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Conservative management of severe coronary artery hematoma and dissection following stent implantation☆

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ABSTRACT

Severe dissection and hematoma following stent implantation can cause acute vessel closure, which requires an immediate bailout procedure. However, bailout from such a situation may not be easy, especially when the hematoma extends to the distal segment of a coronary artery. We present a case of 73-year-old woman with effort angina who underwent PCI to the right coronary artery (RCA). Following stent implantation, there was a massive hematoma from the distal edge of the stent. We tried to create re-entry at the distal part of the hematoma, but were not successful. We managed her conservatively without additional stent placement or creating re-entry. Follow-up coronary angiography on day 68 showed excellent coronary flow. Intravascular ultrasound demonstrated complete healing of the hematoma. A hematoma caused by edge dissection is a challenging complication. Additional stent implantation to cover the entire length of the hematoma and/or cutting balloon dilatation to create re-entry are options; however, these procedures may worsen the situation. Our case clearly showed healing of dissection and hematoma without creating re-entry or additional stent implantation. Conservative management should be considered an option for severe edge dissection and hematoma following stent implantation.

Contents

1. Introduction

Recently, percutaneous coronary intervention (PCI) has been widely applied to complex lesions because of the development of new medical devices and techniques [1,2]. However, there are some complications following PCI. A coronary artery dissection and hematoma following stent implantation is not an uncommon complication of PCI [3]. Although minor stent edge dissection is not associated with morbidity and mortality [4,5], a severe dissection and hematoma can cause acute vessel closure, which requires an immediate bailout procedure [3,6]. However, bailout from such a situation may not be easy, especially when the hematoma extends to the distal segment of the coronary artery. We present a case of the extensive dissection and hematoma, in which we advocated a new therapeutic option. The purpose of this mini-review was to provide the interventional community with a comprehensive understanding of coronary artery hematoma caused by stent edge dissection and the bailout procedures for this complication.

2. Case report

A 73-year-old woman with effort angina underwent PCI to the diffuse and tortuous lesion of the right coronary artery (RCA) (Fig. 1A). A 7-Fr AL1SH guide catheter was inserted in the RCA, and a conventional

