

# Ateroskleroze koronāro artēriju bifurkāciju bojājumos – intravaskulāro metožu ekspertīze



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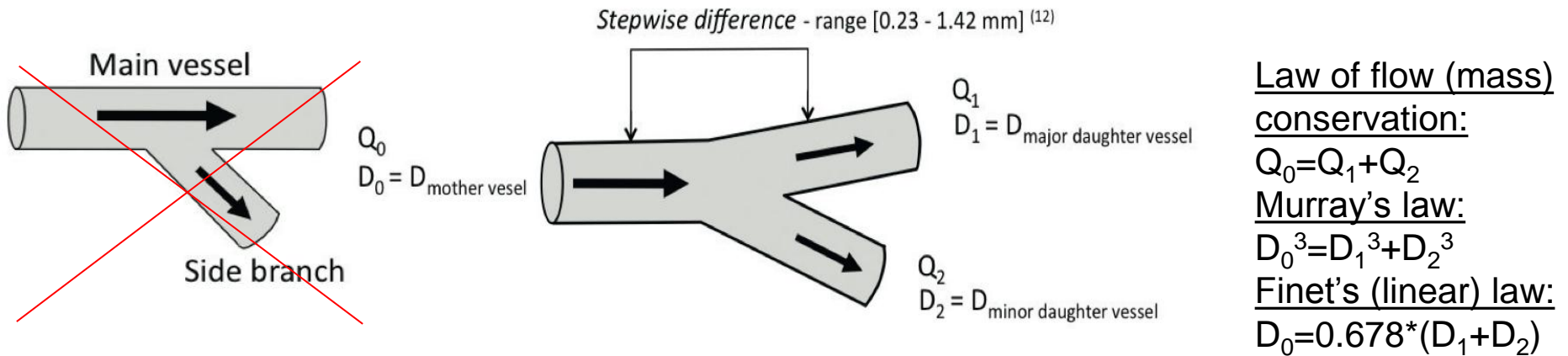
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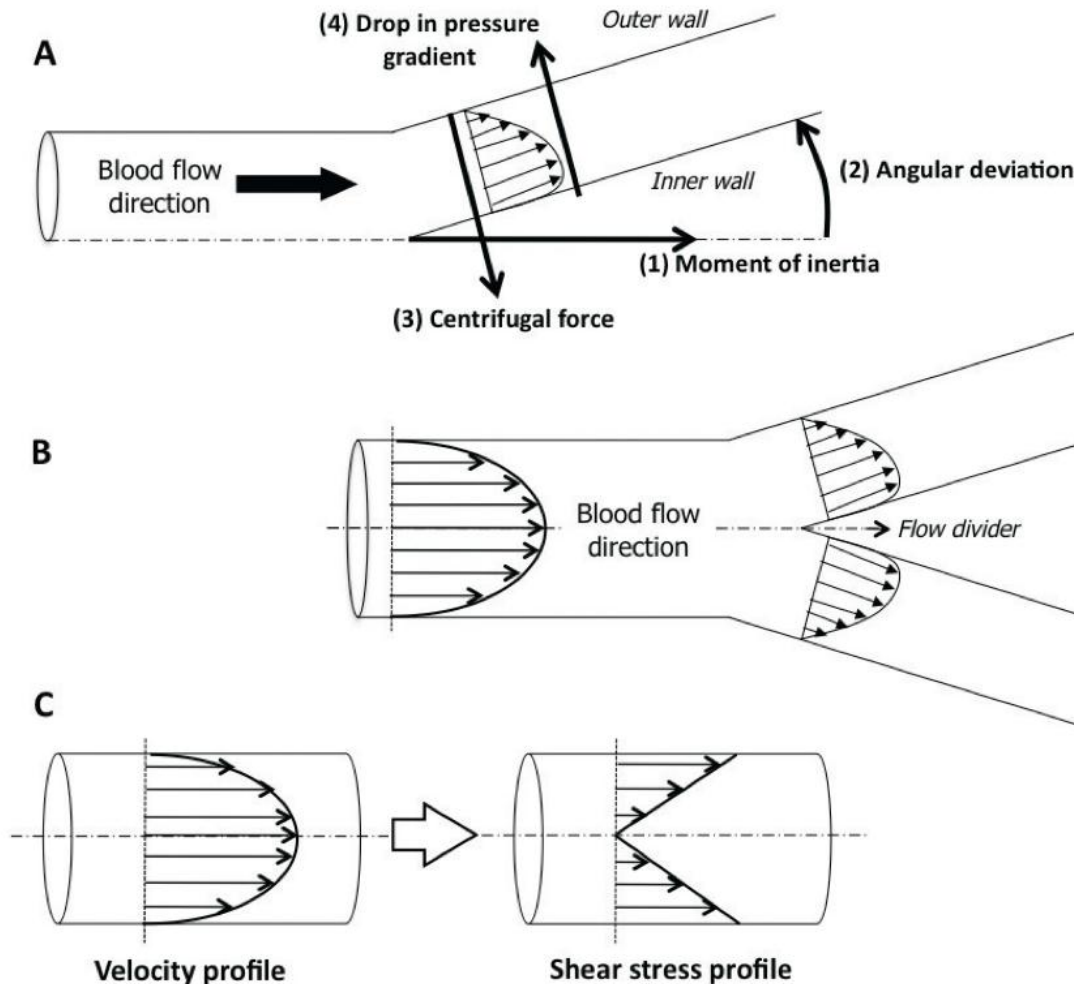
# Bifurkācijas struktūra



- There is no linear decrease from the proximal to the distal diameter of a coronary artery. The diameter is constant between two bifurcations and then diminishes abruptly when the artery branches off into a bifurcation..
- A coronary bifurcation is not composed of a main vessel and a side branch (SB), it has three segments with different diameter and flow (proximal main: PM, distal main: DM and side branch: SB)
- Following the flow/length/diameter relationship the DM is the largest and/or longest segment.



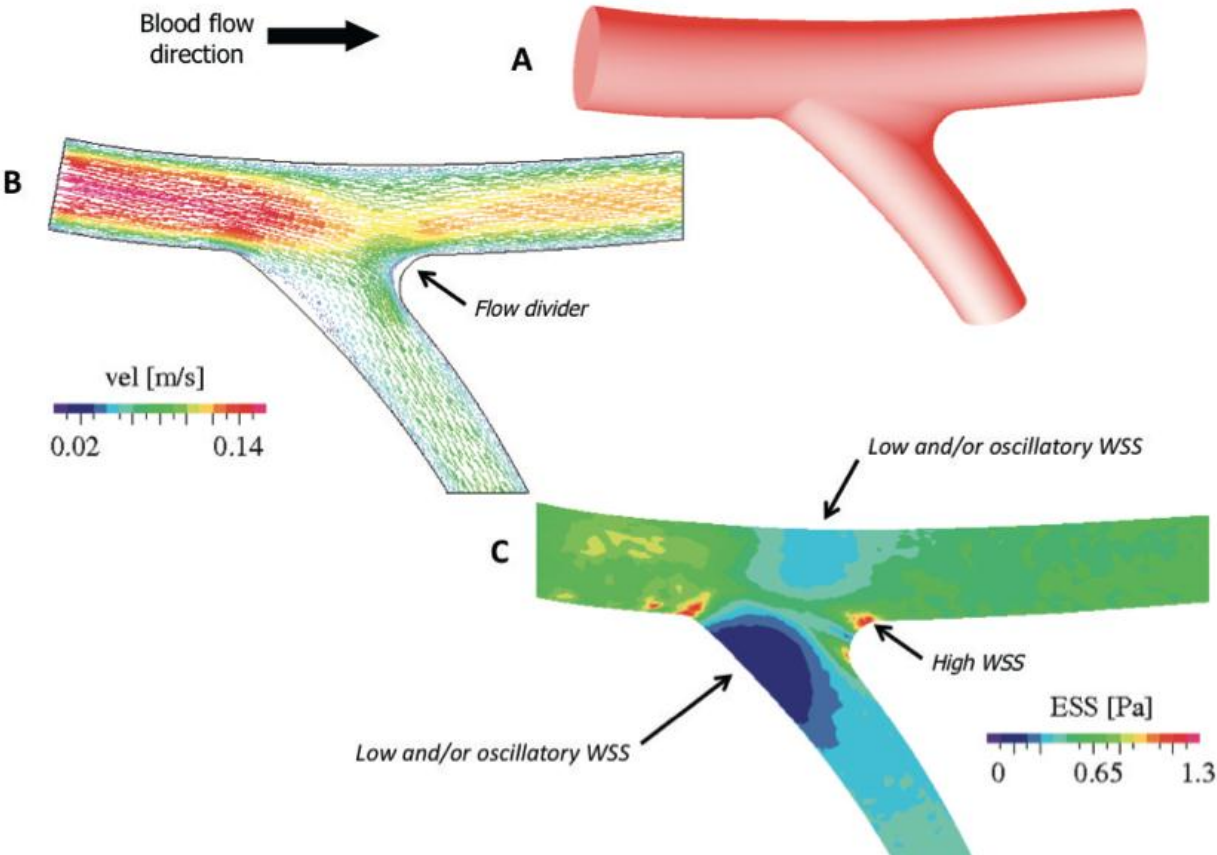
# Bifurkācijas ietekme uz šķidrumu dinamiku



- A) Laminar flow in an artery induces a force of inertia (1) in the direction of flow; a sudden change in direction characterised by an angular deviation (2) induces a centrifugal force (3) which creates a pressure gradient at the exit from the change in direction.
- B) Description of fluid dynamics changes from symmetric laminar flow before the bifurcation to asymmetric flow gradients after division of the flow.
- C) The flow velocity profile is associated with a shear stress profile, corresponding to the derivative of the velocities from their radial position.



