When PCI is the Preferred Revascularization Strategy for Unprotected Left Main Coronary Disease

Michael S. Lee, MD, FACC, FSCAI
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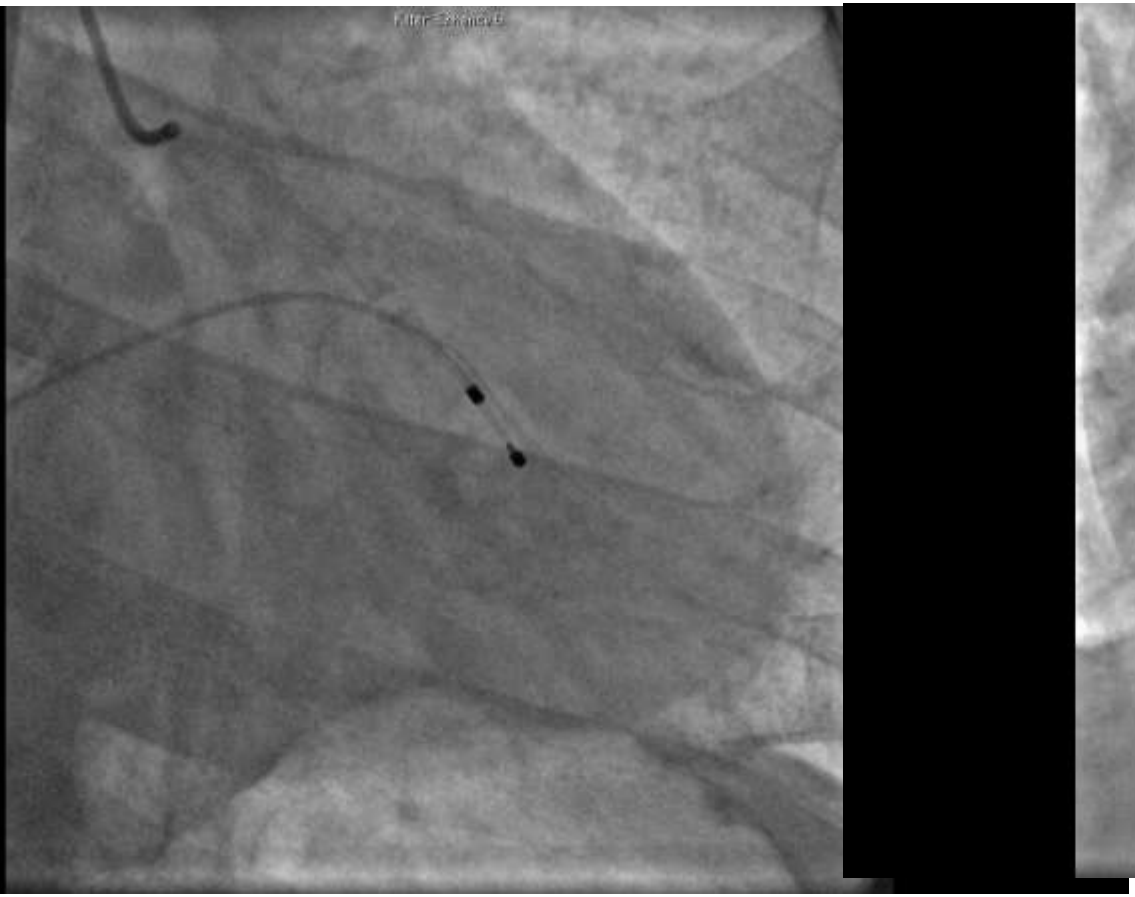
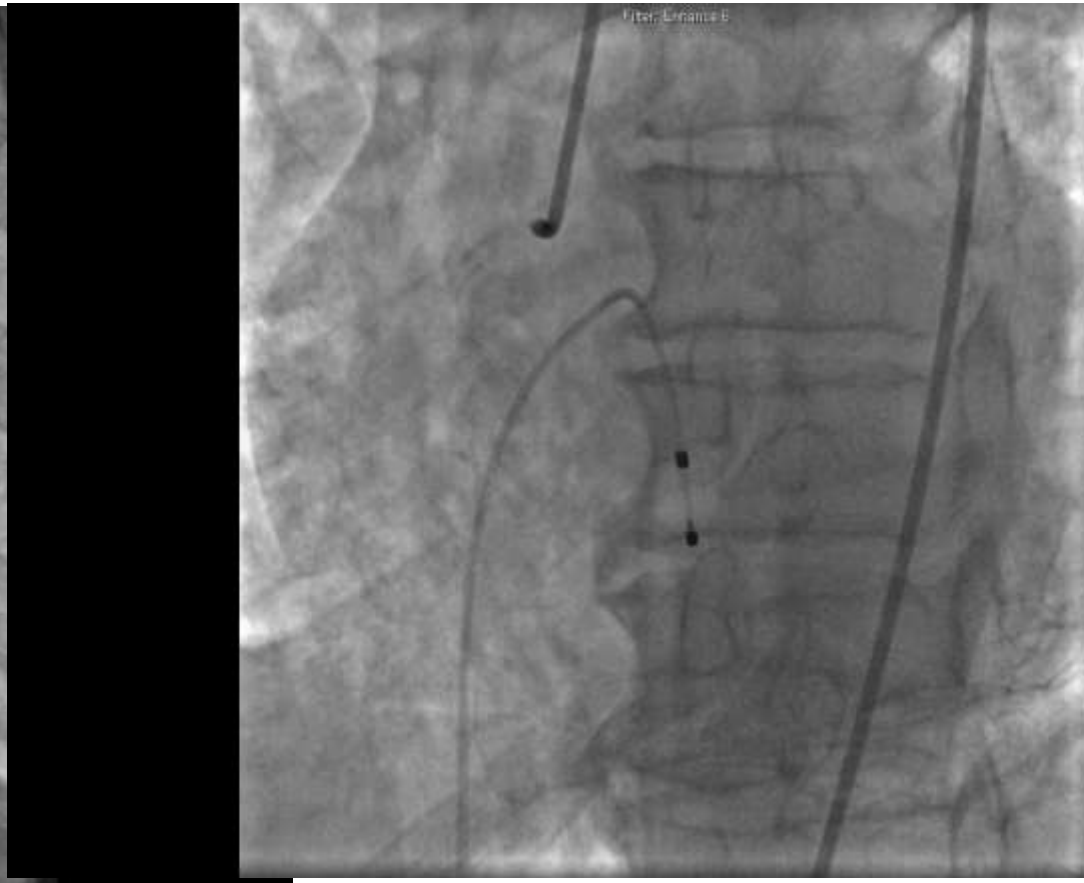
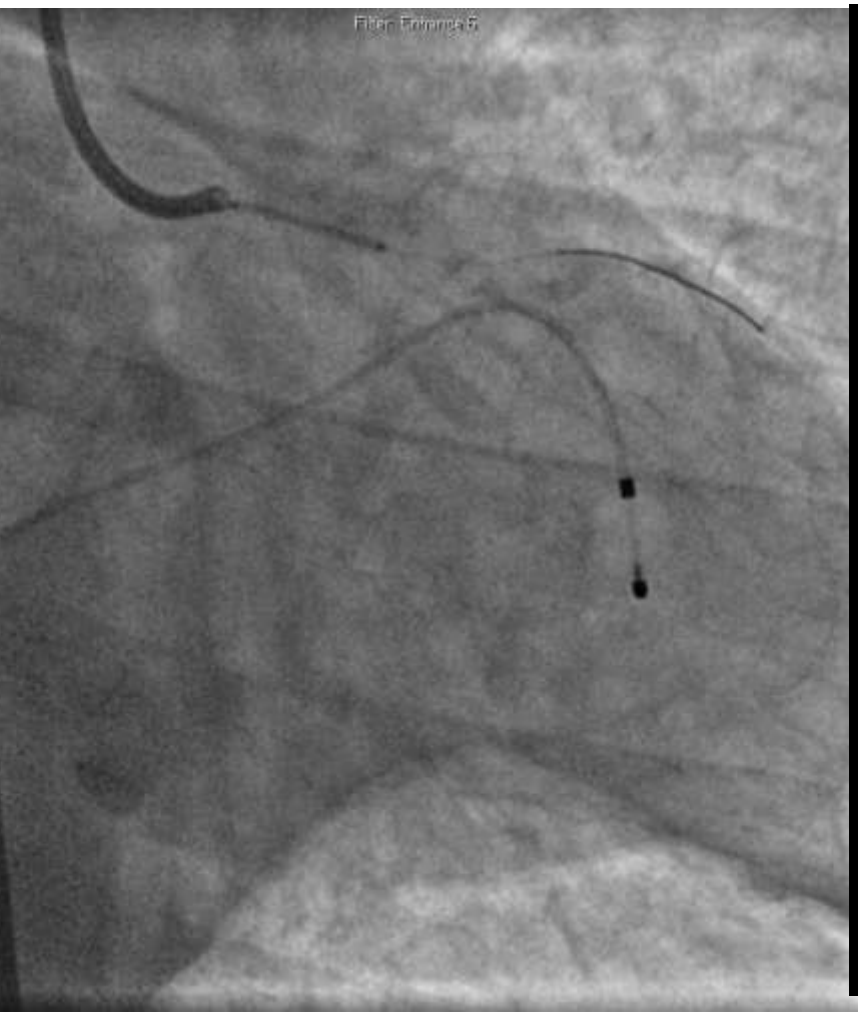
ULMCA PCI in Myocardial Infarction

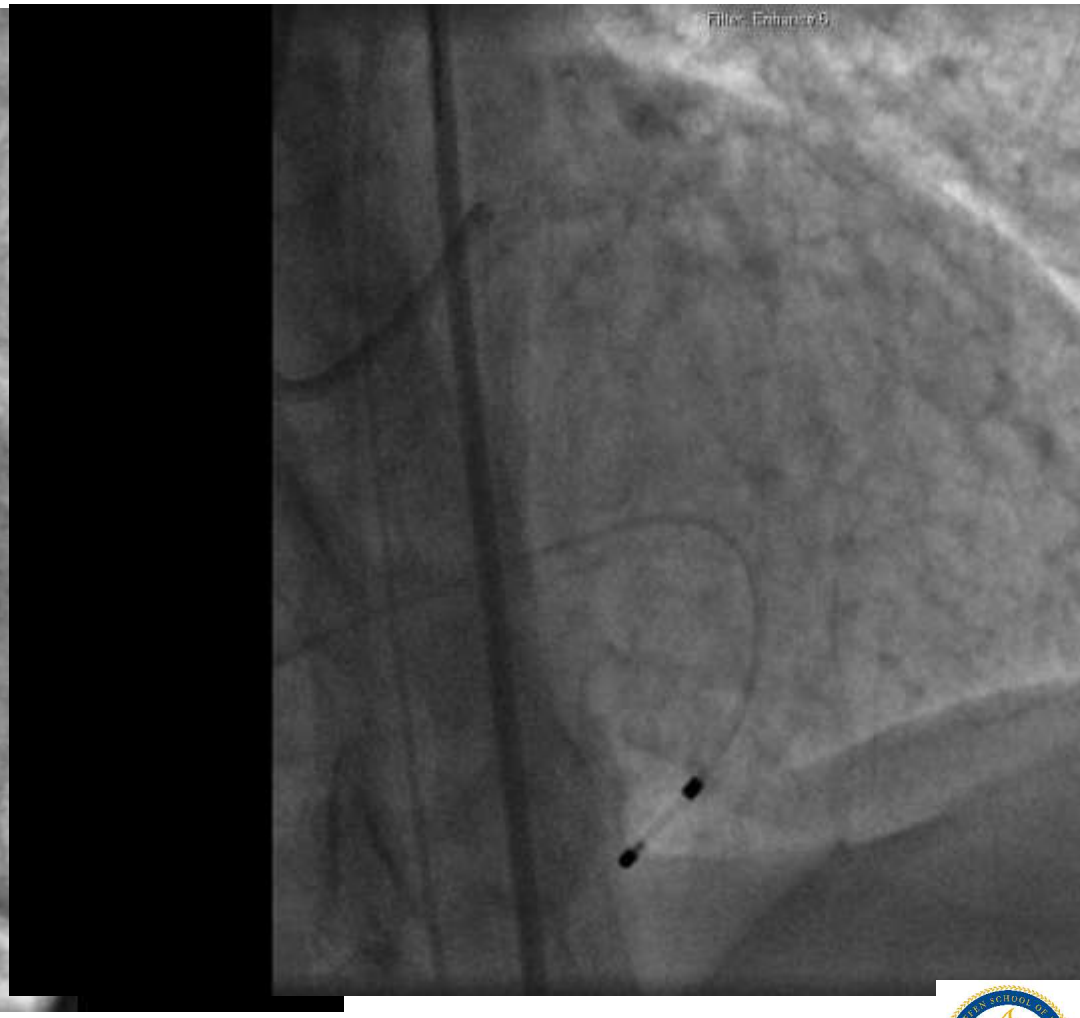




Acute left main occlusion occurs in 0.8% of STEMI

ULMCA PCI in Myocardial Infarction





ULMCA PCI in Myocardial Infarction

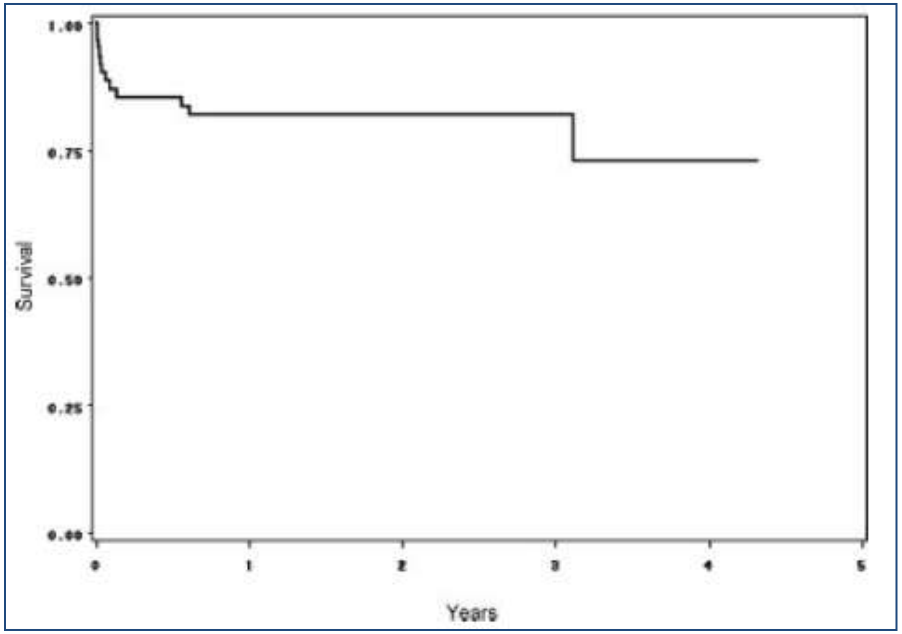
Multicenter International Registry of Unprotected Left Main Coronary Artery Percutaneous Coronary Intervention With Drug-Eluting Stents in Patients With Myocardial Infarction

Michael S. Lee,[1*] MD, Dario Sillano,[2] MD, Azeem Latib,[3] MD, Alaide Chieffo,[3] MD, Giuseppe Biondi Zoccai,[2] MD, Ravi Bhatia,[1] Imad Sheiban,[2] MD, Antonio Colombo,[3] MD, and Jonathan Tobis,[1] MD

