CASE REPORT

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Extremely tortuous coronary arteries – When optical coherence tomography and fractional flow reserve did not help us much

Ekstremno tortuozne koronarne arterije – kada optička koherentna tomografija i frakciona rezerva protoka ne pomažu mnogo

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Abstract

Introduction. Extreme coronary tortuosity may lead to flow alteration resulting in a reduction in coronary pressure distal to the tortuous segment, subsequently leading to ischemia. Therefore the detection of a true cause of ischemia, i.e. whether a fixed stenosis or tortuosity by itself is responsible for its creation, with non-invasive and invasive methods is a real challenge. **Case report**. We presented a case of a patient with a history of stable angina [Canadian Cardiovascular Society (CCS class II)], an abnormal stress test and coronary tortuosity without hemodynamically significant stenosis. Due to suspected linear lesion between the two bends in proximal segment of Right coronary artery (RCA) we performed optical coherence tomography (OCT), minimum lumen area (MLA)-13.19 mm2) and fractional flow reserve (FFR) RCA (0.94). We opted for conservative treatment for stable angina. **Conclusion**. When tortuosities are associated with atherosclerosis in coronary artery for determination of true cause of ischemia invasive methods can be used, such as OCT and FFR.

Key words:
coronary vessels; angina pectoris; blood flow velocity; coronary angiography; tomography, optical coherence.

Apstrakt

Uvod. Ekstremni tortuozitet koronarne arterije može izazvati promene u protoku krvi i samim tim dovesti do pada koronarnog pritiska distalno od tortuoznog segmenta što bi moglo da se manifestuje ishemijom. Samim tim, otkrivanje uzroka ishemije, odgovornog za njen nastanak, šta je fiksna stenoza ili sam tortuozitet, kako neinvazivnim tako i invazivnim metodama, predstavlja pravi izazov. **Prikaz bolesnika**. Prikazan je bolesnik sa stabilnom anginom pektoris [*Canadian Cardiovascular Society* (CCS II)], pozitivnim stres testom i ekstremno tortuoznim koronarnim arterijama, međutim, bez hemodinamski značajnih stenoza. Usled suspektne linearne lezije između dve krivine na proksimalnom segmentu desne koronarne arterije urađena je optička koherentna tomografija (OCT) minimum lumen area (MLA) -13,19 mm^2) i *fractional flow reserve* (FFR) (0,94) pomenute arterije. Opredelili smo se za konzervativno lečenje stabilne angine pektoris. **Zaključak**. Kod udružene ateroskleroze i tortuoziteta koronarne arterije, za ispitivanje uzroka ishemije mogu se koristiti neke od invazivnih metoda, kao što su OCT i FFR.

Ključne reči:
koronarni krvni sudovi; angina pektoris; krv, brzina protoka; angiografija koronarnih arterija; tomografija, optička, koherentna.

Introduction

Extreme coronary tortuosity is conventionally defined as two or more consecutive 180° turns in a major epicardial artery assessed by visual estimation [1]. The etiology of arterial tortuosity is still unclear, but it is believed to be caused by age-dependent or pathological changes of the elastic material in the vessels [2]. We presented a case of a patient with anginal complaints, positive stress test results and extreme tortuous arteries. In this clinical setting, without presence of obvious significant coronary stenosis, it is challenging to determine true origin of anginal complaints.

Case report

A 63-year-old man was admitted at the Cardiology Department for an elective coronary angiography. He had a previous history of anginal complaints [Canadian Cardiovascular Society (CCS II)]. Electrocardiogram showed incom-

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plete right bundle branch block and T wave inversion in III lead. Risk factors for ischemic heart disease were hypertension, hyperlipoproteinemia and smoking. Echocardiography revealed eccentric hypertrophy of the left ventricle with septal hypokinesia and EF 50–55%. Exercise stress test on moderate exertion showed marked, ischemic ST depressions in inferior leads. Coronary angiography was performed through radial artery despite severe tortuosity of radial and subclavian artery, combined with radial spasm (Figure 1). Coronarography revealed absence of the left main (LM) i.e. separate ostiums of left anterior descending (LAD) and left circumfex artery (LCx.) LAD was tortuous artery, without angiographically significant stenosis, and also irrigated big part of an inferior wall (Figure 2). LCx was extremely tortuous artery, with mild atherosclerosis (Figure 2). Right coronary artery (RCA) was extremely tortuous artery proximally, with suspected linear lesion between the two bends (Figure 3). Thus, a decision was taken to further examine the proximal segment of the RCA with optical coherence tomography (OCT) and fractional left main flow reserve OCT, and FFR RCA was performed through femoral artery. First ASAHI SION blue guide wire was easily placed down in postero-lateral (PL) branch. Than OCT RCA revealed only mild atherosclerosis minumum lumen area (MLA) measured in the lesion level-13.19 mm^2], with an oval cross section, typical for tortuous arteries [9] (Figure 4). It turned out that the so-called lesion is nothing more than a curve on an artery. FFR RCA, measured with dedicated pressure wire

