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Case report

Percutaneous treatment of catheter-induced dissection of the right coronary artery and right coronary sinus of Valsalva and ascendenting aorta up to aortic arch

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Abstract Acute aortic dissection during coronary arteriography or percutaneous coronary intervention is quite rare, but potentially dangerous complication In recent years, some reports have shown that stenting the ostium of the coronary artery (right coronary or left main artery) can be a valid, possibly life-saving therapeutic option. We describe a case in which a right coronary artery (RCA) dissection occurred during diagnostic coronary angyography and extended beyond the coronary ostium into the ascending aorta. Sealing of the aortic dissection and rescue of the RCA with stabilization of the patient was possible with rapid stenting of the right coronary ostium.

Kew words dissection of right coronary artery, aortic dissection, PCI

Introduction

Acute aortic dissection during coronary arteriography or percutaneous coronary intervention is quite rare, but life-threatening complication (1-6). Patients in this clinical setting may have a potential risk for acute myocardial infarction (MI) requiring emergency surgery (7). Awareness of the problem and its prompt recognition are essential and the possibility of such a complication should be kept in mind when the patient develops severe chest pain during angioplasty. Still, there remains a paucity of data regarding the risk factors and management of aorto-coronary dissection.

Case presentation

A 55-year-old hypertensive male with a history of posterior MI (few years ago and with successful PCI/stenting LCx : CTO+collaterals) was referred to our institution for coronary angiography because of stabile angina. Risk factors for CAD included current smoking, positive family history for CAD. At admission he was afebrile, blood pressure was 150/100 mmHg, with rhythmic heart beats. Electrocardiogram revealed: Q wave and negative T wave in II, III, aVF, V1, V2. Exercise treadmill stress test was negative. Echocardiography revealed referent left chamber diameters, and hypokinetic infero-posterior wall. Pericard was without effusion. Laboratory referent values of cardiospecific enzymes and other parameters were within normal limits.

Left coronary system injection showed a non significant lesion of the left anterior descending artery (LAD)(Figure 2) and with no significant in-stent and in-segment restenosis on circumflex artery (Figure 1). Using a 6 Fr Judkins Right 4 (JR4) catheter, the ostium of the RCA was easily cannulated and contrast medium was manually injected, but subsequent vigorous injection of contrast medium caused a spiral dissection in the proximal RCA with rapid forward extension distally and acute occlusion of the distal part of RCA (Figure 3-5).

The patient experienced an abrupt onset of severe chest pain and ST-segment elevation in the inferior leads followed by hypotension (systolic blood pressure of 80 mmHg) and bradycardia. Aspirin (300 mg p.o), clopidogrel (600 mg p.o.) and heparin (5000 IU intravenous) were administered. Using a 6 Fr Launcher (JR 4) guiding catheter, the ostium of the RCA was cannulated, and a 0.014 inch floppy Balanced Middle Weight guidewire was advanced into the true lumen in the side branch (RV branch-Figure 6). Double wire technique was used (2nd wire Balance Middle Weight guide wire was used to pass in the distal part of RCA through the dissection and 4,0x15 mm stent was implanted into the ostium of the RCA, achieving restoration of the PDA flow) in attempt to seal the entry site of the dissection, as the only valid and life-saving therapeutic option for patient (Figure 7). Further contrast injection into the RCA retrogradely escaped into the ascending aorta through the dissected lumen beyond the coronary ostium, and showed clear involvement of the right coronary sinus of Valsalva (CSV) (Figure 6 and7). Extension to the ascending aorta occurred during injections done for stent positioning in the proximal, medial and distal part of RCA. There was retention of contrast in the ascending aorta. An aortography was not performed due to the patient's unstable condition. Altogether, 5 stents were successfully implanted in the RCA, with the last stent

