



CONSEQUENCES OF THE IMPOSSIBILITY TO PROVIDE A FINAL KISSING BALLOON IN DUAL STENT BIFURCATION TECHNIQUE

Marin Vučković¹ and Sandra Šarić^{1,2}

¹Department of Cardiology, Osijek University Hospital Centre, Osijek, Croatia

²Faculty of Medicine, Josip Juraj Strossmayer University of Osijek, Osijek, Croatia

SUMMARY – Final kissing balloon is the cornerstone of double stent techniques for bifurcation lesions. It provides restoring of the optimal anatomic and physiological features of coronary artery bifurcations. Skipping this step can lead to catastrophic consequences, and resolving complication can be very challenging despite all available tools and tricks. Some interventional tools can be helpful but can also result in new complications. This is a case report on an unsuccessful attempt of resolving an acute complication after coronary artery bifurcation stenting with two-stent technique, despite all tricks we had in our pocket at that time. In this report, we will also show problems that can occur when trying to cross stent strait with microcatheter, and use of intracoronary imaging in resolving foreign body location.

Key words: *bifurcation stenting, final kissing balloon, two-stent technique, foreign body, intravascular ultrasound*

Introduction

Stenting coronary bifurcation is the art of finding the optimal bifurcation technique that restores the anatomy and functionality of coronary bifurcation. Every coronary angiogram is unique like every tree in a park. 15-20 % of all coronary lesions are bifurcation lesions (1). Feasibility of placing stents in coronary bifurcation depends on the dimension of mother and daughter vessels, bifurcation angle, plaque burden and the plaque anatomic positioning. Two-stent bifurcation techniques are accompanied with a higher risk of major adverse cardiovascular events – MACE (2,3), periprocedural risk of MI (4), and coronary restenosis rate in the follow up (5). Clinical trials can not provide an universal answer on what bifurcation technique should be used, but final kissing balloons in two-

stent bifurcation techniques should be done to reduce MACE (6,7,8).

Case presentation

Our patient was a 64-year-old gentleman who came to UHC Osijek from another hospital institution in our region. He was transferred because of non-ST elevation myocardial infarction (NSTEMI) for an early angiography procedure.

He is diabetic, with a history of arterial hypertension for at least five years. He had prior NSTEMI four years before and a percutaneous coronary intervention with positioning of one drug eluting stent (DES) in the proximal part of the first diagonal branch (D1).

Coronary angiography was performed and an ad hoc PCI of the mid-left anterior descending artery (LAD) on bifurcation with D1, Medina 1,1,1 was stented with 2 DES with the planned mini crush (MC) technique. Simultaneous kissing balloons (SKB) were not introduced because of the impossibility to rewire

Corresponding author:
Marin Vučković
marin.vuckovic@gmail.com

the first diagonal branch after positioning the stent in LAD. The procedure was finished with a good angiography result of LAD and dissection type B distally to the stent in D1, but the optimal TIMI III contrast flow (Thrombolysis in Myocardial Infarction) in both branches (Fig 1). Stenting this type of dissection was not necessary, so SKB was not performed.