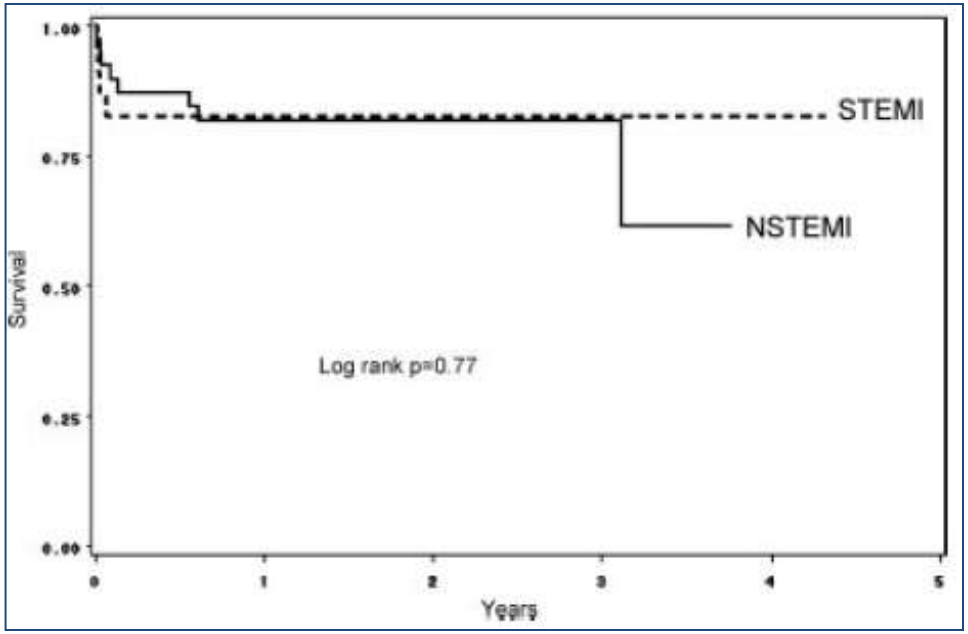
Background: Patients who present with myocardial infarction (MI) and unprotected left main coronary artery (ULMCA) disease represent an extremely high-risk subset of patients. ULMCA percutaneous coronary intervention (PCI) with drug-eluting stents (DES) in MI patients has not been extensively studied. Methods: In this retrospective multicenter international registry, we evaluated the clinical outcomes of 62 consecutive patients with MI who underwent ULMCA PCI with DES (23 ST-elevation MI [STEMI] and 39 non-ST-elevation MI [NSTEMI]) from 2002 to 2006. Results: The mean age was 70 ± 12 years. Cardiogenic shock was present in 24%. The mean EuroSCORE was 10 ± 8. Angiographic success was achieved in all patients. Overall in-hospital major adverse cardiac event (MACE) rate was 10%, mortality was 8%, all due to cardiac deaths from cardiogenic shock, and one patient suffered a periprocedural MI. At 586 ± 431 days, 18 patients (29%) experienced MACE, 12 patients (19%) died (the mortality rate was 47% in patients with cardiogenic shock), and target vessel revascularization was performed in four patients, all of whom had distal bifurcation involvement (two patients underwent repeat PCI and two patients underwent bypass surgery). There was no additional MI. Two patients had probable stent thrombosis and one had possible stent thrombosis. Diabetes [hazard ratio (HR) 4.22, 95% confidence interval (CI) (1.07–17.36), $P = 0.04$), left ventricular ejection fraction [HR 0.94, 95% CI (0.90–0.98), $P = 0.005$), and intubation [HR 7.00, 95% CI (1.62–30.21), $P = 0.009$) were significantly associated with increased mortality. Conclusions: Patients with MI and ULMCA disease represent a very high-risk subgroup of patients who are critically ill. PCI with DES appears to be technically feasible, associated with acceptable long-term outcomes, and a reasonable alternative to surgical revascularization for MI patients with ULMCA disease. Randomized trials are needed to determine the ideal revascularization strategy for these patients.

ULMCA PCI in Myocardial Infarction

Overall Survival

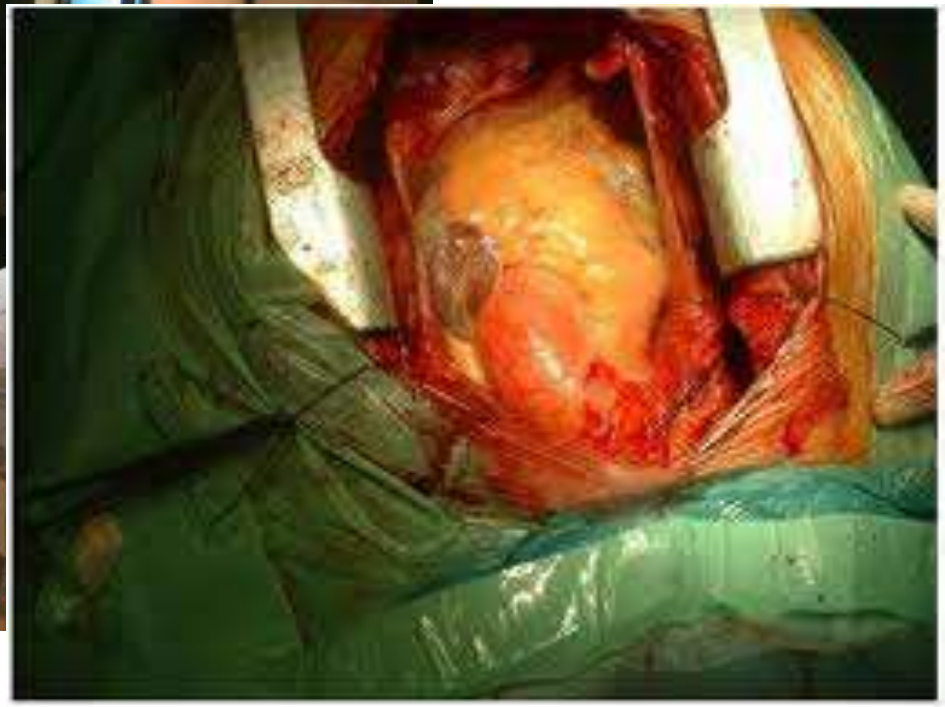


STEMI vs. NSTEMI



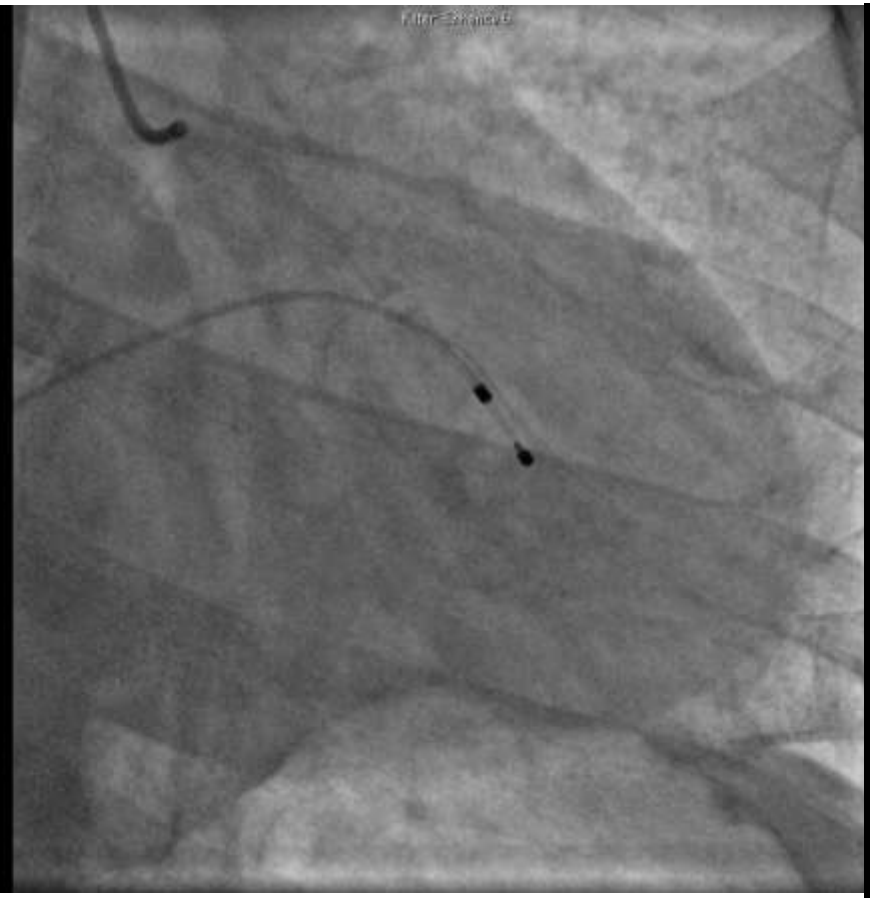
N=62
Cardiogenic shock 24%
All in-hospital deaths from cardiogenic shock

