



LESSER FOR THE BETTER OUTCOME: OPTICAL COHERENCE TOMOGRAPHY-GUIDED MINIMAL-CONTRAST ANGIOPLASTY IN A HIGH-RISK PATIENT WITH EVOLVING CONTRAST-INDUCED NEPHROPATHY

Cardiology

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ABSTRACT

Background: Contrast-induced nephropathy (CIN) remains one of the most common and preventable complications of diagnostic and therapeutic coronary procedures, and it disproportionately threatens patients who present with acute myocardial infarction superimposed on pre-existing renal impairment. **Case Summary:** A 76-year-old man with a background of alcohol use presented with chest pain, breathlessness and palpitations. He was diagnosed with an evolved inferior wall myocardial infarction with mild left ventricular systolic dysfunction and an elevated baseline creatinine of 1.9 mg/dl (eGFR 36 ml/min/1.73m²). Diagnostic coronary angiography using a low-osmolar contrast agent (10 ml) identified a severe right coronary artery (RCA) lesion; post-procedure creatinine rose to 2.4 mg/dl (eGFR 27 ml/min/1.73m², Mehran risk score 8), signalling an early contrast-induced nephropathy. Rather than proceed with a further contrast load, the patient underwent optical coherence tomography (OCT)-guided percutaneous coronary intervention using intracoronary saline as the imaging flush, avoiding additional iodinated contrast. OCT confirmed a critical stenosis (minimal lumen area 0.93 mm², area stenosis 82.9%) and guided stent sizing and deployment. The procedure restored TIMI III flow, and serum creatinine improved to 1.8 mg/dl at follow-up. **Conclusion:** In patients with borderline renal reserve who develop rising creatinine after an initial contrast load, saline-flush OCT-guided angioplasty is a feasible strategy that allows both accurate lesion assessment and safe revascularisation while sparing the kidneys further contrast exposure — reinforcing the principle that "lesser" contrast can deliver a "better" outcome.

KEYWORDS

Contrast-Induced Nephropathy; Optical Coherence Tomography; Minimal-Contrast PCI; Inferior Wall Myocardial Infarction; Mehran Risk Score; Chronic Kidney Disease

INTRODUCTION

Contrast-induced nephropathy (CIN) is conventionally defined as a rise in serum creatinine of ≥ 0.5 mg/dl or $\geq 25\%$ from baseline within 48–72 hours of intravascular iodinated contrast exposure, in the absence of an alternative cause. It is the third most common cause of hospital-acquired acute kidney injury and is associated with prolonged hospitalisation, increased cost of care and higher short- and long-term mortality, particularly in patients undergoing primary or urgent percutaneous coronary intervention (PCI) for acute myocardial infarction¹.

The Mehran risk score remains the most widely used bedside tool for stratifying a patient's likelihood of developing CIN before a coronary procedure, incorporating variables such as hypotension, intra-aortic balloon pump use, congestive heart failure, age, anemia, diabetes, contrast volume and baseline renal function; higher scores correlate with a step-wise rise in both CIN and mortality.

When a diagnostic angiogram itself provokes a measurable rise in creatinine, the interventional cardiologist faces a dilemma — the patient remains symptomatic and anatomically revascularisable, yet further contrast exposure carries a tangible risk of precipitating overt renal failure. Imaging-guided, minimal- or zero-contrast percutaneous coronary intervention using intravascular ultrasound (IVUS) or optical coherence tomography (OCT) with a non-iodinated flush medium (saline or low-molecular-weight dextran) has emerged as a strategy to reconcile these competing priorities and has been described in a small but growing series of case reports in patients with advanced chronic kidney disease. We present one such case, in which OCT-guided, saline-flush angioplasty of the right coronary artery allowed successful revascularization of an evolved inferior wall infarct while allowing early renal recovery.

Case Presentation

A 76-year-old man with a history of alcohol use presented with chest pain, shortness of breath and palpitations. Clinical evaluation was consistent with an evolved inferior wall myocardial infarction (IWMI) in sinus rhythm. Transthoracic echocardiography demonstrated regional wall motion abnormality involving the basal-to-mid inferoseptal segments, mild left ventricular systolic dysfunction, grade I diastolic dysfunction and mild aortic regurgitation. Given his symptom burden and echocardiographic findings, he was planned for coronary angiography (CAG).