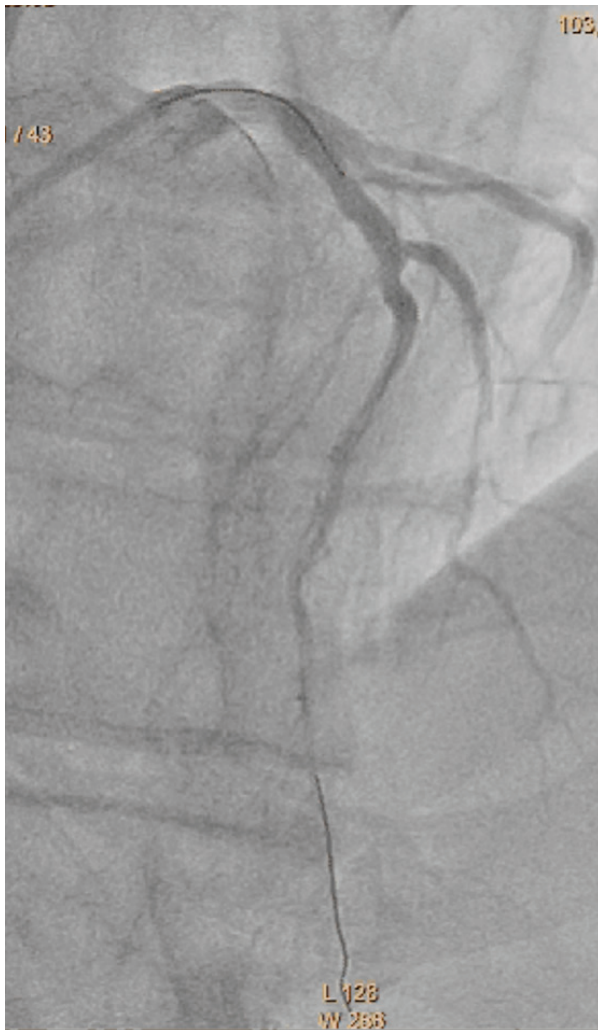


Fig 1. Coronary angiography after mini crush stenting of LAD/D1 (the arrow shows a dissection type B distally from the previously positioned stent in D1)

The patient was discharged on the second day after the procedure with no symptoms of angina pectoris or heart failure.

Ten days after discharge, the patient felt strong chest pain with shortness of breath and examined by

the emergency team. ECG indicated an anterolateral ST elevation myocardial infarction, and he was urgently referred to catheterisation laboratory for a new coronary angiography procedure. Angiography revealed an acute occlusion of ostial D1.

Wiring of D1 was performed using a hydrophilic wire, but the positioning of the smallest balloon (a specialised chronic total occlusion balloon 0.8 mm in diameter) across two layers of stents strats was unsuccessful despite of re-POT, positioning of the guide extension and the anchoring technique. The next step in our mind was to exchange the hydrophilic wire for extra support wire through a microcatheter (MC). We used the Asahi Corsair MC and despite the inability to cross through stent strats, the extra support wire was successfully positioned in the distal part of the occluded D1.

Fluoroscopy immediately revealed a torn-off part of the MC tip positioned in the ostial D1.(Fig 2.) Despite all techniques that were mention earlier (the positioning of the guide extension and the anchoring technique) and the positioning of the extra-support wire through stent strats, the balloon did not pass so we finished our procedure with no success and leaving a torn-off part of the MC tip in the occluded LAD branch.

After that, we decided to inspect the intraluminal area of LAD with intravascular ultrasonography. In spite of the ostial D1 positioning of the torn tip of MCs

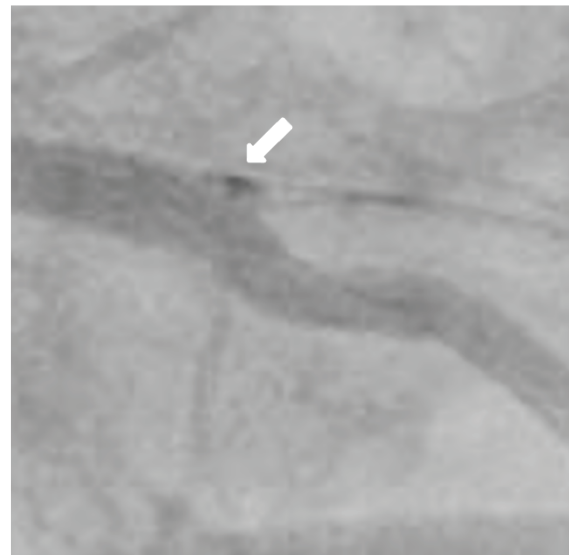


Fig 2. The Asahi Corsair microcatheter torn-off tip (arrow), between the strat layers in the ostial D1



Fig 3. The final result with the left inside the microcatheter torn-off tip

there was no prolapse of the foreign part in the luminal part of LAD, just a few malapposed struts that were corrected with balloon postdilatation. (Fig. 3.)

Discussion

The mechanism of occlusion is not completely clear in this case report of percutaneous coronary intervention, but we believe that it could be a result of two possible failures, i.e., the iatrogenic coronary artery dissection and the two stent layers in front of the side branch ostium.

Coronary artery dissections were categorized as the class A-F type by the National Heart, Lung and Blood Institute classification system (9).

Our patient had a type B coronary artery dissection with TIMI III coronary grade flow. In 1991, Huber et al examined 691 iatrogenic coronary artery dissections that were categorized according to NHLB Institute classification system (10). The patients with the type B coronary artery dissections had no increase in morbidity and mortality compared with the patients without any kind of angiography detected dissections. One hundred forty-eight procedures were categorized as C to F type dissections and were accompanied with an increase in hospital complications (acute closure, need for emergency coronary bypass surgery, repeated angioplasty and acute myocardial infarctions). A clinical success and acute rise in hospital complications in the type B and types C to F dissections were statistically significant. This is the reason why leaving type B dis-

section without stenting could be a safe option in PCI.

