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Orbital and Rotational Atherectomy in Calcified Bifurcations: A Walk in the Park?☆

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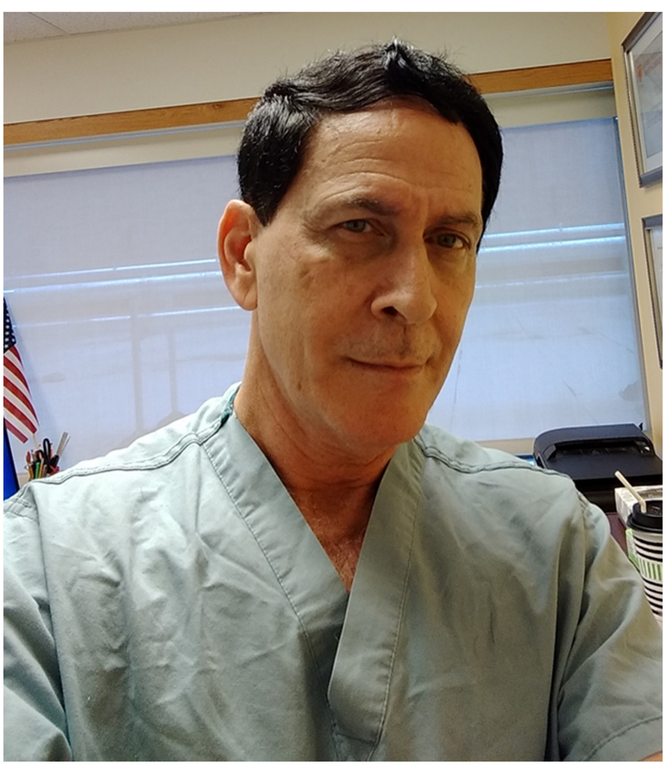

Chambers et al. [1] compared the 30-day outcomes of percutaneous coronary intervention (PCI) of calcified lesions ($n = 145$) and calcified bifurcation ($n = 72$) treated by either rotational atherectomy (RA, $n = 39$) or orbital atherectomy (OA, $n = 33$). Both devices yielded similar excellent 30-day major adverse cardiac events (MACE) rates: 0% and 3% respectively. While the efficacy and safety of OA and RA-based stenting were equally impressive, OA-based PCIs was associated with reduced fluoroscopy time, procedure time and contrast volume. The manuscript creates the impression PCI of calcified bifurcations employing RA or OA can be as safe and effective as calcified non-bifurcation lesions.

The study carries inherent limitations related to design and low patient volume. It's hard to imagine that ablative tools will completely eliminate the short and long-term issues related to PCI of calcified lesions (excessive target vessel failure [2]) and particularly calcified bifurcation; especially imperfect protection and treatment of emerging sidebranches. These limitations are not remedied even by skillful ablation and exceptional bifurcation expertise.

The questions mandating our attention are:

a) ***What is the preferred initial strategy of treating heavily calcified coronary lesions and bifurcation?***

Forward-ablative tools (RA, OA) have an advantage (higher strategy success [3]) over lateral calcium fracturing tools (lithotripsy, cutting or scoring balloons and non-compliant balloons) due to their ability to consistently penetrate and ablate through severely stenosed, serrated, angulated, heavily calcific lesions. Both severity and pressure-resistance of luminal coronary calcification are poorly defined by coronary angiography. Preprocedural intracoronary imaging guidance may not be feasible and infrequently done (35 out of 443 patients in ORBIT II [4]). Non-ablative tools could be initially attempted in view of current data suggesting that restenosis, target vessel revascularization or MACE do not favor forward ablative devices [3,5,6,7]. However, low threshold should be maintained for resorting to ablation as an alternative strategy when lateral calcium fracturing tools fail to cross or generate adequate luminal gain. Hence ablative tools as well as surgical backup arrangements should be available on site when targeting heavily calcified lesions.

Non-ablative approach advantages are: the ability to use multiple conventional wires, cost reduction and avoiding potential risk of ablative tools (slow flow, ischemia, bradyarrhythmia, hypotension, perforation, dissection and burr entrapment for RA burr). However, non-

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Table 1
Rotapro (rotational atherectomy) versus orbital atherectomy 360 [14].

