Presenter Disclosure Information

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Interventional Techniques in Primary PCI

FINANCIAL DISCLOSURE:
No relevant financial relationship exists
Interventional Techniques
in Primary PCI

- Mechanics of PCI
- Reperfusion Strategies for STEMI and Rationale for Timing of Intervention
- Post PCI Outcomes and Discharge Treatment Strategies
Interventional Techniques in Primary PCI

MECHANICS OF PCI
Mechanics of PCI

- Access Site Choice
- Multiple Guiding Catheters
- Multiple Coronary Wires
- Multiple Coronary Balloons
- Multiple Coronary Stents
- Atherectomy Devices
- Thrombectomy Devices
- Intra-Luminal Imaging Devices
Mechanics of PCI

• Functional Assessment Devices
• Ventricular Support Devices
• Rhythm Support
Mechanics of PCI

• Many of these items are used in the evaluation and treatment of a more stable patient than the STEMI patient, although all will have application in special circumstance.
Mechanics of PCI

• In STEMI, the fundamental issues are:

  • Adequate Guide Catheter Support
  • Rapid and safe Intra-Luminal placement of the Coronary Wire
  • Thrombectomy
  • Balloon Dilation
Mechanics of PCI

• Adequate Guide Support means Co-axial Alignment of the guiding catheter with sufficient stability to allow passage of the coronary wire and balloon, thrombectomy catheter and stent; without injuring that artery.

• Access site selection has bearing on this. numerous recent articles attest to Radial Artery access leading to fewer bleeding complications than Femoral access, possibly translating into lower mortality.
Mechanics of PCI

• Radial access, however, also takes longer, requires more fluoroscopy time, uses more contrast, and provides less guide catheter support.
• Femoral access usually avoids these issues and current anti-thrombotic regimens during the procedure may lead to less access site bleeding complication.
• Access choice should be individualized by patient and interventionalist.
Mechanics of PCI

• Thrombectomy is usually beneficial. Simple aspiration catheters have been shown to out-perform complex clot disrupting catheters
Mechanics of PCI

• Stents are usually placed to support the dilated site.
• Temporary Pacing may be needed to support cardiac rhythm
• Intra-Aortic Balloon Pumping or other Ventricular Assist devices may be necessary to support circulation.
Mechanics of PCI

• The fundamental treatment is the mechanical disruption and aspiration of the occluding thrombus and the radial displacement and flattening of the underlying atherosclerotic plaque.

• A stent is placed to prevent elastic recoil of the artery and to seal the ruptured plaque and dissection flaps to the arterial wall.

• A drug eluting stent is often chosen to reduce the risk of later restenosis.
Mechanics of PCI

• The Goal is to accomplish this as safely and rapidly as possible.

• In most cases, this can be achieved within 15 to 20 min of arrival into the cath lab.
Mechanics of PCI

- Radial Artery vs
- Femoral Artery Entry
Mechanics of PCI  Optical Coherence Tomography
Mechanics of PCI

IntraVascular Ultrasound
Mechanics of PCI

Drug Eluting Stent
Mechanics of PCI

Stent Deployment
Mechanics of PCI

Mechanism of Angioplasty and Stenting

Uninflated balloon catheter
Dilated balloon and stent
Stent deployed
Figure 1. Aspiration thrombectomy of a thrombotic occlusion in the coronary artery of a patient with a myocardial infarction. A wire is passed across the coronary occlusion (left), the aspiration catheter is passed to the lesion and thrombus is aspirated through the lumen of the catheter (middle), and then the stent is deployed (right).
Mechanics of PCI  Rheolytic Thrombectomy

AngioJet  Rheolytic  Thrombectomy System

RECIRCULATION REGION

entrained fluid

Saline jets enclosed in catheter create strong vacuum at inflow windows
How do we hit 90 min for PCI?

- **door - ecg**
- **call one call**
- **EMS load time**
- **transport**
- **SH D2B**

**lifeflight**
- 15
- 60
- 5
- 10
- 10

**EMS**
- 15
- 60
- 10
- 5
- 10

125
100
75
50
25
0
Interventional Techniques in Primary PCI

REPERFUSION STRATEGIES FOR STEMI
Reperfusion Strategies for STEMI

• Why 90 minutes for PCI?

• Clear mortality benefit.
Reperfusion Strategies for STEMI

- Myocardial Infarction is a Dynamic Process

- Thrombotic Occlusion of a Coronary Artery initiates a “wavefront” of Infarction that begins at the Endocardial surface and progresses to the Epicardial surface over a period of about 6 hours.
Reperfusion Strategies for STEMI

• Myocardial Infarction is a Dynamic Process

• This Time Course is lengthened or shortened by the presence or absence of Collaterals, and by the presence of absence of Spontaneous Thrombolysis.
• A little History:

• MI mortality was 30% prior to the development of CCU’s in the 1960’s, 15% afterward, due to successful resuscitation from VT/VF events.
• A little History:

• MI mortality dropped further to 10% with care directed toward reduction of Myocardial O2 requirements (bed rest, pain relief, blood pressure reduction, beta blockers.) in the 1960’s and '70’s.
• A little History:

• MI mortality dropped further to 5% after the institution of thrombolytic therapy.
Reperfusion Strategies

• A little History:

• 1976, Chazov successfully opened an occluded coronary with Intra-Coronary Thrombolysin

• 1978, Rentrop repeated this and used a guide wire to assist
• A little History:

• 1979, European Coop Study Group for Streptokinase in AMI reported mortality benefit at 6 months if SK was given IV within 12 hours of onset of MI.
Reperfusion Strategies

• A little History:

• 1986, GISSI trial showed significant 1 year survival benefit using IV SK within 6 hours of AMI onset.

