

IVUS & OCT during carotid artery stenting

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DISCLOSURE STATEMENT OF FINANCIAL INTEREST

Within the past 12 months, I or my spouse/partner have had a financial interest/arrangement or affiliation with the organization(s) listed below

AFFILIATION/FINANCIAL RELATIONSHIP

- Consulting Fees/Honoraria

COMPANY

- Medtronic
- Boston Scientific
- Inspire MD

Main points of IVUS and OCT during non-coronary interventions

- Atherosclerotic plaque / lesions analysis
- Analyse of artery diameter for optimal instruments choosing
- Analyse of intervention results... but we are more often use self-expandable stents and least of all to correct the stent malaposition
- Follow-up analysis

INTRAVASCULAR VISUALISATION

euro
PCR

Resolution (axial)
(lateral)

Size of imaging core

Dynamic range

Frame rate

Scan area

Max. penetration

Blood clearing

Balloon Occlusion
Flushing

Pullback

IVUS

100 - 150 μm
150 - 300 μm

0.8 mm

40 - 60 dB

30 frames/s



4 - 8 mm

Not required

0.5mm/s (no limit)

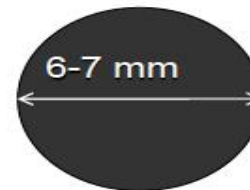
OCT

10 μm
25 - 40 μm

0.4 mm

90 - 100 dB

15 frames/s



1 - 1.5 mm

Required

Required
Required

1mm/s (35mm)



IVUS during CAS

Stent protrusion detected by IVUS during carotid artery stenting

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Shinozaki N., Ogata N., Ikari Y.

Tokai University School of Medicine, Isehara, Japan

71 CAS by IVUS control

61 PRECISE stents (Cordis) and 10 Carotid WallStents (BSC).

Detect 6 stent protrusions (8.5%) by IVUS

4 cases could not detect stent protrusion by angiography

Conclusions: IVUS could detect more frequent protrusion than the incidence previously reported using only angiography. When we manage them adequately, we can reduce peri-procedural stroke. IVUS usage should be recommended to detect stent protrusion and to reduce complication.

Intravascular visualization during carotid interventions

Needed for decrease complications during early postoperative period

J Stroke Cerebrovasc Dis. 2014 Nov-Dec;23(10):2622-5. doi: 10.1016/j.jstrokecerebrovasdis.2014.06.007. Epub 2014 Oct 7.

Plaque protrusion detected by intravascular ultrasound during carotid artery stenting.

Shinozaki N¹, Ogata N², Ikari Y².

Author information

Abstract

BACKGROUND: Stroke is a major complication of carotid artery stenting (CAS) that can occur during the procedure and for up to 30 days after the procedure in the late phase. Although the cause of late stroke after CAS is unknown, plaque protrusion may be one of the potential causes. This study aims to assess the rate of plaque protrusion during CAS by intravascular ultrasound (IVUS).

METHODS: We performed 77 consecutive CAS procedures using IVUS between May 2008 and December 2012. The rate of plaque protrusion was assessed at the end of the procedure using IVUS and angiography.

RESULTS: Mean age of patients was 72.5 ± 7.5 years. Sixty-eight patients were male and 42 had diabetes mellitus. In all, 65 PRECISE stents and 12 Carotid Wall stents were used. All cases were distally protected with filter devices. Six plaque protrusions (7.8%) through the stent struts were detected by IVUS but only 2 (2.6%) by angiography. A predictor of plaque protrusion was preprocedural severe stenosis with flow delay. Additional postdilations ($n = 6$) and stent-in-stent implantations ($n = 4$) were performed to correct the plaque protrusions. No remaining plaque protrusion was observed in the final IVUS. Overall stroke rate was 2.6% (major 0%, minor 2.6%), and these occurred in the catheterization laboratory, but no late stroke was observed at 30 days after procedure.

CONCLUSIONS: IVUS can detect plaque protrusion better than angiography. Because adequate management of plaque protrusion may reduce stroke complications, IVUS usage is worth considering.

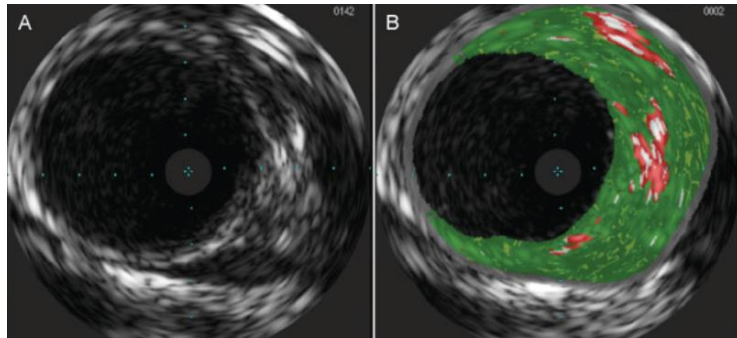
Utilization of Intravascular Ultrasound during Carotid Artery Stenting

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Int J Angiol 2015;24:185–188.



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ICCA STROKE 2019



Abstract

Keywords

- stroke
- carotid stenosis
- carotid stent
- internal carotid artery
- intravascular ultrasound
- microemboli
- ultrasound

For patients at high risk for surgery, carotid artery stenting (CAS) is a viable alternative to help reduce risk of stroke for patients with high-grade carotid artery stenosis; however, a higher incidence of perioperative stroke has been observed in patients undergoing stenting compared to those undergoing open surgery. Intravascular ultrasound (IVUS) is commonly used during coronary artery procedures to help evaluate lesions and to guide stent placement. Multiple groups have sought to determine whether IVUS could also be used during CAS. While IVUS has been shown to be both feasible and safe during CAS, there is limited evidence that demonstrates direct improvement in procedural outcomes. Further studies focusing on clinical outcomes should be conducted in order to justify routine use of this technology during CAS.

Conclusion

In summary, VH-IVUS has the potential for improving clinical outcomes for patients undergoing CAS. Use of IVUS during CAS has been shown to be feasible and safe, however, sufficient benefit of its use remains to be proven. In our experience, the biggest benefit to IVUS has been its ability to guide optimal stent placement within the carotid artery. Nevertheless, limitations to its widespread use remain, including its cost and limited analysis capabilities. Further studies looking at long-term clinical outcomes are warranted, as well as the development of better analytical software.

My experience of CAS during IVUS control

83 patients and 90 CAS

Age - $68,6 \pm 6,9$

Symptomatic lesions – 21 (23,3%)

Asymptomatic lesions – 69 (76,7%)

Degree of stenosis – $82\% \pm 6$

Results:

Protrusion was found by IVUS – 8 (8,8%)

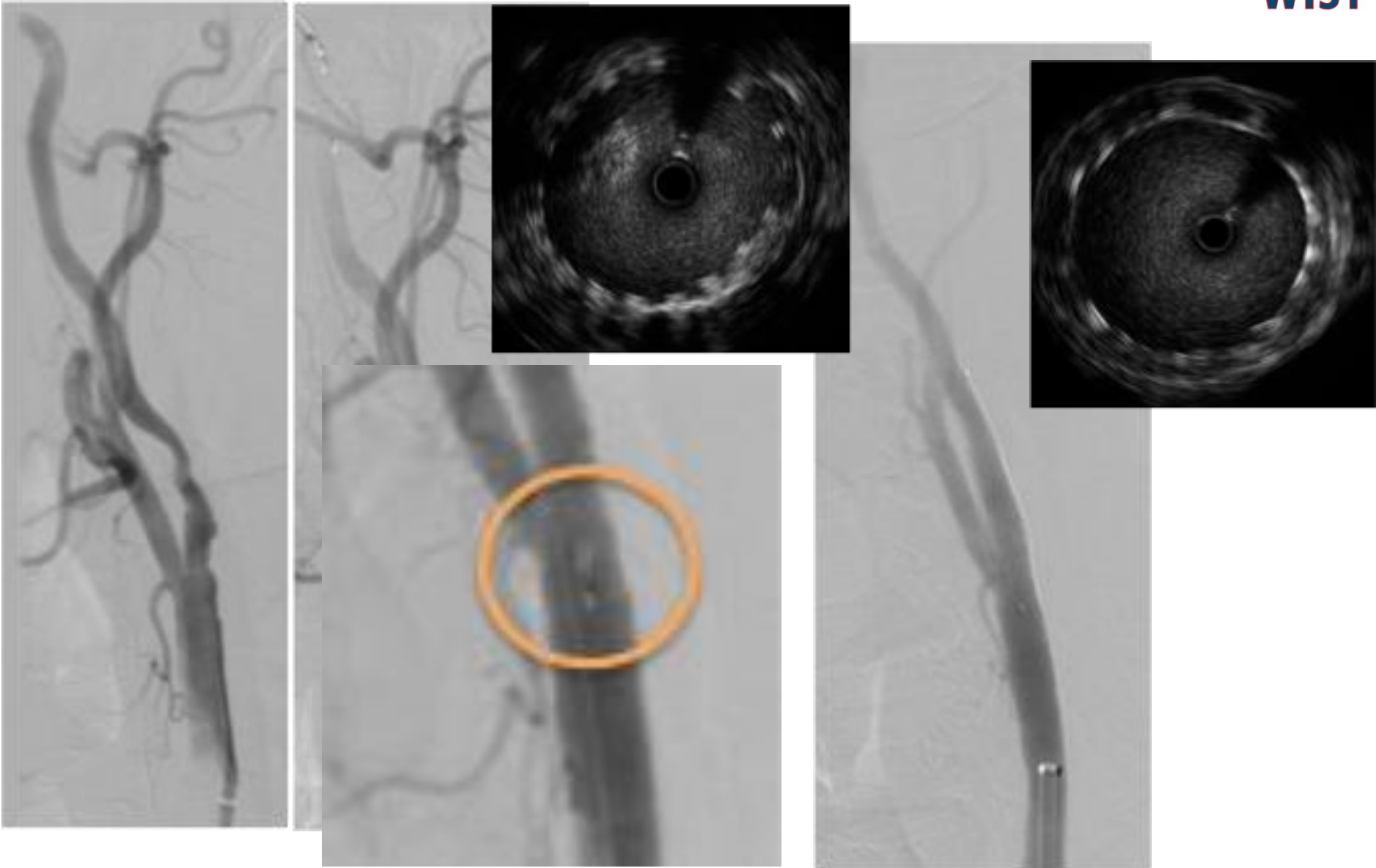
Protrusion didn't check by angio - 6 (6,6%)

