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Image of the Month

Treatment of an iatrogenic left main coronary artery dissection and intramural hematoma by fenestration instead of stent implantation



Tadao Aikawa^{1,2,*}, Naohiro Funayama¹, Daisuke Sunaga¹, Makoto Furugen¹,
Daisuke Hotta¹

¹ Department of Cardiology, Hokkaido Cardiovascular Hospital, 1-30, Minami-27, Nishi-13, Chuo-ku, Sapporo, 064-8622, Japan

² Department of Radiology, Jichi Medical University Saitama Medical Center, 1-847 Amanuma-cho, Omiya-ku, Saitama, 330-8503, Japan

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A 30-year-old woman with chest pain radiating to the left shoulder and dyspnea on exertion was referred to our cardiac outpatient unit for post-coronavirus disease 2019 (COVID-19) syndrome. Her symptom persisted for >1 year after recovery from the suspected COVID-19 infection, which was diagnosed at the early stage of the COVID-19 pandemic in Japan. Her left ventricular ejection fraction was slightly reduced to 54% on cine cardiovascular magnetic resonance imaging, and late gadolinium enhancement imaging demonstrated circumferential mid-wall enhancement of the left ventricle (Video 1). Although coronary computed tomography angiography (CCTA) showed no coronary abnormalities, 8 months of treatment with bisoprolol, 2.5 mg/day, was found partially effective in reducing angina symptoms, suggesting that

ischemia and no obstructive coronary artery disease (INOCA) is a potential cause of angina.¹ Her low blood pressure limited the use of calcium channel blockers and nitrates. Therefore, to diagnose INOCA, she underwent an invasive assessment of the coronary microcirculation. A standard 0.014-inch pressure-temperature sensor-tipped guidewire (PressureWire™ X, Abbott) was placed in the left anterior descending artery (LAD) using a 5 Fr Ikari left 4.0 guiding catheter. Coronary thermodilution curves under resting conditions were successfully obtained by repeated intracoronary bolus injections of 3 mL of saline at room temperature; however, insufficient curves were obtained during hyperemia (Fig. 1A, yellow and green curves in the lower panel). After her fractional flow reserve dropped to 0.39, CCTA showed left main coronary artery (LMCA) dissection with LAD occlusion (Fig. 1B, red and yellow arrows, respectively; Video 2), indicating the National Heart, Lung and Blood Institute (NHLBI) classification type F dissection due to inadvertent deep-seating of the guiding catheter and the thermodilution procedure. Further, the guidewire was inadvertently removed and not advanced easily into the distal LAD. A 6 Fr Judkins left 3.5 guiding catheter was additionally engaged in the LMCA ostium. After crossing the left circumflex artery (LCX) with a 0.014-inch floppy guidewire (Asahi SION blue™, Asahi Intecc), intravascular ultrasound (IVUS) catheter was advanced into the LCX and the false lumen of the LAD. It showed intramural hematomas compressing the true lumina of the LMCA, LAD, and LCX (Fig. 1a-c/Video 3). The entry site of the false lumen was located at the bifurcation of the LMCA (Fig. 1b, blue arrow). An additional guidewire was successfully inserted into the true lumen of the LAD under real-time IVUS guidance. Because of the difficulty encountered in achieving optimal stenting, fenestrations between the true lumen and hematomas were planned. Balloon dilation in the LAD using a 2.25 × 10 mm Wolverine™ cutting balloon (Boston Scientific) and a 3.0 × 9 mm NSE Advance™ scoring balloon (Goodman) was ineffective in evacuating the hematoma. After pulling the fully-inflated Wolverine™ cutting balloon from the distal portion of the hematoma (Video 4), a fenestration was successfully created with the resolution of the hyperechoic area of the hematoma space in the LAD (Fig. 1f). However, substantial hematoma remained at the bifurcation of the LMCA. Thus, we performed kissing balloon inflation at the bifurcation using Wolverine™ balloon for LCX and NSE Advance™ for LAD at 10 atm, achieving an acceptable

Abbreviations: CCTA, coronary computed tomography angiography; COVID-19, coronavirus disease 2019; INOCA, ischemia and non-obstructive coronary artery disease; IVUS, intravascular ultrasound; LAD, left anterior descending artery; LCX, left circumflex artery; LMCA, left main coronary artery; NHLBI, National Heart, Lung and Blood Institute.

* Corresponding author. Tadao Aikawa, MD, PhD, FACC, Department of Cardiology, Hokkaido Cardiovascular Hospital, 1-30, Minami-27, Nishi-13, Chuo-ku, Sapporo, 064-8622, Japan. Tel.: +81 11 563 3911, Fax: +81 11 551 3109.

E-mail address: tadao.aikawa@jichi.ac.jp (T. Aikawa).

