Comparison of acute vessel wall injury after self-expanding stent and conventional balloon-expandable stent implantation: a study with OCT

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Presenter Disclosure Information

Presenter: Eun-Seok Shin, M.D.,Ph.D.

Title: Comparison of acute vessel wall injury after self-expanding stent and conventional balloon-expandable stent implantation: a study with OCT

No relationships to disclose

No industry sponsorship

Background

- Although balloon-expandable stenting techniques with high pressure have proved to be useful for optimal stent implantation to reduce the risks of restenosis and subacute thrombosis, this stent deployment strategy may also increase the risk of creating vessel damage in the stented segment or at its edges.

- On the other hand, a self-expanding stent allows deployment at lower pressures resulting in less intimal trauma.

- The acute impact in vivo from a self-expanding stent on the vessel wall has not been sufficiently evaluated.

- Optical coherence tomography (OCT) is a high-resolution technique that allows very detailed assessment of the relationship between the stent and the vessel wall.

Objective

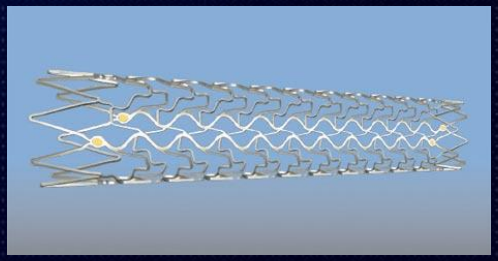
- To qualitatively and quantitatively compare with OCT stent implantation-associated vessel wall injury between a self-expanding stent and conventional balloon-expandable stents, and to compare their clinical impacts during the hospitalization period.

Method

- This study was conducted in single center of the Netherlands (Thoraxcenter, Erasmus MC). All consecutive 89 patients were performed OCT after Balloon-expandable stent implantation in native coronary arteries between May 2007 and March 2009 were included.
- Acute myocardial infarction and long lesion that needed over 50 mm of stent length (n = 33) were excluded.
- We also excluded 16 patients due to poor OCT images.

Method

- Finally 40 patients (45 vessels) with stable angina or unstable angina were included.
- 31 patients (36 vessels) for evaluation of balloon-expandable stent.
- During the same period of time, 9 patients (9 vessels) enrolled in the SECRITT trial were included for evaluation of vProtect® Luminal Shield (self-expanding stent).



OCT acquisition

- OCT acquisition was performed using a commercially available system for intracoronary imaging (LightLab Imaging Inc, Westford, MA, USA).
- In 5 cases, the occlusive technique was used.
- In 40 cases, OCT was acquired with the non-occlusive technique.
- The automated pullback was performed at 3 mm/s (n = 39) or 20 mm/sec (n = 1,C7XR: LightLab Imaging Inc, Westford, MA, USA)

Definitions of the acute impacts of stent implantation in OCT

- **Tissue prolapse:** protrusion of tissue between the stent struts without disruption of the continuity of the vessel luminal surface (Protrusion of tissue between struts was considered tissue prolapse only if the distance from the arc connecting adjacent stent struts to the greatest extent of protrusion was >50 μm)
- **Intra-stent dissection:** disruption of the vessel luminal surface in the stent segment with a visible dissection flap

Heart 2009;95:1913–1919

Definitions of the acute impacts of stent implantation in OCT

- **Edge dissection:** disruption of the vessel luminal surface in the stent edge within the 5 mm proximal and distal segments
- **Incomplete stent apposition (ISA):** at least one stent strut with detachment from the wall >1 thickness of the strut for the respective stent and unrelated with a side branch
- **Thrombus:** irregular mass with dorsal shadowing protruding in the lumen (mural thrombus) or a luminal mass with dorsal shadowing that is not connected to the vessel wall

