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Atherectomy, the narrow line between preparation and complication : a case report

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ABSTRACT

Severely calcified coronary lesions remain a major challenge in percutaneous coronary intervention (PCI), often requiring plaque modification strategies such as rotational atherectomy or excimer laser coronary atherectomy. Although these techniques improve lesion preparation and stent delivery, they are associated with specific procedural complications, including coronary perforation. We report the case of a 71-year-old woman with multiple cardiovascular risk factors who presented with exertional dyspnea and evidence of inferior myocardial ischemia. Coronary angiography revealed a tortuous and severely calcified proximal-to-mid right coronary artery with a critical stenosis. Initial lesion modification using rotational atherectomy failed due to lesion resistance, leading to the use of excimer laser coronary atherectomy. The procedure was complicated by coronary perforation resulting in cardiac tamponade. The patient was successfully managed with emergent pericardial drainage, prolonged balloon inflation, and implantation of a covered stent. This case highlights the challenges of managing heavily calcified coronary lesions and reviews the spectrum of complications associated with coronary atherectomy techniques, with a particular focus on coronary perforation and its management.

KEYWORDS :

coronary calcifications, atherectomy, rotablator, laser, coronary perforation

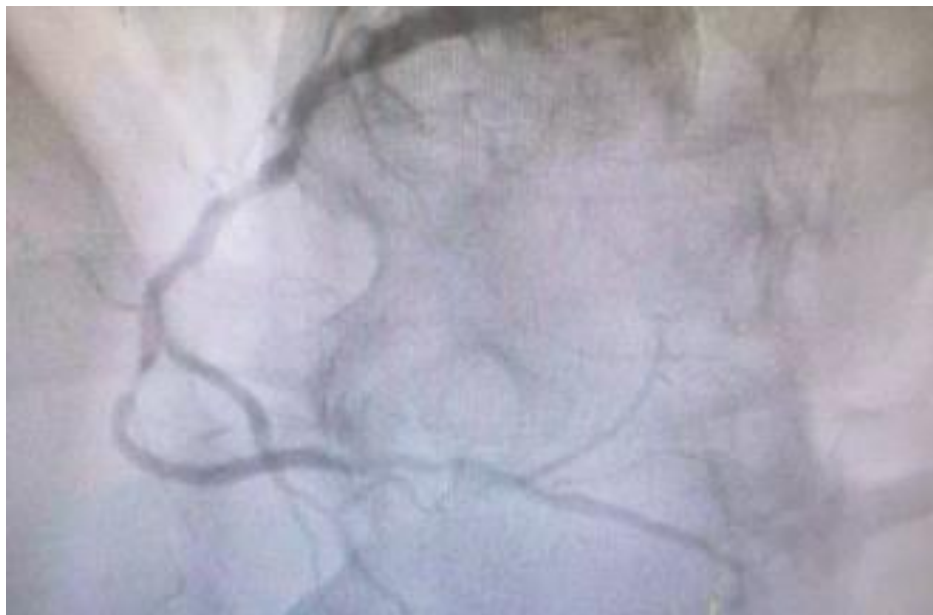
CASE REPORT

CLINICAL PRESENTATION

- A 71-year-old woman with cardiovascular risk factors including hypertension, diabetes mellitus, dyslipidemia, and a history of smoking (currently abstinent) presented with exertional dyspnea.
- Electrocardiography showed sinus rhythm at 71 bpm with an incomplete right bundle branch block and no repolarization abnormalities.
- Transthoracic echocardiography revealed hypokinesia of the inferior and inferoseptal walls.
- Myocardial scintigraphy demonstrated a high coronary calcium score of 808 associated with inferior myocardial ischemia.