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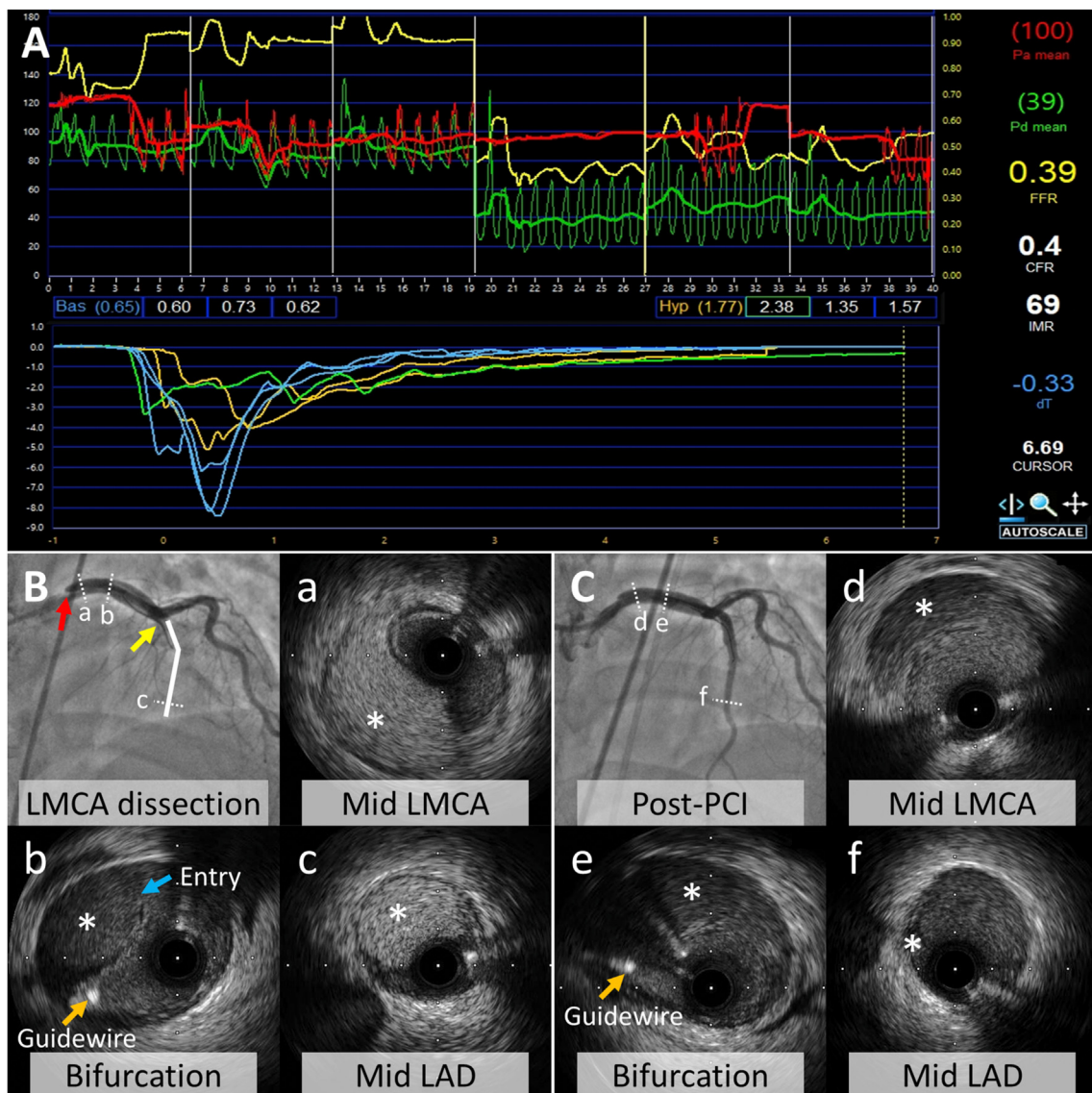


Figure 1. Diagnosis and management of iatrogenic coronary dissection. (A) Coronary thermodilution curves. Insufficient curves are obtained during hyperemia (**yellow and green curves** in the lower panel). (B) LMCA dissection (**red arrow**) with LAD occlusion (**yellow arrow**). **The white line** indicates the compressed LAD. (a–c) Pre-PCI IVUS images. The **Blue arrow** indicates the entry site of the false lumen. (C) Final angiography shows an acceptable result. (d–f) Final IVUS shows regression of hematomas. **Orange arrows** indicate the guidewire in the LCX. **Asterisk** indicates hematomas.

angiographic result (Fig. 1C/Videos 5–6). IVUS showed regression of the hematoma in the LMCA and the residual dissection with false lumen formation (Fig. 1d–e/Video 7). After the procedure, her chest pain was resolved. Follow-up CCTA demonstrated good flow in the distal LAD (Video 8).

Coronary artery fenestration with a cutting or scoring balloon angioplasty has recently been recognized as a useful technique for managing coronary dissection with intramural hematoma.^{2,3} Additionally, pulling back an inflated cutting balloon is used as an off-label treatment for coronary artery dissection without stenting.⁴ Although catheter-induced dissection of LMCA is a rare complication, caution should be exercised while inserting a guiding catheter into the LMCA and performing coronary thermodilution by bolus injection to assess flow reserve.

Conflict of interest

None.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.hjc.2022.02.006>.

References

1. Vallejo Camazon N, Teis A, Martinez Membrive MJ, Llibre C, Bayes-Genis A, Mateu L. Long COVID-19 and microvascular disease-related angina. *Rev Esp Cardiol (Engl Ed)*. 2021. <https://doi.org/10.1016/j.rec.2021.10.010>.
2. Motreff P, Ronchard T, Sanguinetti F, et al. Coronary artery fenestration: a promising technique for rescue management of spontaneous intramural hematoma with luminal compression. *JACC Cardiovasc Interv*. 2018;11:1905–1907. <https://doi.org/10.1016/j.jcin.2018.06.032>.
3. Funayama N, Konishi T, Yamamoto T, Hotta D. Coronary artery hematoma treated with fenestration using a novel NSE Alpha® scoring balloon. *Case Rep Cardiol*. 2017;2017:8189530. <https://doi.org/10.1155/2017/8189530>.
4. Kaya E, Iwata H, Miyazaki S, et al. Successful coronary flow restoration by stent-free strategy using the pull-back method of cutting balloon in spontaneous coronary artery dissection. *CJC Open*. 2019;1:213–215. <https://doi.org/10.1016/j.cjco.2019.05.008>.