

Successful percutaneous coronary intervention using a 4-in-3 “Slender Mother and Child” PCI technique

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Postep Kardiol Inter 2013; 9, 3 (33): 286–290
DOI: 10.5114/pwki.2013.37511

Abstract

We report two cases of successful percutaneous coronary intervention (PCI) using a 4-in-3 “Slender Mother and Child” PCI technique. In both cases, coronary angiography revealed severe stenosis of the right coronary artery (RCA). In both cases, 5-Fr sheathless guiding catheters were inserted into the RCA (virtual 3-Fr PCI) but stents could not pass through because of stents previously implanted at the proximal site of the target lesions. After 4-Fr straight “child” guiding catheters were inserted into the 5-Fr sheathless “slender mother” guiding catheters, they were deployed successfully at the target lesions. This system might be useful to improve stent delivery in virtual 3-Fr PCI.

Key words: 4-in-3, Slender Mother and Child, percutaneous coronary intervention.

Introduction

Since percutaneous coronary intervention (PCI) was introduced by Grüntzig, there has been significant down-sizing of PCI devices [1]. This progressive reduction in catheter size has been associated with a progressive decrease in complications, mainly those related to the access site [2–4]. In addition, down-sizing of catheters has reduced the volume of contrast medium that must be injected [5]. Although PCI using a 5-Fr guiding catheter is expected to attenuate complications such as bleeding and radial artery occlusion, virtual 3-Fr PCI using a 5-Fr sheathless guiding catheter could lead to less invasive PCI as a result of reduction in puncture size [6]. However, a 5-Fr guiding catheter may limit the PCI devices and techniques that can be used compared with a 6-Fr guiding catheter.

Recently, a 4-Fr KIWAMI ST01 Heartrail™ guiding catheter (Terumo, Japan) and a 4-Fr i-Works™ straight guiding catheter (MEDIKIT, Japan) have been used in the clinical setting [7]. These guiding catheters were developed to improve stent delivery in patients with coronary artery disease. These guiding catheters are inserted into a 6-Fr guiding catheter resulting in a 4-in-6 system.

In this article, we present a new system for PCI called the 4-in-5 system and 4-in-3 system.

Case reports

Case 1

A 77-year-old Japanese man visited the outpatient clinic of our institution because of dyspnea on exertion. Coro-

nary angiography (CAG) showed that there was a severely stenotic lesion in the right coronary artery (RCA). He underwent PCI for the RCA lesion. A 5-Fr JR 4.0 Heartrail™ guiding catheter (Terumo, Japan) was positioned in the ostium of the RCA. After wiring into the RCA with a Runthrough NST™ hypercoat guidewire (Terumo, Japan), pre-dilatation was performed using a 3.0 mm × 12 mm LIFESPEAR HP™ balloon catheter (Lifeline, Japan). We tried to deliver a 3.0 mm × 14 mm Nobori™ stent (Terumo, Japan), but the stent could not pass the stenotic lesion because of a proximal stent that had been implanted previously. Although we tried the two-wire technique, the stent still could not be advanced. Next, we inserted a 4-Fr KIWAMI Heartrail™ guiding catheter (Terumo, Japan) into the 5-Fr guiding catheter. After using a balloon catheter to anchor the 5-Fr guiding catheter, a 4-Fr guiding catheter was inserted at the proximal site of the lesion. The stent was implanted and the final CAG result was excellent (Figures 1 and 2).

Case 2

A 65-year-old Japanese man visited the outpatient clinic of our institution because of chest pain on exertion. Coronary angiography showed that there was a severely stenotic lesion in the RCA. He underwent PCI for the RCA lesion. A 5-Fr AL 1.0 Works™ guiding catheter (MEDIKIT, Japan) was positioned in the ostium of the RCA. After wiring into the RCA with a Wizard3™ guidewire (Lifeline, Japan), pre-dilatation was performed using 2.0 mm × 15 mm MINI TREK™

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Received: 1.07.2013, accepted: 12.07.2013.