The final kissing balloon in two-stent techniques appears to be a beneficial step in the research trial conducted by Biondi-Zoccai et al (8) and we encourage every operator not to miss that final step in this type of bifurcation stenting. Wire and balloon crossing through two stents layers can be challenging and sometimes impossible despite outstanding wire flexibility and traceability, balloon design or operator skills and strong support. Knowing what bifurcation technique has the best result in achieving a successful final kissing is very important for choosing the optimal bifurcation stenting strategy.

In most cases, bifurcation lesions can be treated with the provisional stenting approach, but sometimes 2-stent approach is necessary. There have been several randomized trials with different and variable conclusions in 2-stent bifurcation techniques. One trial (11) from 2016 found that the culotte stenting technique had significantly lower incidence of angiographic restenosis compared to TAP stenting, which is a similar result compared to the crush technique in another study (12), but with lesser percentage of FKB. In DK-CRUSH III trial (13), the culotte technique has been associated with inferior results compared to the double kissing crush technique but in the left main disease. In our opinion, the best results can only be achieved with completing every step of the specified technique.

Finally, trying to cross uncrossable struts with MC-s carries a sustainable risk of tip tearing off. Intracoronary imaging can help us understand where that foreign part is positioned and if there is a need to stent it if there is no possibility of pulling it out.

Conclusion

Every percutaneous coronary intervention has the potential to cause complications, and some of those complications may be disastrous. In coronary interventions, it is important to identify and resolve complications. Clinical trials can identify the necessity for stenting coronary artery dissections as well as other important technical steps in coronary interventions, such as the optimal use of final kissing balloons.

References

1. Serruys PW, Onuma Y, Garg S, et al. 5-year clinical outcomes of the ARTS II (Arterial Revascularization Therapies Study II. of the sirolimus-eluting stent in the treatment of patients with multivessel de novo coronary artery lesions. *J Am Coll Cardiol* 2010;55:1093-101.