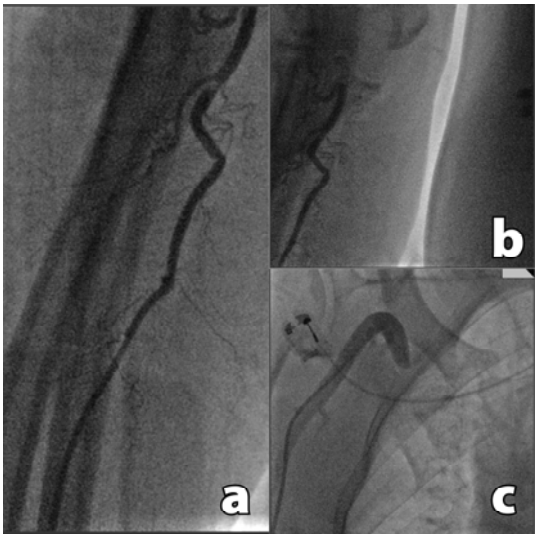

Fig. 1 – a) Spasm; b) Severe tortuosity of radial artery, c) Severe tortuosity of subclavian artery.

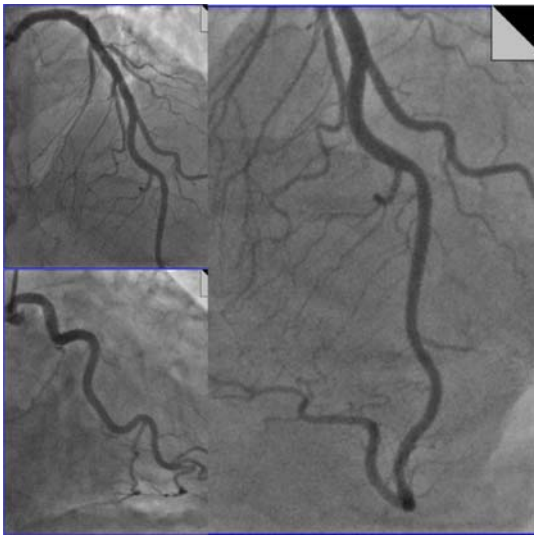

Fig. 2 – Left anterior descending (LAD): tortuous artery, without significant stenosis, also irrigates big part of an inferior wall of left circumflex artery (LCx): extremely tortuous artery, with mild atherosclerosis.

Fig. 3 – Right coronary artery (RCA): extremely tortuous artery proximally, suspected linear lesion proximally, between the two bends.

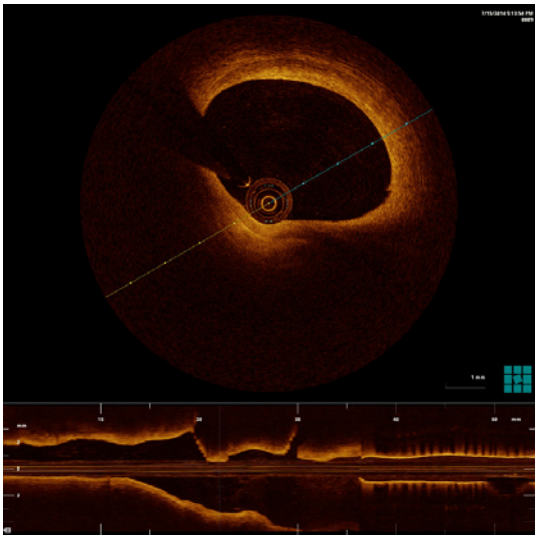

Fig. 4 – Optical coherence tomography (OCT) of right coronary artery (RCA) reveals only mild atherosclerosis, with an oval cross section in the lesion level, typical for tortuous arteries [minimum lumen area (MLA) - 13.19 mm^2]. It turned out that the so-called lesion is nothing more than a curve on an artery.

medially, showed a clearly negative result – 0.94 (Figure 5). RCA angiography with Amplatz GC showed partial straightening of the curves with pressure wire and OCT (Figure 6). Thus, we opted for the optimal medical therapy for treatment stable angina.

