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Clinical Meeting & Exhibition

What Happens in the Cath Lab Stays in the Cath Lab: An Update of Old, New, and Controversial Topics in Interventional Cardiology

Disclosure

- The program chair and presenters for this continuing education activity have reported no relevant financial relationships.

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Bivalirudin versus Heparin in PCI

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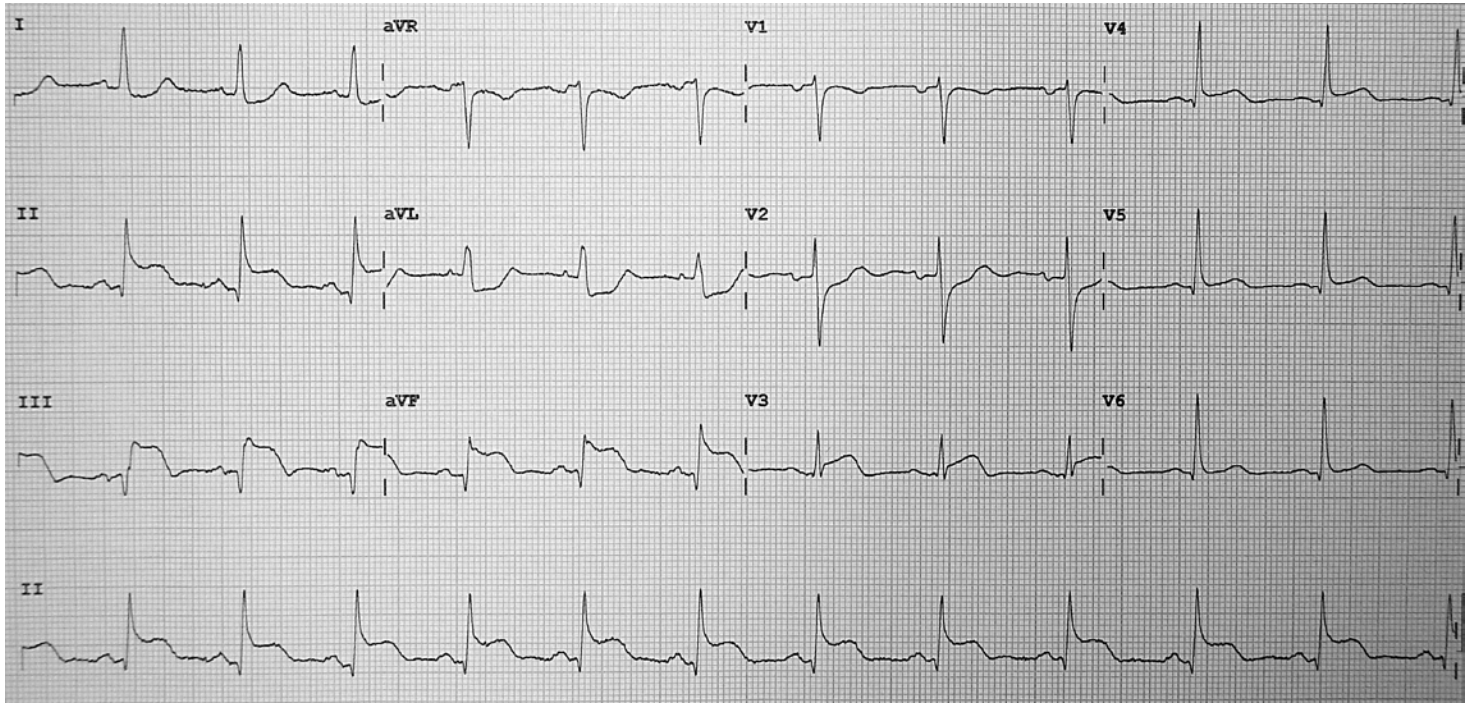
Learning Objectives

1. Describe different risk assessment strategies for bleeding and thrombosus and how they apply to appropriate medication selection
2. Analyze comparative literature and identify patients who may be candidates for UFH vs Bivalirudin

Patient Case

- EJ is a 38 yo male who presents to your emergency department with 2 hours of crushing chest pain. Pain started when plowing his driveway and continued even after resting.
- 12 lead ECG reveals the following:



Adapted from: https://commons.wikimedia.org/wiki/File:Inferior_and_RtV_MI_12_lead.jpg

Patient Case

- EJ is a 38 yo male who presents to your emergency department with 2 hours of crushing chest pain. Pain started when plowing his driveway and continued even after resting.
- 12 lead ECG reveals the following: STEMI
- PMHx: NIDDM x 1 year (on metformin). BMI: 25. No other known Hx
- Vitals: BP:115/68 HR:98 O_2:100% on 2L NC Temp: Afebrile
- EJ was given 325mg Aspirin, 180mg Ticagrelor and wheeled to the Cath Lab

Pre and Post Question: What is the ideal parenteral anticoagulant in EJ while undergoing PCI ?

A Unfractionated Heparin (UFH)

B Bivalirudin

C Either bivalirudin or UFH

D Fondaparinux

What % of patients at your institution get bivalirudin in PCI ?

A > 75 %

B < 75% but > 50%

C < 50% but > 25%

D < 25%

Once upon a time, their were two drugs, Heparin and Glycoprotein Inhibitors (GPI). When used together *in the Cath Lab,* they helped decrease *ischemic events*...but at the cost of *increased* severe bleeding.

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pany reasonably close by, a di