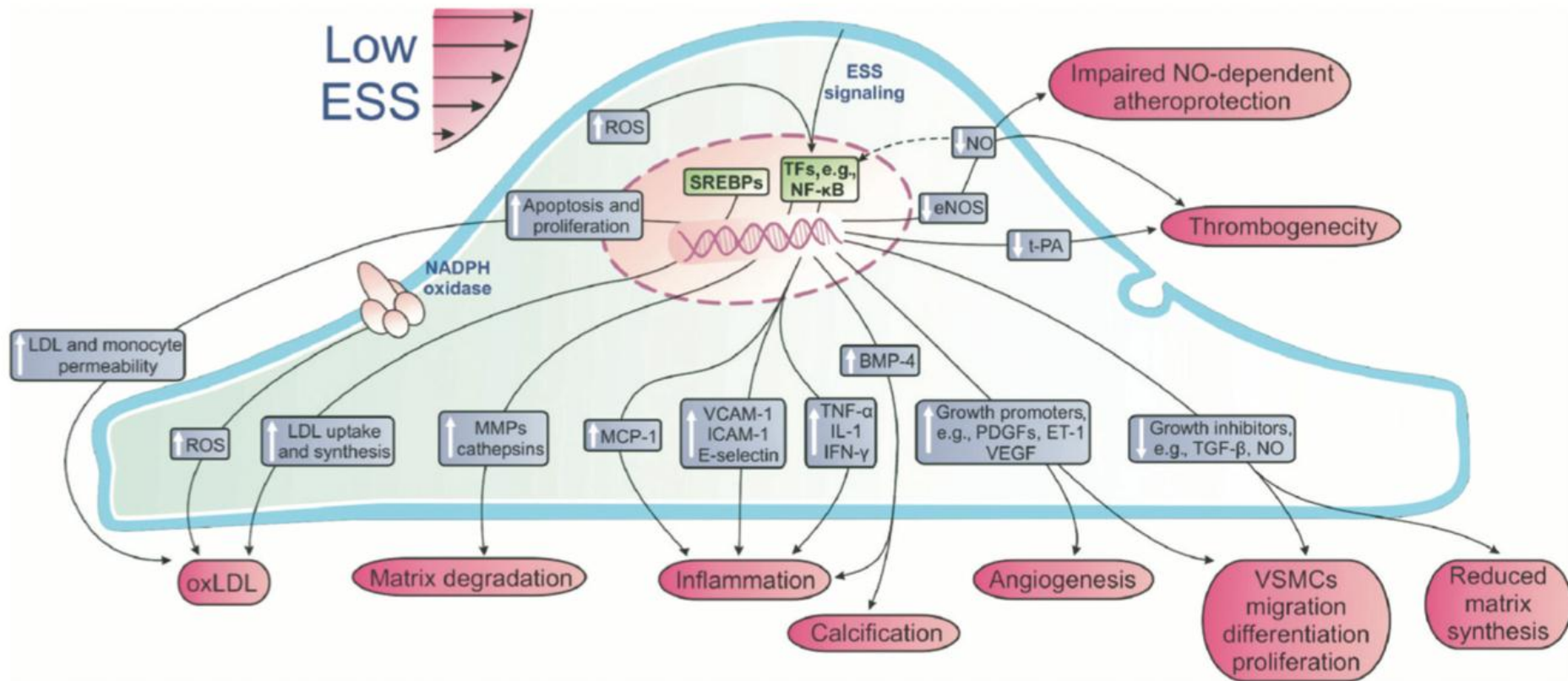
# Sieniņas bīdes spēks (iestiepums) bifurkācijās



- A) The coronary bifurcation model respects a fractal geometry.
- B) Map of velocity profile, showing the preferential route towards the flow divider induced by the force of inertia.
- C) Map of wall shear stress (WSS) showing two contrasting regions at the flow divider where WSS is low, regions where flow is very slow and/or oscillatory.

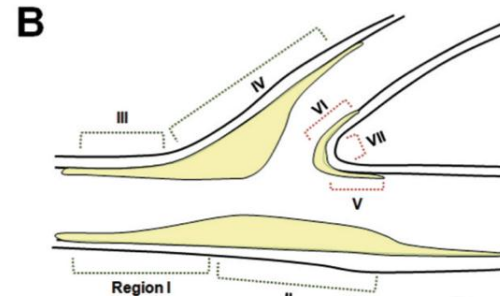
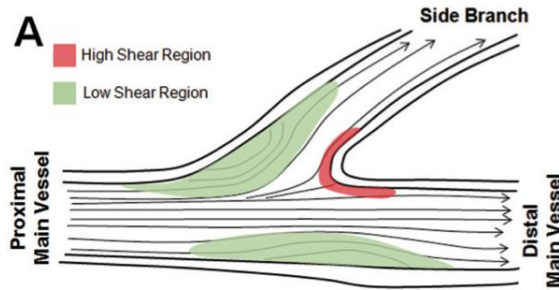


# Zema bīdes spēka (iestiepuma) ietekme uz aterosklerozi

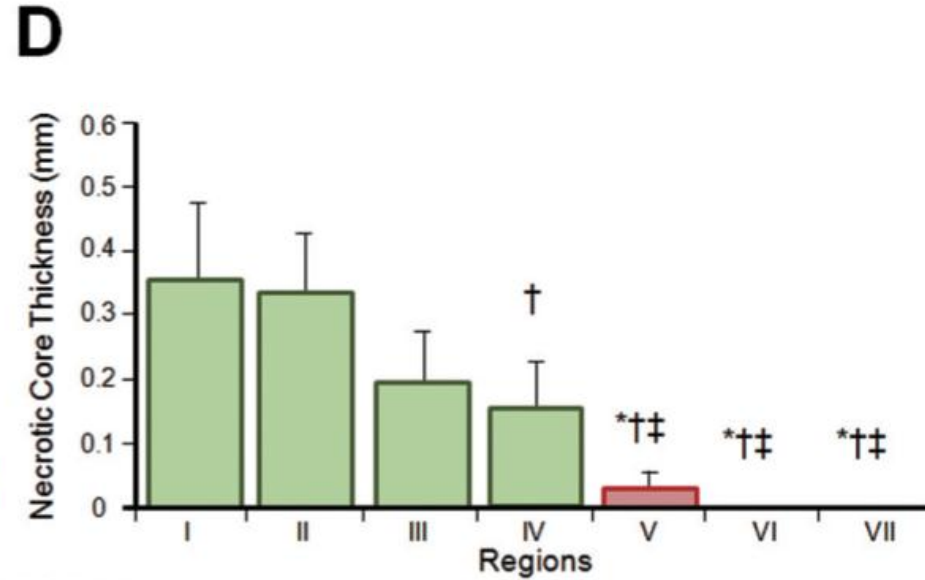
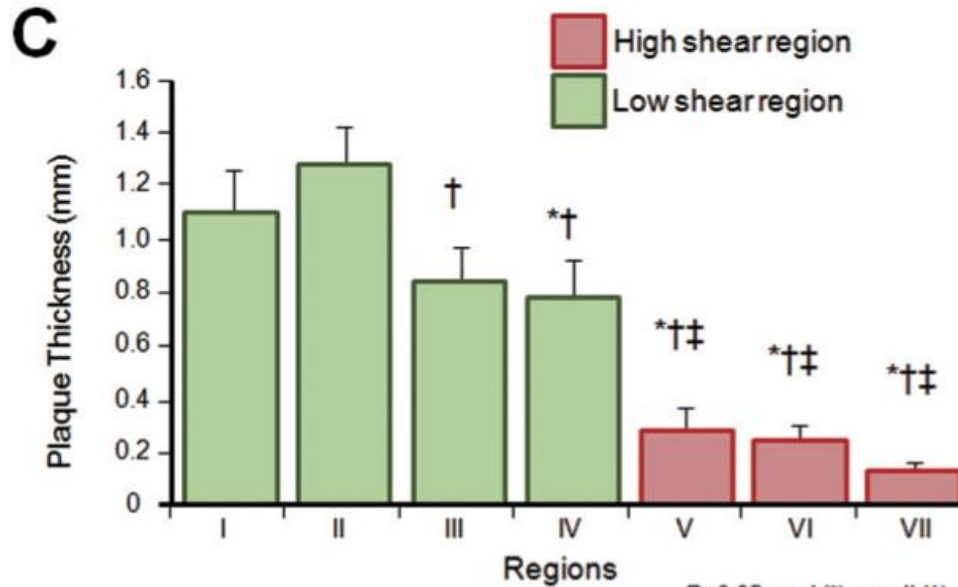


# Plūsmas ietekme uz ateromu bifurkācijās

Flow behavior with low shear regions in the lateral walls and high shear regions at the carina.



Regions: I - Proximal MV, II - Distal MV on the lateral wall, III - Proximal MV on the SB, IV - Distal SB on the lateral wall, V - Distal MV on the flow divider side, VI - Distal SB on the flow divider side, VII - Carina.



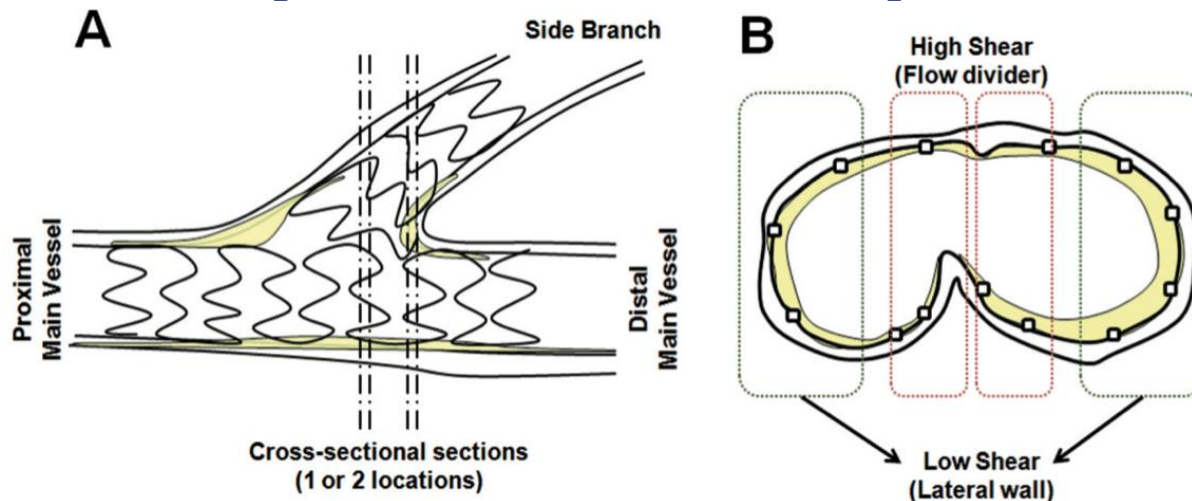
$P < 0.05$ , vs. I (\*), vs. II (†), vs. III & IV (‡)

C: Plaque thickness was greater in regions of low shear as compared to high shear.