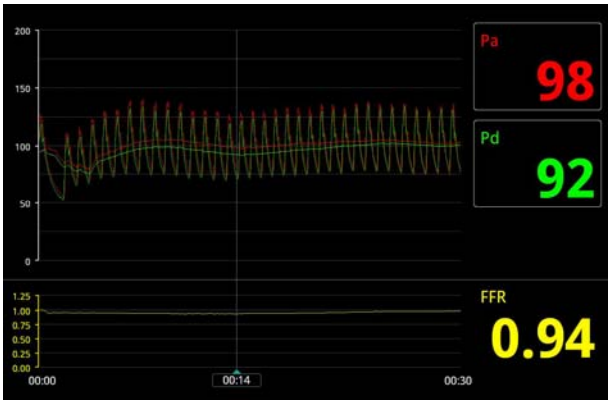

Fig. 5 – Fractional flow reserve (FFR) of right coronary artery (RCA) showed a clearly negative result (0.94), measured medially.

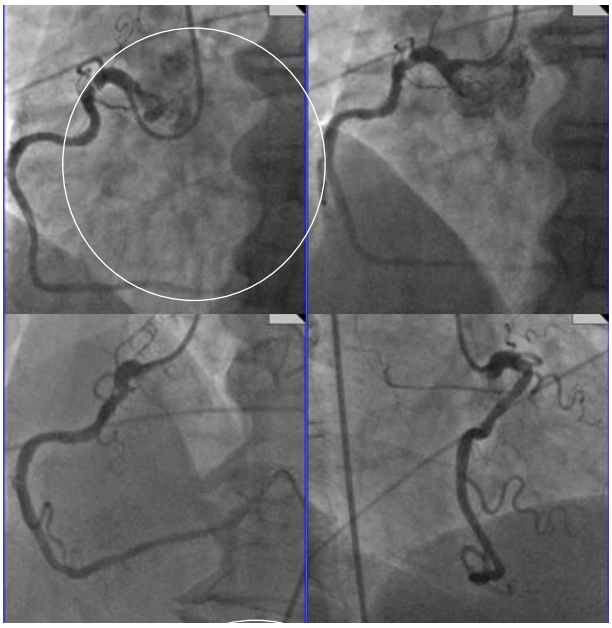

Fig. 6 – Right coronary artery (RCA) angiography with Amplatz GC, partial straightening of the curves with pressure wire and optical coherence tomography (OCT) catheter.

Disscusion

Determinants of coronary tortuosity are gender, age, left ventricle (LV) volume, and muscle mass [3]. Coronary artery tortuosity often correlates with systemic artery tortuosity [4]. Tortuosity is more often seen in the atherosclerotic arteries than in other arteries [5], but less frequently in those with hemodynamically significant stenosis [1]. It is hypothesized that coronary tortuosity leads to flow alteration resulting in a reduction in coronary pressure distal to the tortuous segment of the coronary artery, subsequently leading to ischemia [6–8]. There might be a compensatory mechanism of the tortuous coronary system which will compensate for the theoretical decrease in perfusion pressure in coronary tortuosity at rest [6, 9], while during exercise lack in ability to maintain adequate blood supply [5]. In our case we had a patient with a history of anginal complaints, an abnormal stress test and coronary tortuosity with suspected hemodynamically significant stenosis shown on coronarography. In situation when exercise stress test indicated that inferior wall was in induced ischemia and we found suspected linear lesion between the two bends on proximal segment of RCA, we could not expect that some otherstress tests [stress echo, single/photom emission computed tomography (SPECT)…] would show us what was the real cause of ischemia (stenosis of tortuosity by itself). That is why we performed OCT and FFR RCA, which eventually ended up negative (there was no lesion, nor ischemia). However, it is noticeable that during the performance of FFR, as well as during OCT, came to a partial straightening of the curves (Figure 6), which lead us to accept the result with an amount of doubt. Also there is a myocardial hypertrophy so, even after 100 μg of adenosine was given as intracoronary bolus we cannot be sure that hyperemia was achieved. Conservative treatment was chosen for the treatment of stable angina.

Conclusion

When extreme coronary tortuosity is present, there is also a stenosis of the artery, and it could be very difficult to determine the true cause of ischemia by non-invasive test (i.e. whether it comes from a stenosis or from tortuosity by itself). Further invasive examination [(OCT, FFR, intravascular ultrasound (IVUS)], although quite challenging to perform, could help to determine the hemodynamically significance of stenosis and thus define the manner of treatment.

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