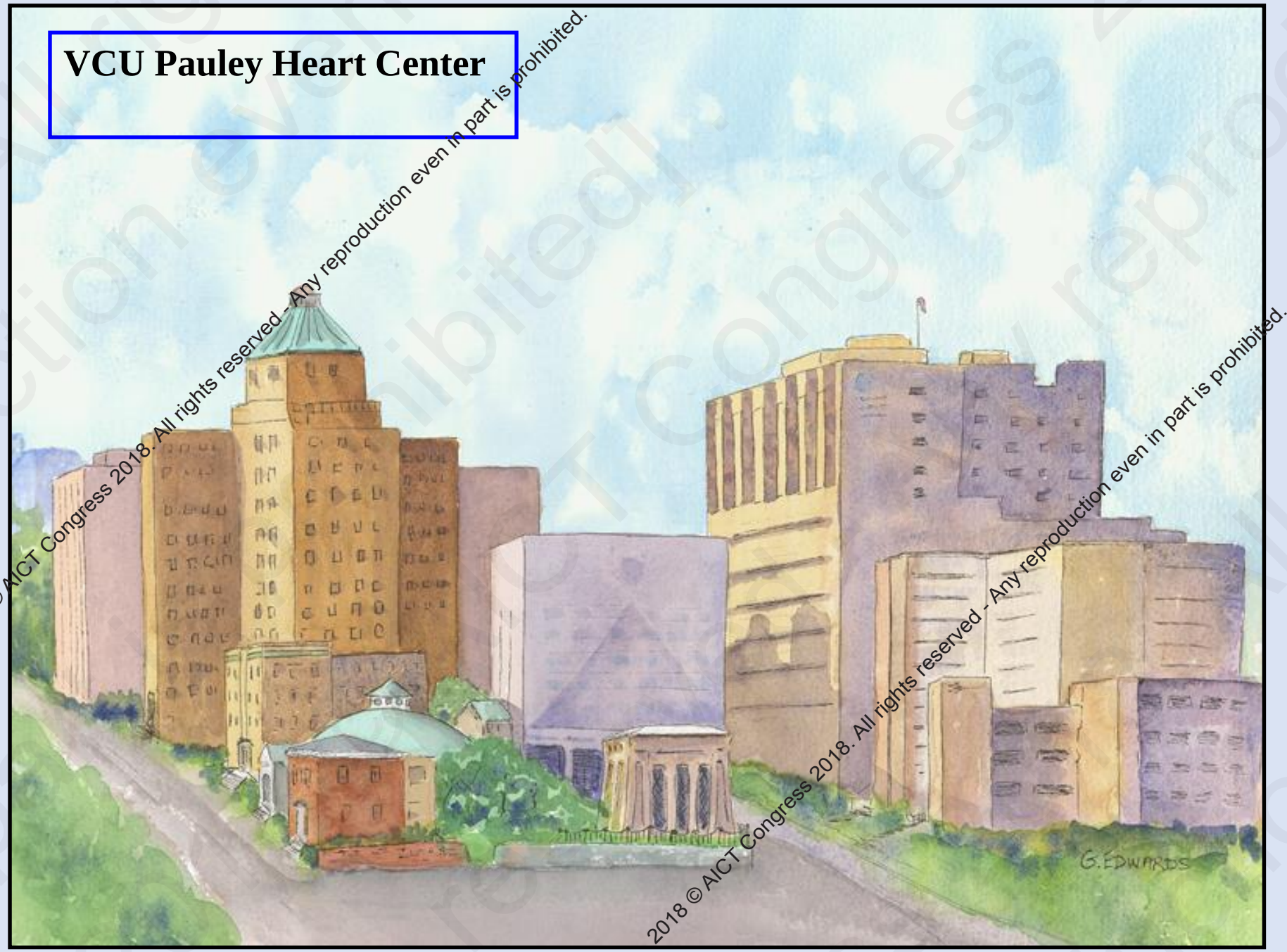
VCU Pauley Heart Center



14th AICT

ASIAN INTERVENTIONAL CARDIOVASCULAR THERAPEUTICS

THE OFFICIAL CONGRESS OF APSIC

Current Strategies in Management of Cardiogenic Shock

George W. Vetrovec, MD, MACC, MSCAI

Professor Emeritus

Virginia Commonwealth University