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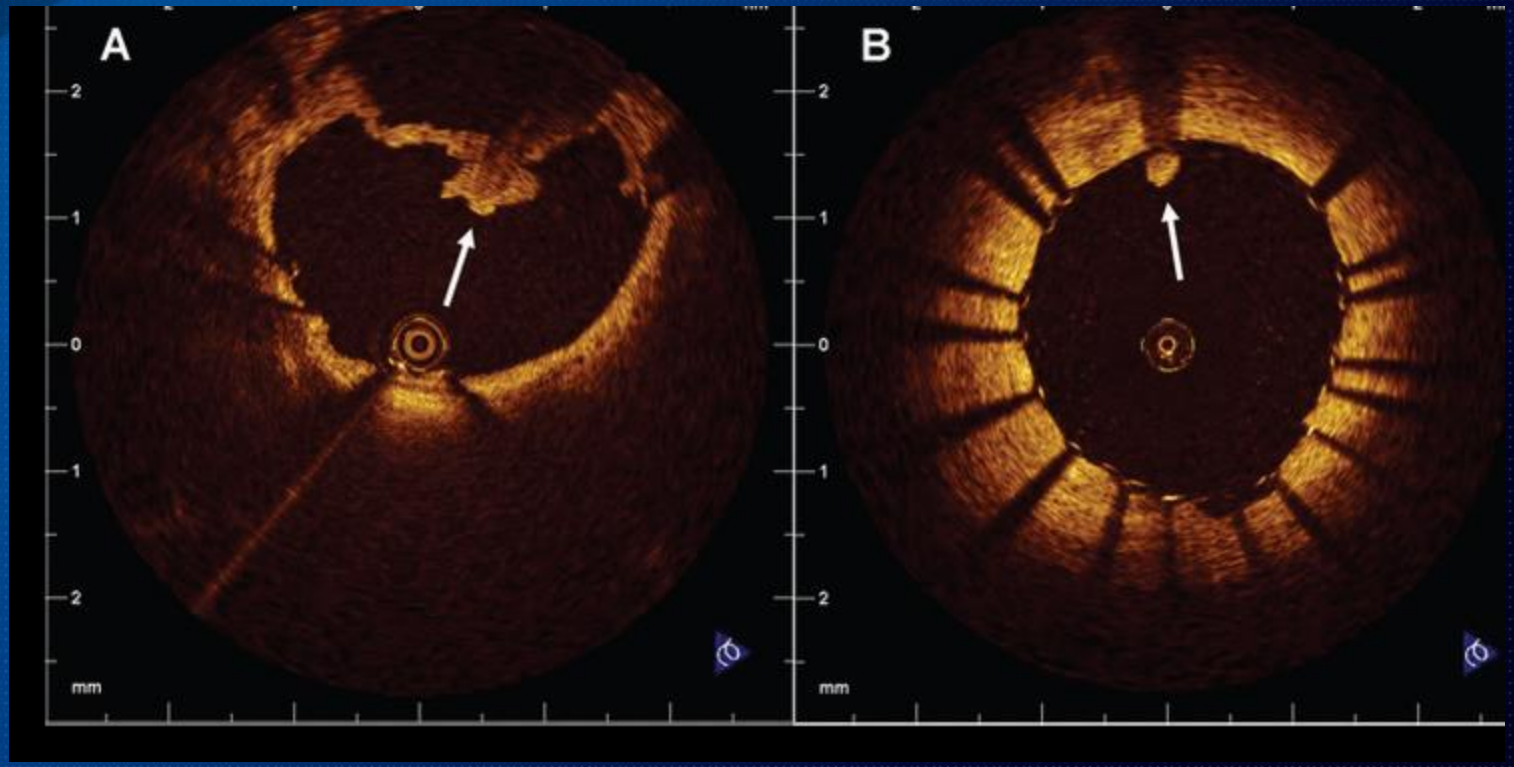

