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Case report

Severe In-Stent Restenosis due to Two Stent Layers: A Case Report

Pavel Somov[1], Dmitriy Marchak[1], Arkhip Matusov[1]

[1]*Pirogov's National Medical Surgical Center, Moscow, Russian Federation*

Abstract

Background: The prevalence of in-stent restenosis is around 3-10%. One treatment option for restenosis is implantation of another drug eluting stent, the so-called "sandwich strategy". Multiple stent layers can potentially reduce the penetration of antiproliferative drugs into the vessel wall, thereby minimizing the effect of the drug. In this clinical case, we encountered restenosis after a previously implanted stent for treatment of restenosis.

Case presentation: A 73-year-old female with previous history of RCA stenting in 2019 due to myocardial infarction. In 2020, RCA restenosis was identified and RCA PCI was performed (Supraflex 2.75x28mm, XienceXpedition 3.5x38mm). The current hospitalization was associated with a recurrence of dyspnea on exertion. Coronary angiographyrevealedan 80% restenosis of the RCA. A decision was made to perform ultra-high-pressure balloonfor this lesion. A stent-boost image was obtained showing stent deformation. Balloon angioplasty was performed using a 3.5x15mm ultra-high-pressure balloon OPN NC (SIS Medical, Switzerland) at 40 atm. Control angiography showed a restoration of vessel lumen. IVUS showed minimal lumen area (MLA) of 8.37 mm^2. Six months latercause of a recurrence of dyspnea on exertion a myocardial scintigraphy was performed, which revealed an ischemic zone of 20-25%. Based on these results, angiography was performed which identified recurrent restenosis in the same segment. IVUS-guided angioplasty with a 4.0x15mm OPN NC in combination with a 4.0x30mm Agent drug-coated balloon (DCB) was performed with inflation at 6 atm for 60 seconds. This resulted in good angiographic results, with an MLA of 9.76mm²and optimal stent expansion throughout.

Conclusion: Treatment of patients with restenosis remains a challenging task. Intravascular imaging is a fundamental factor in restenosis management, allowing determination of restenosis type and selection of optimal treatment strategy to achieve satisfactory results and reduce the risk of repeat interventions.Therefore, the combination of intravascular imaging and dedicated devices is strongly suggested for a more standardized approach for in-stent restenosis.

Key-words In-stent restenosis, Multiple stent layers, Intravascular image

Introduction

Despite the use of 2nd and 3rd generation drug-eluting stents (DES), the risk of developing in-stent restenosis (ISR) remains at 3-10%[1]. One treatment option for restenosis is implantation of another drug eluting stent, the so-called "sandwich strategy[2]. However, a large amount of neointimal hyperplasia and multiple stent layers can potentially reduce the penetration of antiproliferative drugs into the vessel wall, thereby minimizing the effect of the drug[3-5]. In this clinical case, we encountered an ISR after a previously implanted stent for treatment of an ISR.

Clinical Case

A 73-year-old female patient was admitted to our center. From the medical history, it was known that in 2017 coronary artery bypass grafting was recommended due to three-vessel coronary disease, which the patient refused. In 2019, myocardial infarction and percutaneous coronary intervention (PCI) of the right coronary artery (RCA) and left anterior descending artery (LAD) were performed. In 2020, RCA ISR was identified and PCI was performed on the RCA (Supraflex 2.75x28mm, XienceXpedition 3.5x38mm). The current hospitalization was associated with a recurrence of complaints of dyspnea on exertion. Coronary angiography was performed, revealing 80% ISR of the RCA (Figure 1). A decision was made to perform ultra-high-pressure balloonangioplasty for this lesion. Using a right radial approach with a 6F JR4 Launcher (Medtronic, USA),aRinato guidewire (AsahiIntecc, Japan) was advanced into the distal vessel. Intravascular ultrasound (IVUS) examination was performed (Opticross 40, Boston Scientific, USA) (Figure 2). Minimum lumen area was 3.26 mm². A stent-boost image was obtained (Figure 3) showing stent deformation. Balloon angioplasty was performed using 3.0x15mm NC Sprinter (Medtronic, USA), and a 3.5x15mm ultra-high-pressure balloon OPN NC(SIS Medical, Switerland) at 40 atm. Figure 4 shows balloon expansion in stent-boost mode. Figure 5 demon-