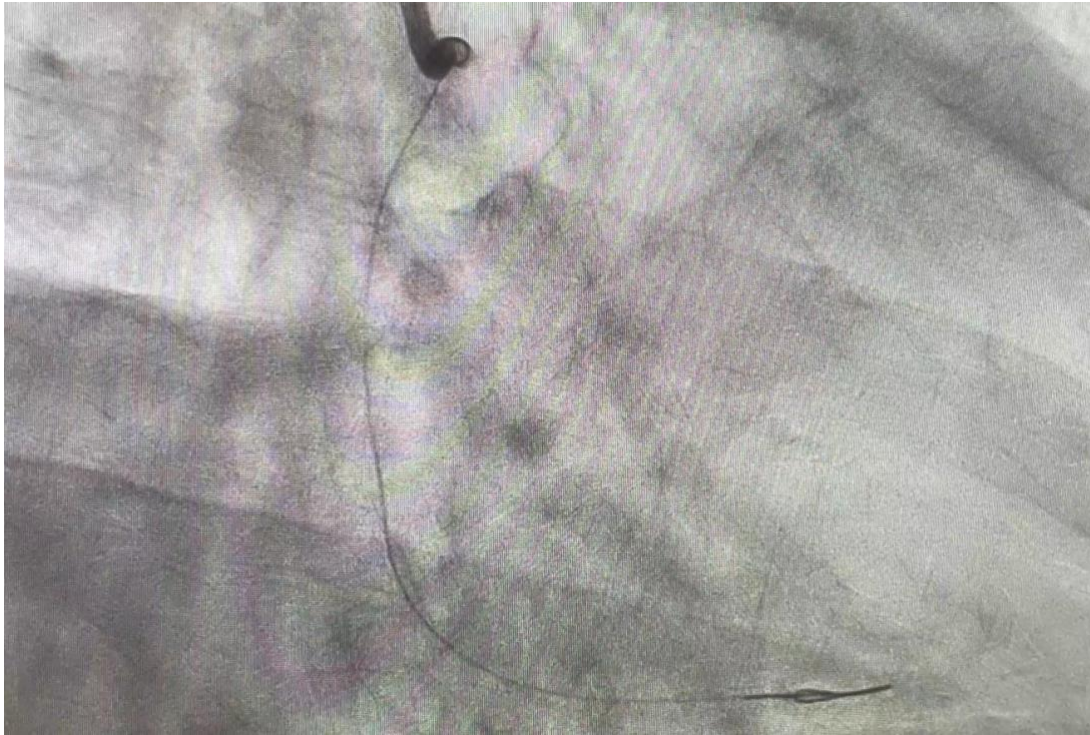
CORONAROGRAPHY

- Segmental stenotic disease of the proximal-to- mid right coronary artery (RCA), which is tortuous, with a very severe stenosis located just before the second bend.
- The left coronary system showed atherosclerotic changes without significant stenosis.



PROCEDURE

- Engagement with an Amplatz 0.75 guiding catheter.
- Advancement of a Sion Black guidewire across the lesion.
- Advancement of a Finecross microcatheter.
- Exchange to a Rotawire guidewire.
- Rotational atherectomy performed using a 1.25 mm burr.
- The lesion was long and highly resistant.
- Rotablator failure.



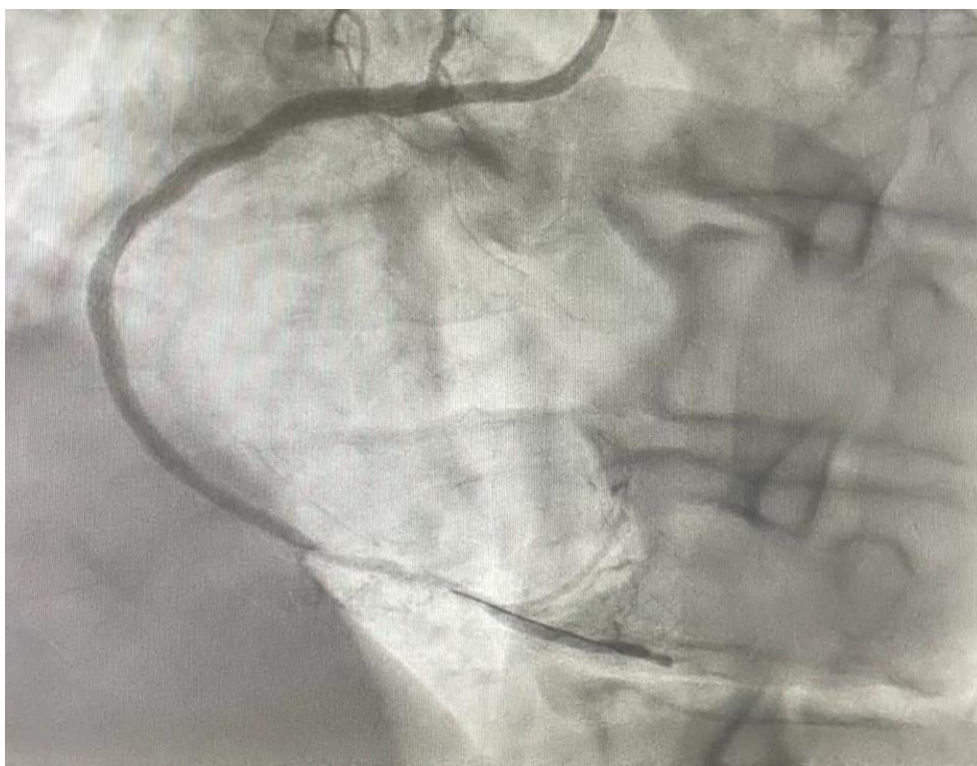
- Excimer laser atherectomy was performed.
- Coronary perforation occurred, complicated by cardiac tamponade.
- The patient was stabilized with resuscitative measures.
- Pericardial drainage was performed.
- Prolonged balloon inflation with a 2×15 mm balloon for 1 minute.
- Implantation of a 2.5×38 mm PK Papyrus covered stent.