MI – 1 (1,1%)

TIA – 4 (4,4%)

Stent malposition – 9 (10%)

Case #1 - Cristallo-Ideale



Case #2

ICCA STROKE 2019

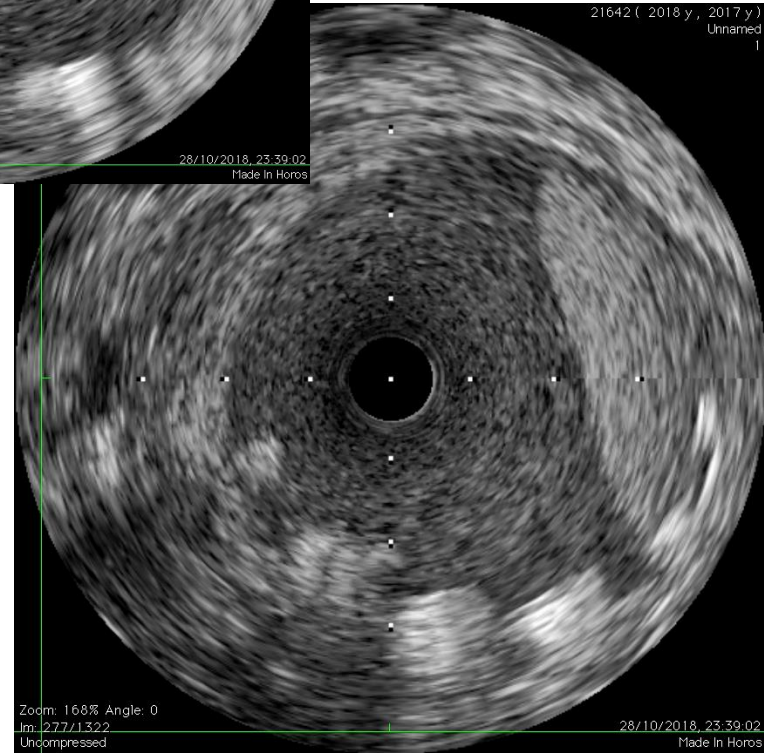
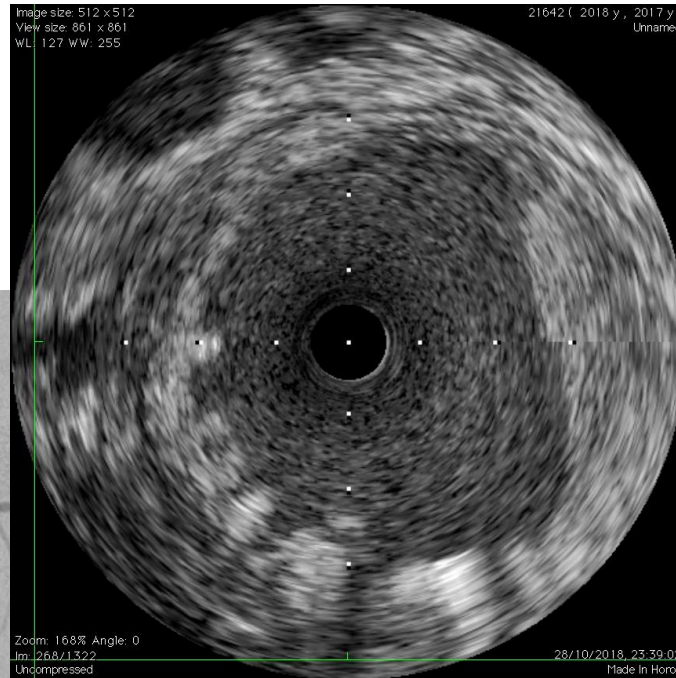


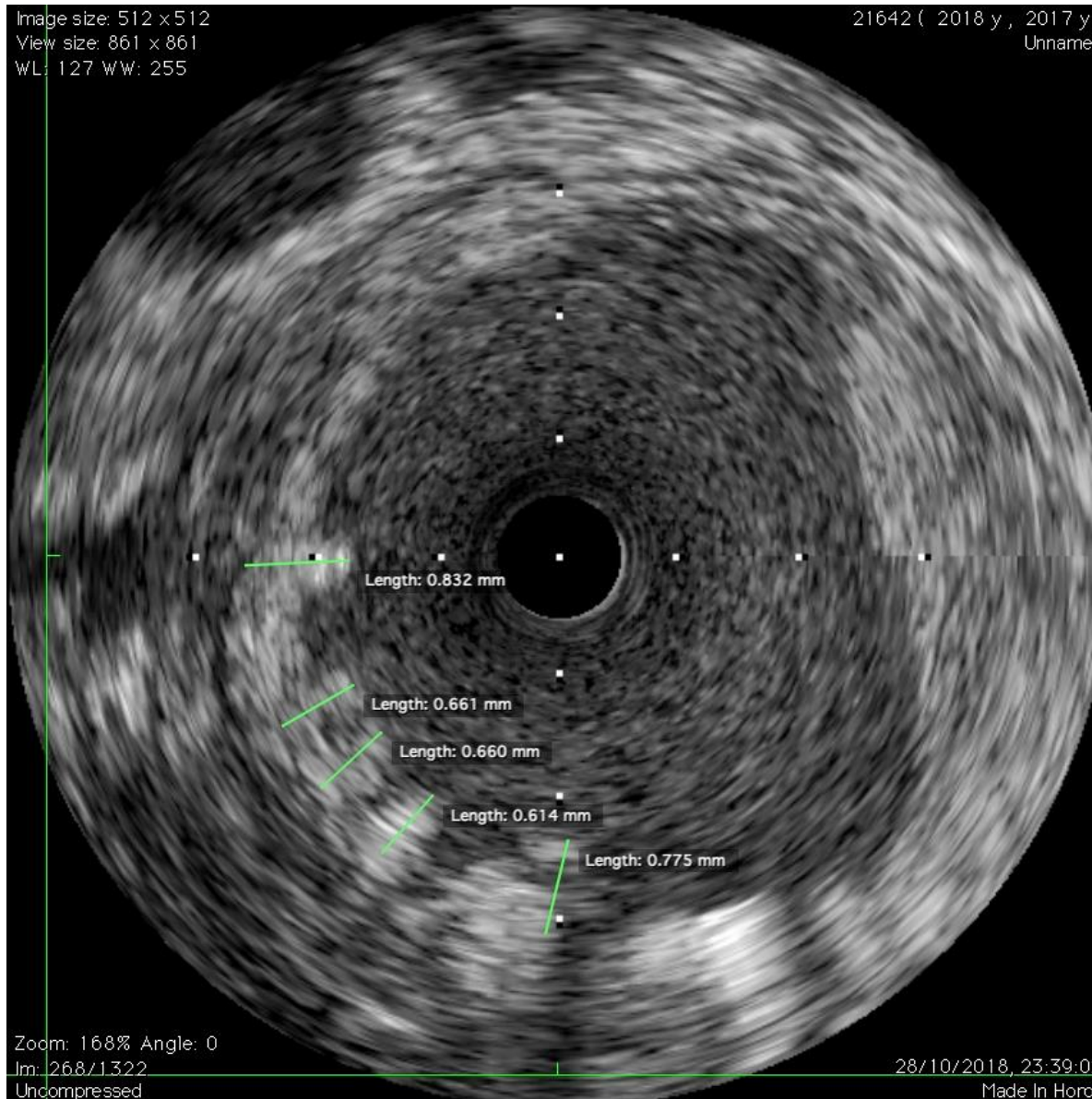


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View size: 861 x 861
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Zoom: 168% Angle: 0