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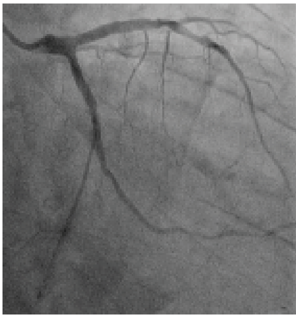
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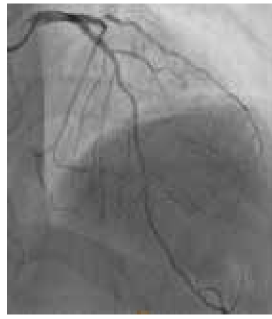
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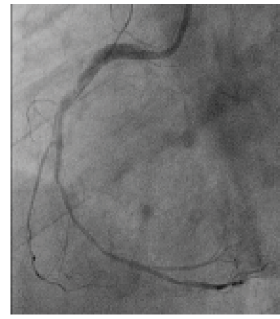
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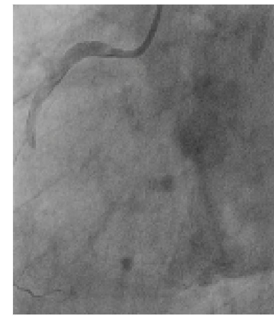
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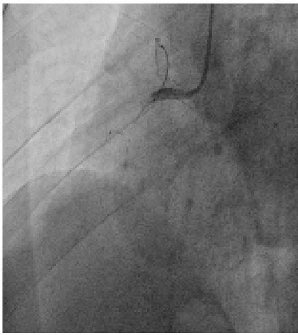
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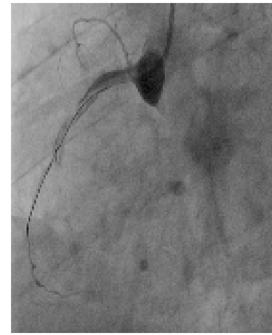
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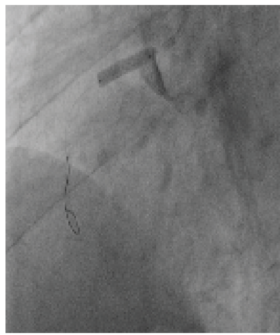
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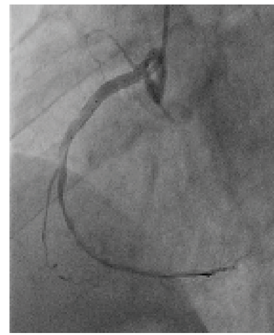
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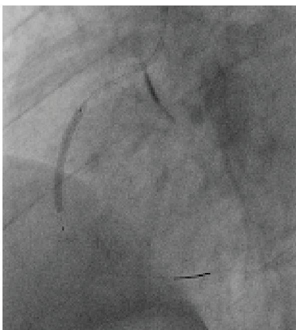
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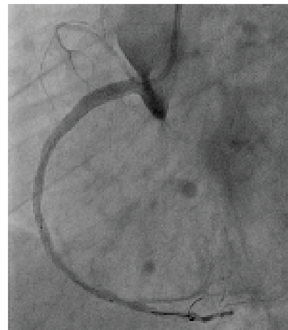
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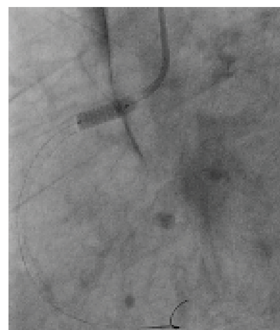
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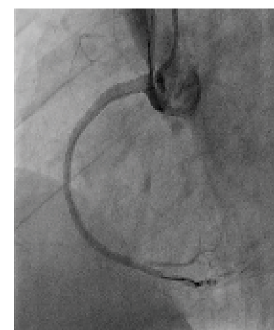
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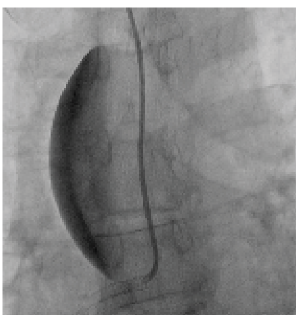
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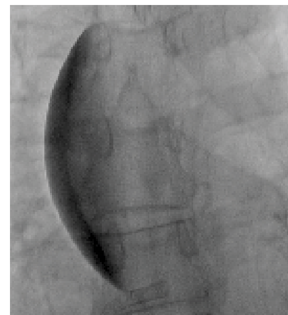
Figure 14

(graft stent;cover stent) in the ostium (Figure 11), covering the first stent implanted in ostial segment of RCA (graft stent to the ostium: 4,0 x 16 mm from the ostial to distal RCA: 4,0 x 15 mm, 3,5 x 18 mm, 3,0 x 33 mm, and 2,75x28 mm respectively)(Figure 7-10). We implanted graft (cover) stent in the ostial part of RCA just to be sure that we completely covered the entry site of the dissection in order to interrupt spreading of the dissection upwards, which appeared to be successful.