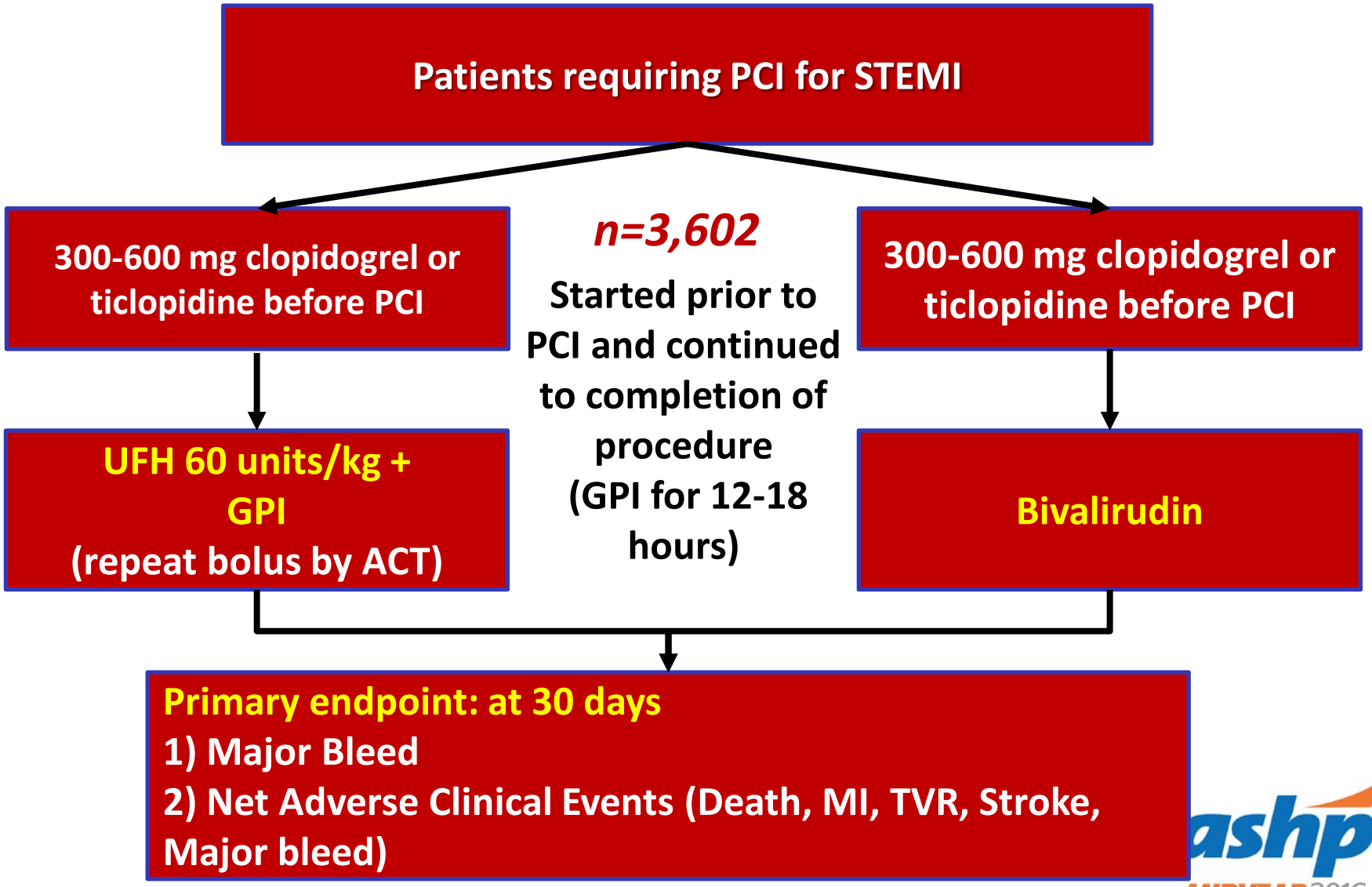
The Antithrombin Wars: A New Hope

Study	Population	Interventions	OUTCOME
CACHET 2002	Elective PTCA or Stenting N=268	Bivalirudin (3 dosing arms) vs UFH (70u/kg) +/- GPI for UFH or Bival	- No Difference in 30 day Death, MI, or uTVR - No Difference in major bleeding
REPLACE-1 2004	Elective or Urgent PCI N=1,056	Bivalirudin +/- GPI vs UFH (60-70u/kg) +/- GPI	- No Difference in 30 day Death, MI, or uTVR - No Difference in major bleeding
RAPLACE-2 2003	Elective or Urgent PCI N=6,010	Bivalirudin +/- GPI vs UFH (65u/kg)+GPI	- No Difference in 30 day Death, MI, or uTVR - **Major Bleeding lower with bivalirudin**
Acuity-PCI (substudy) 2007	Mod-High Risk ACS early PCI N=5,180	Bivalirudin vs UFH or LMWH + GPI	- No Difference in 28 day Death, MI, uTVR, or Stent Thrombosis - **Major Bleeding lower with bivalirudin**

All randomized controlled trials; REPLACE-1, Acuity-PCI not blinded. REPLACE-1 and CACHET were a pilot trials

Am Heart J 2002;143(5):847-53; Am J Cardiol 2004;93(9): 1092-6; JAMA 2003;289(7): 853-63; Lancet 2007;369:907–19

The Antithrombin Wars: HORIZONS-AMI



Stone. NEJM 2008 May 22;358(21):2218-30

The Antithrombin Wars: HORIZONS-AMI

- Results
  - 92.7% patients received PCI
  - 61% received 600mg clopidogrel
  - 1° endpoint: 30 day
    - NACE lower with bivalirudin (9.2% vs 12.1%; p = 0.005)
      - Ischemic events were similar between groups
    - Major bleed lower with bivalirudin (4.9 vs 8.3%; p < 0.001)
  - Lower mortality with bivalirudin (2.1% v 3.1%, p=0.047)
  - Greater stent thrombosis with bivalirudin (1.3% v 0.3%)

Stone. NEJM 2008 May 22;358(21):2218-30

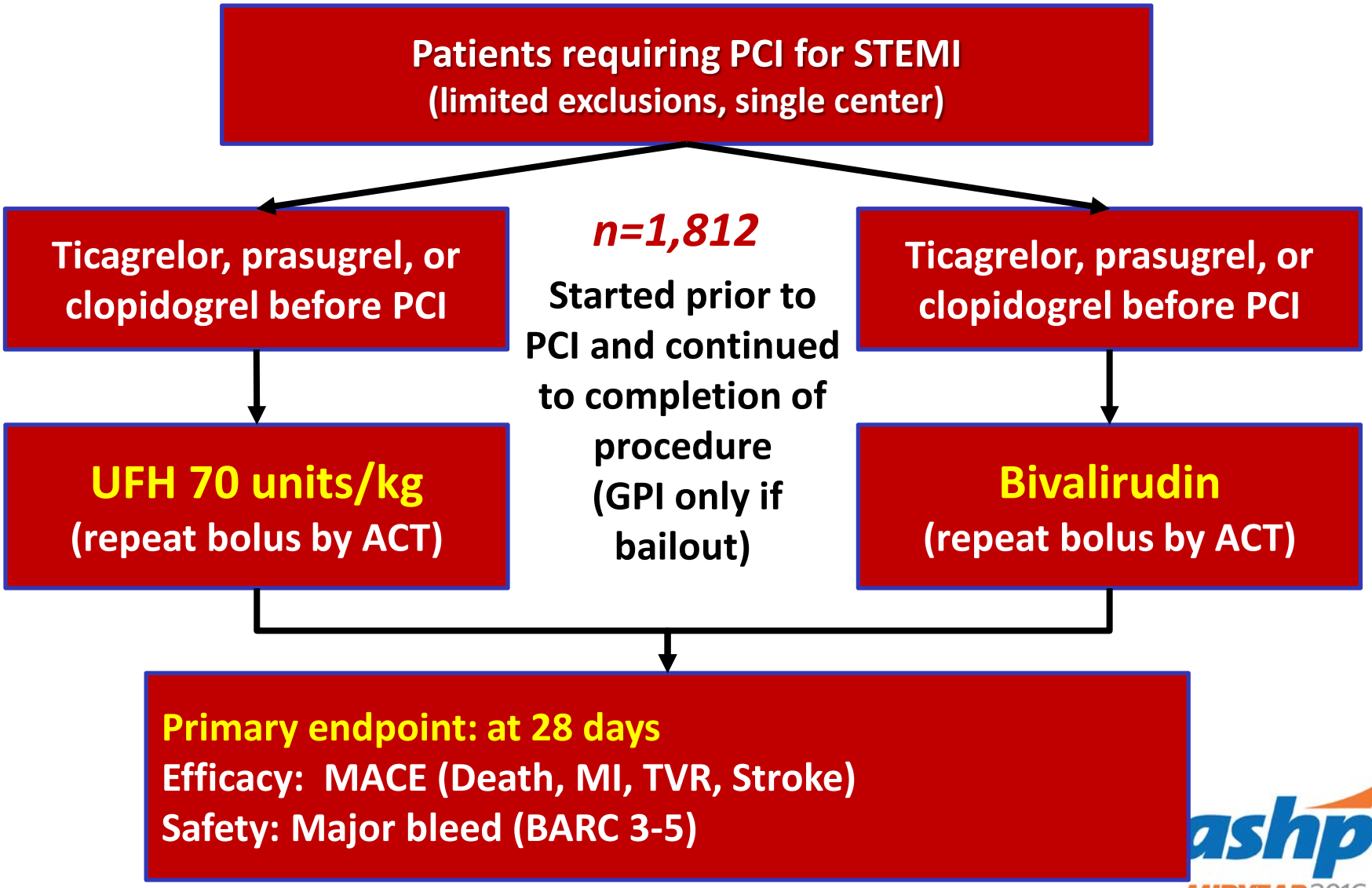
Post Horizons-AMI

Study	Population	Interventions	OUTCOME
ISAR-REACT 2008	Stable/unstable Angina with PCI N=4,570	Bivalirudin vs UFH (140u/kg)	- **No Difference** in 30 day Death, MI, or uTVR (5.9% B vs 5% UFH) - **No Difference** in mortality - **Major Bleeding lower with bivalirudin**
ISAR REACT 3a 2010	Stable/unstable Angina with PCI N=2,505+	UFH (100u/kg) vs ISAR-REACT UFH arm and bivalirudin arm	- UFH 100u/kg **non-inferior to bivalirudin** in NACE* - **Major bleeding lower** in the low dose UFH vs 140u/kg group (adjusted HR)
EuroMAX 2013	STEMI N = 2218	Bivalirudin +/- GPI vs UFH (60-100u/kg)+/- GPI drugs started on transport to hospital	- **No Difference** in 30 day MACE¥ (6% B vs 5.5% H+/-GPI) - **No Difference** in mortality - **Major Bleeding lower with bivalirudin**

* NACE includes major bleeding as part of a Quadruple endpoint; ¥composite adds cerebrovascular to standard MACE

Euro Heart J 2010;31:2482–2491; NEJM 2008;359:688-96; NEJM 2013;369:2207-2217

Heparin Strikes Back: HEAT PPCI



Shazhad et.al. Lancet. 2014;384(9957):1849-58

Heparin Strikes Back: HEAT PPCI

- Results
  - ~15% received GPI as bailout
  - ~90% received ticagrelor or prasugrel
  - ~81% arterial access through radial artery
  - 1 endpoint: MACE at 28 days
    - MACE at 28 days lower with UHF (5.7% v 8.7%, p=0.01)
      - Mostly due to MI and uTVR
    - No difference in Major Bleed (3.5% bival v 3.1% UHF)
  - Greater stent thrombosis with bivalirudin (3.4% v 0.9%)

