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### Vessel Preparation: Understanding the Concept and Its Need

By Venkatesh G. Ramaiah, MD, FACS

The terms *luminal gain* and *plaque modification* were used first as a form of vessel preparation; however, with the introduction and use of drug-coated balloons (DCBs), the term *vessel preparation* seems to be more appropriate in encompassing all methods of therapy that lead not only to luminal gain and plaque modification, but also to enhanced efficacy of DCBs. This is especially so for use in calcified lesions of the superficial femoral artery (SFA) and popliteal artery. The goals for vessel preparation include removing calcification, modifying plaque, and gaining lumen so that DCBs may be more efficacious in delivering drug to the vessel wall.

DCBs have demonstrated safety and efficacy in randomized controlled trials (RCTs),<sup>1-4</sup> and the IN.PACT™ Admiral™ Drug-Coated Balloon has demonstrated 3-year durability.<sup>1</sup> There has also been a resurgence of a leave-nothing-behind treatment approach or reserving stent use for flow-limiting dissections and bailout situations. However, there is a question if this is possible and if DCBs are as effective in more complex, real-world lesions.

The IN.PACT™ Admiral™ DCB has been studied in more complex lesions in the real-world, all-comers IN.PACT Global Study, which included prespecified imaging cohorts: in-stent restenosis (ISR), chronic total occlusions (CTOs), and long lesions. The IN.PACT Global Study and the imaging cohorts (ISR, CTO, and long lesions) demonstrated results consistent with the IN.PACT SFA Trial with low clinically driven target lesion revascularization rates from 2.4% to 11.3% at 12 months. Primary patency rates were also consistent and impressive for the ISR, CTO, and long lesion cohorts ranging from 85.3% to 91.1% at 360 days (Kaplan-Meier

[K-M]). Provisional stent rates ranged from 7.3% to 46.8%; higher provisional stent rates in the study were observed in the long lesion and CTO imaging cohorts.\*<sup>5-8</sup>

Conventional wisdom has been challenged, as there is renewed focus on optimal balloon angioplasty technique to minimize vessel injury and support vessel expansion. The

### Balloon Tips & Tricks

- **Percutaneous transluminal angioplasty (PTA).** Focus on optimal PTA technique.<sup>14</sup> Consider long balloons, slow inflation rate, and long inflation time. Watch out for recoil due to undersizing of balloon or calcium.
- **Specialty PTA.** In more challenging lesions (eg, long, calcified), may increase confidence in appropriate balloon sizing and use. Focus on reducing trauma to the healthy vessel. Consider nitinol-constrained balloon designs, such as Chocolate™\* PTA, to support vessel expansion in more complex lesions without overtreatment.

Chocolate™\* PTA is a specialty PTA balloon designed to deliver controlled dilation in treatment of PAD. Chocolate™ PTA is not a scoring or cutting balloon, but a different advanced angioplasty tool. The unique nitinol-constraining structure reduces the strain and trauma induced on the vessel wall during inflation using “pillows” and “grooves” to relieve stress, modify the plaque, and uniformly distribute circumferential forces to minimize vessel wall trauma.

### In our practice:

- The Chocolate™\* PTA balloon works well for lesions that may not be amenable to atherectomy (small vessels that are 3–4 mm, small focal lesions, smaller-caliber vessels).
- The main goal with Chocolate™\* PTA is to prevent dissections.

\*Note that the primary patency rates of the stented group in the imaging cohort and the full, pure imaging cohort were similar.

DEB SFA-LONG study highlighted a low bailout stent rate (10.9%) in long lesions while demonstrating consistent, durable outcomes of the IN.PACT™ Admiral™ DCB (primary patency at 12 months, 89.3% at 360 day K-M).<sup>9</sup>

Calcium also deserves special consideration. It may limit both vessel expansion (and cause injury) and drug effect.<sup>10,11</sup> Conceptually, atherectomy is promising. In our practice, we have used atherectomy since 2004, and directional atherectomy (DA) plus IN.PACT™ Admiral™ DCB has become our standard of care for SFA and popliteal lesions. DA has been studied in an 800-patient, prospective, multinational study with clinical events committee adjudication of adverse events. DEFINITIVE LE, the largest core lab-adjudicated atherectomy study, evaluated the effectiveness of SilverHawk™ and TurboHawk™ Directional Atherectomy Systems in claudicants and patients with critical limb ischemia in the femoropopliteal and tibioperoneal arteries. The results from DEFINITIVE LE demonstrated patency results similar to that of stents while leaving nothing behind. The bailout stent rate was a low 3.2%.<sup>12</sup> It is possible that atherectomy may complement DCB use in real-world lesions by reducing dissection rate and bailout stenting and removing the barrier to optimal drug absorption.

