



Overcoming an under-expanded and undilatable stent

Cómo superar un stent poco expandido y no dilatado

Arash Hashemi,* Ahmet Karagöz,‡ Arash Gholoobi,§ Lida Ghaffari,‡
Arsis Ahmedieh,* Melisa Uçar,‡ Mehdi Zoghi¶

Keywords:

under-expanded,
balloon uncrossable,
chronic total occlusion.

Palabras clave:

subexpandido, globo
incruzable, oclusión
total crónica.

ABSTRACT

Underexpansion is an important issue for interventional cardiologists in terms of long term results. Herein we report a successful rotablation of an under-expanded stent struts. The patient was a 75 years old female with a history of Percutaneous Coronary Intervention (PCI) on Left Anterior Descending Artery (LAD) with 2 overlapping drug eluting stents a week ago in another center. Unfortunately, the stents were deployed without proper lesion preparation in heavily calcified lesions and hence the stents couldn't be dilated properly after deployment. The stent struts were successfully rotablated with 1.5 and 1.75 burrs respectively followed by subsequent stenting. The patient was discharged uneventfully. Under-expansion of a stent generally arises from inadequate lesion preparation. Impaired healing secondary to under-expanded stent struts is the main cause of re-stenosis in the short term. Hence adequate pre-dilatation especially in heavily calcified lesions is of quite importance. More sophisticated techniques such as Non-Compliant balloon (OPN), rotablation, shock wave balloon and laser should be used for adequate pre-dilatation when conventional balloon pre-dilatation methods fail. These methods can also be used for dilatation of an under-expanded stent. Consequently, under-expansion of a stent is one of the leading causes of stent restenosis. Rota-ablation can be used to debulk the under-expanded stent struts and hence prevent possible short term restenosis.

RESUMEN

La subexpansión es una cuestión importante para los cardiólogos intervencionistas en términos de resultados a largo plazo. En este documento informamos una rotación exitosa de puntales de stent subutilizados. Mujer de 75 años con antecedentes de Intervención Coronaria Percutánea (ICP) sobre Arteria Descendente Anterior (ADA) izquierda con dos stents farmacoactivos superpuestos hace una semana en otro centro. Desafortunadamente los stents se desplegaron sin una preparación adecuada de la lesión en lesiones muy calcificadas y por lo tanto, no se pudieron dilatar adecuadamente después del despliegue. Los struts de la endoprótesis se rotaablizaron con éxito con fresas de 1.5 y 1.75 respectivamente y a continuación se implantó la endoprótesis. El paciente fue dado de alta sin incidentes. La expansión insuficiente de un stent generalmente se debe a una preparación inadecuada de la lesión. El deterioro de la cicatrización secundario a puntales del stent poco expandidos es la principal causa de reestenosis a corto plazo. Por lo tanto, es de gran importancia una predilatación adecuada, especialmente en lesiones muy calcificadas. Se deben utilizar técnicas más sofisticadas como balón Non-Compliant Balloon (OPN), rotablación, balón de ondas de choque y láser para una predilatación adecuada cuando los métodos convencionales de predilatación con balón fallan. Estos métodos también se pueden utilizar para la dilatación de un stent poco expandido. En consecuencia, la expansión insuficiente de un stent es una de las principales causas de reestenosis del stent. La rotaablación se puede utilizar para reducir el tamaño de los puntales del stent poco expandidos y por lo tanto, prevenir una posible reestenosis a corto plazo.

INTRODUCTION

An under expanded stent is a nightmare for an interventional cardiologist. A malapposed stent is the main cause of short time re-stenosis. Hence implanting the stent

after adequate pre-dilatation is of great importance. Especially in heavily calcified lesions, more sophisticated techniques such as OPN balloon, rotablation, shock wave balloon and laser should be used for adequate pre-dilatation when conventional balloon

* Erfan General Hospital, Department of Cardiology, Tehran, Iran.

