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Use of Tornus for a Lesion That is Easily Balloon Crossable but No Expandible Despite High Pressure

CASE REPORT

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ABSTRACT

Coronary angiography (CAG) was performed on a 78-year-old female patient due to class III angina. A calcified critical obstruction was demonstrated in the right coronary artery (RCA). An attempt at percutaneous transluminal coronary angioplasty (PTCA) failed to dilatate the lesion despite high balloon pressure. In a second attempt the lesion was dilatated with the balloon after implementing a tornus penetration device, and then a stent was implanted. A dissection occurred after the stent implantation and it was treated with another stent. The treatment of lesions that cannot be dilatated using conventional PTCA techniques and the role of the tornus penetration device in such cases are discussed.

Key words: Percutaneous transluminal coronary angioplasty, coronary artery stenosis, calcification

INTRODUCTION

Since the first percutaneous coronary intervention (PCI) was performed, the techniques and technology available for the procedures developed in parallel to their difficulties. One of the most common difficulties is calcified and non-expandable lesions (CNELs). These lesions are usually aged, and performing PCI on them may be complicated by insufficient expansion of the balloon, dissection, perforation and acute occlusion (1). If expansion of the lesion via balloon inflation is insufficient, cutting the balloon (1, 3-5), deploying a FX miniRAIL balloon (6) and rotablation (1, 7) are most often used to facilitate the procedure. The tornus is a penetration device developed for chronic total occlusions (CTOs) (1, 8-12) and there are limited data about its use in CNELs.

The tornus device was originally developed for CTOs when the smallest available balloon failed to cross the lesion. In such casees the problem was an inability to cross the lesion. A large sized non-compliant balloon could cross the lesion easily but couldn't dilate the lesion despite high inflation pressure. The use of tornus in this condition is not well studied and we report the first use of tornus in our laboratory.

CASE REPORT

A 78-year-old woman was referred to us with class III anginal chest pain and chest pain after meals. She had had an anterior myocardial infarction 20 months previously, which was successfully treated with streptokinase infusion and then stenting the left anterior descending (LAD) artery. She had a history of known hypertension for 10 years. She was on ramipril 10 mg, aspirin 100 mg, metoprolol 100 mg and atorvastatin 40 mg daily therapy. AN electrocardiogram revealed no specific abnormalities except a loss of R wave progression in leads V1 and V2. Echocardiography showed apical hypokinesis with an ejection fraction of 0.54, and mild aortic and mitral regurgitation. We planned coronary angiography for the patient and, as shown in figure 1, the coronary angiography revealed 99% stenosis in the proximal segment of the right coronary artery (RCA) (30–40% instent restenosis in mid LAD, 60% stenosis of the first diagonal ostium, 40% stenosis in the second diagonal artery and 30% stenosis in the obtus marginalis). We planned PCI for RCA after loading 600 mg clopidogrel and intravenous unfractioned heparin (100 IU per kg) lesion was crossed with 0.014 inch floppy guidewire. We used a 2.0x20 mm balloon first without success and then tried 2.5x20 and 2.5x12 mm non-compliant balloons at high inflation pressures (22 atm) but there was no change. Figure 2 illustrates a 3.25x12 mm non-compliant balloon at 22 atm that finally inflated. Unfortunately (as shown in figure 3) there was no change in the lesion at this point so we stopped the procedure and decided to use tornus at another time because it was not available in the moment. In the second procedure a 2.6F tornus (Asahi Intecc, Aichi, Japan) crossed the lesion easily with counterclockwise rotation in a few seconds and the lesion was degraded so we would be able to implant a stent. Figure 4 shows the vessel after using the tornus use. Next we implanted a 2.75x34 mm drug eluting stent at 20 atm inflation pressure. The stent was implanted with no residual stenosis but a dissection occurred

