11° CONGRESSO NAZIONALE

CAMPUS Cuore

Quello che le Linee Guida Non Dicono

Napoli
5-6 aprile 2024

HOW TO SESSION 2
CARDIOLOGIA INTERVENTISTICA CORONARICA E VALVOLARE

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Quello che le Linee Guida Non Dicono

Napoli
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TECNICHE APPROPRIATE NEL TRATTAMENTO DELLE LESIONI CORONARICHE CALCIFICHE

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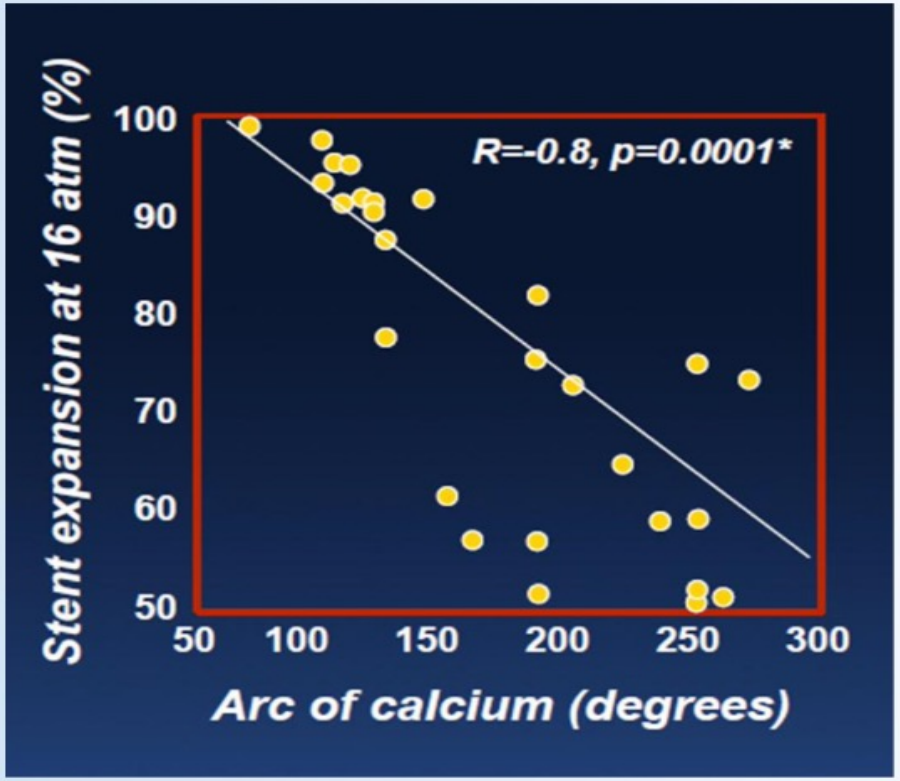
Calcium Inhibits Circumferential Expansion

The greater the arc, length, or thickness of calcium, the greater the likelihood of stent under-expansion[1]

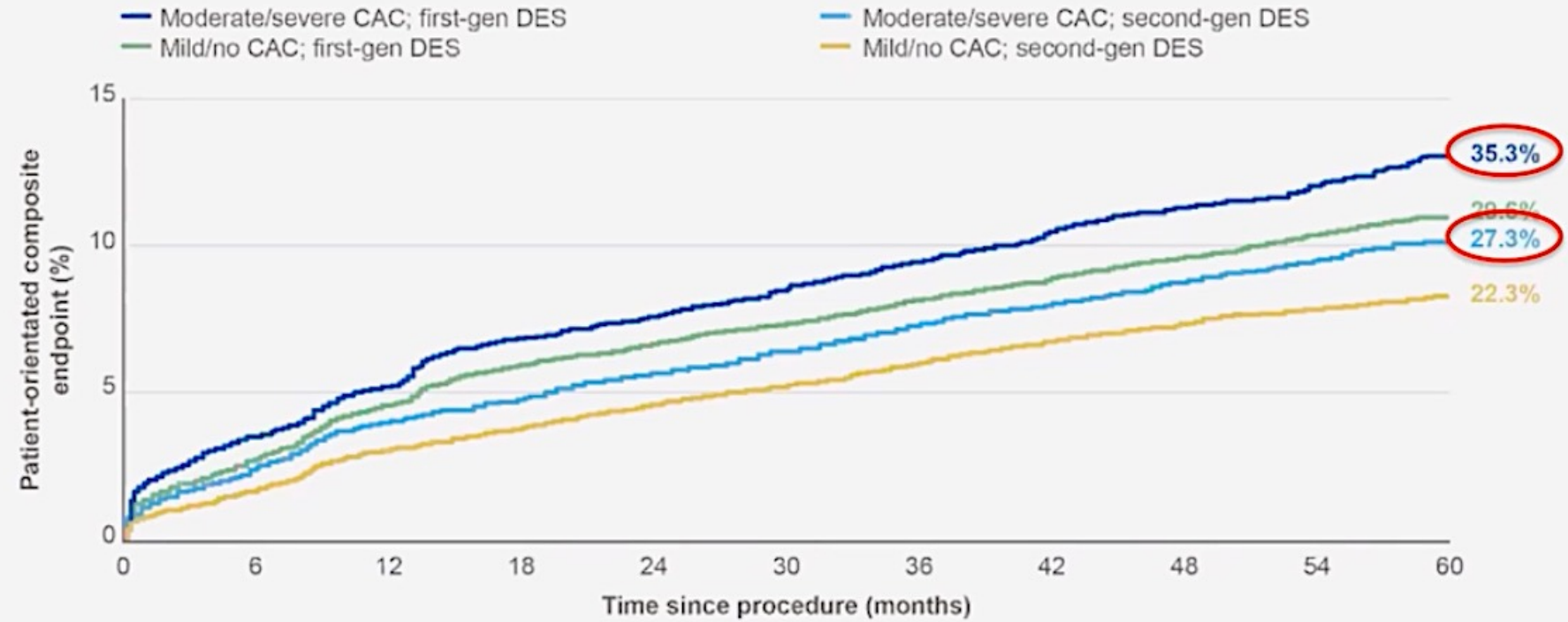
- **Asymmetrical stent expansion** is seen in up to **50% of stents** deployed in calcified lesions[2]
- Stent under-expansion is associated with an **increase in ischemic events** at 1 year[3]

Accurate evaluation of coronary calcification is **critical** to planning a PCI strategy



1. Mintz, G; I. J Am Coll Cardiol Imaging 2015;8(4): 461-71.; 2. Chambers JW, et al. J Am Coll Cardiol Intv 2014; 7:510–8.; 3. Généreux P, et al. JACC 2014; 63(18);1845-54

