 50%. TIMI 3 distal flow.

The patient reported: fatigue, dizziness, and stabbing pain in the precordial region with three months of evolution, for which he was scheduled for rotational atherectomy with the ROTABLATOR and ROTAWire system on August 2019. The procedure initialized by advancing the angioplasty guide to the LAD, in-stent restenosis of 70% was detected in the distal segment *(Figure 1)*, from the LAD artery CHOICE PT guide filament to the distal segment of the second diagonal branch, then the THREADER microcatheter went over the guide and exchanged for ROTAWIRE 0.009″ Floppy 6 Fr. Subsequently, a 1.5 mm drill was used, and three steps of 20 seconds were performed. In the last step, the ROTAWIRE 0.009″ Floppy 6 Fr drill was caught in the

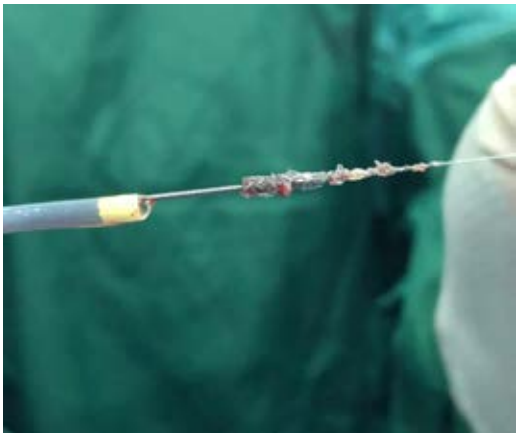

Figure 2: Released bur system with remains of the stent.

proximal segment of the stent, without loss of distal flow and finally, it was released with traction, observing image radiopaque behind the bur, so it was decided to remove the entire system bloc, *Figure 2* shows the released system with remains of the stent behind the bur. It was cannulated again with a MACH I VL 3.5, 7 Fr guide catheter, a BALANCE MIDDLEWEIGHT UNIVERSAL II 0.014" 150 cm intermediate angioplasty guide was used, and an intravascular ultrasound (IVUS) OptiCross 3.0 Fr probe was also used, observing a lesion distal to the stent and corroborating the sub-expansion of the previous stents. Predilated with an NC EMERGE 2.0 × 15 mm balloon at 20 atm and a subsequent NC EMERGE 3.5 × 12 mm balloon up to 22 atm. A GUIDEZILLA II 6 Fr guide extender was used, to improve support, it was moved towards the lesion of the second diagonal branch directed to the middle and distal LAD artery, the PROMUS PREMIER 2.25 × 28 mm stent was delivered, everolimus releasing, overlapping the previous to nominal 11 atm and the proximal part is post-dilated to 22 atm. Then the second PROMUS PREMIER 3 × 24 mm eluting everolimus proximal spliced before delivery and at 20 atm was implemented. It was optimized with the same NC EMERGE 3.15 × 12 mm balloon at 24 atm. Finally, the IVUS OPTICROSS 3 Fr probe was mobilized. Adequate expansion and apposition of the stents and adequate minimum luminal area were observed without a dissection image or thrombus. Final flow TIMI 3, TMP 3.

DISCUSSION

The incidence of coronary calcifications increases with age and with the presence of chronic degenerative diseases like diabetes mellitus, hypertension, dyslipidemia, and renal disease.[7] In this case, we are dealing with an elderly patient with coronary artery disease in the LAD. Stent implantation was decided with unexpected angiographic results, with a 70% residual lesion and inadequate expansion of the stent due to a calcified lesion later visualized by intravascular ultrasound.

During ablation, the operator should be aware of any possible warning signs, which can be: visual (lack of smooth advancement under fluoroscopy), acoustic (changes in tone with variation in resistance encountered by the abrasive bur), or tactile (resistance on the feed knob or excessive driveshaft vibration). If entrapment occurs, timely action is required to eliminate trapped abrasive burs,[8] it should be noted that the use of rotational atherectomy as a therapeutic measure for calcific atheromatosis has been highly effective, reporting a success rate greater than 90%. Furthermore, it has complication in less than 5% of cases; Complications have been reported during RA such as excessive stent damage, distal embolization of metallic particles, excessive heat generation, and trapping of the abrasive bur in the stent;[9] although various eventualities can occur during RA, the entrapment of the abrasive bur has been reported in 0.5 to 1% of these rare complications.[7] One way to solve this complication is to move the patient to an emergent surgical procedure, being the most reliable option to eliminate the trapped abrasive bur. However, surgical removal is invasive, time-consuming, and requires preparation and organization before the procedure, especially for unstable hemodynamic cases. Before sending the patient to surgery, several non-surgical techniques can be tried to retrieve the stuck abrasive bur. Careful and conservative techniques, including diligent stress relief before RA, are critical elements of prevention. In the event of entrapment, the single best technique to remove the abutter is to pull on the ROTAWire, taking advantage of the 0.014-inch spring tip of the wire.[10] To prevent thrombosis,

sufficient heparinization, and glycoproteins IIb/IIIa is recommended prior to these attempts. An intracoronary injection of nitroglycerin and/or verapamil is also suggested to relieve spasm and facilitate antegrade coronary flow.[11] It has been observed that the simplest method to perform is to remove the entire rotating system manually. Extreme force on the shaft and abrasive bur can cause shaft fracture;[11] In this case, the abrasive bur was extracted from the lesion by removing the RA system bloc and exchanging the angioplasty guides for stent repositioning, thus obtaining a successful result.

CONCLUSIONS

Calcified atherosclerosis is a disease of high relevance in the current society; therefore, methods have been developed to combat it. One of the most used options is RA, a highly effective method; however, there exists a complication rate that indicates the need to have protocols to follow according to the eventualities that present themselves along with the procedure, the case presented shows a successful entrapment of the abrasive bur, which marks a precedent on the procedure's methodology.

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