Original Article

The feasibility of Kimny guiding catheter for ST-segment elevation myocardial infarction

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ABSTRACT

Objectives: The Kimny guiding catheter is a single universal guiding catheter used for performing percutaneous coronary intervention (PCI) in both the right coronary artery (RCA) and the left coronary artery (LCA). Although this guiding catheter has been shown to yield high procedural success rates in nonemergent conditions, its feasibility for patients with ST-segment elevation myocardial infarction (STEMI) remains unknown and therefore needs to be further investigated. **Materials and Methods:** We retrospectively enrolled 62 consecutive STEMI patients who underwent primary PCI using the Kimny guiding catheter from January 2016 through December 2017. We then evaluated the rates of engagement and procedural success for PCI of the LCA and RCA with the Kimny guiding catheter. **Results:** Primary PCI of the infarct-related artery (IRA) by means of the Kimny guiding catheter proved to be successful in 61 of the STEMI patients (98.3%). Besides, the procedural success rate was found to be 100% (44/44) for the LCA and 94.4% (17/18) for the RCA ($P = 0.293$). With regard to contralateral (non-IRA) angiography, engagement rates of 97.4% (38/39) and 100% (18/18) were obtained for the RCA and LCA, respectively, ($P = 1.0$). No coronary artery ostial dissection was observed during the procedures. The mean number of total catheters used for each patient turned out to be only 1.035. **Conclusion:** Using the Kimny guiding catheter for primary PCI is feasible and results in high procedural success rates, particularly for the treatment of the LCA, with fewer catheters, and at a lower cost.

KEYWORDS: *Kimny, Percutaneous coronary intervention, ST-segment elevation myocardial infarction*

INTRODUCTION

*P*rimary percutaneous coronary intervention (PCI), which is currently known as the standard reperfusion therapy for ST-segment elevation myocardial infarction (STEMI), has been shown to significantly reduce the rate of mortality when compared with thrombolytic therapy [1-3]. Shorter door-to-balloon (D2B) times are reportedly associated with less mortality [4-7]. Previous studies have suggested that using a single universal guiding catheter, e. g., Ikari Left (IL) (Terumo, Tokyo, Japan), for STEMI patients can decrease the procedure time, D2B time, number of used catheters, and consequent expenditures [8,9]. Besides, the Kimny guiding catheter (Boston scientific, Natick, MA, USA), designed for PCI of both the left and right coronary arteries via the transradial approach, has been reported to result in high rates of engagement and successful stent delivery during nonemergent PCI procedures. The shape of the Kimny guiding catheter consisted of three curves [Figures 1 and 2]. The original design of this catheter was 1.75 cm for the 1st (most distal) segment, 3.2 cm for the 2nd segment, and 3.8 cm for the 3rd segment. It was subsequently modified to 1.45 cm for the 1st segment, 3.0 cm for the 2nd segment, and 3.4 cm for the 3rd segment [10]. The design of current commercial version is 1 cm for the 1st segment and 2.5 cm for the 2nd and 3rd segments. However, there have been no studies to date evaluating the feasibility of using the Kimny guiding catheter for primary PCI. Since the Kimny guiding catheter is the most commonly used guiding catheter for primary PCI at our center, we present herein our single-center experience of using this catheter for the treatment of STEMI patients.

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MATERIALS AND METHODS

We retrospectively reviewed and analyzed the medical chart, cardiac catheterization record, and images of 62 STEMI patients treated with primary PCI from January 2016 to December 2017. The inclusion criteria of the current study were as follows: ST-segment elevation >1 mm in at least two contiguous leads or ST-segment depression >2 mm in at least two contiguous leads from V1 through V4 with suspected acute posterior wall MI at the emergency department, chest pain onset within 24 h, and using the Kimny guiding catheter as a first catheter use during the procedure. Patients were excluded if the operators had <1 year of experience in performing primary PCI.

Before PCI, the patients were cotreated with a loading dose of 200–300 mg aspirin and 300–600 mg clopidogrel or 180 mg ticagrelor. A heparin bolus was administered at a dose of at least 100 U/kg. Glycoprotein IIb/IIIa inhibitors were used at the physician's discretion. The following two primary PCI strategies were adopted at our hospital: one involved directly performing electrocardiography (ECG)-guided PCI of the infarct-related artery (IRA), followed by contralateral (non-IRA) angiography to reduce D2B time [11,12]; and the other consisted of complete

Figure 1: The left is Kimny guiding catheter and the right is Ikari Left 3.5 guiding catheter

left coronary artery (LCA) and right coronary artery (RCA) angiography, followed by PCI of the IRA.

The primary outcome of this study was the procedural success rate, defined as successful catheter engagement of and device (including balloon, aspiration thrombectomy device, and stent) delivery to the IRA. The secondary outcomes included the non-IRA engagement rate, mean number of total catheters used, D2B time, catheterization laboratory-to-balloon (C2B) time, and guide extension catheter use rate. Safety outcome included the coronary artery ostial dissection rate. We also made a comparison between the rates of procedural success and engagement for the LCA and those for the RCA. The study protocol was approved by the research ethics committee of our hospital (research ethics committee number: IRB109-017-B, the written informed consent was waived because the study was a retrospective data analysis).