Corresponding author: Dr Pavel Somov, Doc.p.somov@gmail.com

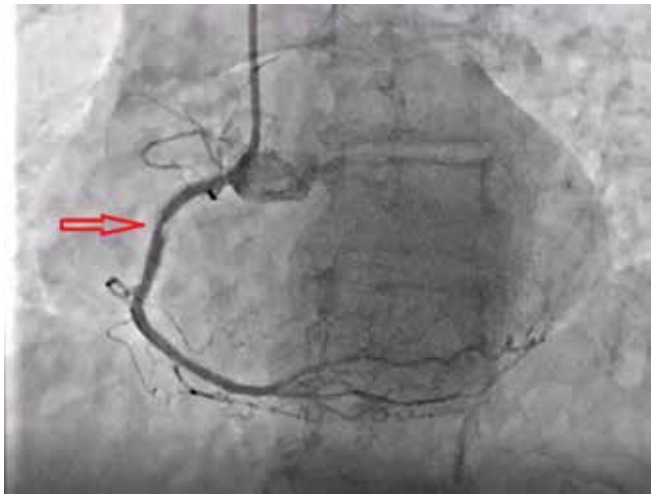

Figure 1. RCA restenosis

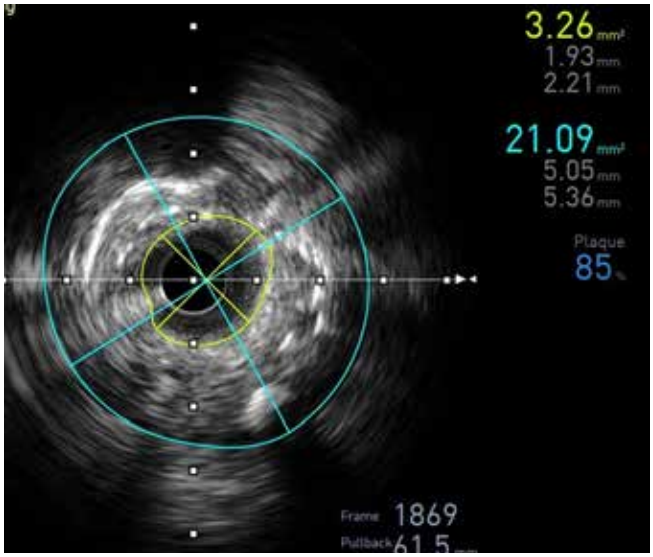

Figure 2. IVUS of RCA restenosis

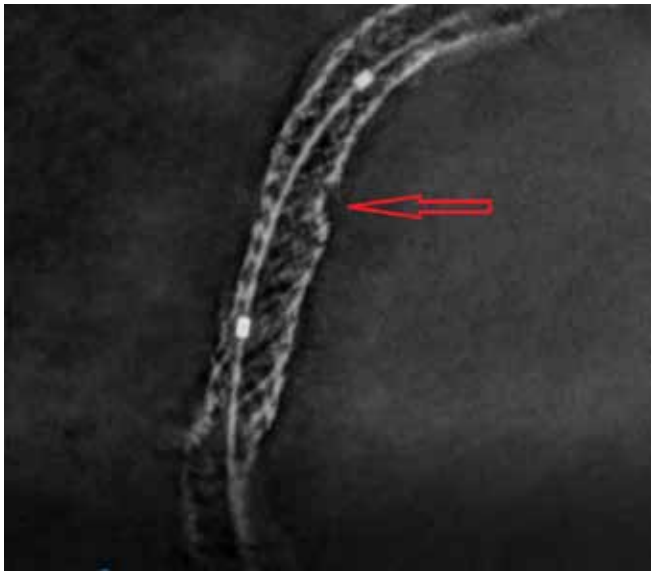

Figure 3. Stent deformation (stent-boost)

Figure 4. Balloon expansion (stent-boost)