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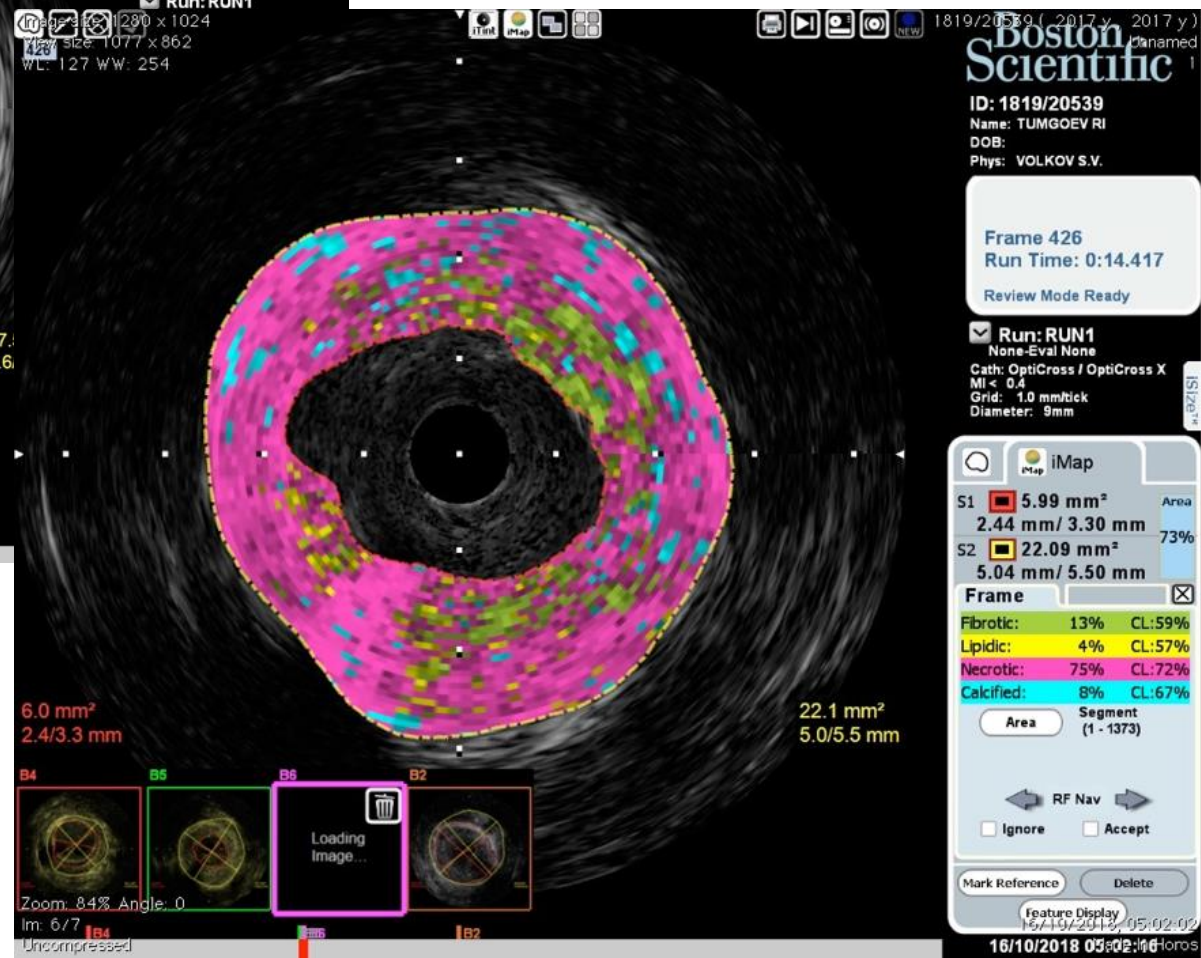
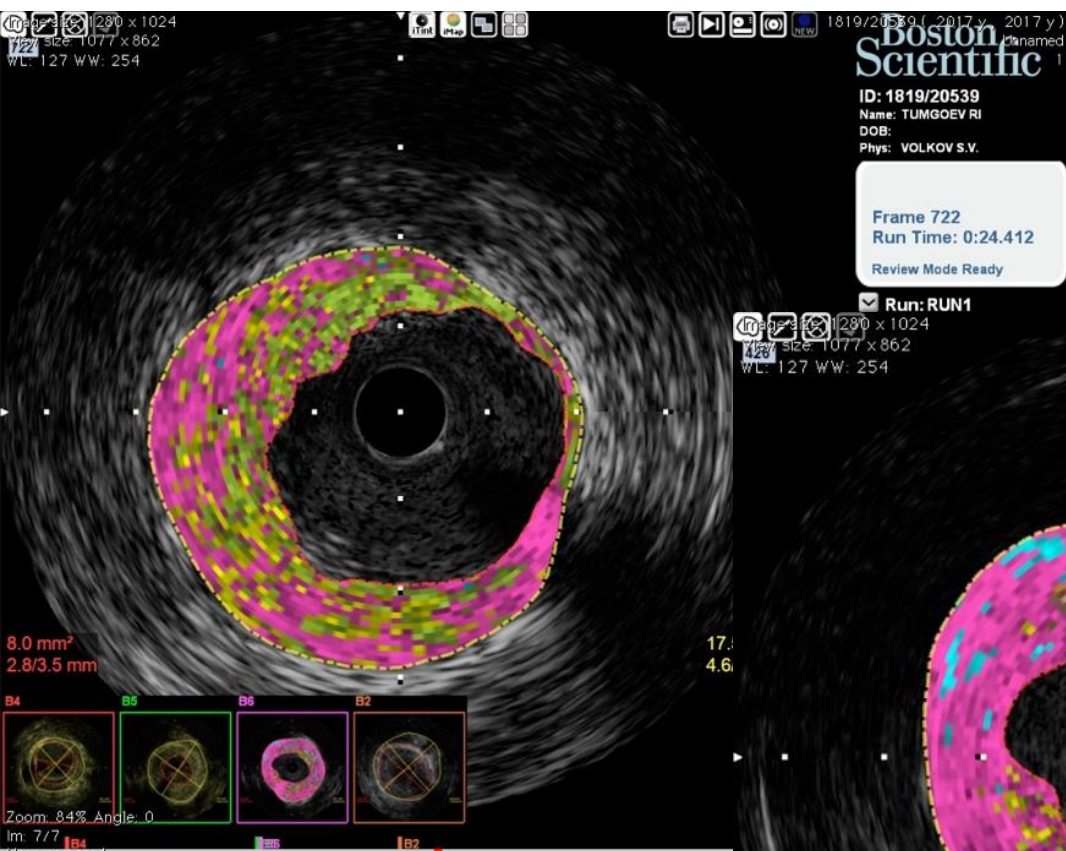


