SHORT COMMUNICATION

Concertina effect: A memorable phenomenon during coronary intervention

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Received 12 May 2013; accepted 30 September 2013
Available online 30 October 2013

Abstract Concertina phenomenon is a transient angiographic series of narrowings during percutaneous coronary intervention in a tortuous vessel induced mainly by a stiff guide wire. Herein, we describe a case of concertina phenomenon in a right coronary artery treated conservatively.

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1. Clinical case

A 72-year old lady, known case of longstanding hypertension on treatment and with mild renal impairment (eGFR 46 umol/L) attended our outpatient cardiology clinic describing typical effort-induced chest pain (Canadian Cardiovascular Society grading of angina pectoris = 2). Non-invasive investigations including myocardial perfusion imaging showed evidence of ischemia in the left anterior descending artery (LAD), left circumflex coronary artery (LCX) and right coronary artery (RCA) territories with preserved left ventricular systolic function (Ejection fraction 61%). Coronary angiography was attempted first through the right radial approach but crossed over to the right femoral approach due to significant right subclavian artery and aortic arch tortuosity. Coronary angiography proved evidence of intermediate mid segment LAD lesion, medium-sized non-dominant and normal LCX. RCA was markedly tortuous with proximal minor irregularities followed by an 80% mid segment lesion (Fig. 1). Percutaneous coronary intervention (PCI) to mid RCA was decided. A 6F JR4 (Medtronic Launcher, Medtronic Inc., Minneapolis, Minnesota) guiding catheter was used to engage the RCA. Choice PT extrasupport 0.014 guidewire (Boston Scientific Corporation, USA) was used to cross the lesion and was placed distally with some effort due to marked vessel tortuosity. We noticed the development of a series of new “pseudo” lesions beyond the diseased distal segment (Fig. 1). Percutaneous coronary intervention (PCI) to mid RCA was decided. A 6F JR4 (Medtronic Launcher, Medtronic Inc., Minneapolis, Minnesota) guiding catheter was used to engage the RCA. Choice PT extrasupport 0.014 guidewire (Boston Scientific Corporation, USA) was used to cross the lesion and was placed distally with some effort due to marked vessel tortuosity. We noticed the development of a series of new “pseudo” lesions beyond the diseased distal segment (Fig. 1). A 2.5/12 mm semi-compliant sprinter balloon (Medtronic Inc., Minneapolis, Minnesota) was deployed at 16 ATMs and post dilated by a non-compliant Quantum balloon 3.5/12 mm (Boston Scientific Corporation, USA) at 20 ATMs. The final projections proved evidence of satisfactory final result with 0% residual stenosis at the stented segment with persistence of the pseudo-lesions beyond the stented segment (Fig. 3). Despite intracoronary nitrates, the pseudo-lesions persisted and only disappeared after guidewire withdrawal (Fig. 4). The patient tolerated the procedure well and was transferred to the ward and continued to be clinically and hemodynamically stable.
2. Discussion

Lesions or stenoses that appear after placement of the interventional guidewire in a tortuous artery and disappear when the wire is withdrawn are known as pseudolesions. This effect is known as the accordion effect or concertina effect.\textsuperscript{1,2} They are produced by straightening of the tortuous vessel by the guide wire. (Fig. 1) shows clearly near normal distal RCA, immediately after wire placement we noticed what is called concertina effect, (Fig. 2). There is no definite percentage in the literature about how frequent this phenomenon is. However, it does not seem to be a common phenomenon. This phenomenon should be well recognized as the alternative diagnoses which include dissection, thrombosis and spasm dictate unnecessary actions or even harmful interventions such as stent placement or aggressive antithrombotic therapy.\textsuperscript{1}

Increased tortuosity of the vessels and the use of stiff interventional guide wires are the two most important risk factors to bring forth this phenomenon. Tortuosity of the vessel, which might be related to atherosclerosis, ageing or hypertension,\textsuperscript{3} is essential for this phenomenon to occur, as we do not encounter this in relatively straight coronary arteries. Another important factor is the stiffness of the interventional wire; the stiffer or heavier the wire is the more pronounced the effect.\textsuperscript{2,3} Hence, it is more commonly seen when using heavy support wires such as Balance Heavy Weight or Choice Extra Support.

Straightening of the tortuous coronary artery by a “stiff” guide wire results in invagination and beading appearance of the vessel. Whether there is a role for spasm in producing or accentuating this effect is unknown. There is nothing in the literature to support or refute this. However, the morphology of the affected segment looks like spasm followed by an ultra short normal segment followed by spasm and so on giving the impression of beads.\textsuperscript{1}

Figure 1 RCA in LAO 40°. Note the proximal minor irregularities, tight mid segment lesion and minimal distal irregularities.

Figure 2 The proximal-mid and distal irregularities show several slit-like stenotic lesions mimicking concertina effect. Despite multiple doses of intracoronary nitrates these lesions did not disappear.

Figure 3 After stent placement in the mid segment, note the persistence of “concertina effect” in the distal RCA segment while the interventional guide wire is still in place.

Figure 4 Final RCA injection in the same 40° LAO projection after stent placement and interventional guide wire withdrawal. Note the disappearance of proximal and distal pseudolesions (concertina effect) with establishment of TIMI III flow and restoring the RCA to its natural geometry.
It is of paramount importance to recognize the anatomy of the blood vessel with the first injection before placement of the interventional guide wire. Such change happens after the guide wire has been placed distally. Interestingly, the affected arterial segment returns to normal immediately after guide wire withdrawal\(^5\) (Fig. 4).

Theoretically, any vessel maybe affected. Most case reports in the literature described this phenomenon in the coronary arteries; specifically the RCA or the left internal mammary arteries. However, this phenomenon has also been described in other vessels such as carotid and external iliac arteries.\(^6,7\)

In most instances such effect has no major clinical sequelae. However, in some cases pseudolesions may cause hemodynamic compromise and ischemia.\(^8\) In those cases, prompt stenting of the originally stenosed segment followed by removal of the stiff wire is of paramount importance. Another trick would be to exchange the stiff wire with a more floppy wire with an over-the-wire balloon or microcatheter.

3. Conclusion

Concertina effect is mainly induced by a stiff interventional guidewire in a tortuous coronary artery. In most instances is a benign effect that does not require special intervention. It is essential for the interventional cardiologists to be aware of such iatrogenic effects because they are basically benign and the wrong diagnosis may result in non-necessary or sometimes harmful interventions.

Conflict of interest

None.

References