Incorporating the MN STEMI Guidelines into Rural Practice
2016 Mission: Lifeline Cardiovascular Emergencies Conference

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Disclosures

Relevant Financial Relationship(s)
None

Off Label Usage
None

No endorsements to any of the products mentioned
Objectives

• Discuss care of STEMI patients
  • Particular focus on rural hospitals

• Review MN Mission: Lifeline STEMI Guidelines

• Active > Passive Learning
Why are we talking about STEMI care?

It’s important
Why are we talking about STEMI care?

Heart Attacks strike 935,000 people a year in the US.
Why are we talking about STEMI care?

1 in 2 men will develop heart disease in their lifetime!
Why are we talking about STEMI care?

1 in 3
Why are we talking about STEMI care?

- Approximately *every 25 seconds*, an American will experience a heart attack, and approximately *every minute*, someone will die of one.
Mechanism

• Spontaneous coronary dissection

• Vasospasm

• CAD
  • Fixed lesion with sub-total occlusion $\rightarrow$ supply-demand mismatch (NSTEMI)
  • Acute plaque rupture with total occlusion (STEMI)
Cardiac Risk Factors

Non-Modifiable

Age/Gender
Woman ≥ 55 yo
Man ≥ 45 yo

Modifiable

Family Hx of PREMATURE ASCVD
1° relative
Woman ≤ 65 yo
Man ≤ 55 yo
Atherosclerosis
Atherosclerosis

Fatty deposits called plaque build up in the walls of the coronary arteries.
Atherosclerosis

An unstable plaque develops with a fatty core and thin fibrous outer shell.
Atherosclerosis
Atherosclerosis

As the blood clot gets larger, the amount of blood flowing by it decreases.
Atherosclerosis

If the blood clot enlarges to completely block the artery, all tissues supplied by that artery begin to die below the blockage.
Myocardial infarction
Thrombolytic
Improved STEMI Survival with Lytic Rx

Figure 2. Cumulative percent survival of the overall population. C = control; SK = streptokinase.
Cardiac Catheterization
Cardiac Catheterization
Cardiac Catheterization
Cardiac Catheterization
Percutaneous Coronary Intervention
Persistent Blockage

Inadequate Blood Flow

Circulatory & End-Organ Failure

Pump Failure

Muscle Death
“Time is muscle” – every minute counts!
A “Hollywood” Myocardial Infarction
A “Non-Hollywood” Code

www.youtube.com “2 cardiac arrests”
A “Non-Hollywood” Code
A “Non-Hollywood” Code
Prevention is Key…

“I’ll have an ounce of prevention.”
But sometimes we’re too late
The Chain of Survival
Weak Chain ≡ Failure
Mission: Lifeline is the American Heart Association’s national initiative to advance the systems of care for patients with ST-segment elevation myocardial infarction (STEMI) and those resuscitated after experiencing an Out-of-Hospital Cardiac Arrest. The overarching goal of the initiative is to reduce mortality and morbidity for STEMI and Out of Hospital Cardiac Arrest patients and to improve their overall quality of care.
Back In The Day - Time from onset to treatment could exceed 200 Minutes (Non-Transfer Patients)
Time = Muscle
Muscle = Life
Case Presentation

- 60 yo woman presents to a PCI-capable hospital
- Chest discomfort x 35 min
- No significant PMHx
- NKDA
Based on the following ECG, you would recommend:

1) Initiation of heparin infusion
2) Morphine
3) Transthoracic Echo
4) Emergent cardiac catheterization
5) Positive airway pressure therapy
Presenting ECG
Based on the following ECG, you would recommend

1) Initiation of heparin infusion
2) Morphine
3) Transthoracic Echo
4) Emergent cardiac catheterization
5) Positive airway pressure therapy
2013 ACCF/AHA Guideline for the Management of ST-Elevation Myocardial Infarction

A Report of the American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines

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

WRITING COMMITTEE MEMBERS*
Primary PCI is the recommended method of reperfusion when it can be performed in a timely fashion by experienced operators.
Primary PCI is the recommended method of reperfusion when it can be performed in a timely fashion by experienced operators.
### SIZE OF TREATMENT EFFECT

<table>
<thead>
<tr>
<th>CLASS I</th>
<th>CLASS IIa</th>
<th>CLASS IIb</th>
<th>CLASS III / CLASS IIIb</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benefit &gt;&gt; Risk</td>
<td>Benefit &gt;&gt; Risk</td>
<td>Benefit ≥ Risk</td>
<td>No Benefit or Harm</td>
</tr>
<tr>
<td>Procedure/Treatment SHOULD be performed/administered</td>
<td>Additional studies with focused objectives needed</td>
<td>Additional studies with broad objectives needed; additional registry data would be helpful</td>
<td>Procedure/Treatment MAY BE CONSIDERED</td>
</tr>
</tbody>
</table>

#### LEVEL A
- Multiple populations evaluated*
- Data derived from multiple randomized clinical trials or meta-analyses

- Recommendation that procedure or treatment is useful/effective
- Sufficient evidence from multiple randomized trials or meta-analyses

#### LEVEL B
- Limited populations evaluated*
- Data derived from a single randomized trial or nonrandomized studies

- Recommendation that procedure or treatment is useful/effective
- Evidence from single randomized trial or nonrandomized studies

#### LEVEL C
- Very limited populations evaluated*
- Only consensus opinion of experts, case studies, or standard of care

- Recommendation that procedure or treatment is useful/effective
- Only expert opinion, case studies, or standard of care

<table>
<thead>
<tr>
<th>COR II: No benefit</th>
<th>COR II: Excess Cost w/o Benefit or Harm</th>
<th>COR II: Harm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not Helpful</td>
<td>Harmful to Patients</td>
<td></td>
</tr>
<tr>
<td>No Proven Benefit</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Recommendation’s usefulness/efficacy less well established
- Some conflicting evidence from multiple randomized trials or meta-analyses

- Recommendation’s usefulness/efficacy less well established
- Some conflicting evidence from single randomized trial or nonrandomized studies

- Recommendation’s usefulness/efficacy less well established
- Only diverging expert opinion, case studies, or standard of care

- Recommendation that procedure or treatment is not useful/effective and may be harmful
- Sufficient evidence from multiple randomized trials or meta-analyses

- Recommendation that procedure or treatment is not useful/effective and may be harmful
- Evidence from single randomized trial or nonrandomized studies

- Recommendation that procedure or treatment is not useful/effective and may be harmful
- Only expert opinion, case studies, or standard of care
Reperfusion Therapy for Patients with STEMI

STEMI patient who is a candidate for reperfusion

Initially seen at a PCI-capable hospital

Send to cath lab for primary PCI
FMC-device time ≤90 min
(Class I, LOE: A)

Diagnostic angiogram

Medical therapy only
PCI
CABG

Initially seen at a non-PCI-capable hospital

DIDO time ≤30 min

Transfer for primary PCI
FMC-device time as soon as possible and ≤120 min
(Class I, LOE: B)