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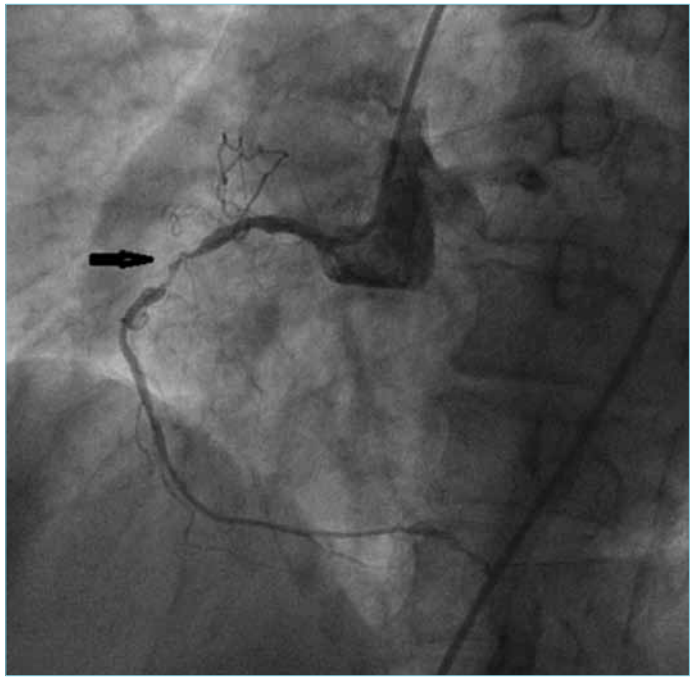

Figure 1. Right coronary angiogram at the left anterior oblique tube position. Arrow shows the irregularly shaped and calcified critical obstruction

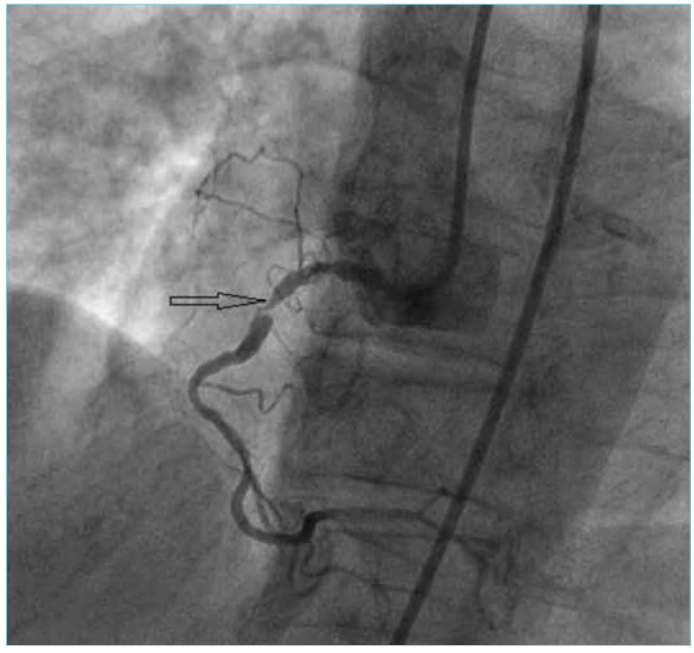

Figure 3. Right coronary angiogram after inflating a 3.25*12 mm non-compliant balloon up to 22 atm pressure at the lateral anterior oblique tube position. Arrow shows the tight lesion that is not dilated

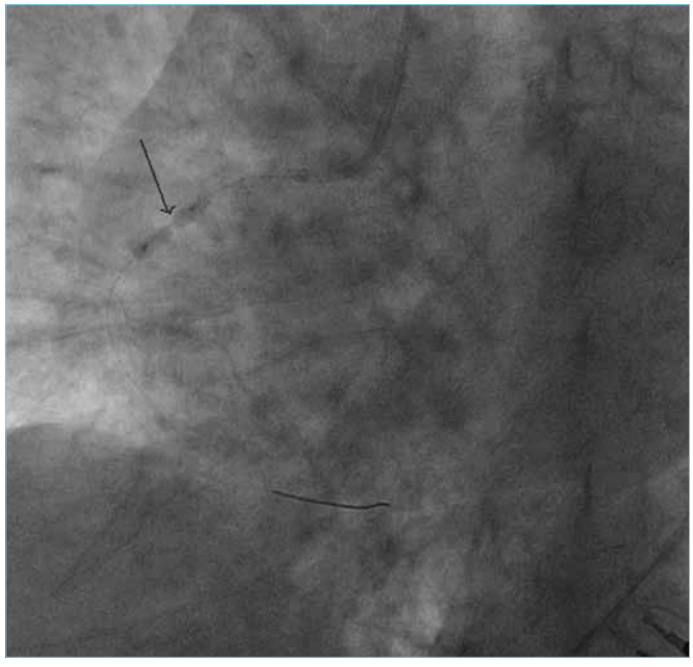

Figure 2. 3.25x12 mm non-compliant balloon inflated at 22 atm pressure in the right coronary artery. Arrow shows the notch on the balloon indicative of no expansion