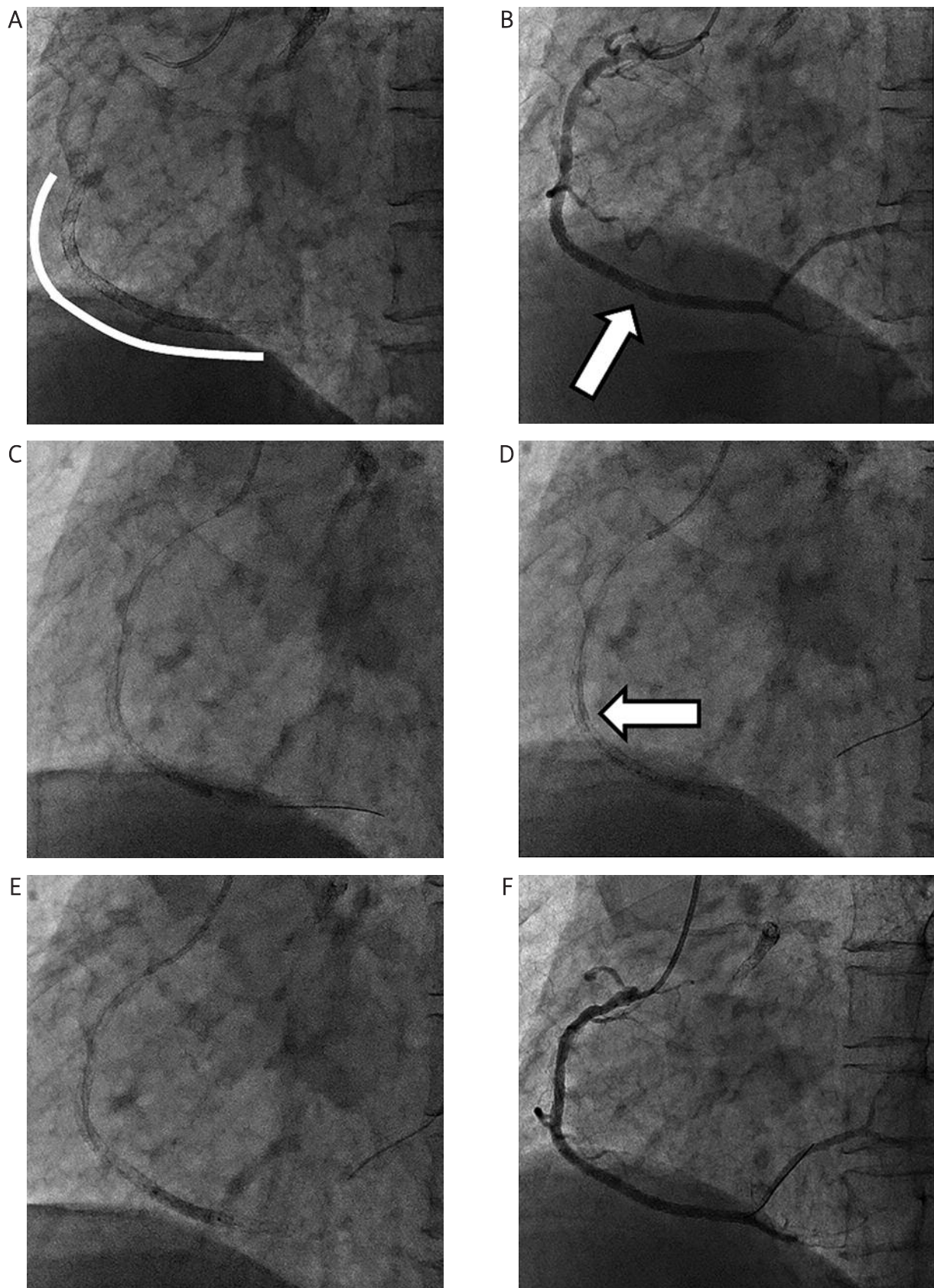


Fig. 1. Results of PCI in case 1. **A** – Stents implanted previously in the RCA (white line). **B** – Severe stenosis in the RCA (white arrow). **C** – Ballooning (#3). **D** – Post-insertion of the 4-Fr guiding catheter (white arrow). **E** – Stenting (#3). **F** – Final shot