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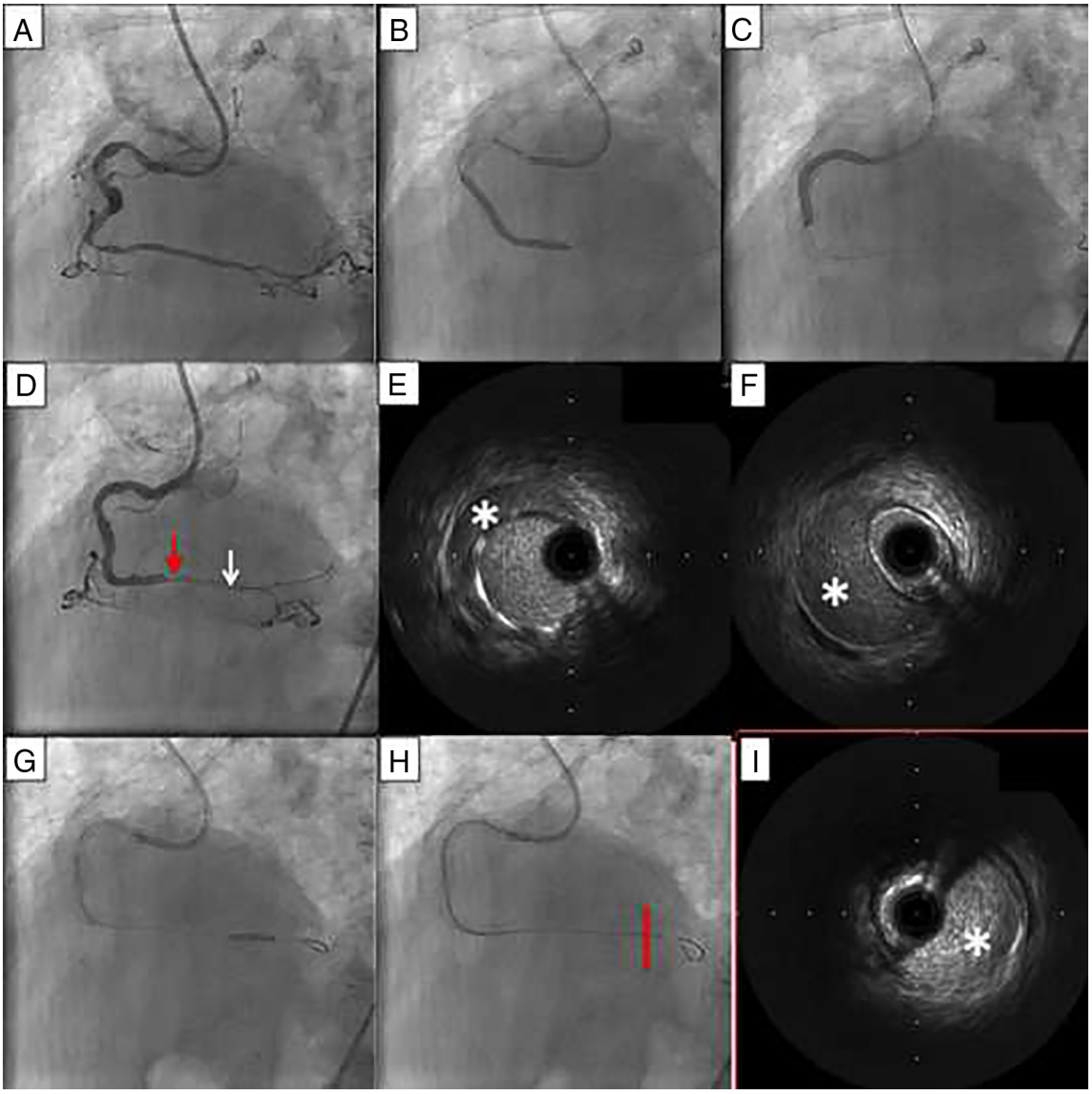


Fig. 1. Initial procedures. (A) Coronary angiography before the procedure. (B, C) Two drug-eluting stents were implanted in the proximal and middle segments of the right coronary artery (RCA). (D) A new stenosis appeared in the distal segment of the RCA. (E) Intravascular ultrasound (IVUS) at the distal edge of the stent revealed hematoma (*) (red arrow in panel D). (F) IVUS at the distal segment of the RCA revealed hematoma (*) compressing the true lumen (white arrow in panel D). (G) A 2.75-mm noncompliant balloon was inflated at the distal end of the hematoma. (H, I) IVUS at the distal end of the hematoma (red line in H) showed the hematoma (*). The size of the hematoma after balloon inflation was equal to or larger than the size of the hematoma before balloon inflation.

guide wire was advanced beyond the lesion. At first, we performed intravascular ultrasound (IVUS) in the distal segment of the target lesion. IVUS revealed diffuse severe stenosis with superficial calcification, although there was no hematoma or dissection in the lesion. The diameter of the distal segment of the target lesion was 3.5 mm, whereas that of the proximal segment was 4.0 mm. Following IVUS, we performed predilatation using a 2.5-mm noncompliant balloon (18 atm). Then, we deployed 2 drug-eluting stents (3.0 × 32 mm and 3.0 × 28 mm) in the proximal and middle segments of the RCA (12 atm) (Fig. 1B, C). Following stent implantation, coronary angiography (CAG) showed a new stenosis in the distal segment of the RAC (Fig. 1D), and IVUS revealed a massive hematoma from the distal edge of the stent to the distal segment of RCA (Fig. 1E, F). The patient complained of chest pain that was accompanied by ST-segment elevation in leads II, III and aV_F. Although we tried to create re-entry at the distal part of the hematoma using a 2.75 mm noncompliant balloon (12 atm) (Fig. 1G), the procedure was not successful, and the hematoma extended to the more distal segment (Fig. 1H, I). To manage this complication, we considered 3 options: additional stenting, a larger balloon to create re-entry, and conservative management. First, because the end of the hematoma was beyond the distal bifurcation of the posterior descending branch and atrioventricular branch, additional stenting toward the atrioventricular branch would block the posterior descending branch. Furthermore, it would not be easy to insert an additional stent beyond the stented segment. Therefore, we abandoned the option of additional stenting. Second, dilatation with a larger balloon might create re-entry, but it also might exacerbate the hematoma. If we could not create re-entry, the hematoma would expand to the more distal segment. Although the probability of creating re-entry is greater from dilatation with a cutting balloon than a conventional balloon, it would have been difficult to pass the cutting balloon beyond the stented segment because of the large profile of the cutting balloon. Therefore, we abandoned the option of a larger balloon to create re-entry. Conservative management was the last option. Since her symptoms and ST-segment elevation gradually improved, we inserted an intra-aortic balloon pump (IABP) and managed her conservatively. We observed the patient in the catheter laboratory for approximately 40 min after the onset of dissection. We did not perform coronary angiography at the end of all procedures, because we

