JACC: CASE REPORTS VOL. 30, NO. 5, 2025

CORONARY, PERIPHERAL, AND STRUCTURAL INTERVENTIONS

CLINICAL CASE

Management of Catheter-Induced Coronary Artery Dissection Leading to Extensive Bidirectional Intramural Hematoma

Ashwani K. Sharma, DM,[a] Sanjeeb Roy, DM,[b] Anurodh Dadarwal, DM[c]

ABSTRACT

Spreading epidemic of atherosclerotic coronary artery disease coupled with huge technical advancement, has led to steep rise in percutaneous coronary interventions. The coronary intervention might be complicated with catheter-induced coronary artery dissection and intramural hematoma. It usually spread antegradely along the course of coronary artery but occasionally retrograde extension into the aorta leads to horrible visual impression. Its size might vary from small to voluminous causing minimum hindrance to complete cessation of flow. Thus, it may manifest as asymptomatic observation to hemodynamic collapse. Quick recognition and prompt bailout stenting of the affected coronary artery is the most common treatment strategy. (JACC Case Rep. 2025;30:103173) © 2025 The Authors. Published by Elsevier on behalf of the American College of Cardiology Foundation. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/).

The contemporary era has witnessed huge technical advancement in percutaneous coronary intervention (PCI). PCI is associated with many complications including catheter-induced coronary artery dissections and intramural hematoma (IMH).[1] A case report is presented here where the PCI of left main coronary artery (LMCA) bifurcation with left circumflex artery (LCx) chronic total occlusion (CTO) was complicated with catheter-induced coronary artery dissections and IMH of ostium to mid right coronary artery (RCA) along with retrograde extension in the aortic root.

TAKE-HOME MESSAGES

- This case highlights the importance of confirmation of proper engagement of contra lateral guide catheter before each injection.
- Quick recognition and bail out stenting is the most common treatment strategy to manage catheter-induced coronary artery dissection.

HISTORY OF PRESENTATION

A 66-year-old man visited the emergency department with episodic rest chest heaviness for 3 days.

PAST MEDICAL HISTORY

His past medical history was unremarkable. He denied the symptoms suggestive of chronic coronary syndrome.

From the [a]Department of the Cardiology, Fortis Escorts Hospital, Jaipur, Rajasthan, India; [b]Department of Cardiac Sciences, C K Birla Hospital, Jaipur, Rajasthan, India; and the [c]Department of Cardiology, Poonia Hospital, Sirsa, Haryana, India.
The authors attest they are in compliance with human studies committees and animal welfare regulations of the authors' institutions and Food and Drug Administration guidelines, including patient consent where appropriate. For more information, visit the Author Center.

Manuscript received October 16, 2024; revised manuscript received November 12, 2024, accepted November 18, 2024.

ISSN 2666-0849 https://doi.org/10.1016/j.jaccas.2024.103173

ABBREVIATIONS AND ACRONYMS

CTO = chronic total occlusion

IMH = intramural hematoma

IVUS = intravascular ultrasound

LAD = left anterior descending artery

LCx = left circumflex artery

LMCA = left main coronary artery

PCI = percutaneous coronary intervention

RCA = right coronary artery

DIFFERENTIAL DIAGNOSIS

Chest heaviness with left upper limb radiation was classical of angina pectoris and the most common differential diagnosis was acute coronary syndrome.