After successful coronary stenting, TIMI 3 flow was achieved (Figure 12), persistent dye-staining of the ascending aorta continues (Figure 13 and14), but the patients' condition stabilized as his chest pain was reduced and ST elevation decreased. On-site transthoracic echocardiography revealed an intact ascending aorta without evidence of an intimal flap, pericardial effusion or aortic regurgitation. The patient was immediately transfered to Clinic of Cardio Surgery for futher evaluation and potential treatment. Aortic dissection was confirmed by CT angio, but surgeons decided to treat it conservatively. Two weeks later, the patient was discharged without symptoms from the Clinic of Cardio Surgery, with following therapy: Ticagrelor (90 mg twice a day), Aspirin (100 mg daily), Atorvastatin (80 mg daily), Pantoprasole (20 mg daily), Nebivolol (5mg daily).

Six months later, CT angio was performed: RCA with good flow and no significant restenosis. Thrombosis of false lumen was completed from a beginning of around 2.5cm from right coronary sinus, involving each supra-aortic branches; left common carotid artery and left subclavian artery were open completely, but truncus brachiocephalicus had eccentric thrombosed false lumen with reduced lumen at the beginning of the right common carotid artery as well as stenosis in the distal part of around 60% up to the bifurcation. The patients was free of any symptoms.

Discussion

Iatrogenic aorto-coronary dissection is quite rare. The overall incidence of catheter-induced coronary dissection remains unknown, but aorto-coronary dissection has been estimated to occur in approximately 0.008–0.02% of diagnostic catheterizations and 0.04–0.06% of PCIs[1-3]. Of the type-A dissections in the International Registry of Aortic Dissection (IRAD), 27% were caused by coronary angiography or interventions. This event is a devastating complication of PCI, with a mortality rate up to 32%, similar to that of spontaneous type-A aortic dissection (35%)[1-7].

The exact mechanism responsible for the propagation of coronary dissection and the occurrence of aortic dissection remains to be established. However, it appears that the entry point originates within the coronary dissection and subsequently leads to progressive retrograde extension of the subintimal space into the aortic root. It occurs following a trauma caused by the tip of the guiding or diagnostic catheter (due to unintended deep intubation), subintimal passage of the rigid guidewire, or because of balloon dilatation. With the advent of complex interventions such as revascularization of chronic total occlusions, left main stenting, ostial and bifurcation lesions and saphenous vein graft lesions, this complication may become more prevalent.

Risk factors for aorto-coronary dissection include hypertension, older age, extensive atherosclerosis and underlying structural weakness of the media (e.g., cystic medial necrosis). Pande et al.[8] reported a case of iatrogenic aortic dissection during angioplasty of the RCA in a patient with cystic medial necrosis.

Our patient was hypertensive without aortic root dilation, and had neither clinical evidence nor family history of Marfan's syndrome or other causes of medial necrosis, although there is no histopathologic specimen. A history of MI has been proposed as a risk factor for aorto-coronary dissection. Dunning et al[9] described two patients with an extensive aorto-coronary dissection. Both of these patients underwent coronary angiography due to acute MI.

Left Amplatz guiding catheters were commonly involved in a disproportionate number of catheter-induced right coronary dissections. The choice of guiding catheter is a risk-benefit trade-off between extra back-up. and the possibility of coronary dissection. Other reported risk factors include variant anatomy of the coronary ostia (e.g., downward sloping origin of the left main coronary artery), vigorous hand injection of contrast material (as in our case), and even vigorous inspiration during contrast injection (respiratory-induced changes in Amplatz shaped catheter position). The size of the diagnostic catheters may also be important. We routinely use 5 Fr catheters for this purpose, but with smaller (4Fr) diagnostic catheters, the incidence of iatrogenic coronary dissections might be reduced.

Cautious techniques that can minimize the occurrence of iatrogenic dissection include: (1) checking pressure before every coronary injection; (2) avoiding deep engagement of guiding catheters and maintaining a steady tension on the guiding catheter while the angioplasty balloon is withdrawn; (3) prompt and timely recognition of this complication; and (4) minimizing futile efforts to halt the progression of the dissection.

Many of the cases of aorto-coronary dissections described in the literature have involved the RCA. Currently, it is unknown why the RCA is more susceptible to retrograde dissection into the CSV than the left main coronary artery (LMCA)[10-13]. Furthermore, it is interesting to note that when dissecting aortic aneurysms involve the coronary arteries, the RCA is also the one usually affected. The inherent properties of the RCA, which defers from the LMCA, may predispose the patient to aorto-coronary dissection.