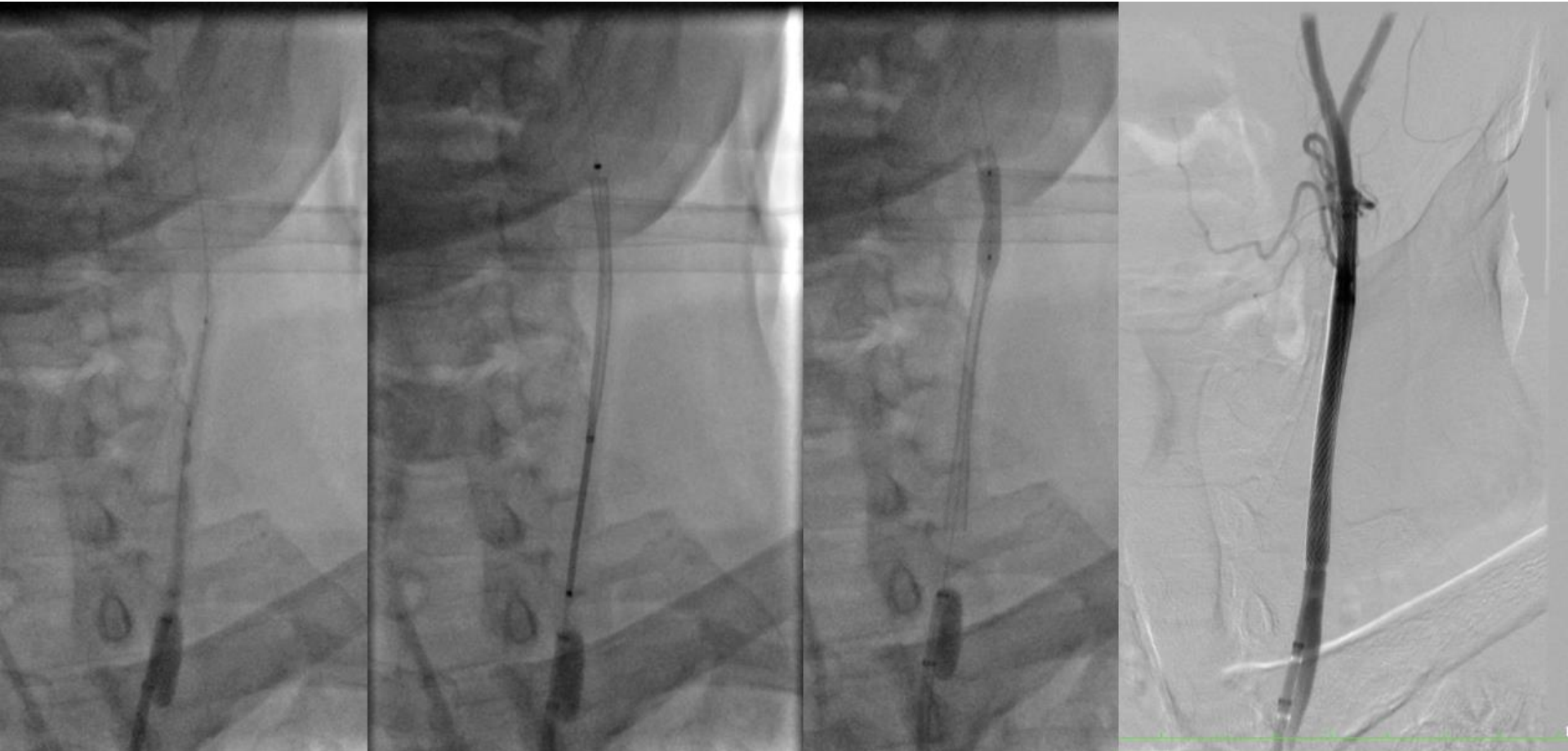
Case #3

IVUS after CEA (5 month follow-up)











Open access peer-reviewed chapter

Optical Coherence Tomography (OCT): A New Imaging Tool During Carotid Artery Stenting

By Shinichi Yoshimura, Masanori Kawasaki, Kiyofumi Yamada, Arihiro Hattori, Kazuhiko
Nishigaki, Shinya Minatoguchi and Toru Iwama

Submitted: June 27th 2012 Reviewed: October 1st 2012 Published: March 6th 2013

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OCT vs IVUS during “symptomatic” and “asymptomatic” lesions

	OCT	VH-IVUS	p-value
Pre-stenting (n = 34)			
Thrombus, n (%)	15 (44.1)	1 (2.9)	<0.001
Neovascularization, n (%)	13 (38.2)	0 (0)	<0.001
Ulceration, n (%)	3 (8.8)	0 (0)	0.24
Calcification, n (%)	13 (38.2)	34 (100)*	<0.001
Lipid, n (%)	28 (82.4)	30 (88.2)**	0.73
Post-stenting (n = 34)			
Plaque protrusion, n (%)	6 (17.6)	0 (0)	0.032

*: shown as 'dense calcified', **: shown as 'fibrofatty and/or necrotic core' on VH-IVUS

Table 1. Comparison of OCT and VH-IVUS findings

OCT vs IVUS during “symptomatic” and “asymptomatic” lesions

	Symptomatic (n=17)	Asymptomatic (n=17)	p-value
Male, n (%)	14 (82.4)	15 (88.2)	"/>0.99
Age, yr	72 ± 10	68 ± 10	0.19
Degree of stenosis, %	84 ± 12	79 ± 7	0.26
OCT findings			
Thrombus	13 (76.5)	2 (11.8)	<0.001
Neovascularization	10 (58.8)	3 (17.6)	0.03
Ulceration	3 (17.6)	0 (0)	0.23
Calcification	7 (41.2)	6 (35.3)	"/>0.99
Lipid-rich component	16 (94.1)	12 (70.6)	0.17
Plaque protrusion	4 (23.5)	2 (11.8)	0.66

Table 2. OCT findings of symptomatic and asymptomatic lesions

My experience of CAS during OCT control

34 patients and 38 CAS

Age - $63,4 \pm 5,7$

Symptomatic lesions – 12 (31,6%)

Asymptomatic lesions – 26 (68,4%)

Degree of stenosis – $88\% \pm 4$

Results:

Protrusion was found by OCT – 6 (15,8%)

Protrusion didn't check by angio - 6 (15,8%)

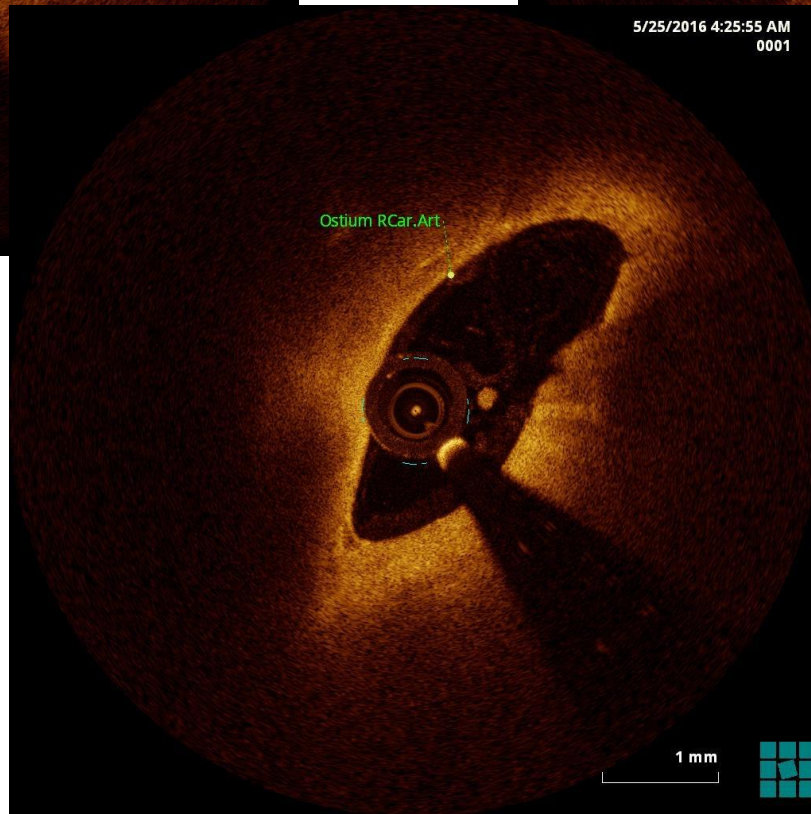
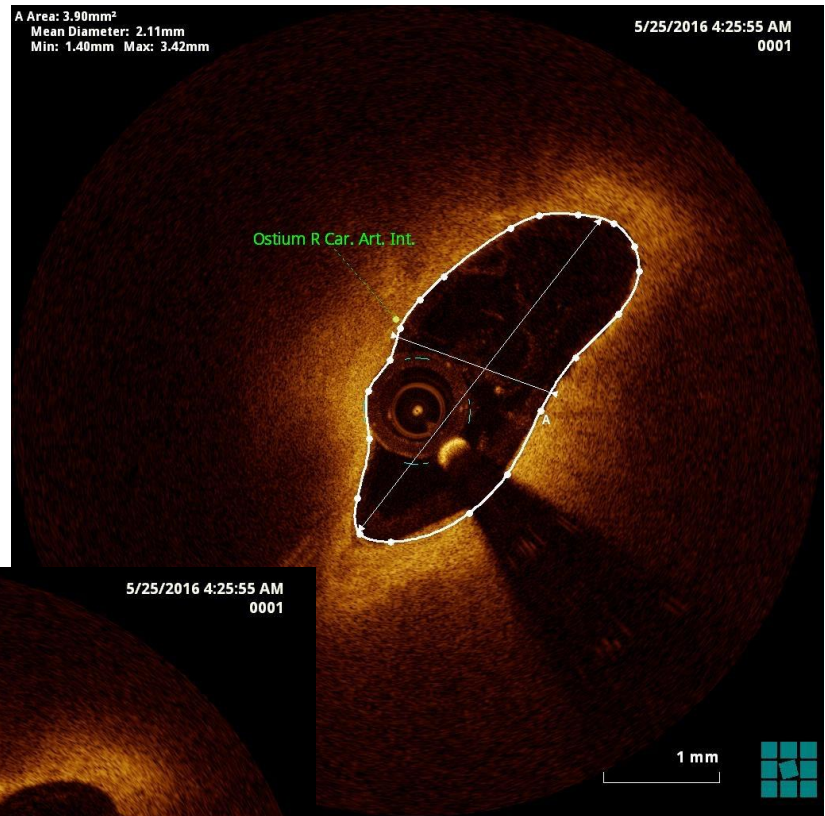
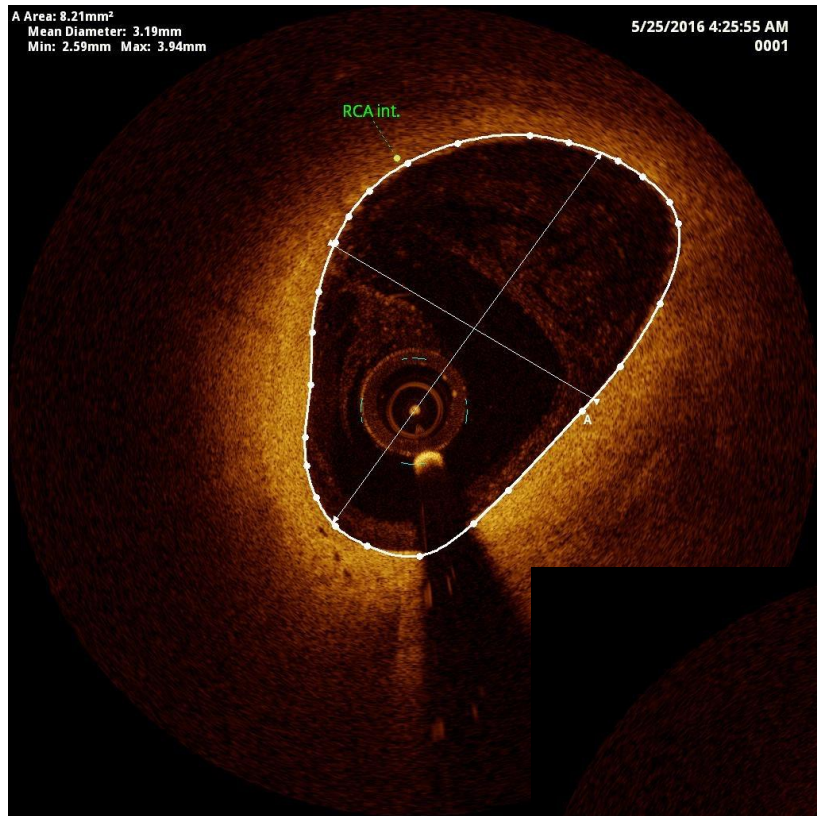
MI – 0 (0,0%)