Transfer for PCI for patients with evidence of failed reperfusion or reocclusion
(Class IIa, LOE: B)

Transfer for angiography and revascularization within 3-24 h for other patients as part of an invasive strategy
(Class IIa, LOE: B)

Administer fibrinolytic agent within 30 min of arrival when anticipated FMC-device >120 min
(Class I, LOE: B)
Sometimes you don’t get an Easy button in life…
Where you live shouldn’t determine if you live
Minnesota STEMI GUIDELINE
Mission: Lifeline Statewide STEMI Interfacility Transfer Guideline
**STEMI (ST Elevation Myocardial Infarction) Diagnostic Criteria:**

- ST elevation at the J point in at least 2 contiguous leads of ≥ 2 mm (0.2 mV) in men or ≥ 1.5 mm (0.15 mV) in women in leads V2-V3 and/or of ≥ 1 mm (0.1 mV) in other contiguous chest leads or the limb leads

- Signs & symptoms of discomfort suspect for AMI (Acute Myocardial Infarction) or STEMI with a duration > 15 minutes < 12 hours

- Although new, or presumably new, BBBst presentation occurs infrequently and may interfere with STE-elevation analysis, care should be exercised in not considering this an acute myocardial infarction (MI) in isolation...In doubt, immediate consultation with PCI receiving center is recommended

- ECG demonstrates evidence of ST depression suspicion of a Posterior MI...with PCI receiving center

- If initial ECG is not diabetic but suspicion is high for STEMI; obtain serial 12 Lead ECG’s at 5-10 minute intervals

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**STEMLINE STEMI GUIDELINE**

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**STEMI GUIDELINE**

**Minnesota STEMI GUIDELINE**

**Minnesota Mission: Lifeline Statewide STEMI Interfacility Transfer Guideline**

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**Notes:**

- FMC (First Medical Contact) to First ECG time ≤ 10 minutes unless pre-hospital ECG obtained

- All eligible STEMI patients receiving a Repertusin Therapy (Primary PCI or fibrinolysis)

- Fibrinolytic eligible STEMI patients with Door-to-Needle time ≤ 30 minutes

- Primary PCI eligible patients transferred to a PCI receiving center with referring center Door-in Door-out (Length of Stay) < 45 min

- Referring Center ED or Pre-Hospital First Medical Contact-to-PCI time ≤ 120 minutes (including transport time)

- All STEMI patients without a contraindication receiving Aspirin prior to referring center ED discharge

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**AHA Mission: Lifeline STEMI Recommendations:**

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**Minnesota STEMI GUIDELINE**

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**STEMI GUIDELINE**

**Minnesota Mission: Lifeline Statewide STEMI Interfacility Transfer Guideline**

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**Minnesota Mission: Lifeline Statewide STEMI Interfacility Transfer Guideline**

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**STEMI GUIDELINE**

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- All eligible STEMI patients receiving a Repertusin Therapy (Primary PCI or fibrinolysis)

- Fibrinolytic eligible STEMI patients with Door-to-Needle time ≤ 30 minutes

- Primary PCI eligible patients transferred to a PCI receiving center with referring center Door-in Door-out (Length of Stay) < 45 min

- Referring Center ED or Pre-Hospital First Medical Contact-to-PCI time ≤ 120 minutes (including transport time)

- All STEMI patients without a contraindication receiving Aspirin prior to referring center ED discharge
The first step in treating a STEMI patient is diagnosis!
STEMI (ST Elevation Myocardial Infarction) Diagnostic Criteria:

- ST elevation at the J point in at least 2 contiguous leads of $\geq 2 \text{ mm (0.2 mV)}$ in men or $\geq 1.5 \text{ mm (0.15 mV)}$ in women in leads V2–V3 and/or of $\geq 1 \text{ mm (0.1 mV)}$ in other contiguous chest leads or the limb leads.
- Signs & symptoms of discomfort suspect for AMI (Acute Myocardial Infarction) or STEMI with a duration > 15 minutes < 12 hours.
- Although new, or presumably new, LBBB at presentation occurs infrequently and may interfere with ST-elevation analysis, care should be exercised in not considering this an acute myocardial infarction (MI) in isolation. If in doubt, immediate consultation with PCI receiving center is recommended.
- ECG demonstrates evidence of ST depression suspect of a Posterior MI...consult with PCI receiving center.
- If initial ECG is not diagnostic but suspicion is high for STEMI, obtain serial 12 Lead ECG’s at 5-10 minute intervals.
MINNESOTA STEMI GUIDELINE

IDENTIFICATION/ DIAGNOSE STEMI
- Signs & Symptoms suspect for AMI (Acute Myocardial Infarction) - Duration < 12 hours
- ST Elevation in 2 contiguous leads as defined by diagnostic criteria on page 2
- Pre-Hospital STEMI confirmed by transmission of ECG from field and/or identified by 12 Lead ECG trained EMS

ACTIVATE TRANSPORT
- Establish availability and ETA of Air or Ground ALS EMS for Interfacility Transfer to Primary PCI Hospital
- Estimate FMC to Potential PCI:
  (Allow approx. 20 min after arrival to PCI)

ACTIVATE YOUR INTERNAL STEMI ALERT
- Alert appropriate provider(s) and team members

ESTABLISH KEY TIMES:
- Symptom Onset: _____
- First Medical Contact (FMC): _____
- ETA at PCI Hospital: _____

Estimated FMC to PCI ≤ 120 minutes
Estimated FMC to PCI 120-180 minutes
Estimated FMC to PCI > 120 minutes
Case Presentation

• 78 yo man has chest pressure x 30 min
• Wife calls 911
• You are a member of the local EMS crew dispatched to patient’s home

• Upon arrival, patient is hemodynamically stable
  • + persistent Sx
Based on the following ECG, what should you do?

1) Transport patient to local, non-PCI capable hospital located 5 min away

2) Transport patient to PCI capable, non-affiliated hospital (i.e. one outside of your health care system) located 25 min away

3) Transport patient to PCI capable, affiliated hospital (i.e. one within your health care system) located 45 min away

4) Transport patient to non-PCI capable hospital located 60 min away
Presenting ECG
Based on the following ECG, what should you do?

1) Transport patient to local, non-PCI capable hospital located 5 min away

2) Transport patient to PCI capable, non-affiliated hospital (i.e. one outside of your health care system) located 25 min away

3) Transport patient to PCI capable, affiliated hospital (i.e. one within your health care system) located 45 min away

4) Transport patient to non-PCI capable hospital located 60 min away
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.*
• Primary PCI preferred >> thrombolytic IF
  • able to be performed by experienced operators
  • ideal FMC-to-device time system goal of 90 minutes or less.
What if…

• The closest PCI capable hospital is 2 hours away
Presenting ECG
Based on the following ECG, what should you do?

