A Pitfall in Selecting Promising Septal Collateral Channels in Percutaneous Coronary Intervention with a Retrograde Approach

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Abstract

Introduction: In percutaneous coronary intervention (PCI) with a retrograde approach, successful guidewire passage through the collateral channels is indispensable. However, success of the procedure depends on the quality of collateral channels, and vascular tortuosity is one of the most common obstacles for successful guidewire passage.

Case Presentation: Herein, we present a case of PCI with retrograde approach for chronic total occlusion at the ostium of the left anterior descending coronary artery. A highly tortuous morphology of the right posterior descending artery (PDA) and septal channels bifurcating from the right PDA with marked angulations were recognized in angiographic images from multiple directions. We could advance a guidewire to the optimal route of the septal collateral channel with guidance provided by these images and successfully completed all PCI procedures.

Conclusions: To pass a guidewire through collateral arteries in PCI with a retrograde approach, careful inspection of angiographic images for thoroughly understanding the optimal route through the collateral vasculature is of great significance.

Keywords: Chronic Total Occlusion, Retrograde Approach, Septal Collateral Channel

1. Introduction

Since the establishment of bidirectional coronary angioplasty in the field of interventional cardiology, a higher success rate of recanalization with an acceptable rate of complications has been achieved. In the procedure of percutaneous coronary intervention (PCI) with a retrograde approach, successful guidewire passage through the collateral channels is a very important part; however, success of the procedure depends on the quality of collateral arteries. In this regard, vascular tortuosity is one of the most common obstacles for successful guidewire passage. To successfully pass a guidewire through the collateral arteries, even though they are tortuous, careful inspection of angiographic images and recognizing the routes of collateral vasculature as thoroughly as possible are of great importance.

2. Case Presentation

A 56-year-old male patient was admitted to our hospital, complaining of worsening dyspnea at rest. The coronary risk factors included hypertension, type II diabetes mellitus, and a current smoking habit. Twelve-lead electrocardiography demonstrated sinus rhythm and slight ST-segment depression in chest leads V4 to V6. Chest X-ray showed pulmonary congestion and pleural effusion on both sides. Ultrasound echocardiography showed severe diffuse motion abnormality in the left ventricular walls. We diagnosed the patient with worsening congestive heart failure. As we could not definitely rule out the involvement of acute coronary syndrome based on his pathology, we emergently performed coronary angiography.

The right coronary angiogram showed moderate stenosis at the ostium (Figure 1A). The patient’s left anterior descending (LAD) coronary artery was totally occluded at a directly proximal site (Figure 1B), and abundant collateral flow via multiple septal perforators was clearly detected (Figure 1C). Although we initially tried to pass a guidewire antegradely to the distal site in the LAD coronary artery, the guidewire could not penetrate the proximal hard cap (Figure 1D); therefore, we evaluated the LAD occlusion to be in the chronic phase. We discontinued the intervention procedure and started pharmaceutical treatment on admission.

After the patient’s recovery from a congestive state, we performed a coronary intervention for the chronic total occlusion (CTO) in the LAD artery. We adapted the strategy with a retrograde approach via septal channels from the beginning. Several septal collateral channels looked to be

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smoothly bifurcating from the right posterior descending artery (PDA) on the right anterior oblique (RAO) image (Figure 2). However, as we tried to cross the guidewire through the septal branch, we encountered some tactile resistance to manipulate the Fielder FC guidewire (Asahi Intecc Co., Ltd., Aichi, Japan), even in the right PDA; also, we could not advance the guidewire towards the septal channels at all.

After many unsuccessful attempts to manipulate the guidewire, we decided to re-evaluate the anatomy of the vasculature. We obtained several angiographic images from multiple directions and noticed the highly tortuous morphology of the right PDA and septal channels bifurcating from the right PDA with marked angulations in the image from the left anterior oblique (LAO) view (Figure 2). Thereafter, we could advance the Fielder FC guidewire with relative ease to the optimal route of the septal collateral channel with guidance provided by these images. The guidewire successfully reached the distal site of CTO in the
The Corsair Microcatheter (Asahi Intecc Co.) also followed the guidewire to the LAD coronary artery (Figure 3A). Then, we exchanged the guidewire with the Gaia second guidewire (Asahi Intecc Co.) and successfully crossed it through the whole CTO body in the plaque space inside the antegrade guide catheter (Figure 3B). After guidewire externalization, we performed all PCI procedures according to the standards (Figure 3C). The final angiogram demonstrated favorable dilation at the CTO lesion, and sufficient coronary blood flow without any flow limitations was achieved (Figure 3D).

3. Discussion

We encountered a patient requiring PCI for CTO at the ostium of the LAD artery. When the occlusion pattern of the branching ostium is an abrupt type, it is usually difficult to antegradey penetrate the optimal entry point of the occluded branch with a guidewire. Under such circumstances, bidirectional coronary angioplasty has been established (1), and a higher success rate of recanalization with an acceptable rate of complications has been achieved (2). However, success with a retrograde approach markedly depends on the quality of collateral arteries. In this regard, vascular tortuosity is one of the most common obstacles against successful guidewire passage.

Due to its straightforward accessibility and reduced risk of causing pericardial extravasation, guidewire passage through collateral channels via the left ventricular septum is the most common and a much safer option, compared to other procedures (3). In the present case, rich collateral arteries through the left ventricular septum were developed. Although the patterns of how septal branches
bifurcate from the LAD coronary artery are not usually so complicated, those that bifurcate from the right PDA are sometimes very complex.

We usually evaluate the anatomy of the vasculature from the right PDA to septal branches, mainly from the view of RAO or anterior-posterior-caudal angiographic projections. In the collected images, configuration of the vascular route was clearly visible and looked less tortuous. We assumed that they were promising for guidewire passage as far as the LAD coronary artery. However, an angiographic image with an LAO view finally provided us with sufficient resolution to recognize the optimal vascular route. We learnt an instructive lesson from this case that radioscopic projections from multiple directions, careful inspection of the angiographic images, and three-dimensional recognition of the collateral vasculature are indispensable for suc-
ccessfully negotiating a guidewire through the optimal vascular route.

The strategy of the retrograde approach in PCI for CTO lesions has become popular, and many successful procedures have been performed throughout the world. Although the importance of grasping the vascular route, configured with collateral channels, is well recognized for the purpose of successful guidewire passage in PCI with a retrograde approach, to the best of our knowledge, there has been no report focusing on this issue. Successful guidewire passage through the collateral channels occupies a considerable weight in the whole PCI procedure with a retrograde approach. Therefore, we believe that this paper would help all interventional cardiologists reconfirm the importance of thoroughly evaluating the configuration of collateral vessels.

Footnote

Authors’ Contribution: Both Ryota Urata and Tetsuya Nomura are the main authors of this paper. Yusuke Hori, Kenichi Yoshioka, Hiroshi Kubota, Daisuke Miyawaki, Takeshi Sugimoto, and Masakazu Kikai critically reviewed the manuscript. Natsuya Keira and Tetsuya Tatsumi made major contributions to the conception and design. All authors read and approved the final manuscript.

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