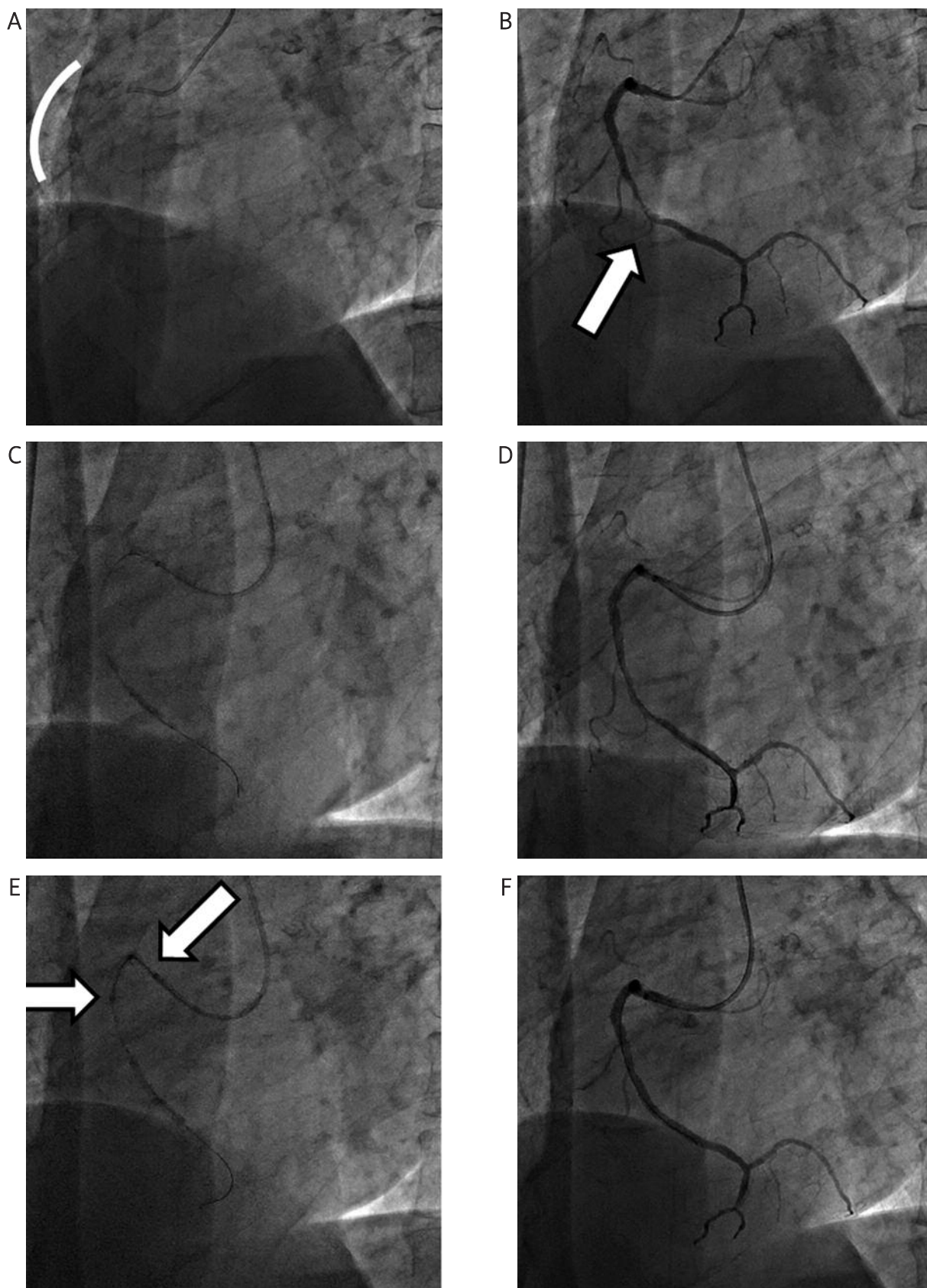


Fig. 2. Results of PCI in case 2. **A** – Stent implanted previously in the RCA (white line). **B** – Severe stenosis in the RCA (white arrow). **C** – Ballooning (#2-3). **D** – CAG after ballooning (#2-3). **E** – Post-insertion of the 4-Fr guiding catheter (white arrows). **F** – Final shot

balloon catheters (Abbott, USA). We tried to deliver a 2.5 mm × 24 mm Nobori™ stent (Terumo, Japan), but the stent could not pass because of a stent that had been implanted previously at the proximal site of the lesion. Although we tried the two-wire technique, the stent still could not pass. Next, we inserted a 4-Fr i-Works™ guiding catheter (MEDIKIT, Japan) into the 5-Fr guiding catheter. After using a balloon catheter to anchor the 5-Fr guiding catheter, a 4-Fr guiding catheter was advanced into the proximal site of the lesion. The stent was implanted and the final CAG result was excellent (Figure 3).