1) Transport patient to local, non-PCI capable hospital located 5 min away

2) Transport patient to PCI capable, non-affiliated hospital (i.e. one outside of your health care system) located 120 min away

3) Transport patient to PCI capable, affiliated hospital (i.e. one within your health care system) located 135 min away

4) Transport patient to non-PCI capable hospital located 60 min away
Time = Muscle

Muscle = Life
• Primary PCI preferred >> thrombolytic IF
  • able to be performed by experienced operators
  • ideal FMC-to-device time system goal of 90 minutes or less.

• (Assuming it takes 20 min from cath lab entry → device):
  • If the closest PCI-capable hospital is > 60 min away, strongly consider transporting to closest ER (even at non-PCI capable facility)
You are an ER provider for:

- 78 yo man BIBA for chest pressure x 40 min
- Wife calls 911, FMC (EMS) was 10 min ago
As an ER provider, what should you do?

1) Administer ASA (81 mg x 4), heparin bolus and infusion, Plavix 300 mg, full dose thrombolytic therapy

2) Administer ASA (81 mg x 4), heparin bolus and infusion, Plavix 75 mg, half dose thrombolytic therapy

3) Administer ASA (81 mg x 4), heparin bolus w/out infusion, Plavix 600 mg, half dose thrombolytic therapy

4) Administer ASA (81 mg x 4), heparin bolus w/out infusion, Plavix 600 mg, immediate xfer to PCI capable hospital
As an ER provider, what should you do?

1) Administer ASA (81 mg x 4), heparin bolus and infusion, Plavix 300 mg, full dose thrombolytic therapy

2) Administer ASA (81 mg x 4), heparin bolus and infusion, Plavix 75 mg, half dose thrombolytic therapy

3) Administer ASA (81 mg x 4), heparin bolus w/out infusion, Plavix 600 mg, half dose thrombolytic therapy

4) Administer ASA (81 mg x 4), heparin bolus w/out infusion, Plavix 600 mg, immediate xfer to PCI capable hospital

It Depends…
To Lyse or Not to Lyse?
To Lyse or Not to Lyse?

1) Proximity to PCI capable facility

2) External factors affecting expeditious transfer (e.g. weather)

3) Contraindications to lytic therapy

Let \( z = \sqrt[2]{y} = y^{1/2} \)

So \( dz = \frac{1}{2}y^{-1/2} dy = \frac{1}{2z\sqrt{y}} dy \)

And \( z^2 = y \) and \( z=0 \implies y=0 \)

\( z = \sqrt{v} \implies y = v \)
Primary PCI is Preferred Rx (goal<120 min)

\[
\begin{align*}
\text{Let } z &= \sqrt{y} = y^{1/2} \\
\text{So } dz &= \frac{1}{2} y^{-1/2} dy = \frac{1}{2 z} dy \\
\text{And } z^2 &= y \quad \text{and } z=0 \Rightarrow y = 0 \\
z &= \sqrt{v} \Rightarrow y = v
\end{align*}
\]

• Formula: Time spent in ED + transport time + 20 minutes for PCI
• If above sum is <120 minutes, primary PCI should be treatment of choice
**EXAMPLE 1:** 30 minutes in ED + 60 minutes transport + 20 minutes PCI = 110 minutes

Transfer for Primary PCI

**EXAMPLE 2:** 70 minutes in ED + 40 minutes transport + 20 minutes PCI = 140 minutes

Administer lytics if patient is a candidate and transfer immediately to PCI center
If FMC to PCI < 120 min, or if not lytic appropriate, choose Primary PCI, (green box)
If FMC to PCI 120-180 min & going to Abbott NW, choose pharmaco-invasive (blue box)
If FMC to PCI > 120 min, or if > 180 min & going to Abbott NW, choose fibrinolytic strategy (yellow box)

**Estimated FMC to PCI ≤ 120 minutes**

Or FMC > 120 minutes, and one of the following:
- Fibrinolytic Ineligible
- Resuscitated out-of-hospital cardiac arrest patients whose initial ECG shows STEMI
- Evidence of either Cardiogenic Shock or Acute Severe CHF

**Do NOT give Lytic/TNK!**

**Estimated FMC to PCI 120-180 minutes**

- Establish if Fibrinolytic appropriate (See page 2 for contraindications)
- Goal: Door to Needle < 30 minutes
1. **For all ages transferring not utilizing** Pharmaco-invasive strategy proceed to Full Dose Fibrinolytic Strategy
2. **For patients** transferring to Abbott NW/NIH utilizing Pharmaco-invasive strategy, administer HALF-Dose TNK IV and transfer for PCI (Dosing table pg. 2)

**All:**
- Aspirin 81 mg x 4 chewed (*Dose to achieve 324 mg)
- Heparin IV Bolus 60 Units/kg, max 4,000 Units (No IV Heparin Drip)
- Ticagrelor 180 mg PO
  (If Ticagrelor not available, then give Clopidogrel 600 mg PO)

**Estimated FMC to PCI >120 minutes**

- Establish if Fibrinolytic appropriate (See page 2 for contraindications)
- Goal: Door to Needle < 30 minutes
- Consider consultation with PCI receiving Center Cardiology prior to administration of fibrinolytic.

**For all ages transferred with an estimated FMC to PCI > 180 minutes**

**All:**
- Aspirin 81 mg x 4 chewed (*Dose to achieve 324 mg)
- Heparin IV Bolus 60 Units/kg, max 4,000 Units
- Heparin IV Drip 12 Units/kg/hr, max 1,000 Units/hr

**For AGE ≤ 75 years old:**
- Clopidogrel 300 mg PO
- TNK “FULL-Dose” IV

**For AGE > 75 years old:**
- Clopidogrel 75 mg PO
- TNK “HALF-Dose” IV
Transfer for Primary PCI

Estimated FMC to PCI ≤ 120 minutes

Or FMC > 120 minutes, and one of the following:

- Fibrinolytic Ineligible
- Resuscitated out-of-hospital cardiac arrest patients whose initial ECG shows STEMI
- Evidence of either Cardiogenic Shock or Acute Severe CHF

**Do NOT give Lytic/TNK!**

All:

- Aspirin 81 mg x4 chewed
  (*Dose to achieve 324 mg*)
- Heparin IV Bolus 60 Units/kg, max 4,000 Units (No IV Heparin Drip)
- Ticagrelor 180 mg PO
  (If Ticagrelor not available, then give Clopidogrel 600 mg PO)
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.*
If FMC to PCI < 120 min, or if not lytic appropriate, choose Primary PCI, (green box)

If FMC to PCI 120-180 min & going to Abbott NW, choose pharmaco-invasive (blue box)

If FMC to PCI > 120 min, or if > 180 min & going to Abbott NW, choose fibrinolytic strategy (yellow box)
Pharmaco-Invasive Strategy (Abbott Northwestern)

Estimated FMC to PCI 120-180 minutes

1. For all ages transferring **not utilizing** Pharmaco-invasive strategy proceed to Full Dose Fibrinolytic Strategy

2. For patients transferring to Abbott NWMH utilizing Pharmaco-invasive strategy, administer HALF-Dose TNK IV and transfer for PCI (Dosing table pg. 2)