Figure 5. Angio result

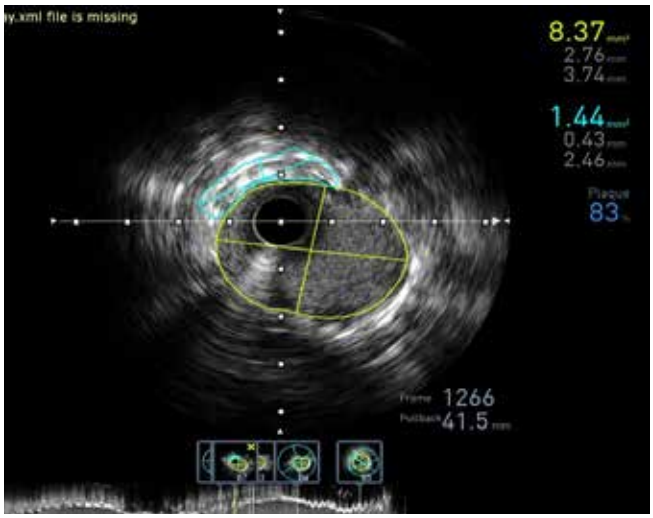

Figure 6. IVUS control. Minimum lumen area 8.37 mm²

strates control angiography with restoration of vessel lumen. IVUS showed minimum lumen area of 8.37 mm² (Figure 6), with neocalcification area and structures of the two previously implanted stents highlighted in blue. The patient was prescribed atorvastatin 40mg, clopidogrel 75mg, aspirin 100mg, and ezetimibe 10mg. Six months later, cause of a recurrence of dyspnea on exertion a myocardial scintigraphy was performed, which revealed an ischemic zone of 20-25% (Figure 7). Based on these results, angiography was performed which identified recur-