Engagement technique

For the engagement of RCA, we inserted the Kimny guiding catheter tip in the left sinus of the Valsalva and then rotated it clockwise toward the RCA ostium with slight pulling back until the tip entered the RCA ostium. For the engagement of LCA, we inserted the Kimny guiding catheter tip in the left sinus of the Valsalva and pushed the catheter tip over the LCA ostium. The tip was then pulled back slowly until the tip entered into the LCA ostium.

Statistical analysis

Continuous variables were expressed as mean ± standard deviation, categorical variables as frequencies, and time variables as medians with interquartile ranges. The Fisher's exact test was implemented to compare the rates of procedural success and non-IRA engagement for the RCA with those obtained for the LCA. The data were analyzed by GraphPad software (GraphPad Software, Inc., La Jolla, CA, USA). $P < 0.05$ was considered statistically significant.

RESULTS

Baseline patient characteristics are shown in Table 1. The patients were predominantly male (73%), with an overall
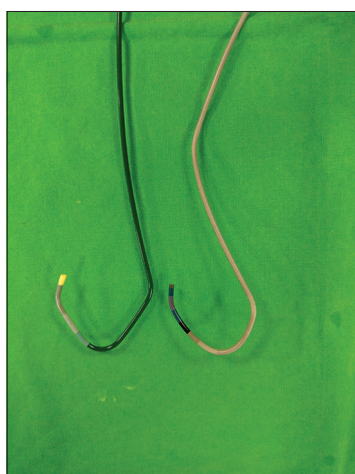

Figure 2: (a) Kimny guiding catheter for engagement of the left coronary artery and (b) for engagement of the right coronary artery

mean age of 65.7 years. The rate of dual antiplatelet therapy prior to primary PCI was 100% (85.5% ticagrelor and 14.5% clopidogrel). While 82.3% of the patients presented with Killip class 1-2, those with a Killip class of 3 and 4 constituted 9.7% and 8.1% of the study population, respectively. Procedure characteristics and results are shown in Table 2. The vascular access was obtained via the radial artery in a large proportion of the patients (92%), whereas the femoral artery was chosen in only 8% of the cases. PCI of the IRA was performed before contralateral angiography in 82.3% of the subjects and after complete angiography in 17.7% of the cases. The

procedural success rate was found to be 100% when the LCA was identified as the IRA, including 37 cases of the left anterior descending artery and 7 cases of the left circumflex artery (LCX)–and 94.4% in cases of the RCA confirmed as the IRA, without revealing any statistically significant difference between the RCA and LCA ($P = 0.293$). The only case of procedure failure occurred due to engagement failure in a patient who received treatment in the RCA, which was successfully engaged by means of the Judkins right (JR) guiding catheter. In the 61 procedural success cases, thrombus aspiration catheters were used in 19 cases and stents were deployed in 57 cases. Both devices were delivered successfully.

With respect to contralateral angiography of the non-IRA, the LCA and RCA appeared to have an engagement rate of 100% and 97.4%, respectively. One failed case of RCA (as the non-IRA) engagement was successful engaged by the JR diagnostic catheter. It should be noted that 5 patients, at the physician's discretion, did not receive contralateral coronary angiography of the RCA after PCI of the LCA as the IRA was performed. The possible reasons included radial artery spasm, patient's intolerance to the prolonged procedure, or physician's ignorance. No coronary artery ostial dissection was observed in any of the cases. The mean number of total catheters used per each patient was only 1.035 (the patients who did not undergo contralateral RCA angiography were excluded when calculating the mean numbers of total catheters and total diagnostic catheters). In only one case, where the LCX was identified as the IRA, a guide extension catheter was used for stent delivery.

Table 1: Patient characteristics

Variables (*n*=62)	Mean±SD, *n* (%)
Age (years)	65.7±11.1
Male sex	42 (72.6)
Hypertension	36 (58.0)
Diabetes mellitus	28 (45.2)
Current smoker	25 (40.3)
Dyslipidemia	49 (79.0)
Body height (cm)	162.5±8.3
Body weight (kg)	68.6±13.1
Killip class	
I and II	51 (82.3)
III	6 (9.7)
IV	5 (8.1)
Aspirin	62 (100)
Clopidogrel	9 (14.5)
Ticagrelor	53 (85.5)

SD: Standard deviation

Table 2: Procedure characteristics and results

Variables	Mean±SD, *n* (%), median (25th-75th IQR)	*P*
Vascular access (*n*=62)		
Radial	57 (91.9)	
Femoral	5 (8.1)	
Primary PCI strategy (*n*=62)		
Direct IRA PCI	51 (82.3)	
IRA PCI after complete angiography	11 (17.7)	
IRA (*n*=62)		
LAD	37 (59.7)	
RCA	18 (29.0)	
LCX	7 (11.3)	
IRA procedural success rate		
Total (*n*=62)	61 (98.4)	0.293
LCA (*n*=44)	44 (100.0)	
RCA (*n*=18)	17 (94.4)	
Non-IRA engagement rate		
Total* (*n*=57)	56 (98.2)	1.0
LCA (*n*=18)	18 (100.0)	
RCA* (*n*=39)	38 (97.4)	
Number of diagnostic catheters use/patient*	0.018±0.132	
Number of guiding catheters use/patient	1.016±0.127	
Number of total catheters use/patient*	1.035±0.186	
Door-to-balloon time (min)	58 (49.3-69.8)	
C2B time (min)	18.5 (14-24.8)	