Shazhad et.al. Lancet. 2014;384(9957):1849-58

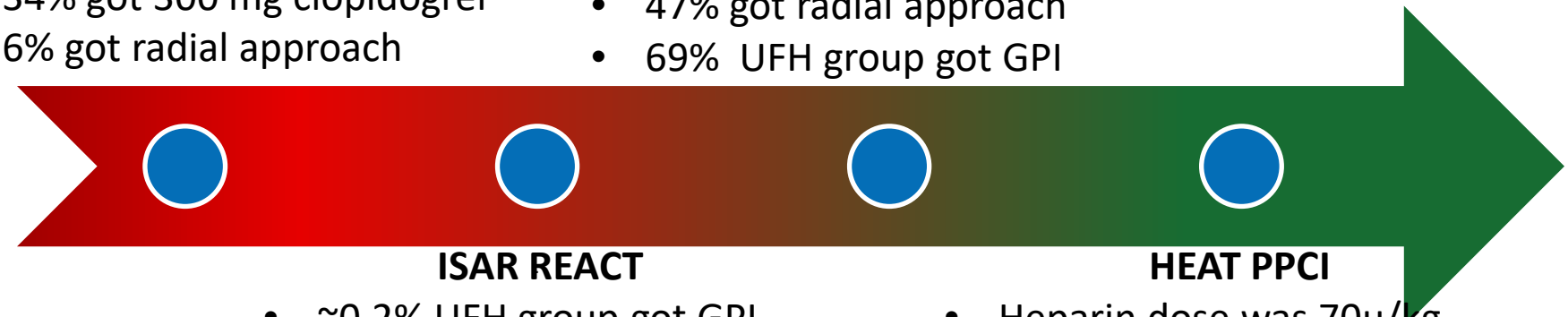
Why the Difference from HORIZONS-AMI to HEAT PPCI?

HORIZONS-AMI

- ~98% UFH group got GPI
- 34% got 300 mg clopidogrel
- 6% got radial approach

EUROMAX

- Heparin dose was 100u/kg
- ~50% got prasugrel/ticagrelor
- 47% got radial approach
- 69% UFH group got GPI



ISAR REACT

- ~0.2% UFH group got GPI
- 99% got 600 mg clopidogrel
- Heparin dose was 140u/kg

Caveat: non STEMI study

HEAT PPCI

- Heparin dose was 70u/kg
- ~90% got prasugrel/ticagrelor
- 82% got radial approach
- ~15% got GPI overall

What % of Cath lab patients at your institution are accessed by radial approach?

A > 75 %

B > 50%

C > 25%

D Less than 25%

What % of patients at your institution receive a GPI in the Cathlab ?

A > 25 %

B 15% - 25%

C Less than 15%

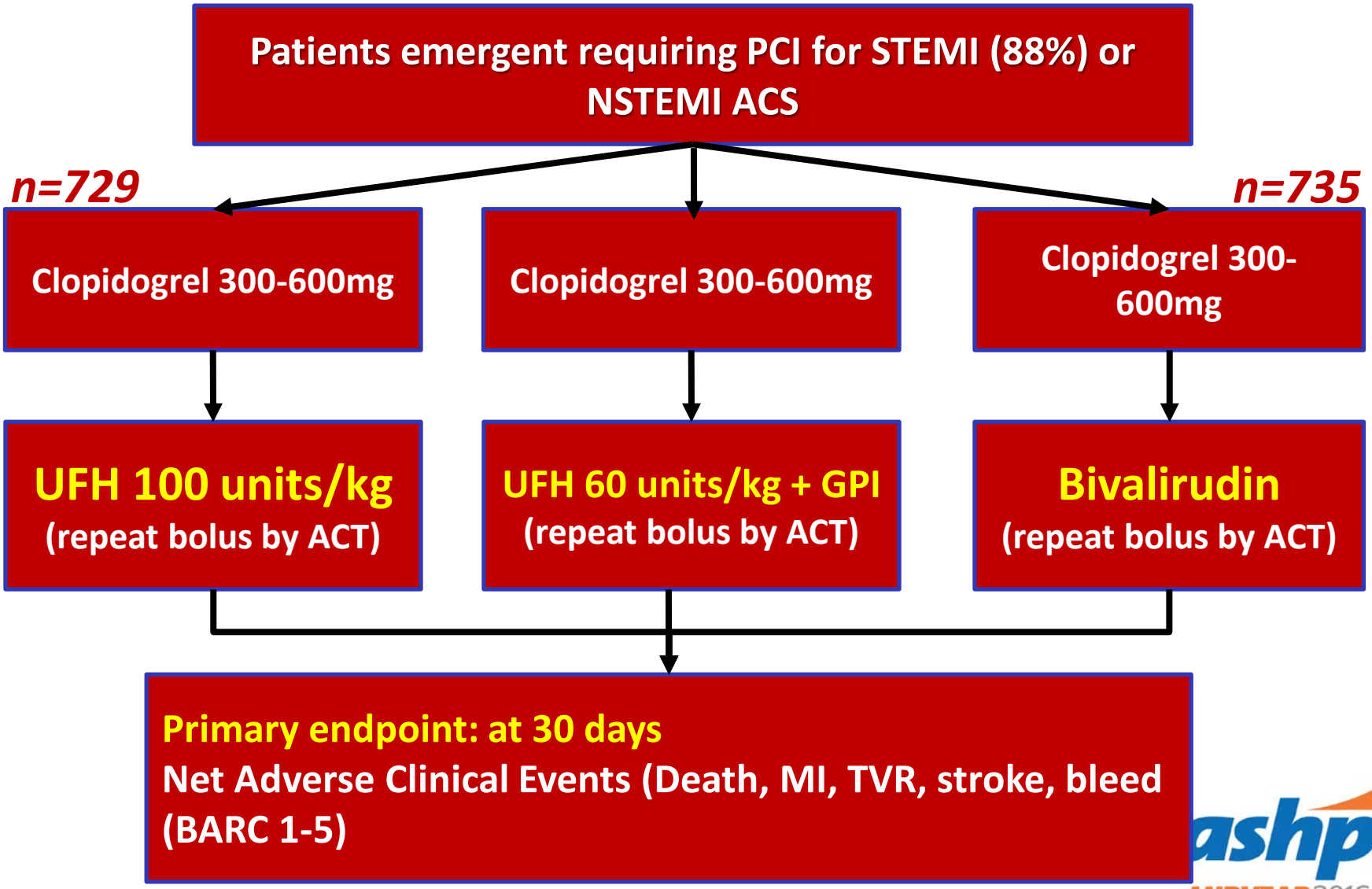
D Not sure

Controversies of the HEAT-PPCI

- Consent process considered unethical by some
- 13% GPI use in bivalirudin group is higher than normal
- Only ~82% patients underwent PCI
- Repeat dosing in bivalirudin group was higher (13%) than in historic studies
- Stent thrombosis in bivalirudin (3.4%) much higher than historic studies

- Many concluded that we should wait for BRIGHT and MATRIX

The Return of Bivalirudin?: BRIGHT Trial



JAMA. 2015;313(13):1336-1346

The Return of Bivalirudin?: BRIGHT Trial

- Results: 2,194 patients
  - NACE at 30 days was lower with bivalirudin (8.8%) vs UFH alone (13.3%)
    - Major difference was secondary to bleeding endpoint
    - No difference in ischemic endpoints
      - Death was 1.8% in either group