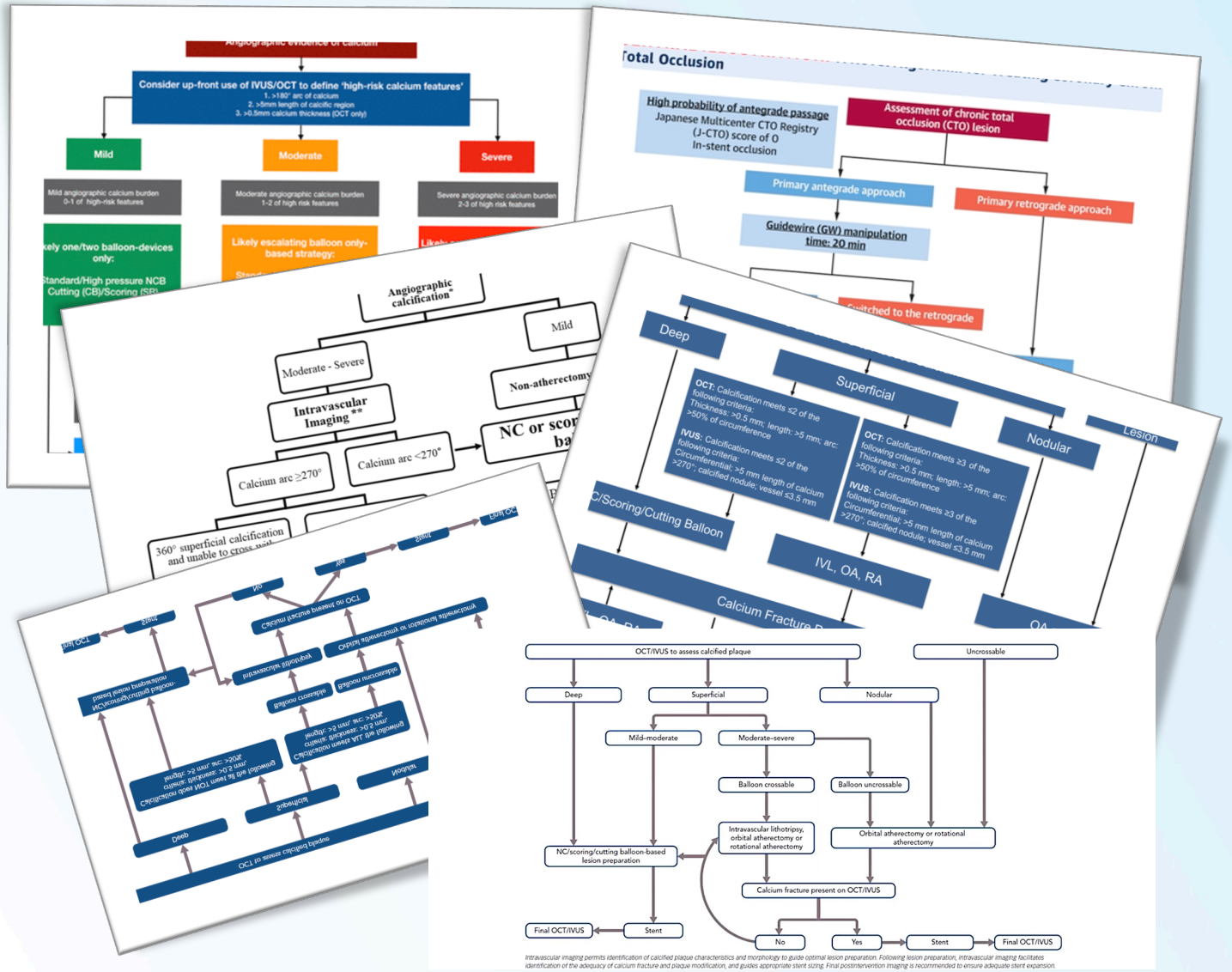
CAC Inhibits PCI Optimization and Drives MACE



Number at Risk

Moderate/severe CAC; first-gen DES	2,408	2,159	2,030	1,908	1,851	1,770	1,482	983	889	763	462
Moderate/severe CAC; second-gen DES	3,803	3,541	3,362	3,268	3,175	3,092	2,901	1,479	1,291	1,074	663
Mild/no CAC; first-gen DES	5,465	5,024	4,734	4,503	4,371	4,234	3,621	2,667	2,426	2,160	1,118
Mild/no CAC; second-gen DES	8,157	7,761	7,430	7,236	7,026	6,856	6,346	3,334	2,982	2,558	1,526

Guedney, P. et al. J Am Coll Cardiol Intv. 2020;12(12):1417-28



Chateau Dillon, Paris

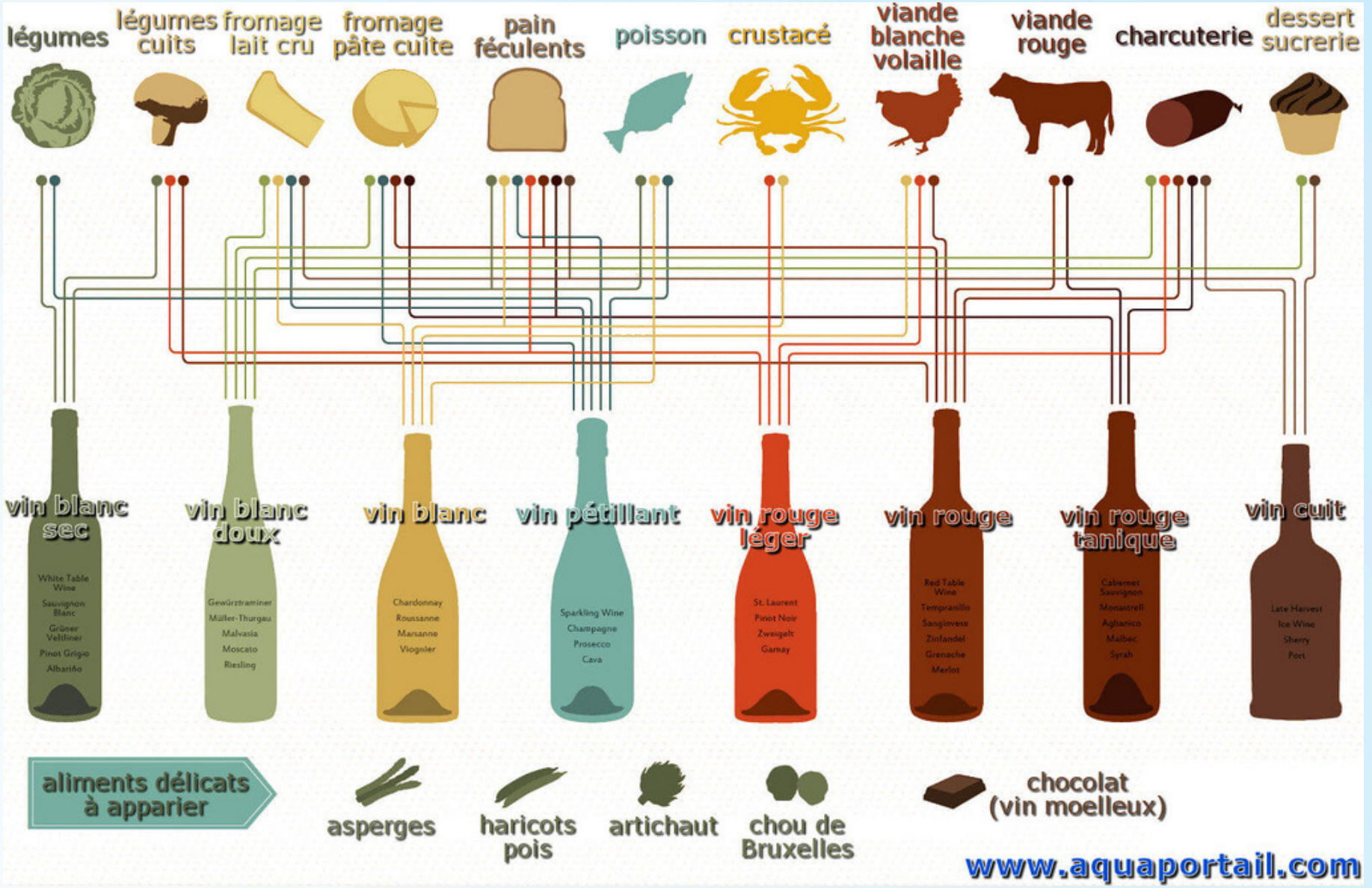
Calcified Coronary Lesions Treatment Techniques