D: Necrotic core thickness was significantly greater in low shear regions as compared to high shear with absent of necrotic core at the carinal region (VII)



# Plūsmas ietekme uz arteriālo dzīšanu pēc stenta implantācijas



**Table 2. Morphometric comparison between high shear vs. low shear regions in DES and BMS.**

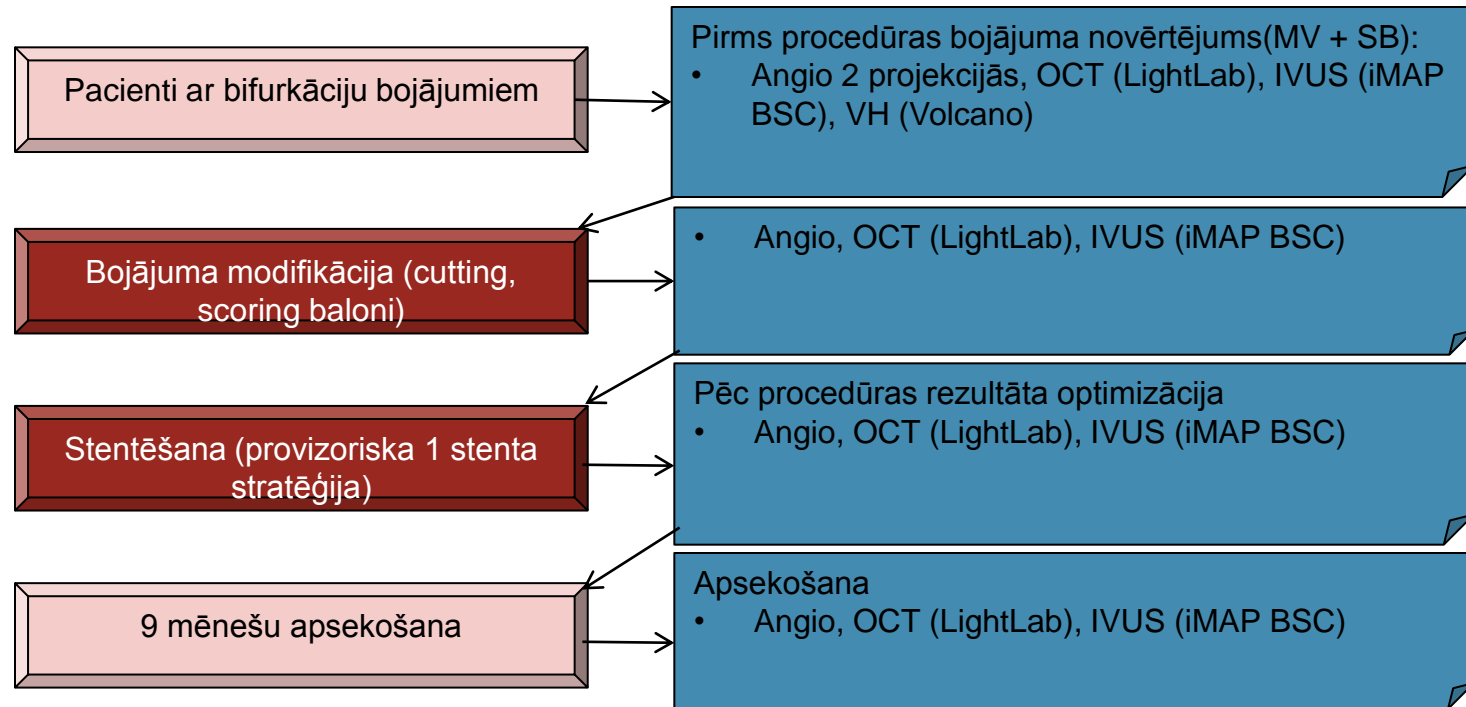
	DES (12 lesion, 17 stents)		p value	BMS (14 lesion, 18 stents)		p value	P value for DES vs. BMS	
	High shear (flow divider)	Low shear (lateral walls)		High shear (flow divider)	Low shear (lateral walls)		High shear	Low shear
Neointimal thickness (mm)	0.07 [0.03, 0.15]	0.17 [0.09, 0.23]	0.001	0.26 [0.16, 0.73]	0.44 [0.17, 0.67]	0.25	0.0002	0.004
Fibrin deposition (%Struts)	60 [21, 67]	17 [0, 55]	0.01	8 [0, 33]	3 [0, 21]	0.21	0.008	0.19
Uncovered struts (%Struts)	40 [16, 76]	0 [0, 15]	0.001	0 [0, 21]	0 [0, 0]	0.10	0.004	0.38

DES: drug-eluting stent; BMS: bare metal stent; Values are expressed as median and interquartile range



# Aterosklerozes vizualizācija koronārās bifurkācijās

Prospektīvs, viena centra, nerandomizēts, pilota pētījums pacientiem ar *de novo* bifurkāciju bojājumiem (n=70), kam veic perkutānu koronāru intervenci ar zālēm pildītu stentu intravaskulārās vizualizācijas metožu kontrolē



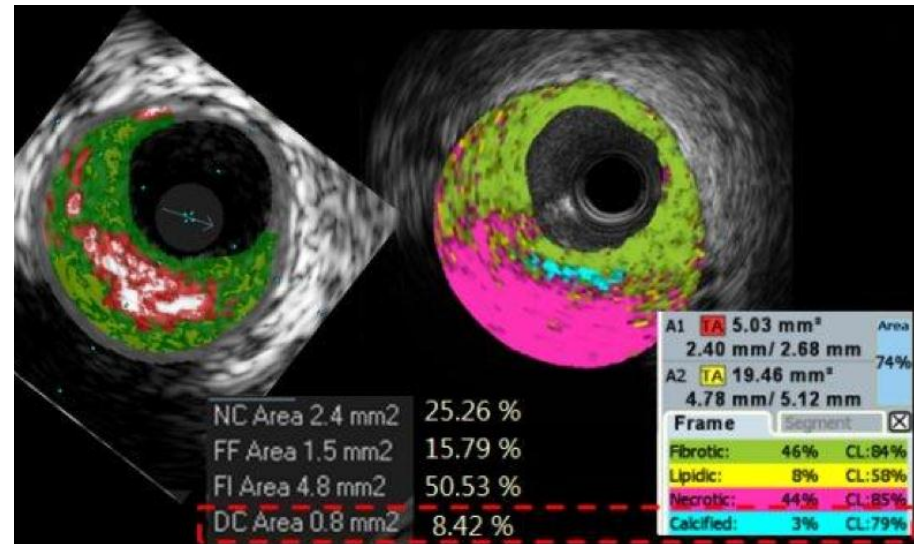
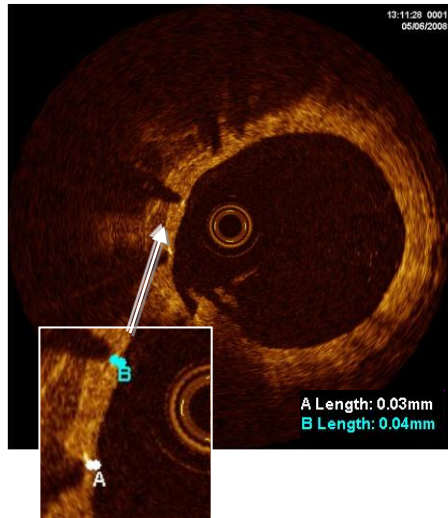
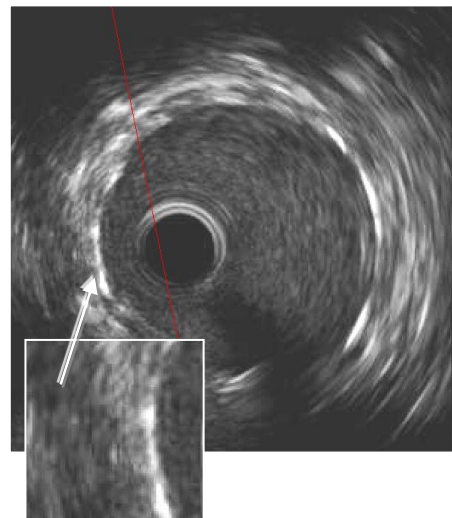
## Rezultāti:

- Pabeigta pacientu iekļaušana (n=70)
- Turpinās pacientu apsekošana (n=60)



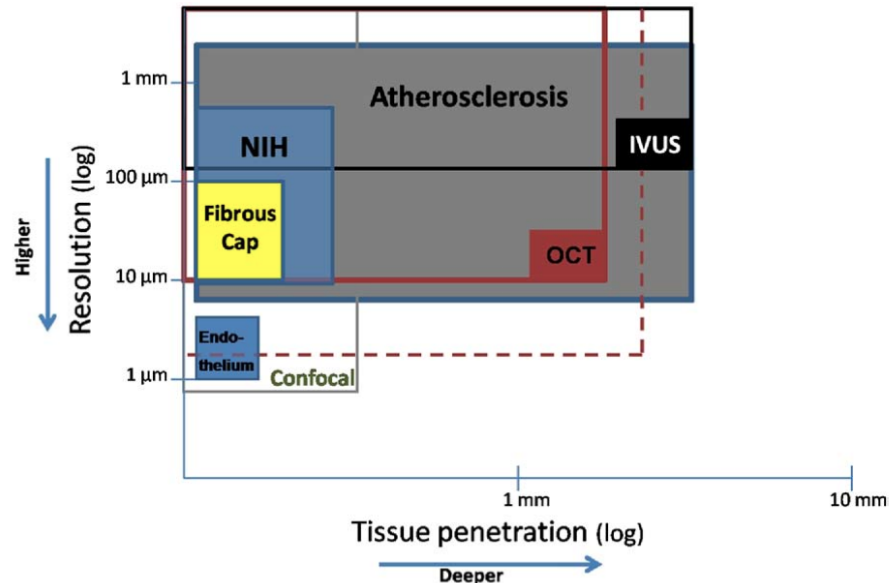


# Aterosklerozes vizualizācijas metožu salīdzinājums



# IVUS vs OCT aterosklerozes procesa vizualizācijā

	OCT <sup>a</sup>	IVUS <sup>b</sup>
Energy source	Near-infrared light	Ultrasound (20–45 MHz)
Wave-length, $\mu\text{m}$	1.3	35–80
Resolution, $\mu\text{m}$	15–20 (axial); 20–40 (lateral)	100–200 (axial); 200–300 (lateral)
Frame rate, frames/s	15–20	30
Pull-back rate, mm/s	1–3	0.5–1
Max. scan diameter, mm	7	15
Tissue penetration, mm	1–2.5	10