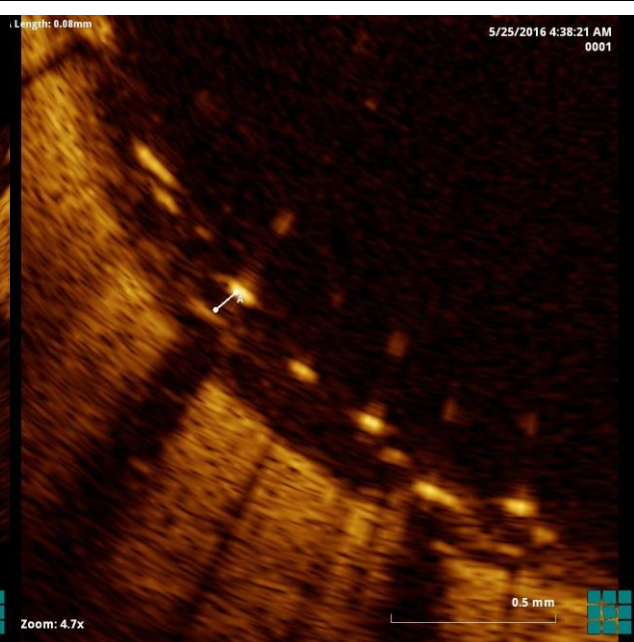
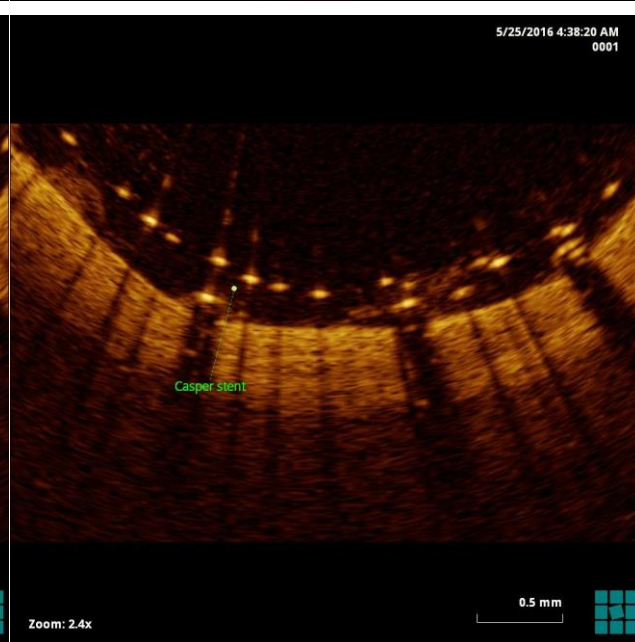
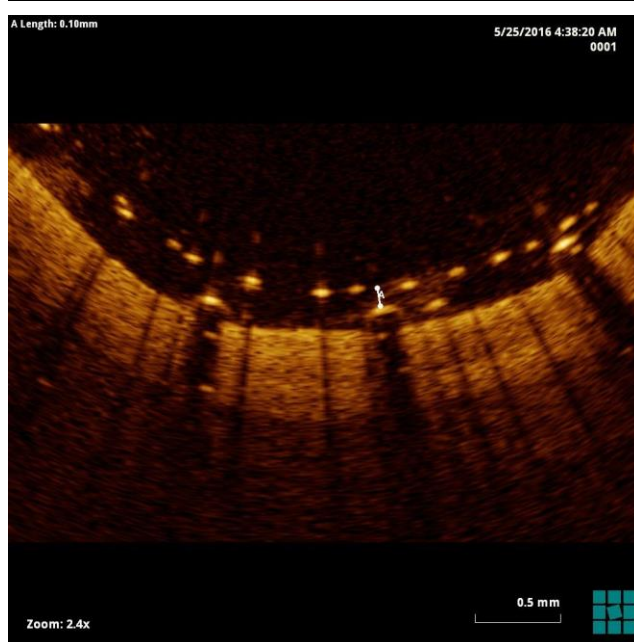
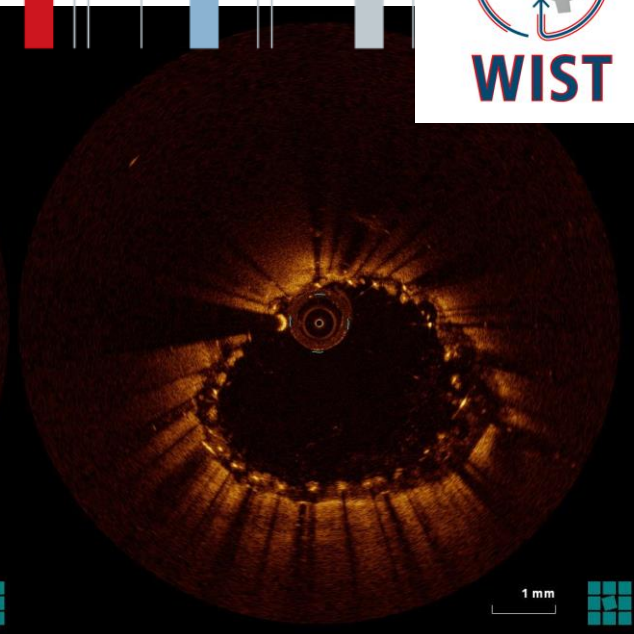
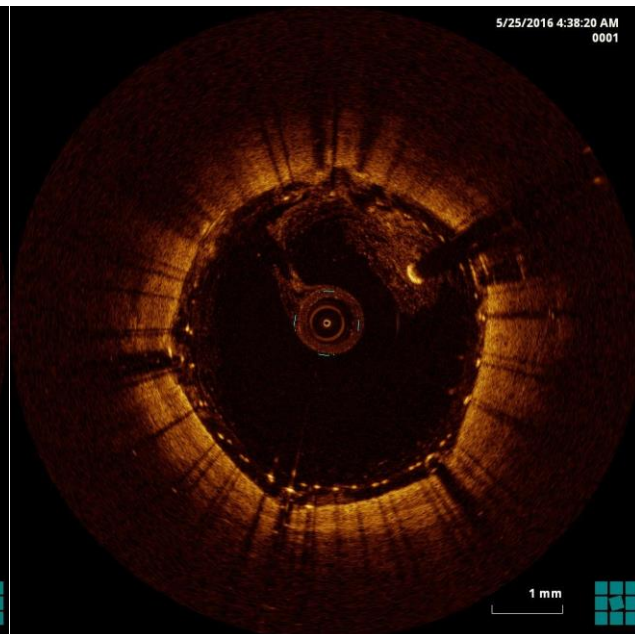
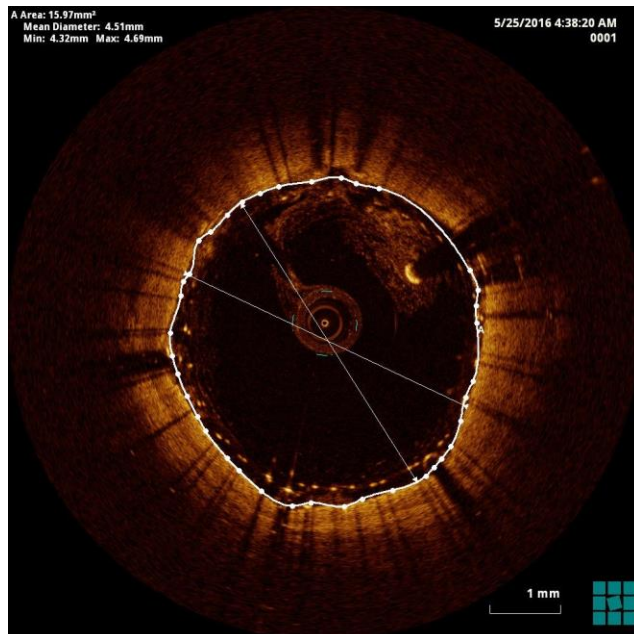
TIA – 0 (0,0%)

