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From Ulnar Access to Intravascular Lithotripsy in the Emergency Setting: A Unique Case of Acute ST-Elevation Myocardial Infarction Recapitulating Several Niche Interventional Cardiology Techniques for Primary Percutaneous Coronary Intervention

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Abstract

Primary percutaneous coronary intervention (PCI) for ST-elevation myocardial infarction (STEMI) typically relies on well-established access and device strategies. However, complex anatomical constraints may necessitate unconventional approaches. We report a case of acute anterior STEMI in a dialysis-dependent patient with no usable radial or femoral access. Ulnar artery cannulation enabled

emergency angiography, revealing a long, calcified proximal left anterior descending artery occlusion. A microcatheter-specialty guidewire combination achieved lesion crossing, followed by guide extension catheter support to facilitate delivery. Intravascular lithotripsy (IVL) was employed to modify extensive calcification, allowing for stent implantation with restoration of TIMI 3 flow. The patient had an uneventful recovery. This case underscores the procedural relevance of niche interventional techniques—including alternative access, advanced lesion crossing strategies, guide support augmentation, and IVL—in select, high-risk STEMI patients. The discussion contextualizes each tool within the evidence base, suggesting that such a sequential, integrative strategy may be valuable when standard PCI is inadequate. As the prevalence of severe coronary calcification rises, especially among patients with chronic kidney disease or peripheral artery disease, awareness and appropriate deployment of these adjuncts may expand the boundaries of effective emergent PCI.

Introduction

Primary percutaneous coronary intervention (PCI) remains the gold standard in the management of ST-elevation myocardial infarction (STEMI).(1) However, anatomical challenges, vascular limitations, and lesion complexity may necessitate the use of advanced interventional strategies.(2) In particular, patients with limited access options and severely calcified lesions often present technical barriers to standard PCI.(3)

Recent innovations such as intravascular lithotripsy (IVL), guide extension catheters, and high-performance microcatheters and guidewires have expanded the interventionalist's toolkit (**Table 1**).(4,5) Nonetheless, their integration into the acute STEMI setting remains relatively infrequent and is often reserved for select, high-risk scenarios in more stable settings.

We present a case of anterior STEMI managed via left ulnar access, in which successful reperfusion was achieved using a composite strategy including microcatheter-facilitated lesion crossing, guide extension catheter support, and IVL. The case serves to highlight the procedural flexibility and clinical relevance of niche techniques in complex emergent PCI.

Case

A 49-year-old man with a decades-long history of dialysis presented with acute chest pain and anterior ST-elevation on electrocardiogram. Urgent coronary angiography was indicated, but both radial

arteries were unsuitable due to prior interventions and occlusion, and femoral access was limited by peripheral vascular disease. Left ulnar artery access was established using a 6F hydrophilic sheath.

Diagnostic angiography revealed a proximally occluded, long, and heavily calcified left anterior descending (LAD) artery (**Figure 1**). Crossing was attempted using a Finecross MG microcatheter (Terumo, Tokyo, Japan) and a Samurai guidewire (Boston Scientific, Natick, MA, USA), enabling successful traversal of the occlusion. Given the poor deliverability across the calcific segment, a GuideZilla II guide extension catheter (Boston Scientific) was advanced to enhance device support. Intravascular lithotripsy was then performed using the Shockwave C2+ balloon catheter (Shockwave Medical, Santa Clara, CA, USA), delivering pulses effectively through the calcific lesion. This facilitated full balloon expansion and stent delivery.

Final angiography confirmed Thrombolysis in Myocardial Infarction (TIMI) 3 flow restoration in the LAD, without complications. The patient had an uneventful post-procedural course and was discharged on dual antiplatelet therapy.

Review of the evidence

In emergent primary PCI as well as in other complex PCI cases, vascular access selection is often critical and when both radial arteries are unavailable and femoral access is contraindicated, left ulnar access emerges as a feasible alternative.(6) Multiple studies have established its safety and efficacy, including a systematic review and meta-analysis totaling 5,276 patients, which found no significant difference in major adverse cardiac events (MACE) or vascular complications between ulnar and radial access.(7) A later single-center cohort demonstrated a high procedural success rate (>92 %) with low complication incidence, including minimal hematoma and negligible ischemic events when ulnar access was used after radial failure.(8) These findings underpin the rationale for choosing ulnar access in complex scenarios with exhausted conventional sites among skilled and experience operators, in a bailout setting.(9,10,11)

Crossing the heavily calcified LAD occlusion presented a further challenge, and indeed microcatheter-wire combos, such as the one hereby presented based on Finecross MG and Samurai guidewire, are well suited for tight, tortuous, and calcified lesions.(12,13) Although robust trials are lacking, interventional consensus supports this pairing due to its low profile, high torqueability, and navigation precision, reducing risks of vessel trauma or perforation. In acute settings, where contrast use must be minimized and speed is critical, such combinations are invaluable.