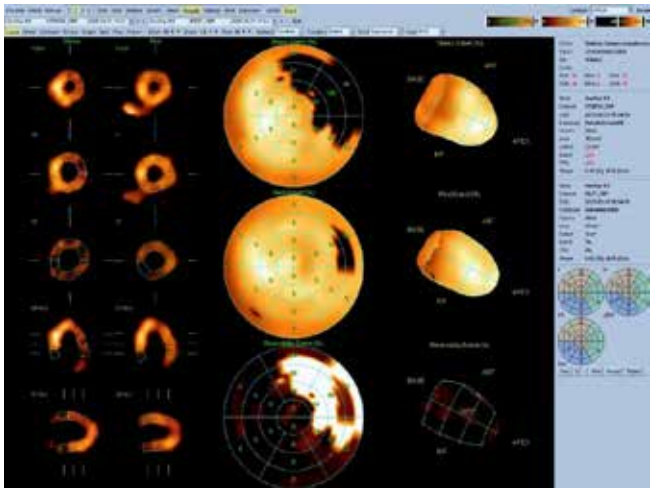

Figure 7. Myocardial scintigraphy

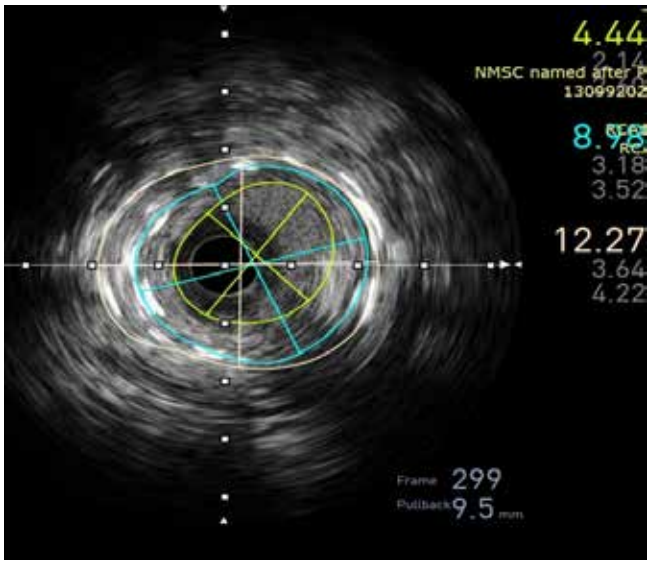

Figure 9. IVUS of restenosis

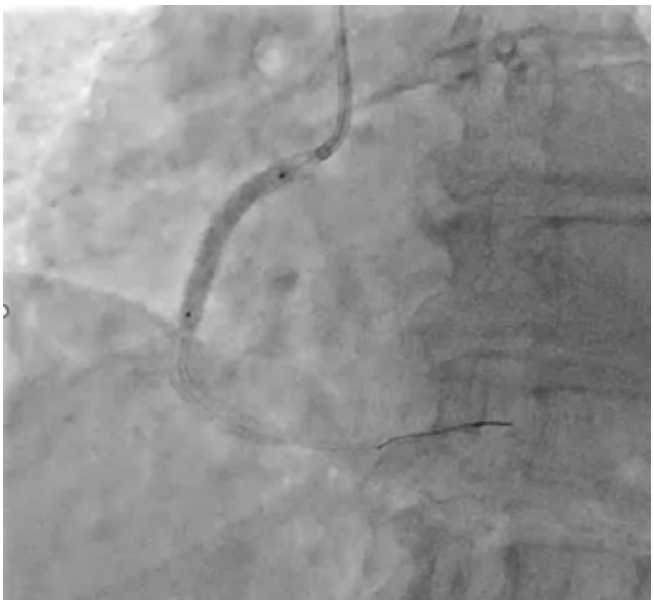

Figure 11. DCB 4.0x30

rent ISR in the same segment (Figure 8). After the discussion of the case with our Heart Team we decided to perform drug-coated balloon (DCB) angioplasty. IVUS was performed (Figure 9) and repeat angioplasty with an ultra-high-pressure balloon in combination with a drug-

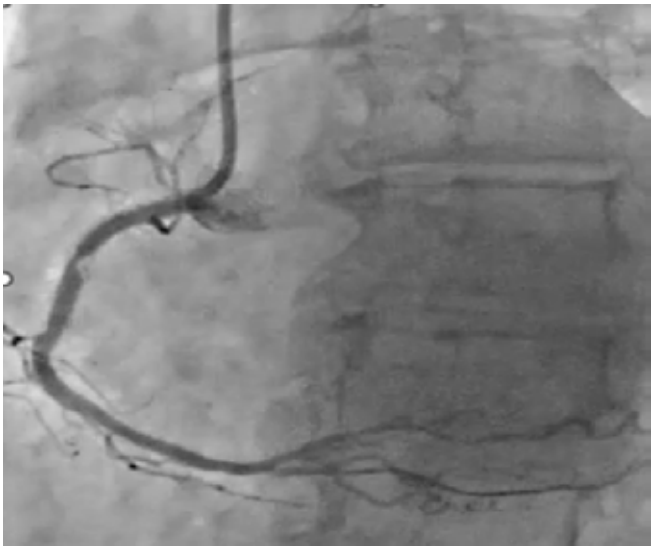

Figure 8. Recurrent RCA restenosis

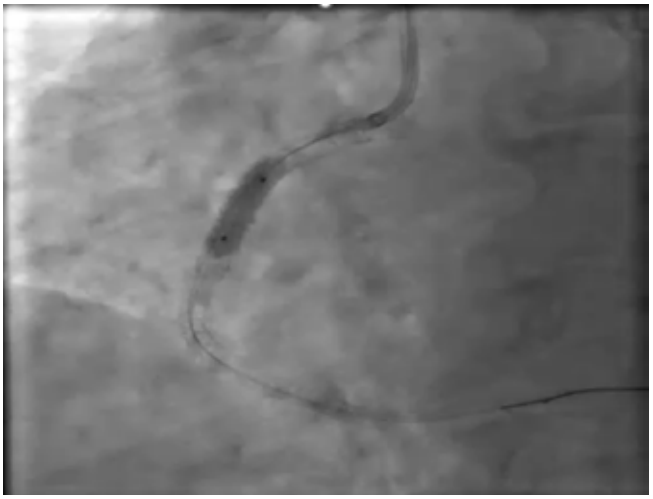

Figure 10. OPN 4.0x15

Figure 12. Angio result

coated balloon was planned. Balloon angioplasty with 4.0x15mm OPN NC (SIS Medical, Switzerland)(Figure 10) was done. DCB angioplasty with 4.0x30mm Agent (Boston Scientific, USA) (Figure 11) was performed with inflation for 60 seconds at 6 atm. This resulted in good angiographic result (Figure 12), and MLA on IVUS of 9.76 mm² (Figure 13) with optimal stent expansion throughout.At the six-month follow-up, the patient remained angina free.