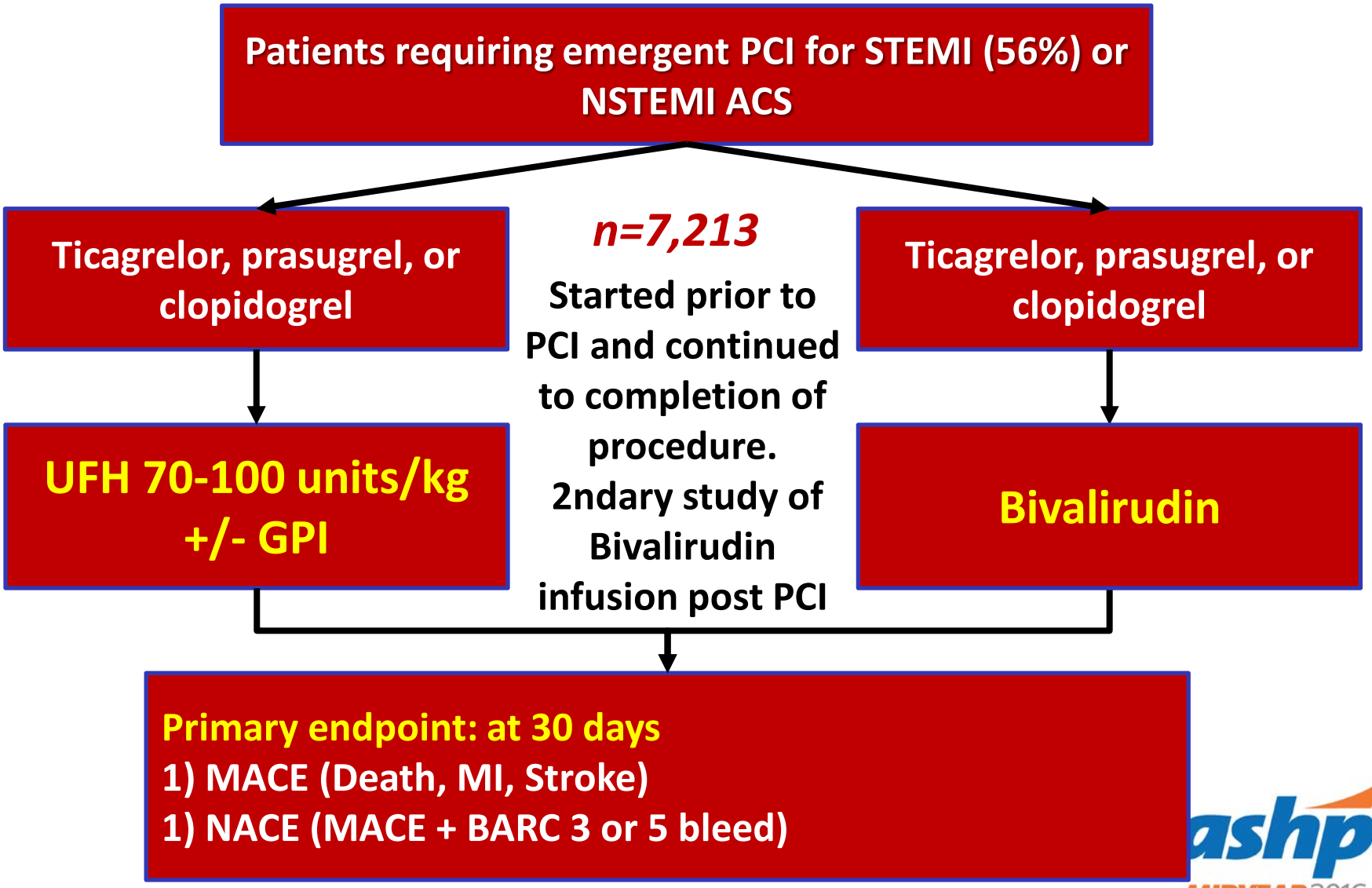
JAMA. 2015;313(13):1336-1346

The Return of Bivalirudin?: BRIGHT Trial

- Bleeding in 1° outcome in BRIGHT Trial
  - Defined as any BARC 1-5
    - o “bleeding that is not actionable and does not cause the patient to seek unscheduled performance of studies, hospitalization, or treatment by a healthcare professional”
- Major Bleed outcome: BARC 3-5
  - No difference between bivalirudin and UFH only group (0.5%B vs 1.5%H, 95% CI,-2 to 0.1)

JAMA. 2015;313(13):1336-1346

The Return of Bivalirudin?: MATRIX Antithrombin



NEJM 2015;373(11):997-1009

▪ NEJM 2015;373:997-1009

The Return of Bivalirudin?: MATRIX Antithrombin

- Results: 7,213 patients
  - ~46% received clopidogrel as choice P2Y12 prior to angiography
  - 21.8% of UFH group received planned GPI
    - Mean UFH dose in this group: 69.3 units/kg
  - 50% had radial access
    - Radial access did not impact results of study outcome per authors

NEJM 2015;373:997-1009

The Return of Bivalirudin?: MATRIX Antithrombin

- Results: 7,213 patients
  - No difference in MACE at 30 days (10.3% B v 10.9% H, p=0.44)
  - No difference in NACE at 30 days (11.2% B v 12.4% H, p=0.12)
  - Major Bleed (BARC 3 or 5) lower in bivalirudin group (1.4% v 2.5%, p<0.001)
    - 0.7% of bleeds in UFH group received planned GPI
  - Mortality lower in the bivalirudin group (1.7% v 2.3%, p=0.04)

NEJM 2015;373(11):997-1009

Where does all this leave us?

- HEAT PPCI have differing results from BRIGHT, MATRIX
  - These studies also had differing methodology

- Many hope the VALIDATE-SWEDEHEART Trial will offer more insight
  - Hybrid Registry based randomized controlled trial
  - Will enroll 6,000 STEMI/NSTEMI patients getting PCI
  - Will use Death, MI and BARC 2, 3 or 5 as composite endpoint
  - Prasugrel, ticagrelor or cangrelor as part of DAPT

Am Heart J 2016;175:36-46

Using the Force: Assessment of Risk

- National Cardiovascular Data Registry (NCDR) – CathPCI registry
  - Includes 1,000+ catheterization lab centers
  - 2013 publication on assessing bleed risk through evaluation of NCDR data
  - 1,043,759 PCI Procedures evaluated
    - 80% to develop model, 20% to validate model

JACC:CARD INT. 2013;6(9):897-904

Using the Force: Assessment of Risk

- National Cardiovascular Data Registry (NCDR) – CathPCI registry
  - Bleeding definitions used
    - Access site bleed: hematoma >10cm femoral, >5cm brachial, >2 cm radial
    - Retroperitoneal, GI, GU, Intracranial Hemorrhage
    - Cardiac Tamponade
    - Post Procedure Hgb ↓ >3g/dl (if baseline Hgb ≤ 16g/dl) or transfusion (nonCABG)

JACC:CARD INT. 2013;6(9):897-904

Using the Force: Assessment of Risk

- National Cardiovascular Data Registry (NCDR) – CathPCI registry
  - 31 data points assessed for modeling
    - Demographic and PMHx (eg. DM)
    - Presenting characteristics (eg. Shock)
    - Procedural characteristics (eg. Left main PCI)
    - Lab Values (eg. Pre-PCI Hgb)

Using the Force: Assessment of Risk

Results

- Independent Risks: Points
  - STEMI: 15
  - Age: 10-20
  - BMI (low or high): 5-15
  - No Previous PCI: 10
  - Chronic kidney dz: 10-30
  - Cardiac Arrest w/in 24 h
  - Female: 20
  - Hb (low or high): 5-10
  - PCI status: 20-40

- Score system developed and validated
  - Sum points from 0 – 210
  - Risk stratified nominally
    - Low: ≤ 25 (<2%)
    - Medium: 26 – 65 (2-6%)
    - High: > 65 (>6%)

JACC:CARD INT. 2013;6(9):897-904

Assessment of Risk in Practice

- Single-center pilot study
- Implemented modified NCDR bleed risk scoring tool (2009 version) in elective PCI
  - Adapted renal function scoring due to EMR restrictions
  - Defined low/med/high risk scores
  - Initial validation with 2331 historical cases prior to go-live
  - Risk score used as part of global assessment by interventional cardiologist
- Bivalirudin use and bleeding incidence compared to historical cohort
  - Bleeding definition per NCDR CathPCI Registry v.4

Pharmacotherapy 2015;35(4):388--395

Assessment of Risk in Practice

- Results
  - Pilot cohort N = 100 vs historical N = 814
  - Adherence to bleed risk score was 68%
  - Bivalirudin use reduced in low risk patients compared to historical control (41.8% vs 87.1%, $p<0.01$)
  - No difference in bleed found (underpowered though)

Pharmacotherapy 2015;35(4):388--395

Does your program use a formal bleed risk tool for PCI cases ?

A Yes

B No

C I don’t know

Key Takeaways

- Therapeutic changes, such as radial access, limited GPI use, use of newer P2Y12 inhibitors, etc, have changed the risks of ischemia and bleeding in the Cathlab
- Recent Bivalirudin v UFH studies have shown conflicting results due to inconsistent methodology
  - HEAT PPCI: majority radial approach, 15% GPI, minimal clopidogrel
  - BRIGHT Trial: Higher UFH dosing, different bleeding outcome measures, majority clopidogrel use
  - MATRIXAntithrombin: high use of GPI in UFH group, 50% radial approach
- Use of bleed risk scoring may help in cath labs that still feel bivalirudin offers a bleeding advantage

Pre and Post Question: What is the ideal parenteral anticoagulant in EJ while undergoing PCI ?