DA combined with DCB was explored in the DEFINITIVE AR (Anti-Restenosis) study. DEFINITIVE AR was a pilot study to assess the effect of treating a lesion with DA followed by DCB (DA+DCB) versus DCB alone. It was a prospective, multicenter, randomized study. Randomization was performed for DA+DCB versus DCB alone; there was also a nonrandomized DA+DCB arm for severely calcified lesions. Patency rates were favorable for the DA+DCB arm at 1 year. Results suggest that achieving  $\leq 30\%$  residual stenosis after DA leads to better outcomes, which were sustained through 2 years.<sup>13</sup>

Still, we need more real-world data. In the future, these concepts may be proven by the REALITY Study, which is aiming to evaluate patient outcomes following adjunctive use of DA and DCB. REALITY looks at real-world lesions by including more complex disease (long, moderate, and severely calcified symptomatic femoropopliteal lesions and/or occlusions). This study and other studies that bring together atherectomy and DCB may shed more light on this approach and the importance of vessel preparation when treating femoropopliteal artery lesions. ■

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## Goals for optimal vessel preparation in the DCB world:

- Open vessel, while avoiding barotrauma, ideally without a stent
- Remove disease, remove barrier to drug uptake—debulk the calcium
- Gain lumen,  $\leq 30\%$  residual restenosis

## What is in the future?

- New vessel preparation tools
- A better understanding of optimal vessel preparation
- More data on which tools and therapies to use, when, and how
- More data on clinical outcomes and economic value

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### IN.PACT™ Admiral™ Paclitaxel-Coated PTA Balloon Catheter

#### Indications for Use:

The IN.PACT™ Admiral™ Paclitaxel-Coated PTA Balloon catheter is indicated for percutaneous transluminal angioplasty, after appropriate vessel preparation, of de novo, restenotic, or in-stent restenotic lesions with lengths up to 180 mm in superficial femoral or popliteal arteries with reference vessel diameters of 4-7 mm.

#### Contraindications

The IN.PACT™ Admiral™ DCB is contraindicated for use in:

- Coronary arteries, renal arteries, and supra-aortic/cerebrovascular arteries
- Patients who cannot receive recommended antiplatelet and/or anticoagulant therapy
- Patients judged to have a lesion that prevents complete inflation of an angioplasty balloon or proper placement of the delivery system
- Patients with known allergies or sensitivities to paclitaxel
- Women who are breastfeeding, pregnant or are intending to become pregnant or men intending to father children. It is unknown whether paclitaxel will be excreted in human milk and whether there is a potential for adverse reaction in nursing infants from paclitaxel exposure.

#### Warnings

- Use the product prior to the Use-by Date specified on the package.
- Contents are supplied sterile. Do not use the product if the inner packaging is damaged or opened.
- Do not use air or any gaseous medium to inflate the balloon. Use only the recommended inflation medium (equal parts contrast medium and saline solution).
- Do not move the guidewire during inflation of the IN.PACT™ Admiral™ DCB.
- Do not exceed the rated burst pressure (RBP). The RBP (14 atm [1419 kPa]) is based on the results of in vitro testing. Use of pressures higher than RBP may result in a ruptured balloon with possible intimal damage and dissection.
- The safety and effectiveness of using multiple IN.PACT™ Admiral™ DCBs with a total drug dosage exceeding 20,691 µg of paclitaxel in a patient has not been clinically evaluated in the IN.PACT SFA Trial.

#### Precautions

- This product should only be used by physicians trained in percutaneous transluminal angioplasty (PTA).
- This product is designed for single patient use only. Do not reuse, reprocess, or resterilize this product. Reuse, reprocessing, or resterilization may compromise the structural integrity of the device and/or create a risk of contamination of the device, which could result in patient injury, illness, or death.
- Assess risks and benefits before treating patients with a history of severe reaction to contrast agents.
- The safety and effectiveness of the IN.PACT™ Admiral™ DCB used in conjunction with other drug-eluting stents or drug-coated balloons in the same procedure or following treatment failure has not been evaluated.
- The extent of the patient's exposure to the drug coating is directly related to the number of balloons used. Refer to the Instructions for Use (IFU) for details regarding the use of multiple balloons and paclitaxel content.
- The use of this product carries the risks associated with percutaneous transluminal angioplasty, including thrombosis, vascular complications, and/or bleeding events
- Vessel preparation using only pre-dilatation was studied in the clinical study. Other methods of vessel preparation, such as atherectomy, have not been studied clinically with IN.PACT™ Admiral™ DCB.
- This product is not intended for the expansion or delivery of a stent.