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- Aspirin 81 mg x4 chewed (*Dose to achieve 324 mg)
- Heparin IV Bolus 60 Units/kg, max 4,000 Units (No IV Heparin Drip)
- Clopidogrel 600 mg PO
- TNK “HALF-Dose” IV
Estimated FMC to PCI >120 minutes

- Establish if Fibrinolytic appropriate (See page 2 for contraindications)
- Goal: Door to Needle < 30 minutes
- Consider consultation with PCI receiving Center Cardiology prior to administration of fibrinolytic.
**For all ages transferred with an estimated FMC to PCI > 180 minutes

All:
- Aspirin 81 mg x 4 chewed (*Dose to achieve 324 mg)
- Heparin IV Bolus 60 Units/kg, max 4,000 Units
- Heparin IV Drip 12 Units/kg/hr, max 1,000 Units/hr

For AGE ≤ 75 years old:
- Clopidogrel 300 mg PO
- TNK “FULL-Dose” IV

For AGE > 75 years old
- Clopidogrel 75 mg PO
- TNK “HALF-Dose” IV
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.
When fibrinolytic therapy is indicated or chosen as the primary reperfusion strategy, it should be administered within 30 minutes of hospital arrival.
The importance of time to thrombolysis in acute myocardial infarction and the absolute reduction in 35-day mortality in a meta-analysis of over 50,000 patients. The benefit from thrombolytic therapy is greatest when it is administered within two hours of symptom onset. The survival benefit is progressively reduced as the delay in therapy increases; after two hours, the benefit from thrombolytic therapy fits a linear function (black line) in which the benefit falls by approximately 1.6 lives per 1000 patients per hour of treatment delay.

Data from Boersma E, Maas ACP, Simoon ML. Lancet 1996; 348:771.
Estimated FMC to PCI >120 minutes

- Establish if Fibrinolytic appropriate (See page 2 for contraindications)
- Goal: Door to Needle < 30 minutes
- Consider consultation with PCI receiving Center Cardiology prior to administration of fibrinolytic.

**For all ages transferred with an estimated FMC to PCI > 180 minutes

All:
- Aspirin 81 mg x 4 chewed
  (*Dose to achieve 324 mg)
- Heparin IV Bolus 60 Units/kg, max 4,000 Units
- Heparin IV Drip 12 Units/kg/hr, max 1,000 Units/hr

For AGE ≤ 75 years old:
- Clopidogrel 300 mg PO
- TNK "FULL-Dose" IV

For AGE > 75 years old
- Clopidogrel 75 mg PO
- TNK "HALF-Dose" IV
Age & Lytic Dosing – STREAM Trial

- STREAM: a modern STEMI trial that looked at those that could not get Primary PCI within 1 hour.
  - Previous fibrinolytic trials did not include very many elderly patients

- After recruiting about 20% of the trial participants, it was noticed that the Intracranial Hemorrhage / Stroke rate for those over 75 years old was over 8%.

Armstrong, et al; Fibrinolysis or Primary PCI in ST-Segment Elevation Myocardial Infarction (STREAM Investigation Team); NEJM, March 10, 2013.
**Table 3. Strokes and Nonintracranial Bleeding Events within 30 Days.**

<table>
<thead>
<tr>
<th>Event</th>
<th>Fibrinolysis (N=944)</th>
<th>Primary PCI (N=948)</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>no./total no. (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total strokes</td>
<td>15/939 (1.6)</td>
<td>5/946 (0.5)</td>
<td>0.03</td>
</tr>
<tr>
<td>Intracranial hemorrhage</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Any</td>
<td>9/939 (1.0)</td>
<td>2/946 (0.2)</td>
<td>0.04</td>
</tr>
<tr>
<td>After protocol amendment*</td>
<td>4/747 (0.5)</td>
<td>2/758 (0.3)</td>
<td>0.45</td>
</tr>
<tr>
<td>Primary ischemic stroke</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Without hemorrhagic conversion</td>
<td>5/939 (0.5)</td>
<td>3/946 (0.3)</td>
<td>0.51</td>
</tr>
<tr>
<td>With hemorrhagic conversion</td>
<td>1/939 (0.1)</td>
<td>0/946</td>
<td>0.50</td>
</tr>
<tr>
<td>Nonintracranial bleeding</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Major</td>
<td>61/939 (6.5)</td>
<td>45/944 (4.8)</td>
<td>0.11</td>
</tr>
<tr>
<td>Minor</td>
<td>205/939 (21.8)</td>
<td>191/944 (20.2)</td>
<td>0.40</td>
</tr>
<tr>
<td>Blood transfusion</td>
<td>27/937 (2.9)</td>
<td>22/943 (2.3)</td>
<td>0.47</td>
</tr>
</tbody>
</table>

* On August 24, 2009, the study protocol was amended to reduce the dose of tenecteplase by 50% in patients 75 years of age or older because of an excess of intracranial hemorrhage in this age group.

Rates of stroke were low in the two study groups, but both intracranial hemorrhagic and primary ischemic strokes were more frequent in the fibrinolysis group than in the primary PCI group (Table 3). After the dose reduction of tenecteplase in patients 75 years of age or older, there were no cases of intracranial hemorrhage (0 of 97 patients), as compared with 3 of 37 patients (8.1%) in this age group before the amendment. The rate of major nonintracranial bleeding was 6.5% in the fibrinolysis group, and 4.8% in the primary PCI group, a difference that was not significant (P=0.11). The rates of blood transfusions were also similar in the two study groups (2.9% and 2.3%, respectively; P=0.47).
Estimated FMC to PCI > 120 minutes

- Establish if Fibrinolytic appropriate (See page 2 for contraindications)
- Goal: Door to Needle < 30 minutes
- Consider consultation with PCI receiving Center Cardiology prior to administration of fibrinolytic.

**For all ages transferred with an estimated FMC to PCI > 180 minutes

All:
- Aspirin 81 mg x 4 chewed
  (*Dose to achieve 324 mg)
- Heparin IV Bolus 60 Units/kg, max 4,000 Units
- Heparin IV Drip 12 Units/kg/hr, max 1,000 Units/hr

For AGE ≤ 75 years old:
- Clopidogrel 300 mg PO
- TNK “FULL-Dose” IV

For AGE > 75 years old
- Clopidogrel 75 mg PO
- TNK “HALF-Dose” IV
Clopidogrel dosing with Fibrinolytic

- Fibrinolytics trigger platelet activation, and anti-platelet medications are essential (Aspirin and Clopidogrel)

- Very little data exist yet for using ticagrelor or prasugrel along with fibrinolytics, so clopidogrel remains preferred
Initial presentation to non-PCI site

- Transfer for primary PCI preferred **IF**
  - FMC-to-device time < 120 minutes
  - Goal door in – door out (DIDO) time < 45 min
ED time and Risk-adjusted in-hospital mortality
Direct EMS patients