A. Unfractionated Heparin (UFH)

B. Bivalirudin

C. Either Bivalirudin or UFH

D. Fondaparinux

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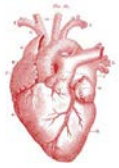
Is Cangrelor the New CHAMPION for Antiplatelet Therapy during Percutaneous Coronary Intervention?

Douglas L. Jennings, PharmD, FACC, FAHA, FCCP, BCPS
Clinical Pharmacy Manager – Heart Transplant
NewYork Presbyterian Columbia University Medical Center

Objectives

1. Outline the evolution of P2Y12 inhibitors and evaluate the role of cangrelor in modern percutaneous coronary interventions.

Antithrombotic Therapy During PCI



Platelet Activation

Inactive Platelets

TxA ↓ ↓ ADP

Activated Platelets

↓

Aggregated Platelets

Aspirin

P2Y12 Antagonists

GP IIb/IIIa Inhibitors

Coagulation Cascade

Factor Xa

↓

Factor II

↓

Thrombin

Heparin
Bivalirudin
Fondaparinux
Enoxaparin

Oral $P2Y_{12}$ Inhibitors

Criterion	Clopidogrel	Prasugrel	Ticagrelor
Absorption / Bioavailability	80 – 100% 10-15% (esterases)	80 – 100%	30 – 40%
Tmax	2 hours	30 min	1.5 hours
Onset of Action	No LD: 3 – 5 days 300 mg LD: ≥ 6 hours 600 mg LD: 2-4 hours	No LD: 3 days 60 mg LD: 60 min	180 mg LD: 30 – 60 min
Protein Binding	95%	98%	99%
Metabolism	Hepatic (3A4, 2C19, 1A2, 2B6)	Hepatic (3A4, 2B6, 2C9, 2C19)	Hepatic (3A4/5)
Elimination	50% urine 46% feces	68% urine 27% feces	26% urine 58% feces
T½	6 hours	7 hours	7 hours
Platelet recovery	~ 5 days	~ 7 days	~ 3-5 days

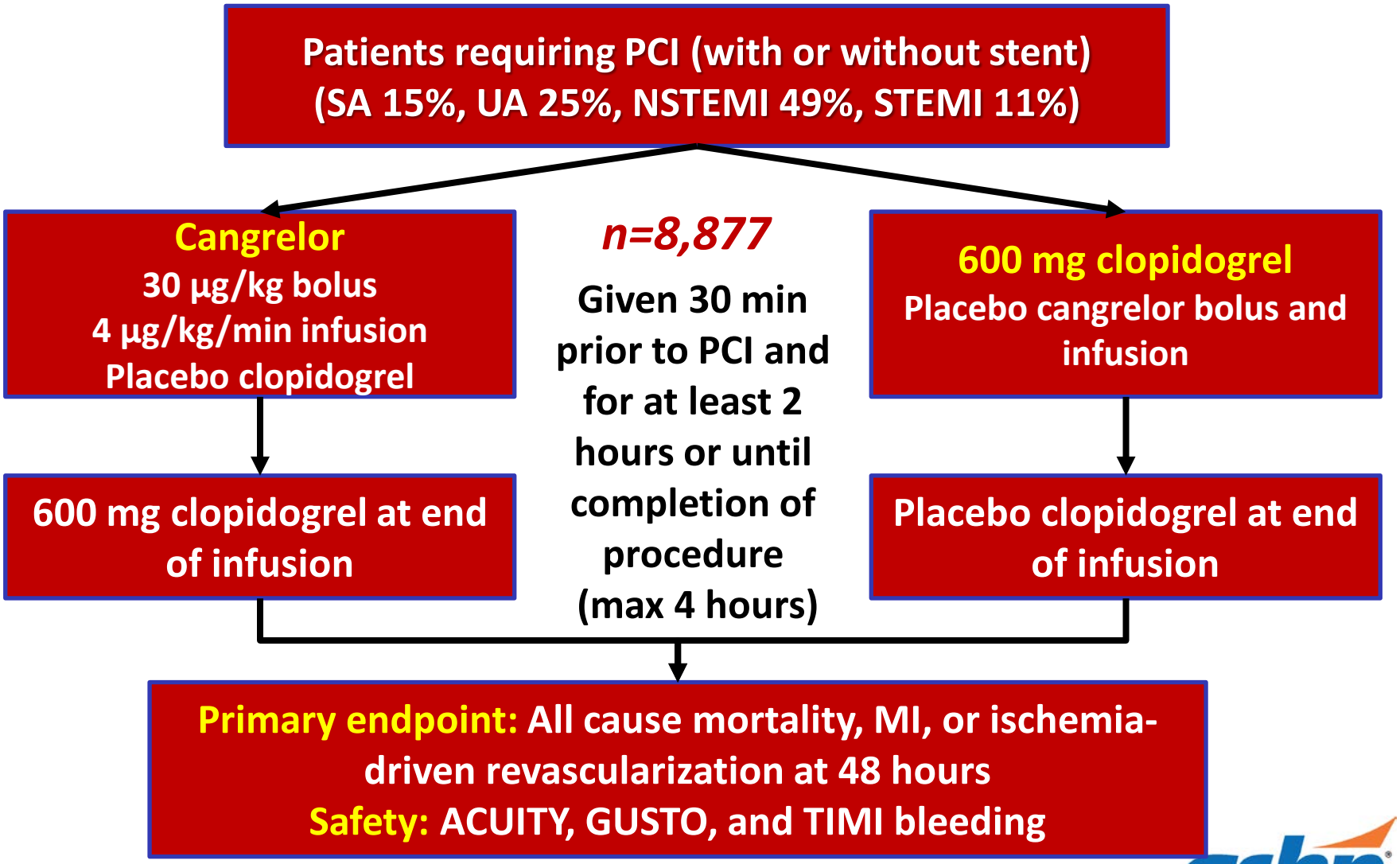
LD = loading dose.

Characteristics of Cangrelor

Criterion	Cangrelor
Absorption / Bioavailability	100%
Tmax	2 minutes
Onset of Action	2 minutes
Volume of distribution	3.7 to 5.1 L
Protein Binding	97%
Metabolism	Dephosphorylation Ecto-enzymes (ATPases)
Elimination	58% urine 35% feces
T½	3 to 6 minutes
Platelet recovery	60 to 90 minutes

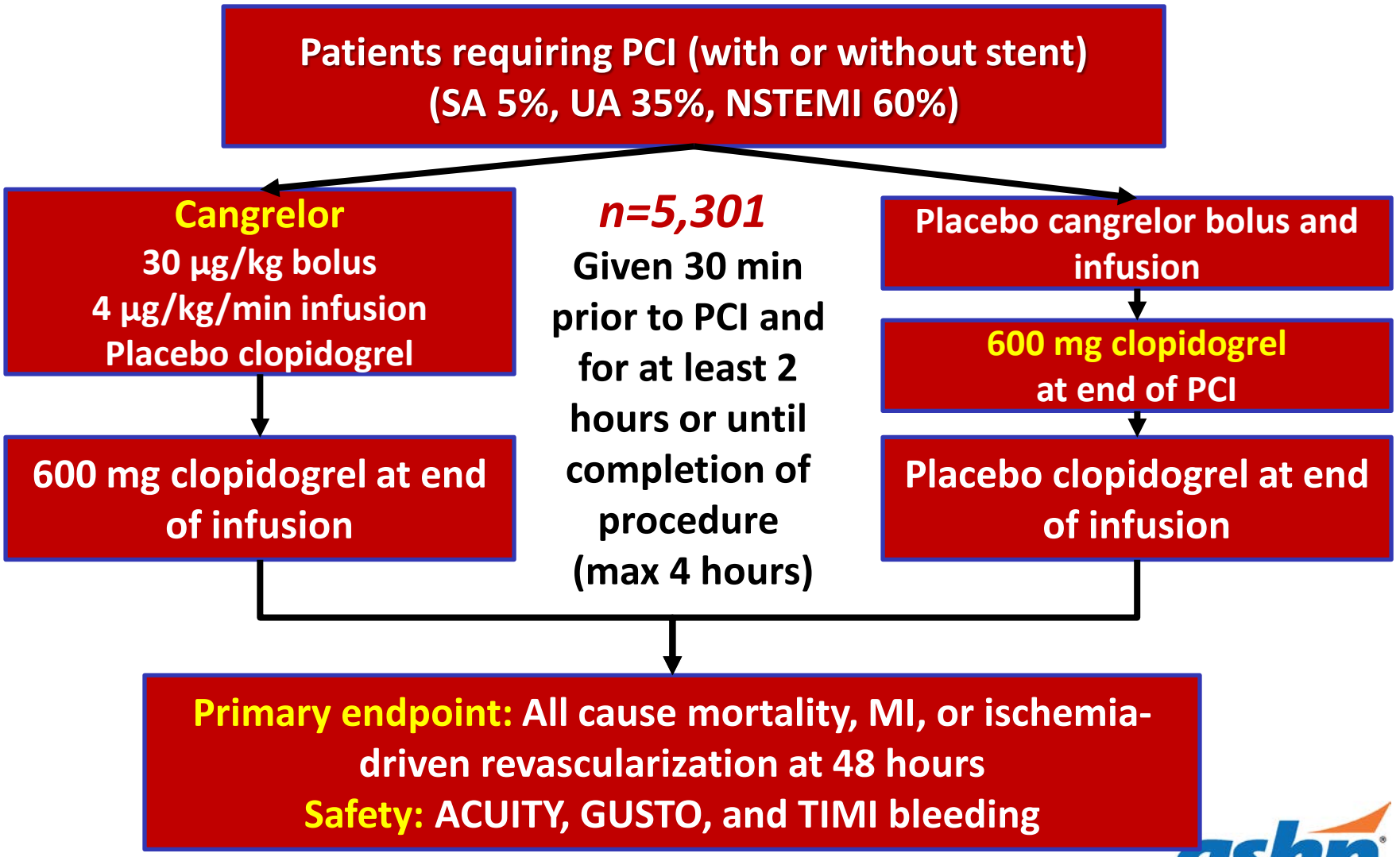
Future Cardiol 2014;10:201-213.