Balloon Based Techniques

- Cutting/Scoring/Chocolate Balloon
- High Pressure Balloon
- Coronary Lithotripsy

Ablative Techniques

- Excimer Laser Atherectomy
- Rotational Atherectomy
- Orbital Atherectomy


légumes
légumes cuits
fromage lait cru
fromage pâte cuite
pain féculents
poisson
crustacé
viande blanche volaille
viande rouge
charcuterie
dessert sucrerie
vin blanc sec
White Table Wine
Sauvignon Blanc
Grüner Veltliner
Pinot Grigio
Albariño
vin blanc doux
Gewürztraminer
Müller-Thurgau
Malvasia
Moscato
Riesling
vin blanc
Chardonnay
Roussanne
Marsanne
Viognier
vin pétillant
Sparkling Wine
Champagne
Prosecco
Cava
vin rouge léger
St. Laurent
Pinot Noir
Zweigelt
Gamay
vin rouge
Red Table Wine
Tempranillo
Sangiovese
Zinfandel
Grenache
Merlot
vin rouge tanique
Cabernet Sauvignon
Monastrell
Aglianico
Malbec
Syrah
vin cuit
Late Harvest
Ice Wine
Sherry
Port
aliments délicats à apparier
asperges
haricots pois
artichaut
chou de Bruxelles
chocolat (vin moelleux)
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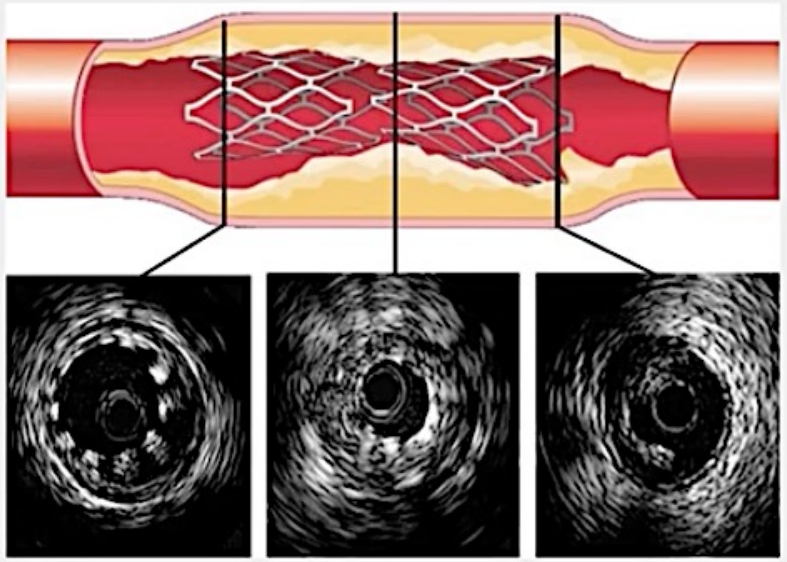
Prevalence of Severe Calcification

US & EU PCI patients[3,4] 6% to 20%



Shows incomplete apposition, incomplete expansion and an edge tear.[12]

- Angiography underestimates severity of calcification[5]
  - Calcification seen in
    - 38% of coronary lesions via angiogram
    - 73% via intravascular imaging[6]

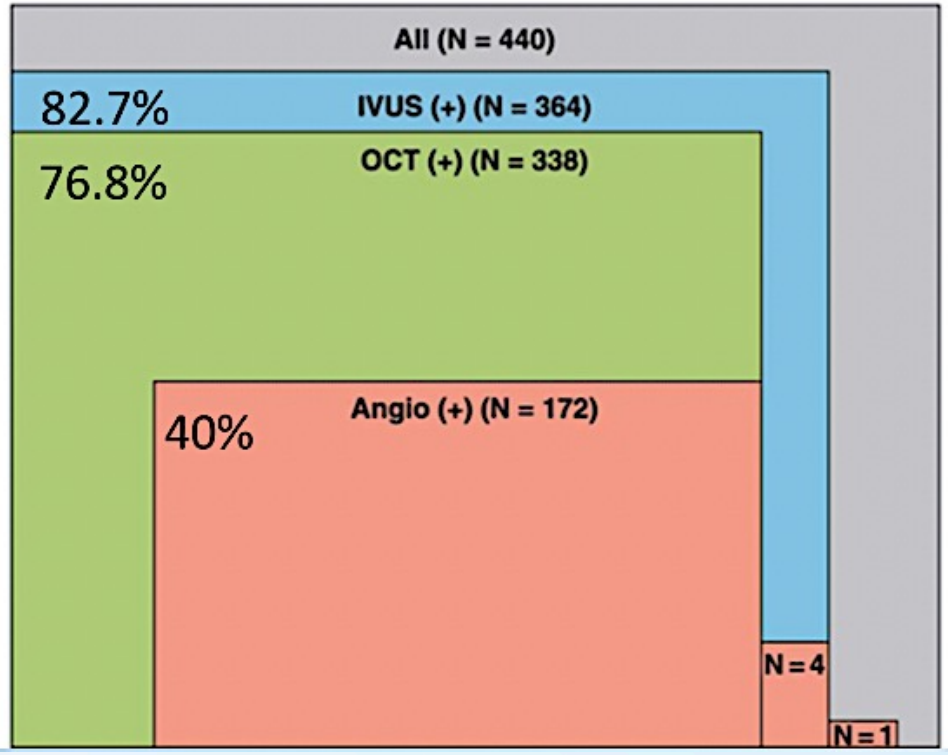
- Technically challenging[5-10]
  - Respond poorly to angioplasty
  - Difficult to completely dilate
  - Prone to dissection during balloon angioplasty or predilatation
  - Stent underexpansion, asymmetric expansion, and malapposition

1. Lee T, et al. J Am Coll Cardiol Img 2017;10:883–91.
2. Nishida K, et al. Am J Cardiol 2013;112:647-655.
3. Genereux P, et al. JACC. 2014;63:1845-1854.
4. Bourantas CV, et al. Heart. 2014;100:1158-1164.
5. Mintz G, et al. Circulation. 1995 Apr 1;91:1959-65.
6. Fitzgerald PJ, et al. Circulation. 1992;86:64-70.
7. Cavusoglu E, et al. CCI. 2004;62:485-498.
8. Gilutz H, et al. CCI. 2000;50:212-214.
9. Moussa I, et al. Circulation. 1997;96:128-136.
10. Mosseri M, et al. CRM. 2005;6:147-53.
11. Nakano M, et al. Eur Heart J. 2013;34:3304-13.
12. Buckley CJ. Vascular Disease Management. 2011;8:87-92.
13. Meerkin D, et al. JIC. 2002;14:547-51.
14. Chambers JW, Diage T. Expert Rev Med Devices. 2014;11(5):457–466.