‡ Samsun University, Faculty of Medicine, Department of Cardiology, Samsun, Turkey.

§ Masshad University of Medical Sciences, Faculty of Medicine, Department

of Cardiology, Masshad, Iran.

¶ Ege University Faculty of Medicine, Department of Cardiology, İzmir, Turkey.

Received:
12/22/2023

Accepted:
05/03/2024

How to cite: Hashemi A, Karagöz A, Gholoobi A, Ghaffari L, Ahmedieh A, Uçar M et al. Overcoming an under-expanded and undilatable stent. *Cardiovasc Metab Sci.* 2024; 35 (2): 50-53. <https://dx.doi.org/10.35366/116274>

pre-dilatation methods fail. Herein we report a case of successful rotablation of an under-expanded stent struts.

CASE PRESENTATION

The patient was a 75 years old female with a history of Percutaneous Coronary Intervention (PCI) on Left Anterior Descendent (LAD) coronary artery with two overlapping drug eluting stents a week ago in another center. Unfortunately, the stents were deployed without proper lesion preparation in heavily calcified lesions and hence the stents couldn't be dilated properly after deployment. The first operator implanted a 2.75 stent via insufficient pre-dilatation in LAD which was severely under expanded and post dilation with a 3.0×12 mm Non-Compliant (NC) balloon up to 35 atm had failed. The stents were malapposed and under-expanded so the patient was referred to our clinic for bailout management.

In our center, first NC balloon with 40 atm and then OPN balloon with 42 atm were performed but both failed. Since shock wave and laser system were unavailable rotablation of the under-expanded stent struts was our next approach. At first the wire was exchanged with a soft rota wire and then the rotablation was performed with 1.5 burr. After multiple rota runs and aggressive NC balloon post dilatation, the rota burr was upgraded to 1.75 (*Figure 1*). The rotawire was exchanged with an extrasupport rotawire over the microcatheter to gain more support for different rota burr and change the contact points of the burr.

After multiple rota and balloon post dilatation IVUS was performed to evaluate the lesion and fracture in the previous stent, ablated previous stent struts and relative debulking in calcium burden were detected (*Figure 2*). Hence stenting over ablated and fractured previous stent was decided. A 3.5×38 mm drug eluting stent was deployed at 20 atm (*Figure 3*).

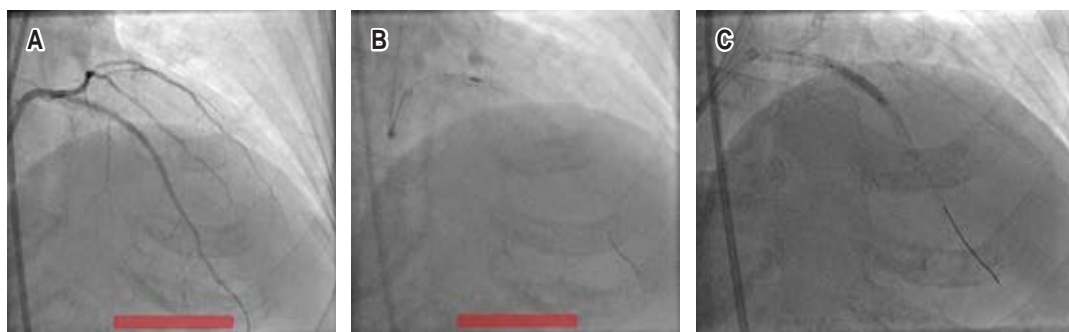


Figure 1: **A)** Angiographic appearance of underexpanded stent struts. **B)** Rotablation of underexpanded stent struts. **C)** Non-compliant balloon dilatation after rota runs.