CHAMPION PCI: Trial Design



N Engl J Med 2009;361:2318-2329.

CHAMPION PLATFORM: Trial Design



N Engl J Med 2009;361:2330-2341.

CHAMPION PCI and PLATFORM Trials

70% interim analysis of PCI trial

- Low chance of superiority, no safety concerns

70% interim analysis of PLATFORM

- Low Chance of superiority

Both trials halted enrollement

- PCI: 98.6%, PLATFORM: 82.8%

N Engl J Med 2009;361:2318-2329.
N Engl J Med 2009;361:2330-2341.

CHAMPION PCI and PLATFORM Trials: Efficacy

	CHAMPION PCI Trial			CHAMPION PLATFORM Trial		
Endpoint (%)	Cangrelor (n=3889)	Clopidogrel (n=3865)	p-value	Cangrelor (n=2654)	Clopidogrel (n=2641)	p-value
Primary endpoint	7.5	7.1	0.59	7.0	8.0	0.17
Death from any cause	0.2	0.1	0.42	0.2	0.7	0.02
MI	7.1	6.6	0.36	6.7	7.2	0.42
IDR	0.3	0.6	0.10	0.7	0.9	0.44
Stent thrombosis	0.2	0.3	0.34	0.2	0.6	0.02
Q-wave MI	0.1	0.3	0.12	0.2	0.3	0.25
Death, Q-wave MI, ISR	0.6	0.9	0.14	0.9	1.6	0.02

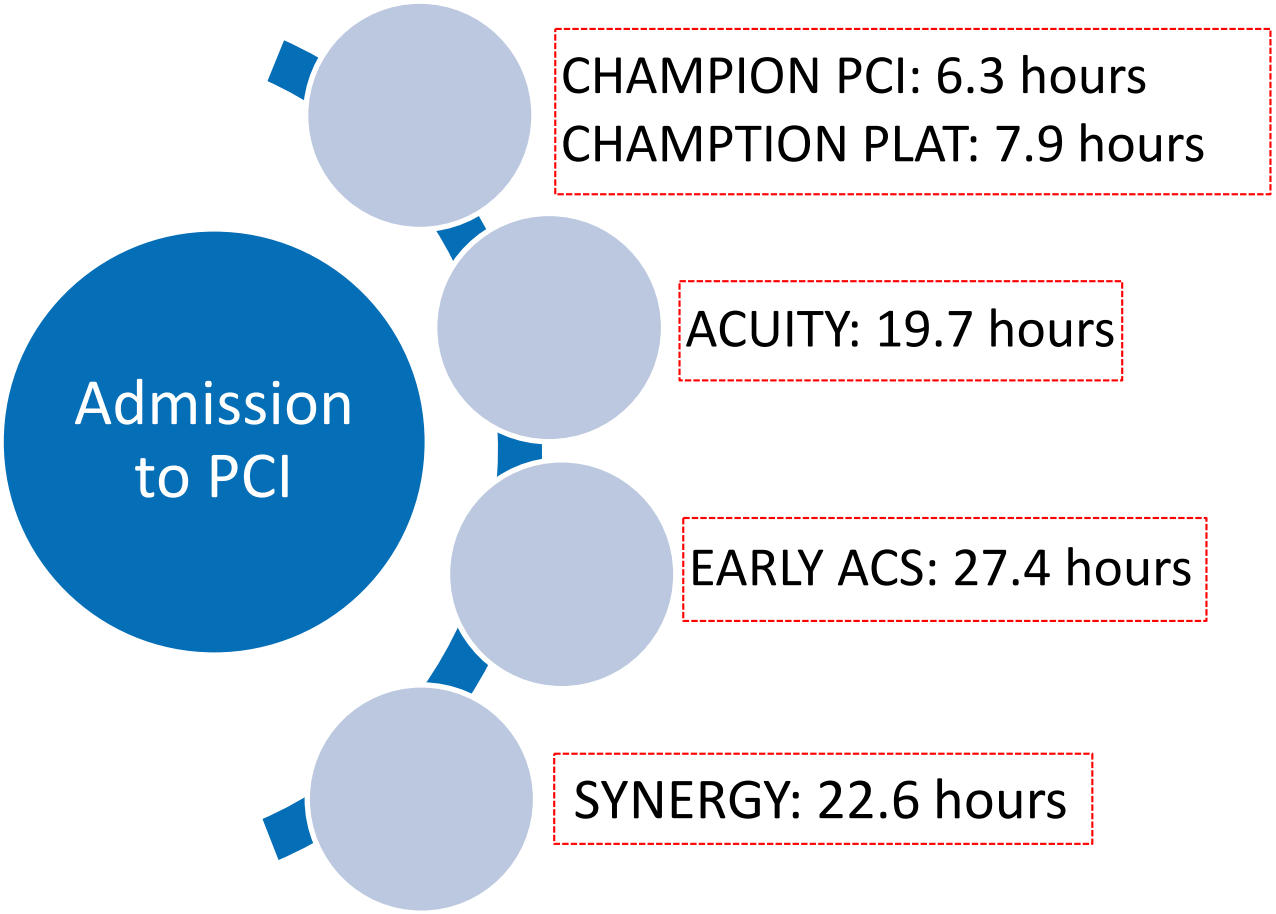
N Engl J Med 2009;361:2318-2329.
N Engl J Med 2009;361:2330-2341.

CHAMPION PCI and PLATFORM Trials: Safety

	CHAMPION PCI Trial			CHAMPION PLATFORM Trial		
Endpoint (%)	Cangrelor (n=4374)	Clopidogrel (n=4365)	p-value	Cangrelor (n=2660)	Clopidogrel (n=2646)	p-value
ACUITY minor	17.6	15.2	0.003	12.0	9.3	0.001
ACUITY major	3.6	2.9	0.06	5.5	3.5	<0.001
GUSTO mild	19.6	16.9	0.001	16.0	11.7	<0.001
GUSTO mod	0.9	0.8	0.42	0.8	0.5	0.23
GUSTO severe	0.2	0.3	0.82	0.3	0.2	0.45
TIMI minor	0.8	0.6	0.21	0.8	0.6	0.34
TIMI major	0.4	0.3	0.39	0.2	0.3	0.17

N Engl J Med 2009;361:2318-2329.
N Engl J Med 2009;361:2330-2341.