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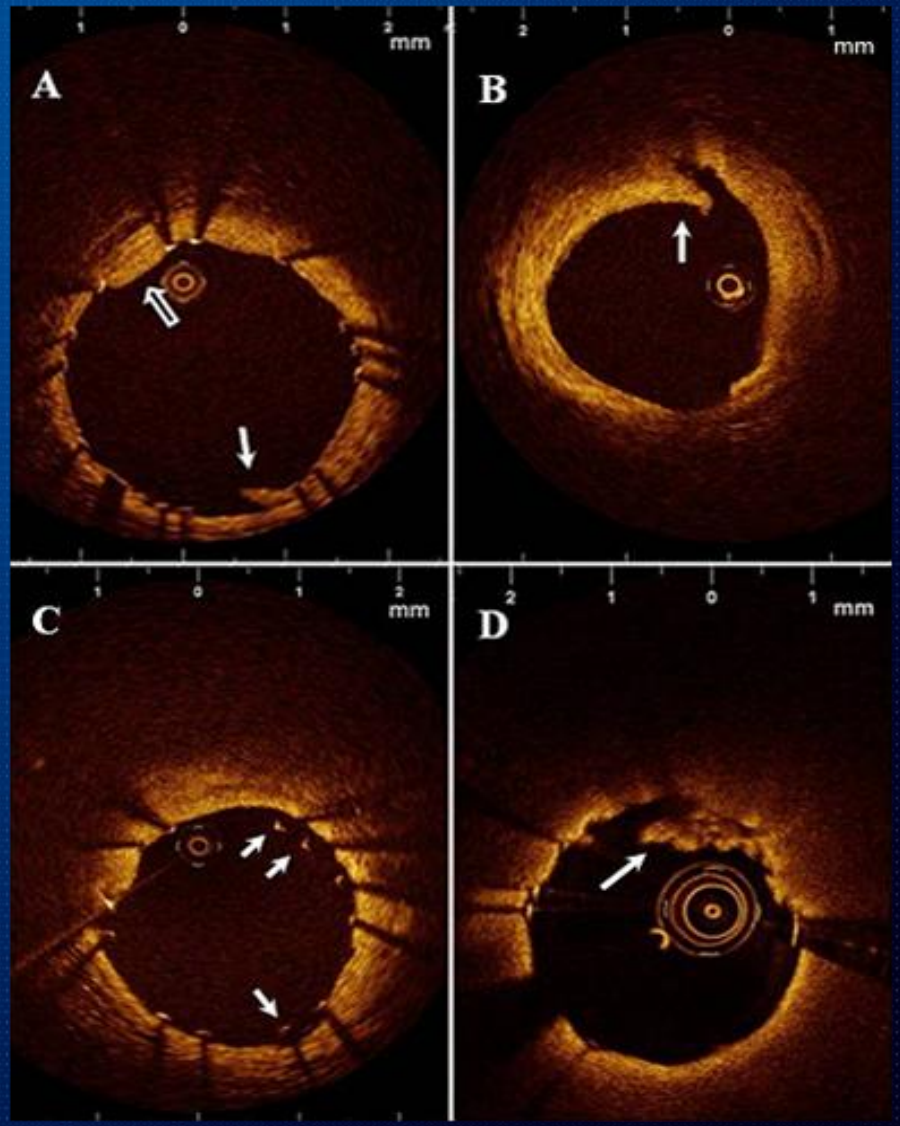
Various OCT images of acute impacts after stent implantation