	IVUS (+)	IVUS (–)
Angio (+)	176	1
Angio (–)	188	75

	OCT (+)	OCT (–)
Angio (+)	172	5
Angio (–)	166	97

	OCT (+)	OCT (–)
IVUS (+)	338	26
IVUS (–)	0	76



Wang X et al. *JACC Cardiov Imaging* 2017: 10(8): 869-879

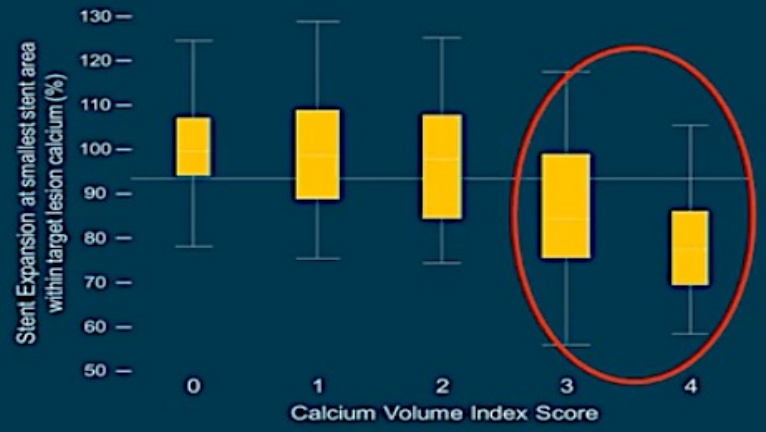
Influence of Ca^{2+} on Stent Expansion by OCT

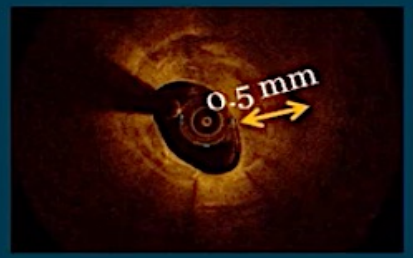
OCT-Based Calcium Volume Index Score[1]

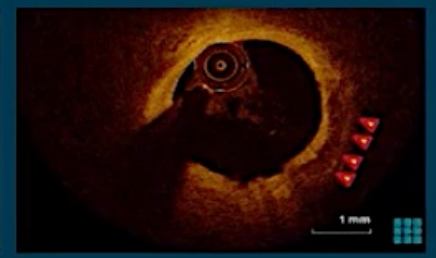
1. Maximum Calcium Angle (°)	≤ 90°	► 0 point
	90° < Angle ≤ 180°	► 1 point
	> 180°	► 2 points
2. Maximum Calcium Thickness (mm)	≤ 0.5 mm	► 0 point
	> 0.5 mm	► 1 point
3. Calcium Length (mm)	≤ 5.0 mm	► 0 point
	> 5.0 mm	► 1 point
Total score	**0 to 4 points**	

Rule of 5's

- 0.5 mm thickness
- 5.0 mm long
- 50% vessel arc

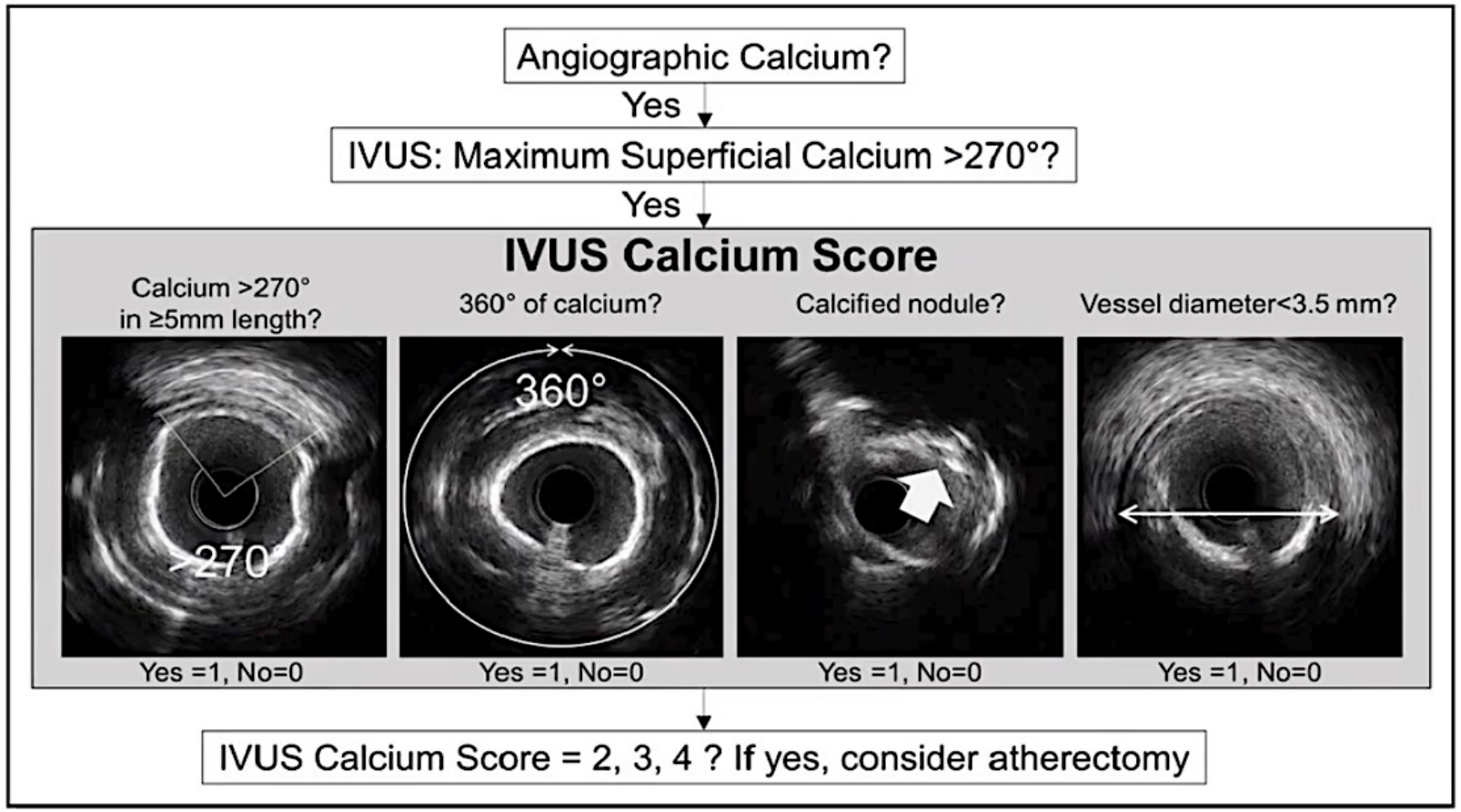






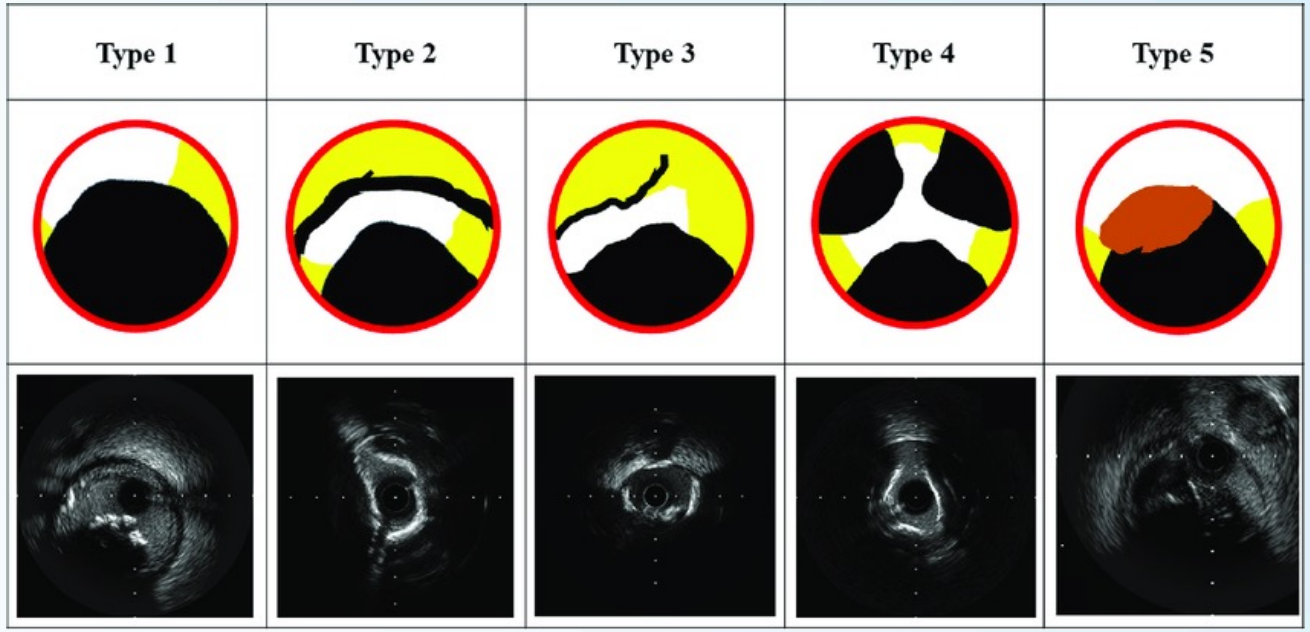
1. Fujino, A. et al. A new optical coherence tomography-based calcium scoring system to predict stent under expansion. *EuroIntervention*, April 2018; 13(18):e2182-e2189.