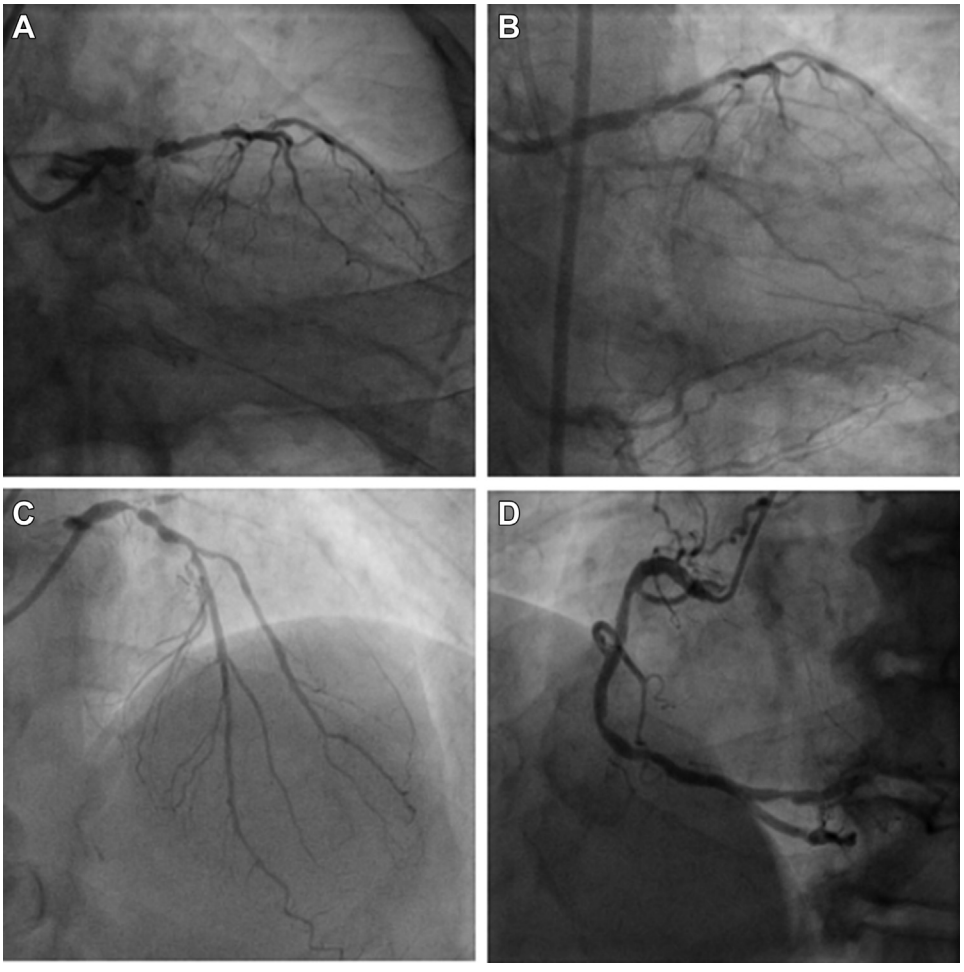
INVESTIGATIONS

His electrocardiogram revealed T-wave inversion in lateral leads. Transthoracic echocardiography revealed a normal left ventricular ejection fraction without any regional wall motion abnormality. Cardiac specific troponin T level was normal. Based upon all these investigations, the diagnosis of unstable angina was considered. He underwent coronary angiography via right trans radial arterial access (**Figures 1A to 1D**, Videos 1 and 2), which revealed LMCA bifurcation disease, left anterior descending artery (LAD) and diagonal bifurcation disease with LCx CTO.

MANAGEMENT

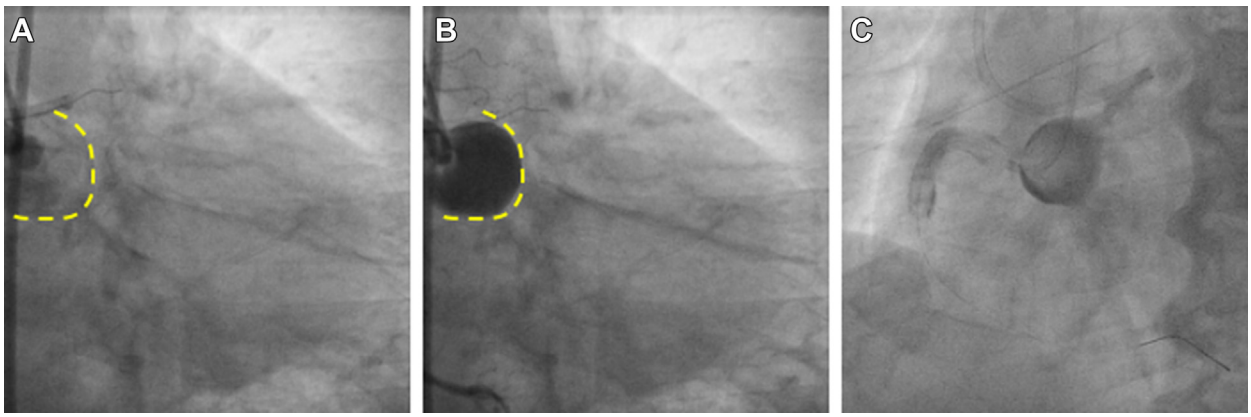
Revascularization options were discussed in detail in the form of coronary artery bypass surgery and multivessel PCI. The patient and family declined for former and opted for PCI. After written informed consent, the patient underwent coronary angioplasty.

