

EDITORIAL COMMENT

Ars Longa, Vita Brevis*

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Ease of use has dictated the destiny of all new techniques and devices in interventional cardiology. The popularity of stents began when they became as easy to use and more predictable than balloons. Conversely, directional and rotational atherectomy fell into oblivion or became confined to a small niche application. Some of these devices have been underused, even when proved beneficial, such as filters in saphenous vein graft treatment or thrombectomy in acute myocardial infarction. For chronic total occlusions (CTOs), the only route to success passes through the use of multiple dedicated wires, guided by contralateral injection, and of over-the-wire (OTW) balloons or microcatheters, sometimes inserted retrogradely via collateral vessels with the use of devices with exotic names like Tornus and Corsair (Asahi Intecc, Nagoya, Japan).

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No wonder few interventionalists have ventured into this uncharted territory. The problem is, however, that CTOs are very frequent and are present in >30% of patients with significant coronary stenoses and almost 50% of patients with multivessel disease. Failure to tackle these lesions means high rates of surgical referral or, worse, incomplete percutaneous revascularization, with long-term results that are bound to be no better than medical therapy (1) and worse than surgery (2).

After the publication of SYNTAX (Synergy between PCI with Taxus and Cardiac Surgery) (3), to support a greater role of percutaneous coronary intervention in multivessel and left main disease, we examined every fraction of percentage difference in death, stroke, and new revascularization in the 1,800 patients randomized. Maybe we also should have paid equal attention to the 1,077 suitable patients screened who went straight to surgery because they were deemed unsuitable for angioplasty, mainly because of complex CTOs.

The SYNTAX study was conducted in some of the best centers on both sides of the Atlantic and 24.2% of these

patients with 3-vessel disease or left main disease in the percutaneous coronary intervention (PCI) arm had at least 1 CTO. When we see the real-world practice, as observed in the National Cardiovascular Data Registry quoted in this nice review (4), the attempt rate in CTOs is 13.6% in the U.S. Our Japanese colleagues report and give convincing demonstrations in live courses that CTOs can be successfully opened in >90% of cases with a low complication rate and excellent long-term patency with the use of drug-eluting stents (5). Unlike primary angioplasty for ST-segment elevation myocardial infarction and prompt invasive treatment of acute coronary syndromes, elective angioplasty in patients with stable angina or silent ischemia does not reduce mortality, with the possible exception of CTO recanalization. The advantages in recovery of left ventricular function and late survival were consistently confirmed in addition to the expected relief of symptoms and reduced need of coronary artery bypass grafting, as nicely reported in this updated review from Grantham et al. (6) in this issue of *JACC: Cardiovascular Interventions*.

Then, why don't we do more? The answer is simple: a lack of training and insufficient volume to maintain and increase specific CTO experience. The apprenticeship is the cornerstone of training in interventional cardiology, like in most "surgical" specialties. You do not learn how to open CTOs from watching live cases lasting hours in courses or listening to experts presenting new techniques and devices. You need to work hands-on, first assisting and later being assisted by experienced surgeons to gain the confidence to push the wire into the unknown, to keep drilling and steering it along the virtual track you expect the vessel to follow until you meet the distal end of the occlusion. You need to learn to immediately detect when your wire is deflected toward the subintima and then stop, without jeopardizing your chances of success by creating large dissections, sometimes switching to a new parallel wire that will be guided by the position of the first wire in a false track. You need to learn to avoid too many useless antero-grade injections and to select the best views for each segment, switching to orthogonal views when needed. If you want to add another 10% to 15% success rate and tackle some "impossible" CTOs, you need to learn to patiently engage collaterals, visualize them subselectively, and master new wires, long balloons, and dedicated devices to support their progression to the distal end of the occlusion and beyond (7).

In Europe, we often show contempt for what we term the "low-volume American operators." In reality I have seen many well-respected, high-volume catheter laboratories in Europe in which the use of OTW balloons, microcatheters, contralateral injection, anchor balloons, and trapping balloons, the cornerstone of CTO treatment, is watched with a mixture of curiosity and amazement by the staff. If the case continues beyond 1 to 2 h, everyone starts pointing to

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high-radiation doses or contrast use as valid reasons to stop. Volume is not equal to quality, and quickly performing many angioplasties does not mean an operator is proficient when he or she treats different an animal like the CTO. For a technique such as interventional cardiology, which is becoming more and more complex, spanning from structural heart disease and peripheral interventions to acute and chronic coronary syndromes, we should apply the Roman motto, or the title of this editorial, "Ars longa, vita brevis": Life is too short to learn all the tricks and subtleties of this craft, and we should not pretend to be the best in every aspect but rather concentrate in 1 or 2 selected fields in which we can become truly good and proficient.

How and when do we learn these new skills? Do not expect to learn them as a young trainee. Before you begin handling complex CTOs, you need a minimum background of 500 to 1,000 "normal" PCIs to master guiding support, delivery of balloons and stents around calcific bends, proper lesion preparation, side branch protection, and stent expansion. When you reach the point, you can start advanced CTO training. As a respected young independent operator, you have to think hard and decide whether you are masochistic enough to accept to go back to training and learn a technique that often requires spending long hours in surgery and where you still have a chance at the end to face the patient and say, "Sorry, I failed." You should also check your volume of angioplasty procedures and have a frank discussion with your colleagues to see whether you can have and maintain the anticipated volume of referrals to ensure that you perform a minimum of 50 to 100 cases/year (7). Because time in the catheter laboratories is limited, you are likely to perform fewer cases than your colleagues, an annoying problem if you and your center are compensated by number of procedures because you will become the black sheep, consuming too many resources to produce not enough revenue.

If you are still committed to go ahead and specialize in CTO treatment, you have to find a practical and effective way to do it. The easiest way is to already practice in a catheter laboratory at which other CTO operators are willing to teach. The alternative is to go to other catheter laboratories once a week or once in a fortnight, possibly bringing there your most complex CTOs, a routine that should include at least 50 to 100 cases, which may mean 1 to 2 years during which time you will be mainly watching and assisting. This experience can be a frustrating one, but it also can become very rewarding if you develop good

cooperation and learn team work. The ability to discuss and alternate as an operator with another experienced colleague during these long interventions is also helpful to maintain focus, improve success, and reduce complications.

Even when you have completed your specific training, you have to accept that you have never finished learning in a field in which the success rate is still far from 100% and would be much lower if many CTOs were not avoided at this stage. This rate explains the continuous proliferation of new devices and techniques to improve outcome. Maybe you are tempted to wait until CTO treatment becomes as easy and predictable as a computer war game, where we fire laser or radiofrequency energy from the control room using a 3-dimensional reconstruction of the occluded vessels for guidance. Do not wait too long: unfortunately, this is not happening soon and your CTO patients desperately need these procedures now.

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