Intravascular Ultrasound–Derived Calcium Score to Predict Stent Expansion in Severely Calcified Lesions



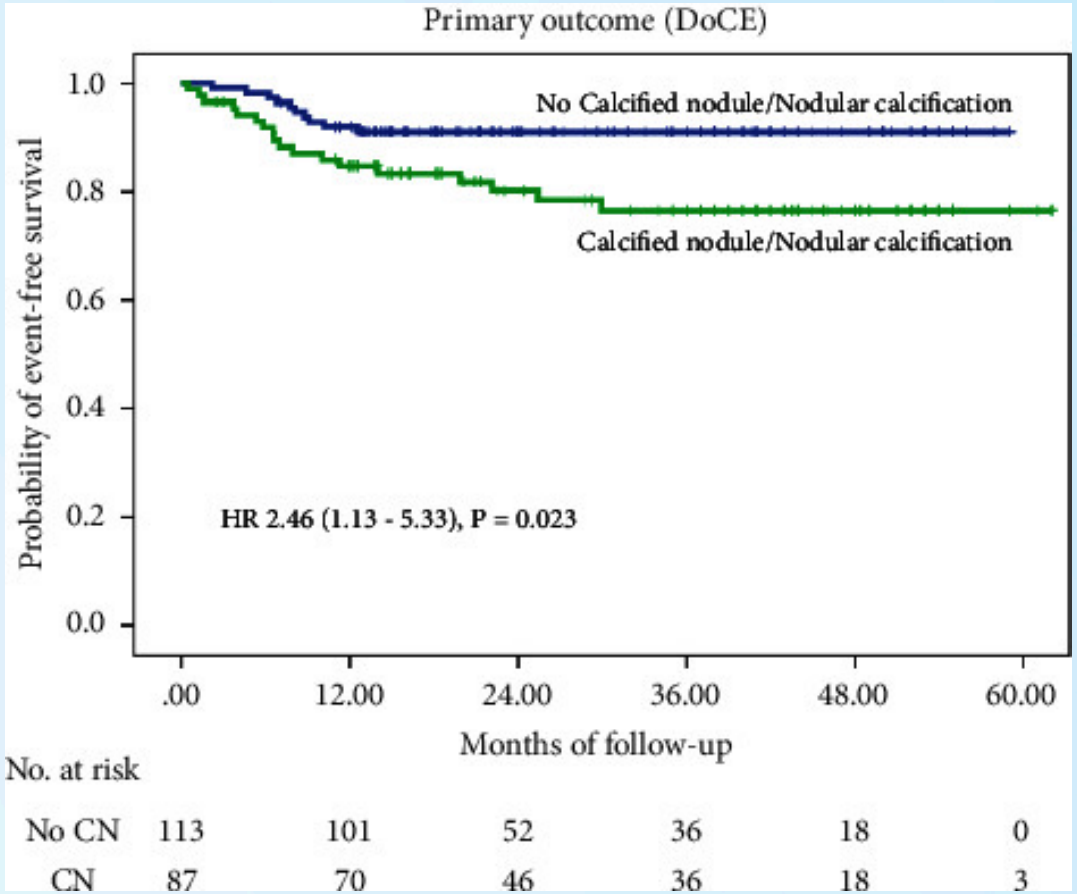
Circ Cardiovasc Interv. 2021;14:e010296.

Calcified Nodules



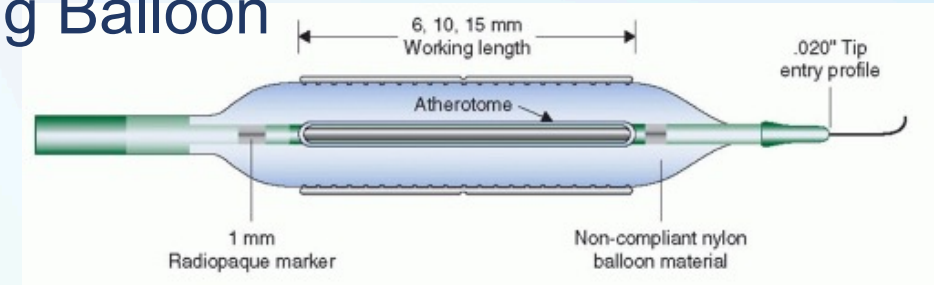
Black: Calcification
Yellow: Non-calcified plaques
Orange: Visible thrombus
White : Vessel lumen
Red: Vessel wall (media)

Watanabe et al. *PLoS ONE* 2020; 15(11): e0241836



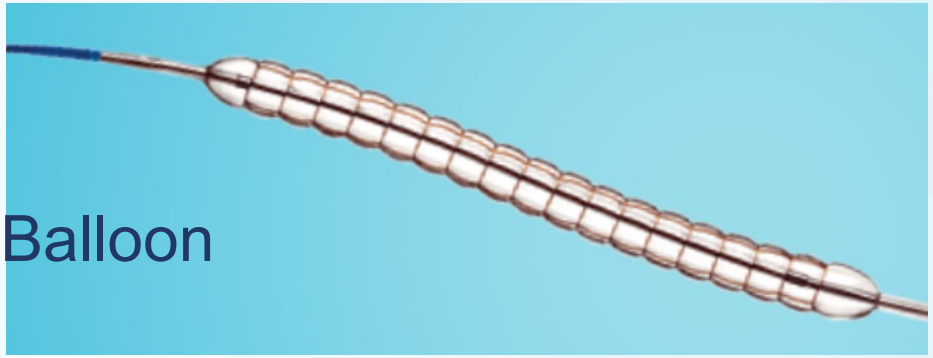
Pengchata et al. *J Int Card* 2023; 2023: 6456695