Coronary device delivery across rigid calcific plaques often exceeds the support capacity of standard guiding catheters, and thus guide extension catheters like GuideLiner (Teleflex, Wayne, PA, USA), Guideplus (Nipro, Osaka, Japan), GuideZilla II, and Telescope (Medtronic, Minneapolis, MN, USA) augment support by facilitating deeper intubation and stabilizing device platforms.(14) Although mostly supported by observational reports, their use significantly improves deliverability in anatomically difficult segments, increasingly becoming a standard in complex PCI.(15,16)

Lesion preparation in calcified vessels has evolved significantly over the last decades, shifting from traditional atherectomy techniques (rotational, orbital), which may carry increased risk of embolization and no-reflow phenomena, particularly in ACS scenarios, to IVL.(17,18) Indeed, IVL offers a user-friendly and safe non-ablative alternative to atherectomy, fracturing concentric calcium using acoustic pressure waves at low pressure.(18) For instance, the prospective BENELUX-IVL registry, which included over 400 patients, showed comparable technical success and in-hospital MACE rates between ACS and chronic cases.(19) Other studies have also confirmed low complication rates (<1 % perforation) and high procedural success, even with long, heavily calcified lesions typical in STEMI with IVL.(20) Accordingly, these data highlight the expanding role of IVL potential to fill a gap where atherectomy might risk harm.

Finally, this case illustrates the importance of a layered, tool-based strategy in challenging STEMI. While each adjunct—ulnar access, microcatheter-assisted crossing, guide extension, IVL—has demonstrated individual efficacy, their coordinated application in a single emergent case is rare but illustrative. Such synergy maximizes procedural success while minimizing interruptions, complications, and the need for alternative devices. As calcified coronary disease becomes more prevalent, especially in aging populations, the integration of advanced PCI adjunct toolkit into acute STEMI protocols may reduce failure rates and enhance outcomes.

Conclusions

This case highlights the practical value of ulnar access and intravascular lithotripsy in emergent PCI for complex, calcified STEMI lesions. A sequential, tool-integrated strategy enabled safe and effective revascularization when conventional approaches were not feasible. Broader adoption of such niche techniques may enhance outcomes in anatomically and procedurally high-risk acute coronary settings.

Declarations

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Conflict of Interest

The Authors declare that there is no conflict of interest.

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Disclosure

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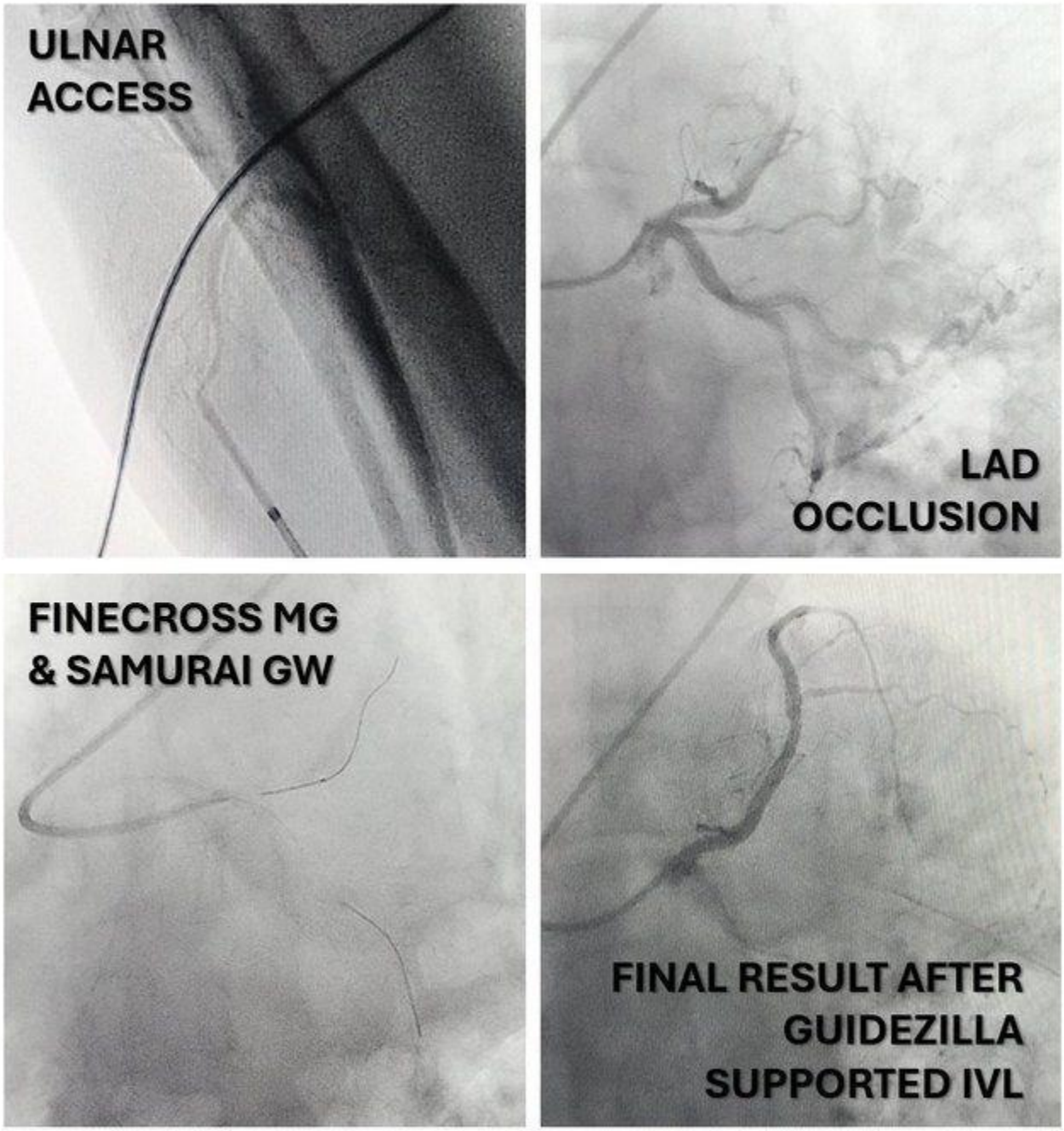
Figure 1

