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Case Report

"Slipstream technique"—New concept of intravascular ultrasound guided wiring technique with double lumen catheter in the treatment of coronary total occlusions

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ABSTRACT

Intravascular ultrasound (IVUS)-guided guidewire manipulation technique is often useful to cross the lesion of chronic total occlusion (CTO) antegradely and solve retrograde CTO failure cases. However, this technique is usually complex because we need many devices and it requires many steps. Some steps usually take time and/or sometimes create a large dissection space which cause the procedure to fail. To overcome a weakness in this technique, we introduce the new IVUS-guided wiring technique with double lumen catheter named "Slipstream technique" here. This technique is simple, easy, and associated with less injury. It will be helpful for penetrating into the true lumen from the subintimal space with a guidewire correctly and safely.

<**Learning objective:** IVUS-guided wiring technique in the treatment of chronic total occlusion is usually complex. The key point of new IVUS-guided wiring technique is to put both the IVUS catheter and double lumen catheter on the same wire. This manner is simple. Moreover, it will increase the stability of double lumen catheter and be helpful to manipulate the second guidewire effectively.>

Introduction

After the introduction of the retrograde approach [1], the success rate of percutaneous coronary intervention (PCI) for chronic total occlusion (CTO) increased by up to 80–90% [2]. However, there are some situations in which it is difficult to advance the guide wire and microcatheter into the CTO lesion, even though the guide wire and microcatheter can pass through the collateral channel retrogradely [3]. Although intravascular ultrasound (IVUS)-guided guidewire manipulation is often useful to cross the lesion [4–6] and solve retrograde CTO-PCI failure cases, this technique is usually complex because we need many devices and it requires many steps.

In addition, the performance of guidewires is sometimes reduced by instability or entanglement. Here, we introduce a more simple and effective IVUS-guided wiring technique with a double lumen catheter for the treatment of CTOs.

Case report

A 64-year-old male with stable angina was admitted to a hospital. Coronary angiography showed severe stenosis in the distal part of the right coronary artery (RCA) and a CTO in the proximal left anterior descending artery (LAD). The first attempt at recanalization of the LAD-CTO was performed in September 2015 after the treatment of RCA, but unfortunately it failed. The doctor who performed the procedure consulted us about the 2nd attempt for the LAD-CTO, so we decided to try again after some discussion.

In May 2016, the 2nd attempt for PCI was performed. Angiography revealed a CTO of the proximal LAD (Fig. 1a, b), confirming that nothing changed in comparison to the prior session. With an 8-Fr guiding catheter, a SION blue (Asahi Intec, Nagoya, Japan) was inserted into a septal branch to check the entry point by IVUS (NavifocusWR; Terumo Corp., Tokyo, Japan) (Fig. 1c). Gaia 1st (Asahi Intec, Nagoya, Japan) was inserted into the CTO lesion first, and subsequently exchanged for Gaia 2nd (Asahi Intec) inside the lesion because of tissue stiffness. Gaia 2nd advanced gradually and passed into the diagonal branch (Fig. 1d, e). After passing Gaia 2nd into the diagonal branch, we changed it to floppy guidewire (SION blue) to avoid the coronary perforation. We tried

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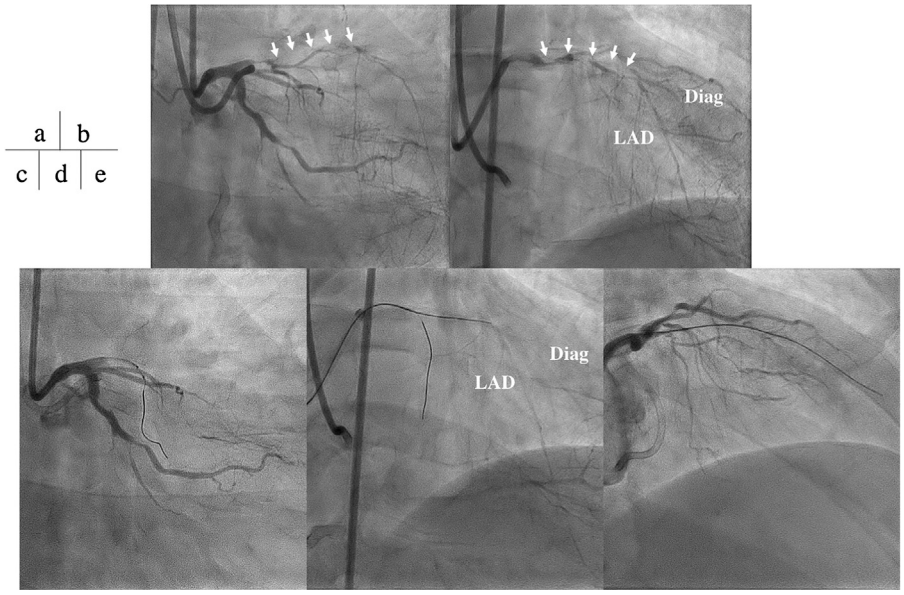