Richmond, Virginia

Conflicts of Interest

Speaker's name: George W. Vetrovec, MD, MACC, MSCAI

Abiomed – Consultant
Merck – Consultant
FDA - Consultant

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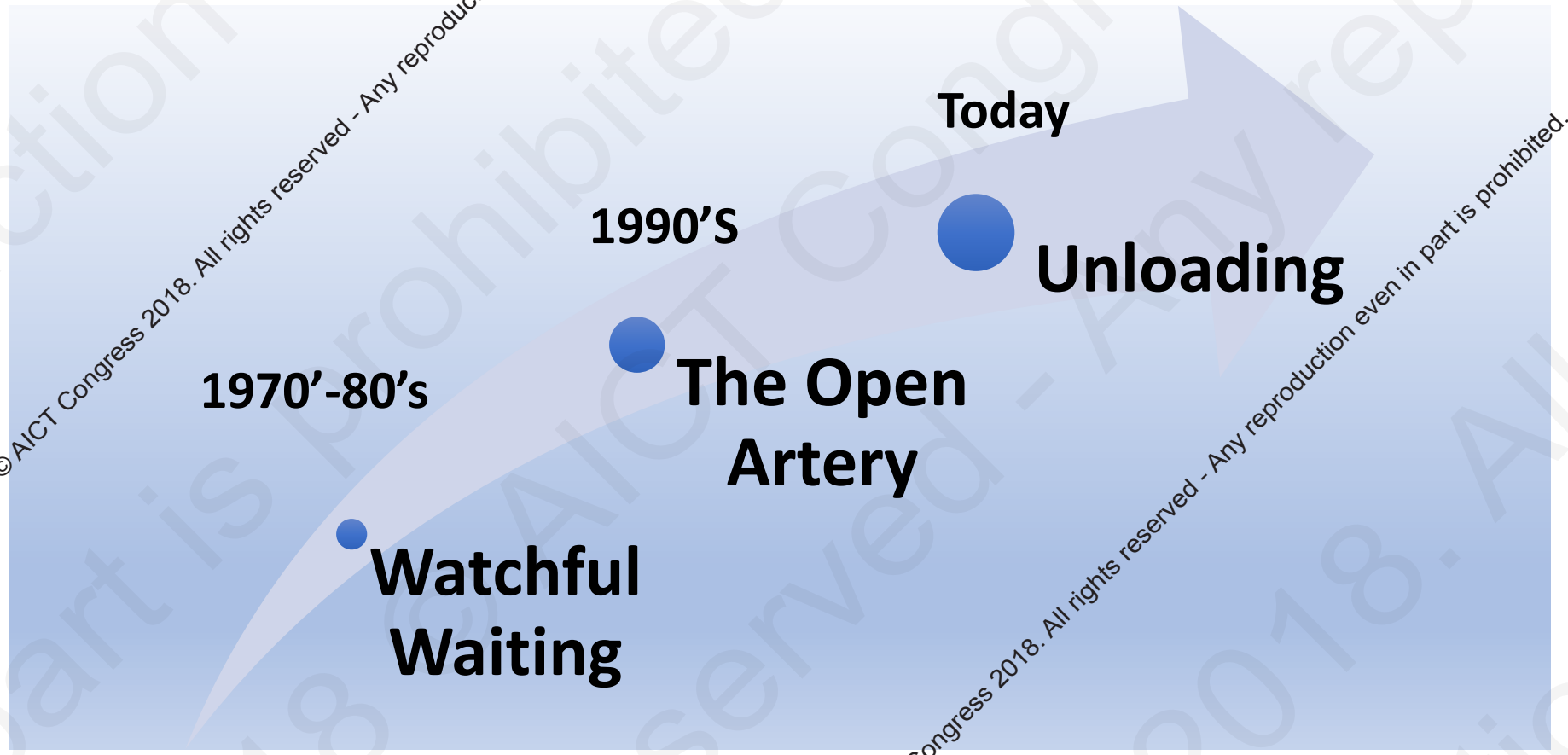
Management of Cardiogenic Shock



