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CASE REPORT

Rotational Atherectomy Stuck Burr Retrieval, A Percutaneous Approach

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Abstract

Cardiovascular disease remains the leading cause of death worldwide. Besides conventional therapies to treat coronary artery disease, which ranges from preventative measures to invasive intervention, complex percutaneous coronary intervention techniques have been developed that yield several techniques including rotational atherectomy (RA). It is evident that RA has benefits primarily in treating calcific coronary artery lesions predominantly lesion modification. Similar to other invasive procedures, RA carries variable risks such as perforation, entrapped burr, slow-flow and dissection. Entrapped burr can lead to devastating complications, where it may end up by emergency surgery. The authors report a rare complication of RA, Kokeshi phenomenon, where the stuck burr was successfully retrieved percutaneously.

Keywords: Coronary Angiography, Atherectomy, Coronary, Coronary Artery Disease, Cardiovascular Diseases, Percutaneous Coronary Intervention, Drug-Eluting Stents, Coronary Restenosis, Coronary Artery Bypass

Introduction

Entrapped burr is a rare complication of rotational atherectomy (RA) known as Kokeshi phenomenon. Encountering such complications is possible as the number of cases of complex and high-risk coronary interventions that use RA is increasing. The factors leading to such a complication is variable while techniques of percutaneous retrieval of the entrapped burr have been widely developed leading to avoidance of emergency surgery. In this case report, child-in-a-mother technique (Cunnington M, 2012) utilizing a guideliner was used to retrieve the burr percutaneously. Moreover, the authors elaborate on other techniques that were reported to overcome this complication safely.

Case presentation

A 71-year-old male smoker with type II diabetes mellitus, dyslipidemia, hypertension, and renal impairment on medical therapy was diagnosed with a non-ST elevation myocardial infarction and transferred for a percutaneous coronary intervention (PCI). Left ventricular function was preserved. There were non-specific changes on electrocardiogram. Anti-ischemic measures were followed, and the patient was taken for coronary angiogram (CAG) (Figure 1). A right radial approach was followed, and the angiogram showed heavily calcified multiple vessel disease with a significant lesion in the posterior descending artery (PDA) (Figure 1) and an intervention to the PDA lesion was planned.

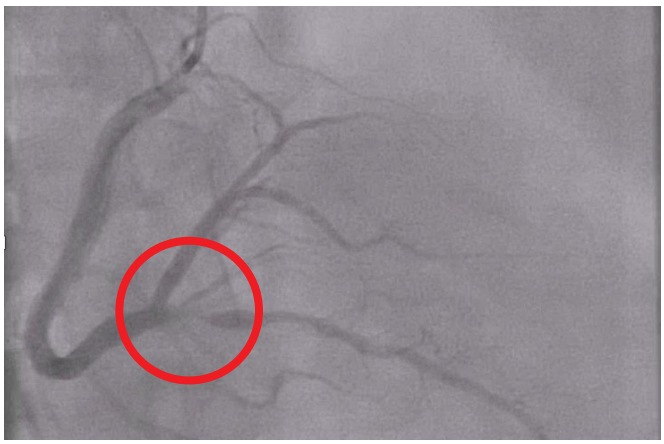

Figure 1: Right coronary angiogram showing a lesion in the posterior descending artery (PDA)

The right coronary artery (RCA) (Figure 1) ostium was successfully intubated with 7.5F JR4 sheathless guide (Asahi Intecc) then 0.014-inch BMW wire (Abbott Vascular) crossed the PDA lesion and was parked distally. It was not possible to cross the lesion with 1.5mm x 15mm Tazuna Balloon (Terumo). As the calcified lesion was angiographically evident, it was decided to proceed with RA for lesion modification. The authors parked an Apex OTW balloon (Boston Scientific) tip of the lesion and exchanged the BMW wire (Abbott Vascular) with Rota wire (Boston Scientific). Considering the large caliber of the right system, a 1.75mm Rota burr (Boston Scientific) was advanced and multiple runs were performed with a speed of 170,000 rpm. Unexpectedly, there was fast deceleration in the Rota speed with changes in rotablation runs sound. The burr was entrapped at the lesion site (Figure 2). Gentle traction failed to retrieve the burr. The patient experienced chest pain and there was thrombolysis in myocardial infarction (TIMI) II flow. Attempt was made to pass Pilot wire (Abbott

Figure 2: An angiogram showing the stuck burr distal to the lesion

Vascular) and Tazuna balloon (Terumo) through the side of the burr (Boston Scientific), but the Pilot wire (Abbott Vascular) failed to pass the distal RCA and the Tazuna balloon (Terumo) was unable to be accommodated within the lesion. In another attempt to retrieve the stuck burr (Boston Scientific), we cut the Rota shaft and removed the hypotube. This was intended to create space for passing a Guideliner catheter (Vascular solutions) passed the lesion as the rotablator system (the rota shaft and the hypo tube) is not designed to accommodate the guideliner catheter (Vascular solutions) due to its small diameter. The 7F guideliner catheter (Vascular solutions) stabilized the lesion (Figure 3) and by counter traction, the entrapped burr was retrieved.