Fig. 1. Baseline coronary angiography in the right oblique caudal projection (a) and the right oblique cranial projection (b). CTO begins from the proximal of LAD to the bifurcation between LAD and diagonal branch (Diag) (arrow). (c) Intravascular ultrasound catheter was inserted in septal branch to identify the entrance of occluded LAD (arrow). (d) Guidewire (Gaia 2nd) advanced close to the end of CTO (arrow). (e) Gaia 2nd passed into diagonal branch.
CTO, Chronic total occlusion; LAD, left anterior descending artery.

to insert another guidewire (SION blue) into the LAD with a double lumen catheter (SASUKE; Asahi Intec), but it could not advance. To understand the reason why, we observed the bifurcation between the LAD and the diagonal branch by IVUS. After the dilation with 1.5 mm balloon catheter, we advanced IVUS catheter to the distal part of diagonal branch. The IVUS image showed that there was a single-layered wall between LAD and the diagonal branch (Fig. 2).

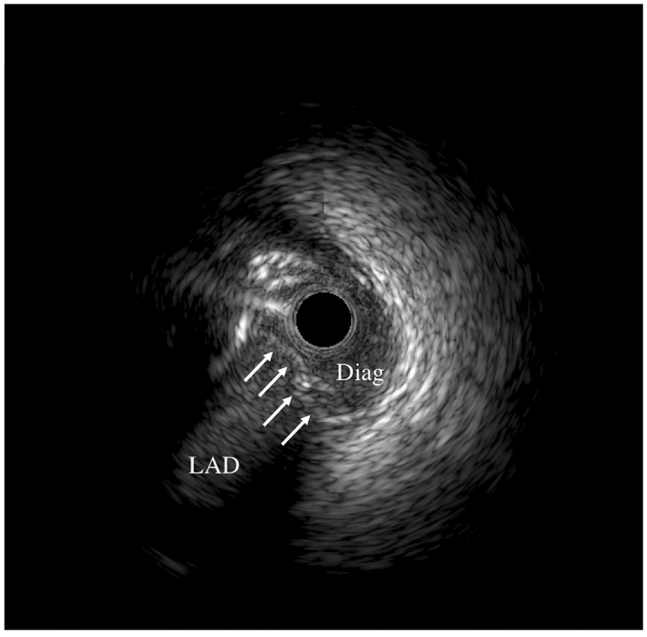

Fig. 2. Intravascular ultrasound image showed that there was a barrier between diagonal branch (Diag) and the left anterior descending artery (LAD) (arrow).

To puncture this wall correctly, we decided to use an IVUS-guided wiring technique.

In the case of usual IVUS-guided wiring techniques, we insert another guidewire and microcatheter along the IVUS catheter. This process sometimes takes a lot of time. Moreover, this step may make a large dissection space and cause the procedure to fail. To avoid this situation, we evolved a new method named the "Slipstream" technique.

After pulling out the IVUS catheter once, we inserted it again using only the 1st guidewire lumen. Afterwards, we put the double lumen catheter on the same guidewire which was used in the IVUS catheter and advanced it to the tip of the IVUS catheter. By using the 1st guidewire lumen only, the double lumen catheter reaches closer to the tip of IVUS catheter (Fig. 3a), thereby significantly increasing the stability. In addition, the 2nd guidewire port of SASUKE is close to the transducer of NavifocusWR in this system. This makes it helpful and easy to identify the tip of the guidewire on the IVUS image during the procedure.

Using this system, we could puncture the barrier with the new Gaia 2nd as the 2nd guidewire and advance it into the LAD correctly (Fig. 3b–d and Movie 1). Finally, we put a stent in the LAD and finished the procedure.

Discussion

We introduced a new IVUS-guided wiring technique with double lumen catheter in this report. The advantage of this technique is simple and more atraumatic in comparison to the previous one. In traditional methods [4–6], the 2nd guidewire alone or both guidewire and microcatheter have to be inserted along the IVUS catheter up to the transitional site between the true limen and subintimal space. This step in the procedure usually takes time and/or sometimes creates a large dissection space which causes the procedure to fail. To prevent a waste of time and a risk like this, it is effective to put and advance the double lumen catheter on the 1st guidewire which was used for insertion of the IVUS catheter. In most cases, it is easy and safe to advance both the

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