Lessons From CHAMPION PLATFORM and PCI



Lessons From CHAMPION PLATFORM and PCI

Q-wave MI Definition

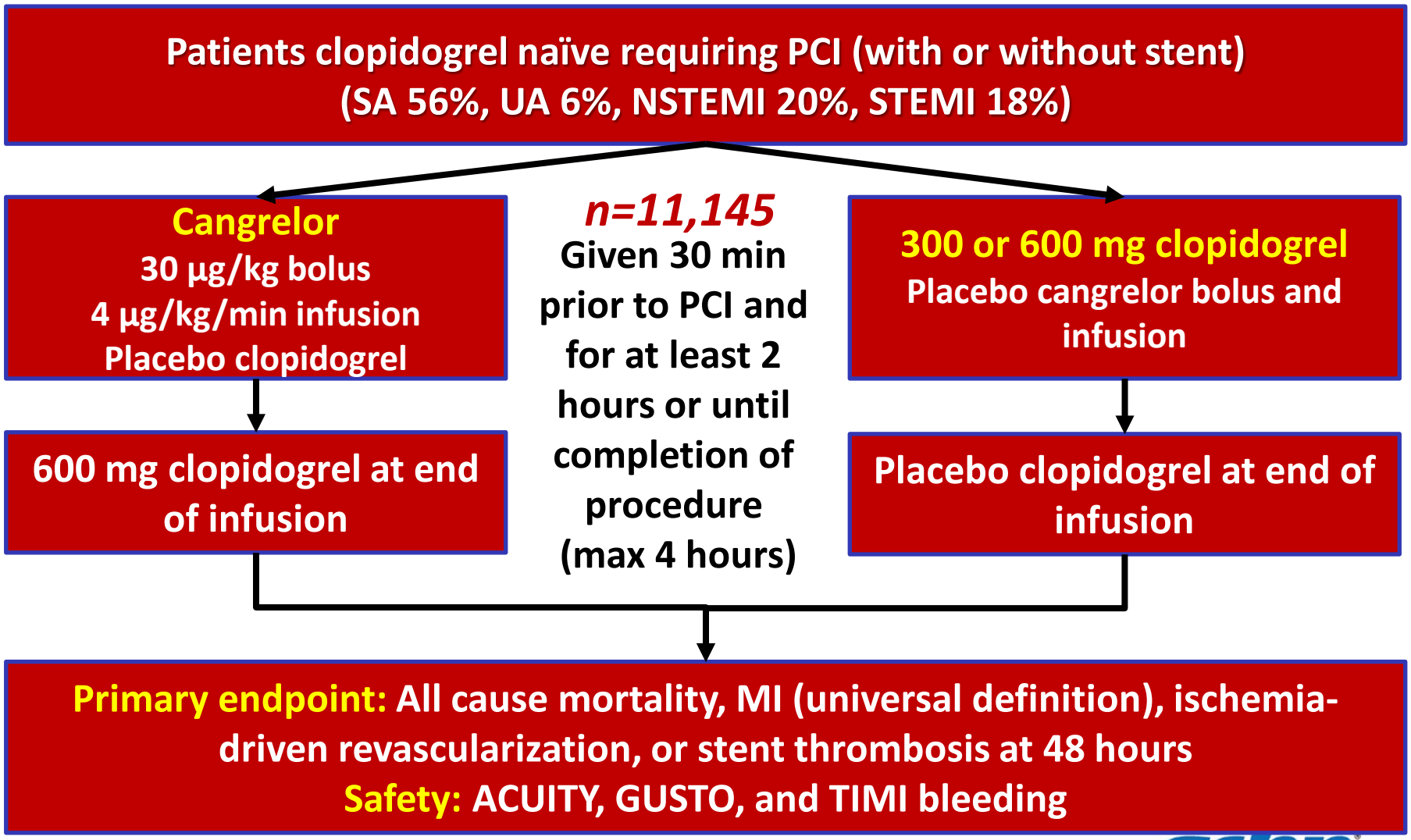
- 33% ↓ in CHAMPION PCI
- 44% ↓ in PLATFORM

University Definition (pooled n= 13,049)

- Death, MI, IDR: 3.1% vs. 3.8% (p=0.037)
- Stent thrombosis: 0.2 vs. 0.4 (p=0.0184)

Circulation 2007;116:2634-2653.
Am Heart J 2012;163:182-190.e4.

CHAMPION PHOENIX: Trial Design



N Engl J Med 2013;368:1303-1313.

CHAMPION PHOENIX Results

Efficacy Endpoint (%)	Cangrelor (n=5472)	Clopidogrel (n=5470)	p-value
Primary endpoint	4.7	5.9	0.005
Death from any cause	0.3	0.3	>0.999
MI	3.8	4.7	0.02
IDR	0.5	0.7	0.22
Stent thrombosis	0.8	1.4	0.01
Safety Endpoint (%)	**Cangrelor (n=5529)**	**Clopidogrel (n=5527)**	**p-value**
ACUITY minor	4.3	2.5	<0.001
ACUITY major	11.8	8.6	<0.001
GUSTO severe	0.2	0.1	0.44
GUSTO moderate	0.4	0.2	0.13
TIMI major	0.1	0.1	>0.999
TIMI minor	0.2	0.1	0.08

N Engl J Med 2009;368:1303-1313.

CHAMPION PHOENIX: Additional Results

30 Day Results	• Primary endpoint: 6 vs. 7%; p=0.03 • Stent thrombosis: 1.3 vs. 1.9%; p=0.01
Fewer Procedural Complications	• Stent thrombosis: 0.6 vs. 1.0%; p=0.04 • Rescue IIb/IIIa: 2.3 vs. 3.5%; p<0.001
Infusion Duration	• ≤ 129 minutes: 5.1% vs. 6.0% • > 129 minutes: 4.2% vs. 5.8%

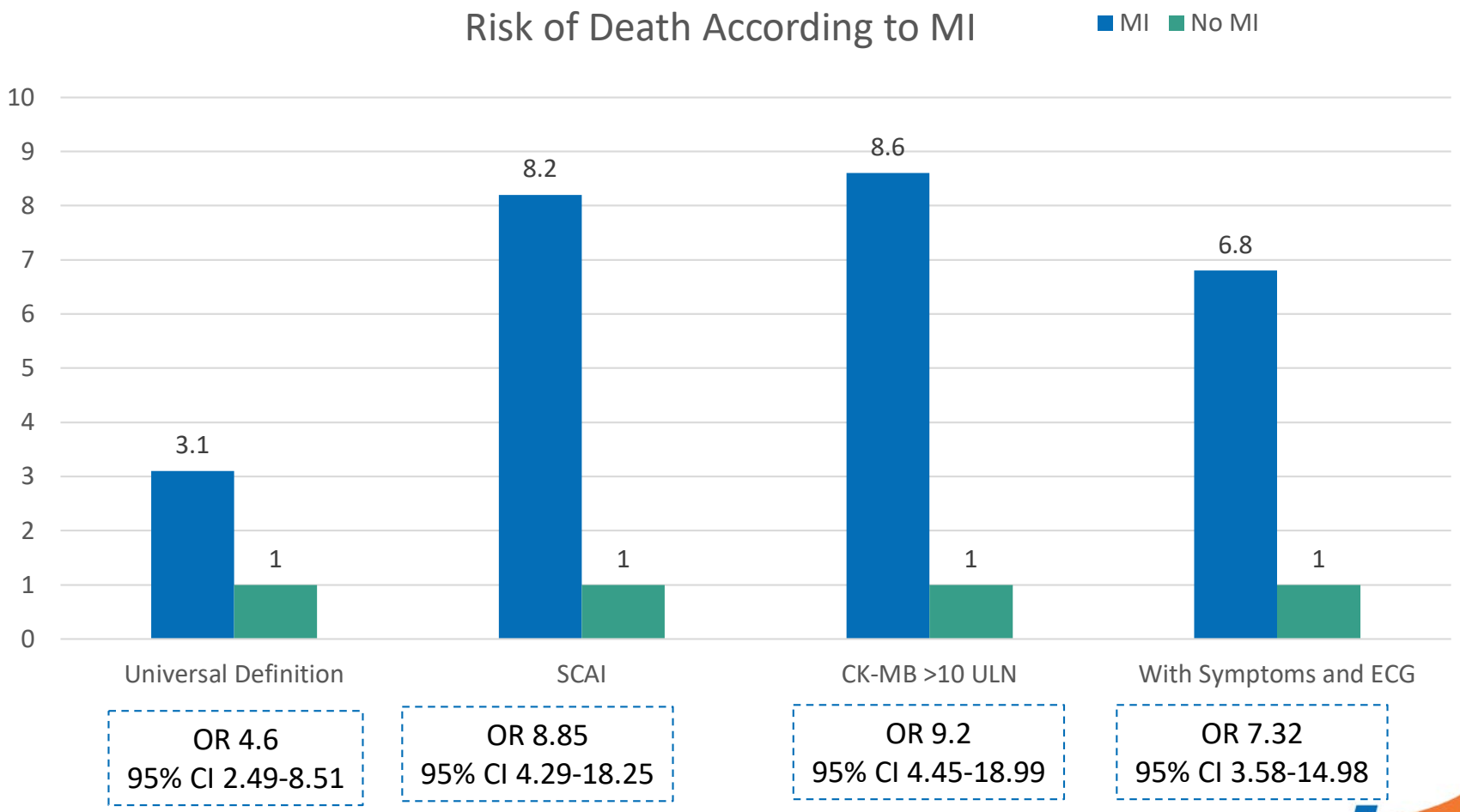
J Med 2009;368:1303-1313.
Lancet 2013;382:1981-1992.