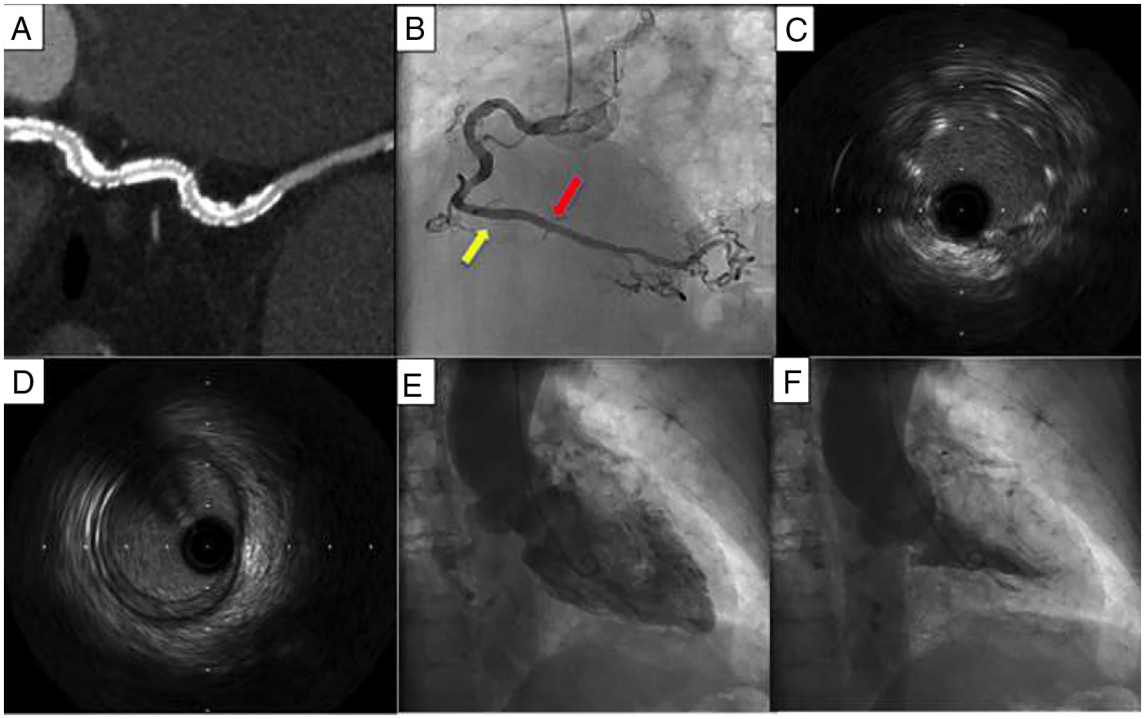


Fig. 2. Follow-up images. (A) Coronary computed tomography did not show any hematoma at the stent distal edge. (B) Coronary angiography showed excellent coronary flow. (C) IVUS at the stent distal edge (yellow line in B) did not show any hematoma. (D) IVUS at the distal segment (red arrow in B) of the RCA revealed healing of the hematoma. (E, F) Left ventriculography showed good contraction without asynergy.

were concerned that the injection of contrast medium might expand the coronary dissection and decrease coronary flow. Since her symptoms were tolerated and vital signs were stable with IABP support, we brought her to the coronary care unit. Although her cardiac biomarkers were mildly elevated, she was discharged on day 9 without any complications. Computed tomography angiography on day 34 (Fig. 2A) and CAG on day 68 (Fig. 2B) showed excellent coronary flow. IVUS demonstrated healing of the hematoma (Fig. 2C, D), and left ventriculography showed normal contraction (Fig. 2E, F).