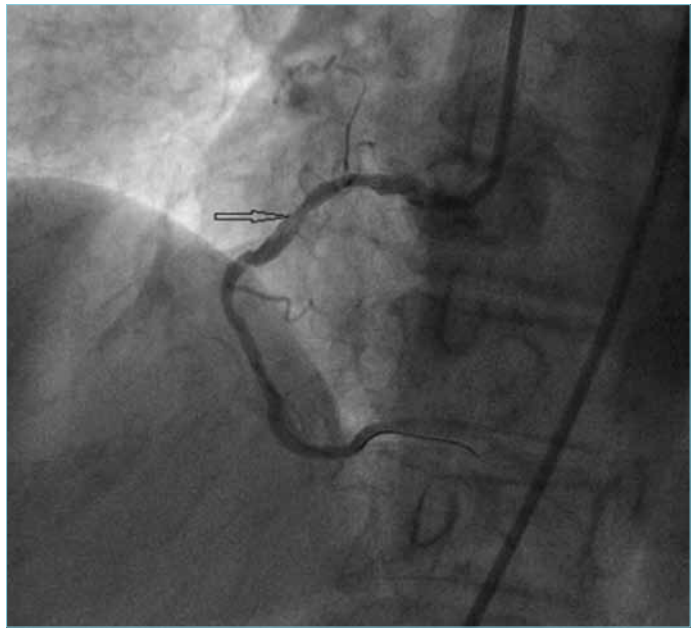

Figure 4. Right coronary angiogram at the left anterior oblique tube position after penetrating the lesion with the tornus device before stent implantation. Arrow shows the dilatated lesion after tornus use

from the proximal part of the stent to the RCA ostium. Figure 5 illustrates the dissection. We implanted a second drug eluting stent (2.75x16 mm) to overcome this problem and post-dilatation was then applied to the overlapping stent segments and RCA ostium with 2.75x18 mm and 3.25x15 mm non-compliant balloons. Finally we achieved Trombolysis In Myocardial Infarction (TIMI) III flow with no residual stenosis. Figure 6 shows the final angiography of the RCA. The patient was discharged from the hospital and at the first month followup she was free of angina.

DISCUSSION

Despite new strategies and technological developments, CNELs are still challenging problems. As compared with non-calcified lesions, the risk of complications or failure of the procedure are higher in

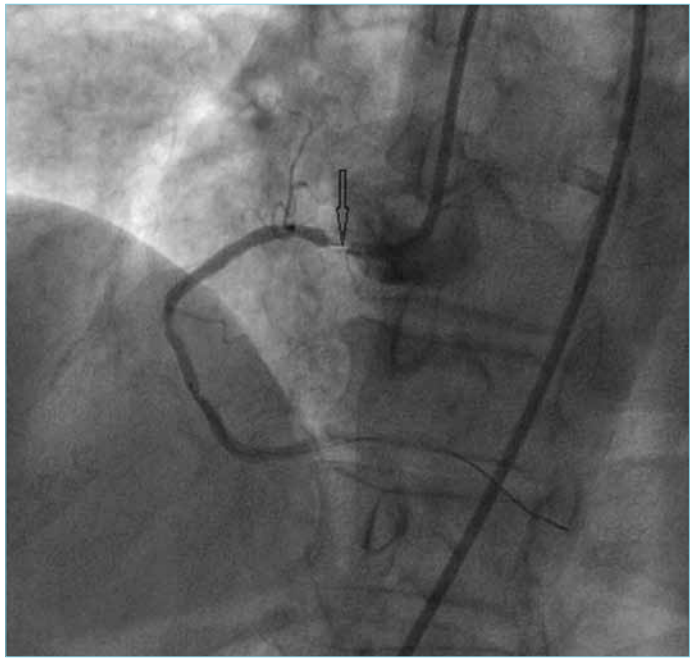

Figure 5. Right coronary angiogram at the left anterior oblique tube position after stent implantation. Arrow shows the dissection in the proximal right coronary artery

CNELs. Non-expandable lesions typically include heavy calcification and superficial circumferential calcification, but sometimes the calcification may be localized (1). If the stent is deployed before dilatation of the vessel it may cause stent thrombosis or restenosis due to insufficient expansion. The operator must be aware of the lesion's characteristics. In particular, radioopacities on the scan prior to contrast injection are warning clues about a lesion's expandability. Some investigators use intravascular ultrasound (IVUS) to further evaluate the calcifications. If the calcification is greater than 270˚ of vessel circumference they recommend the direct use of rotablation (1).