Stent malposition – 1 (2,6%)

Case #4 - Casper stent

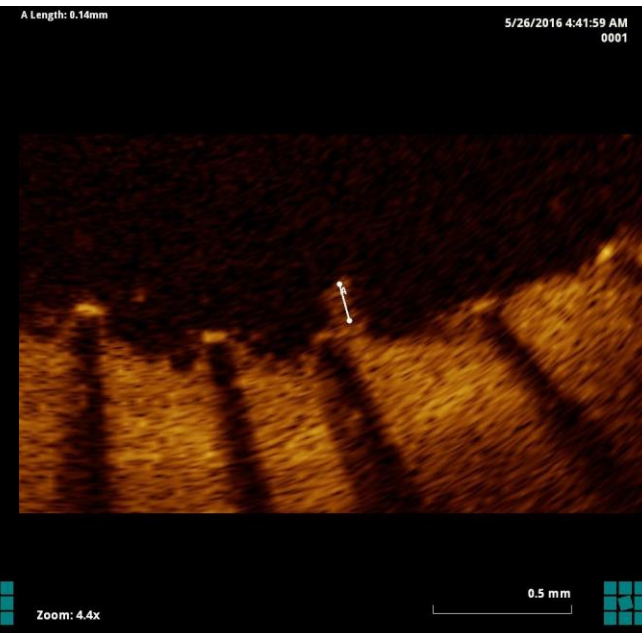
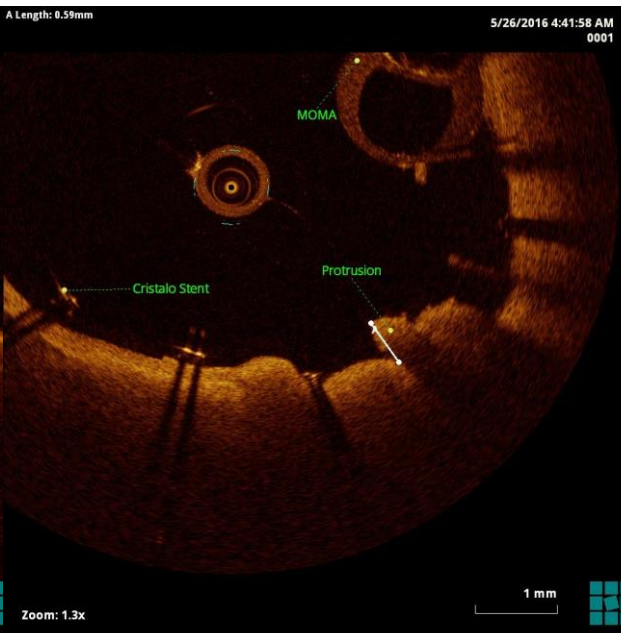
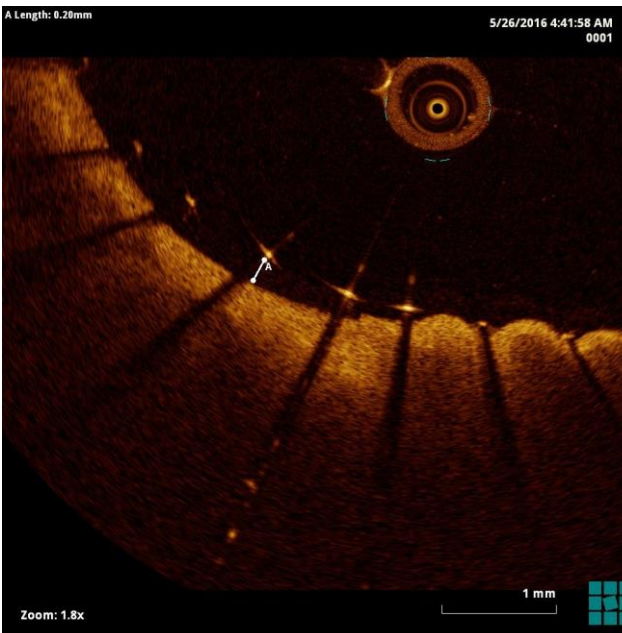
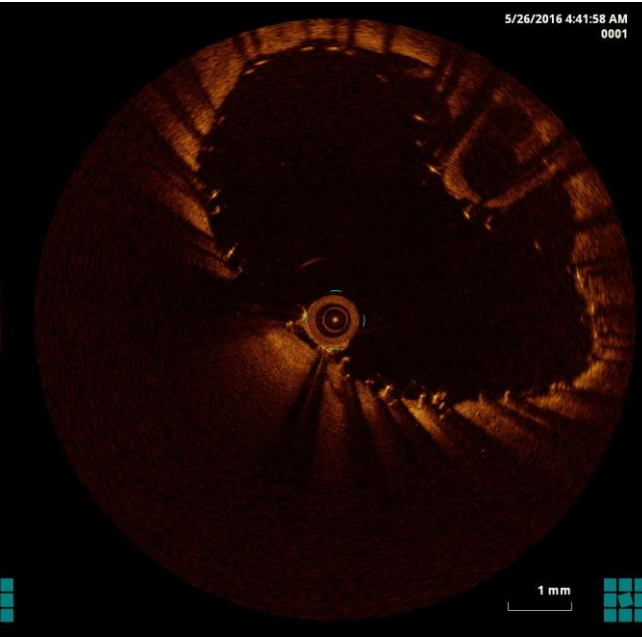
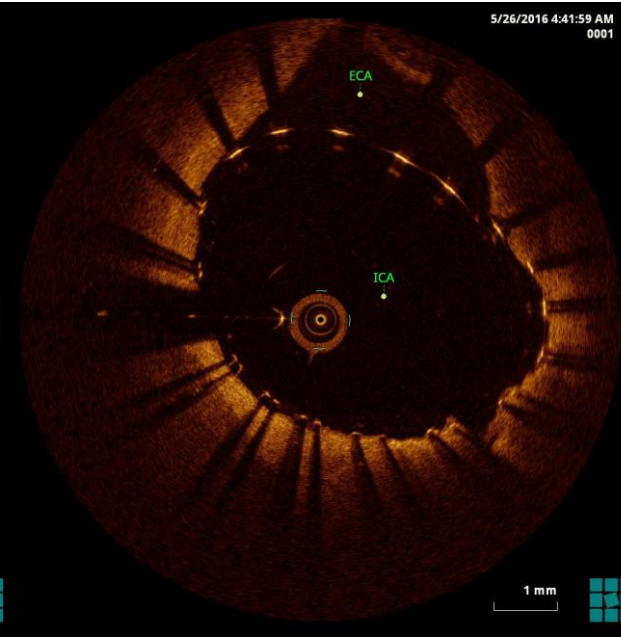
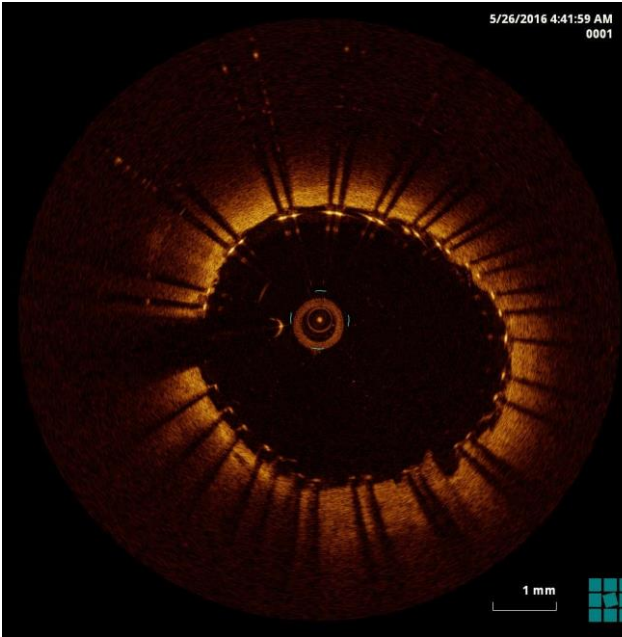