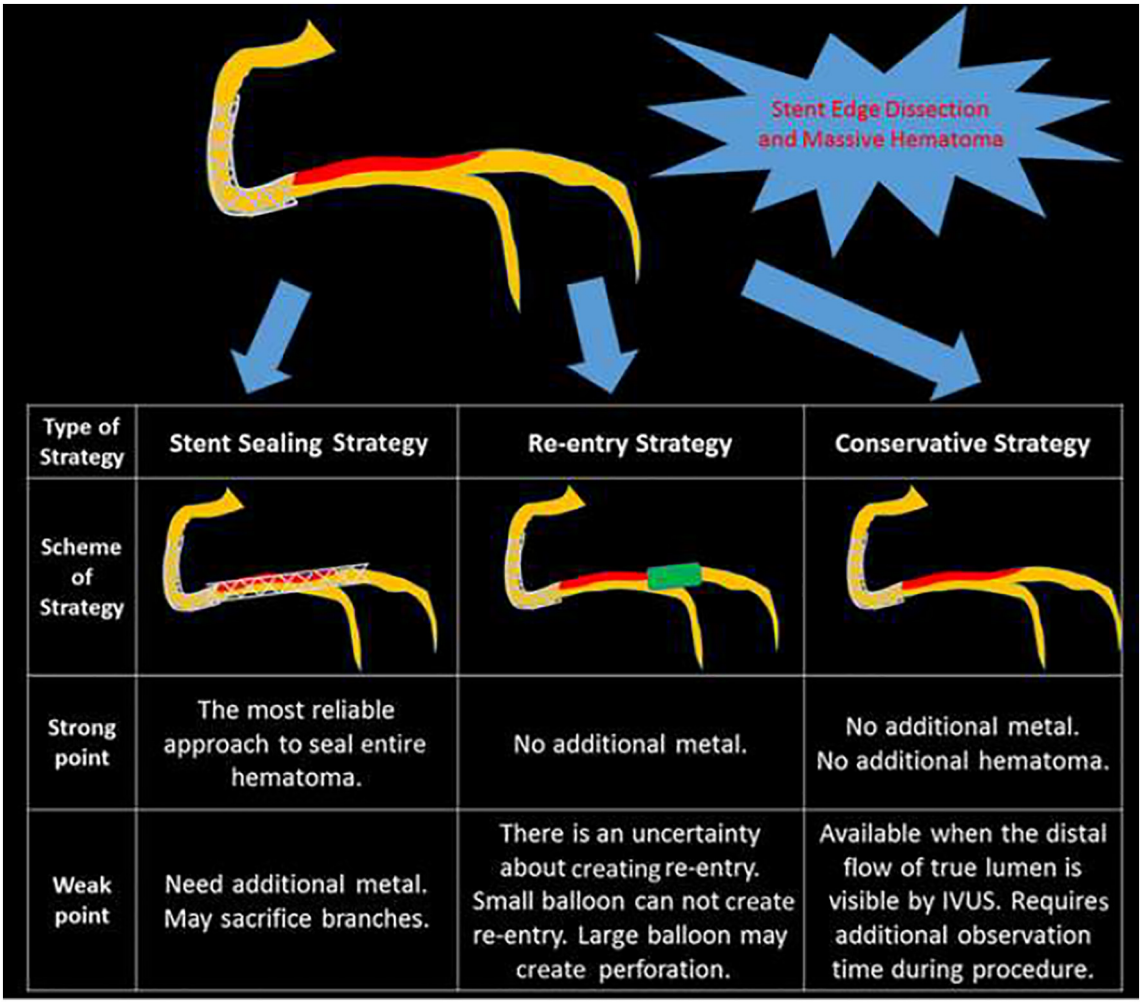
3. Discussion

A hematoma caused by stent edge dissection is a challenging complication. Additional stent implantation to cover the entire length of the hematoma and/or cutting balloon dilatation to create re-entry are options [7,8]; however, these procedures may worsen the situation in cases like ours. Additional stent implantation may cause occlusion of branches, and the total length of all stents would be longer than expected. Moreover, stent delivery may be difficult, because the additional stent must be advanced through the implanted stents [9]. Although creating re-entry would not require an additional stent, the success rate of this procedure has not been reported in the literature. Only cases of successful interventions to create re-entry have been reported [8,10], and this suggests a publication bias. The creation of re-entry requires an appropriate balloon diameter, because an oversized balloon may cause vessel perforation and an undersized balloon may not achieve re-entry. Furthermore, a cutting balloon may be better to create re-entry than a conventional balloon [8]; however, the delivery of a cutting balloon to the distal segment of the coronary artery is difficult because of the large profile of a cutting balloon.

Our case clearly showed healing of the dissection and hematoma without creating re-entry or additional stent implantation. The strategy of conservative management was derived from our previous experience with PCI in chronic total occlusion (CTO) and spontaneous coronary artery dissection (SCAD). Although we sometimes create a huge hematoma and dissection when antegrade wiring in CTO is not successful [11], such hematomas usually disappear in a few months, partly because of the blind end of the pseudolumen. The hematoma caused by stent edge dissection also ends blindly. Because the risk of complications is considerably high in patients with SCAD treated by PCI [12,13], conservative management with medical therapy is frequently selected in the treatment of SCAD [14,15]. However, a highly skilled group reported a high PCI success rate in patients with SCAD using optical coherence tomography (OCT) [16]. Natural healing of SCAD has frequently been reported in the literature [15]. Intravascular imaging studies in SCAD did not always identify the sites of re-entry as well as entry of the hematoma [17]. Furthermore, the presence of re-entry is not essential for the healing of SCAD. Therefore, we believe that re-entry is not necessary during the healing of hematoma caused by stent edge dissection. The comparison of bailout strategies for edge dissection is illustrated in Fig. 3.