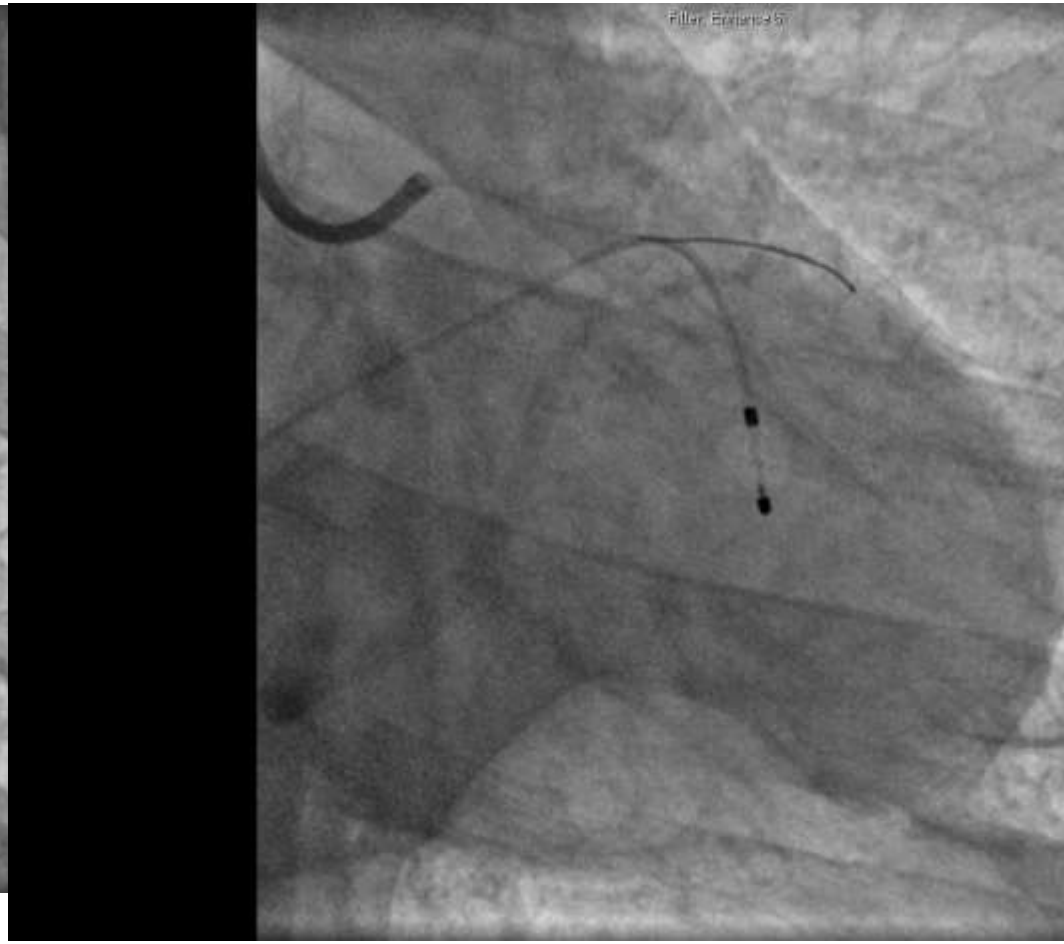
ULMCA PCI in Myocardial Infarction



Minimum 1 hour

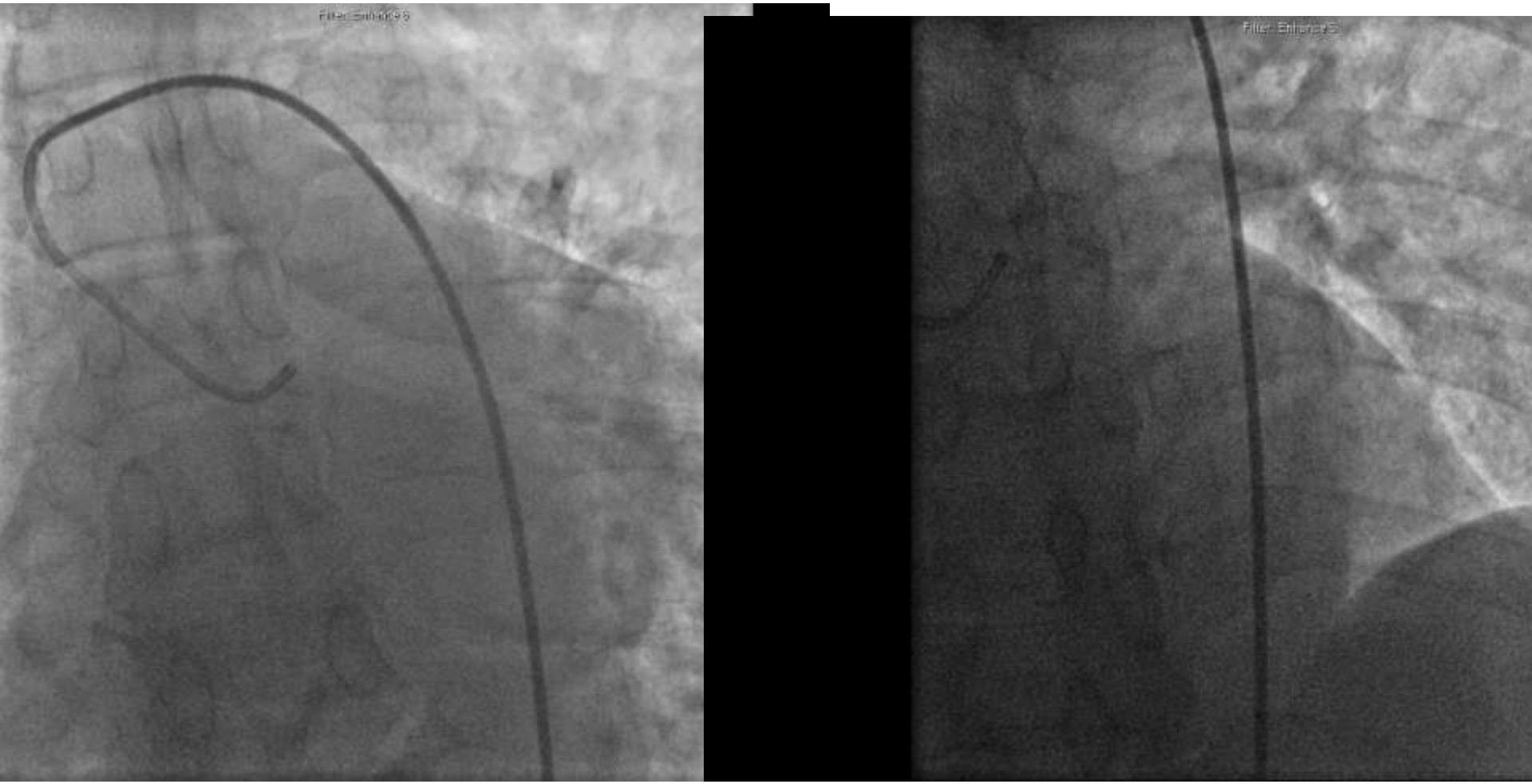
ULMCA PCI in Myocardial Infarction



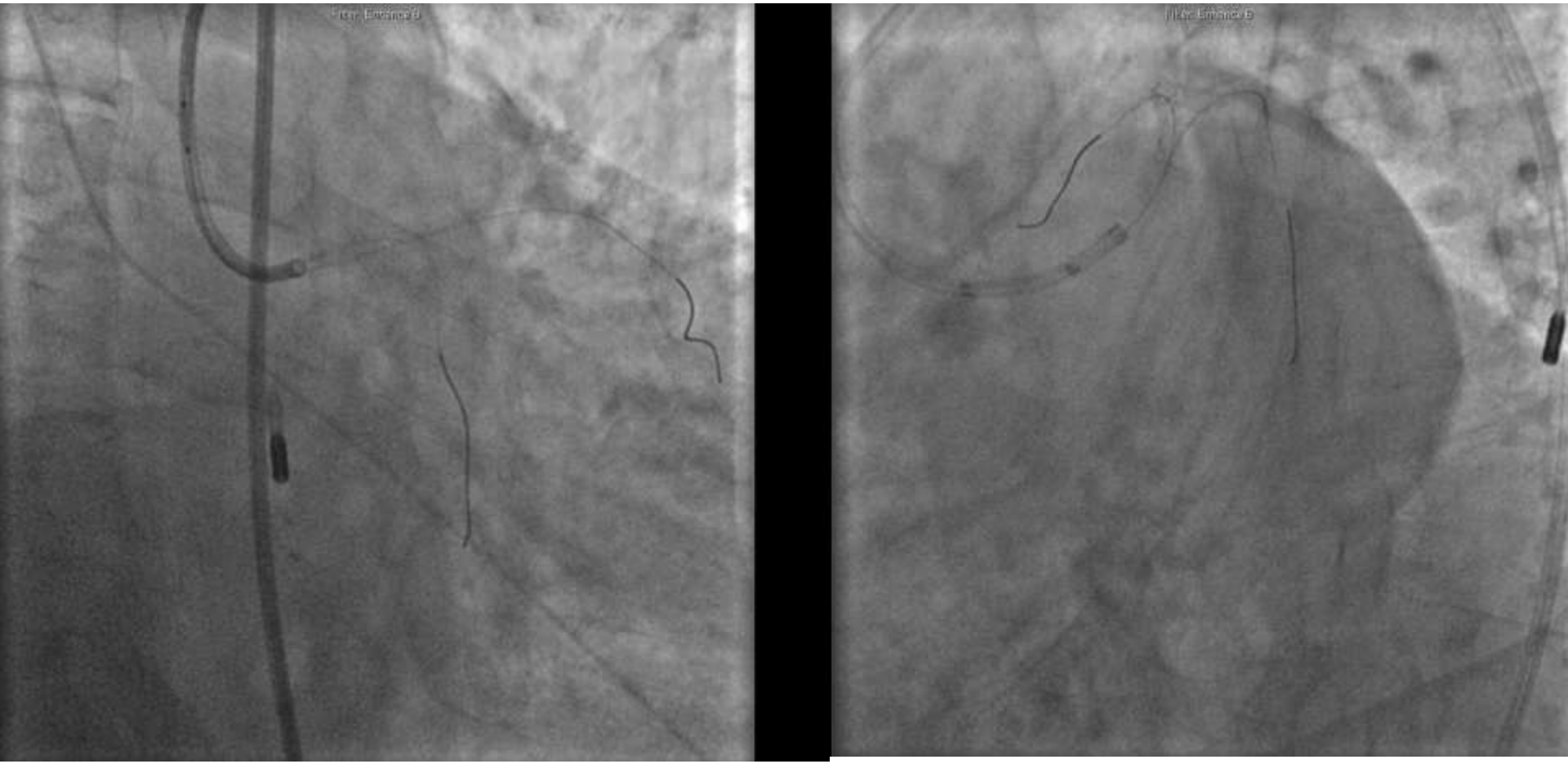


5 minutes!