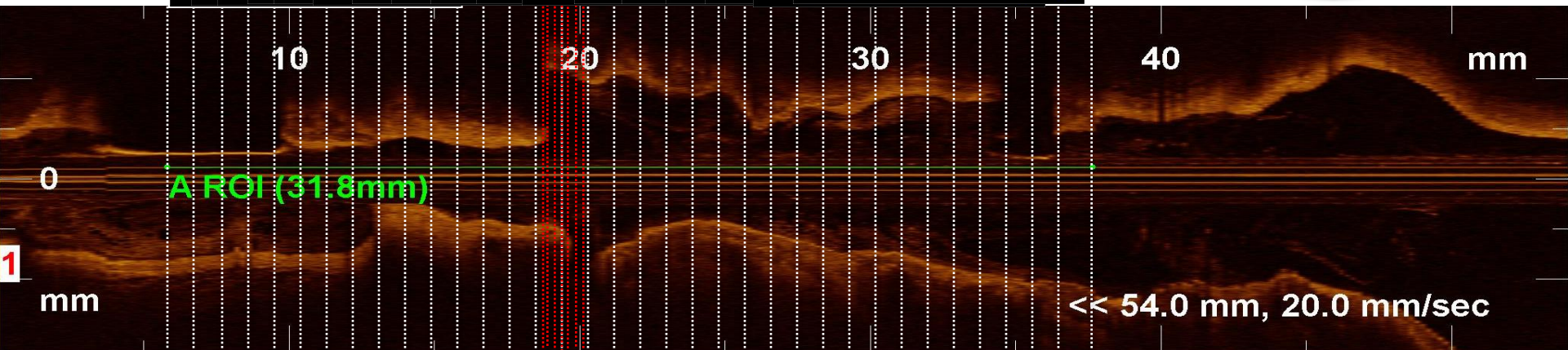
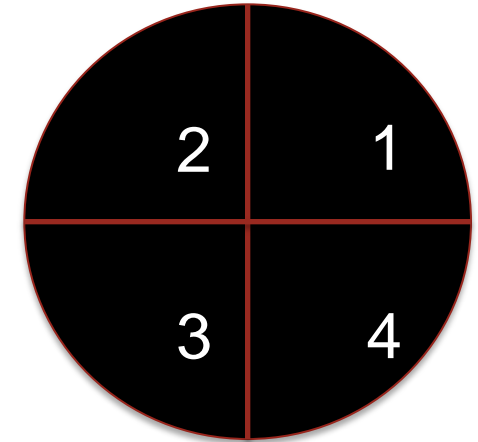
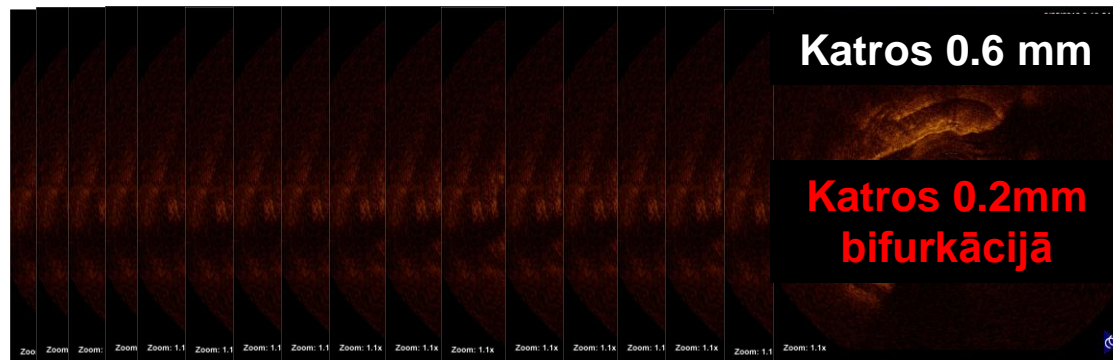
Prati F et al. *Eur Heart J* 2010;31:401–415

Bezerra HG et al. *J Am Coll Cardiol Intv* 2009;2:1035–46

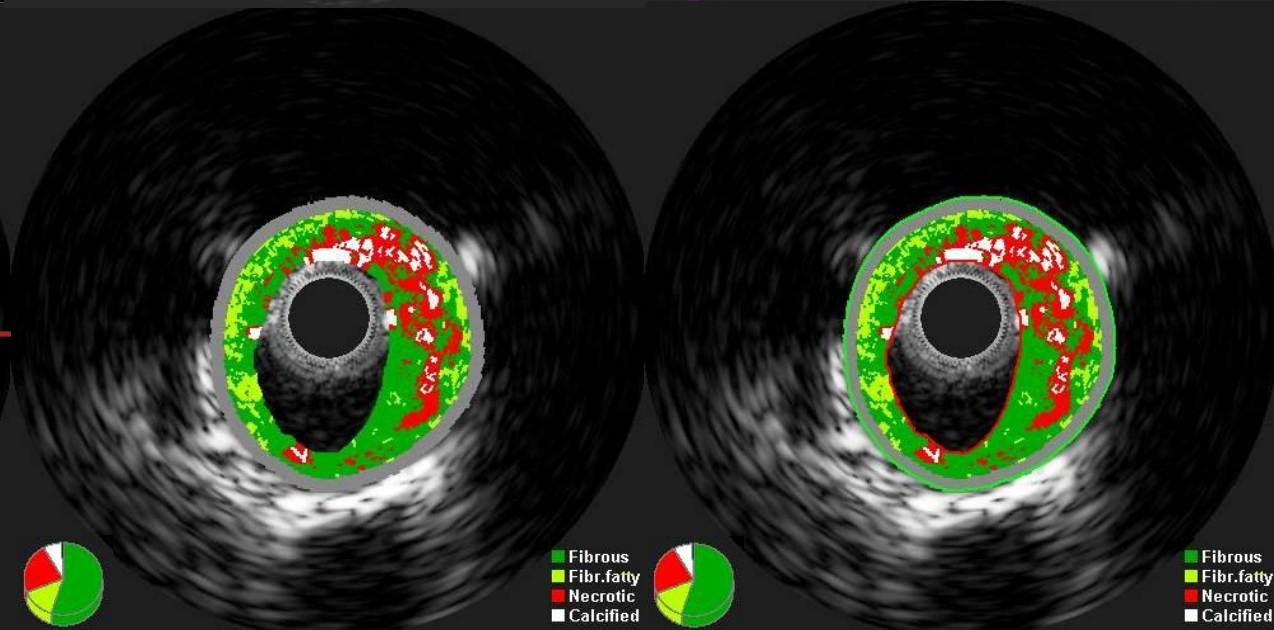
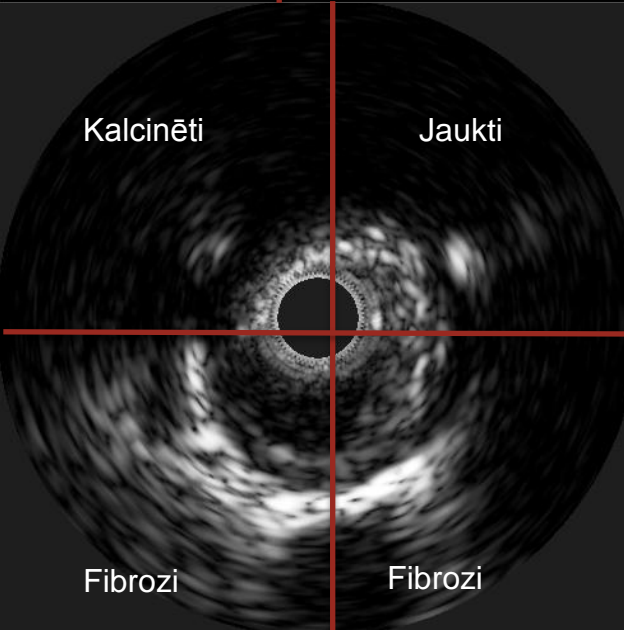
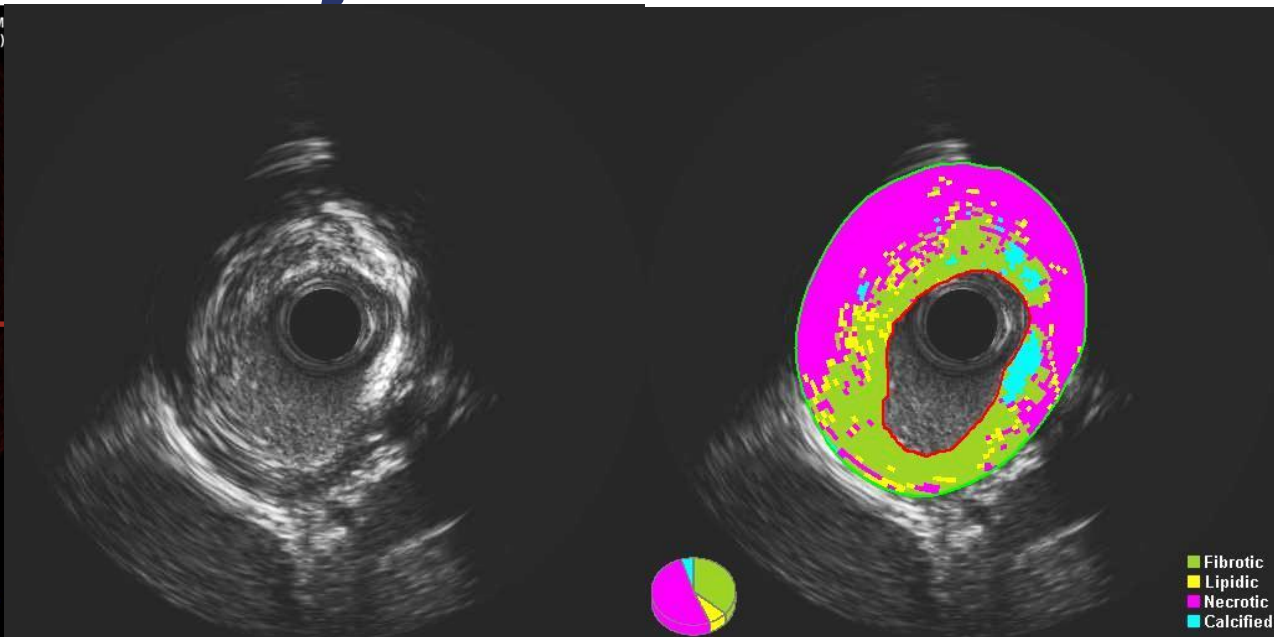
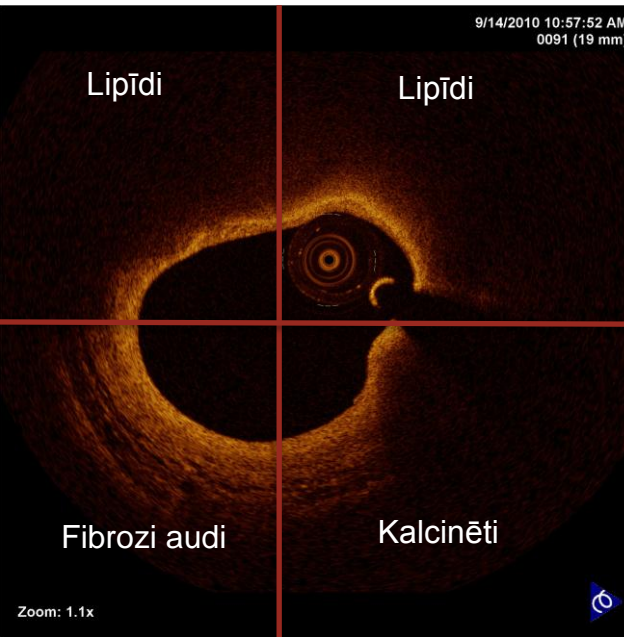


