



Innovative Strategies for Chronic Total Occlusions

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CHRONIC total occlusion percutaneous coronary intervention (CTO PCI) strategies were thoroughly discussed at the EuroPCR 2024 Annual Global Course in Paris, France. Experts in the field gathered to discuss the advantages and limitations of various approaches, including the use of intravascular ultrasound (IVUS) when locating ambiguous proximal caps. Experts discussed several techniques in the context of success rate and patient safety, with a focus on what changes can be made to current guidelines to ultimately improve patient outcomes in high-risk cases.

THE PARALLEL WIRE TECHNIQUE

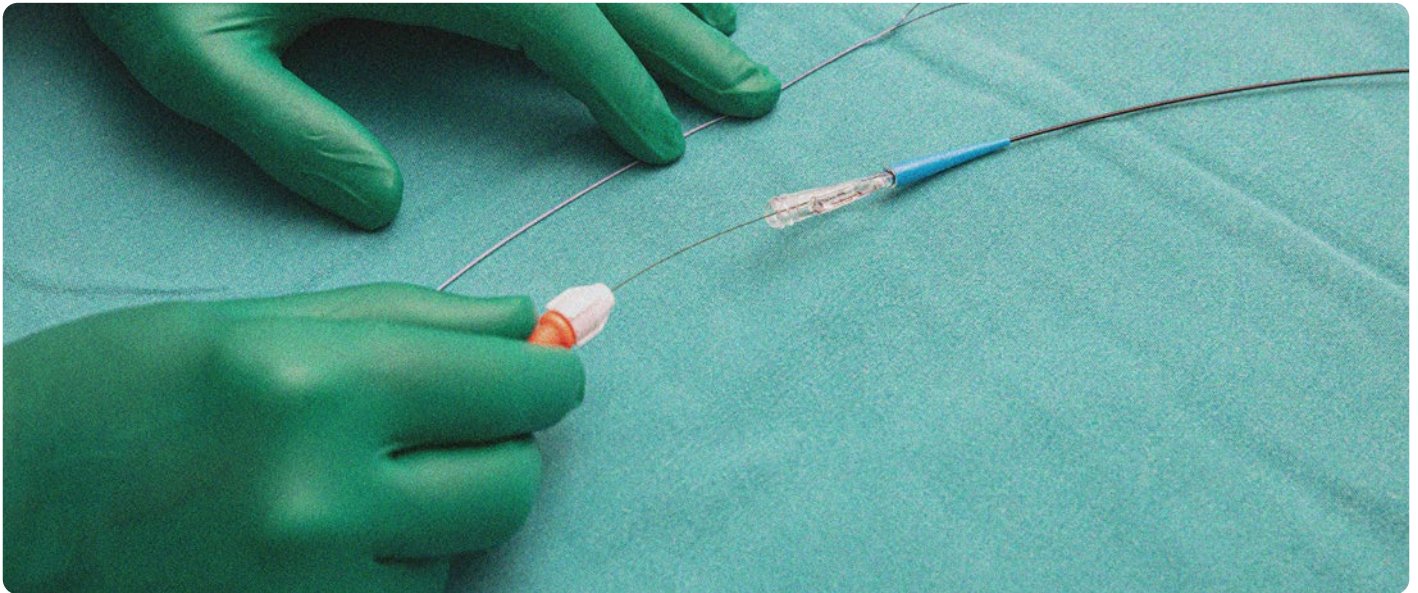
Omer Goktekin, Memorial Bahçelievler Hospital, Istanbul, Türkiye, started by discussing the use of parallel wire technique (PWT) in cases where antegrade strategies fail. With PWT, a second guidewire is introduced whilst the first wire acts as a reference point and provides stability. Goktekin explained that the second wire should have better torque ability and may require a different tip shape according to the behaviour of the first wire; for example, a wire with a higher tip load may be necessary. While PWT is a well-known technique, it has been used less frequently in recent years due to the introduction of new, innovative wires, such as Gaia wires (Asahi Intecc USA, Irvine, California, USA). However, Goktekin emphasised that PWT should not be forgotten amid these newer strategies. “Parallel wiring is still a valid and quick option and tackles CTOs by utilising two wires simultaneously,” he said. In particular, PWT is a favourable option when the primary wire is in the subintima and has a good distal landing zone.

Goktekin also noted that, with PWT, the second wire manipulation can be augmented by a dual-lumen catheter on the first wire. In discussing the different uses of dual lumen catheters (when used during PWT, or as a device for achieving distal re-

entry [ADR]), panel members explained that when the wire is located before the distal cap, then you are performing a PWT; but when the wire is below the distal cap, you can transform your parallel wire technique to perform ADR, with the assistance of a ReCross device (IMDS, Roden, The Netherlands). Maksymilian Opolski, Institute of Cardiology, Warsaw, Poland, expanded on the differences between PWT and ADR, explaining that whilst PWT is safer and more time-effective, ADR has more technical success. Opolski also noted that PWT is cheaper and is still common in various countries, emphasising the point made by Goktekin, that “PWT is a classic but not an old-fashioned technique.” However, Goktekin did highlight that in cases where there is a large subintimal haematoma (for instance due to aggressive wire manipulation), or if there is a poor distal landing zone, then PWT is not the preferred choice.