• 21 day mortality was:
  • SK 10.7%
  • Placebo 13.0%

• 1 year mortality was:
  • SK 17.2%
  • Placebo 19%
• A little History:

• 1982, Hartzler reported the first Direct Angioplasty results for AMI.

• Technical success was reported with a completely open vessel in 93% of 500 patients.
• A little History:

• Multiple Trials since have evaluated and compared Thrombolytic and Interventional Strategies for AMI care in effort to find the most effective therapy and to make it available to the entire population.
Reperfusion Strategies

• The benefit of fibrinolysis is greatest in 1st 4 hours.

• Absolute mortality benefit over placebo:
  3% for treatment within 6 hours
  2% for treatment 7-12 hours
  0% for treatment after 12 hours

Lancet 1994 Feb 5;343(8893):311-22
The clinical benefits of fibrinolysis are only associated with TIMI 3 flow (normal flow).

TIMI 3 flow is only achieved in 50% of cases compared to 95% with primary PCI.
Reperfusion Strategies

- A review of 23 RCT's demonstrated a 2% absolute mortality reduction favoring PCI.

(Nallamothu et al AJC 2003;92:824)
• DANAMI-2 showed a reduction of 30-day MACE with primary PCI (8.0%) vs thrombolysis (13.7%)

• post hoc analysis showed largest reduction in mortality in patients with TIMI risk score $\geq 5$. (25% vs 36%)
2013 ACCF/AHA Guideline for the Management of ST-Elevation Myocardial Infarction

Developed in Collaboration with American College of Emergency Physicians and Society for Cardiovascular Angiography and Interventions

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Regional Systems of STEMI Care, Reperfusion Therapy, and Time-to-Treatment Goals
Patients with cardiogenic shock or severe heart failure initially seen at a non–PCI-capable hospital should be transferred for cardiac catheterization and revascularization as soon as possible, irrespective of time delay from MI onset (Class I, LOE: B).†Angiography and revascularization should not be performed within the first 2 to 3 hours after administration of fibrinolytic therapy.

Helping Cardiovascular Professionals
Regional Systems of STEMI Care, Reperfusion Therapy, and Time-to-Treatment Goals

All communities should create and maintain a regional system of STEMI care that includes assessment and continuous quality improvement of EMS and hospital-based activities. Performance can be facilitated by participating in programs such as Mission: Lifeline and the D2B Alliance.

Performance of a 12-lead ECG by EMS personnel at the site of FMC is recommended in patients with symptoms consistent with STEMI.
### Regional Systems of STEMI Care, Reperfusion Therapy, and Time-to-Treatment Goals

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Reperfusion therapy should be administered to all eligible patients with STEMI with symptom onset within the prior 12 hours.

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Primary PCI is the recommended method of reperfusion when it can be performed in a timely fashion by experienced operators.

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EMS transport directly to a PCI-capable hospital for primary PCI is the recommended triage strategy for patients with STEMI with an ideal FMC-to-device time system goal of 90 minutes or less.*

*The proposed time windows are system goals. For any individual patient, every effort should be made to provide reperfusion therapy as rapidly as possible.
Regional Systems of STEMI Care, Reperfusion Therapy, and Time-to-Treatment Goals

Immediate transfer to a PCI-capable hospital for primary PCI is the recommended triage strategy for patients with STEMI who initially arrive at or are transported to a non–PCI-capable hospital, with an FMC-to-device time system goal of 120 minutes or less.*

In the absence of contraindications, fibrinolytic therapy should be administered to patients with STEMI at non–PCI-capable hospitals when the anticipated FMC-to-device time at a PCI-capable hospital exceeds 120 minutes because of unavoidable delays.

*The proposed time windows are system goals. For any individual patient, every effort should be made to provide reperfusion therapy as rapidly as possible.
Regional Systems of STEMI Care, Reperfusion Therapy, and Time-to-Treatment Goals

When fibrinolytic therapy is indicated or chosen as the primary reperfusion strategy, it should be administered within 30 minutes of hospital arrival.*

Reperfusion therapy is reasonable for patients with STEMI and symptom onset within the prior 12 to 24 hours who have clinical and/or ECG evidence of ongoing ischemia. Primary PCI is the preferred strategy in this population.

*The proposed time windows are system goals. For any individual patient, every effort should be made to provide reperfusion therapy as rapidly as possible.
LAD angiogram

Elderly male with Anterior STEMI
Right Coronary angiogram

Severe RCA mid-vessel stenosis
Left Coronary angiogram

Final result
Left Coronary
Re-cath 3-4 weeks later to treat the RCA
Left Coronary angiogram

Verification of LCA status prior to PCI for RCA
RCA prior to PCI
Right Coronary PCI

vessel wired
Right Coronary PCI stent deployment
Right Coronary angiogram

After stent placement
Interventional Techniques in Primary PCI

POST-PCI OUTCOMES AND DISCHARGE TREATMENT STRATEGY
Post PCI outcomes and Discharge Treatment Strategy

- Evaluate and Treat Residual CAD. Complete ReVascularization is associated with improved long term prognosis.
  - Staged PCI
  - CABG
  - Medical therapy
Post PCI outcomes and Discharge Treatment Strategy

• Evaluate and Treat LV Dysfunction.

- ACE-Inhibition or ARB
- Beta Blockade
- Life Vest for EF below 35%
- ICD for sustained EF below 35% after 2 months
- CRT for Class III CHF, reduced EF, LBBB
Post PCI outcomes and Discharge Treatment Strategy

- Cardiac Rehab for all
- Dual Anti-Platelet therapy
- Long Term Statin use
- Risk Factor Modification