We should mention the limitations and uncertainties of the present case. There was hematoma at the stent edge, but entry of the dissection was not clearly identified by IVUS. The location of the entry of the dissection might have been in the stented segment (stent body) rather than at the stent edge. Furthermore, we could not identify re-entry by IVUS; however, there is the possibility that re-entry was missed by IVUS, and OCT rather than IVUS may be required to detect small entry or re-entry of dissection [18]. Conservative management was selected in our case, because both additional stenting and dilatation with a larger balloon were not feasible. It is also possible that a good result might have occurred by chance.

We should mention the risk of conservative management. If the true lumen is completely compressed by the hematoma so that coronary flow is eliminated, an additional stent should be implanted or re-entry should be created using a balloon. Since the injection of contrast media would worsen the situation, IVUS should be useful to evaluate coronary flow in the true lumen [19]. In the present case, we identified coronary flow in the true lumen by IVUS and had sufficient time in the catheter laboratory to monitor the patient after the onset of hematoma. Therefore, we were able to select conservative management. In conclusion, conservative management should be added as the option for edge dissection and hematoma following stent implantation.



Type of Strategy	Stent Sealing Strategy	Re-entry Strategy	Conservative Strategy
Scheme of Strategy			
Strong point	The most reliable approach to seal entire hematoma.	No additional metal.	No additional metal. No additional hematoma.
Weak point	Need additional metal. May sacrifice branches.	There is an uncertainty about creating re-entry. Small balloon can not create re-entry. Large balloon may create perforation.	Available when the distal flow of true lumen is visible by IVUS. Requires additional observation time during procedure.

Fig. 3. The comparison of bailout strategies for edge dissection.

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