fixed vessel contour

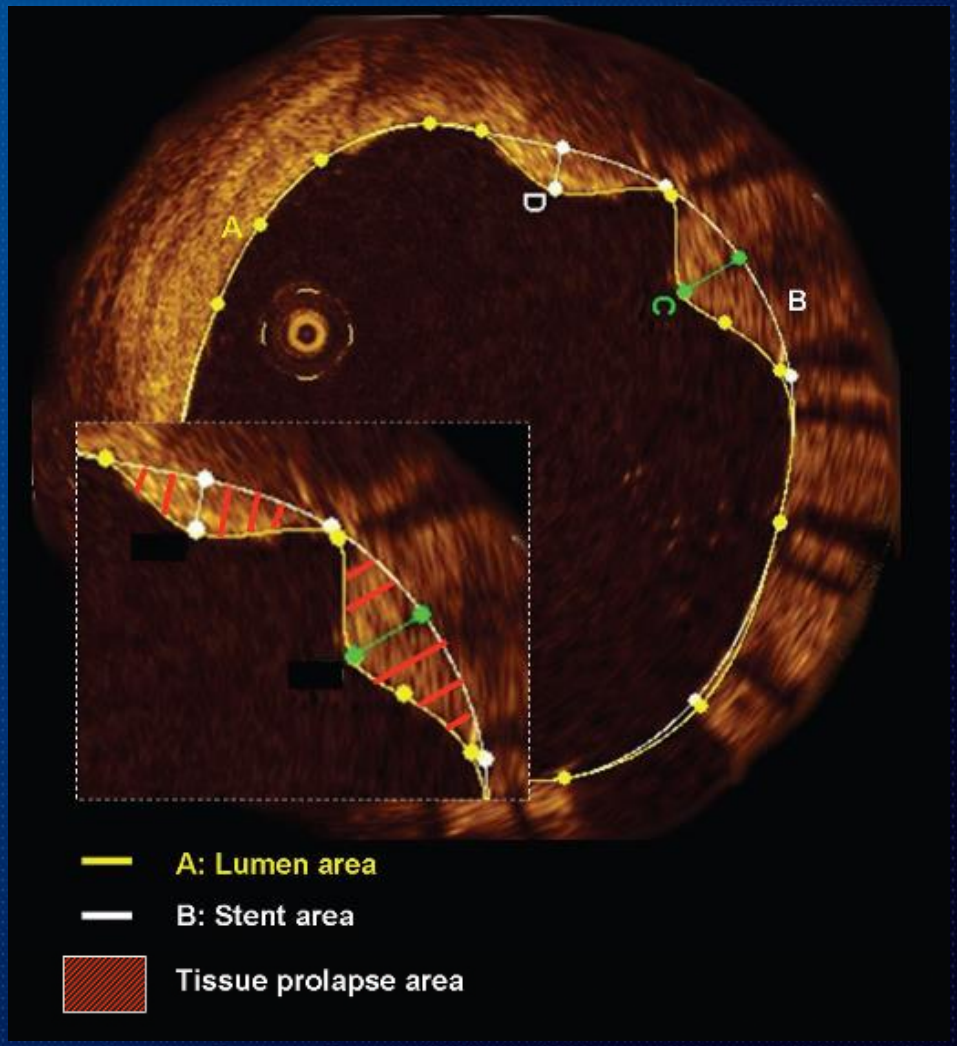
Quantitative OCT analysis of the acute impacts of stent implantation

- The analyzed region comprised the stented segment and the 5 mm proximal and distal peri-stent segments.
- The lumen and stent areas were measured at 1 mm intervals.
- In the case of tissue prolapse, the number of sites with tissue prolapse and the area were measured.

Quantitative OCT analysis of the acute impacts of stent implantation

- When there were signs of intra-stent dissection, the number of dissection flaps was counted and the length of the flap from its tip to the joint point with the vessel wall was measured.
- When edge dissection was present, the length of the dissection flap was measured in a similar way as described for the intra-stent dissection flap.

