Facilitation of Rotablator-Stenting by Measuring Angiographic Lesion Length With the Navicath (type-MUTO), a New Measuring Microcatheter

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SUMMARY

In the present study, the usefulness and feasibility of a new measuring microcatheter, the Navicath (Type-MUTO) microcatheter, for facilitating the stenting procedure subsequent to ablation using a rotablator (rota-stenting) is described. A method for measuring the length of the targeted lesion (lesion length) angiographically with the Navicath when exchanging the guide wires is presented using 2 representative cases of rota-stenting. In addition, the validity of the selected stent according to the measurement of lesion length with the Navicath was evaluated by comparing the length of the selected stent with lesion length before PCI measured by quantitative coronary angiography. Based on the results obtained, we believe the Navicath is useful for facilitating rota-stenting, and may even be applicable to PCI in general. (Int Heart J 2006; 47: 139-146)

Key words: Coronary angioplasty, Microcatheter, Rotablator, Stenting, IVUS

It is important to measure the length of a targeted lesion (lesion length) when performing percutaneous coronary intervention (PCI). In addition, it is essential to implant a coronary stent that is as long as the measured lesion length but as less as possible in order to reduce the incidence of poststenting restenosis (in-stent restenosis; ISR).1) However, it is usually difficult to measure lesion length angiographically or by intravascular ultrasoundgraphy (IVUS) when the targeted culprit lesion is complex, such as in the case of a diffuse, long, tortuous, calcified, and/or proximally bent lesion, and if the hemodynamic state of the patient is
unstable. Therefore, a method for rapidly and reliably measuring lesion length, particularly in cases of complex PCI, is needed.

A rotablator (RA) is a useful devise with which to reduce the calcified burden before stenting by pulverizing the superficial calcification, and stenting subsequent to RA (rota-stenting) is a useful procedure for reducing restenosis in calcified diffusely stenotic lesions. However, since several serious complications have been reported with rota-stenting,2) the procedures for measuring lesion length and exchanging the guide wires need to be simplified and improved.

In the present study, we have investigated the usefulness of the Navicath measuring microcatheter to overcome these complications associated with rota-stenting and describe the results obtained in 2 patients.

DESCRIPTION OF NAVICATH

Figures 1A and B show the Navicath (Type-MUTO) measuring microcatheter. The effective length is 130 cm. The Navicath can be inserted into a 6 Fr guiding catheter, and the guide wires can be exchanged using the Nanto method, which is described below. Thin metal wires are coiled at a width of 1 mm at intervals of 10 mm (Figure 1). The length of a diffuse stenotic lesion that is about 5 cm can be measured visually at once (Figures 2 and 3C). The Navicath costs ¥77,700 which is cheaper than IVUS (Atlantis™ SR pro, Boston Scientific Scimed, Inc. Maple Grove, MN, USA) (¥161,000).
CASE REPORT 1: Rota-stenting was performed in a 76-year-old woman for a diffusely calcified stenotic lesion at a proximal site in the LAD (Segment #6-7). The guiding catheter and guide wire (GW) used were a Champ 3.0 Mach-1 (Boston Scientific Scimed) and a Neo's Route (Asahi Intec, Co., Thailand), respectively. Since IVUS could not be performed due to severe stenosis, RA was performed with a burr size of 1.5 mm after exchanging the GW from the Neo's Route to a Rota-floppy wire using a Navicath. After several ablations, the GW was changed again rapidly to the Neo's Route with the Navicath. When changing the GW, lesion length was measured angiographically and was found to be less than 25 mm (Figure 2), and the Navicath was removed by infusing half-contrast medium according to the Nanto method (applying 20 atm with an Indeflator). An S 670 (3.0 mm size and 24 mm long, Medtronic, Inc. Minneapolis, MN, USA) was implanted and PCI was successfully completed without complications.

CASE REPORT 2: A 72-year-old woman underwent rota-stenting for a diffusely calcified stenotic lesion at a proximal site in the left anterior descending artery (LAD) (Figure 3A). The guiding catheter and the guide wire (GW) were a Champ
Figure 3. Conventional stenting of diffuse long lesion after ablation by exchanging guide wires with Navicath. A: Diffuse calcified long lesion from #5 to #7 was observed. B: The calcification was ablated with a burr size of 1.5 mm. After this ablation, additional ablation was performed with a burr size of 1.75 mm. C: Lesion length was measured with a Navicath when guide wires were exchanged. White arrow indicates the metallic symbol of Navicath, and the lesion was longer than 50 mm. D: Predilation with ballooning was performed to pass IVUS. E: IVUS again failed to pass through. F: Angiographic view of LAD after stenting from #7 distal to the #5 ostium. PCI was angiographically successful compared with (A). G: Finally, IVUS was passed and optimal stenting was ascertained.
3.0 Mach-1 and Neo’s Route, respectively. Since it was expected IVUS could not pass through the severe stenosis, RA was performed with burr sizes of 1.5 (Figure 3B) and 1.75 mm. After changing the GW from Neo’s Route to rota-floppy wire using a Navicath, the diffuse long lesion length was measured angiographically with the Navicath and was determined to be more than 50 mm (Figure 3C). The Navicath was removed according to the Nanto method. However, IVUS again failed to pass through the lesion (not shown). Therefore, plain old balloon angioplasty (POBA) with a balloon diameter of 2.5 mm (Maverick, Boston Scientific Scimed) was performed from a distal site to the proximal site in the LAD at 14 atm (Figure 3D). However, IVUS failed to pass through the lesion again (Figure 3E), so Cypher stents (Cordis Europa N.V., Roden, Netherlands) were implanted, successfully, from the distal site of #7 to the ostial of #5 (Figure 3F). After stenting, optimal stenting was ascertained with IVUS (Figure 3G). PCI was successfully accomplished without complications.