<table>
<thead>
<tr>
<th>Emergency department time</th>
<th>In hospital mortality</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;= 30 min</td>
<td>3.6%</td>
<td></td>
</tr>
<tr>
<td>30 - 45 min</td>
<td>7.0%</td>
<td>P&lt;0.001</td>
</tr>
<tr>
<td>&gt; 45 min</td>
<td>10.8%</td>
<td></td>
</tr>
</tbody>
</table>

n=4939 n=2575 n=3054
Initial presentation to non-PCI site

- Transfer for primary PCI preferred **IF**
  - FMC-to-device time $< 120$ minutes
  - Goal door in – door out (DIDO) time $< 45$ min

- Otherwise, lyse
  - Goal door-to-needle time $< 30$ min
Minnesota STEMI GUIDELINE
Mission: Lifeline Statewide STEMI Interfacility Transfer Guideline

STEMI (ST Elevation Myocardial Infarction) Diagnostic Criteria:

- ST elevation at the J point in at least 2 contiguous leads of ≥ 2 mm (0.2 mV) in men or ≥ 1.5 mm (0.15 mV) in women in leads V2–V3 and/or of ≥ 1 mm (0.1 mV) in other contiguous chest leads or the limb leads.
- Signs & symptoms of discomfort suspect for AMI (Acute Myocardial Infarction) or STEMI with a duration > 15 minutes < 12 hours.
- Although new, or presumably new, LBBB at presentation occurs infrequently and may interfere with ST-elevation analysis, care should be exercised in not considering this an acute myocardial infarction (MI) in isolation. If in doubt, immediate consultation with PCI receiving center is recommended.
- ECG demonstrates evidence of ST depression suspect of a Posterior MI; consult with PCI receiving center.
- If initial ECG is not diagnostic but suspicion is high for STEMI, obtain serial 12 Lead ECG’s at 5-10 minute intervals.
If FMC to PCI < 120 min, or if not lytic appropriate, choose Primary PCI, (green box)

If FMC to PCI 120-180 min & going to Abbott NW, choose pharmaco-invasive (blue box)

If FMC to PCI > 120 min, or if > 180 min & going to Abbott NW, choose fibrinolytic strategy (yellow box)

---

**Estimated FMC to PCI ≤ 120 minutes**

- Or FMC > 120 minutes, and one of the following:
  - Fibrinolytic Ineligible
  - Resuscitated out-of-hospital cardiac arrest patients whose initial ECG shows STEMI
  - Evidence of either Cardiogenic Shock or Acute Severe CHF

  *Do NOT give Lytic/TNK!*

**Estimated FMC to PCI 120-180 minutes**

- Establish if Fibrinolytic appropriate (See page 2 for contraindications)
- Goal: Door to Needle < 30 minutes

1. For all ages transferring not utilizing Pharmaco-invasive strategy proceed to Full Dose Fibrinolytic Strategy
2. For patients transferring to Abbott NW/NHI utilizing Pharmaco-invasive strategy, administer HALF-Dose TNK IV and transfer for PCI (Dosing table pg. 2)

**Estimated FMC to PCI >120 minutes**

- Establish if Fibrinolytic appropriate (See page 2 for contraindications)
- Goal: Door to Needle < 30 minutes
- Consider consultation with PCI receiving Center Cardiology prior to administration of fibrinolytic.

**For all ages transferred with an estimated FMC to PCI > 180 minutes**

**All:**
- Aspirin 81 mg x 4 chewed (*Dose to achieve 324 mg*)
- Heparin IV Bolus 60 Units/kg, max 4,000 Units (No IV Heparin Drip)
- Ticagrelor 180 mg PO (If Ticagrelor not available, then give Clopidogrel 600 mg PO)

**For AGE ≤ 75 years old:**
- Clopidogrel 300 mg PO
- TNK “FULL-Dose” IV

**For AGE > 75 years old:**
- Clopidogrel 75 mg PO
- TNK “HALF-Dose” IV
ACTIVATE CODE STEMI / STEMI ALERT AT PCI HOSPITAL
(See Page 2 for phone #, or follow your regional STEMI protocol)

TRANSPORT PATIENT AS SOON AS POSSIBLE!
Fax or Transmit ECG and other pertinent records
(EMS reports, allergies, past medical history, etc.)

- Aspirin 81 mg x4 chewed (*Dose to achieve 324 mg)
- Heparin IV Bolus 60 Units/kg, max 4,000 Units (No IV Heparin Drip)
- Ticagrelor 180 mg PO (If Ticagrelor not available, then give Clopidogrel 600 mg PO)

- Aspirin 81 mg x4 chewed (*Dose to achieve 324 mg)
- Heparin IV Bolus 60 Units/kg, max 4,000 Units (No IV Heparin Drip)
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- TNK “HALF-Dose” IV

- Heparin IV Drip 12 Units/kg/hr, max 1,000 Units/hr

For AGE ≤ 75 years old:
- Clopidogrel 300 mg PO
- TNK “FULL-Dose” IV

For AGE > 75 years old:
- Clopidogrel 75 mg PO
- TNK “HALF-Dose” IV
2013 AHA Mission: Lifeline STEMI Best Practice Guidelines:

- FMC (First Medical Contact)-to-First ECG time < 10 minutes unless pre-hospital ECG obtained
- All eligible STEMI patients receiving a Reperfusion (PPCI or fibrinolysis) Therapy
- Fibrinolytic eligible STEMI patients with Door-to-Needle time ≤ 30 minutes
- PPCI eligible patients transferred to a PCI receiving center with referring center Door in- Door out (Length of Stay) ≤ 45 minutes
- Referring Center ED or Pre-Hospital First Medical Contact-to-PCI time ≤ 120 minutes (including transport time)
- All STEMI patients without a contraindication receiving Aspirin prior to referring center ED discharge

Patients with a contraindication to transfer or PCI:

- Aspirin within 24 hours of hospital arrival, and aspirin at discharge
- Beta blocker at discharge
- LDL >100 who receive statins or lipid lowering drugs
- STEMI patients with left ventricular systolic dysfunction on ACEI/ARB at discharge
- STEMI patients who smoke with smoking cessation counseling at discharge

4-2014
Case Presentation

• 55 yo woman has intermittent chest burning x half day (? GERD)
• Sx worsen and she presents to local ER (a non-PCI center)

• You are the ER provider
• + Sx for approx. 16 hours
Based on the following ECG, what should you do?

1) Administer full dose lytic therapy
2) Administer half dose lytic therapy
3) Transfer for primary PCI (located 1 hour away)
4) Administer high dose NSAIDs for pericarditis
Presenting ECG
Based on the following ECG, what should you do?

1) Administer full dose lytic therapy
2) Administer half dose lytic therapy
3) Transfer for primary PCI (located 1 hour away)
4) Administer high dose NSAIDs for pericarditis
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 [if can be performed within 120 min of FMC].
In the absence of contraindications, fibrinolytic therapy should be given to patients with STEMI and onset of ischemic symptoms within the previous 12 hours when it is anticipated that primary PCI cannot be performed within 120 minutes of FMC.