# Pangas kvalitatīvā analīze

Panga tiek raksturota kā fibroza, kalcinēta, lipīdiem bagāta vai normāla 4 kvadrantos

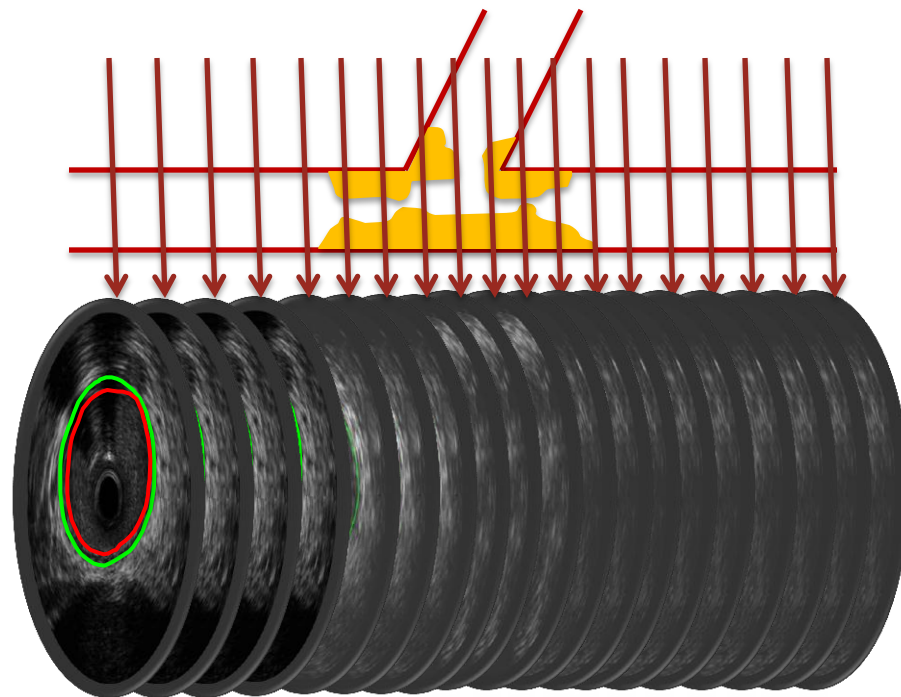


# Gadījums

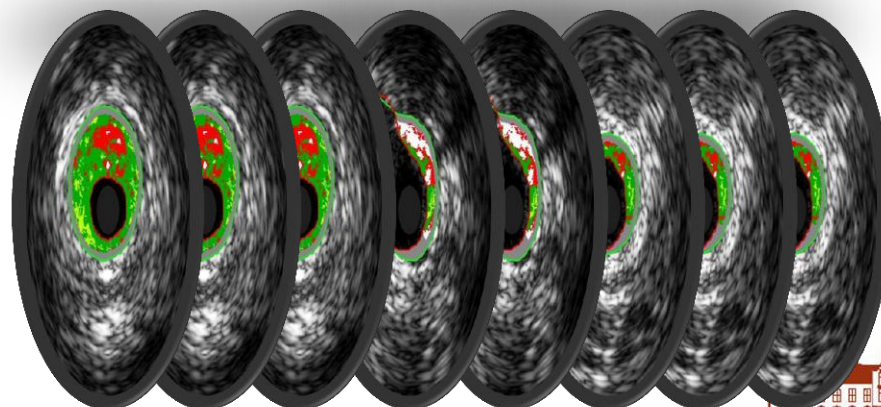


# Kāpēc ir nesakritība starp iMAP un VH?

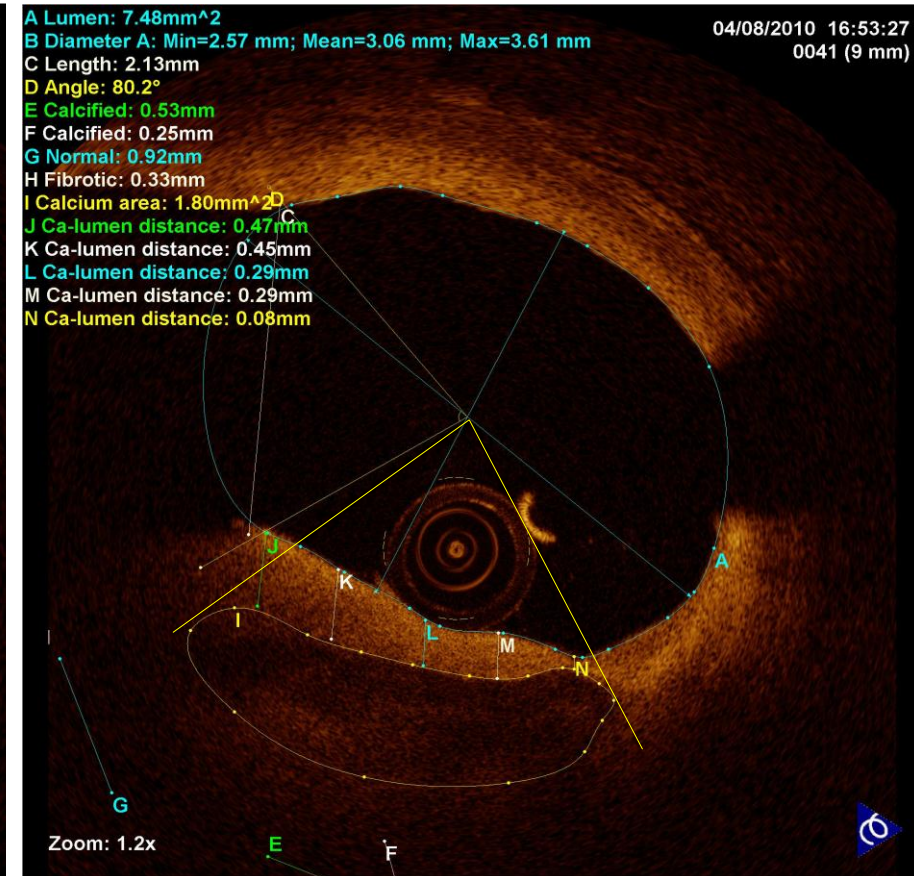
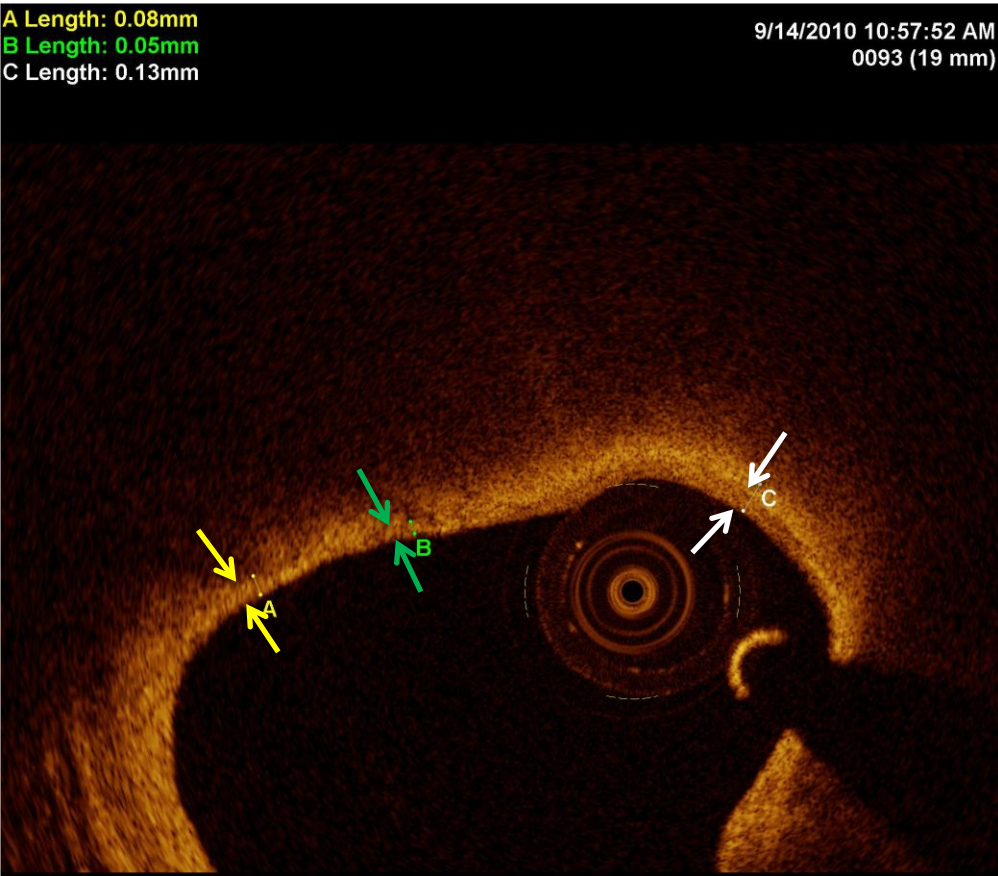
IVUS ar iMAP



VH IVUS (EKG  
triggerēts)