Cutting Balloon



Scoring Balloon

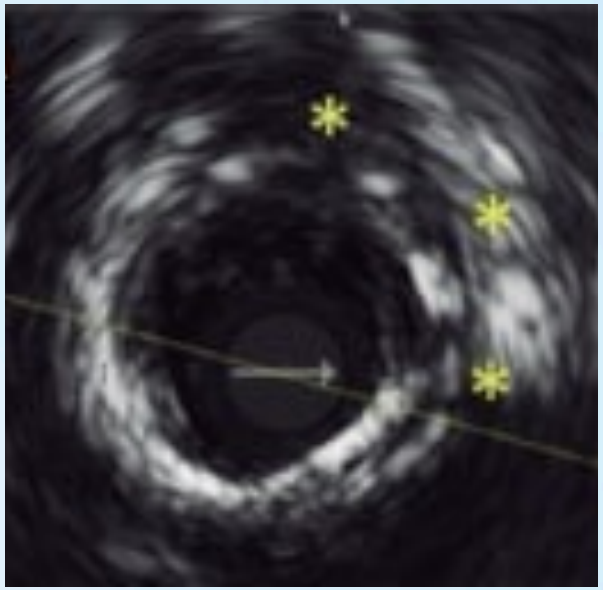
Chocolate Balloon



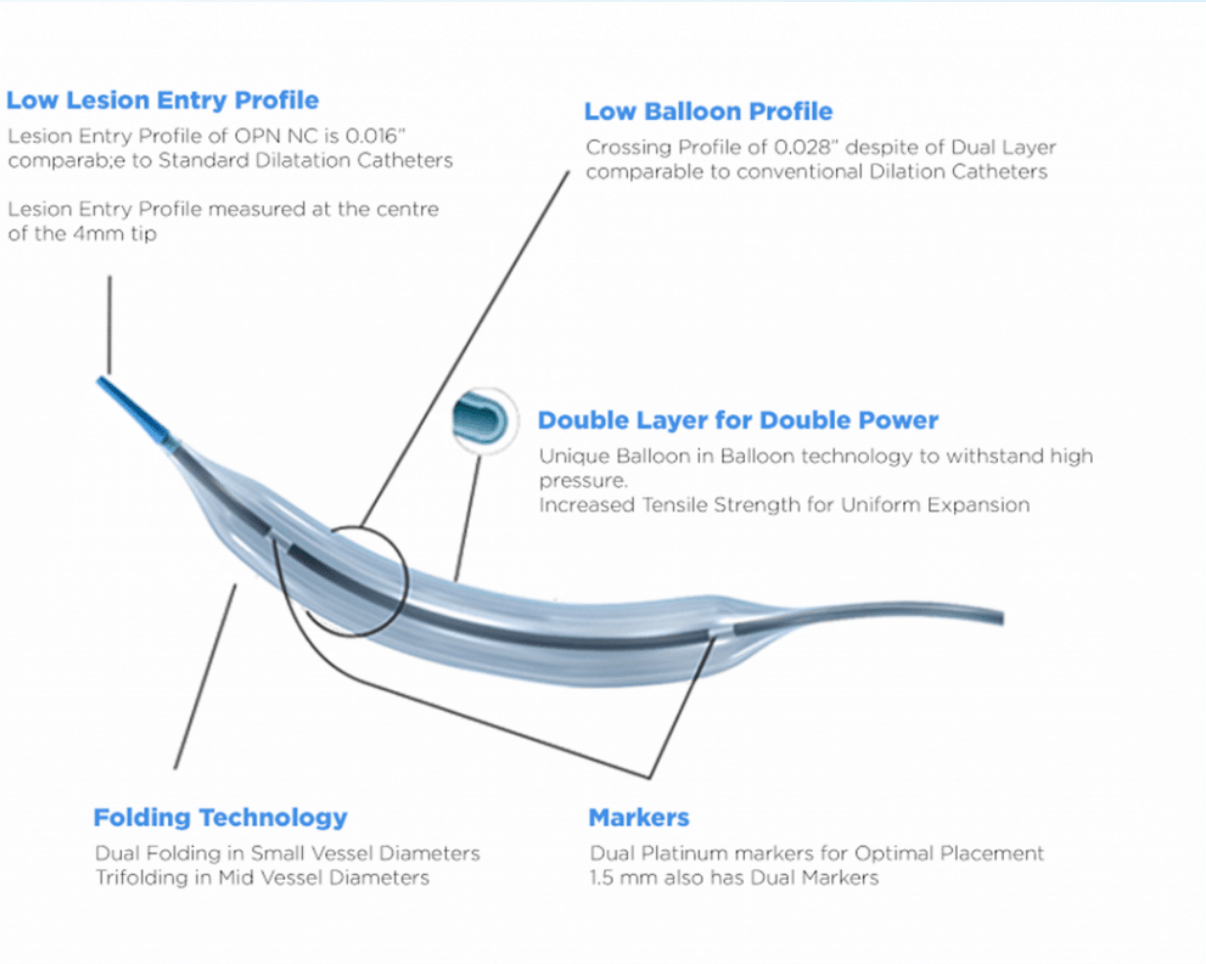
Calcium Fracture

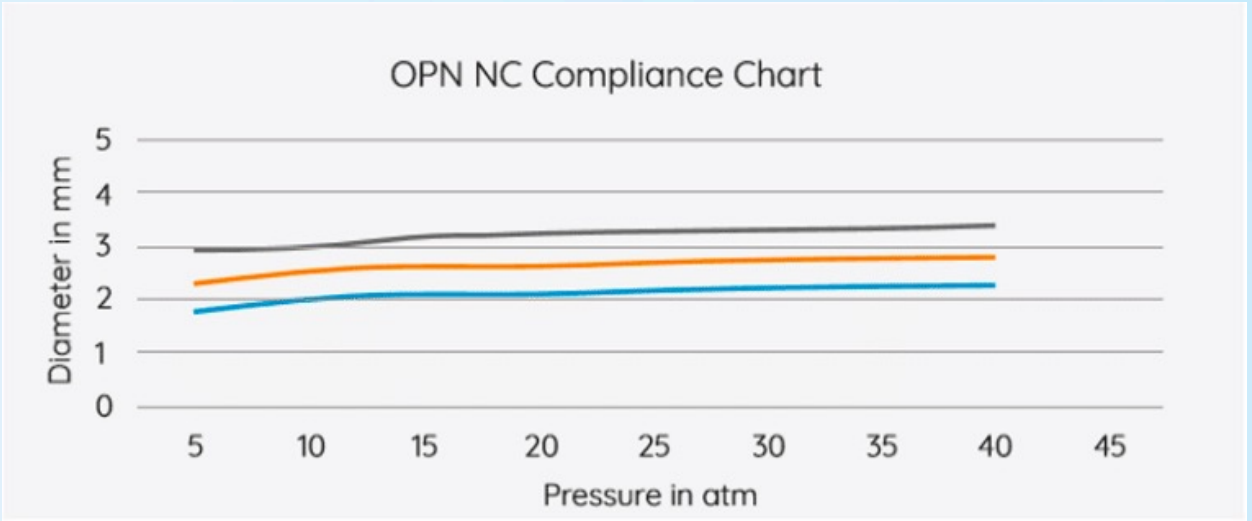
↓

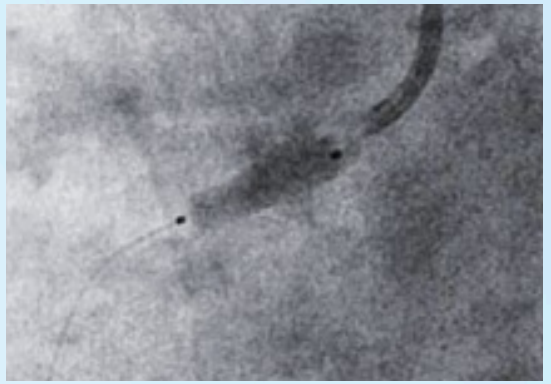
Reduced elastic recoil