Discussion

We report two cases of successful PCI using the 4-in-3 technique. This technique is the so-called “Slender Mother and Child” technique, where a 4-Fr “child” guiding catheter is inserted into a 5-Fr “slender mother” sheathless guiding catheter (virtual 3-Fr PCI system). Because the performance of a 5-Fr sheathless PCI system appears to be comparable to one using a 5-Fr guiding catheter, while the puncture-site damage remains equivalent to that of a 3-Fr introducer sheath, it is called a virtual 3-Fr PCI system.

Saito *et al.* demonstrated that based on the radial artery inner diameter, 72.6% of female and 85.7% of male Asian patients could physically accept a 6-Fr sheath [8]. The ratio of the radial artery to sheath diameter has been shown to be an important predictor of the reduction in radial artery flow after transradial intervention, and radial occlusion rates are significantly lower if the ratio of radial artery inner diameter/sheath outer diameter is ≥ 1.0 . Thus, less invasive PCI using 5-Fr, 5-Fr sheathless and 4-Fr guiding catheters is expected to be widely adopted by interventional cardiologists to attenuate access site-related complications [2]. We have reported that down-sizing of the sheath reduces bleeding complications and radial artery occlusion after transradial catheterization [3]. Although some techniques are available for slender PCI using 5-Fr and 4-Fr guiding catheters, these catheters may limit the PCI devices and techniques that can be used [9–11]. In our cases, Nobori stents were deployed through a 4-Fr “child” catheter. Most currently available stents including bare metal stents (Integrity, Medtronic, USA; MULTI-LINK 8, Abbott, USA; S-Stent, Biosensors International, Ltd.) and drug-eluting stents (Nobori, Terumo, Japan; XIENCE PRIME, Abbott, USA; PROMUS Element, Boston Scientific, USA; Resolute Integrity, Medtronic, USA) are compatible with 4-Fr guiding catheters. However, there is a possibility that the tortuosity of the access artery might compress the inner lumen of the catheters, and these stents may not pass through 4-Fr guiding catheters in some patients.

In addition, combinations such as a 5-Fr Heartrail™ guiding catheter (Terumo, Japan) and a 4-Fr KIWAMI ST01 Heartrail™ guiding catheter (Terumo, Japan), and a 5-Fr Works™ guiding catheter (MEDIKIT, Japan) and a 4-Fr i-Works guiding catheter (MEDIKIT, Japan) have been recommended to match the outer diameter of the “child” guid-

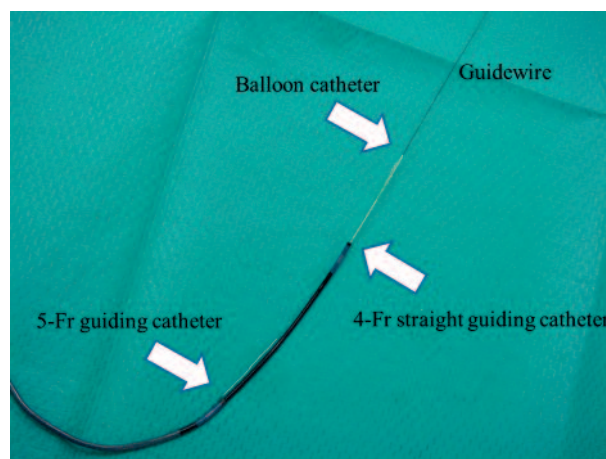


Fig. 3. A color photograph of the 4-Fr and 5-Fr guiding catheters

ing catheter with the inner diameter of the “slender mother” guiding catheter. Without this type of matching, it may be difficult to insert a “child” guiding catheter from one manufacturer into a “slender mother” guiding catheter from another manufacturer.

If it is difficult to deploy a stent into the target lesion in slender PCI, then our “Slender Mother and Child” system may be useful to deliver the stent.

In conclusion, we present a new PCI system called a 4-in-3 technique. Although this system could increase the possibility of slender PCI using a 5-Fr guiding catheter, it limits the PCI devices and techniques that can be used.

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