A cutting balloon, the FX MiniRAIL balloon and rotational atherectomy are techniques that are used to overcome CNELs (3-7). A cutting balloon consists of three microknifes and is effective in degrading plaque, but its high profile hinders its use in tortuous vessels (3-5). The FX MiniRAIL balloon system looks like a cutting balloon but it has two wires over the balloon instead of microknifes (3, 6). Rotablation atherectomy is mostly used in CNELs. The rotational atherectomy system abrades inelastic plaque inside the vessel into small particles. It requires a system that consists of an advancer, drive shaft, burr and a monitoring console (3, 7). Rotablation is the preferred procedure today and the European Society of Cardiology (ESC) guidelines recommend the use of rotablation in CNELs with class IC indication (2).

The tornus device was originally developed for CTOs (8-12) and has been used in CNELs, but data about its use in this context is insufficient to date, so its level of indication is class IIbC in the European Society of Cardiology (ESC) guidelines (2). Tornus and rotablation were compared in a small study regarding success rate, complications and procedure duration. Major and minor complications were the same but the device success rate was lower and procedure duration was longer with the tornus (10).

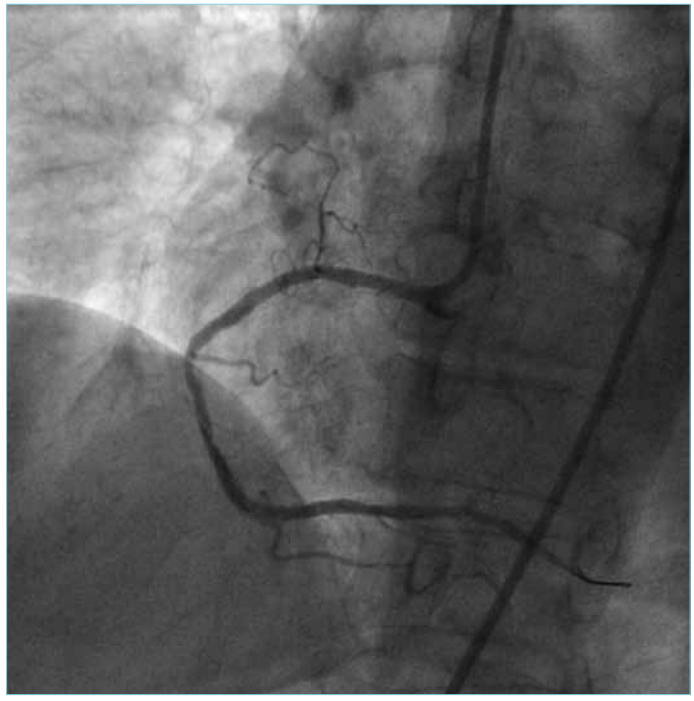

Figure 6. Final right coronary angiogram at the left anterior oblique tube position after stenting the dissection with another stent

In our case we used a tornus because of availability. The lesion was crossed in a few seconds, balloon dilatation was successful after tornus use and then a stent could be implanted. Dissection occurred proximal to the stent and was successfully treated with another stent. The main shaft of the tornus is a coreless stainless coil, with eight wires stranded in the coil in a right-handed fashion (clockwise) (8). It can cross through lesions easily with a counterclockwise rotation along with a guidewire. It is important to emphasise that while rotating the tornus the guidewire must be fixed and must not rotate with the tornus to avoid complications such as spiral dissection, rupture, device failure and acute vessel occlusion. Although we used the tornus properly, dissection still occurred proximal to the stent. The best therapy for dissection is stenting the dissected part of the vessel, as we did in our case.

CONCLUSION

Although the tornus was primarily developed for CTOs, which are impossible to cross with low profile balloons, it can also be used in conditions where the problem is a lesion that can easily be crossed but still cannot be dilatated.

Informed Consent: Written informed consent was obtained from the patient who participated in this study.

Peer-review: Externally peer-reviewed.

Authors' contributions: Conceived and designed the experiments or case: AT, MB. Performed the experiments or case: AT, MB. Analysed the data: AT. Wrote the paper: AT, MB. All authors have read and approved the final manuscript.

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