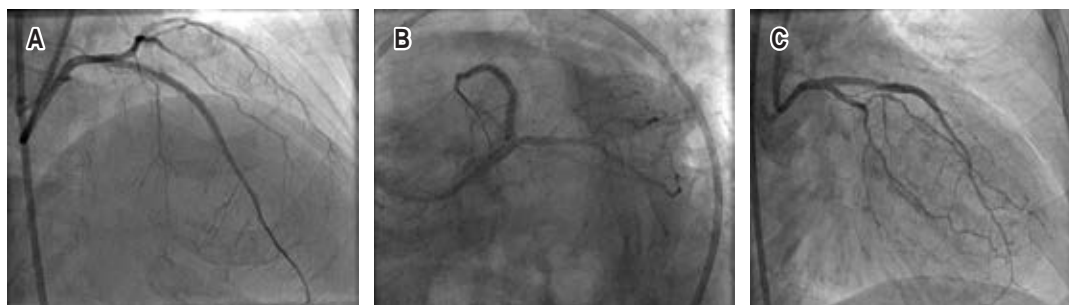


Figure 2: **A)** Angiographic appearance after multiple rota runs and balloon dilatations. **B)** A 3.5×38 mm drug eluting stent was deployed inside the first under-expanded stent at 20 atm. **C)** Final angiographic appearance.

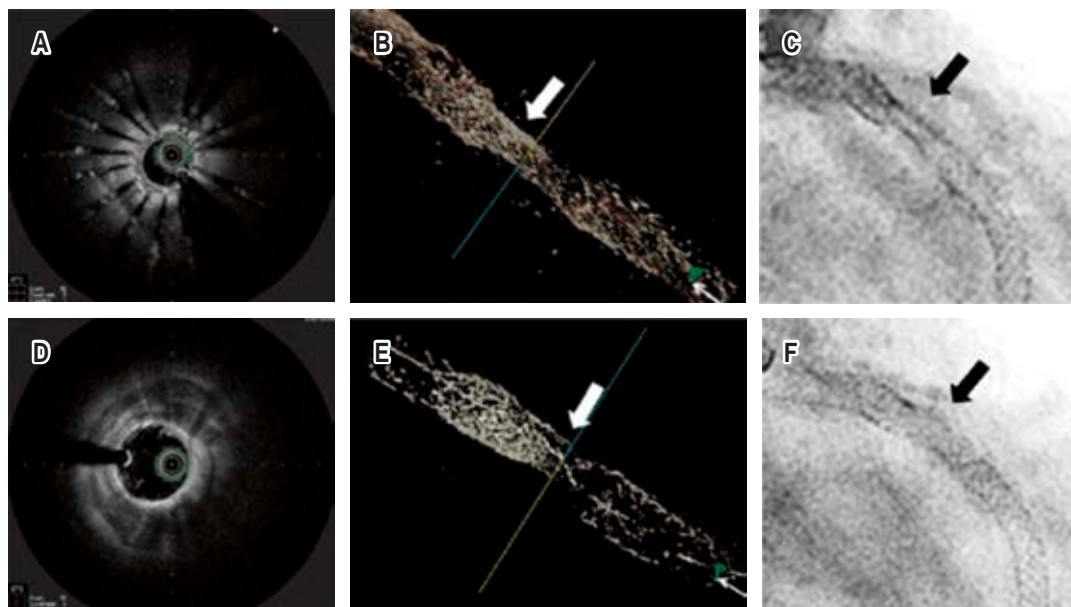


Figure 3: **A)** Intravascular ultrasound showing under-expanded stent. **B)** Optic coherence tomography appearance before rotablation of under-expanded stent struts. **C)** Clear stent appearance showing the under-expanded part of the stent. **D)** Intravascular ultrasound shows destruction of the under-expanded stent struts after rotablation. **E)** Absence of under-expanded stent struts in optical coherence tomography. **F)** Appearance in clear stent function after rotablation.

DISCUSSION

This paper reveals that rotablation of under-expanded stent struts can be performed as a bail-out option when the first choice maneuvers such as high pressure Non-Compliant (NC) and OPN balloon inflations fail.