*5 cases without doing non-IRA RCA angiography were excluded for calculation. The *P* value is comparison of the data of RCA and LCA. PCI: Percutaneous coronary intervention, IRA: Infarct-related artery, LAD: Left anterior descending artery, LCX: Left circumflex artery, RCA: Right coronary artery, LCA: Left coronary artery, SD: Standard deviation, IQR: Interquartile range, C2B: Catheterization laboratory-to-balloon

DISCUSSION

Both of the Kimny and IL guiding catheters are universal guiding catheters used for PCI of the left and right coronary arteries. A larger number of studies have focused on the IL guiding catheter as compared to the Kimny guiding catheter. A study of the IL guiding catheter with the largest number of subjects showed that the engagement rate was high for both RCA (97.6%) and LCA (99.4%) coronary angiography [13]. Nonetheless, only 7.1% (44 patients) of the cases had STEMI. According to the findings of our study, in the patients with STEMI, the Kimny guiding catheter exhibits excellent performance for the treatment of the LCA, with a procedural success rate of 100%. The engagement rate, however, is slightly lower when the RCA is identified as the IRA, without any statistical significance. It is possibly due to the fact that the engagement of the RCA is more demanding and thus requires more manipulation in comparison with that of the LCA. Due to time stress of primary PCI, the operator may change the guiding catheter rapidly, if difficulties in engagement are faced. In the present study, the mean number of total catheters used was very low and similar as that used in a previous IL study for the patients with STEMI [8]. In our study that represented the Kimny guiding catheter provides sufficient support for the usual cases of STEMI, we used the guide extension catheter in only one patient. Although Kimny guiding catheter is designed for transradial approach, there were five cases via transfemoral approach due to radial artery cannulation failure; all were procedure success (three cases for RCA and two for LCA). A study showed another universal guiding catheter multiaortic curve (MAC) had 93.9% initial guiding success rate (their definition was the same as our procedure success) for primary PCI. The guiding success rate was 100% for IRA-RCA and 89.3% for IRA-LCA. For non-IRA angiography, the engagement rate of RCA was 99% and LCA was 96% by MAC [14]. Compared to our study, Kimny guiding catheter might be better for LCA-PCI and MAC guiding catheter might be better for RCA-PCI. Thus, further studies are needed to evaluate the feasibility of using the various universal guiding catheters for different IRA-PCI by ECG-guided approach. Regarding the safety issue, a previous IL study on routine coronary angiogram and PCI showed the coronary ostium dissection rate is 0.48% [13]. Although the coronary ostium dissection rate is 0% in our study, the adverse event rate may have been underestimated because of small case numbers. Table 3 shows the comparison of different single universal guiding catheters for STEMI. The outcomes in these studies may have been affected by the different institutional practice methods.

Study limitations

First, this study only reported the feasibility of Kimny guiding catheter for primary PCI in patients with STEMI without any control group, and the case number was small. However, no study has compared the efficacy of different single universal guiding catheters. Second, five cases did not undergo contralateral RCA angiogram after LCA-IRA-PCI as per the discretion of the physician, and the engagement rate of RCA by Kimny guiding catheter might be overestimated or underestimated. Third, our data only included operators who had >1 year of experience in primary PCI. The engagement and complication rates might be associated with the learning curve of the guiding catheter manipulation.

CONCLUSIONS

When STEMI and IRA are LCA, Kimny guiding catheter is an excellent choice for primary PCI because of its easy engagement and the excellent procedural success rate. For RCA, Kimny guiding catheter has slightly lower engagement rate, but still well support for device delivery. Using the Kimny guiding catheter as a single universal guiding catheter in patients with STEMI not only can reduce the number of used catheters as well as consequent expenditures, but also leads to a high procedural success rate, especially when the LCA is confirmed as the IRA.

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Conflicts of interest

There are no conflicts of interest.

Table 3: Comparison of different single universal guiding catheters for ST-segment elevation myocardial infarction

	Kimny	Ikari left	Multi-aortic curve
Door to balloon time (min)	58	55 [8]	77.4 [14]
C2B time (min)	18.5	NA	16.6 [14]
Guiding success rate for LCA (%)	100.0	97.6* [13]	89.3 [14]
Guiding success rate for RCA (%)	94.4	98.6* [13]	100.0 [14]
Ostial dissection rate (%)	0.0	0.48* [13]	NA
Number of total catheters use/patient	1.035	1.06 [8]	1.12 [14]

*The data are not only for STEMI cases but for all cases of coronary intervention and diagnostic angiogram. STEMI: ST-segment elevation myocardial infarction, NA: Not assessed, C2B: Catheterization laboratory-to-balloon, RCA: Right coronary artery, LCA: Left coronary artery

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