Immediate and total stent recoil after a successful Platinum-chromium Everolimus-eluting stent deployment: Case report and systematic review

Une complication immédiate de l'angioplastie coronaire avec un stent actif à élution d'évérolimus: à propos d'un cas et revue de la littérature

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Summary

A patient who presented with NSTEMI and underwent a successful Platinum-chromium Everolimus-eluting stent (PtCr-EES) in the left anterior descending artery followed by an acute stent radial collapse. This case confirms the exsisting risk of stent recoil as described in the literature. This presentation is characterized by the immediate and total recoil of a well-deployed 3.5 x 20 mm PtCr-EES. Acute stent collapse represents a critical feature of stent failure. Identification of lesions at high risk is mandatory so that the necessary preventive measures are implemented.

Keywords

acute stent recoil, NSTEMI, case report

Résumé

Le cas d'un patient qui s'est présenté avec un NSTEMI traité par angioplastie de l'interventriculaire antérieure (IVA) par un stent actif à élution de platine-chrome-évérolimus (PtCr-EES) compliquée d'un recoil du stent. Ce cas confirme le risque existant de recoil du stent tel que décrit dans la littérature. L'identification des lésions à haut risque est obligatoire pour que les mesures préventives nécessaires soient mises en œuvre.

Mots-clés

recoil, angioplastie, syndrome coronaire aigu

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CASE REPORT

A 51-year-old male patient consulted the emergency room with NSTEMI, persistent angina, T –Inversion in V2-V5 and highly elevated Troponin T (575 pg/ml, normal value 14 pg/ml) in context of ongoing myocardial ischemia. He is smoker and has non-treated elevated LDL. The LV ejection fraction was mildly reduced (49%).

A coronaroangiography was urgently performed and showed a chronic proximal RCA obstruction, a severe proximal LAD stenosis with TIMI II flow and an intact RCX (Figure1). A 6-French size JL4 guide catheter (The Launcher™, Medtronic) was inserted from the radial artery and engaged to the LCMA ostium. A percutaneous coronary intervention in LAD was started with uncomplicated crossing of the LAD lesion with a HI-Torque Balance Middleweight ™ Guide Wire (Abbott vascular). The lesion was prepared with a 2.5 x 12 mm semicompliant balloon (Emerge™ MR Boston Scientific) up to the rated burst pressure. The patient developed an intensification of angina in the context of low ischaemia tolerance.

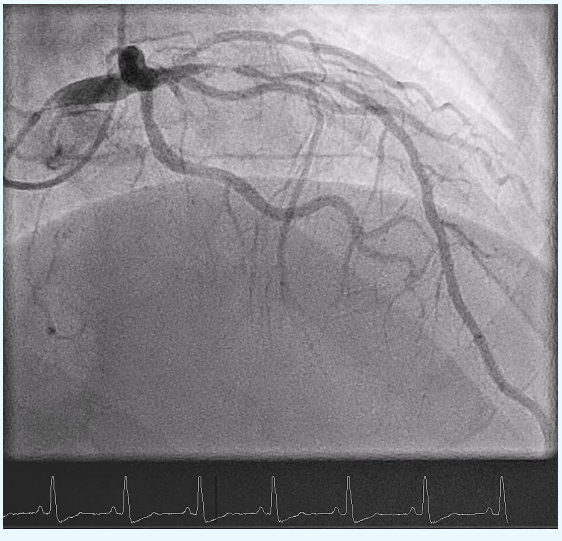

Figure 1. RAO cranial view with severe LAD stenosis

An 3.5 x 20 mm everolimus-eluting platinum chromium (PtCr) stent (Promus ELITE™, Boston Scientific) was successfully deployed up to the rated burst pressure (16 atmosphere). The balloon inflation was held for 8 seconds and had to be stopped due a resumption of the angina attack (Figure 2). A good angiographic result with well expanded stent was achieved. Stent edge dissection was not detected. The patient was afterwards symptom-free. 10 min after the end of the procedure, the patient complained of severe angina. The monitor shows a change in the ST segment, so that a re-coronaroangiography was immediately carried out.