Baseline investigations revealed a serum creatinine of 1.9 mg/dl (estimated glomerular filtration rate [eGFR] 36 ml/min/1.73m²), placing him at heightened baseline risk of contrast-induced nephropathy. He was pre-hydrated with intravenous fluids, and CAG was performed using a low-osmolar contrast agent with continued intravenous hydration.

Investigations and Coronary Angiography

Coronary angiography, performed with 10 ml of low-osmolar contrast, revealed a severe lesion in the right coronary artery (RCA) — the vessel supplying the infarcted inferior wall. Post-procedure surveillance identified a rise in serum creatinine to 2.4 mg/dl, with a corresponding fall in eGFR to 27 ml/min/1.73m² — an early biochemical signature of contrast-induced nephropathy. The Mehran risk score was calculated at 8 (moderate-to-high risk category). Renal ultrasonography was unremarkable, and urine output remained satisfactory throughout, arguing against an alternative structural or obstructive cause for the creatinine rise.

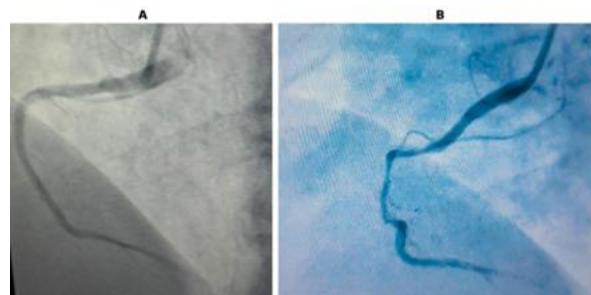


Figure 1. Right coronary artery angiography. (A) Baseline angiogram showing a severe stenosis in the mid-RCA. (B) Angiogram following optical coherence tomography-guided, saline-flush percutaneous coronary intervention, demonstrating a widely patent vessel with restoration of TIMI III flow.

Management: OCT-Guided, Saline-Flush Angioplasty

Because the patient remained symptomatic with an anatomically significant, infarct-related RCA lesion, yet had already demonstrated a contrast-related rise in creatinine, the decision was made to proceed with percutaneous coronary intervention while minimizing further contrast exposure. Optical coherence tomography was used to characterize the lesion and to guide wiring, balloon sizing and stent

optimization, with intracoronary saline substituted for contrast as the imaging flush medium — thereby limiting the cumulative iodinated-contrast burden to the 10 ml already administered during diagnostic angiography.

OCT pullback through the RCA lesion confirmed a critical stenosis, with a minimal lumen area of 0.93 mm² and an area stenosis of 82.9%, flanked by reference lumen areas of 4.77 mm² (proximal) and 6.11 mm² (distal) over a lesion length of 38.8 mm. These measurements guided balloon and device sizing without any additional contrast injection.

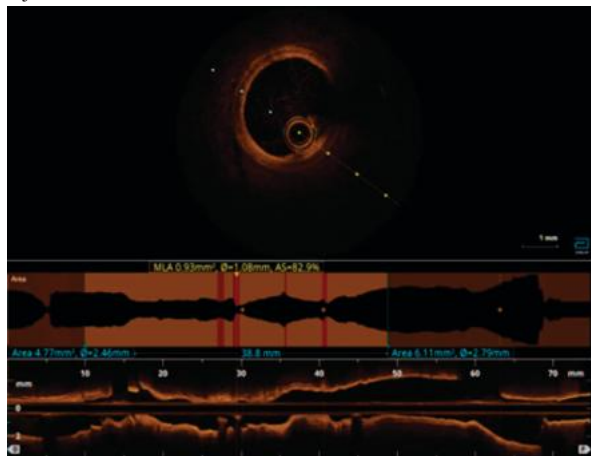


Figure 2. Representative optical coherence tomography (OCT) pullback of the right coronary artery culprit lesion. The cross-sectional frame (top) and longitudinal reconstruction (bottom) demonstrate a minimal lumen area of 0.93 mm² with 82.9% area stenosis, bracketed by proximal (4.77 mm²) and distal (6.11 mm²) reference segments — measurements that allowed saline-flush, contrast-sparing device sizing and stent optimization.