**RESULTS**

In order to evaluate the validity of the selected total stent length with a Navicath when changing the GW, the total stented length (stented length) was compared with the lesion length before PCI measured by quantitative coronary angiography (QCA) (CAAS-II system, the Netherlands) (Prelesion length). They were estimated in 15 consecutive lesions treated by rota-stenting using a Navicath.
during a 33 month period from October 2002 to June 2004. No major complications occurred in any of these PCIs.

The mean value of stented length (27.2 mm) was not significantly different from that of the prelesion length (26.3 mm) \((P = 0.96, \text{unpaired } t\text{ test})\). Figure 4 shows there was a good correlation between the stented length and prelesion length \((y = 0.90 x + 3.59, r = 0.974, P < 0.0001)\). Based on statistical analysis, the method of which was described in one of our previous studies, the slope and y-intercept of this regression line were not significantly different from the formation \((y = x)\) determined when the stented length was assumed to be equal to the prelesion length. Thus, the stented length was the same as the prelesion length.

**DISCUSSION**

The usefulness of the Navicath measuring microcatheter was examined since it is important to measure lesion length visually, easily, and accurately using only an angiogram without IVUS. The Navicath is the only measuring microcatheter used during PCI. Although the conventional method for measuring lesion length and determining total stented length uses only angiography, this technique is difficult and inaccurate when a lesion is diffuse, long, tortuous, and/or bent. In the upcoming drug-eluting stent (DES) era, it is believed a DES should be implanted for as long as possible, therefore, the measurement of total stented length is the key step in PCI. Recently, several marker-wires have also been used to measure lesion length. However, these can only be applied when the wires can be easily passed through the targeted lesion because the marker wire needs to be pulled back from the distal site to measure the lesion length. These cases did not meet the criteria, particularly in cases of rota-stenting in which the procedure needs to be simplified without any undue complications. Therefore, in addition to the advantages of microcatheters, the feasibility of using the Navicath for facilitating the rota-stenting procedure by measuring lesion length angiographically when exchanging the guide wires before stenting is described. We also believe that the Navicath can be applied to PCI in general.

The advantages of the Navicath in rota-stenting are as follows. First, when a rotablator (RA) is needed to ablate a diffusely long and calcified stenotic lesion, in the majority of cases IVUS can not pass through not only before ablation but also after ablation, as we observed with cases 1 and 2 (Figure 3C). Therefore, the motorized pullback method with IVUS \(^5\) could not be used. Thus, measuring the length of a diffusely long stenotic lesion angiographically with the Navicath before direct stenting was statistically relevant (Figure 4). Second, when the targeted lesion was bent proximally but stretched by crossing IVUS, the IVUS-derived measurement was not accurate. In addition, iatrogenic ischemia was usu-
ally induced by further reducing the coronary flow, making the induction of complications possible. The Navicath could be inserted into the coronary artery by passing through the stenosis without these difficulties (Figures 2, 3C). Third, the Navicath is, as is the case with other microcatheters, useful when supporting backup was needed for passing the guide wire without inducing ischemia, particularly when a complex PCI such as RA is needed. Fourth, the Navicath is useful for rapidly returning the guide wire after ablation. Furthermore, in the case of no-reflow phenomenon\(^5\) established after ablation, coronary flow could be steadily restored by infusing nitroprusside\(^6\) and tirofiban\(^7\) from the tip of the Navicath. These were all useful in the rota-stenting procedure.

On the other hand, the Navicath is also thought to have the following limitations. First, determination of the cross-sectional areas of the vessel and stent (intravascular findings), which is an advantage associated with IVUS, can not be performed with the Navicath. Therefore, like in case 2, when IVUS could not be passed before stenting despite after RA and ballooning (Figure 3E), the position and the cross-sectional area of stents after the lesion was dilated by stenting needed to be ascertained because the residual atherosclerotic plaque at the edge of stent is the major mechanism of the stent restenosis\(^8,9\) and because underexpansion of the stent is the predictive factor of restenosis after sirolimus-eluting stent implantation.\(^10\) The second point is the cross-ability of the tip of the Navicath. Since the coiling is metallic, it is slightly thicker than other microcatheters. However, if the Navicath can not be passed through the stenotic lesion, IVUS could also not be passed through. Therefore, predilatation with ballooning or RA would be performed to dilate the stenosis, a procedure which does not result in a PCI procedural delay. Accordingly, the Navicath was useful and without any major limitations during rota-stenting.

In conclusion, the usefulness of a novel measuring microcatheter, the Navicath, in the facilitation of rota-stenting has been described, and the Navicath also appears to be useful in PCI in general.

**REFERENCES**