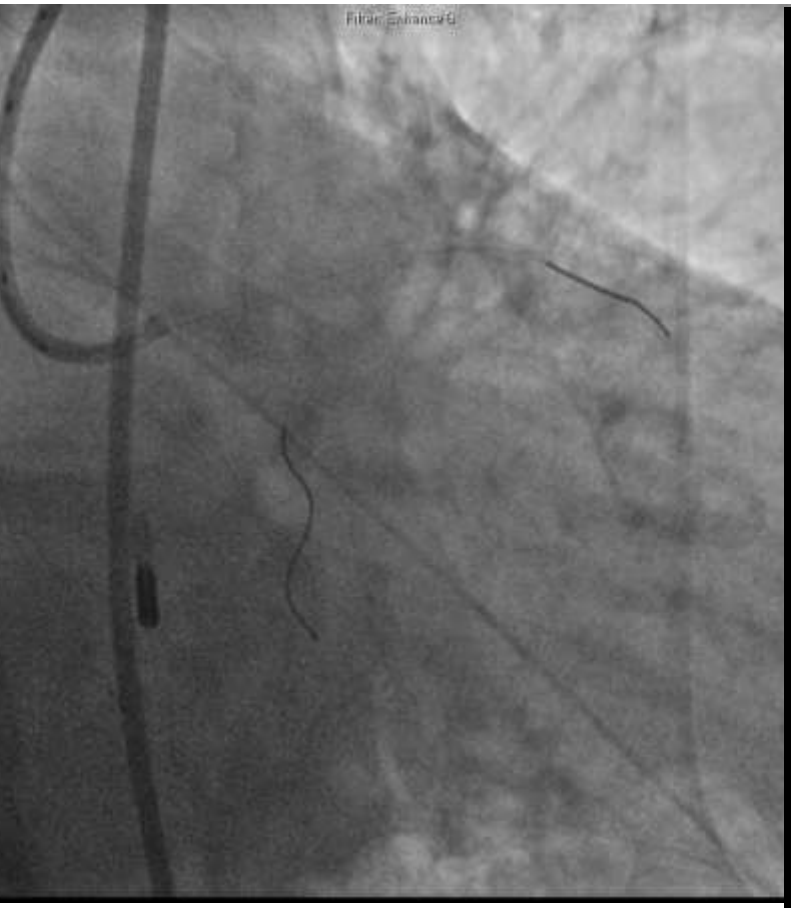
ULMCA PCI in Myocardial Infarction

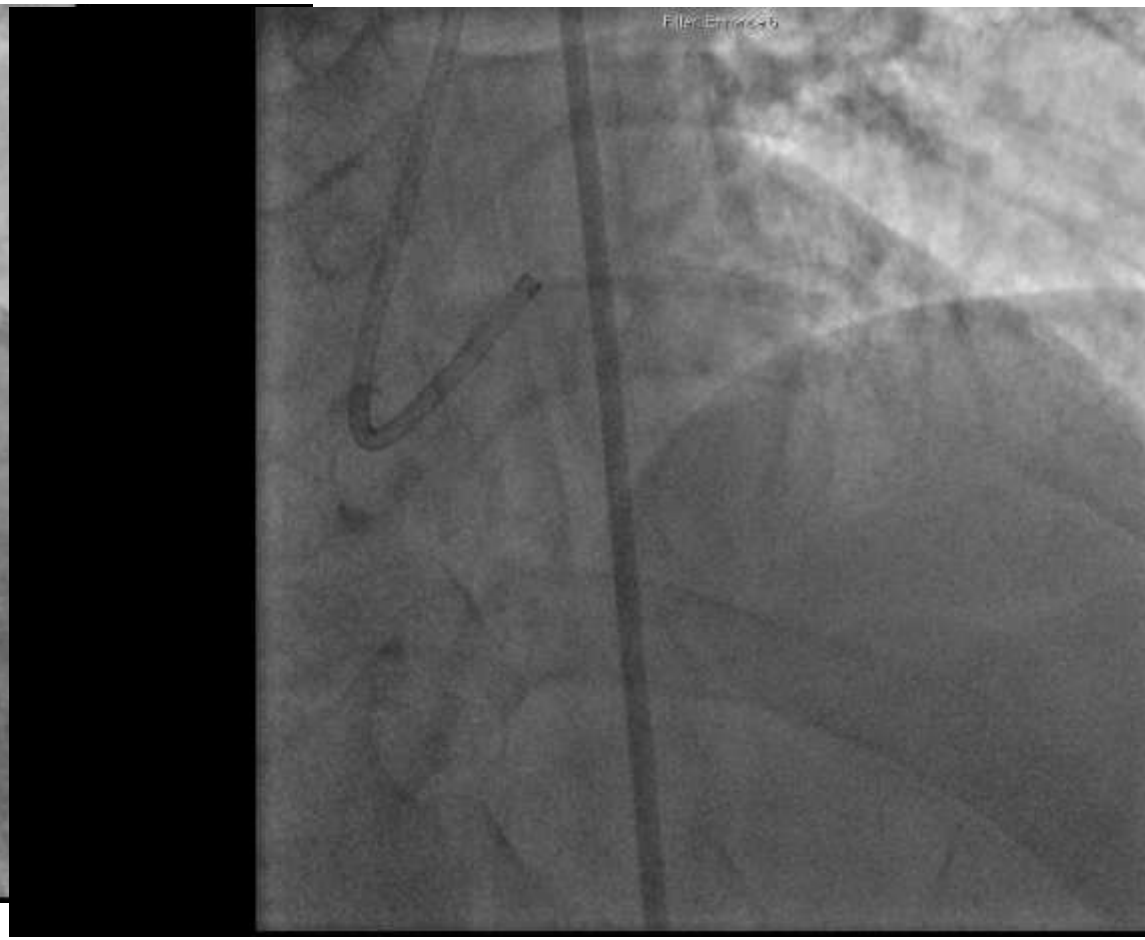


ULMCA PCI in Myocardial Infarction

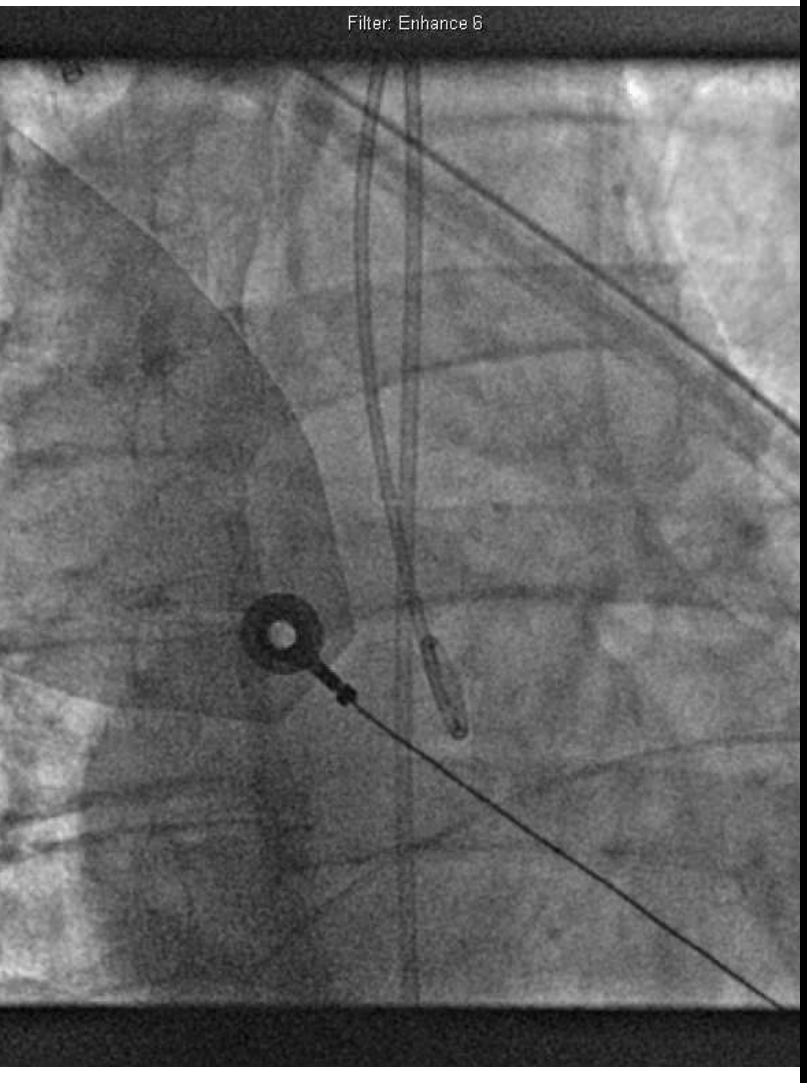


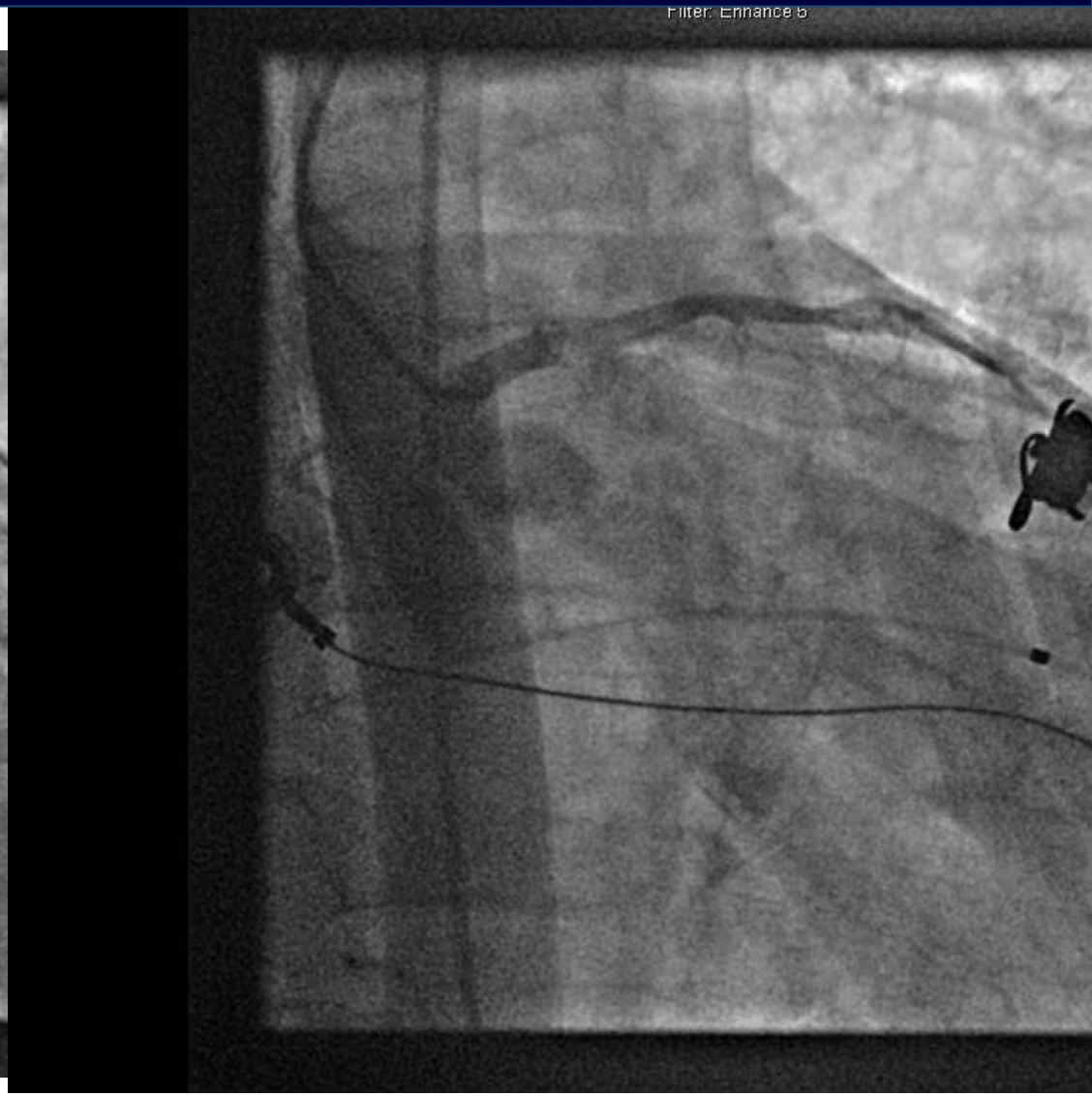
ULMCA PCI in Myocardial Infarction



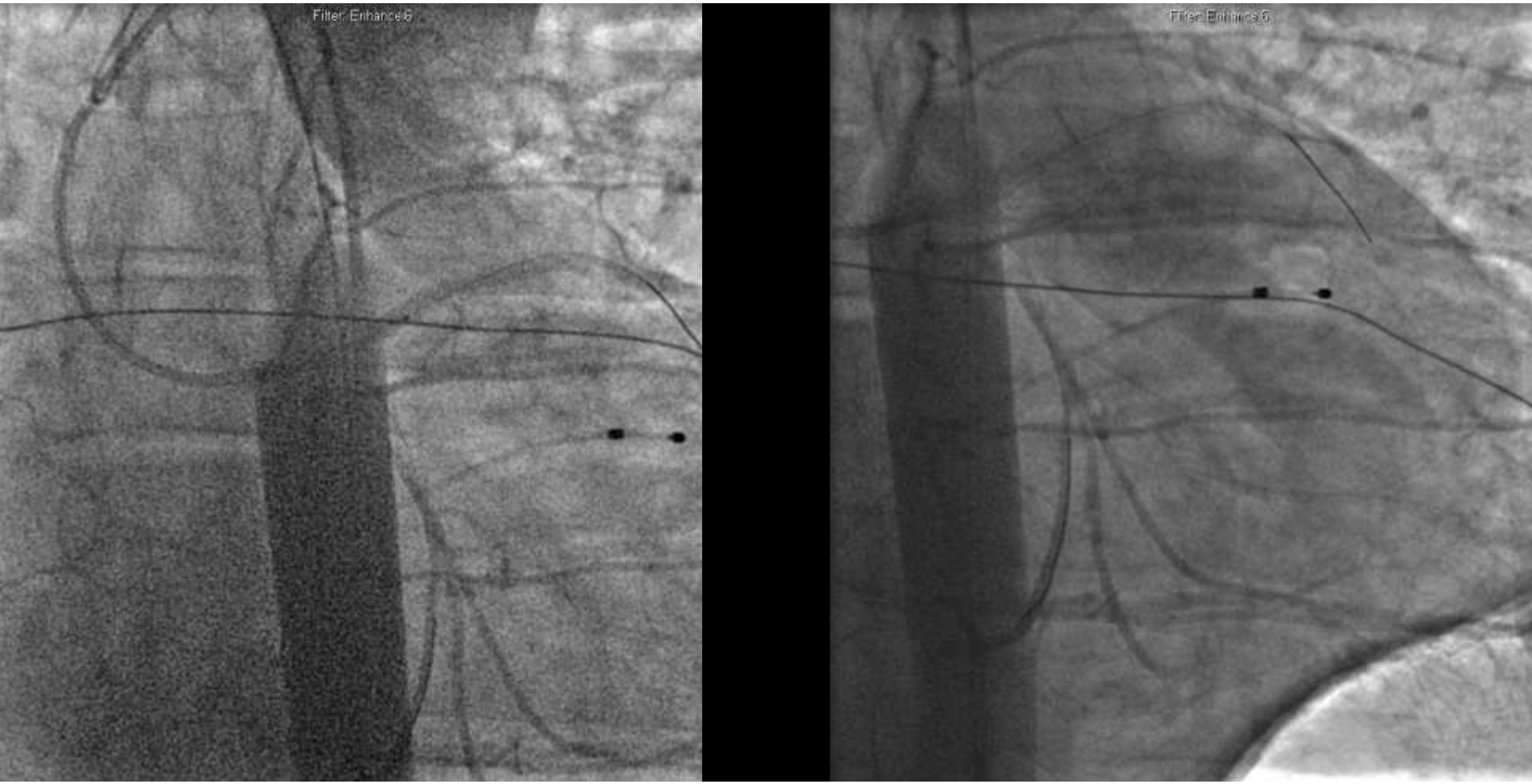


ULMCA PCI in Myocardial Infarction

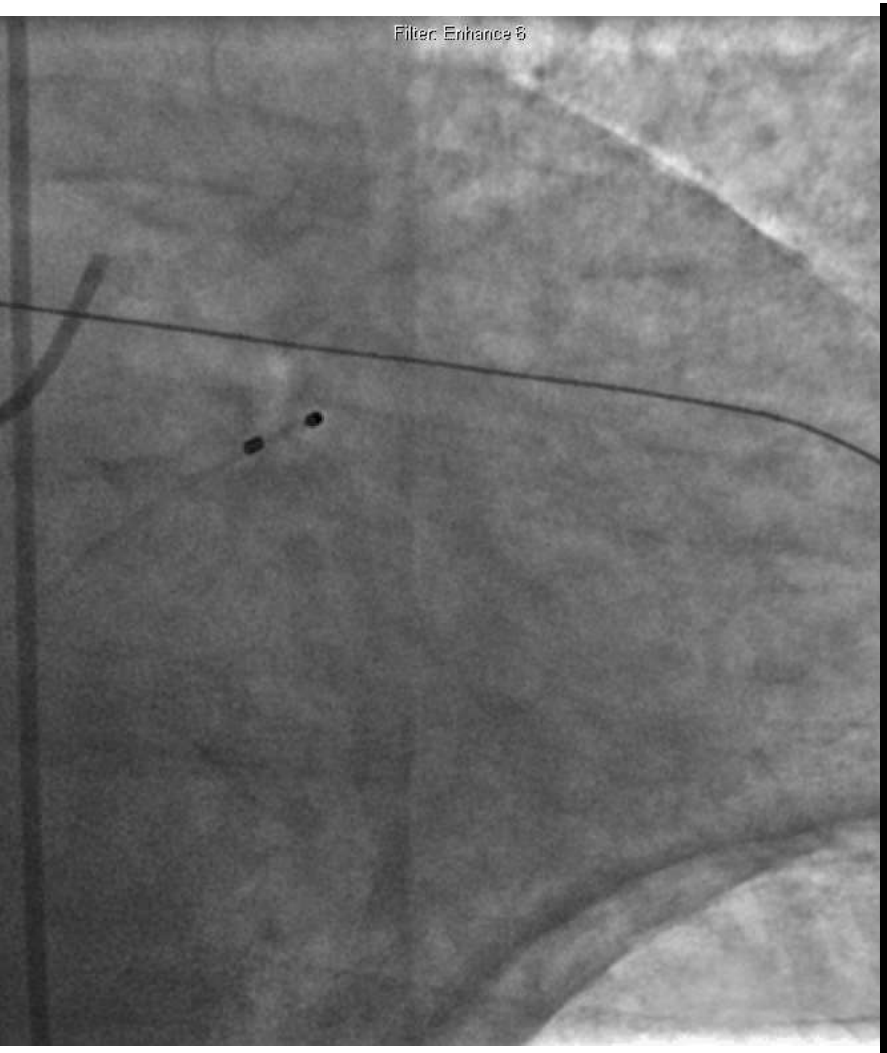


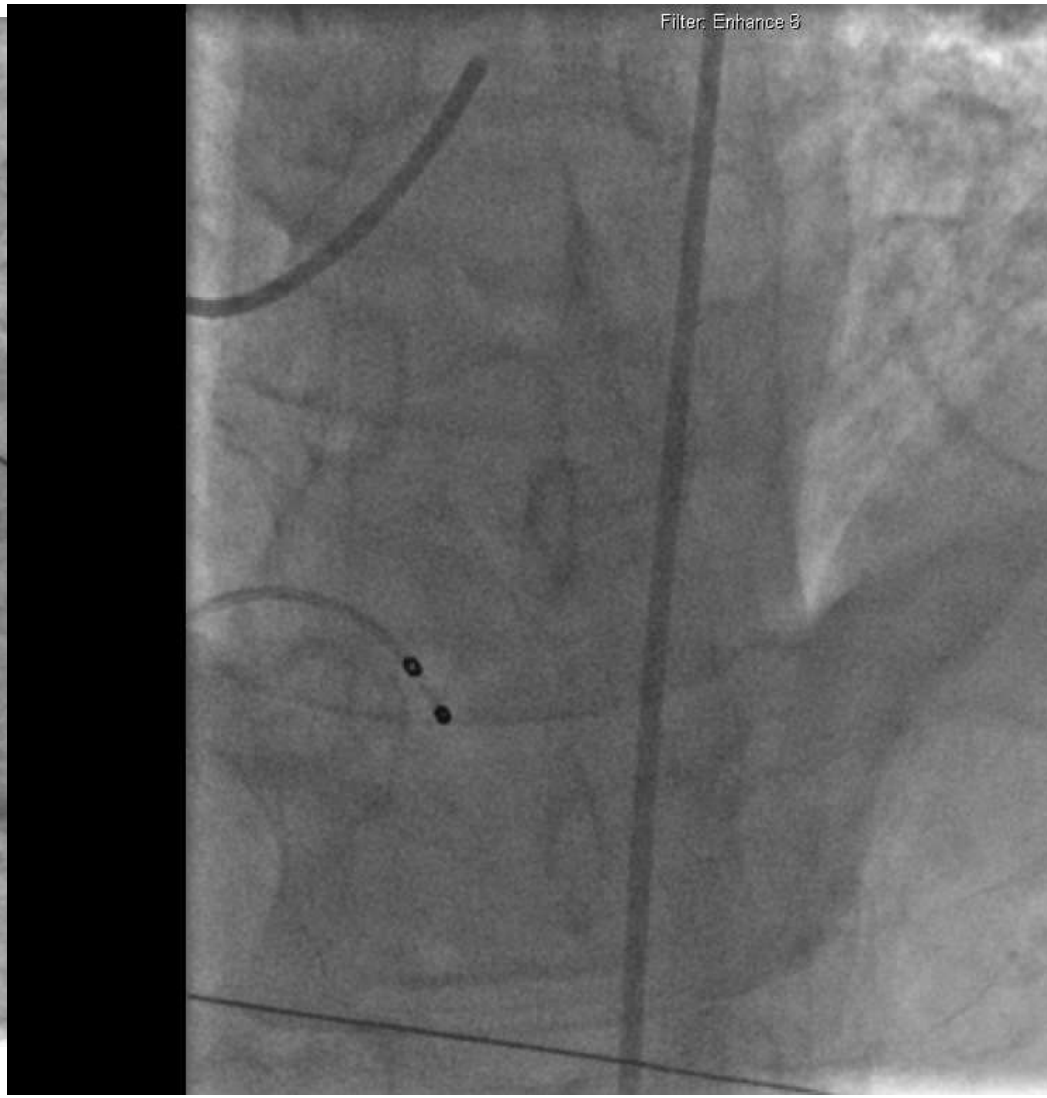


ULMCA PCI in Myocardial Infarction



ULMCA PCI in Myocardial Infarction





ULMCA PCI in Myocardial Infarction

STATE-OF-THE-ART PAPER

Unprotected Left Main Coronary Disease and ST-Segment Elevation Myocardial Infarction

"Absent a randomized trial, it is our belief that physicians and guidelines committees should recognize emergent PCI as the preferred reperfusion modality for selected patients with MI and LMCA occlusion."

pared with CABG with acceptable short- and long-term outcomes, and is associated with a lower risk of stroke. PCI of the ULMCA should be considered as a viable alternative to CABG for selected patients with MI, including those with ULMCA occlusion and less than Thrombolysis In Myocardial Infarction flow grade 3, cardiogenic shock, persistent ventricular arrhythmias, and significant comorbidities. The higher risk of target vessel revascularization associated with ULMCA PCI compared with CABG is an acceptable tradeoff given the primary need for rapid reperfusion to enhance survival. (J Am Coll Cardiol Intv 2010;3:791–5) © 2010 by the American College of Cardiology Foundation

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PRACTICE GUIDELINE

2011 ACCF/AHA/SCAI Guideline for Percutaneous Coronary Intervention

A Report of the American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines and the Society for Cardiovascular Angiography and Interventions

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2.2. Revascularization to Improve Survival: Recommendations

Left Main CAD Revascularization

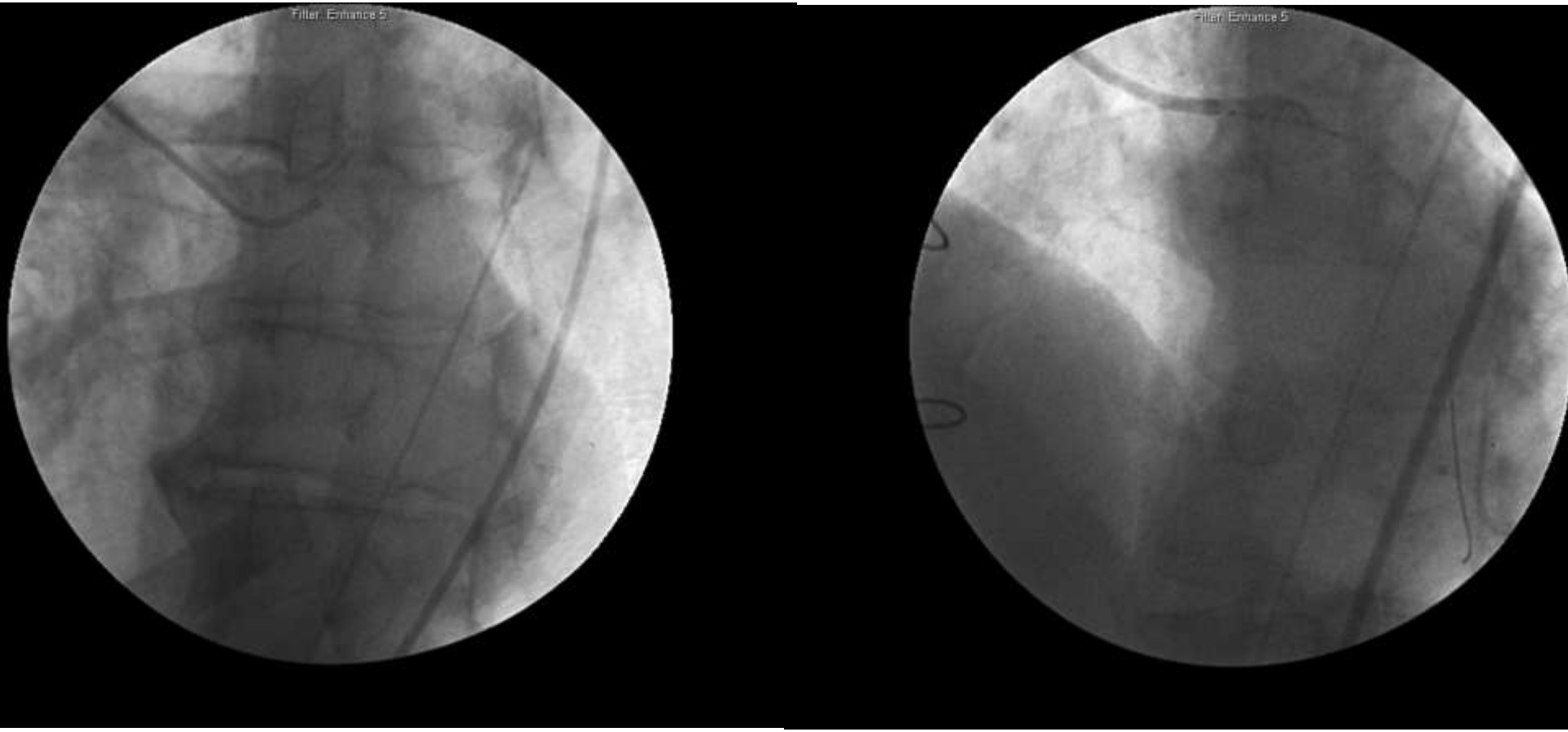
CLASS I

1. CABG to improve survival is recommended for patients with significant (≥50% diameter stenosis) left main coronary artery stenosis (24–30). *(Level of Evidence: B)*