#### Potential Adverse Effects

The potential adverse effects (e.g. complications) associated with the use of the device are: abrupt vessel closure; access site pain; allergic reaction to contrast medium, antiplatelet therapy, or catheter system components (materials, drugs, and excipients); amputation/loss of limb; arrhythmias; arterial aneurysm; arterial thrombosis; arteriovenous (AV) fistula; death; dissection; embolization; fever;

hematoma; hemorrhage; hypotension/hypertension; inflammation; ischemia or infarction of tissue/organ; local infection at access site; local or distal embolic events; perforation or rupture of the artery; pseudoaneurysm; renal insufficiency or failure; restenosis of the dilated artery; sepsis or systemic infection; shock; stroke; systemic embolization; vessel spasms or recoil; vessel trauma which requires surgical repair.

Potential complications of peripheral balloon catheterization include, but are not limited to the following: balloon rupture; detachment of a component of the balloon and/or catheter system; failure of the balloon to perform as intended; failure to cross the lesion.

Although systemic effects are not anticipated, potential adverse events that may be unique to the paclitaxel drug coating include, but are not limited to: allergic/immunologic reaction; alopecia; anemia; gastrointestinal symptoms; hematologic dyscrasia (including leucopenia, neutropenia, thrombocytopenia); hepatic enzyme changes; histologic changes in vessel wall, including inflammation, cellular damage, or necrosis; myalgia/arthralgia; myelosuppression; peripheral neuropathy.

Refer to the Physician's Desk Reference for more information on the potential adverse effects observed with paclitaxel. There may be other potential adverse effects that are unforeseen at this time.

Please reference appropriate product Instructions for Use for a detailed list of indications, warnings, precautions and potential adverse effects. This content is available electronically at [www.manuals.medtronic.com](http://www.manuals.medtronic.com).

**CAUTION:** Federal law (USA) restricts this device to sale by or on the order of a physician.

### Chocolate™ PTA Balloon Catheter

**Important Information:** Indications, contraindications, warnings and instructions for use can be found in the product labeling supplied with each device.

**Indications for Use:** The Chocolate™ PTA Balloon Catheter is intended for balloon dilatation of lesions in the peripheral vasculature, including the iliac, femoral, ilio-femoral, popliteal, infra-popliteal, and renal arteries.

**CAUTION:** Federal (USA) law restricts this product for sale by or on the order of a physician.

### HawkOne™ Directional Atherectomy System

**Important Information:** Indications, contraindications, warnings and instructions for use can be found in the product labeling supplied with each device.

**Indications for Use:** The HawkOne™ peripheral directional atherectomy system is intended for use in atherectomy of the peripheral vasculature. The HawkOne catheter is indicated for use in conjunction with the SpiderFX embolic protection device in the treatment of severely calcified lesions. The HawkOne catheter is NOT intended for use in the coronary, carotid, iliac or renal vasculature.

**CAUTION:** Federal (USA) law restricts this product for sale by or on the order of a physician.

### SilverHawk™ Plaque Excision System

**Important Information:** Indications, contraindications, warnings and instructions for use can be found in the product labeling supplied with each device.

**Indications for Use:** The SilverHawk™ Peripheral Plaque Excision System is intended for use in atherectomy of the peripheral vasculature. The catheter is NOT intended for use in the coronary, carotid, iliac or renal vasculature.

**CAUTION:** Federal (USA) law restricts this product for sale by or on the order of a physician.

### TurboHawk™ Plaque Excision System

**Important Information:** Indications, contraindications, warnings and instructions for use can be found in the product labeling supplied with each device.

**Indications for Use:** The TurboHawk™ Peripheral Plaque Excision System is intended for use in the atherectomy of the peripheral vasculature. The TurboHawk catheter is NOT intended for use in the coronary, carotid, iliac, or renal vasculature.

The TurboHawk Catheter is indicated for use in conjunction with the SpiderFX™ Embolic Protection Device in the treatment of severely calcified lesions (LS-C and LX-C only).

**CAUTION:** Federal (USA) law restricts this product for sale by or on the order of a physician.