2. Park TK, Park YH, Song YB, et al. Long-term clinical outcomes of true and non-true bifurcation lesions according to Medina classification- results from the COBIS (COronary Bifurcation Stent) II registry. *Circ J*. 2015;79:1954-1962.
3. Armstrong EJ, Yeo KK, Javed U, et al. Angiographic stent thrombosis at coronary bifurcations: short- and long-term prognosis. *JACC Cardiovasc Interv*. 2012;5:57-63.
4. van Houwelingen KG, van der Heijden LC, Lam MK, et al. Long-term outcome and chest pain in patients with true versus non-true bifurcation lesions treated with second-generation drug-eluting stents in the TWENTE trial. *Heart Vessels*. 2016;31:1731-1739.
5. Roh JH, Lee JH, Kim YH, et al. Procedural predictors of angiographic restenosis after bifurcation coronary stenting (from the choice of optimal strategy for bifurcation lesions with normal side branch and optimal stenting strategy for true bifurcation lesions studies). *Am J Cardiol*. 2015;116:1050-1056.
6. Gaido L, D'ascenzo F, Imori Y, Wojakowski W, Saglietto A, Figini F, Mattesini A, Trabattoni D, Rognoni A, Tomassini F, Bernardi A, Ryan N, Muscoli S, Helft G, De Filippo O, Parma R, De Luca L, Ugo F, Cerrato E, Montefusco A, Pennacchi M, Wańha W, Smolka G, De Lio G, Bruno F, Huczek Z, Boccuzzi G, Cortese B, Capodanno D, Omedè P, Mancone M, Nuñez-Gil I, Romeo F, Varbella F, Rinaldi M, Escaned J, Conrotto F, Burzotta F, Chieffo A, Perl L, D'amico M, Di Mario C, Sheiban I, Gagnor A, Giammaria M, De Ferrari G; Impact of Kissing Balloon in Patients Treated With Ultrathin Stents for Left Main Lesions and Bifurcations An Analysis From the RAIN-CARDIOGROUP VII Study; *Circulation: Cardiovascular Interventions*; 10.1161/CIRCINTERVENTIONS.119.008325
7. Annapoorna S. Kini, MD; George D. Dangas, MD, PhD; Usman Baber, MD, MS; Yuliya Vengrenyuk, PhD; David E. Kandzari, MD; Martin B. Leon, MD; Marie-Claude Morice, MD; Patrick W. Serruys, MD, PhD; A. Pieter Kappetein, MD, PhD; Joseph F. Sabik 3rd, MD; Ovidiu Dressler, MD; Roxana Mehran, MD; Samin K. Sharma, MD; Gregg W. Stone, MD. Influence of final kissing balloon inflation on long-term outcomes after PCI of distal left main bifurcation lesions in the EXCEL trial. *EuroIntervention* 2020;16:218-224. DOI: 10.4244/EIJ-D-19-00851
8. Biondi-Zoccai, G., Sheiban, I., De Servi, S. *et al.* To kiss or not to kiss? Impact of final kissing-balloon inflation on early and long-term results of percutaneous coronary intervention for bifurcation lesions. *Heart Vessels* 29, 732-742 (2014). <https://doi.org/10.1007/s00380-013-0416-0>
9. Rahman, Zaina & Ullah, Mohammad & Choudhury, AK. (2011). Coronary Artery Dissection and Perforation Complicating Percutaneous Coronary Intervention – A Review. *Cardiovascular Journal*. 3. 10.3329/cardio.v3i2.9198.
10. Huber, Michael & Mooney, Jodi & Madison, James & Mooney, Michael. (1991). Use of a morphologic Classification to predict clinical outcome after dissection from coronary angioplasty. *The American journal of cardiology*. 68. 467-71. 10.1016/0002-9149(91)90780-O.
11. Ferenc M, Gick M, Comberg T, Rothe J, Valina C, Toma A, Löffelhardt N, Hochholzer W, Riede F, Kienzle RP, Achdari A, Neumann FJ. Culotte stenting vs. TAP stenting for treatment of de-novo coronary bifurcation lesions with the need for side-branch stenting: the Bifurcations Bad Krozingen (BBK) II angiographic trial. *Eur Heart J*. 2016 Dec 1;37(45):3399-3405. doi: 10.1093/eurheartj/ehw345. Epub 2016 Aug 30. PMID: 27578807.
12. Kervinen K, Niemelä M, Romppanen H, Erglis A, Kumsars I, Maeng M, Holm NR, Lassen JF, Gunnes P, Stavnes S, Jensen JS, Galløe A, Narbutė I, Sondore D, Christiansen EH, Ravkilde J, Steigen TK, Mannsverk J, Thayssen P, Hansen KN, Helqvist S, Vikman S, Wiseth R, Aarøe J, Jokelainen J, Thuesen L; Nordic PCI Study Group. Clinical outcome after crush versus culotte stenting of coronary artery bifurcation lesions: the Nordic Stent Technique Study 36-month follow-up results. *JACC Cardiovasc Interv*. 2013 Nov;6(11):1160-5. doi: 10.1016/j.jcin.2013.06.009. PMID: 24262616.
13. Chen SL, Xu B, Han YL, Sheiban I, Zhang JJ, Ye F, Kwan TW, Paiboon C, Zhou YJ, Lv SZ, Dangas GD, Xu YW, Wen SY, Hong L, Zhang RY, Wang HC, Jiang TM, Wang Y, Sansoto T, Chen F, Yuan ZY, Li WM, Leon MB. Clinical Outcome After DK Crush Versus Culotte Stenting of Distal Left Main Bifurcation Lesions: The 3-Year Follow-Up Results of the DKCRUSH-III Study. *JACC Cardiovasc Interv*. 2015 Aug 24;8(10):1335-1342. doi: 10.1016/j.jcin.2015.05.017. PMID: 26315736.

Sažetak

POSLJEDICA IZOSTANKA PROVOĐENJA FINALNOG KISINGA BALONA U TEHNICI DVA STENTA

M. Vučković i S. Šarić

Finalni „kissing“ balona (FKB) je vitalan korak prilikom stentiranja koronarnih bifurkacija s tehnikom dva stenta. FKB omogućava povrat optimalnih anatomskih i fizioloških karateristika koronarnih arterijskih bifurkacija. Preskakanje ovoga koraka može dovesti do katastrofalnih posljedica, a njihovo rješavanje može biti vrlo zahtjevno unatoč dostupnim alatima i trikovima. Intervencijski alati mogu pomoći u rješavanju koronarnih komplikacija, ali isto tako mogu dovesti do novih komplikacija. Ovaj prikaz slučaja je neuspješan pokušaj rješavanja akutne komplikacije nakon bifurkacijskog stentiranja koronarne arterije sa tehnikom dva stenta unatoč brojnim trikovima kojima smo se poslužili u tom trenutku. Ovim prikazom željeli smo pokazati probleme koji se mogu dogoditi prilikom prolaska mikrokateretera kroz stratove stenta te korištenje intrakoronarnog oslikavanja za prikaz lokacije stranog tijela.

Ključne riječi: *stentiranje koronarnih bifurkacija, finalni kissing balona, tehnika dva stenta, strano tijelo, intravaskularni ultrazvuk*