In the absence of contraindications and when PCI is not available, fibrinolytic therapy is reasonable for patients with STEMI if there is clinical and/or ECG evidence of ongoing ischemia within 12 to 24 hours of symptom onset and a large area of myocardium at risk or hemodynamic instability.
Initial presentation to non-PCI site

- Transfer for primary PCI preferred **IF**
  - FMC-to-device time < 120 minutes
  - Goal door in – door out (DIDO) time < 45 min

- Otherwise, lyse
  - Goal door-to-needle time < 30 min
Case Presentation

• 55 yo woman has intermittent chest burning x half day (? GERD)

• Sx worsen and she presents to local ER (a non-PCI center)

• You are the ER provider

• + Sx for approx. 16 hours
Presenting ECG
Case Presentation

- SBP 90 mmHg, tachypneic, O2 sat 89% (RA)
- Lungs: bilateral rales \(\frac{1}{2}\) way up
- Skin: cool & clammy

- Labs:
  - Cr 1.6 (previously 0.9)
  - INR 1.5 (not on any meds)
Based on the previous ECG and concern for cardiogenic shock what should you do?

1) Administer full dose lytic therapy
2) Administer half dose lytic therapy
3) Transfer for primary PCI (located 2 hours away)
4) Administer vitamin K
Based on the previous ECG and concern for cardiogenic shock what should you do?

1) Administer full dose lytic therapy
2) Administer half dose lytic therapy
3) Transfer for primary PCI (located 2 hours away)
4) Administer vitamin K
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.
If FMC to PCI < 120 min, or if not lytic appropriate, choose Primary PCI, (green box)
If FMC to PCI 120-180 min & going to Abbott NW, choose pharmaco-invasive (blue box)
If FMC to PCI > 120 min, or if > 180 min & going to Abbott NW, choose fibrinolytic strategy (yellow box)

**Estimated FMC to PCI ≤ 120 minutes**

- Or FMC > 120 minutes, and one of the following:
  - Fibrinolytic Ineligible
  - Resuscitated out-of-hospital cardiac arrest patients whose initial ECG shows STEMI
  - Evidence of either Cardiogenic Shock or Acute Severe CHF

  **“Do NOT give Lytic/TNK!”**

**All:**
- Aspirin 81 mg x 4 chewed (*Dose to achieve 324 mg*)
- Heparin IV Bolus 60 Units/kg, max 4,000 Units (No IV Heparin Drip)
- Ticagrelor 180 mg PO
  (If Ticagrelor not available, then give Clopidogrel 600 mg PO)

**Estimated FMC to PCI 120-180 minutes**

- Establish if Fibrinolytic appropriate (See page 2 for contraindications)
- Goal: Door to Needle < 30 minutes

1. **For all ages transferring not utilizing** Pharmaco-invasive strategy proceed to Full Dose Fibrinolytic Strategy
2. **For patients** transferring to Abbott NW/NHI utilizing Pharmaco-invasive strategy, administer HALF-Dose TNK IV and transfer for PCI (Dosing table pg. 2)

**All:**
- Aspirin 81 mg x 4 chewed (*Dose to achieve 324 mg*)
- Heparin IV Bolus 60 Units/kg, max 4,000 Units
- Heparin IV Drip 12 Units/kg/hr, max 1,000 Units/hr

**For AGE ≤ 75 years old:**
- Clopidogrel 300 mg PO
- TNK “FULL-Dose” IV

**For AGE > 75 years old**
- Clopidogrel 75 mg PO
- TNK “HALF-Dose” IV

**Estimated FMC to PCI >120 minutes**

- Establish if Fibrinolytic appropriate (See page 2 for contraindications)
- Goal: Door to Needle < 30 minutes
- Consider consultation w/PCI receiving Center Cardiology prior to administration of fibrinolytic.

**For all ages transferred with an estimated FMC to PCI > 180 minutes**
Estimated FMC to PCI ≤ 120 minutes

Or FMC > 120 minutes, and one of the following:

- Fibrinolytic Ineligible
- Resuscitated out-of-hospital cardiac arrest patients whose initial ECG shows STEMI
- Evidence of either Cardiogenic Shock or Acute Severe CHF

**Do NOT give Lytic/TNK!

All:
- Aspirin 81 mg x4 chewed
  (*Dose to achieve 324 mg)
- Heparin IV Bolus 60 Units/kg, max 4,000 Units (No IV Heparin Drip)
- Ticagrelor 180 mg PO
  (If Ticagrelor not available, then give Clopidogrel 600 mg PO)

Transfer for Primary PCI
Case Presentation

- 46 yo man with chest heaviness, diaphoresis, and dyspnea x 45 min while shoveling snow
- He presents to local ER (a non-PCI center)
- You are the ER provider
Presenting ECG
Case Presentation

- The closest PCI facility
  - 2 hours away by car (normal driving conditions)
  - 45 min away by air
But it looked like this driving to ER…
What should you do?

1) Administer full dose lytic therapy
2) Administer half dose lytic therapy
3) Transfer for primary PCI (located > 2 hours away)
4) Call in sick
What should you do?

1) Administer full dose lytic therapy
2) Administer half dose lytic therapy
3) Transfer for primary PCI (located > 2 hours away)
4) Call in sick
**ABSOLUTE CONTRAINDICATIONS FOR FIBRINOLYSIS**

- Chest Pain / Symptom Onset > 12 hours
- Suspected aortic dissection
- Any prior intracranial hemorrhage
- Structural cerebral vascular lesion or malignant intracranial neoplasm
- Any active bleeding (excluding menses)
- Ischemic stroke within 3 months
- Significant closed-head or facial trauma within 3 months
- Pregnancy

**RELATIVE CONTRAINDICATIONS FOR FIBRINOLYSIS**

- Chest Pain / Symptom Onset > 6 hours
- Current use of oral anticoagulants (Warfarin, Dabigatran, Rivaroxaban, Apixaban, etc.)
- Uncontrolled hypertension on presentation (SBP > 180 or DBP > 90 mmHg)
- History of ischemic stroke more than 3 months, dementia, or known intracranial pathology not covered in contraindications
- Traumatic or prolonged CPR (over 10 minutes)
- Major surgery within last 3 weeks
- Recent internal bleeding (within last 2-4 weeks)
Which lytic is recommended?

1) Streptokinase
2) Tissue Plasminogen Activator (tPA)
3) Tenecteplase (TNKase)
4) Reteplase (RPA)
Which lytic is recommended?

1) Streptokinase
2) Tissue Plasminogen Activator (tPA)
3) Tenecteplase (TNKase)
4) Reteplase (RPA)
Why TNKase vs. RPA or TPA?