Following balloon angioplasty and stenting, angiography confirmed restoration of brisk, TIMI grade III flow through the RCA (Figure 1B), with an excellent final angiographic result achieved without incremental contrast exposure beyond the diagnostic study.

Outcome and Follow-up

The patient's renal function was tracked closely across the three phases of his hospital course: on admission, after diagnostic angiography, and after the OCT-guided PTCA.

The patient's serum creatinine levels were closely monitored throughout the periprocedural period. Upon initial admission, baseline serum creatinine was recorded at 1.9 mg/dL. Following diagnostic angiography, a transient elevation to 2.4 mg/dL was noted, reflecting mild acute kidney injury. However, after optical coherence tomography (OCT)-guided percutaneous transluminal coronary angioplasty (PTCA) and targeted supportive management, renal function improved, with serum creatinine decreasing to 1.8 mg/dL prior to discharge.

Serum creatinine, which had risen after the initial diagnostic study, improved to below the admission baseline following the contrast-sparing intervention, and urine output remained well maintained throughout. The patient was discharged in a haemodynamically stable condition with restored epicardial flow and no requirement for renal replacement therapy.

DISCUSSION

This case illustrates a strategy that is increasingly relevant to interventional practice: when a diagnostic procedure itself produces an early rise in creatinine in a patient who still requires revascularization, imaging-guided, contrast-sparing PCI offers a way to complete the necessary intervention without compounding renal injury¹². Several case reports have now described dextran- or saline-based OCT-guided zero- or ultra-low-contrast PCI in patients with advanced chronic kidney disease, with favourable procedural and short-term renal outcomes, and pooled analyses of these small series suggest that contrast-induced acute kidney injury rates with imaging-first strategies compare favourably with historical CIN rates after conventional angiography.

The rationale rests on three principles that this case demonstrates in combination. First, intravascular imaging (OCT or IVUS) provides cross-sectional lumen and reference measurements — here, a minimal lumen area of 0.93 mm² with 82.9% area stenosis — that are at least as precise as angiographic estimation for sizing balloons and stents, without requiring repeated contrast injections to confirm apposition or expansion. Second, substituting saline (or low-molecular-weight dextran) for contrast as the OCT flush medium removes the largest single source of incremental contrast volume during PCI, since OCT pullbacks conventionally rely on contrast to clear blood from the vessel lumen³. Third, co-registration of the OCT pullback with the existing angiographic road-map, together with the use of bony or catheter landmarks, allows accurate stent positioning even with markedly reduced fluoroscopic contrast use.

The Mehran risk score, calculated at 8 in this patient, placed him in a category associated with a substantially elevated risk of CIN and downstream cardiovascular and renal morbidity if a conventional, contrast-heavy PCI strategy had been pursued. Adequate periprocedural hydration — instituted both before diagnostic angiography and continued through the interventional stage — together with the minimal-contrast strategy, likely both contributed to the recovery in renal function observed here⁴. It is difficult to fully separate the relative contributions of hydration and contrast avoidance in a single case, and this remains an acknowledged limitation of any single-patient report.

This case is illustrative rather than definitive: it is a single-patient observation without a comparator arm, and the follow-up creatinine value represents a short-term endpoint rather than sustained renal outcome data⁵. Nonetheless, it adds to a small but consistent body of literature suggesting that OCT-guided, contrast-sparing angioplasty is technically feasible, and it offers a practical bedside illustration of how such a strategy can be deployed in a real-world patient who had already manifested early contrast-induced renal injury — precisely the scenario in which clinicians are often most reluctant to proceed with further intervention.

Take-Home Messages

- Contrast-induced nephropathy is a common and consequential complication of diagnostic and therapeutic coronary procedures, particularly in patients with pre-existing renal impairment undergoing angiography for acute myocardial infarction.
- Adequate peri-procedural hydration remains a foundational preventive measure for CIN.
- Intravascular imaging (OCT/IVUS) should be preferred over repeated contrast injections for lesion assessment and stent optimisation in patients at high risk of CIN⁶.
- Practical steps to reduce contrast dose include imaging-guided sizing, co-registration of angiography with intravascular imaging, use of bony or catheter landmarks, and construction of a "coronary skeleton" road-map before intervention.
- In carefully selected patients who develop an early creatinine rise after diagnostic angiography, saline-flush OCT-guided PCI can allow safe completion of revascularisation while sparing further contrast exposure.

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