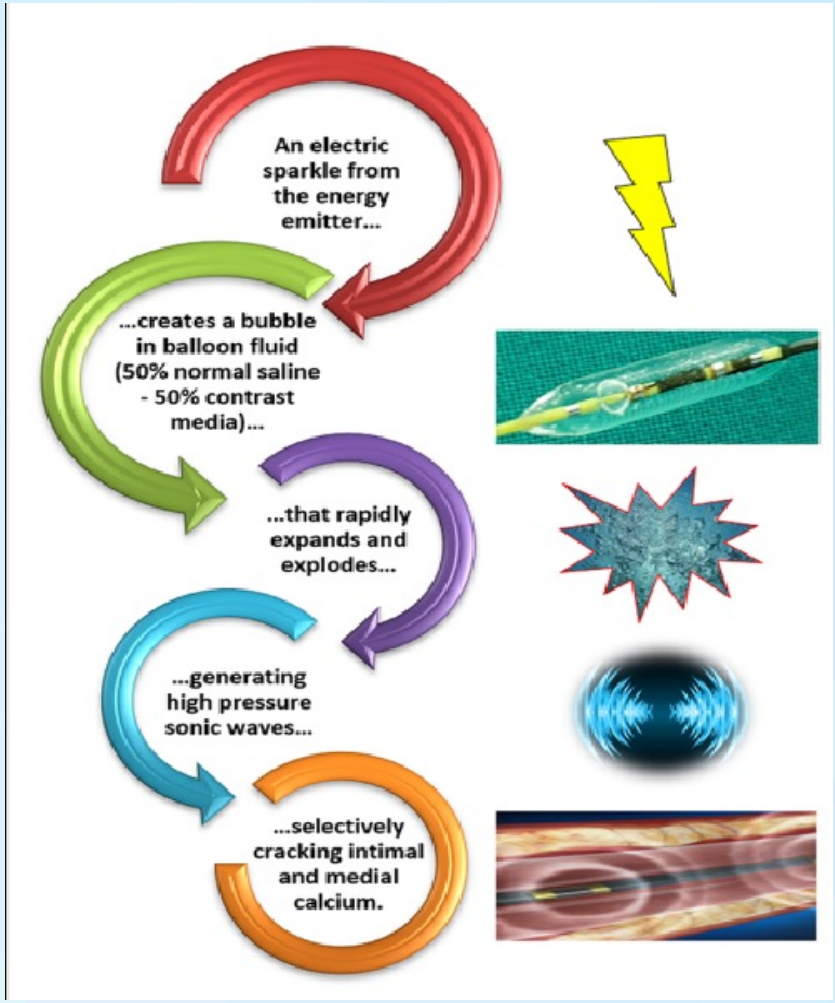
Ultra High Pressure NC Balloon - OPN



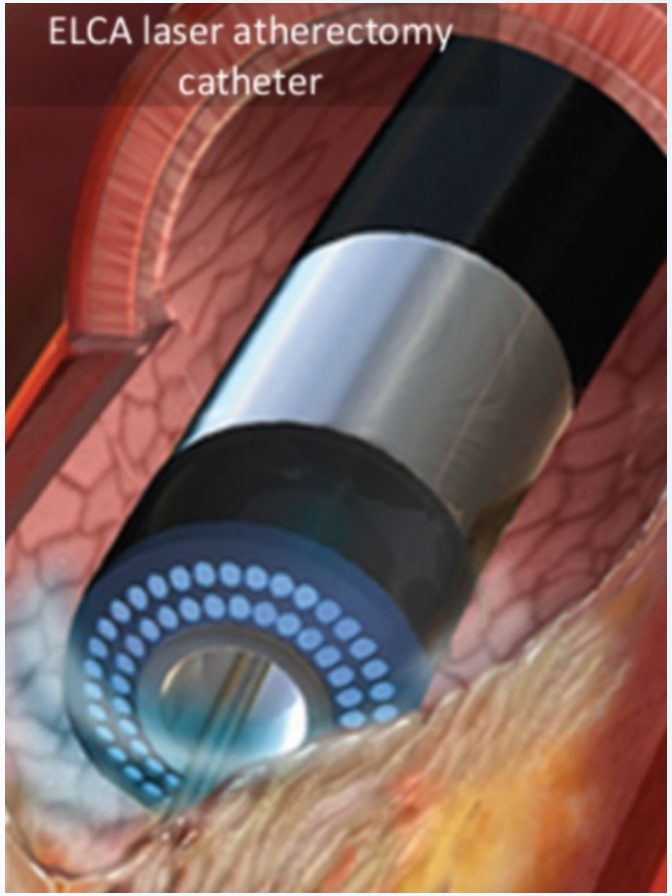




Coronary Lithotripsy



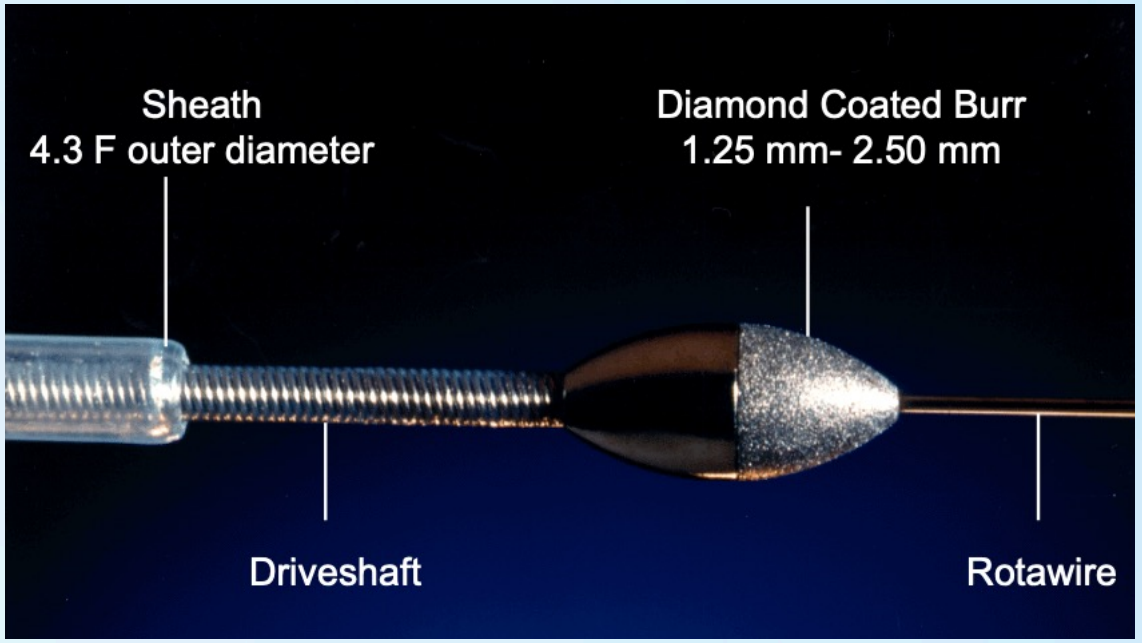
Excimer Laser Atherectomy



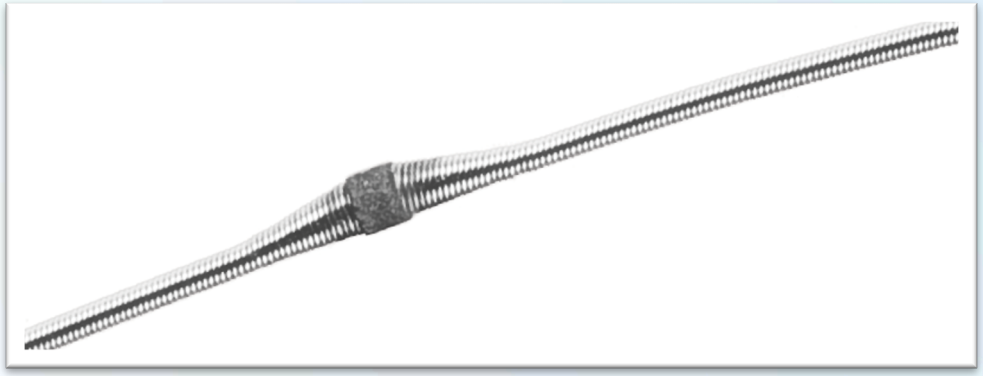
Plaque modification:

- Photochemical: break molecular carbon bonds
- Phototermal: elevation of temperature of intracellular water
- Photomechanical: expansion and implosion of vapour bubbles

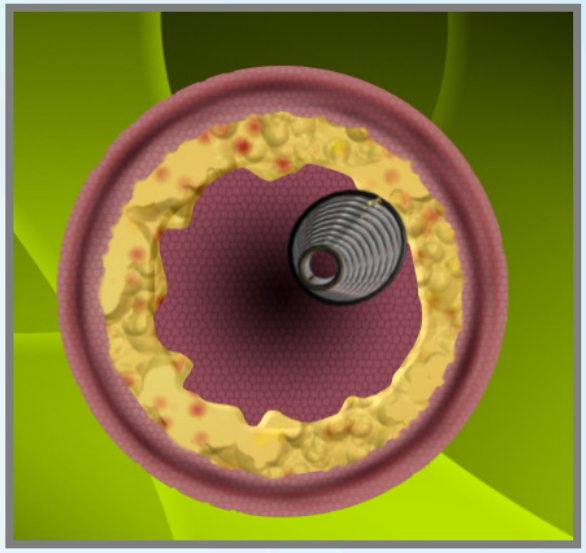
Rotational Atherectomy



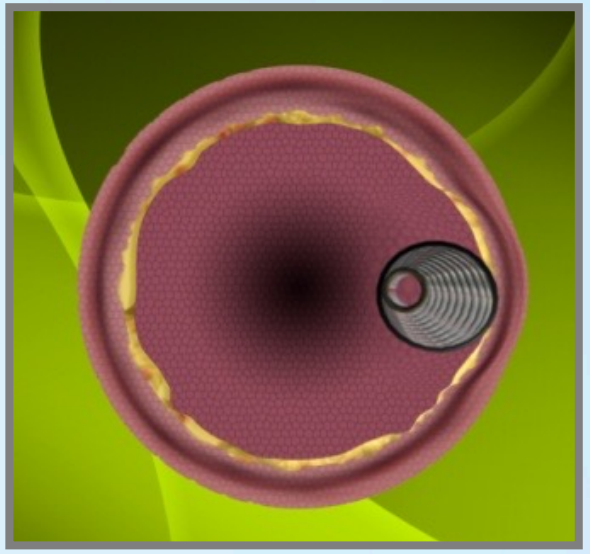
Orbital Atherectomy

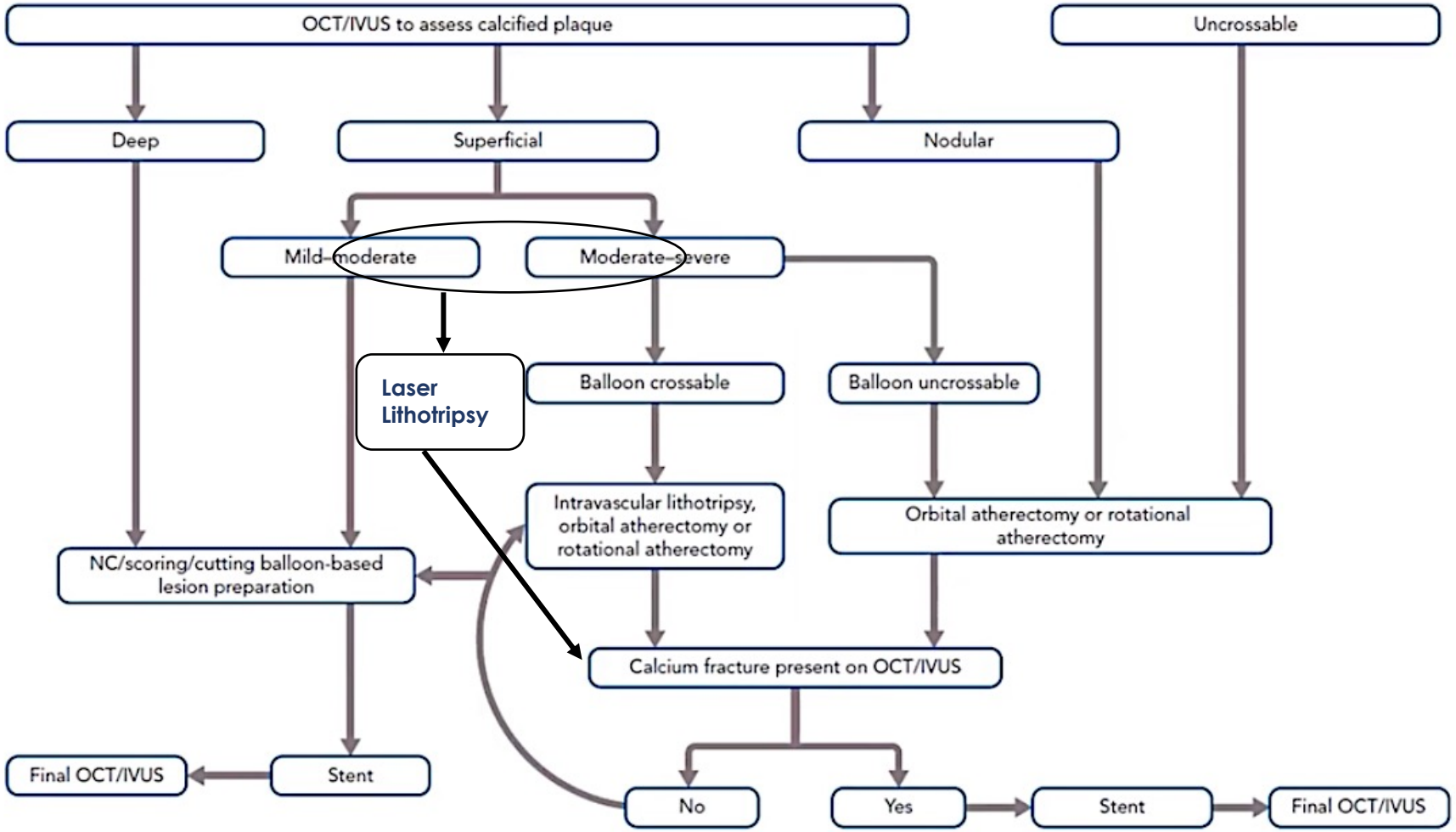


Crown will only sand the hard components of plaque



Soft components (plaque/tissue) flex away from crown





Intravascular imaging permits identification of calcified plaque characteristics and morphology to guide optimal lesion preparation. Following lesion preparation, intravascular imaging facilitates identification of the adequacy of calcium fracture and plaque modification, and guides appropriate stent sizing. Final postintervention imaging is recommended to ensure adequate stent expansion.

Truesdell et al. *US Cardiology Review* 2020: 14: e05

Take Home Messages

- Correct procedural planning: intracoronary imaging (before, during and post procedure), adequate vascular access and sheath size, anatomical evaluations, matherial check
- Be (quite) sure to take home result
- Avoid complications if possible; if not, treat!
- Never implant a stent in calcium without adequate preparation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