# Pangas kvalitatīvo parametru kvantitatīvā analīze

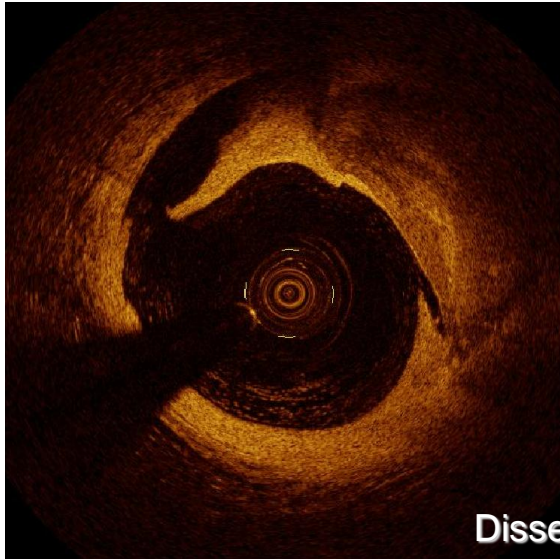


Fibrozās cepures biezums lipīdiem bagātā pangā

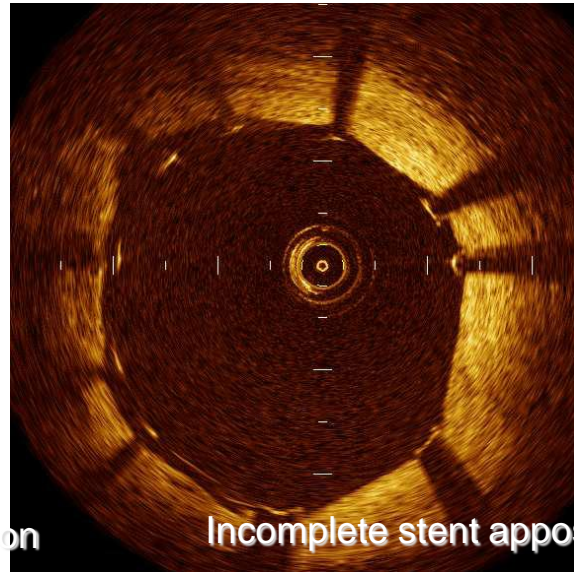
Kalcinātu laukums, leņķis, dziļums



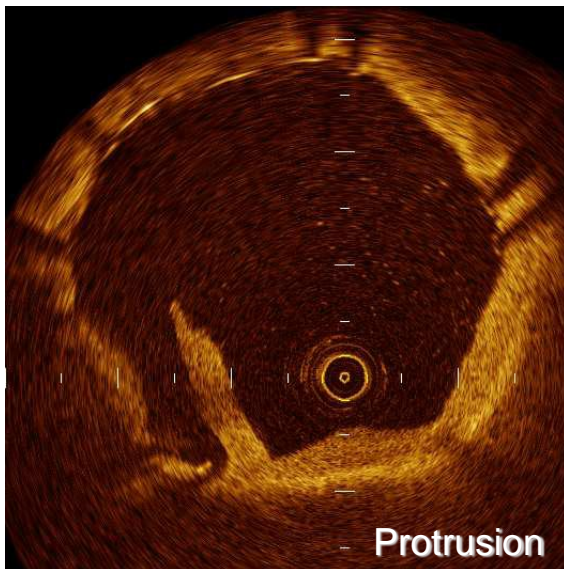
# PCI rezultātu kvalitatīvie rādītāji



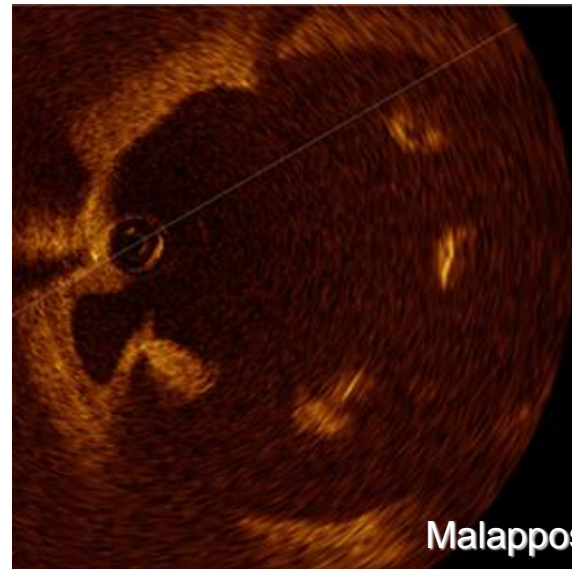
Dissection



Incomplete stent apposition



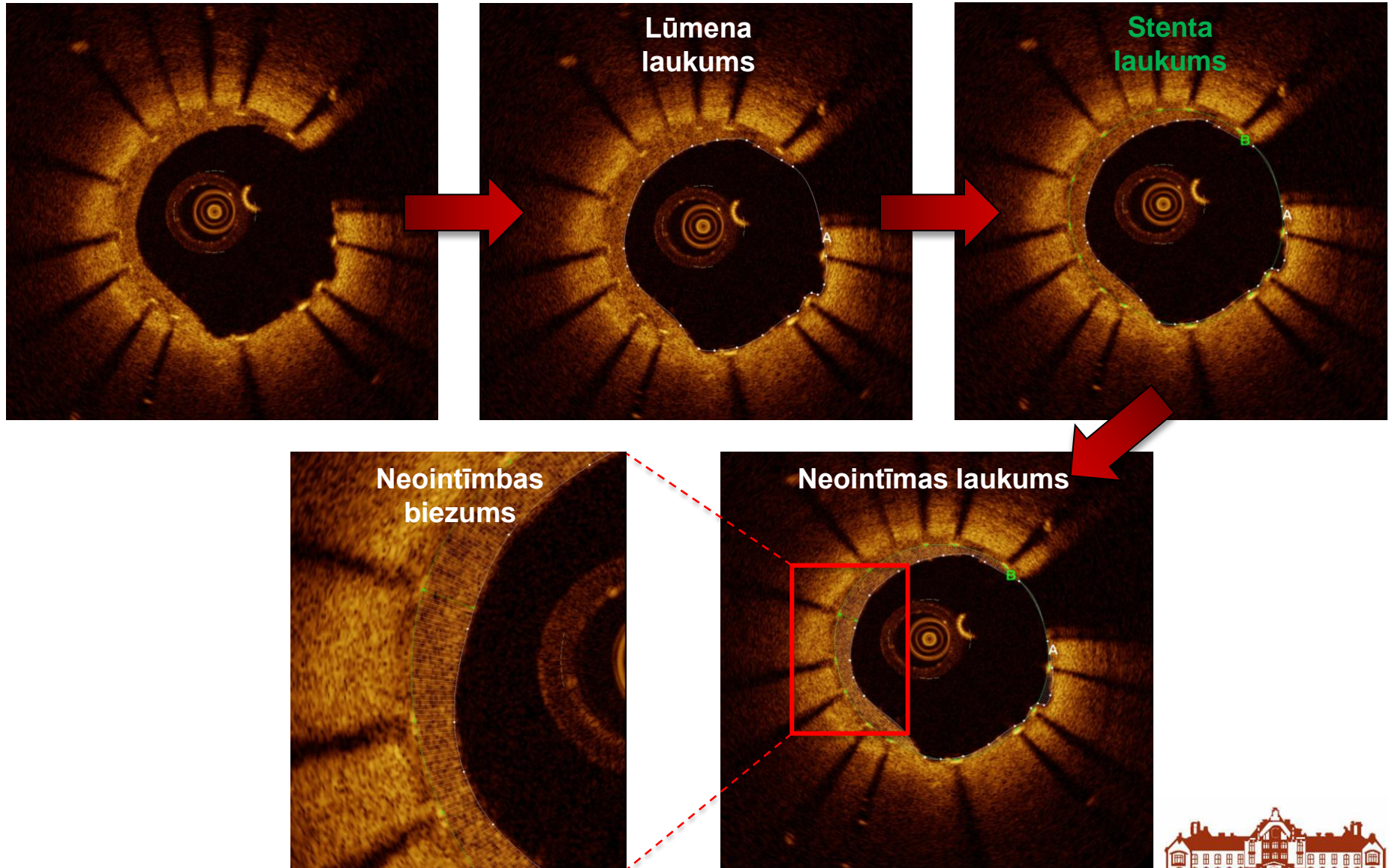
Protrusion



Malapposition



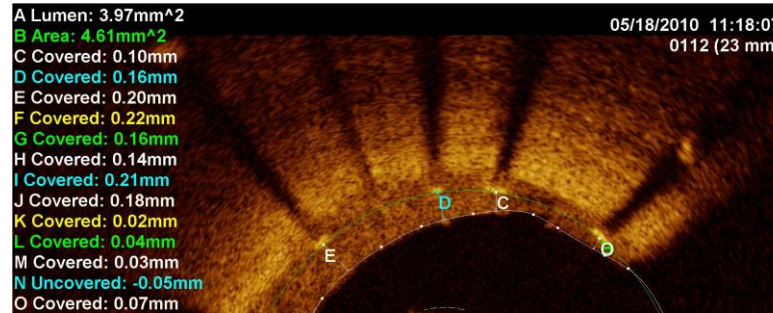
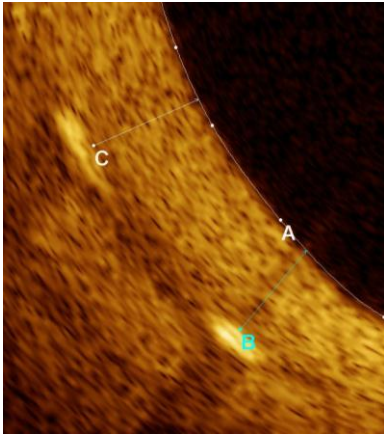
# Kvantitatīvā analīze