Highlights of primary percutaneous coronary intervention in a challenging left anterior descending culprit lesion.*



*a pertinent video is available at: https://drive.google.com/file/d/1VVVvwLjxW9Yfmw8LZGwufw3MZ4SdKz2C

Table 1

Niche interventional techniques and devices which can prove beneficial in highly selected cases of primary percutaneous coronary intervention (PCI). ACS: acute coronary syndrome; CTO: chronic total occlusion; ISR: in-stent restenosis; IVL: intravascular lithotripsy; PAD: peripheral artery disease; PMID: PubMed ID; STEMI: ST-elevation myocardial infarction.

Technique/ Device	**Purpose**	**Clinical Scenarios**	**Supporting Evidence**	**Estimated frequency of adoption**	**References (provided as PMID)**
Drug-coated balloons	Local antiproliferative therapy without permanent implants	In-stent restenosis, small vessel disease, stent-less strategy in high-bleeding risk	Trials and registries have shown safety and efficacy in ISR and selected de novo lesions; emerging use in STEMI limited but expanding	<5%	30171374 34648080 40662340
Guide extension catheters	Increase support and facilitates device delivery	Calcific lesions, poor guide engagement	Registry-based support for use in complex PCI	<5%	28984768 36061563 36890839
Intravascular imaging	Lesion assessment, calcium quantification, and PCI optimization	Ambiguous angiographic findings, stent failure, left main PCI	Trials have reported improved outcomes with imaging-guided PCI	<20%	33224769 36922062 40863354
IVL	Plaque modification for heavily calcified segments	ACS with concentric calcium, resistant lesions	Trials and registries have demonstrated safety and efficacy	<1%	39201049 38482928 40359895
Laser aherectomy	Photoablation of thrombus, plaque, or under-expanded stents	ISR, thrombotic occlusions, no-reflow	Case series support use; limited randomized data; niche tool for bailout scenarios	<1%	28582200 39569386 40568277
Microcatheters	Lesion crossing support in tortuous or calcified anatomy	STEMI with challenging vessel morphology	Widely used; interventional consensus guides selection	<5%	30929525 35355971 37984326
Rotational atherectomy	Ablative calcium debulking using high-speed rotating burrs	Severely calcified, undilatable lesions in stable or select ACS cases	Supported by registries; limited data in STEMI due to embolic risks	<1%	39569386 40217654 40356295

Scoring balloons	Controlled plaque modification through circumferential scoring elements	Fibrotic, calcified, or resistant lesions; ISR	Observational studies suggest efficacy in achieving optimal stent expansion and facilitating lesion preparation	<1%	29162780 34432207 39742224
Small balloon low-pressure pullback	Disrupts intraluminal thrombus or resistant occlusion using mechanical traction	STEMI with balloon-uncrossable lesions, heavy thrombotic burden	Emerging evidence from case reports; safe and effective in resistant lesions	<1%	40384375
Specialty guidewires	High torque and penetration capability in calcific lesions	CTO-like lesions, long occlusions in acute settings	Commonly used in complex PCI; operator preference-dependent	<20%	27316507 39276961 40223600
Super high-pressure balloons	Ultra high-pressure non-compliant dilation to crack resistant lesions	Balloon-uncrossable or under-expanded stents, heavy calcification	Case reports and registries support use in undilatable lesions	<1%	36842933 39806843 40700542
Thrombectomy	Removal of thrombus to improve flow and reduce embolization risk	Large thrombus burden in STEMI, no-reflow, slow-flow phenomena	While randomized trials do not support its routine use, selective application remains	<5%	16022970 26892810 38673564
Ulnar artery access	Alternative vascular access when radial/femoral sites are unusable	Severe PAD, prior radial occlusion, failed conventional access	Systematic reviews and cohort studies support feasibility and safety	<1%	21446376 29388387 35037897

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