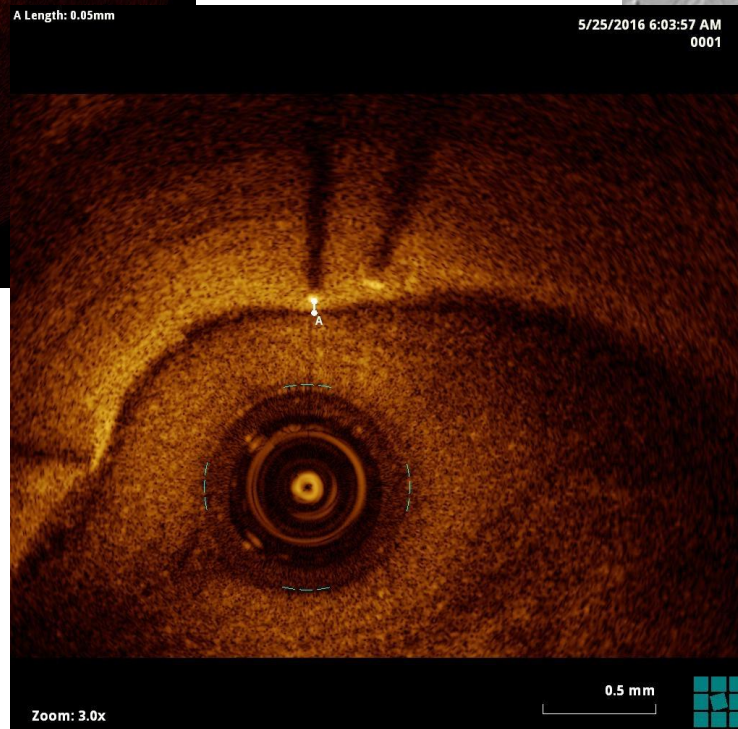
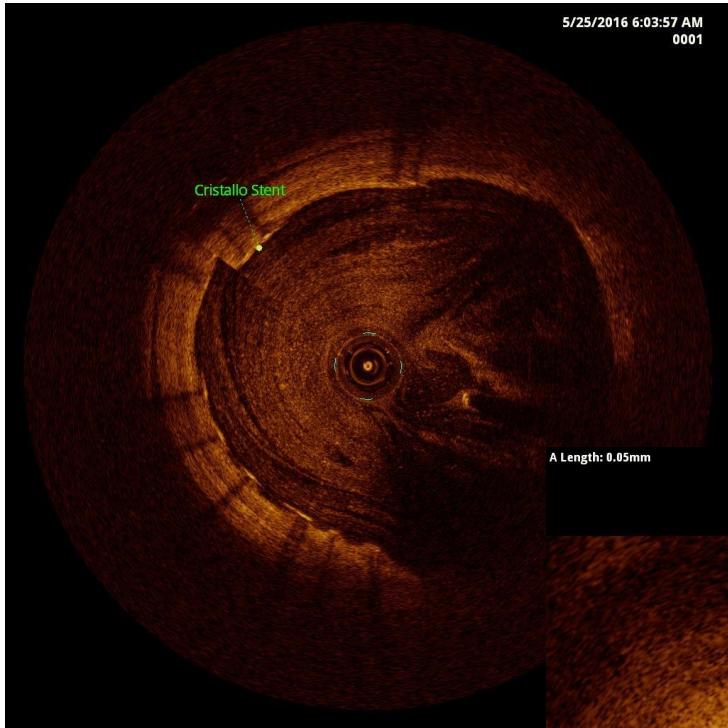
Case #5 - Cristallo-Ideale



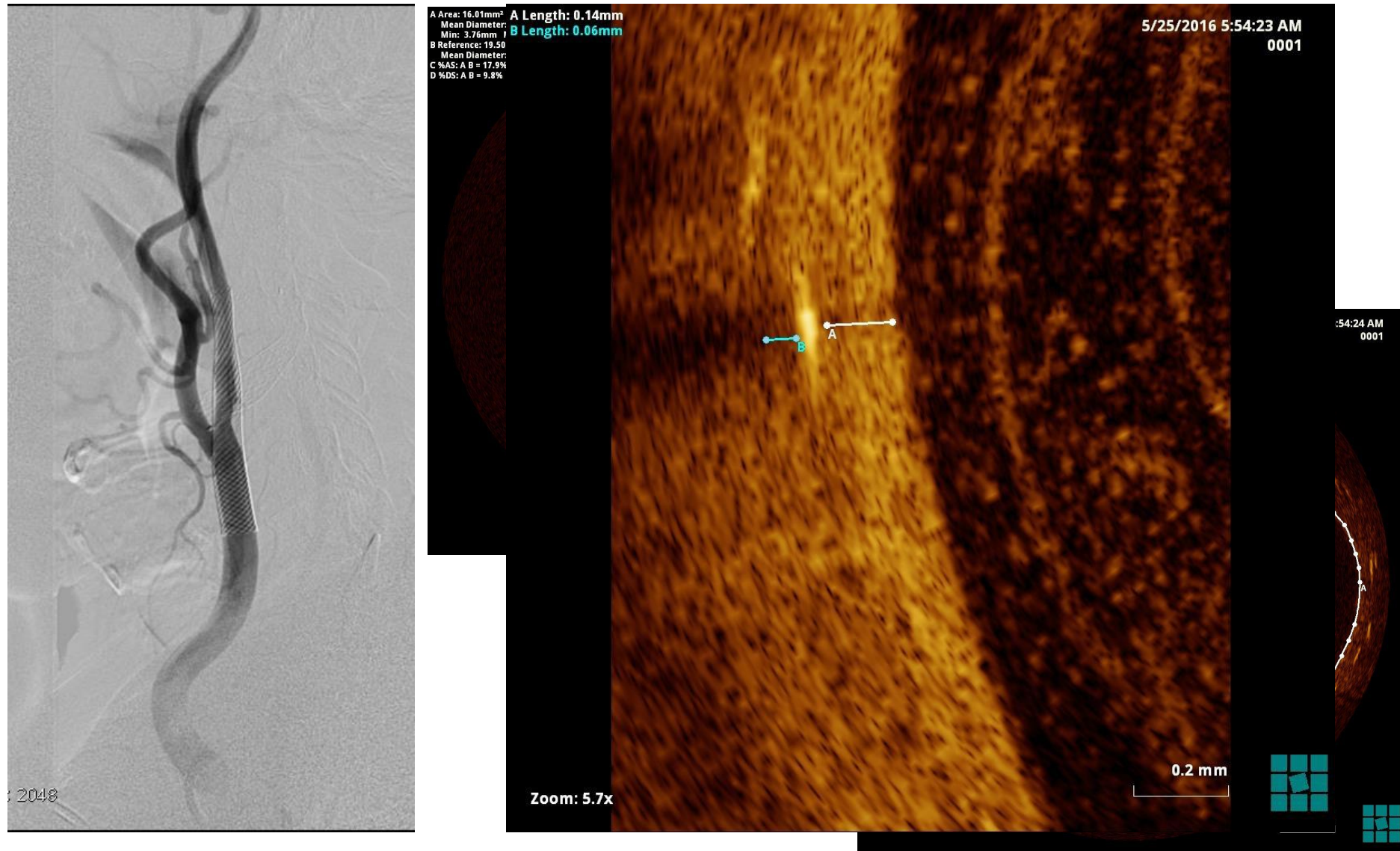


Case #6 – 3-years follow-up (Cristallo Ideale)