Figure 2. Caudal view with successfully deployed PtCr-EES in the proximal LAD

A 6-French size JL4 guide catheter (The Launcher™, Medtronic) was inserted from the femoral artery and engaged to the LCMA ostium. The LAD was totally occluded at the proximal stent edge (Figure3). The deployed stent was in its medial and distal part significantly collapsed. The HI-Torque Balance Middleweight ™ Guide (Abbott vascular) failed to cross the stent obstruction. A HI-TORQUE PILOT™ 50 Guide Wire (Abbott vascular) crossed the collapsed stent laboriously. The LAD flow remained unrestituted. An Infation with a 2.0 mm x 15 mm NC-Balloon (NC-Emerge™ - Boston Scientific) in the collasped stent was performed. The way the balloon unfolded in the stent confirmed the suspicion of a relevant radial stent collapse (Figure 4). The attempt to insert the IVUS catheter into the stent led to angina and a fall in blood pressure in a patient with low ischaemia tolerance. The intervention was finalised with a two successive 8 second post-dilatation with a 3.5 mm x 15 mm NC-Balloon (NC-Emerge™ - Boston Scientific) up to 18 atm (Figure 5). A flow TIMI III was than achieved (Figure 6).

Figure 3. Caudal view with totally occluded LAD after Stenting

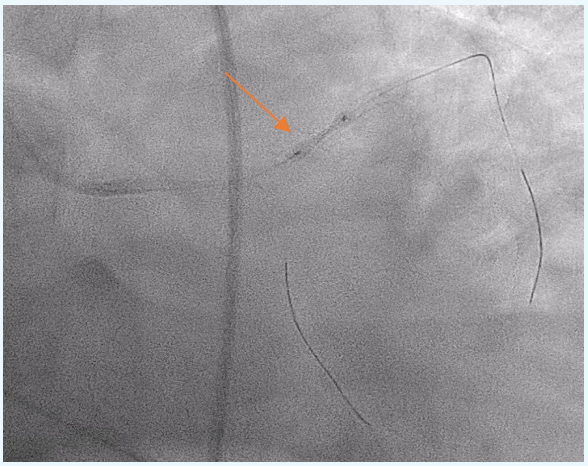

Figure 4. Caudal view with successfully deployed PtCr-EES in the proximal LAD

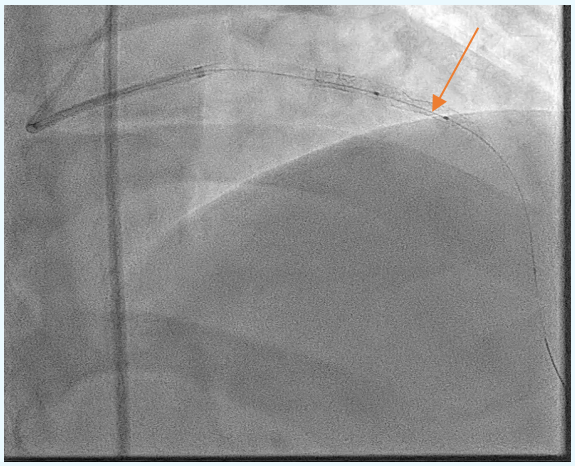

Figure 5. Caudal view with Infation of 2.0 mm x 15 mm NC-Balloon. Notice the Stent collapse

