

# The First Clinical Experience With a Novel Catheter for Collateral Channel Tracking in Retrograde Approach for Chronic Coronary Total Occlusions

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**Objectives** The aim of this study was to report the initial experience with a novel catheter in the retrograde approach for chronic total occlusion (CTO).

**Background** Although the use of the retrograde approach in percutaneous coronary intervention for CTO has been established, some procedural difficulties remain.

**Methods** A novel over-the-wire catheter (channel dilator) specifically designed for the retrograde approach has been developed for the treatment of CTO. The channel dilator was used in 93 CTO lesions after successful wiring of collateral channels using the retrograde approach.

**Results** Successful channel crossing of the catheter was achieved in 90 of the lesions (96.8%), and the channel dilator successfully advanced into the occlusion reversely during retrograde wiring in 85 lesions (94.4%). Of the 75 lesions with successful advancement of the retrograde wire into the proximal true lumen, the entire occlusion was crossed retrograde with the channel dilator in 63 lesions (84.0%). To evaluate the feasibility of the catheter, 93 CTO lesions in the preceding period were compared. Procedure and fluoroscopy time tended to be lower in the study group than in the control group. The success of the retrograde procedure was significantly higher in the study group than in the control group (98.9% vs. 92.5%,  $p = 0.030$ ).

**Conclusions** The channel dilator may facilitate the conventional retrograde approach with a high level of success. (J Am Coll Cardiol Intv 2010;3:165–71) © 2010 by the American College of Cardiology Foundation

Recanalization of chronic total occlusion (CTO) by percutaneous coronary intervention (PCI) has been widely attempted since the mid-1990s as the result of technical improvements and introduction of available devices (1–5). One of the most recent advancements related to the CTO-PCI was the introduction of the retrograde approach. The first report of PCI using the retrograde approach was described in 1990 (6). However, the investigators used only saphenous vein grafts for the treatment of nonoccluded lesions in native coronary arteries in that study. Since then, the retrograde approach has been considered an alternative method for treating CTO, especially among Japanese interventional cardiologists, despite its indication being limited to lesions with large epicardial collateral where saphenous vein grafts can be used. In 2005, the septal channel dilation technique (7) and controlled antegrade and retrograde subintimal tracking (CART) technique (8) were developed to enhance advantages of the retrograde approach. The former contributed to expand its indications whereas the latter enhanced its credibility. The CART technique was developed to create subintimal dissection with limited extension only at the site of CTO (9). These 2 techniques

#### Abbreviations and Acronyms

**CART** = controlled antegrade and retrograde subintimal tracking

**CTO** = chronic total occlusion

**PCI** = percutaneous coronary intervention

have improved procedural success rates and eventually established the basis of the current technique used of the retrograde approach. However, some procedural difficulties still remain. For example, the septal dilation technique always carries the risk of septal injury. The CART technique requires retrograde balloon access into the occlusion; however, complexities of the anatomy often prevent the device from crossing even after dilation of the septal channel. In addition, long procedural times always carry the risk of donor artery trouble, such as thrombus formation. To overcome these difficulties and facilitate the procedure, we developed a novel catheter for collateral channel tracking during the retrograde approach. The aim of this study was to report the initial experience with the novel catheter in treating CTO.

#### Materials and Methods

The Corsair microcatheter (Asahi Intecc Co. Ltd, Aichi, Japan) was originally developed as a collateral channel dilator to facilitate retrograde approaches for CTO-PCI. This is an over-the-wire hybrid catheter that has features of a microcatheter and a support catheter. Figures 1 and 2 show a picture and the design of the Corsair. The shaft consists of 8 thin wires wound with 2 larger wires. This spiral structure allows the bidirectional rotation to be transmitted to the distal shaft for crossing small tortuous collateral channels. The working shaft length is 150 cm and

the distal part of the catheter within 60-cm length is coated with hydrophilic polymer to provide lubricity. The braided portion of the catheter is covered with polyamide elastomer, and the inner lumen of the shaft (excluding the connector portion) is lined with a fluoropolymer layer to enable tip injections and facilitate movement of the guidewire. The tip contains tungsten powder and a marker that enhances the visibility of the catheter. The maximum outside diameter is 0.93 mm (2.8-F), and the inner diameter is 0.45 mm, which is suitable for a 0.014-inch guidewire.

The Corsair microcatheter was applied to patients in whom successful collateral channel tracking was achieved during the retrograde approach in CTO-PCI, without case selection and when it was available. The standard procedure was as follows. First, an attempt was made to advance the Corsair microcatheter through the channel without balloon dilation. If this was unsuccessful, the dilation technique was applied in septal channels. Second, the retrograde wiring into the occlusion was done using the Corsair microcatheter and the catheter was also advanced into the occlusion if necessary. Third, after a successful retrograde wire crossing or reverse CART procedure, the Corsair microcatheter was advanced through the entire occlusion if possible. Retrograde wire crossing implies crossing the entire occlusion using retrograde wire only (9–12). The reverse CART technique is a modification of the CART technique, in which antegrade balloon dilation creates a space that leads the retrograde wire toward the proximal true lumen (8,9). The kissing wire and knuckle wire techniques without balloon dilation are defined as bilateral wiring techniques (9,12).

Data were collected from 2 experienced CTO-PCI operators in whom the Corsair microcatheter was initially supplied for examination. The baseline and procedural-related characteristics, procedural success rate, and complications were compared with those of the control group. To eliminate the bias in other procedural techniques and devices, the control group included the same number of patients in whom successful collateral channel tracking was achieved by each operator just before introduction of the Corsair.

Q-wave myocardial infarction was diagnosed with the documentation of new pathological Q waves in 2 or more contiguous leads in an electrocardiogram associated with any elevation of creatine kinase-myocardial band. Non-Q-wave myocardial infarction was defined as the elevation of creatine kinase to more than twice the upper limit associated with any elevation of creatine kinase-myocardial band without the appearance of Q-waves. Written informed consent to the protocol approved by each institutional review board was obtained from all eligible patients.

**Statistical methods.** Continuous variables were expressed as the mean  $\pm$  SD. Variable categories were expressed as frequencies. Student *t* test or a nonparametric analysis using the Mann-Whitney *U* test was used for numerical comparisons between groups. The chi-square test or Fisher exact

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