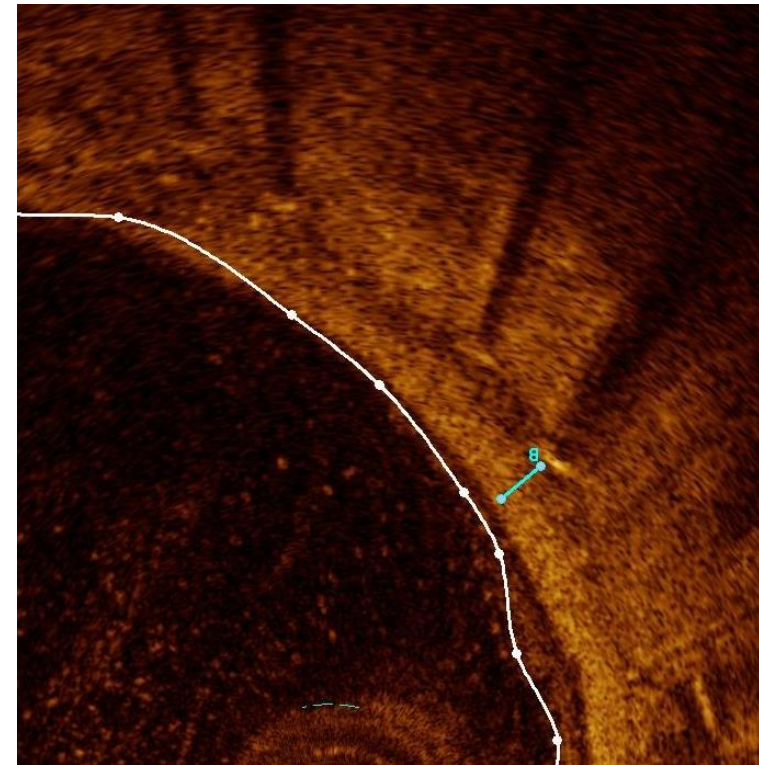
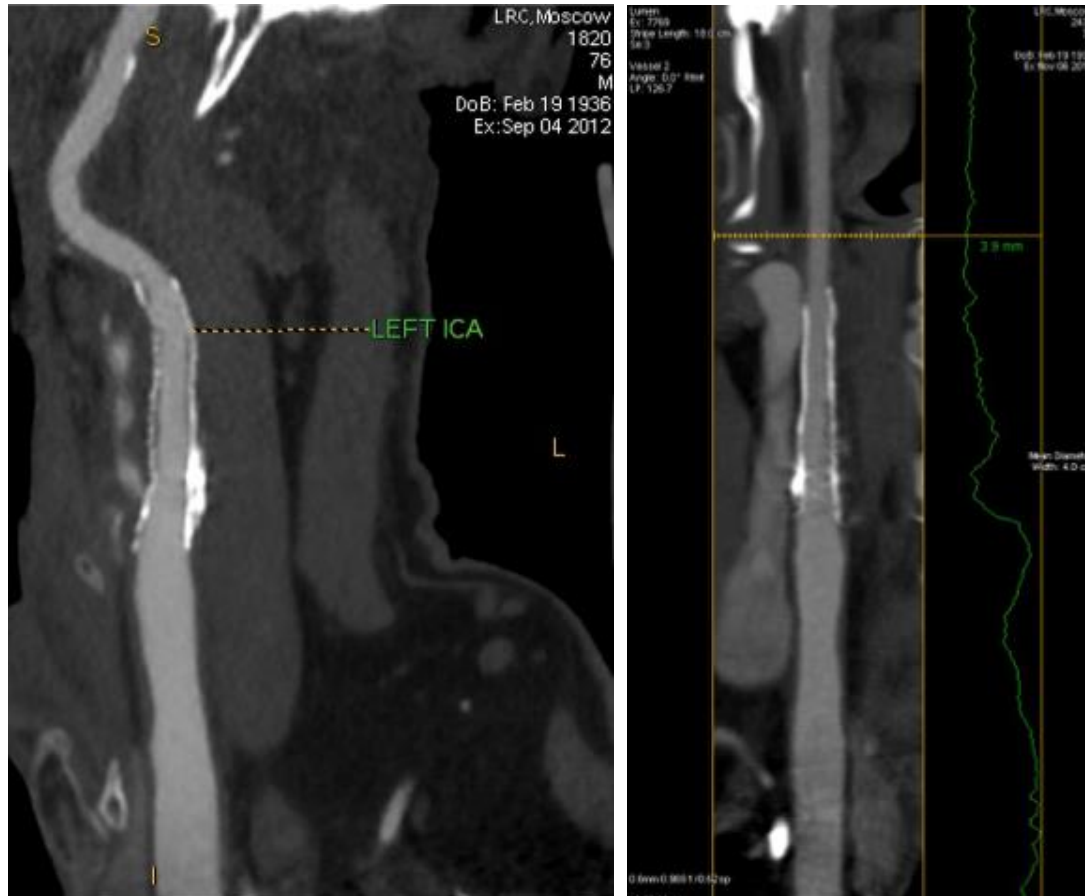




Case #7 – 3-years follow-up (Carotid WallStent)



Case #8 – 8-years follow-up (Precise)



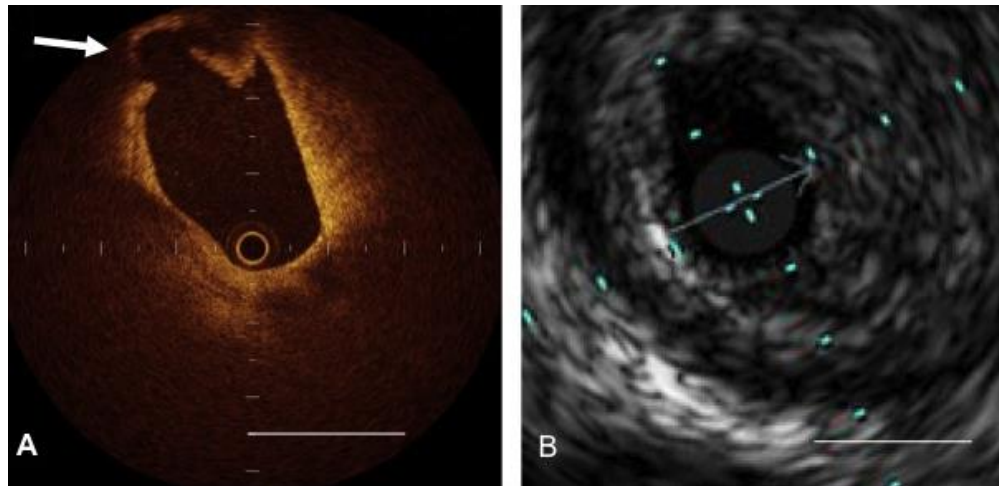
Chapter 6 OPEN ACCESS

Optical Coherence Tomography (OCT): A New Imaging Tool During Carotid Artery Stenting

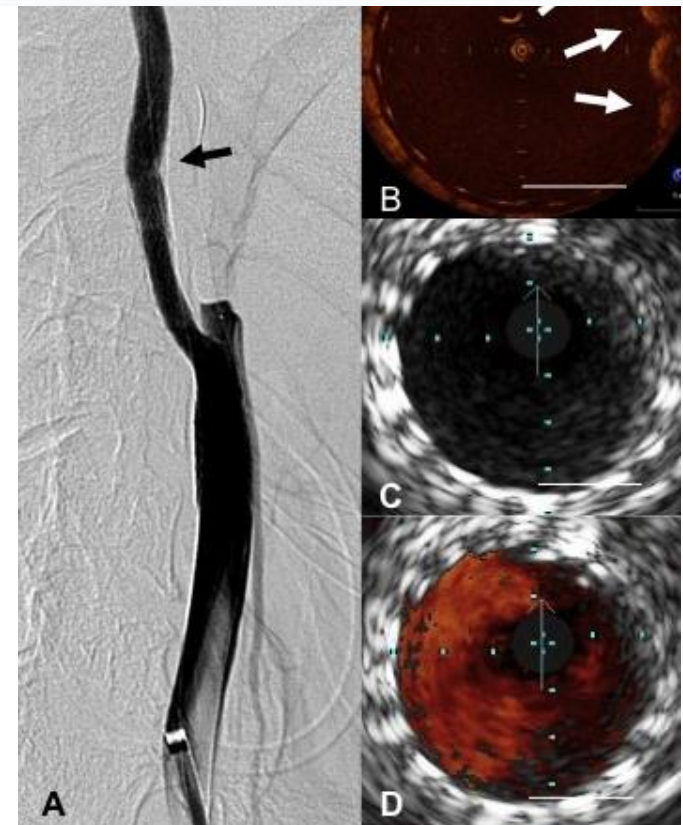
By Shinichi Yoshimura, Masanori Kawasaki, Kiyofumi Yamada, Arihiro Hattori, Kazuhiko Nishigaki, Shinya Minatoguchi and Toru Iwama

DOI: 10.5772/53962

OCT & IVUS compare during CAS



Plaque rupture by OCT. No plaque rupture by IVUS



Plaque protrusion by OCT. No protrusion by IVUS

Take-home message:

Intravascular visualization (IVUS/OCT) leads to optimization of CAS → less complications, less stent thrombosis and better long-term results

IVUS & OCT help to evaluation of suitable stent landing zones, selection of an appropriate stent size and angioplasty balloon, and confirmation that appropriate artery wall dilation with stent-wall apposition

IVUS & OCT help for assessment and understanding of the stroke mechanism formation in the early postoperative period after CAS

Thank you for your attention!