CLASS IIa

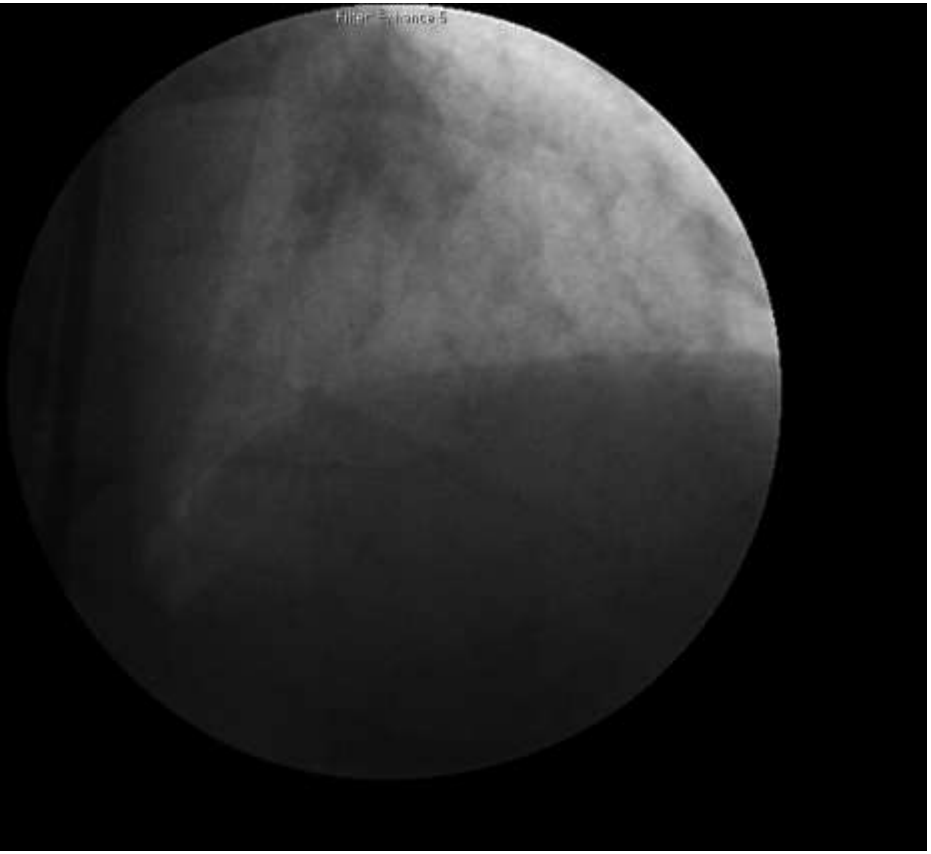
1. PCI to improve survival is reasonable as an alternative to CABG in selected stable patients with significant (≥50% diameter stenosis) unprotected left main CAD with: 1) anatomic conditions associated with a low risk of PCI procedural complications and a high likelihood of good long-term outcome (e.g., a low SYNTAX score [≤22], ostial or trunk left main CAD); and 2) clinical characteristics that predict a significantly increased risk of adverse surgical outcomes (e.g., STS-predicted risk of operative mortality ≥5%) (13,17,19,23,31–48). *(Level of Evidence: B)*
2. PCI to improve survival is reasonable in patients with UA/NSTEMI when an unprotected left main coronary artery is the culprit lesion and the patient is not a candidate for CABG (13,36–39,44,45,47–49). *(Level of Evidence: B)*
3. PCI to improve survival is reasonable in patients with acute STEMI when an unprotected left main coronary artery is the culprit lesion, distal coronary flow is less than TIMI (Thrombolysis In Myocardial Infarction) grade 3, and PCI can be performed more rapidly and safely than CABG (33,50,51). *(Level of Evidence: C)*

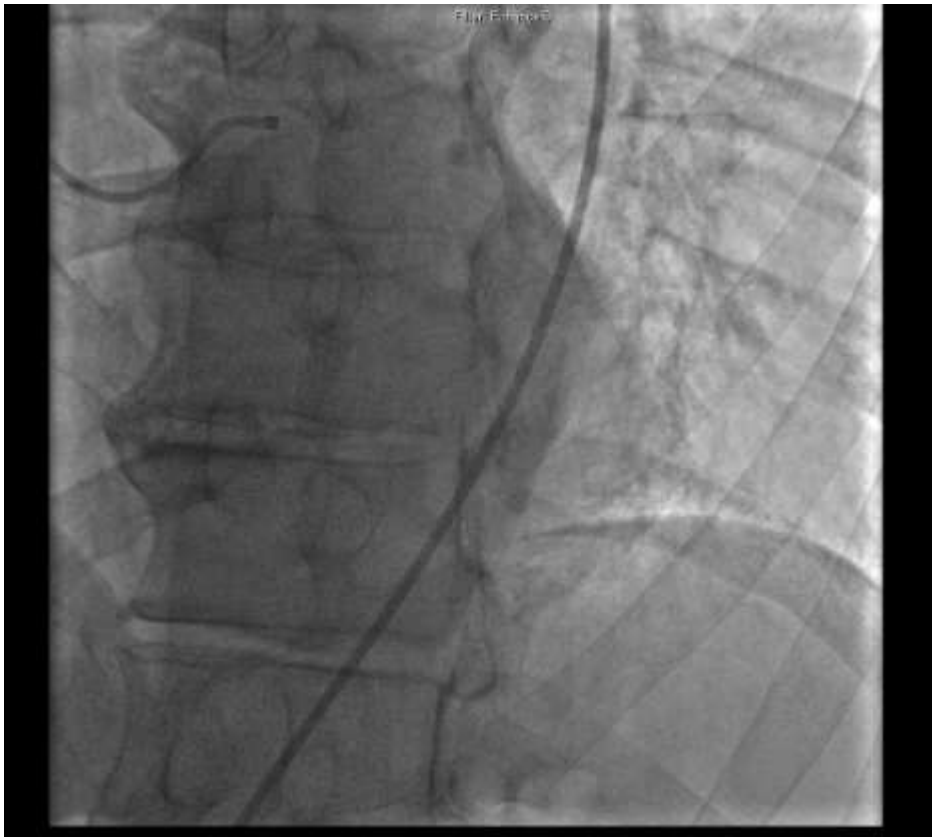
ULMCA PCI in Cardiac Allograft Vasculopathy



ULMCA PCI in Cardiac Allograft Vasculopathy

5-year follow-up



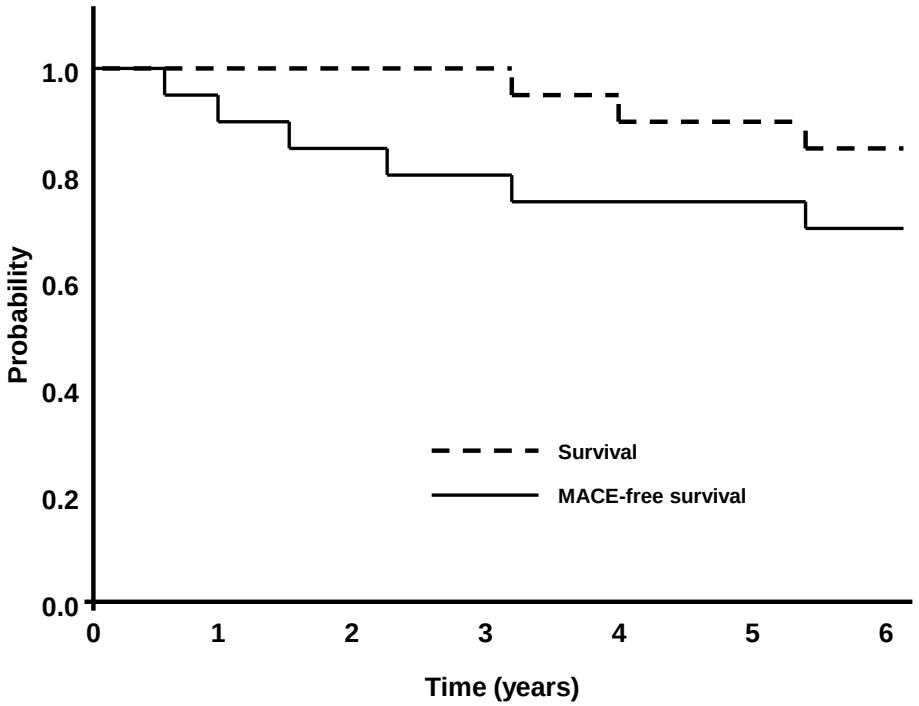


Kaplan-Meier Analysis of Survival and MACE-free Survival

Long-Term Outcomes After Percutaneous Coronary Intervention of Left Main Coronary Artery for Treatment of Cardiac Allograft Vasculopathy After Orthotopic Heart Transplantation

Michael S. Lee, MD*, Tae Yang, MD, William Fearon, MD, Michael Ho, MD, Giuseppe Tarantini, MD, Jola Xhaxho, MD, Mark Weston, MD, Ashkan Ehdaie, MD, LeRoy Rabbani, MD, and Ajay J. Kirtane, MD

The present study evaluated the safety and efficacy of percutaneous coronary intervention (PCI) of the unprotected left main coronary artery (ULMCA) for the treatment of cardiac allograft vasculopathy (CAV) in consecutive unselected patients with orthotopic heart transplantation (OHT). PCI in patients with OHT with CAV has been associated with greater restenosis rates compared to PCI in patients with native coronary artery disease. A paucity of short- and long-term data is available from patients with OHT who have undergone PCI for ULMCA disease. The present retrospective, multicenter, international registry included 21 patients with OHT and CAV who underwent ULMCA PCI from 1997 to 2009. Angiographic success was achieved in all patients. Drug-eluting stents were used in 14 of the 21 patients. No major adverse cardiac events or repeat OHT occurred within the first 30 days. At a mean follow-up of 4.9 ± 3.2 years, 3 patients (14%) had died, myocardial infarction had occurred in 1 patient (5%), and target lesion revascularization had been required in 4 patients (19%). Follow-up angiography was performed in 16 patients (76%), and restenosis was observed in 4 (19%). No stent thrombosis of the ULMCA was observed. One patient (5%) underwent coronary artery bypass grafting, and 5 patients (24%) underwent repeat OHT. In conclusion, the results of our study have shown ULMCA PCI to be safe and reasonably effective in patients with OHT and represents a viable treatment strategy for CAV in these patients. (Am J Cardiol 2010;xx:xxx)



The American Journal of Cardiology

Original Contribution

Long-Term Outcomes of Percutaneous Coronary Intervention in Transplant Coronary Artery Disease in Pediatric Heart Transplant Recipients

Michael S. Lee, MD[1], Ritu Sachdeva, MD[2], Moo Hyun Kim, MD[3], Rajesh Sachdeva, MD[4]

ABSTRACT: Objective. The purpose of this study was to assess the safety and efficacy of percutaneous coronary intervention (PCI) with bare-metal and drug-eluting stents (DES) in pediatric orthotopic heart transplantation (OHT) recipients who developed transplant coronary artery disease (TCAD). **Background.** The short- and long-term outcomes in pediatric OHT patients with TCAD who underwent PCI are not well known. **Methods.** A retrospective review of medical records from two centers of pediatric OHT recipients who underwent PCI for TCAD was performed. From 1994 to 2011, twelve patients underwent PCI for TCAD at the two centers. **Results.** Mean age at PCI was 15.1 ± 3.5 years, time since transplant was 7.0 ± 4.8 years. Procedural success was attained in all patients. Seven patients (58.3%) received DES. All patients were free from major adverse cardiac events (MACE) at 3 months. At a mean follow-up of 7.1 ± 4.9 years, 6 patients (50%) experienced MACE: 4 patients (33%) died (2 with rejection, 1 with possible stent thrombosis, and 1 had sudden death), 1 patient (8.3%) had myocardial infarction, and 1 patient (8.3%) underwent target vessel revascularization. Five patients (41.2%) underwent repeat OHT. Surveillance angiography was performed in 6 patients (50%), and binary restenosis was observed in 2 patients (33.3%), both of whom received DES. **Conclusions.** Even though TCAD is a progressive disease, PCI is a feasible and effective palliative measure in pediatric OHT recipients. Noncompliance to immunosuppressive and antiplatelet therapy can contribute to MACE in these patients.

J INVASIVE CARDIOL 2012;24(6):xxx-xxx

Key words: xxxxx

Transplant coronary artery disease (TCAD), which is characterized by intimal proliferation and diffuse coronary narrowing, leads to graft dysfunction, and is a major cause of morbidity and mortality after the first year following orthotopic heart transplantation (OHT).[1-3] Percutaneous coronary intervention (PCI) has been performed as a palliative treatment for TCAD as medical therapy does not prevent intimal hyperplasia and repeat OHT is not always a viable option because of the paucity of organs and is associated with increased mortality.[4] Long-term data evaluating PCI in pediatric patients with TCAD are lacking, with most studies being small and limited to case reports.[5-7] The purpose of this study was to assess the short- and long-term outcomes of pediatric OHT patients with TCAD who underwent PCI with bare-metal (BMS) and drug-eluting stents (DES).

From the [1]Division of Cardiology, UCLA Medical Center, Los Angeles, California; [2]the Division of Pediatric Cardiology, University of Arkansas for Medical Sciences and Arkansas Children's Hospital, Little Rock, Arkansas; [3]the Division of Cardiology, Dong-A University Medical Center, Busan, South Korea; and [4]the Division of Cardiology, University of Arkansas for Medical Sciences, Little Rock, Arkansas.

Disclosure: The authors have completed and returned the ICMJE Form for Disclosure of Potential Conflicts of Interest. Dr Lee discloses Speaker's Bureau fees from Boston Scientific Corporation, Bristol-Myers Squibb, Merck, and St. Jude Medical. Dr Rajesh Sachdeva discloses Speaker's Bureau fees from Volcano Corporation. Drs Ritu Sachdeva and Dr Kim report no disclosures.