Tissue prolapsed area



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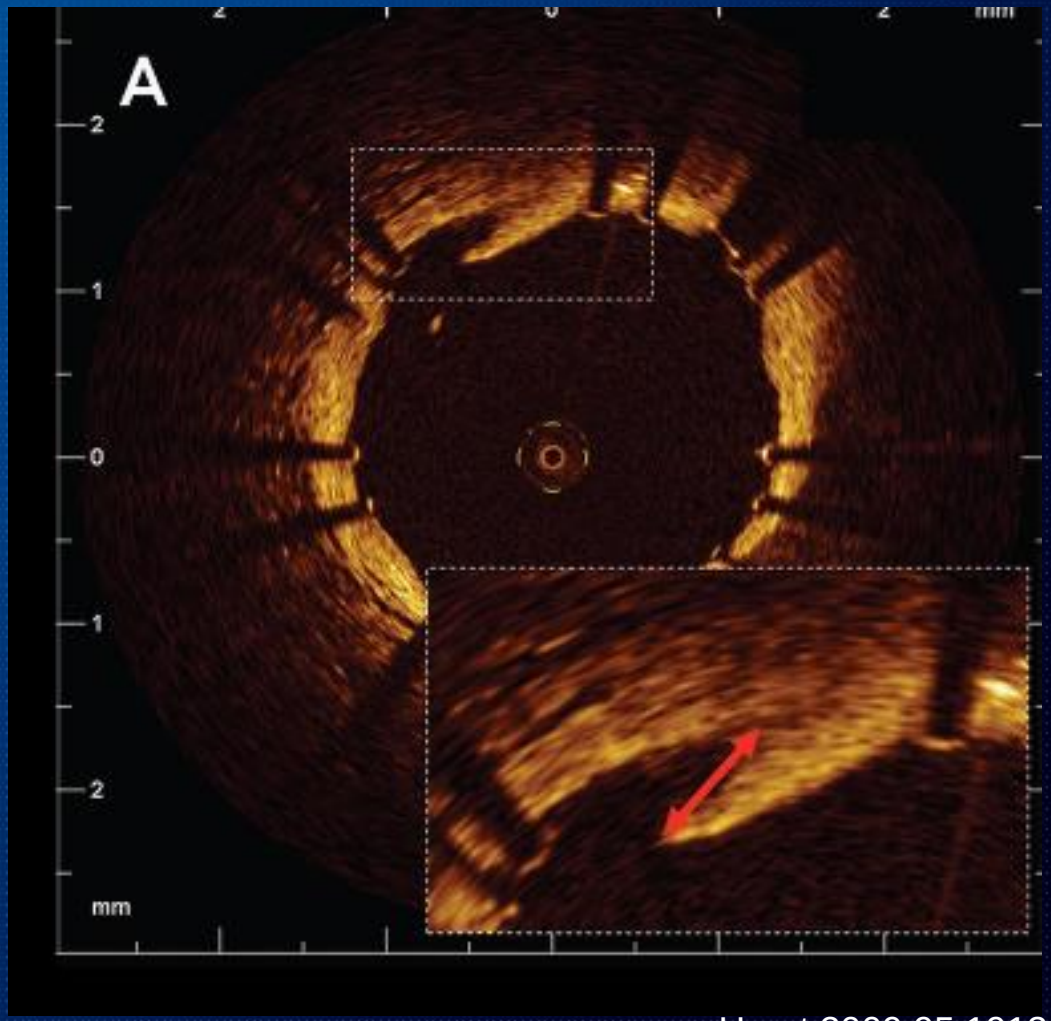
Intrastent dissection length



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Quantitative OCT analysis of the acute impacts of stent implantation

- At sites of ISA, maximum depth in single cut was measured.
- The presence of thrombus was qualitatively assessed and maximum length of thrombus was measured.
- To account for differences in stent length, the number and total area of tissue prolapse and the number of dissection flaps were corrected according to the stent length and expressed on a per mm basis.
- Image analysts were blinded to the clinical and procedural characteristics.