- Tenecteplase (TNKase) is an effective, fibrin specific clot buster
  - Given as a **single 5 second IV bolus**, and **does not need to be repeated** due to it’s longer half-life
- Reteplase (RPA) is also a reasonable lytic
  - IV push over 2 minutes, but **must be repeated after 30 minutes** due to shorter half-life
  - (We hope STEMI’s are on the way to the PCI hospital by then, and second bolus of RPA might get missed)
- TPA also works, but is not as practical
  - Requires **3 steps and 90 minutes to administer**
TNKase Review

- Criteria review for administration
- Relative contraindications
- Absolute contraindications
- Simplicity of dosing
  - Weight based and reference chart
- Mixing and administration technique
TNKase Administration

- Remove shield assembly (use red cannula)
- Withdraw 10 mL Sterile water
- Inject sterile water into TNKase vial
- SWIRL GENTLY
- Draw out appropriate dose and recap the red cannula
### TNKase Dosing

<table>
<thead>
<tr>
<th>Patient Weight</th>
<th><strong>FULL-DOSE</strong></th>
<th><strong>HALF-DOSE</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>59 kg or less</td>
<td>30 mg = 6 mL</td>
<td>15 mg = 3 mL</td>
</tr>
<tr>
<td>60 - 69 kg</td>
<td>35 mg = 7 mL</td>
<td>18 mg = 3.5 mL</td>
</tr>
<tr>
<td>70 - 79 kg</td>
<td>40 mg = 8 mL</td>
<td>20 mg = 4 mL</td>
</tr>
<tr>
<td>80 - 89 kg</td>
<td>45 mg = 9 mL</td>
<td>23 mg = 4.5 mL</td>
</tr>
<tr>
<td>90 kg or more</td>
<td>50 mg = 10 mL</td>
<td>25 mg = 5 mL</td>
</tr>
</tbody>
</table>
2 Indications for Half-Dose TNKase

1) Pharmaco-Invasive Strategy (Abbott NW)

2) Lytic Rx for age > 75 years (STREAM Trial)
Challenge!!!
Which of the following is the most appropriate management following lytic administration (at a non-PCI facility)?

1) Monitor patient for 90 min to assess for lytic success, transfer only if lytic failure
2) Monitor patient for 90 min to assess for lytic success, repeat lytic dose if lytic failure
3) Transfer patient immediately for immediate cardiac cath (“facilitated PCI”)
4) Transfer patient immediately to PCI-capable facility; if lytic failure, delay cath for 24 hours (bleeding risk)
5) Transfer patient immediately to PCI-capable facility; if lytic failure, proceed with immediate cath (“rescue PCI”)

Which of the following is the most appropriate management following lytic administration (at a non-PCI facility)?

1) Monitor patient for 90 min to assess for lytic success, transfer only if lytic failure
2) Monitor patient for 90 min to assess for lytic success, repeat lytic dose if lytic failure
3) Transfer patient immediately for immediate cardiac cath (“facilitated PCI”)
4) Transfer patient immediately to PCI-capable facility; if lytic failure, delay cath for 24 hours (bleeding risk)
5) Transfer patient immediately to PCI-capable facility; if lytic failure, proceed with immediate cath (“rescue PCI”)
Case Presentation (cont.)

• 46 yo man with chest heaviness, diaphoresis, and dyspnea x 45 min while shoveling snow
• He presents to local ER (a non-PCI center)
• Dx: Lateral STEMI
• Status post lytic therapy and transferred to closest PCI facility
• You are the receiving medical provider at the PCI facility
Case Presentation (cont.)

• Upon arrival, patient reports improved Sx

• EMS reports lateral ST segment elevations almost completely resolved
Case Presentation (cont.)

- En route, patient developed run of the rhythm shown
Which of the following is the most appropriate now?

1) Amiodarone bolus and infusion
2) Continue to monitor patient and plan for cath within next 24 hours
3) Refer for immediate cardiac cath
4) Administer half dose lytics
5) Repeat full dose lytics
Which of the following is the most appropriate now?

1) Amiodarone bolus and infusion
2) Continue to monitor patient and plan for cath within next 24 hours
3) Refer for immediate cardiac cath
4) Administer half dose lytics
5) Repeat full dose lytics
Clinical markers of lytic success

- Improvement in symptoms
- $\geq 50\%$ decline in ST segment elevations
- Reperfusion arrhythmia (e.g. AIVR, shown)
Angiography should be performed ideally between 3 to 24 hours after successful lysis.
Adjunctive Therapies
If FMC to PCI < 120 min, or if not lytic appropriate, choose Primary PCI, (green box)
If FMC to PCI 120-180 min & going to Abbott NW, choose pharmaco-invasive (blue box)
If FMC to PCI > 120 min, or if > 180 min & going to Abbott NW, choose fibrinolytic strategy (yellow box)
Estimated FMC to PCI >120 minutes

- Establish if Fibrinolytic appropriate (See page 2 for contraindications)
- Goal: Door to Needle < 30 minutes
- Consider consultation with PCI receiving Center Cardiology prior to administration of fibrinolytic.

**For all ages transferred with an estimated FMC to PCI > 180 minutes

All:
- Aspirin 81 mg x 4 chewed (*Dose to achieve 324 mg)
- Heparin IV Bolus 60 Units/kg, max 4,000 Units
- Heparin IV Drip 12 Units/kg/hr, max 1,000 Units/hr

For AGE ≤ 75 years old:
- Clopidogrel 300 mg PO
- TNK “FULL-Dose” IV

For AGE > 75 years old
- Clopidogrel 75 mg PO
- TNK “HALF-Dose” IV
Pharmaco-Invasive Strategy (Abbott Northwestern)

1. For all ages transferring not utilizing Pharmacoinvasive strategy proceed to Full Dose Fibrinolytic Strategy

2. For patients transferring to Abbott NW/HL utilizing Pharmacoinvasive strategy, administer HALF-Dose TNK IV and transfer for PCI (Dosing table pg. 2)

All:
- Aspirin 81 mg x 4 chewed (*Dose to achieve 324 mg)
- Heparin IV Bolus 60 Units/kg, max 4,000 Units (No IV Heparin Drip)
- Clopidogrel 600 mg PO
- TNK “HALF-Dose” IV
Estimated FMC to PCI ≤ 120 minutes

Or FMC > 120 minutes, and one of the following:

- Fibrinolytic Ineligible
- Resuscitated out-of-hospital cardiac arrest patients whose initial ECG shows STEMI
- Evidence of either Cardiogenic Shock or Acute Severe CHF

**Do NOT give Lytic/TNK!

All:

- Aspirin 81 mg x4 chewed (*Dose to achieve 324 mg)
- Heparin IV Bolus 60 Units/kg, max 4,000 Units (No IV Heparin Drip)
- Ticagrelor 180 mg PO
  (If Ticagrelor not available, then give Clopidogrel 600 mg PO)
Heparin IV Bolus Dose and No IV Drip for Primary PCI

- Heparin has often created confusion, and quite frankly – delays in STEMI transfer

- HORIZONS AMI: early Heparin IV bolus to STEMI patients reduces stent thrombosis

- There is value in not wasting time with heparin infusion
  - incompatible pumps and tubing
  - dosing errors

- Once arriving at the cath lab, more heparin can be given, or the patient might be started on bivalirudin (Angiomax) IV Drip
In the case of fibrinolysis, patients do need a Heparin IV Infusion during transfer.