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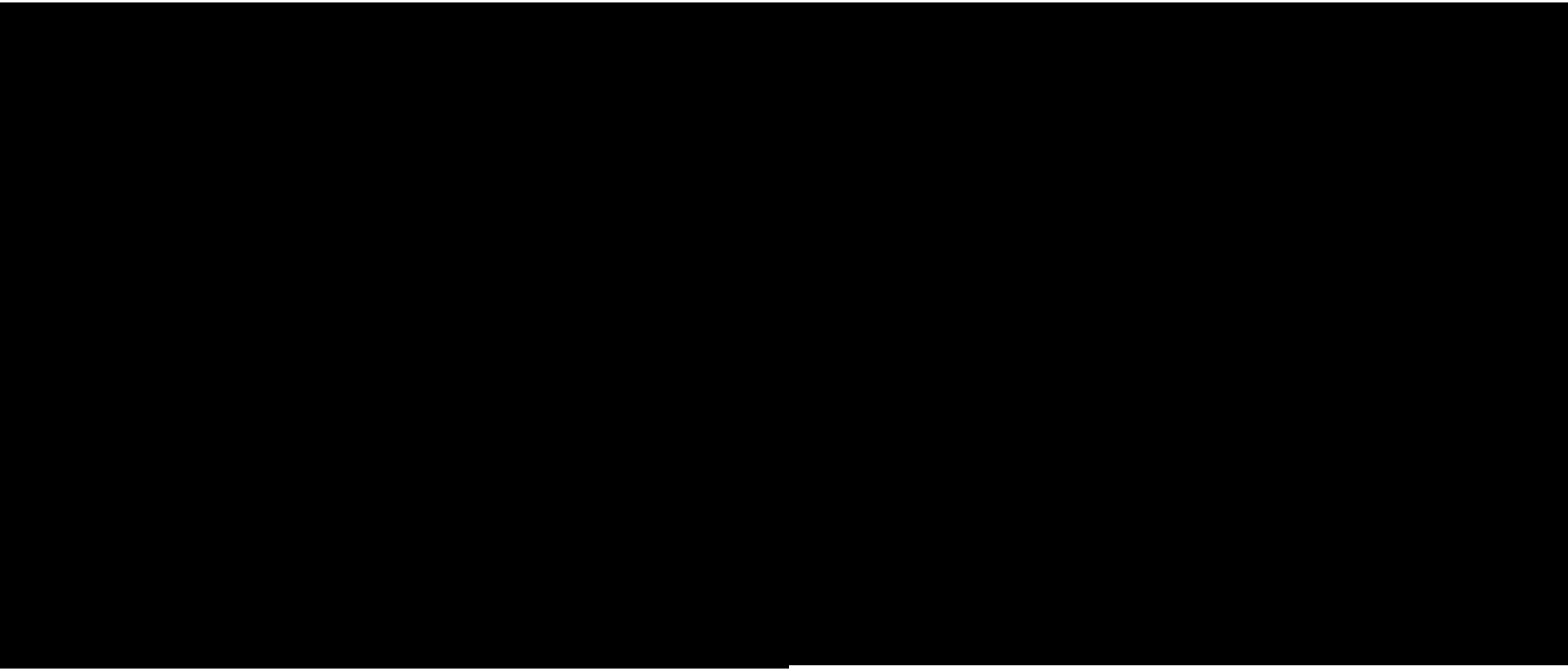
Methods

Between 1994 and 2010, twelve pediatric patients (age ≤19 years) who underwent PCI for TCAD at the University of California, Los Angeles Medical Center in Los Angeles, California (8 patients) and University of Arkansas for Medical Sciences, Arkansas Children's Hospital in Little Rock, Arkansas (4 patients) were included in the study. The study was approved by Institutional Review Board at both institutions. Medical records were reviewed to obtain information regarding patient demographic, angiographic, and clinical outcomes data.

Patients underwent PCI with standard techniques via the transfemoral approach. BMS were used prior to 2003. Following that, DES were used at the discretion of the operator. The DES available to the operator included sirolimus-eluting stents (Cypher; Cordis, Johnson and Johnson Corporation), paclitaxel-eluting stents (Taxus; Boston Scientific Corporation) and everolimus-eluting stents (Xience V; Abbott Vascular). All patients received intravenous heparin during the PCI. Dual antiplatelet therapy with aspirin and a thienopyridine (ticlopidine or clopidogrel) were recommended for a minimum of 1 month if BMS were used and a minimum of 6 months if DES before 2008 and a minimum of 1 year after 2008. Intracoronary nitroglycerin was administered to prevent vasospasm. Immunosuppressive therapy was managed by the transplant cardiologists based upon their institutional protocols. Follow-up angiography was performed within the first 6 to 12 months or sooner if clinically indicated. Thereafter, angiography was performed at least annually or more frequently if PCI was performed. Reasons for failure to perform follow-up angiography included early death, repeat OHT, or noncompliance.

Major adverse cardiac events were defined as a composite of all-cause death, myocardial infarction, and target vessel revascularization. *Cardiac death* was defined as any death without clear non-cardiac cause. *Myocardial infarction* was diagnosed when serum creatine kinase levels increased to more than twice the upper limit of normal range with an elevated creatine kinase

ULMCA PCI in Cardiac Allograft Vasculopathy



13-year old female s/p heart transplantation with cardiac allograft vasculopathy

ULMCA PCI in Cardiac Allograft Vasculopathy

Crush Technique

Final results

Left Main Compression from Pulmonary Artery Aneurysm

Catheterization and Cardiovascular Interventions 00:000–000 (2010)

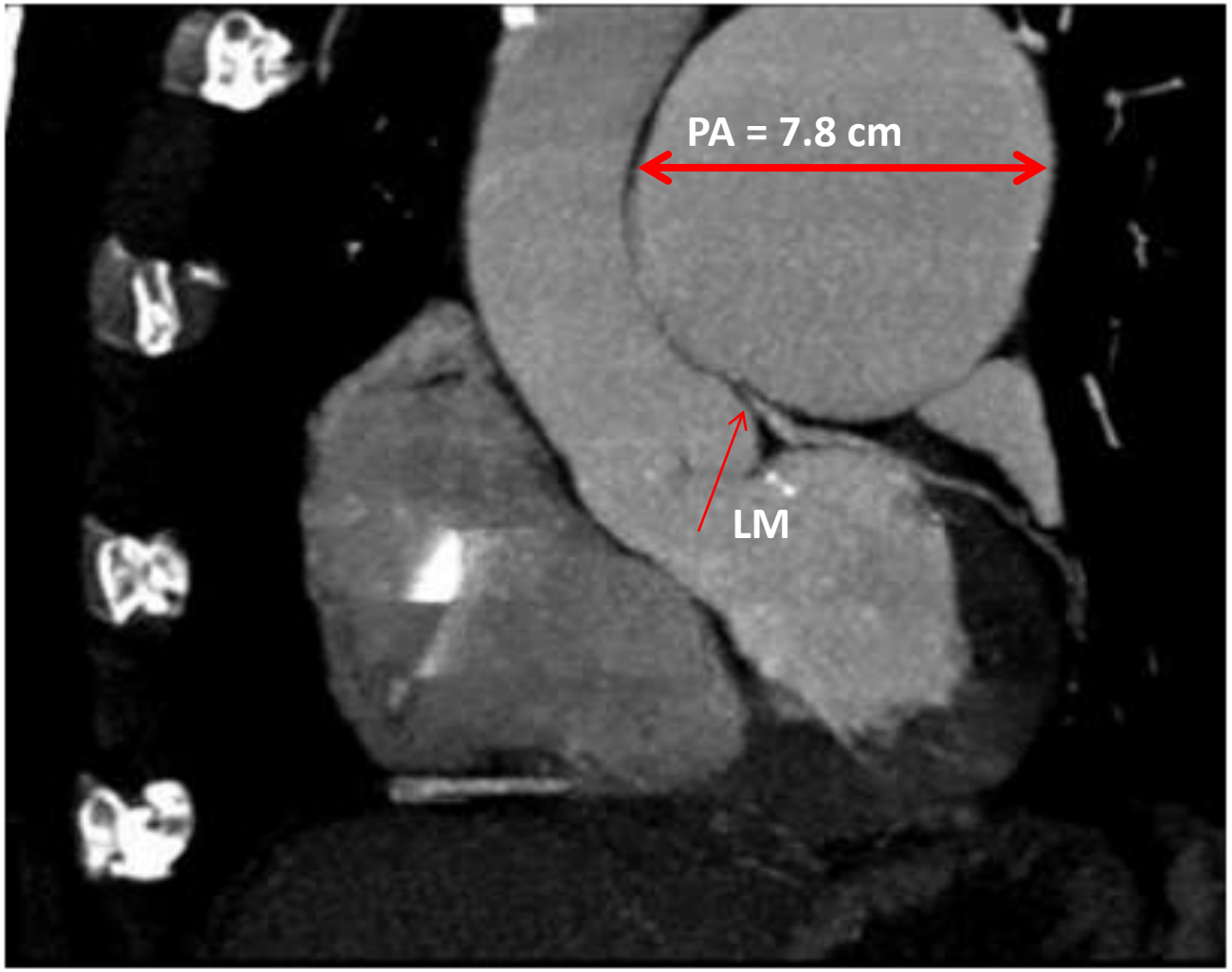
Interventional Rounds

Left Main Coronary Artery Compression from Pulmonary Artery Enlargement Due to Pulmonary Hypertension: A Contemporary Review and Argument for Percutaneous Revascularization

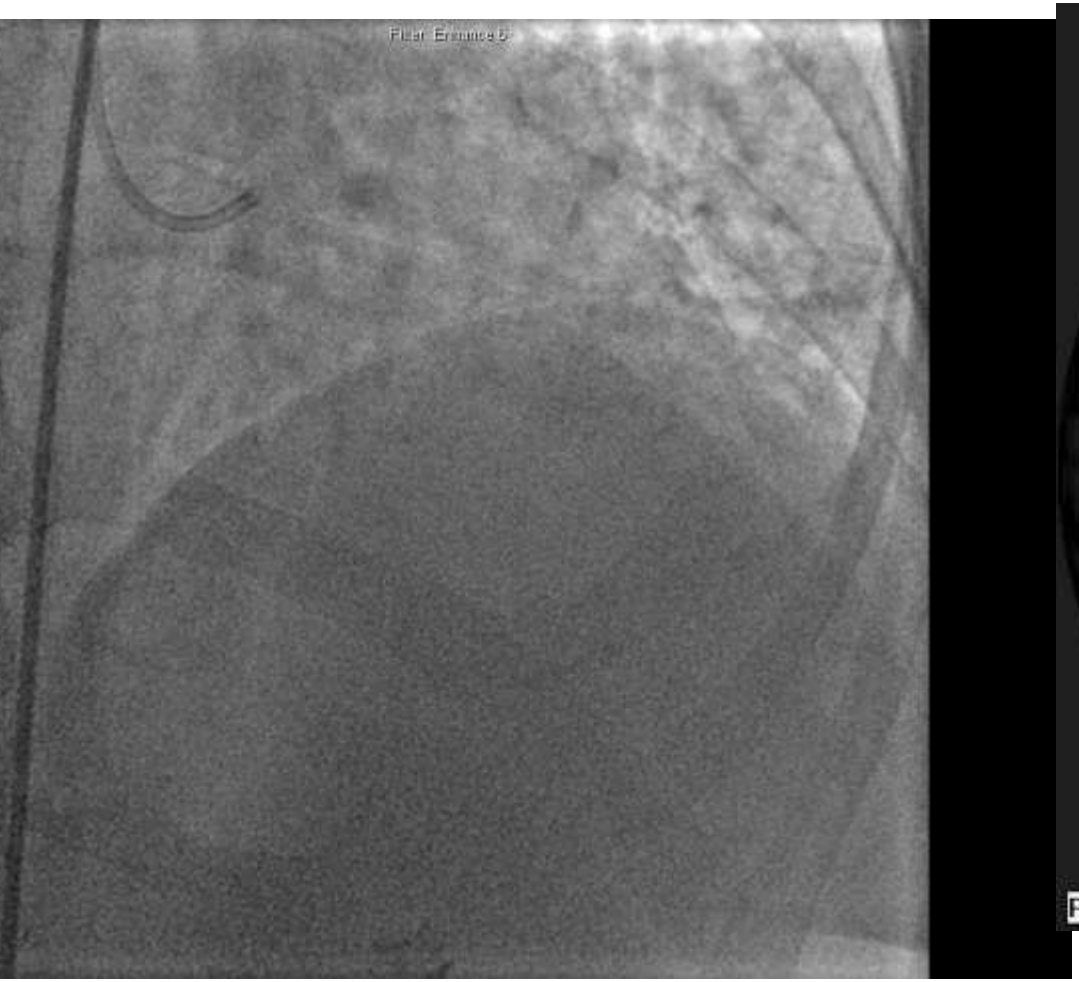
Michael S. Lee,[1*] MD, Jared Oyama,[1] MD, Ravi Bhatia,[2] MD, Young-Hak Kim,[3] MD, and Seung-Jung Park,[3] MD

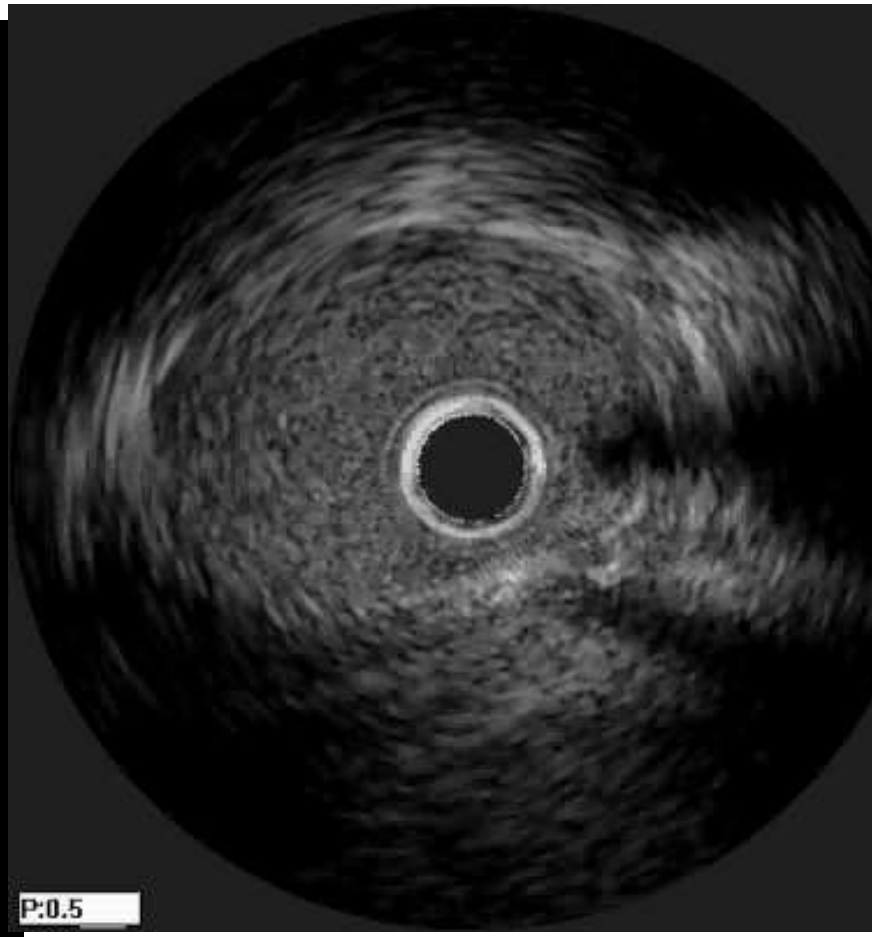
Extrinsic compression of the left main coronary artery by an enlarged pulmonary artery is an increasingly recognized and potentially reversible cause of angina and left ventricular dysfunction in patients with pulmonary hypertension. The diagnosis of extrinsic left main coronary artery compression requires a high index of suspicion and should be considered in patients with severe pulmonary hypertension who experience angina. Coronary angiography with intravascular ultrasound is the gold standard for diagnosis of this condition, though cardiac computed tomography and magnetic resonance angiography allow for noninvasive means of screening. The optimal treatment is debatable, but percutaneous coronary intervention appears to be a feasible, safe, and effective treatment option for patients with extrinsic compression of the left main coronary artery from pulmonary artery enlargement. Given the high risk of postoperative right ventricular failure and mortality observed with surgical revascularization in these patients, we recommend that physicians recognize percutaneous coronary intervention as the preferred revascularization strategy for selected patients with extrinsic compression of the left main coronary artery due to pulmonary hypertension.