FIGURE 1 Coronary Angiography



(A) Significant disease at left main bifurcation, along with CTO of proximal LCx, (B) which is filling in retrograde manner from RCA. (C) Proximal to mid LAD had diffuse disease. (D) RCA had noncritical lesion. CTO = chronic total occlusion; LAD = left anterior descending coronary artery; LCx = left circumflex coronary artery; RCA = right coronary artery.

FIGURE 2 Formation of Intramural Hematoma During Simultaneous Dual Injection



Contrast injection through mal-aligned JR guide catheter led to ostial dissection which quickly propagated distally up to mid RCA and proximally in the aortic root (outlined by broken yellow line), limited to sinuses of Valsalva and sparing the tubular segment of aorta. The dissection had involved almost entire root. JR = Judkin right catheter; other abbreviations as in Figure 1.

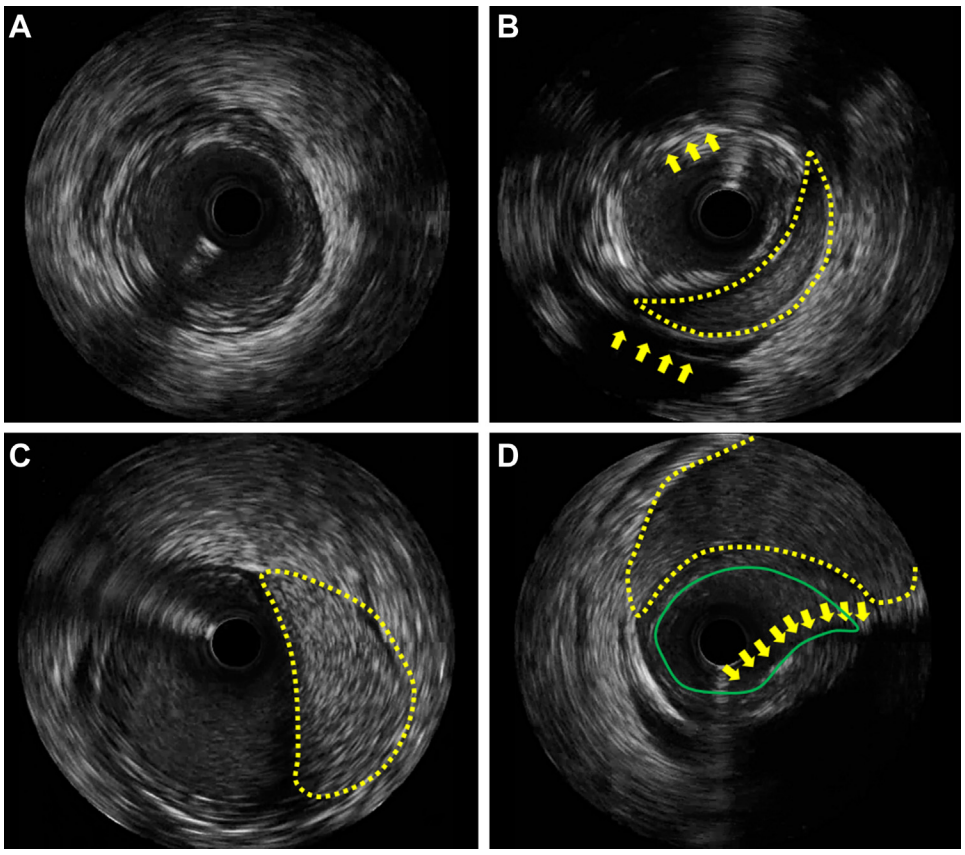
The LMCA was engaged with an 8F guide catheter via right femoral arterial access and RCA was engaged with a 6F guide catheter through radial access for contralateral injection. The lesion in LCx was began to cross with Fielder XT-A wire (Asahi Intecc, Seti). To assess wire navigation, contralateral injection was given in RCA. During this injection, a dissection appeared at RCA ostium and quickly propagated by hydraulic force both proximally and distally. Proximally, it spread into the aortic root, limited to sinus of Valsalva, whereas distally it extended up to mid RCA (**Figures 2A to 2C**, Video 3). It was Dunning grade II aortocoronary dissection. Immediate wiring was performed with Sion wire (Asahi Intecc, Seti). Fortunately, the distal perfusion was preserved so intravascular ultrasound (IVUS) imaging was performed, which revealed significant IMH (**Figures 3A to 3D**). It also ensured the luminal course of guide wire. As per the IVUS measurements, direct stenting with 3.0 × 38.0 mm drug eluting stent was performed in ostial to mid RCA (**Figure 4A**). With gentle check, mild contrast staining was appearing outside the stent silhouette but not in the root (**Figure 4B**). Within-stent dilatation was performed with a 3.5 × 15.0 mm noncompliant balloon up to 26 atmospheric pressure (atm). Check angiogram revealed good results with complete sealing of the false lumen (**Figure 4C**).