CHAMPION PHOENIX: Additional Results

	Cangrelor (n=5472)	Clopidogrel (n=5470)	OR (95% CI)	P-value
MI – Universal Definition	207 (3.8%)	255 (4.7%)	0.80 (0.67-0.97)	0.02
MI – SCAI Definition	53 (1.0%)	81 (1.5%)	0.65 (0.46-0.92)	0.01
MI – Peak CK-MB >10x ULN	50 (0.9%)	78 (1.4%)	0.64 (0.45-0.91)	0.01
Q Wave	11 (0.2%)	18 (0.3)	0.61 (0.29-1.29)	0.19
None-Q Wave	196 (3.6%)	237 (4.3%)	0.82 (0.68-1.0)	0.04
MI with symptoms and ECG changes	62 (1.1%)	99 (1.8%)	0.62 (0.45-0.86)	0.004

Circ 2016: DOI 10.1161/CIRCULATIONAHA.115.020829

CHAMPION PHOENIX: Additional Results



Circ 2016: DOI 10.1161/CIRCULATIONAHA.115.020829

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CHAMPION PHOENIX: Additional Results

	Cangrelor (n=1,014)	Clopidogrel (n=1,045)	OR (95% CI)	P-value
Death	2 (0.2)	2 (0.2)	1.03 (0.14-7.33)	0.97
MI – Universal Definition	37 (3.6)	59 (5.6)	0.63 (0.42-0.96)	0.03
Stent Thrombosis	7 (0.7)	15 (1.4)	0.48 (0.19-1.18)	0.1
TIMI Major Bleeding	2 (0.2)	1 (0.1)	2.07 (0.19-22.85)	0.5
GUSTO Severe or Moderate Bleeding	5 (0.5)	6 (0.6)	0.86 (0.26-2.83)	0.8
ACUITY-defined Major Bleeding	21 (2.1)	15 (1.4)	1.46 (0.75-2.84)	0.26

J Am Coll Cardiol Intv 2015;8:424–33.

CHAMPION PHOENIX: Interpretation

Patients — Low risk patient population

- Mostly unstable angina
- Mostly biomarker negative

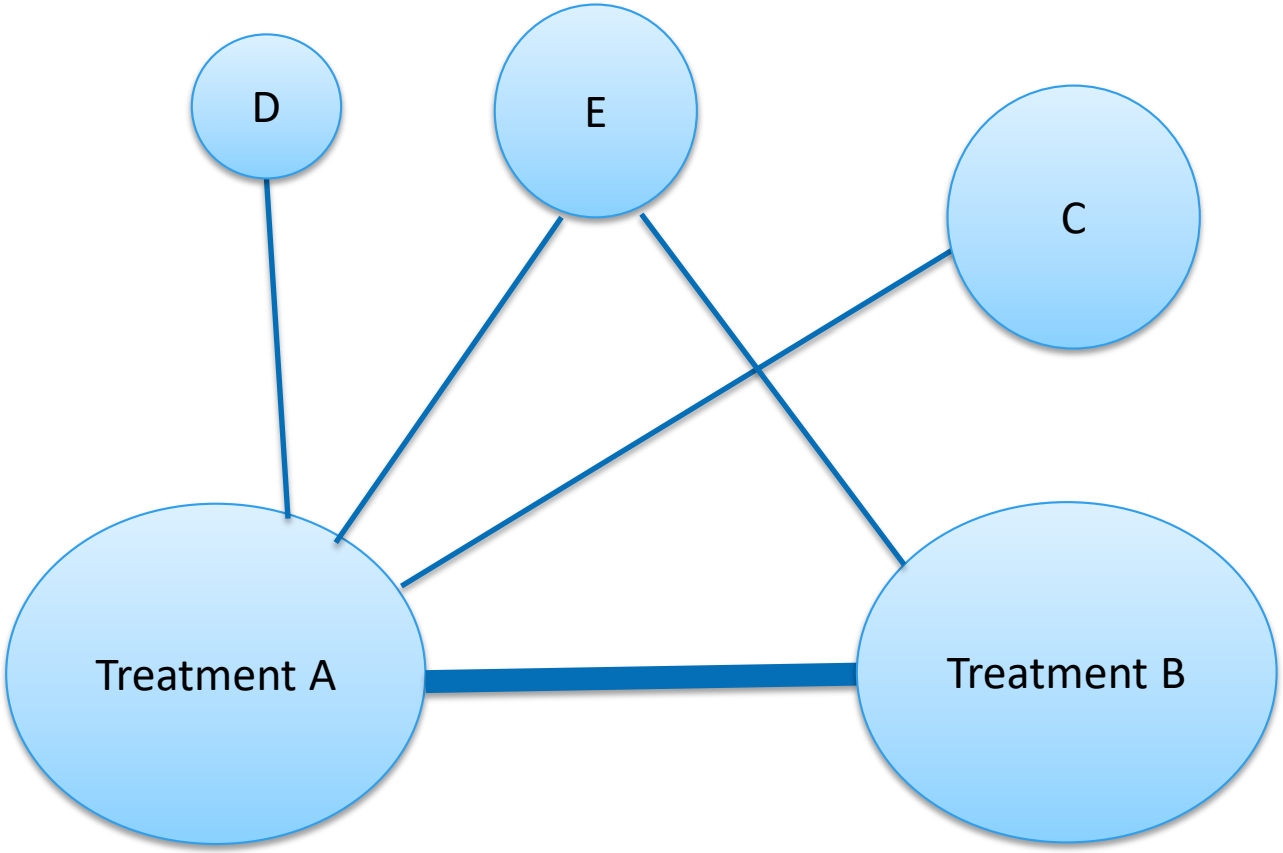
Comparator — Use of clopidogrel

- During or after PCI
- 25% received 300 mg loading dosing

Other drugs — GP IIb/IIIa inhibitors

- Use as rescue therapy
- Upstream use?

Network Meta-analysis



Network Meta-analysis: STEMI Patients

Prasugrel versus:	Death/MI/TVR in hospital
Studies (n)	13
Patients (n)	22,747
Events (n)	1,143
Clopidogrel (S)	*0.52 (0.36-0.74)*
Clopidogrel (H)	*0.44 (0.31-0.61)*
Clopidogrel (U)	*0.72 (0.50-0.99)*
Ticagrelor (S)	1.42 (0.25-7.45)
Ticagrelor (U)	0.71 (0.20-7.97)
Cangrelor	*0.51 (0.31-0.87)*

J Am Coll Cardiol Intv 2016;9:1036–46.

A Case for Cangrelor?

- 56 year old male patient with no known history passes out during a basketball game
- CPR is started, AED → Vfib, down ~8 minutes
- Aspirates, intubated by EMS, ST elevations present
- Cath lab activated, pPCI planned, then hypothermia
- IV heparin started, otherwise no oral access for meds

A Case for Cangrelor?

A. Place NG tube, crush ticagrelor

B. Upstream IIb/IIIa inhibitor

C. Cangrelor

D. Switch to bivalirudin

A Case for Cangrelor?

- 67 year old female patient is admitted with 8 hours of sputtering chest pain
- History of HTN, high cholesterol, OA
- Meds: HCTZ, simvastatin, as needed acetaminophen
- Found to have + trop, ST depressions
- Given aspirin, ticagrelor, and heparin at 10 pm
- Transferred to tele floor, chest pain has subsided
- Plan angiography in AM with PCI if indicated

A Case for Cangrelor?

A. Continue ticagrelor peri-PCI

B. Switch to prasugrel peri-PCI

C. Plan for cangrelor peri-PCI

D. Switch to clopidogrel peri-PCI

Cangrelor: Key Takaways

- Key Takeaway #1
  - Cangrelor has unique advantages over currently available P2Y12 receptor antagonists
- Key Takeaway #2
  - Local practice should dictate place of cangrelor during PCI
    - Use of GPIIb/IIIa antagonists, ticagrelor, etc.
- Key Takeaway #3
  - Patient characteristics should be used to guide choice of when to use cangrelor

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