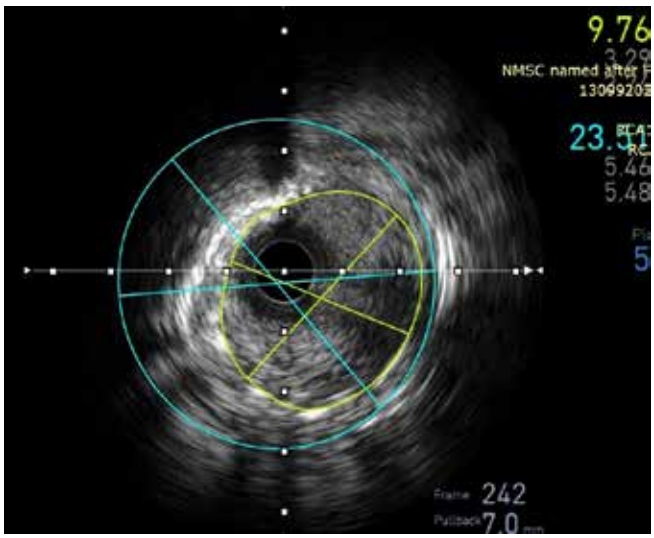

Figure 13. IVUS control

Discussion and Conclusion

There are various strategies for treating DES ISR. Repeated DES implantation compared with DCB application has shown the most favorable results regarding repeat restenosis. However, repeated stent implantation leads to reduction in vessel lumen and increases the risk of stent thrombosis[6-8]. The ISAR-DESIRE 3 study showed comparable results of using DCB and DES in treating restenosis[9]. Upon examination of angiograms with stent-boost mode, we identified stent deformation, therefore we encountered not only restenosis after implantation of two stent layers, but also deformation of the previously stented segment, which further complicated the correction of this lesion. According to the Waksman classification, in this case there is combined restenosis Type 1 (mechanical stent deformation) and Type 5 (2 or more stent layers)[10]. In complex restenosis cases, the use of ultra-high-pressure balloons OPN NC (SIS Medical, Switzerland) is the correct choice for two reasons: first, to achieve greater vessel lumen through re-expansion of previously placed stents. Second, to increase lumen by compression of neointimal tissue that appears during restenosis, which is confirmed using IVUS[11]. In our clinical case, intravascular imaging, ultra-high-pressure balloons, and DCB were used for treatment of complex ISR. According to the restenosis treatment algorithm (Figure 14) proposed by Shlofmitz et al., we selected the optimal treatment strategy for this lesion[12]. However, in the first intervention, a DCB was not used, which likely led to recurrent restenosis at 6 months. During repeat treatment of restenosis, larger ultra-high-pressure balloons were used based on IVUS results (Figure 9), and 4.0x30mm Agent DCB (Boston Scientific, USA) was utilized.At the six-month follow-up, she remained angina free. The current guidelines on myocardial revascularization recommend re-stenting with DES and the use of DCB. In our case, the overlap of multiple stent layers was known, so re-stenting with DES might raise concerns about the addition of metallic layer. The multiple layers may cause further endothelial growth associated with stent thrombosis and recurrent ISR. An OPN balloon was used to expand deformed segment and DCB was used to avoid the additional metallic layer

Treatment of patients with restenosis remains a challenging task. Intravascular imaging is a fundamental factor in restenosis management, allowing determination of restenosis type and selection of optimal treatment strategy to achieve satisfactory results and reduce the risk of repeat interventions.Therefore, the combination of intravascular imaging and dedicated devices is strongly suggested for a more standardized approach for treatment of ISR.