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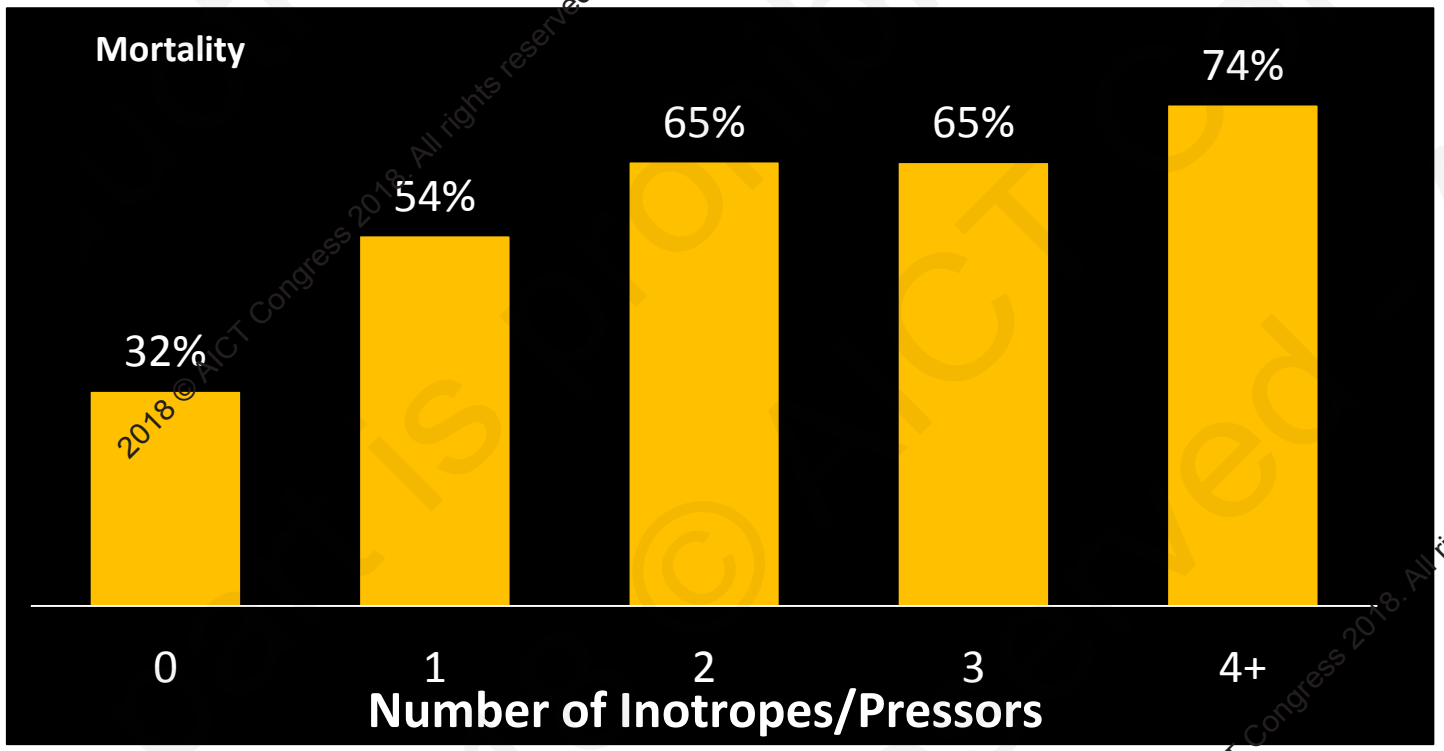
Increased Inotrope Exposure is associated with Mortality in AMI/CGS

Mortality and Number of Inotropes from cVAD Registry[1]

P<0.001 (N=287)



1. Basir M, Schreiber T, Grines C, et al. Am. J. of Cardiology, 2016

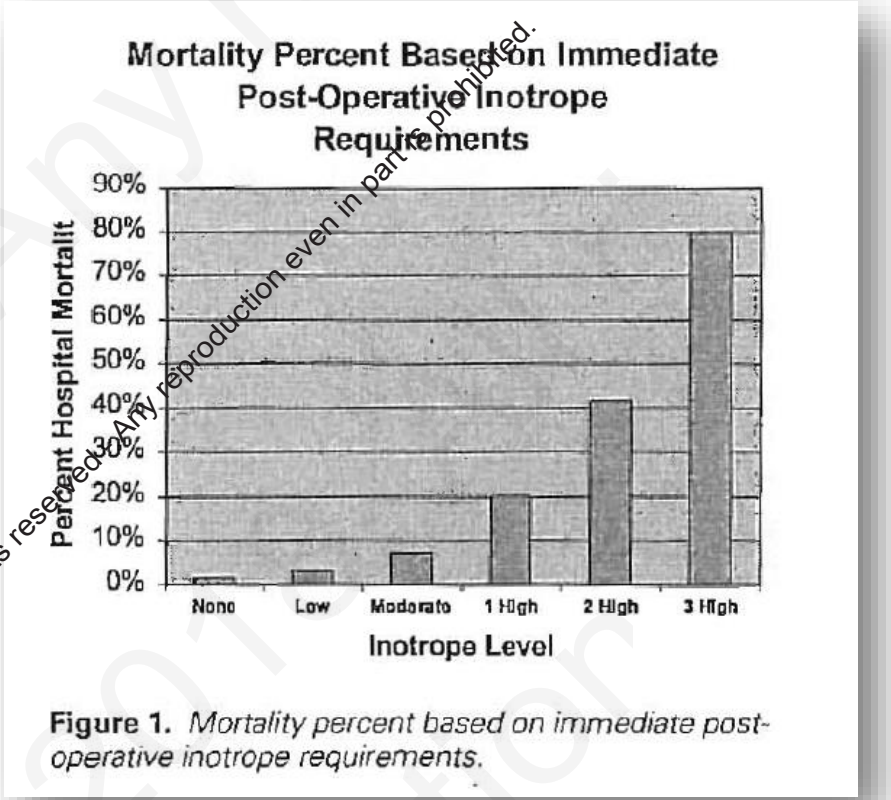


Figure 1. *Mortality percent based on immediate post-operative inotrope requirements.*