Then, the lesion in LAD was crossed with Sion wire. Then the LCx CTO was crossed with 0.014-inch × 190 cm Gaia-II (Asahi Intecc, Seti) wire with the help of a microcatheter (**Figure 5A**). The lesion in the ostio-proximal LCx followed by LAD was adequately dilated. A 2.75 × 28.00 mm Xience Pro stent (Abbott) was deployed in ostio-proximal LCx and crushed with 3.0 × 15.00 mm noncompliant balloon. D1 was wired with another Sion wire and then 3.5 × 38.0 mm Xience Prime stent was deployed in ostial LMCA to mid LAD. There was distal edge dissection with preserved flow in first diagonal. After removing the diagonal wire, 2.5 × 15.0 mm Xience Pro stent was deployed in mid LAD, which perfectly sealed the edge dissection. LCx rewiring, strut separation, post dilatation, kissing balloon inflation and proximal optimization were performed in standard manner. Remaining LAD stented segments were also adequately post dilated. There was cessation of flow in D1 (**Figure 5B**) with appearance of anginal pain. Therefore, it was rewired with Pilot-200 wire (Abbot Vascular) and strut separated with 2.0 × 12.0 mm balloon at 12 atm. A 2.5 × 23.0 mm Xience Pro stent was deployed with T and protrusion technique. Post dilatation and kissing balloon inflation were completed. Final angiogram (**Figures 5C to 5D**, Videos 4 and 5) and IVUS showed good results.

OUTCOME AND FOLLOW-UP

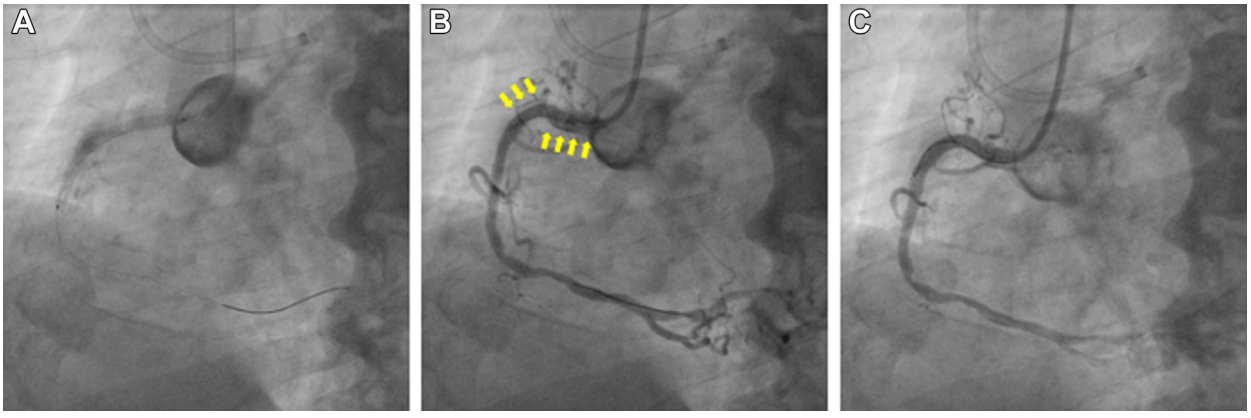
The patient remained asymptomatic since then. Because stenting decompressed the IMH of RCA and also sealed the entry site for aortic extension, a follow-up computed tomography scan was not planned. Stress echocardiography did not reveal inducible ischemia at follow-up.