Left Main Compression from Pulmonary Artery Aneurysm

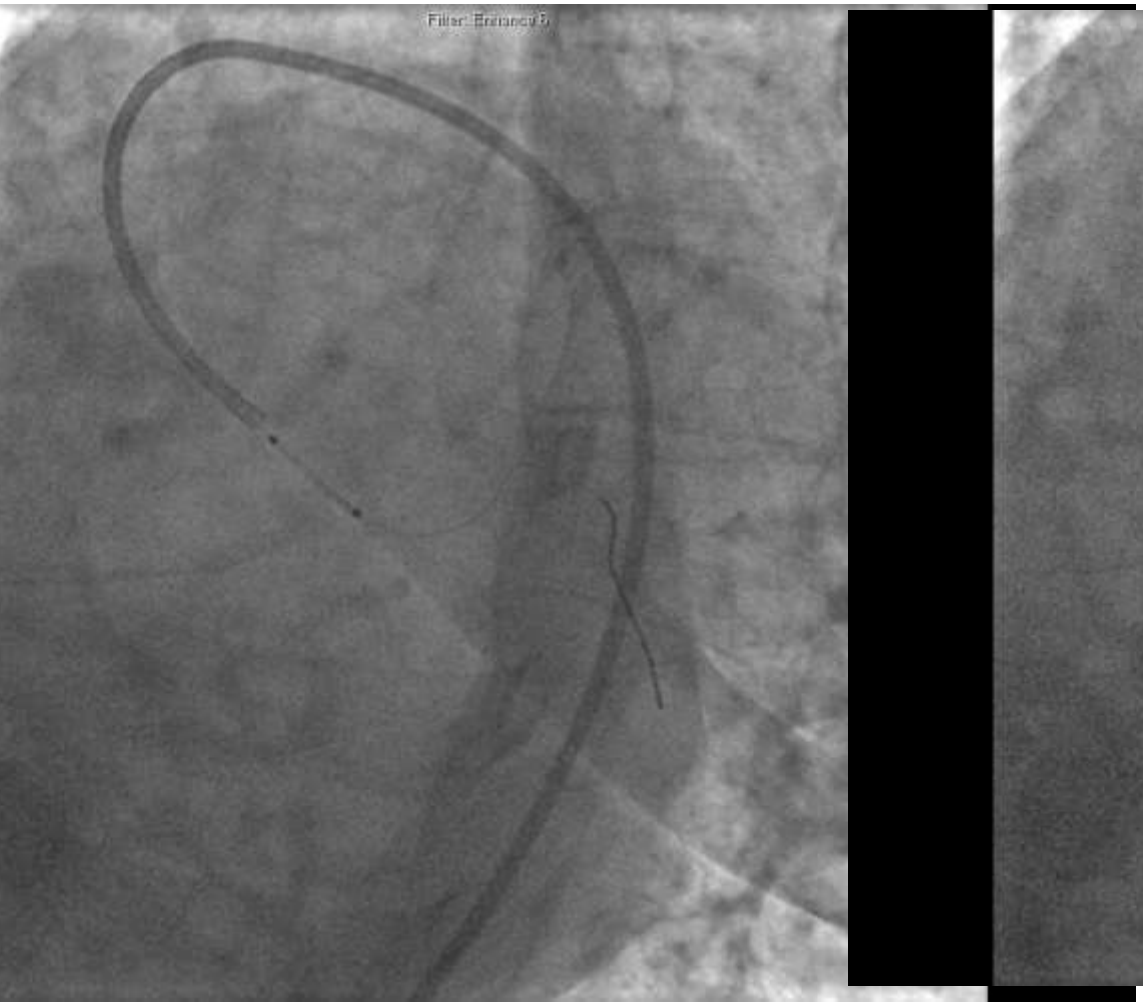


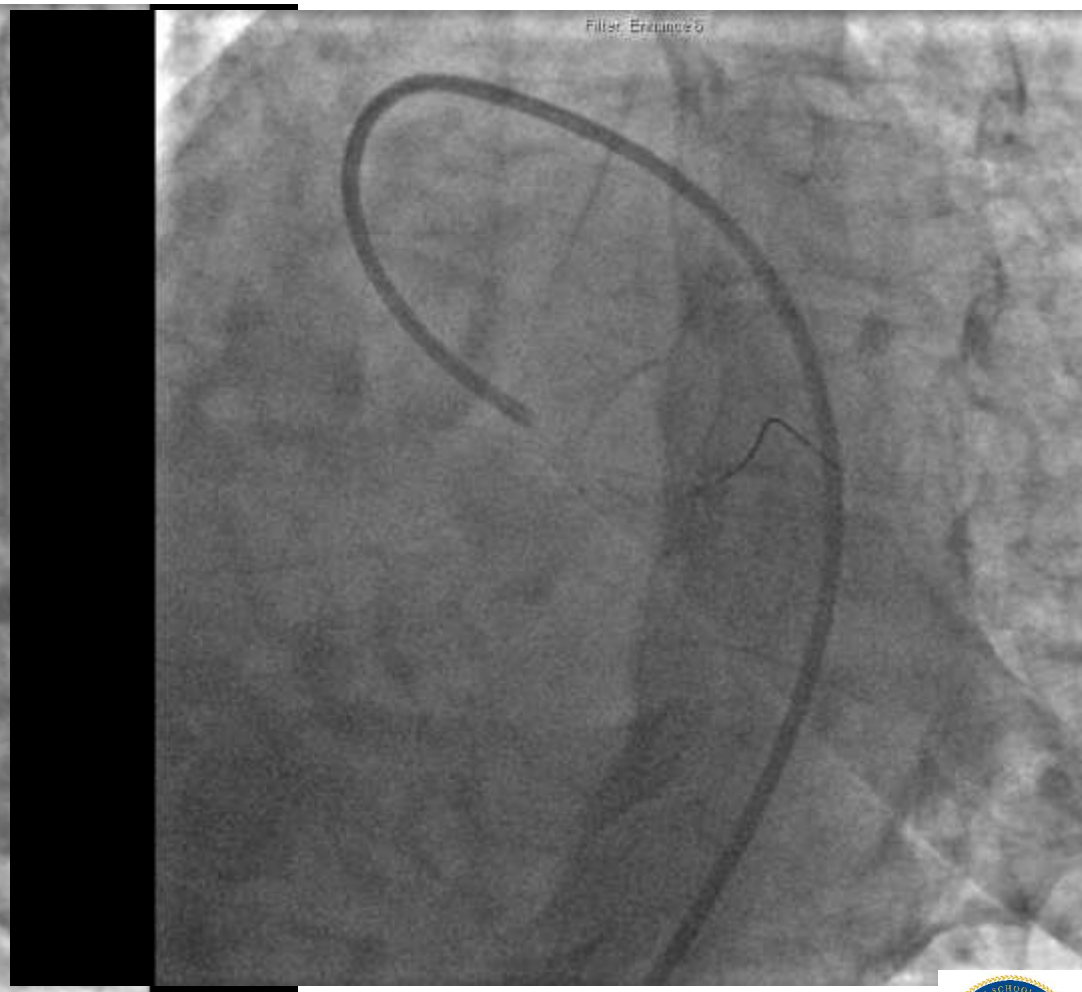
Left Main Compression from Pulmonary Artery Aneurysm



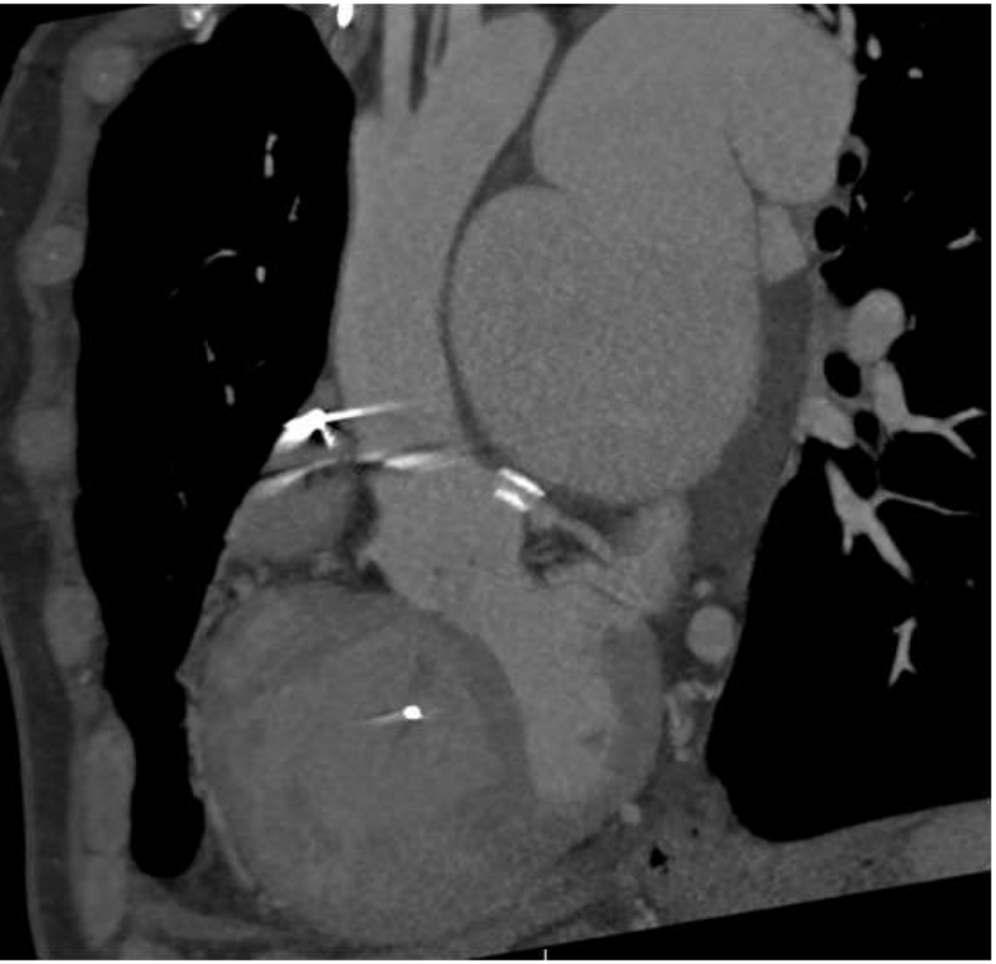


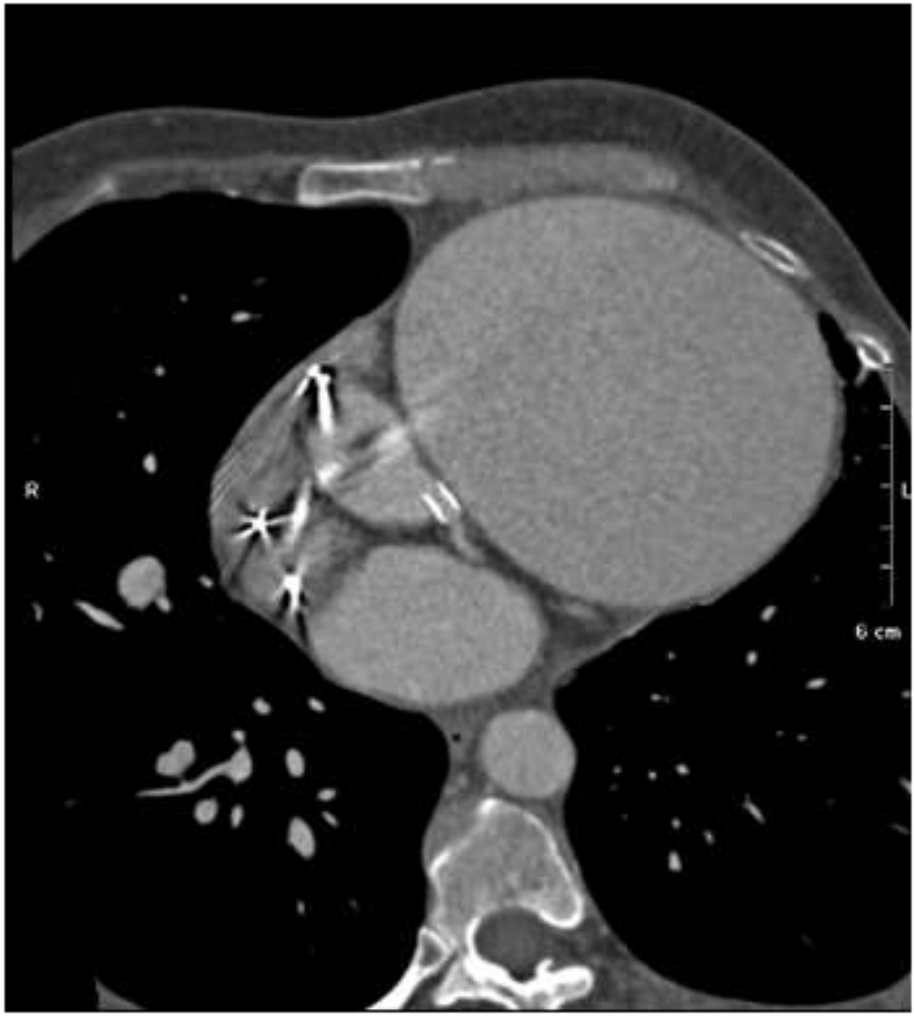
Left Main Compression from Pulmonary Artery Aneurysm



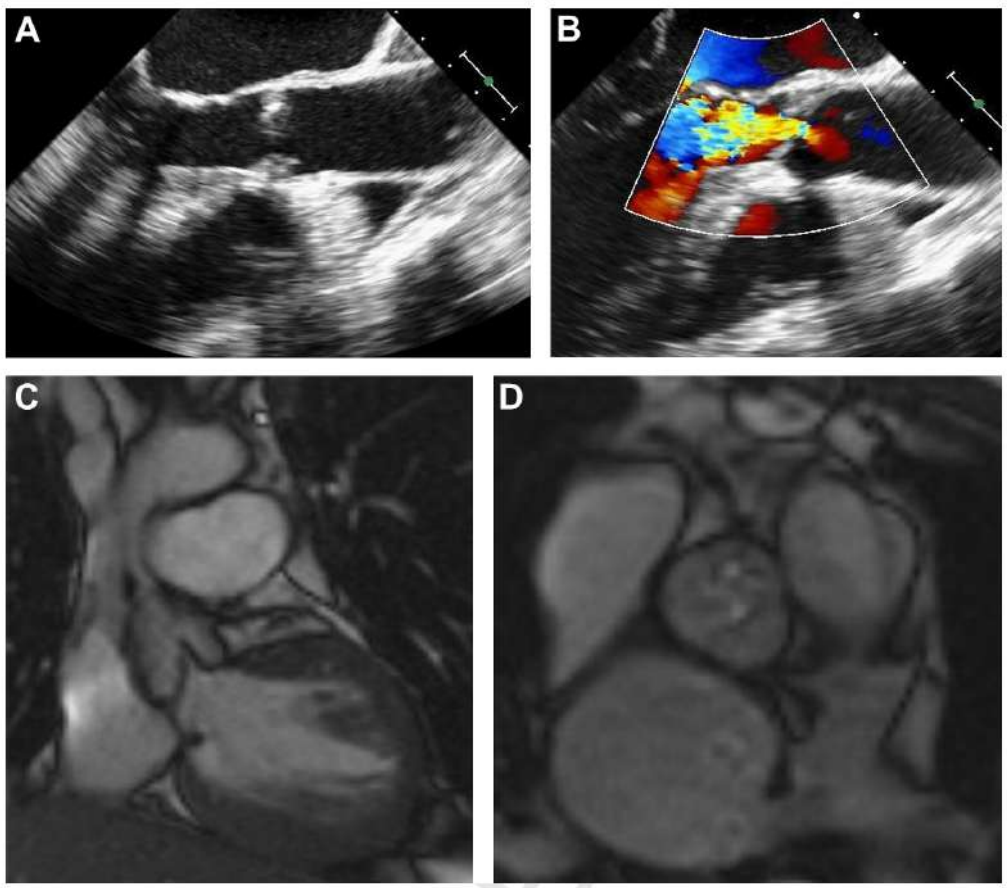


6-month CT Angiography





Cardiovascular Complications of Radiation Therapy



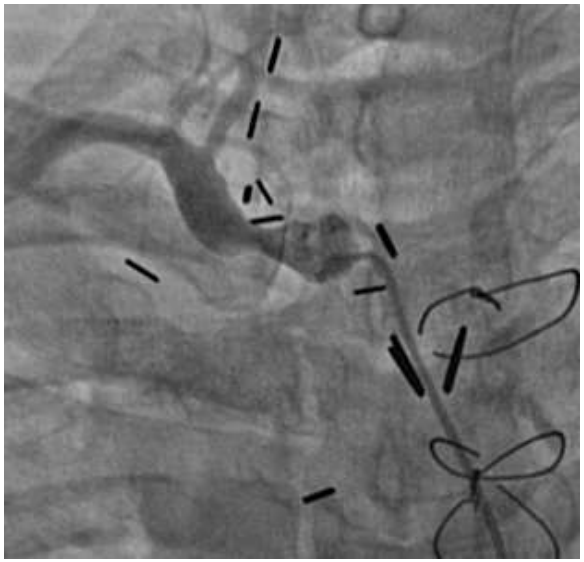


Figure 1. A 42-year-old woman with a history of Hodgkin disease diagnosed in her early 20s was treated with radiotherapy, chemotherapy, and thoracotomy for debulking. Transesophageal echocardiography demonstrates aortic stenosis with a calculated aortic valve area of 0.9 cm^2 *(A)* and aortic regurgitation *(B)*. Cardiac magnetic resonance imaging shows poor leaflet opening of the aortic valve *(C, D)*.