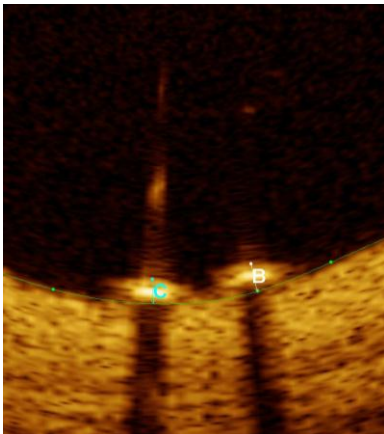


# Stenta stratu analīze

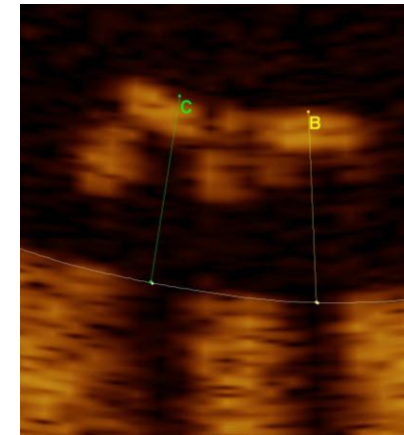
## Pārklātas



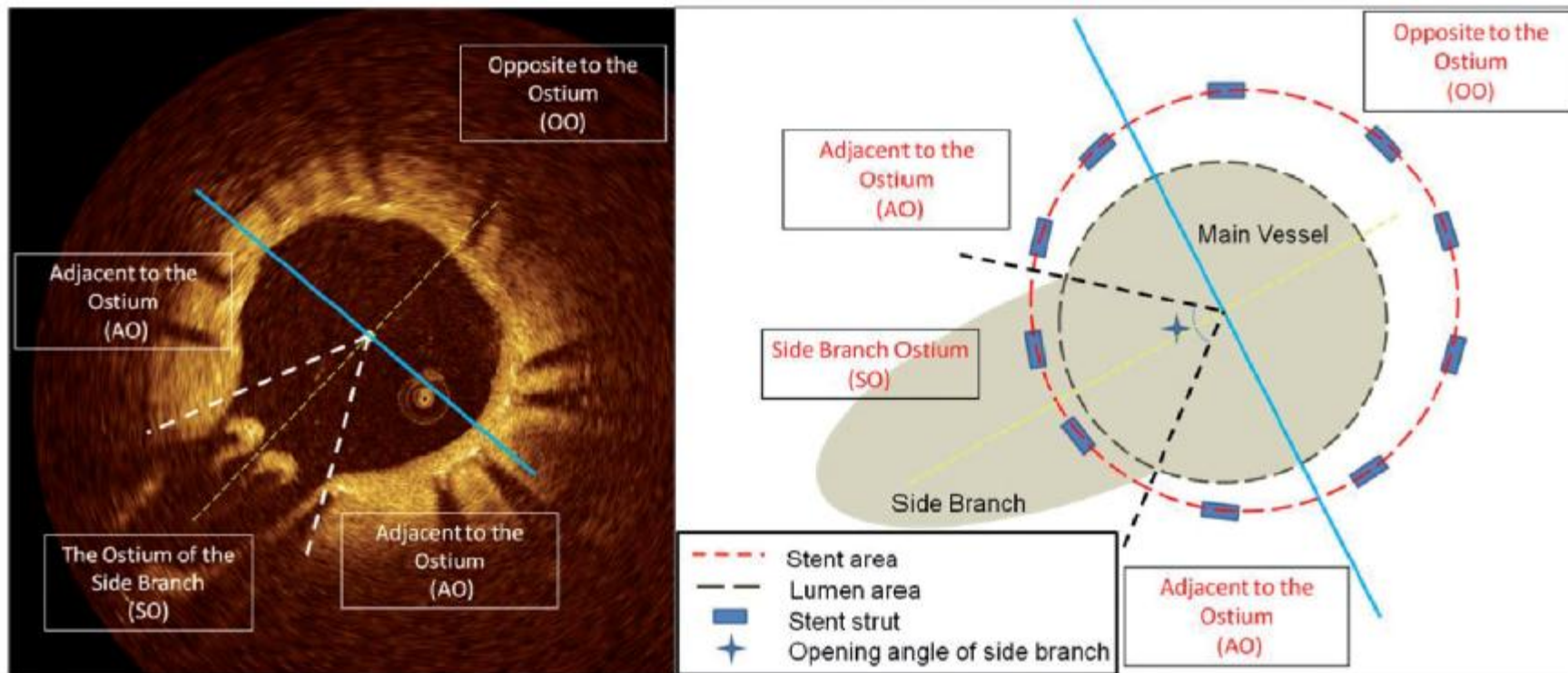
## Nepārklātas



## Malapozīcija



# Bifurkācijas analīze



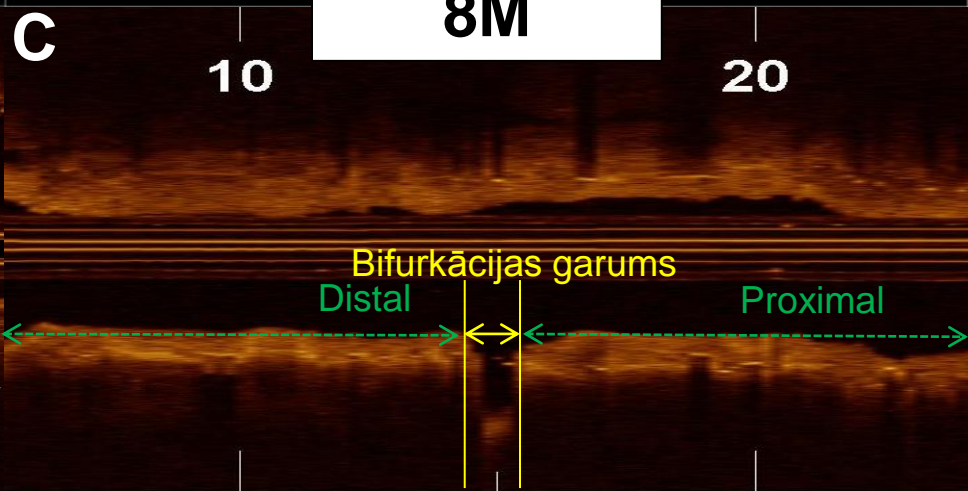
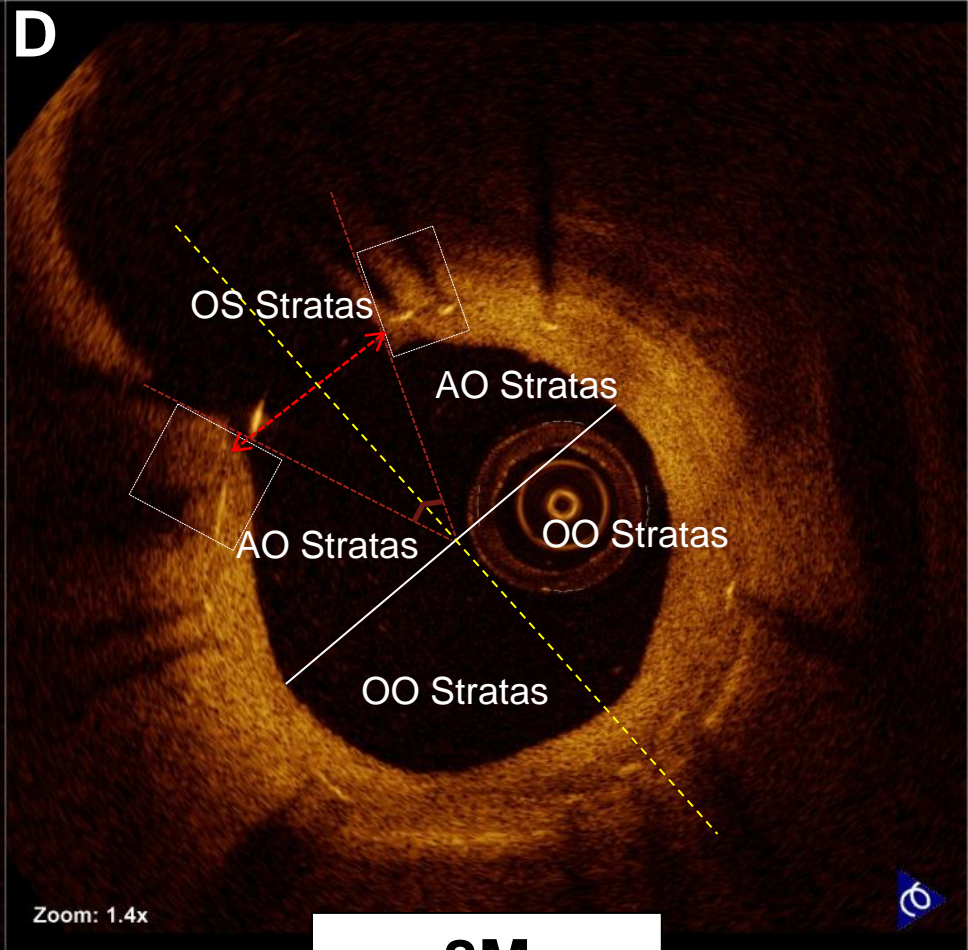
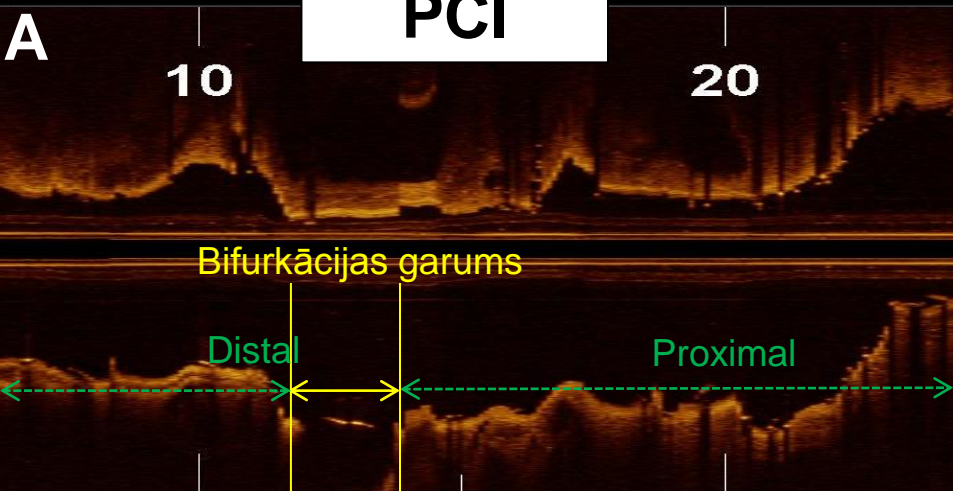
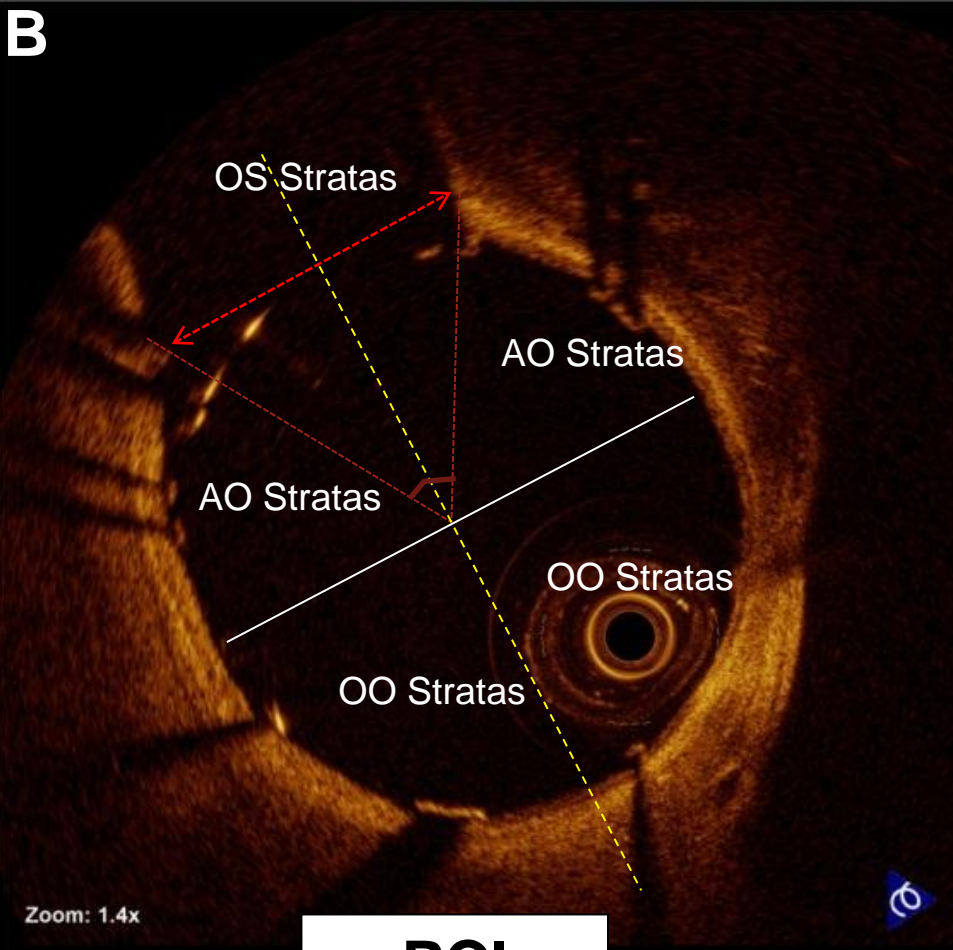
Segmenti:

Sānu zara ostijas segments (SO)

Segmenti blakus sānu zara ostijai (AO)

Segmenti pretēji sānu zara ostijai (OO)

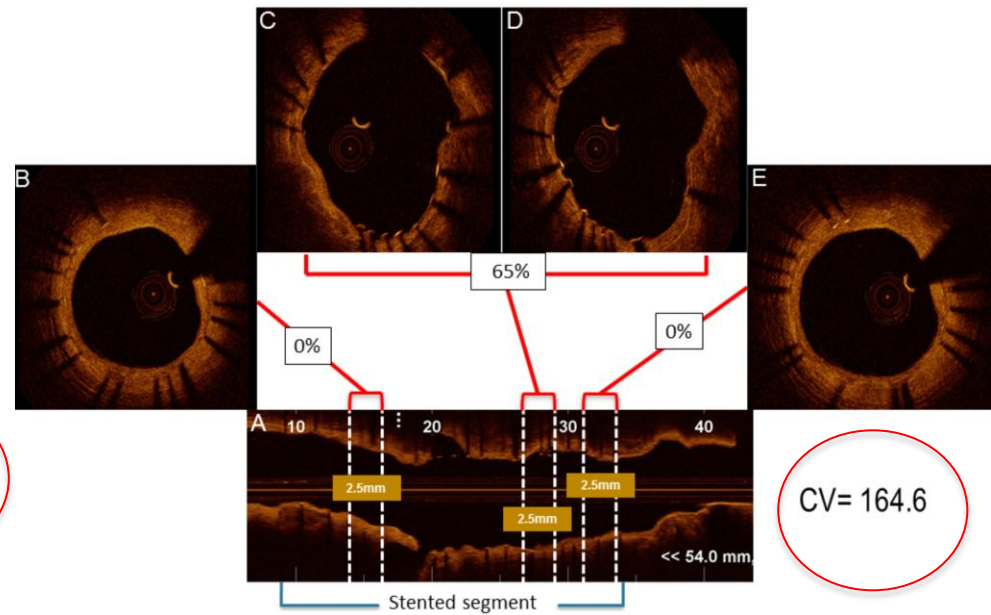
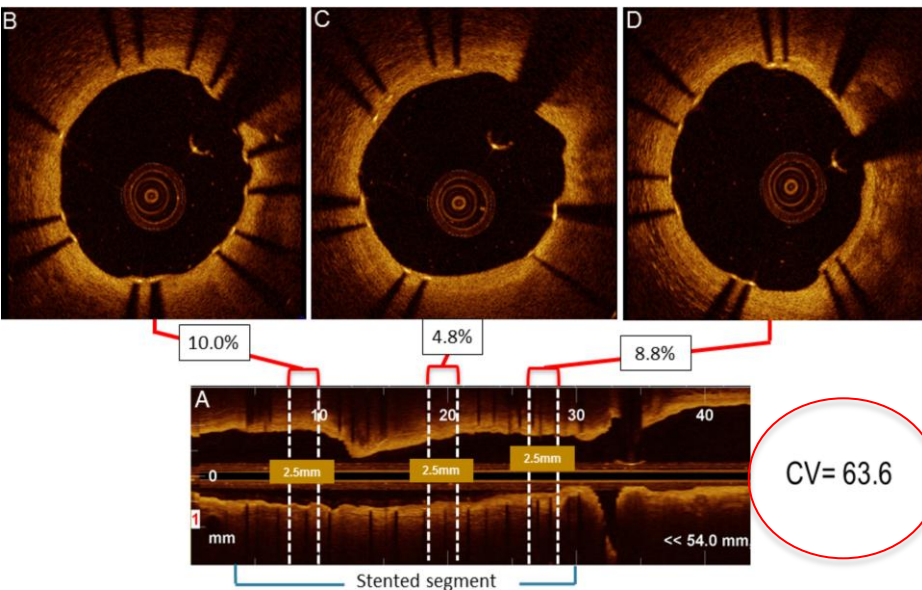




# Kvantitatīvā un kvalitatīvā analīze ik 2,5 mm garos klasteros

Stratu analīze  
Malapozīcijas analīze  
Stenta ekspansijas analīze

Ik 2,5 mm garos klasteros precīzākai  
arteriālās dzīšanas novērtēšanai



8% nepārklātas  
stratas



# Kvantitatīvā un kvalitatīvā analīze ik 2,5 mm garos klasteros

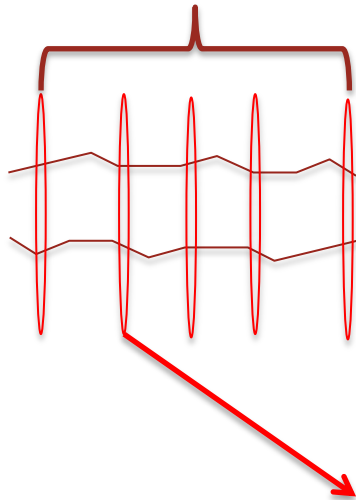
Stratu analīze

Malapozīcijas analīze

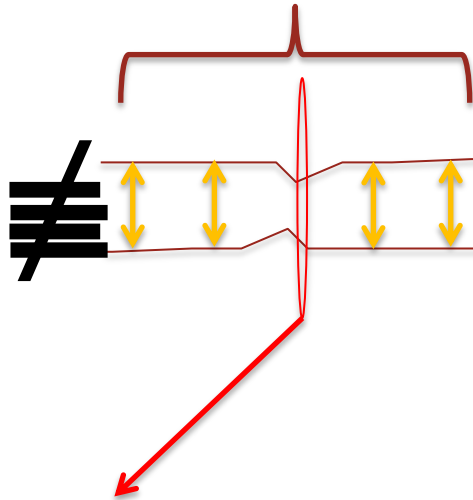
Stenta ekspansijas analīze

Ik 2,5 mm garos klasteros precīzākai  
arteriālās dzīšanas novērtēšanai

Vairāki nepilnīgas ekspansijas  
segmenti



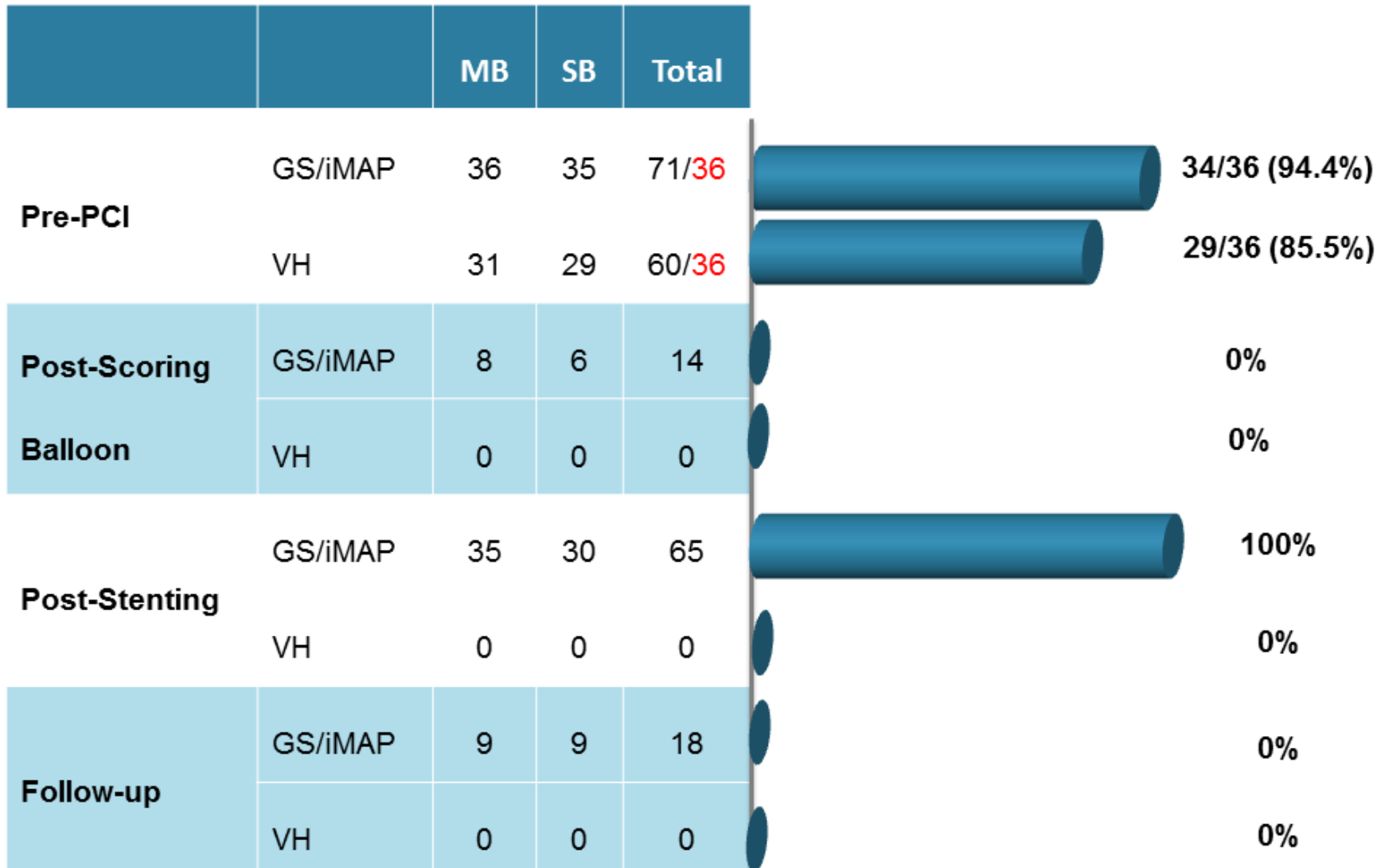
Viens nepilnīgas  
ekspansijas segments



**MSA = 5 mm<sup>2</sup>**



# Analīzes progress uz šo brīdi



Pirmais lielais ziņojums gaidāms Eiropas bifurkācijas kluba mītiņā 2012. gada oktobrī

