Laser Lithotripsy Technique for Treatment of Under-deployed Stents

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Ca. 15% of stents are Under-deployed Causes of Under-deployment

- Failure to evaluate artery with IVUS or OCT
- Failure to prepare artery with debulking device and/or:
 - High pressure balloon
 - Cutting or scoring balloon
- Inexperienced operators invariably choose undersized balloons and stents, because they think they are safer.

Laser Technique for Under-deployed Stents Consequences of Under-deployment

- Continuing symptoms
- In-stent restenosis
- Early and late Stent thrombosis
- Problem was untreatable prior to introduction of laser technique.

Laser Technique for Under-deployed Stents Pathology

- With properly deployed stents, pathology (if present) is inside the stent.
- With under-deployed stents pathology and constraint are both inside and outside the stent.
- Pathology inside the stent can be treated with:
 - Laser
 - Rotablator
 - Cutting or scoring balloons
 - High pressure balloons
 - Brachytherapy

Pathology outside the stent can only be addressed with laser or bypass surgery.

Laser Technique for Under-deployed Stents Analogies

- The laser technique here descibed purposely creates and accentuates what is considered an undesirable side effect during laser angioplasty.
- This is analogous to CTO techniques where one intentionally goes subintimal.
- Or, the technique for fighting forest fires of starting a fire from the direction to which the original fire is advancing in order that when the two fires meet there will be nothing left to burn.

Laser Technique for Under-deployed Stents **Theory**

- Purpose is to break up material outside the stent, especially calcium by maximizing the acoustic component of excimer laser ablation.
- Acoustic effect is generally considered an undesirable side effect that can lead to dissection.
- Acoustic effect can be minimized by injection of saline during lasing.
- Injection of contrast during lasing magnifies acoustic effect.

Laser in Saline vs Contrast



Contrast

Laser Technique for Under-deployed Stents **Technique**

- Use undersize laser catheter at maximum power (fluence) and maximum rate.
- Inject contrast during lasing.
- Repeat two, three or more times.
- Confine lasing to inside the stent.
- Follow with generously sized high pressure balloon until it is fully expanded.
- If high pressure balloon will not fully inflate, repeat lasing.

Laser Technique for Under-deployed Stents



Technique Also Works for very Late Extrinsic Compression of Older Stents

61 y.o. Man with New Onset Angina

- CABG remote past
- BMS proximal LCX year 2000
- Brachytherapy LCX 2003
- New onset angina December 2009
- Cath elsewhere showed proximal stenosis in stent with extrinsic compression on the stent.
- CABG was recommended
- Patient transferred to UM for PCI.

Calcium nodule impinging on outside of stent Calcium



IVUS Findings

- >80% stenosis of LCX stent
- Severe Fibrosis <u>within</u> the stent
- Severe Fibrosis <u>outside</u> the stent

3.5 mm x 10 mm cutting balloon would not expand fully even at high pressure (16 Bar)

Cutting Balloon

Post Cutting Balloon



High energy Excimer (0.9mm catheter at 80J/80Hz) Laser to improve compliance inside and outside stent

Laser in stent



Fully Expanded 3.5 x 15 high pressure balloon post Laser



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3.5 x 15 balloon fills out completely post laser



DES placed, because of late in-stent restenosis

4.0 x 18 Xience @ 10 bar



Post dil with 3.5 x 15 NC Sprinter @ 25 bar



Final Result – IVUS MLA = 7 mm^2



Seven year follow-up

Results of SPECT imaging:

- No Reversible ischemia.
- Medium sized severe intensity persistent Antero-Apical defect.
- Left ventricular enlargement.
- Antero-Apical Dyskinesia.
- Estimated ejection fraction is 38%.

Conclusion:

- 1. Abnormal Study.
- 2. No Reversible Ischemia.
- 3. Medium size Antero-Apical Infarct.
- 4. Reduced Ejection Fraction with Antero-Apical Dyskinesia.

Laser Technique for Under-deployed Stents **Caveats**

- Do not move laser catheter during lasing.
 - You are not trying to remove material from inside of stent.
 - You are intentionally creating chaos outside the stent.
 - Even though the laser catheter sits in the middle of the stent, the accentuated acoustic effect extends the entire length of the stent and beyond.
- Do not lase outside (proximal or distal) to the stent.

Laser Technique for Under-deployed Stents What <u>Not</u> to Do



Summary

- Laser lithotripsy is a technique utilizing an undesirable side effect of excimer laser angioplasty to resolve two previously unmet needs:
 - under-deployed stents.
 - Late extrinsic compression of previously properly deployed stents.
- When used properly this powerful technique can work wonders.
- When abused, controlled chaos becomes chaos..