Under-expansion of a stent due to inadequate lesion preparation poses a great challenge for the interventional cardiologist and generally there are a few strategies to fix this problem. The possible maneuvers are leaving the under-expanded stent as it is, prolonged high pressure NC balloon inflation, OPN balloon, rota-ablation of the under-expanded stent, shock wave balloon and laser or surgery as a last resource.¹⁻⁴

In this case, due to absence of laser and shock wave, our choice was rotablation of the under-expanded stent struts. The greatest concern with longitudinal stent ablation is to slip through the under expanded stent without ablating the metal and leaving the burr immovable. Hence in this case the burr

advanced more gradually and more carefully than our usual approach. During the procedure, multiple runs and NC balloon dilatations were performed. Changing distal wire position and exchange between soft and extra support rota wire facilitated the contact between the burr and the stent. The other concern is slow flow and no reflow due to metallic debris and stent thrombosis due to heat generation so short runs were preferred in our case. Thankfully, none of these complications happened in our case probably due to our particular attention about keeping the rota runs as short as possible. In line with our current case, recent Optical Coherence Tomography (OCT), Intravascular Ultrasound (IVUS) and also electron microscopy studies have also shown that stent ablation by rotablation can remove under-expanded stent struts.⁵⁻⁷

CONCLUSIONS

Consequently, under-expansion of a stent is one of the leading causes of stent restenosis.

Under-expansion of a stent has a challenging consequences for the interventional cardiologists. It could cause of stent restenosis. There are some options to maintain stent restenosis and rotablation is one of them. Rotablation can be used to debulk the under-expanded stent struts and hence prevent possible short term restenosis.

REFERENCES

1. Secco GG, Ghione M, Mattesini A, Dall'Ara G, Ghilencea L, Kilickesmez K et al. Very high-pressure dilatation for undilatable coronary lesions: indications and results with a new dedicated balloon. *EuroIntervention*. 2016;12(3):359-365. Available in: https://doi.org/10.4244/EIJY15M06_04
2. Díaz JF, Gómez-Menchero A, Cardenal R, Sánchez-González C, Sanghvi A. Extremely high-pressure dilation with a new noncompliant balloon. *Tex Heart Inst J*. 2012;39(5):635-638.
3. Goktekin O, kilic ID, Karagoz A. A bail-out intervention: low-speed rotablation for management of an underexpanded stent causing recurrent stent restenosis. *EJMCR*. 2020;4(12):441-444. Available in: <https://doi.org/10.24911/ejmcr/173-1593949307>
4. Si D, Liu G, Tong Y, He Y. Rotational atherectomy ablation for an unexpandable stent under the guide of IVUS: a case report. *Medicine (Baltimore)*. 2018;97(7):e9978. Available in: <https://doi.org/10.1097/MD.0000000000009978>
5. Koide M, Inoue K, Matsuo A, Fujita H. Optical coherence tomography findings after longitudinal ablation for an underexpanded stent in a heavily calcified lesion: a case report. *BMC Cardiovasc Disord*. 2016;16(1):241. Available in: <https://doi.org/10.1186/s12872-016-0419-8>
6. Ku PM, Huang TY, Chen ZC, Woo M, Hung JS. IVUS-guided rotational atherectomy for unexpandable paclitaxel-eluting stent: a case report and review of literature. *J Geriatr Cardiol*. 2013;10(3):226-229. Available in: doi: 10.3969/j.issn.1671-5411.2013.03.014
7. Ho PC, Weatherby TM, Dunlap M. Burr erosion in rotational ablation of metallic coronary stent: an electron microscopic study. *J Interv Cardiol*. 2010;23(3):233-239. doi: 10.1111/j.1540-8183.2010.00543.x.

Declaration of patient consent: the patient's consent have been added.

Funding: no financial support was received for this study.

Declaration of patient consent: the authors declare no conflict of interest.

Correspondence:

Melisa Uçar, MD

E-mail: mmelisaucar@icloud.com