**Estimated FMC to PCI >120 minutes**
- Establish if Fibrinolytic appropriate (See page 2 for contraindications)
- Goal: Door to Needle < 30 minutes
- Consider consultation with PCI receiving Center Cardiology prior to administration of fibrinolytic.

**For all ages transferred with an estimated FMC to PCI > 180 minutes**

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- Aspirin 81 mg x 4 chewed (*Dose to achieve 324 mg)
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- TNK “FULL-Dose” IV

**For AGE > 75 years old:**
- Clopidogrel 75 mg PO
- TNK “HALF-Dose” IV
Why Heparin vs. Enoxaparin?

- SYNERGY Trial: enoxaparin (Lovenox) may be better than Heparin
- Enoxaparin: not as practical to use for STEMI, and creates other challenges for patient care
Why Heparin vs. Enoxaparin?

• To be given correctly, enoxaparin must be given as an IV bolus, followed by a sub-cutaneous injection 15 minutes later

(15 minutes later, we hope a STEMI patient is already on the way to the Cath Lab!)

• Enoxaparin (Lovenox) comes in pre-filled syringes that cannot be given IV (must transfer to another syringe)
Why Heparin vs. Enoxaparin?

• Subcutaneous absorption can be impacted by a patient in cardiogenic shock, with poor peripheral perfusion

• When arriving at the cath lab, we cannot easily measure a bedside anti-Xa to assess level of anticoagulation

• If the patient starts to bleed, we cannot easily reverse it with protamine, like we can with Heparin
Why Heparin vs. Enoxaparin?

- Heparin is not perfect, but we can
  - easily measure it,
  - reverse it quickly with protamine if need be, and
  - we have the option to switch to bivalirudin in the cath lab if desired.
Case Presentation

• 60 yo woman presents to a PCI-capable hospital

• Chest discomfort x 35 min, NKDA
Case Presentation

- Vitals: 150/90, HR: 60, O2 Sat: 92% (RA)
- Active chest pain
Which of the following is not recommended at this time?

1) ASA 81 mg x 4
2) Ticagrelor 180 mg po x 1 (or Plavix 600 mg po x 1)
3) Activate Code STEMI
4) Oxygen via nasal cannula 2L
5) Sublingual NTG
Which of the following is not recommended at this time?

1) ASA 81 mg x 4
2) Ticagrelor 180 mg po x 1 (or Plavix 600 mg po x 1)
3) Activate Code STEMI
4) Oxygen via nasal cannula 2L
5) Sublingual NTG
AVOID (Air vs Oxygen in STEMI) Trial

**Primary Endpoint Infarct Size**

<table>
<thead>
<tr>
<th>Troponin I, mcg/L</th>
<th>Oxygen Arm N=200</th>
<th>No Oxygen Arm N=205</th>
<th>Ratio of means (Oxygen/No Oxygen)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geometric Mean Peak (95% CI)</td>
<td>57.4 (48.0 – 68.6)</td>
<td>48.0 (39.6 – 58.1)</td>
<td>1.20 (0.92 – 1.55)</td>
<td>0.18</td>
</tr>
<tr>
<td>Median Peak (IQR)</td>
<td>65.7 (30.1, 145.1)</td>
<td>62.1 (19.2, 144.0)</td>
<td></td>
<td>0.17</td>
</tr>
</tbody>
</table>

**SpO₂ in patients with STEMI**

- **Oxygen Arm**
- **No Oxygen Arm**

**Arrival of paramedics**
- **Arrival at hospital**
- **Arrival at cath lab**
- **2 hours post procedure**
- **4 hours post procedure**

P trend <0.01

**Area under curve p = 0.12**

AVOID (Air vs Oxygen in STEMI) Trial

Supplemental oxygen therapy in patients with STEMI but without hypoxia increased...
- Myocardial injury
- Recurrent myocardial infarction
- Major cardiac arrhythmia

... and was associated with larger myocardial infarct size assessed at six months
AVOID (Air vs Oxygen in STEMI) Trial

• Why withhold oxygen in STEMI?
• Supplemental oxygen may
  • reduce coronary blood flow
  • increase coronary vascular resistance
  • contribute to reperfusion injury through increased formation of reactive oxygen species
Top Patient Care Priorities:

- Establish DNR/Resuscitation Status
- Obtain vital signs and assess pain level on scale of 1-10
- Cardiac Monitor & attach hands-free defibrillator pads
- Establish Saline Lock - large bore needle (left arm preferred)
- Oxygen PRN at 2 L/min and titrate to SpO2 > 90%
- Assess Allergies (Note if reaction to IV Contrast?)
Pop Quiz!!!
Case Presentation

• 55 yo woman has chest pressure x 30 min

• You are the first medical responder (EMS, ED provider)

• Upon presentation, patient is hemodynamically stable, O2 Sat: 88% (RA)
  • + persistent Sx
Presenting ECG
Which of the following is not recommended at this time?

1) ASA 81 mg x 4
2) Heparin bolus
3) Activate Code STEMI
4) Oxygen via nasal cannula 2L
5) Sublingual NTG
Which of the following is not recommended at this time?

1) ASA 81 mg x 4
2) Heparin bolus
3) Activate Code STEMI
4) Oxygen via nasal cannula 2L
5) Sublingual NTG
Presenting ECG
Concern for Posterior MI → Obtain Right-sided leads to r/o RV infarct

- RV infarct
  - Preload Dependent
  - NTG will reduce preload & potentially cause hypotension / hemodynamic collapse
ST Elevation is an EMERGENCY!
Why are we talking about STEMI care?

- Approximately *every 25 seconds*, an American will experience a heart attack, and approximately *every minute*, someone will die of one.
Primary PCI is the recommended method of reperfusion when it can be performed in a timely fashion by experienced operators.
Sometimes you don’t get an Easy button in life…
Time = Muscle
Muscle = Life
Reperfusion

Thrombolysis
DOOR TO N: 30 MIN.

Angioplasty
FMC TO DEV: 90 MIN.

Sooner is Better
STEAMI Goal Times

- FMC to ECG acquisition < 10 minutes
- PCI capable hospital direct presentation, FMC-PCI time < 90 minutes
- Non-PCI capable hospital presentation, Door In Door Out <45 minutes

- Transfer for primary PCI only if FMC-PCI time < 120 minutes...
  
  … Otherwise lytics within 30 minutes of arrival time followed by urgent transfer
Total Ischemic Time: True Determinant of Survival
The Chain of Survival
Total Ischemic Time: True Determinant of Survival
Weak Chain ≡ Failure
Mission: Lifeline is the American Heart Association’s national initiative to advance the systems of care for patients with ST-segment elevation myocardial infarction (STEMI) and those resuscitated after experiencing an Out-of-Hospital Cardiac Arrest. The overarching goal of the initiative is to reduce mortality and morbidity for STEMI and Out of Hospital Cardiac Arrest patients and to improve their overall quality of care.
We Can Do It!
Thank you!

wong.benjamin@mayo.edu