FIGURE 3 IVUS Analysis of IMH



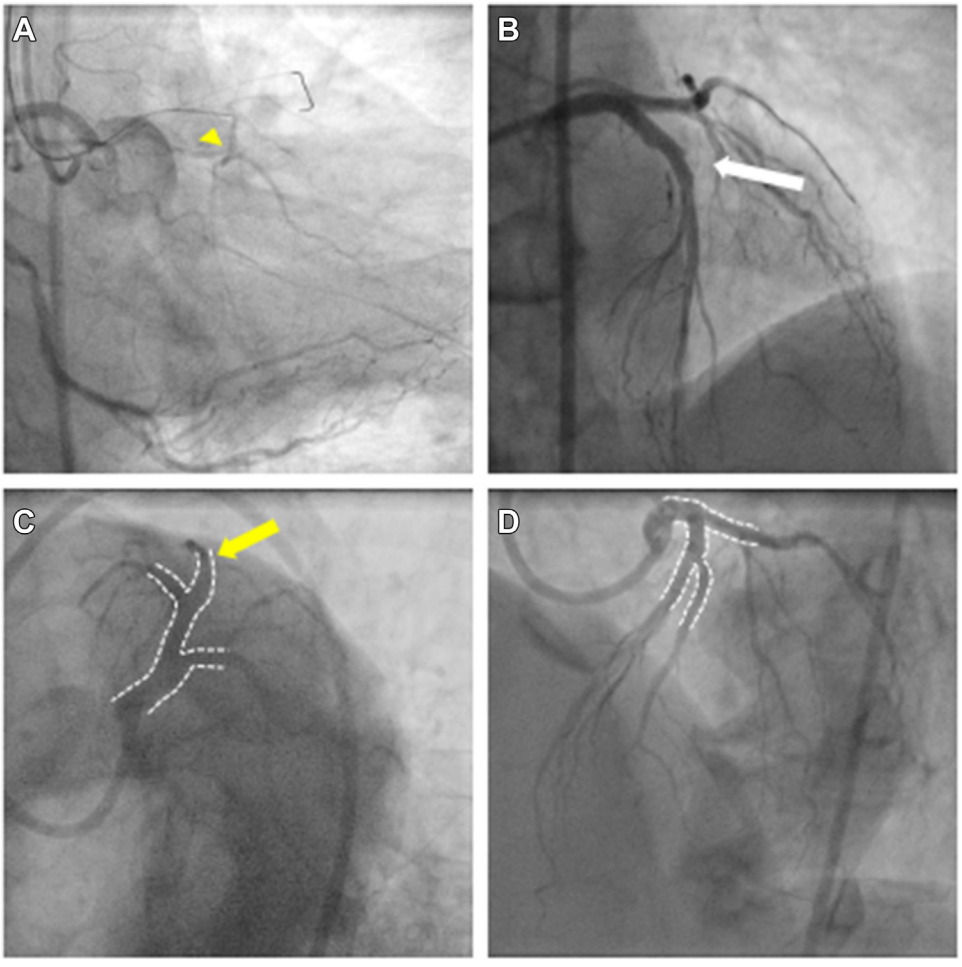
Normal healthy segment of the mid RCA (A) followed by crescent shaped hyper echoic collection in the wall of mid to proximal RCA outlined with broken yellow lines (B to D). Its volume is maximum in proximal RCA involving 180° circumference limited by calcified plaque in 3 to 9 O'clock position (yellow arrows). There was significant compression of the true lumen (outlined by green line).

FIGURE 4 Management of Intramural Hematoma



Direct stenting was performed in ostial to mid RCA (A). (B) There was still some flow in the false lumen (yellow arrows) which was completely sealed after further post dilatation (C). Abbreviation as in Figure 1.