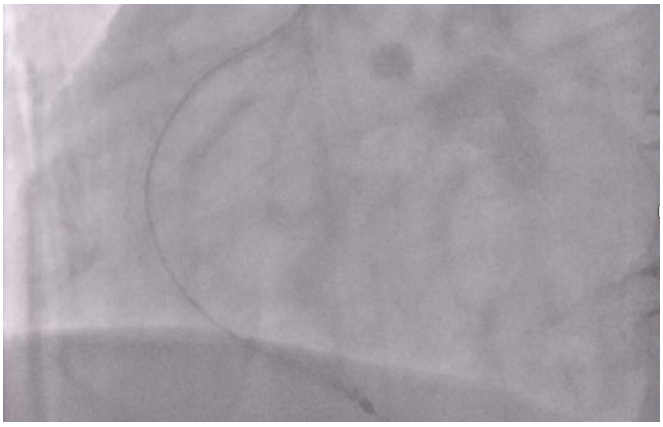

Figure 3: 7F guideliner support catheter (Vascular Solutions) passed to the tip of the lesion after removing the rotablator shaft to accommodate the catheter, child-in-a-mother technique. Afterwards the lesion was stabilized, then a counter force applied where the wire is pulled and the guideliner is stabilizing the lesion leading to stuck burr retrieval

The authors then re-crossed the lesion with BMW wire (Abbott Vascular) and successfully ballooned the ostial and mid PDA with non-compliant balloon (Abbott Vascular) respectively. Finally, a 3.0mm x 12mm Xience Pro drug-eluting stent (Abbott Vascular) was deployed in the ostial PDA and TIMI III flow was achieved. Angiographic result was excellent (Figure 4), and patient was hemodynamically stable. At four years of follow up, patient is doing well and angina free.

Figure 4: Right coronary angiogram final result after the stent deployment

Discussion

The authors report a rare complication of RA, Kokeshi phenomenon. PCI techniques are variable. Different approaches were developed including.[1] RA has its benefits in treating complex lesions an individualized approach where patients are not suitable for surgeries, architecturally complex lesions and lesions that fail with PCI.[1,2] RA carries variable risks including perforation, dissection, slow flow / no flow phenomena and major complications (death, myocardial infarction and emergency coronary artery bypass graft (CABG) [3] RA was observed to have a high major adverse cardiac events (MACE) in a recent multicentral study from Japanese registry.[4] With the introduction of Drug-eluting-stents (DES) and development of RA techniques, MACE rates improved.[5]

RA is intended for plaque modification, and this is achieved by advancing the diamond-encrusted elliptical burr longitudinally and orthogonally with friction force. Heat production occurs with a rotating burr along with microembolization. Complications such as periprocedural myocardial infarction and restenosis can be avoided by a gradual intermittent pecking motion. One of the most life-threatening complications is the entrapment of the burr rotablator described in the literature "a nightmare of rotational atherectomy"[7] these complications are uncommon with a reported incidence of 0.4%.[8] By the fundamentals of rotational atherectomy, a counter force on a mutually perpendicular axis against the calcified lesion will lead to forward friction reduction that results in advancement of the spinning diamond coated burr and lesion modification. Unexpectedly, spasm, advancement of a small burr beyond a calcified lesion, under-deployed stents, or in-stent stenosis without sufficient ablation can lead to a stalled burr.[9]

Different techniques were developed to avoid emergency surgery. The simplest technique that can be attempted to retrieve a stuck burr is by gentle manual traction, but this conveys a substantial risk of vessel injury or shaft fracture.[8] Another approach suggested is by distal advancement of rotablator then instant retrieval while spinning. In a case series, more than 33% was managed by passing the second wire and balloon dilation next to the burr which resulted in successful retrieval of the burr. The challenge was passing the balloon but since the lesion is tight and balloon cannot be advanced,[8] and this might need advancing the second guide from another access. In a recently reported case, the operator encountered the entrapment twice in the same procedure, where they successfully retrieved the burr each time with different approaches. The first attempt was by applying the same technique that was tried during this case while in the second attempt, the operator faced resistance and changed the technique. Similar steps were followed, and a snare was added to help in burr traction where it was successfully retrieved.[10] An innovative approach was also reported where the operator used subintimal tracking and reentry (STAR) technique to retrieve the stuck burr successfully and percutaneously. This technique formerly used for chronic total occlusion. First, through the subintimal space a tapered 3-g tip hydrophilic wire was advanced beyond the lesion

and stuck burr. Then, successfully reentered the true lumen placing the wire distal to the lesion. Finally, an attempt to dilate the lesion next to the bur was successful to restore the flow and dislodge the burr, afterward, the stuck burr was retrieved without difficulty using Microsnare kit.[11] Laser coronary atherectomy facilitates PCI in complex lesions and in stent restenosis,[12] and entrapped devices, it can facilitate retrieval by modifying or softening the lesion. This technique was used to retrieve an entrapped guide wire, but there was no reported case for an entrapped burr.[13]

Conclusion

Entrapped burr, known as Kokeshi phenomenon, can lead to devastating complications, where it may end in emergency surgery open-heart surgery. The current advances in percutaneous complex interventions and the vast use of advance percutaneous techniques such RA, the number of complications will rise. The authors have reported success in this method to resolve a serious complication percutaneously without the need for open-heart surgery. The patient was discharged home after the procedure and upon the follow up appointment in the cardiology clinic, there was no evidence of ischemia, and had a normal functional capacity and was asymptomatic.

Disclosure

No conflict of interests.

No sponsorship was provided.

Consent was taken from the patient.

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