Clinical follow-up

- The presence of events (death, myocardial infarction, target lesion revascularization, target vessel revascularization and stent thrombosis) during the hospitalization period following stent implantation was registered in both groups.
- Myocardial infarction (MI) defined as chest pain together with ST-elevation or new left bundle branch block and an increase in cardiac enzymes (i.e. creatine kinase-MB fraction of 3 times the upper limit of normal)

Results

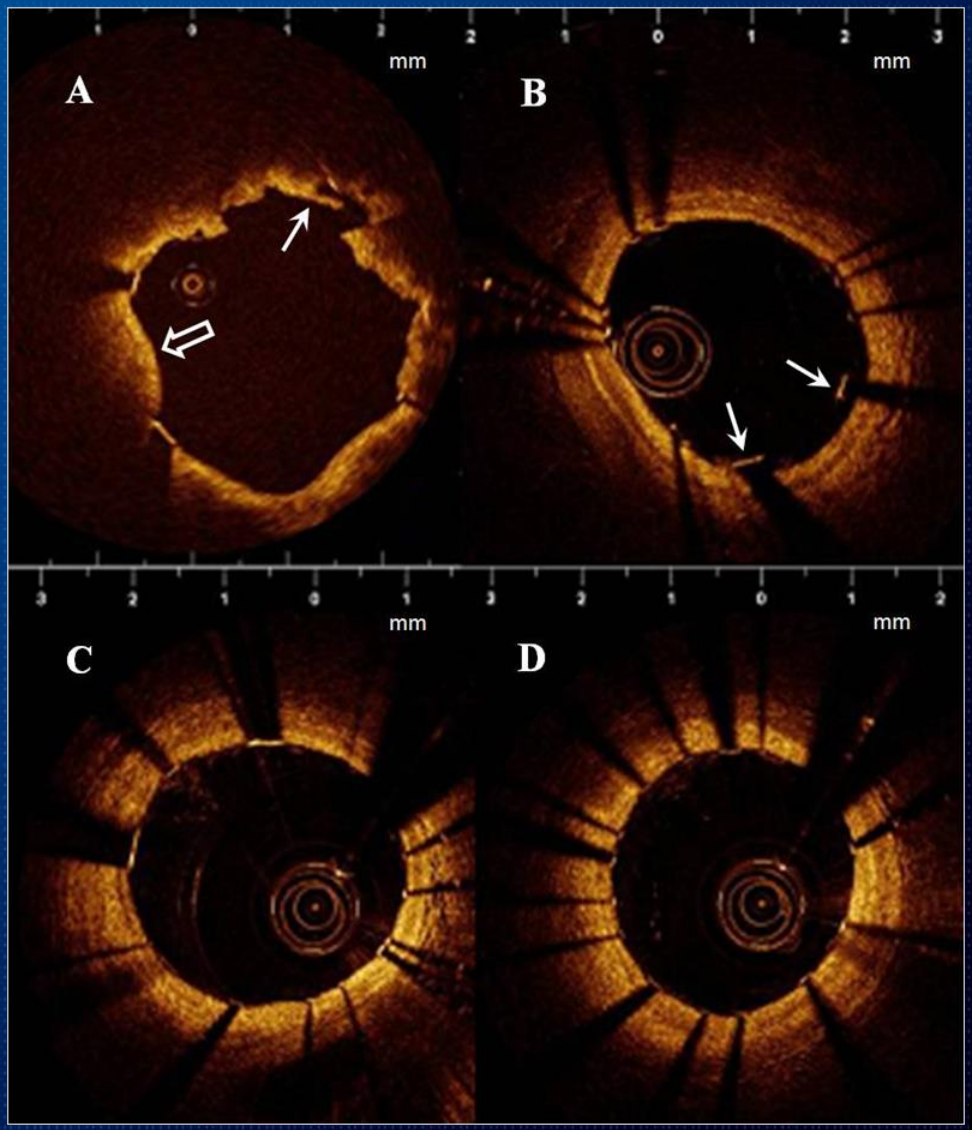
Clinical and procedural characteristics of self-expanding stent (vProtect® Luminal Shield; group 1) vs. balloon-expandable stent (group 2)