	Rotapro	Orbital atherectomy	Implications
Guide required	**6F***: 1.25, 150/**7F**: 1.75 **8F**: 2.00, 2.125/**9F:** 2.25, 2.38/**10F:** 2.5	**6F Guide (lumen diameter ≥ 0.066″):** 1.25 mm. crown	Large size RA burrs mandate femoral approach
Increase ablation diameter	By upsizing burr diameter	Increase OA rpm from 80,000 to 120,000	RA: Burr/artery ≤70% OA: vessel diameter ≥2 mm
Expected lumen diameter generated	**Burr diameter**	**80 rpm:** 1.53–1.64 **120 rpm:** 1.68–1.84	Wire bias affects lumen in both OA duration affects lumen
Ablation particle size (μm)	**5** μm (heat and platelet activation and spasm)	**<2 μm**	OA results in less no reflow and reduced TVP and atropine use.
TVP use	For RCA, dominant LCx, LM especially larger burrs. (related to burr size rpm and duration)	0.9%	Can be partially mitigated by careful technique, atropine use, and maneuvers.
Ablation speed	Range 130–180 rpm[a] (Typically, 160,000 rpm)	80,000 or 120,000 rpm	
Ablation direction	Forward only	Forward & backward	RA at risk of "burr entrapment"
Wire	Rota wire Floppy & Extra-support 0.009″ (330 cm length) 0.014″ 2.2–2.8 cm spring tip	Viper 0.012″ (325 cm length) with spring tip	Rotawire floppy support is poor. Change to conventional 0.014″ wire to balloon or stent

RCA- right coronary artery, LM-left main, LCx- left circumflex.
[a] Optimal RA technique suggests now use of single small burr (typically 1.5 mm, burr to artery ration 0.5–0.6), 145 rpm, gradual bur advancement with pecking motion, runs ≤20 s, with decelerations <5000 rpm [15].

ablative strategy can result in prolonged procedure time, excessive contrast and radiation [8], the temptation to use high-pressure inflation, device entrapment, suboptimal lesion preparation and strategy failure.

Metanalysis [9] of 22 trials ($n = 244{,}796$) assessing lesion modification modalities prior to stenting (mostly RA, cutting and scoring balloons) revealed similar short term and better long-term outcome lesion modification, while observational trials suggest higher rates of early MACE and more restenosis. Future trials NCT 0202851 (RA versus scoring balloon) NCT03108456 (OA versus balloon angioplasty) NCT02819531 (RA or OA versus scoring balloon) may further define the benefit of calcified lesion preparation by various devices.

b) ***Should minimal ablation or aggressive ablation be executed prior to balloon dilatation and stent deployment?***

While the European expert consensus [10] suggests that ablation burr size should be minimal (using predominantly 1.25–1.50 mm burrs as the initial default strategy) others advocate burr to artery ratio of 0.7. The authors do not discuss burr sizing, ablation speeds and times. While certain studies employed predominantly a single 1.5 mm burr [3] (average starting and final burr 1.5 ± 0.2 mm). Bifurcations treated by RA [11] employed on average cases 1.2 ± 0.4 burrs/PCI. In ORBIT II [12] 73.4% of the lesions were treated by both 80,000 RPM and 120,000 RPM, 5.1% were treated exclusively by 120,000 RPM and only 21% were treated by 80,000 RPM.

c) ***Should ablation be limited to the main vessel or extended to sidebranches?***

The authors did not discuss whether calcification was present and whether ablation was done on the main branch sidebranch or both. While ablation may facilitate optimal stenting in calcified lesions and potentially protect diseased and calcified sidebranches [13] the advantage of ablation in non-calcified or calcified sidebranches lesions is lacking.

d) ***What should be the considerations of preferring one ablation system over the other?***

Table 1 compares the properties of RA & OA systems. OA has some advantages over RA: more supportive guidewire, 2 ablating speeds generating 2 different ablating diameters, bidirectional ablation, smaller ablation particles (reducing the risk of no-reflow bradyarrhythmia and ischemia), smaller guiding catheter requirements for large diameter ablation. The cost of single OA device is considerably higher than a RA device. RA has been used extensively over 29 years with considerable experience in off-label indication like: in-stent restenosis (especially with under-expanded or crushed stent struts), left main PCI, long (>25 mm), angulated (>45°) ostial or vein graft lesions, acute coronary syndromes and chronic total occlusions. The operators experience and familiarity with this device is invaluable.

1. Conclusion

Calcified bifurcations can be treated with RA or OA-facilitated stenting with high success rate and low 30-day MACE. Both devices have higher device success than lateral calcium fracturing tools. The device preference should be tailored to the lesion anatomy, patient's clinical characteristics along with the operator proficiency.

Declaration of Competing Interest

None of the authors has conflict of interest in-reference to this manuscript.

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