FIGURE 5 **Angioplasty of Left System**



After wiring the LAD, CTO segment of the LCx was crossed with Gaia II wire (A). Initially, it was subintimal (yellow arrow head) and then luminal crosssing was achieved. LMCA bifurcation angioplasty was performed with mini crush technique. There was occlusion of first diagonal during LAD stent post dilatation (white arrow) (B), which was stented with T and protrusion technique (yellow arrow). All the stented segments are outlined with dashed white lines (C and D). CTO = chronic total occlusion; other abbreviations as in Figure 1.

DISCUSSION

Catheter-induced coronary artery dissection is a feared complication of coronary angiography. It is more common in vessels with ostial plaque, but may occur in normal vessels also. There is no difference in the incidence of coronary dissection with respect to access site, whether transradial or transfemoral.[1]

It may remain asymptomatic or, by compromising the true lumen, may quickly give rise to ischemia or infarction with varied manifestations.[2] Dilatation of the vessel and persistent contrast staining are the immediate clue for diagnosis. Multimodality imaging helps in diagnosing and assessing the extent of hematoma. These include endovascular imaging in the form of IVUS and optical coherence tomography or noninvasive cardiac computed tomography angiography imaging. On IVUS, it appears as a crescent-shaped homogenous hyperechoic collection in the tunica media owing to reflection of ultrasound waves from erythrocyte aggregates. However, it may appear hypoechoic if filled with contrast (corresponding with contrast staining on angiography) or saline. IVUS demonstrates entry site in majority of the patients, and the re-entry site is visible in minority of the cases.[3] Optical coherence tomography has better axial

and lateral resolution, so it can demonstrate the entry and re-entry sites more clearly and frequently. Unlike IVUS, it carries the risk of IMH propagation by hydraulic forces.

Timely recognition and prompt bailout stenting of the affected coronary artery is the most common treatment strategy.[4] Minor dissections are straightforward to treat. However, the management of more complex dissections is often challenging requiring microfenestration with cutting balloon. No added intervention is required for aortic involvement as long as the aortic dissection is not extensive.[5]

CONCLUSIONS

Guide-induced coronary dissection and intra mural hematoma is an uncommon but feared complication of coronary intervention arising primarily from nonaligned guide catheter.

These dissections may extend retrogradely in the aortic root with scary fluoroscopic appearance.

If these are limited to sinuses, then they are managed conservatively while the coronary hematomas are managed with prompt stenting.

FUNDING SUPPORT AND AUTHOR DISCLOSURES

The authors have reported that they have no relationships relevant to the contents of this paper to disclose.

ADDRESS FOR CORRESPONDENCE: Dr Ashwani Kumar Sharma, Fortis Escorts Hospital, E-223, Hawa Sarak, Ram Nagar Extension, Sodala, Jaipur, Rajasthan, India. E-mail: ashwanikumarsharma00@gmail.com.

REFERENCES

1. Pietro D, Paul WB, Omar A, et al. Association between the access site for coronary angiography and catheter-induced coronary artery dissection. *J Soc Cardiovasc Angiogr Interv*. 2023;2:100606.

2. Jacek K, Michał G, Barbara K, Wojciech T, Krzysztof P, Marek S. Catheter-induced coronary artery and aortic dissections: a study of mechanisms, risk factors and propagation causes. *Cardiol J*. 2024;31:398-408. https://doi.org/10.5603/CJ.a2022.0050

3. Bilal H, Dishang B, Vishal D. Coronary artery intramural hematoma: a rare complication of percutaneous coronary intervention. *Radiol Case Rep*. 2022;17:3770-3773. https://doi.org/10.1016/j.radcr.2022.07.001

4. Takeshi O, Toshitaka O, Naoei I, Masahiko O. Intramural hematoma extending from a dissection within an implanted stent: a case report treated with fenestration using a cutting balloon. *Eur Heart J Case Rep*. 2024;8:ytae223. https://doi.org/10.1093/ehjcr/ytae223

5. Erick S, Yaniv L, Ariel R. Iatrogenic aortocoronary dissection during right coronary artery procedures: a systematic review of the published literature. *J Soc Cardiovasc Angiogr Interv*. 2022;1:100443. https://doi.org/10.1016/j.jscai.2022.100443

KEY WORDS bail out stenting, catheter-induced coronary artery dissection, hydraulic force, intramural hematoma, coronary intramural hematoma, multimodality imaging, micro fenestrations, retrograde extension

APPENDIX For supplemental videos, please see the online version of this paper.