COMPLICATION : CORONARY PERFORATION



FINAL RESULT



DISCUSSION

- Severe coronary calcification represents one of the most important technical challenges in percutaneous coronary intervention (PCI). Calcified plaques reduce vessel compliance, impair balloon expansion, and compromise optimal stent deployment, which may lead to restenosis or stent thrombosis.
- To overcome these limitations, plaque modification techniques such as rotational atherectomy and excimer laser coronary atherectomy are frequently used. Rotational atherectomy (RA), originally developed by David Auth and widely adopted in interventional cardiology, uses a high-speed rotating burr to selectively ablate calcified plaque. Excimer laser coronary atherectomy (ELCA), approved by the U.S. Food and Drug Administration, uses ultraviolet laser energy to vaporize plaque and thrombus.
- Despite their effectiveness in complex lesions, atherectomy techniques carry a risk of complications, including coronary dissection, slow-flow or no-reflow phenomena, burr entrapment, and coronary perforation. Coronary perforation is a rare but potentially life-threatening complication that may lead to cardiac tamponade and hemodynamic collapse.
- We report a case of coronary perforation occurring during combined rotational and excimer laser atherectomy in a heavily calcified right coronary artery and discuss the mechanisms, risk factors, and management strategies for atherectomy-related complications.

ATHERECTOMY IN CALCIFIED CORONARY LESIONS

- Severely calcified coronary lesions are present in up to 20–30% of PCI procedures and are associated with lower procedural success and higher complication rates. Atherectomy techniques aim to modify calcified plaque to facilitate balloon expansion and optimal stent deployment.
- Rotational atherectomy preferentially ablates inelastic calcified plaque while sparing elastic arterial tissue. Excimer laser coronary atherectomy works through photochemical, photothermal, and photomechanical mechanisms, allowing plaque vaporization and modification.
- In particularly resistant lesions, combined or sequential use of plaque modification techniques may be required.

COMPLICATIONS OF CORONARY ATHERECTOMY

- 1. Slow-Flow and No-Reflow: Slow-flow or no-reflow phenomena occur due to distal embolization of plaque debris and microvascular obstruction. These complications are more common with rotational atherectomy and may lead to transient myocardial ischemia.
- 2. Coronary Dissection : Dissections may occur due to mechanical trauma from devices or aggressive plaque modification. Although many dissections are manageable with stenting, extensive dissections can compromise coronary flow.
- 3. Burr Entrapment : A rare but specific complication of rotational atherectomy is burr entrapment within severely calcified lesions, particularly when large burrs are used or when excessive forward force is applied.
- 4. Coronary Perforation : Coronary perforation is among the most severe complications of PCI and is associated with high morbidity and mortality. The incidence during atherectomy procedures is higher than in standard PCI.
 - Risk factors for perforation include:
 - Severe calcification, Tortuous coronary anatomy, High-energy device use, Aggressive plaque modification, Oversized devices
 - In the present case, several of these factors were present: severe calcification, vessel tortuosity, and the sequential use of two atherectomy techniques.
 - Coronary perforation may lead to pericardial effusion and cardiac tamponade, requiring rapid recognition and management.

MANAGEMENT STRATEGIES

1. Immediate balloon inflation at the perforation site
 2. Reversal of anticoagulation when appropriate
 3. Pericardiocentesis in cases of tamponade
 4. Implantation of a covered stent
 5. Emergency surgery if percutaneous measures fail
- The PK Papyrus covered stent, developed by Biotronik, is commonly used for sealing coronary perforations due to its flexibility and deliverability in complex anatomy.
 - In this case, prompt recognition and rapid implementation of these measures resulted in successful stabilization of the patient.

CONCLUSION :

- This case illustrates the challenges associated with the treatment of heavily calcified coronary lesions and highlights the potential complications of advanced plaque modification techniques.
- Although rotational atherectomy and excimer laser coronary atherectomy are valuable tools for managing complex calcified lesions, they carry an increased risk of serious complications such as coronary perforation.
- Careful patient selection, appropriate device sizing, and operator experience are essential to minimize procedural risks. Rapid recognition and prompt management of complications—including pericardial drainage and covered stent implantation—are critical for favorable outcomes.

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