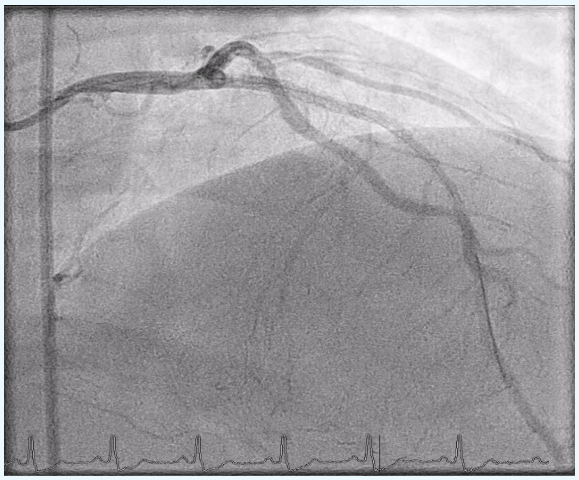

Figure 6. RAO cranial view with the final result

DISCUSSION

The determining concept in stent implantation and in understanding the acute stent recoil is radial strength, which is a quantitative measure of stent scaffolding strength and the ability of a stent to maintain the vessel lumen [1].

The manufacturer's estimation of the stented lumen dimensions and those that are actually obtained are significantly discrepant, even with the use of moderately high pressures to deploy the stents [2]. Oversizing the stent delivery balloon relative to the balloon-vessel ratio resulted in a greater restriction on balloon deployment and expansion [3].

The elastic recoil of the atheromatous lesion and non-diseased sections of the arterial wall occurs after stent deployment [2]. Stents are designed with a high radial force to prevent recoil following deployment. Nevertheless, acute elastic recoil is in vivo not rare and produces the loss in acute gain achieved with balloon angioplasty.

Recent trends in metallic stent materials include CoCr or PtCr alloys enable thinner-strut stent designs (81 μm) compared with conventional stainless steel stents biolimus-eluting stent (135 μm). Despite the theoretical advantages in flexibility and deliverability concern has also been raised about possibly reduced radial strength.

PtCr-EES has the same strut thickness as the CoCr-EES

(81 µm), however some studies has proven that PtCr-EES could gain higher strength than the CoCr-EES. As a result, PtCr-EES could have lower acute stent recoil [4].

Special Lesion factors predict a stent fracture including calcified, severely tortuous vessels, excessive hinge motion, treated chronic total occlusions and Ostial stent location [5].

A distortion of implanted coronary stent along its longitudinal axis during coronary is frequently seen with newer drug eluting stents, especially Promus Element. It is usually caused by impact of guide catheter tip, or following passage of catheters like balloon catheter, IVUS catheter, guideliner, etc. [6].

In this case, the stent balloon was withdrawn after complete deflation and with manual stabilisation of the guiding to prevent deep intubation. In this regard, a deformation of the Promus stent was unlikely.

Several in vivo studies using QCA, IVUS, or OCT demonstrated that sufficiently longer balloon inflations (25-60 seconds or longer) resulted in better stent expansion compared with a shorter balloon inflation [7].

However, maintaining a long stent inflation time especially in non-protected left main coronary artery disease, proximal left anterior descending, lesions close to the left main coronary artery, proximal right coronary lesion with right dominant coronary artery, or the donor artery of collateral circulations could provoke a blood pressure drop, severe bradycardia or angina recurrence.

The frequency of balloon inflation represents another important factor affecting stent expansion. In BES, CoCr-EES and PtCr-EES, three-time-inflation group showed significantly lower acute stent recoil compared with one-time-inflation [8]. An expiremental study consisting of MLD comparaison after post-dilatations using a non-compliant balloon (3.25 mm, 20 atm) as a single long (30 sec) vs. multiple short (10 sec x3) deployments, demonstrated a better result and tolerance oft the multipe short deployment regime [9]. The same study pleaded for the use of the same stent balloon for the second deloyment rather than switchting to NC balloon, as the first strategy appears effective and cost-efficient [9]. It has been concluded in this case, that the collapse of the stent was a result of the several mechanisms including obviously insufficient expansion time, rigidity and localisation of the lesion.

RESULTAS

Acute stent recoil is the predominant mechanism by which stents fail to achieve the nominal CSA of their dilating balloon, and in the worst scenario to stent collapse und total vessel obstruction. Adequate treatment of certain stenoses, whose characteristic predicts stent collapse, requires postdilatation strategies to overcome the recoil phenomenon and result in a final stent cross section area that approximates the reference artery CSA.

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