AMBIGUOUS PROXIMAL CAPS: OPTIMISING THE USE OF IVUS AND CT

Evald Christiansen, Cardiology Department of Aarhus University Hospital, Denmark, narrowed the topic of discussion to focus on approaches used to target ambiguous proximal caps. He explained that IVUS



“**The implementation of an investment strategy will increase the accessibility and provision of CTO PCI**”

can be used to identify the presence of calcium in the cap, which can implicate wire choice. Currently, the Global Chronic Total Occlusion Crossing Algorithm acts as a guideline for strategy options when there is proximal ambiguity. The guideline states that if a proximal cap is ambiguous and there is the presence of a side branch, then you can conduct IVUS to identify the location of the proximal cap, and subsequently decide if there is a feasible retrograde option. Christiansen began his presentation by describing a case report in which both an antegrade puncture with a double lumen catheter and a retrograde puncture retrogradely with the support of a microcatheter failed during a procedure. A subsequent CT scan revealed that the proximal cap was not in the circumflex artery, as they had originally thought, but in the left anterior descending artery. Christiansen described how they subsequently used IVUS to confirm luminal entry and to verify the safety of the circumflex artery after stenting.

Importantly, the use of CT in this case report led to a discussion by the panel on the use of CT scans in current guidelines. Christiansen suggested that in all cases of failed puncture attempts, a CT scan should

be carried out. He informed the audience that the guidelines in Denmark state that a CT scan is the first course of action when a patient has stable symptoms. He proposed that all cardiologists should learn how to use and interpret CT scans in the context of complex CTO, and that CT should be incorporated into the Global Chronic Total Occlusion Crossing Algorithm. Opolski pointed out that sometimes IVUS can cause an artefact due to the large amount of calcium, particularly in patients that are post coronary artery bypass grafting; and therefore, CT is a better option in these cases. Gabriele Gasparini, Humanitas Research Hospital, Milan, Italy, argued that perhaps CT scans should be implemented in the pre-assessment stage, which is prior to the Global Chronic Total Occlusion Crossing Algorithm.

Roberto Diletti, Thoraxcenter, Erasmus MC, Rotterdam, the Netherlands, wrapped up the discussion by explaining that whether the procedure involves an IVUS-guided puncture, or if different software is utilised, it is essential to use IVUS afterwards to confirm that the puncture is in the correct location. Diletti concluded that “the final IVUS is the most important.”

INVESTMENT PROCEDURES AS STANDARD PRACTICE

The session was completed with an insightful talk by Margaret Mcentegart, Columbia University Irving Medical Center, New York, USA, whose presentation focused on her proposal to conduct an investment procedure for every high-risk patient.

“**In all cases of failed puncture attempts, a CT scan should be carried out**”

Mcentegart began by explaining that, while dedicated CTO registries of expert, high-volume operators report success rates with contemporary CTO PCI of up to 90%, in real-world databases, success rates are only about 60%. Additionally, the complications associated with CTO PCIs are higher than non-CTO PCIs, which further highlights the need to improve success rates and safety for patients who undergo CTO PCI procedures. To improve success rates and reduce complications, Mcentegart suggested that an investment procedure should be incorporated into the Global Chronic Total Occlusion Crossing Algorithm. She explained that this is different to a modification procedure (where the proximal cap and CTO body are modified after an unsuccessful CTO PCI), as an investment procedure is a planned, initial procedure to modify the proximal cap, occlusive segment, and distal cap before the subsequent completion procedure. Whilst modification procedures can improve safety and success rates, they occur after a failed attempt, which is something that physicians should try to avoid.

Mcentegart corroborated her argument by providing evidence from case reports of successful CTO PCIs after investment procedures. The two cases presented by Mcentegart are part of a prospective CTO study involving the assessment of investment procedures in 200 patients who are categorised as high-risk CTOs,

with a Japanese chronic total occlusion (J-CTO) score of at least 3 with high-risk retrograde options. Mcentegart and colleagues hypothesised that in higher-risk CTOs, a planned investment procedure will be associated with improved cumulative procedural success and safety and will facilitate an increased proportion of cases being completed antegrade. They also hypothesised that the implementation of an investment strategy will increase the accessibility and provision of CTO PCI, adding that it will make CTO PCI more palatable for the wider cardiology community.

Circling back to the use of IVUS when identifying ambiguous proximal caps, Mcentegart revealed that data from their prospective study have highlighted discrepancies between angiography and IVUS in imaging the location of the proximal cap. She explained that often, the distal cap location detected on IVUS is more proximal than it appears on an angiogram. Mcentegart suggested that the results of the study will provide insights into the morphology of CTOs and the difference between IVUS and angiograms.

In her closing remarks, Mcentegart emphasised that, unless there is a concern of perforation, which is unlikely with the implementation of the investment strategy, they advise not to take a final picture at the end of the procedure, as this can cause hydraulic injury. However, Mcentegart concluded that ultimately, patient safety is the main concern, and if there is suspicion of perforation, then physicians may deem this necessary.

Overall, the session underscored the need for continuous innovation and reassessment of strategies in CTO PCI. The discussions and proposals, such as the use of PWT and investment procedures, aim to refine techniques and improve patient outcomes. Future research might validate these strategies and lead to changes in global guidelines, ultimately enhancing the standard of care for high-risk patients.