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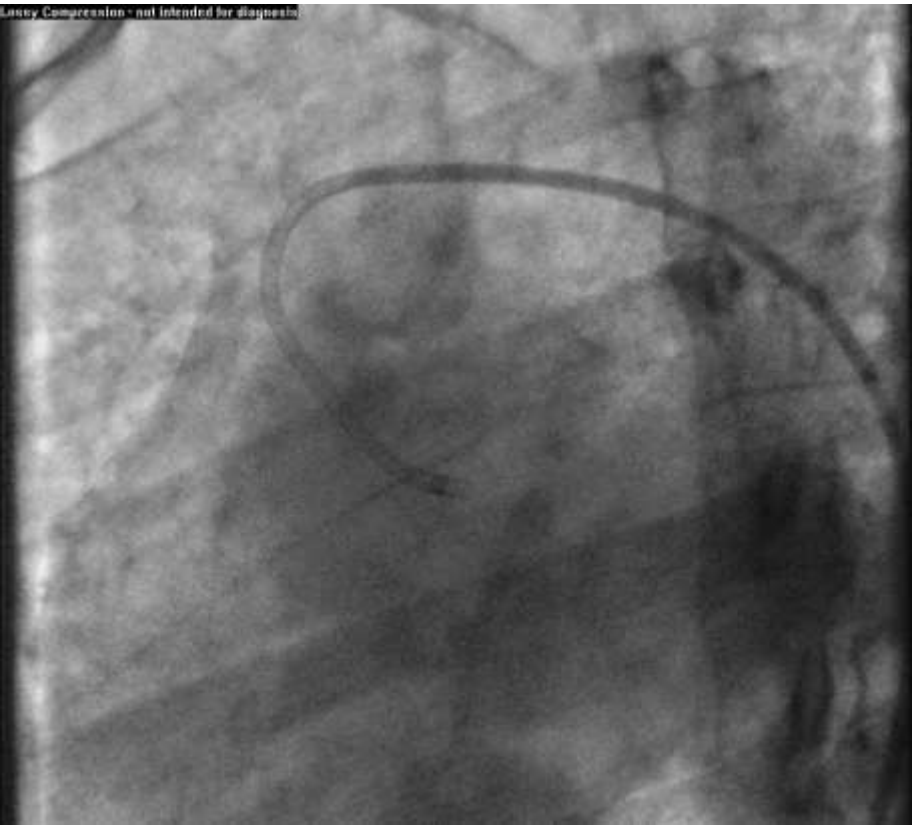
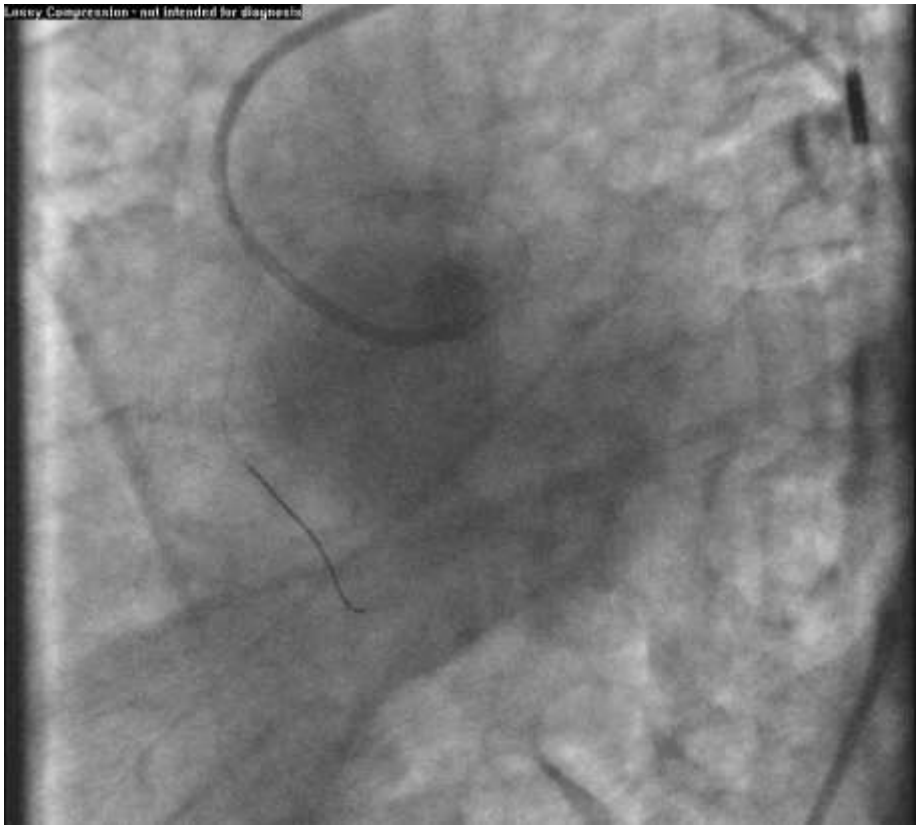
Ostial Left Main Disease Due to Radiation Therapy

LAO caudal



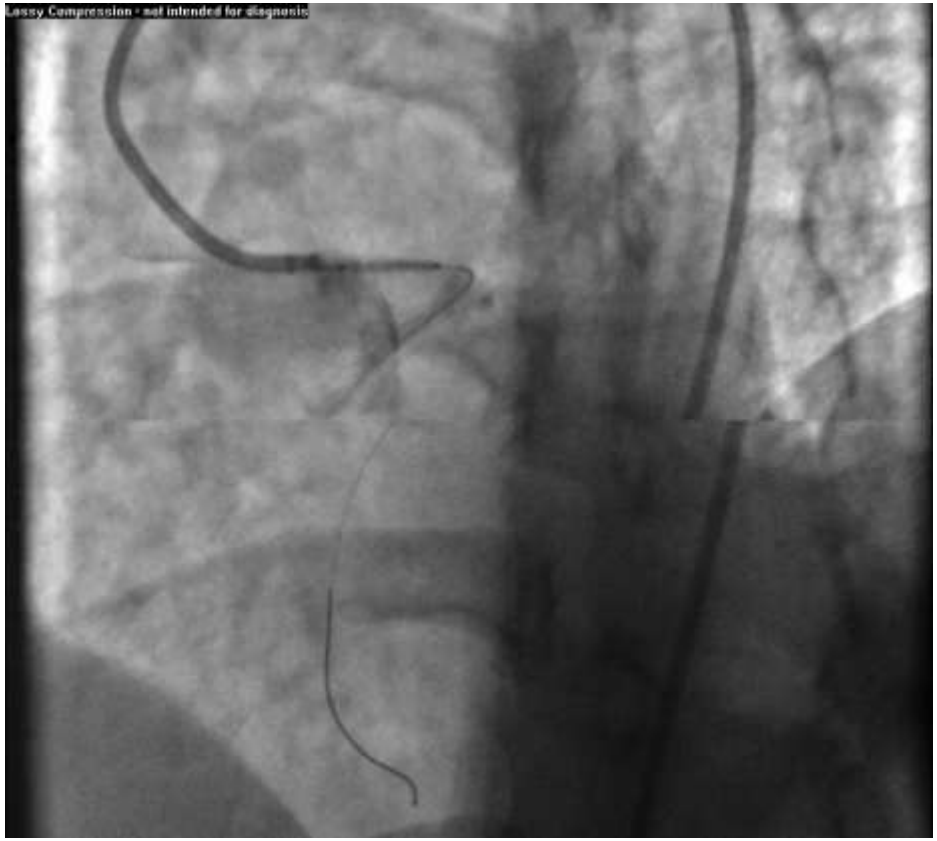
s/p POBA



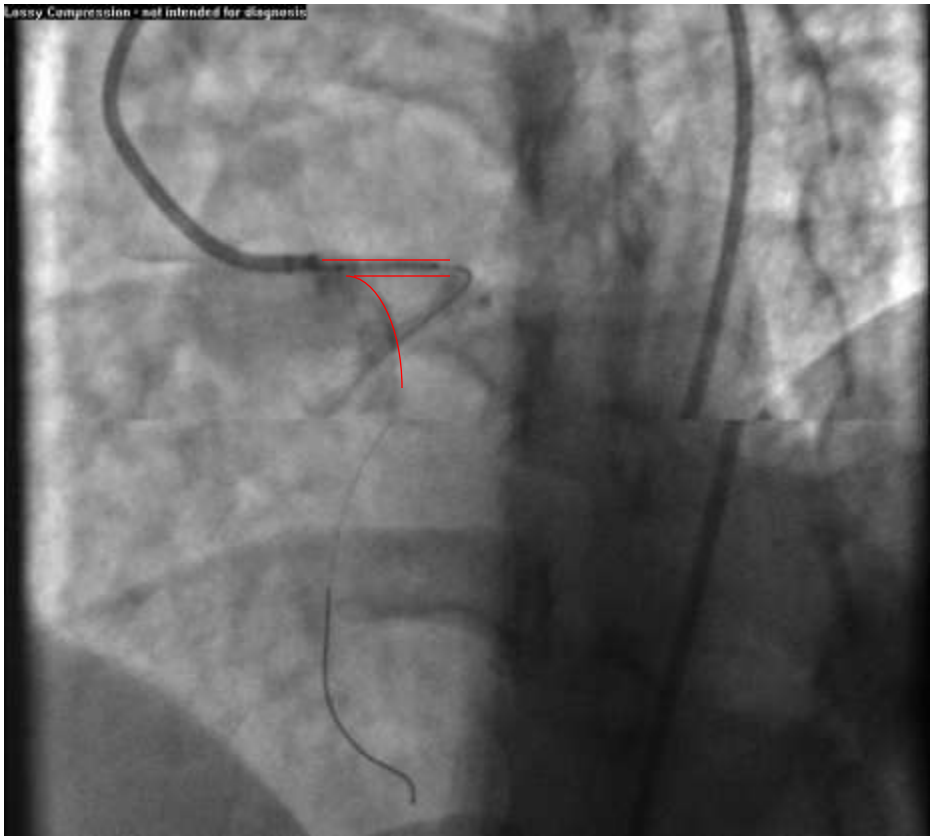
22-year old female with Hodgkin's disease s/p radiation therapy

Ostial Left Main Disease Due to Radiation Therapy

LAO cranial



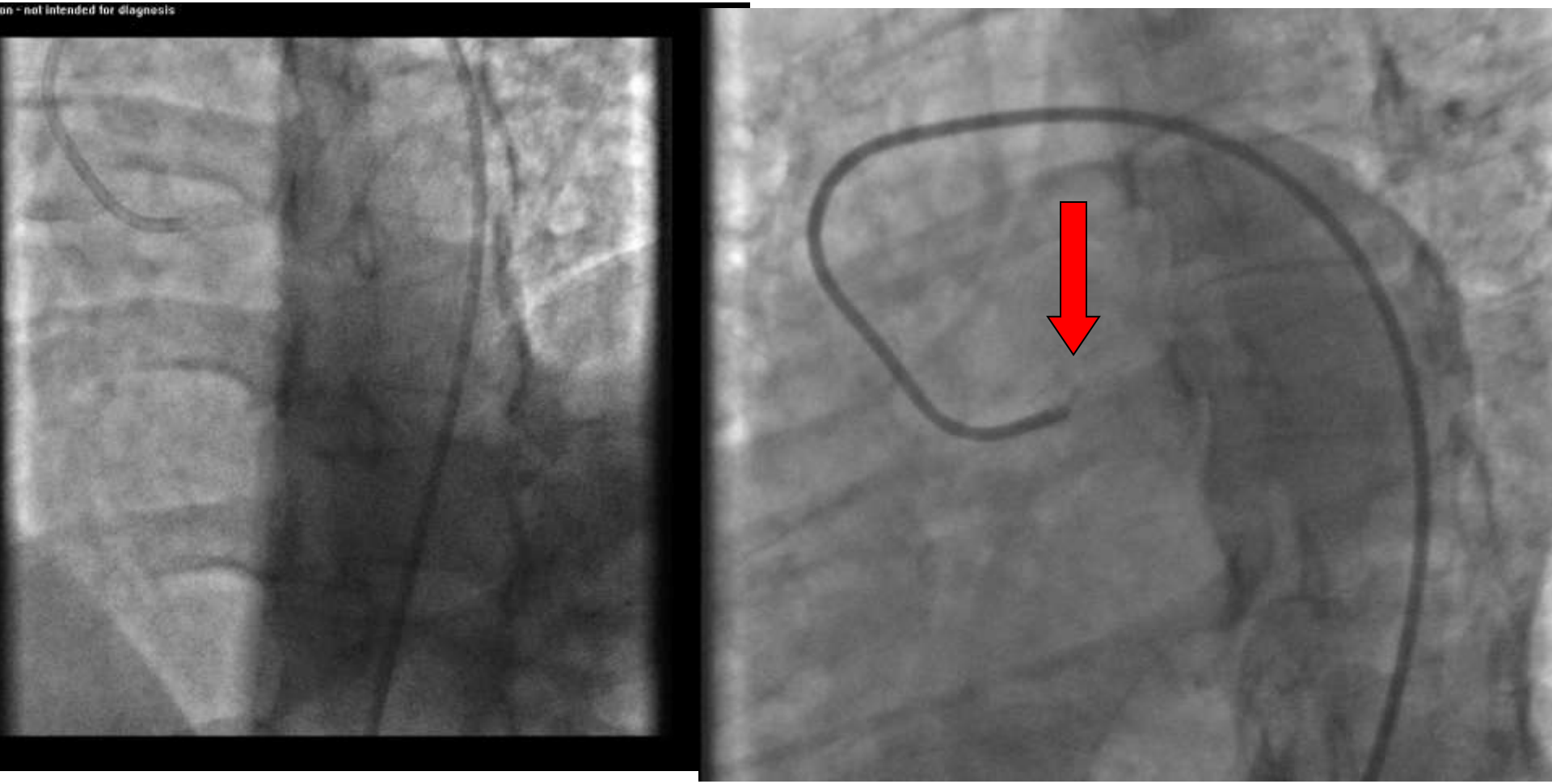
LAO cranial



Ostial Left Main Disease Due to Radiation Therapy

LAO cranial

Stent fracture



Lee MS, et al. Catheter Cardiovasc Interv 2006

Thank You!