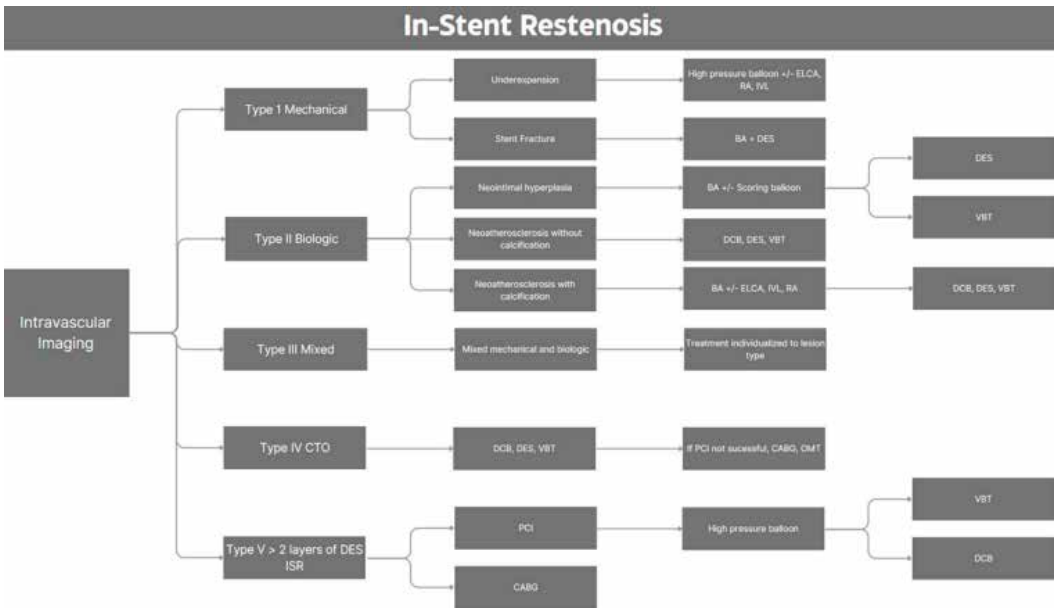

Figure 14. Algorithm of ISR treatment.

BA indicates balloon angioplasty; CABG, coronary artery bypass graft; CTO, chronic total occlusion; DCB, drug-coated balloon; DES, drug-eluting stent; ELCA: excimer laser coronary atherectomy; ISR, in-stent restenosis; IVL, intravascular lithotripsy; IVUS, intravascular ultrasound; OCT, optical coherence tomography; OMT, optimal medical therapy; PCI, percutaneous coronary intervention; RA, rotational atherectomy; and VBT, vascular brachytherapy.

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Sažetak

Tesna In-Stent Restenoza uzrokovana postojanjem dva sloja stenta: Prikaz slučaja

Pavel Somov[1], Dmitriy Marchak[1], Arkhip Matusov[1]

[1]Pirogov's Nacionalni Centar za Hirurgiju, Moskva, Ruska Federacija

Uvod: *Prevalenca restenoze u stentu je oko 3-10%. Jedna od opcija lečenja restenoze je implantacija još jednog stenta koji oslobađa lek, takozvana „sendvič strategija". Višestruki slojevi stenta mogu potencijalno smanjiti prodor antiproliferativnih lekova u zid krvnog suda, čime se minimizira efekat leka. U ovom kliničkom slučaju, naišli smo na restenozu nakon prethodno implantiranog stenta za lečenje restenoze.*

Prikaz slučaja: *73-godišnja žena sa prethodnom istorijom stentiranja desne koronarne arterije (DKA) 2019. godine zbog infarkta miokarda. 2020. godine identifikovana je restenoza DKA i izvršena je ponovna perkutana koronarna intervencija (PKI) DKA (Supraflex 2,75x28 mm, XienceXpedition 3,5x38 mm). Aktuelna hospitalizacija je bila povezana sa ponovnom pojavom dispneje pri naporu. Koronarna angiografija je otkrila 80% restenoze DKA. Doneta je odluka da se za ovu leziju izvede stentiranje balonom ultravisokog pritiska. Dobijena je slika stent-busta koja prikazuje deformaciju stenta. Balonska angioplastika je izvršena pomoću balona ultravisokog pritiska 3,5x15 mm OPN NC (SIS Medical, Švajcarska) na 40 atm. Kontrolna angiografija je pokazala restauraciju lumena krvnog suda. Intravenozni ultrazvuk (IVUS) je pokazao minimalnu površinu lumena (MLA) od 8,37 mm2. Šest meseci kasnije, zbog ponovne dispneje pri naporu, urađena je scintigrafija miokarda, koja je otkrila ishemijsku zonu od 20-25%. Na osnovu ovih rezultata, urađena je ponovna angiografija koja je identifikovala rekurentnu restenozu u istom segmentu. Intravaskularnim ultrazvukom vođena angioplastika sa balonom 4,0x15 mm OPN NC u kombinaciji sa 4,0x30 mm balonom obloženim lekom (DCB) izvršena je sa inflacijom na 6 atm tokom 60 sekundi. Ovo je rezultiralo dobrim angiografskim rezultatima, sa MLA od 9,76 mm² i optimalnim širenjem stenta.*

Zaključak: *Lečenje pacijenata sa restenozom stenta je i dalje izazovno. Intravaskularn imidžing je fundamentalni faktor u uspešnom lečenju restenoze, omogućavajući određivanje tipa restenoze i izbor optimalne strategije lečenja kako bi se postigli zadovoljavajući rezultati i smanjio rizik od ponovljenih intervencija. Stoga se snažno preporučuje kombinacija intravaskularnog imidžinga i posvećenih uređaja za standardizovani pristup lečenja restenoze u stentu.*

Ključne reči: *Restenoza, Slojevi stenta, Intravskularni imidžing*