Moles et al.[14] reported the first cases of aortic dissection as a complication of PCI. Their two cases had different evolutions. In their first case, the dissection of the aorta was limited to the left CSV, and surgical intervention was not necessary. In their second case, on the other hand, surgical management was necessary because the entry was in the aortic intima adjacent to the conal artery, leading to dissection of the ascending aorta. A patient reported by Varma et al.[15] with RCA dissection during PCI extending into the aortic root died within 48 hours with conservative treatment. Dunning et al. (9) described two patients with a Class 3 dissection who were submitted to surgery, and who died before discharge. In Maiello's report[16], a case of extensive dissection (Class 3) of the ascending aorta that occurred during angioplasty of the RCA was successfully treated by means of coronary stent implantation. Sutton et al.[17] described a case in which retrograde dissection of the aorta necessitating urgent surgical repair occurred during an attempt to open a chronically occluded RCA. Initially localized, the dissection extended during an attempt to seal the right coronary ostium. They suggested that if localized retrograde aortic dissection occurred, the management would depend on the stability of the distal coronary vessel. If stable, a conservative approach would be preferable to an attempt to seal the dissection.

Still, there remains a paucity of data regarding the management of aorto-coronary dissections and wide variety of potential clinical outcomes hampers attempts to standardize treatment. Despite the lack of evidence-based guidelines for the optimal treatment of aorto-coronary dissection, some reports have shown that stenting the ostium of the coronary artery (RCA or left main) can be a valid and life-saving therapeutic option for the patient. It is reasonable to attempt to seal the entry site of the dissection with PCI and stenting first, then the extent of dissection can be assessed (as in our case). From the technical viewpoint, soft-tip wires should be used when attempting to access the true lumen, and if the initial wire enters the false lumen, another soft-tip wire should be carefully manipulated into the true lumen (double-wire technique)[18]. Stenting should be performed as soon as possible, as saving time is mandatory in this setting, and implantation should be started distally and finally to the RCA ostium.

The evolution of the aorto-coronary dissection can be monitored by means of transesophageal echocardiography. This conservative management (the "watchful

waiting" strategy, suggested by Alfonso et al.[19]) is a reasonable option only in the hemodynamically stable patient with localized aortic dissection (as in our case). On the other hand, the progression of an aortic dissection with unstable hemodynamics, acute severe aortic regurgitation, hemopericardium and intractable chest pain are clear indications for intervention. The sinus of Valsalva dissections that remain localized during catheterization tend to resolve spontaneously in the first month. Localized dissections of coronary arteries have also been successfully treated conservatively, although Mulvihil et al.[20] have described intense healing of these localized coronary dissections, resulting in scar formation with coronary flow obstruction.
To guide the choice for the best therapeutic strategy, a classification of iatrogenic dissection of the ascending aorta has been proposed. This classification is based on the extent of dissection to the aortic root. A focal dissection limited to the coronary cusp (Class 1), and a dissection extending to the ascending aorta but 40 mm in length (Class 3) is still controversial, and ostial stenting may be life-saving, as in our case.
In the present case, an extensive iatrogenic aortic dissection that was limited to the ascending aorta was successfully managed by stenting the ostium of the RCA and monitoring the aortic dissection by CT angio and transthoracic echocardiography.

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Sažetak

Perkutano lečenje kateterom izazvane disekcije desne koronarne arterije i desnog sinusa Valsalve sa propagacijom prema ascedentnoj aorti i aortnom luku

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Akutna disekcija aorte tokom koronarne arteriografije ili perkutane koronarne intervencije prilično je retka, ali ozbiljna komplikacija Poslednjih godina neki izveštaji pokazuju da stentiranje ostijuma koronarne arterije (desna ili leva koronarna arterija) može biti adekvatna i životno spašavajuća terapijska opcije. Predstavljamo slučaj u kojem je disekcija desne koronarne arterije (RCA) nastala tokom dijagnostičke koronarne angiografije sa širenjem prema sinusu Valsalve i ascendentnoj aorti. Zaustavljanje disekcije aorte i zbrinjavanje RCA sa kliničkom stabilizacijom pacijenta bilo je moguće brzom implantacijom stenta u ostijum desne koronarne arterije.

Ključne reči: disekcija desne koronarne arterije, disekcija aorte, PCI