	Group 1 (n = 9)	Group 2 (n = 36)	*p*
Age	68.4 ± 9.9	62.9 ± 10.0	0.15
Male	5 (55.6)	28 (77.8)	0.22
Hypertension	8 (88.9)	23 (63.9)	0.24
Diabetes Mellitus	0	7 (19.4)	0.32
Dyslipidemia	8 (88.9)	26 (72.2)	0.42
Smoker	2 (22.2)	9 (25.0)	1.0
Previous MI	5 (55.6)	16 (44.4)	0.71
Previous CABG	0	2 (5.6)	1.0
Previous PCI	4 (44.4)	16 (44.4)	1.0
Vessel			0.53
LAD	3 (33.3)	19 (52.8)	
LCX	1 (11.1)	5 (13.9)	
RCA	5 (55.6)	12 (33.3)	
Stent type			<0.001
BMS	9 (100)	6 (16.7)	
Paclitaxel-eluting stent	0	1 (2.8)	
Zotarolimus-eluting stent	0	3 (8.3)	
Everolimus-eluting stent	0	26 (72.2)	
Lesion type B2 or C	2 (22.2)	17 (47.2)	0.26
Stent length (mm)	17.1 ± 5.2	26.2 ± 8.8	0.006
Implantation pressure (atm)	0	16.3 ± 3.7	<0.001
Predilatation	2 (22.2)	18 (50.0)	0.25
Postdilatation	5 (55.6)	14 (38.9)	0.62

Acute impacts of stent implantation on the vessel wall in self-expanding stent (vProtect® Luminal Shield; group 1)vs. balloon-expandable stent (group 2)

	Group 1 (n = 9)	Group 2 (n = 36)	*p*
Post-stenting measurement (mm²)			
Lumen area	7.9 ± 2.3	7.3 ± 1.7	0.3
Stent area	8.0 ± 2.3	7.6 ± 1.9	0.6
Minimum stent area	6.3 ± 2.3	6.0 ± 1.7	0.7
Tissue prolapse			
Number of vessels with tissue prolapse	9 (100)	36 (100)	1.0
Number of tissue prolapse per mm	0.34 ± 0.34	0.64 ± 0.56	0.03
Average area (mm²)	0.06 ± 0.03	0.13 ± 0.08	<0.001
Total area per mm (mm²)	0.02 ± 0.01	0.06 ± 0.06	0.001
Intrastent dissection			
Number of vessel with intra-stent dissection	4 (44.4)	33 (91.7)	0,004
Number of dissected flaps per mm	0.06 ± 0.08	0.21 ± 0.18	0,003
Average length (µm)	79.6 ± 103.7	277.6 ± 110.0	<0.001
Edge dissection			
Proximal	0	10 (27.8)	0.17
Distal	0	14 (38.9)	0.04
Average length (µm)	0	515.2 ± 403.4	<0.001
Incomplete stent apposition			
Number of vessels	7 (77.8)	23 (63.9)	0.7
Maximum depth (µm)	178.2 ± 156.7	267.2 ± 72.1	0.03
Thrombus			
Number of vessels	2 (22.2)	16 (44.4)	0.28
Maximum length (µm)	131.4 ± 30.3	297.6 ± 121.5	0.08

Balloon-expandable stent vs. self-expanding stent



fixed vessel contour

In-hospital events

- There were no events (death, MI, target-lesion revascularization, target-vessel revascularization or stent thrombosis) during the hospitalization period in both groups.

Limitations

- It is a non-randomised study, and a relatively small population was included in the self-expanding stent group.

- The two study groups were not matched for lesion severity. Because target lesions were relatively simple in the self-expanding stent group and acute vessel injury might increase in the conventional balloon-expandable stent group, a large prospective study is needed to confirm our observations on the acute impact of self-expanding and balloon-expandable stents.

Conclusions

- Although a very high proportion of patients showed tissue prolapse or intra-stent dissection visible by OCT after stent implantation in both groups, the self-expanding vProtect® Luminal Shield stent appears to be less frequently associated with intra-stent and edge dissection than conventional balloon-expandable stents.

Conclusions

- However, the vessel-wall injuries were not associated with in-hospital clinical events.
- OCT-detectable acute vessel-wall injury after stenting might therefore not be associated with early clinical events.

Thank you for your attention !

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