Samuels LE et al , J Card Surg. 1999

IABP-SHOCK

The NEW ENGLAND JOURNAL of MEDICINE

ESTABLISHED IN 1812 OCTOBER 4, 2012 VOL. 367 NO. 14

Intraaortic Balloon Support for Myocardial Infarction with Cardiogenic Shock

Holger Thiele, M.D., Uwe Zeymer, M.D., Franz-Josef Neumann, M.D., Miroslaw Ferenc, M.D., Hans-Georg Olbrich, M.D., Jörg Hausleiter, M.D., Gert Richardt, M.D., Marcus Hennersdorf, M.D., Klaus Empen, M.D., Georg Fuernau, M.D., Steffen Desch, M.D., Ingo Eitel, M.D., Rainer Hambrecht, M.D., Jörg Fuhrmann, M.D., Michael Böhm, M.D., Henning Ebelt, M.D., Steffen Schneider, Ph.D., Gerhard Schuler, M.D., and Karl Werdan, M.D., for the IABP-SHOCK II Trial Investigators*

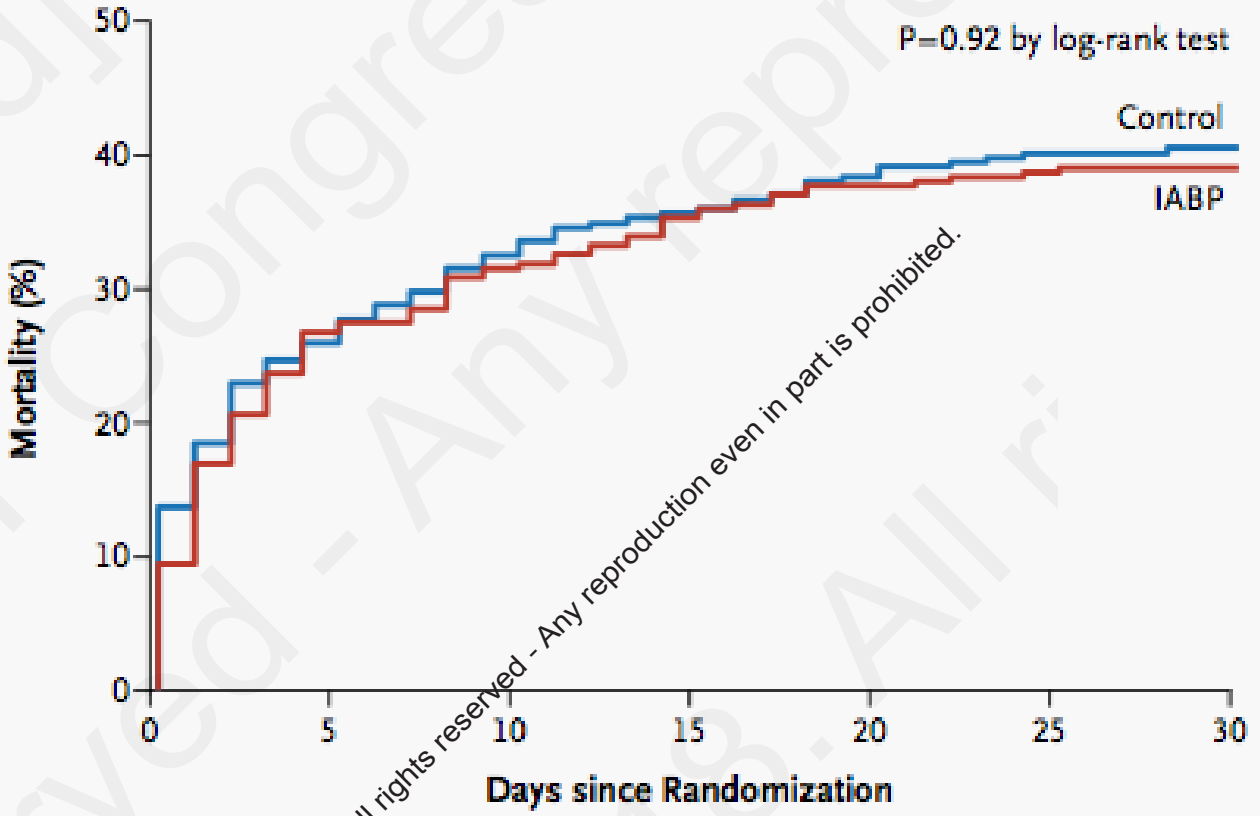


Figure 1. Time-to-Event Curves for the Primary End Point.

Time-to-event curves are shown through 30 days after randomization for the primary end point of all-cause mortality. Event rates represent Kaplan–Meier estimates.

Theile et al: NEJM 2012;367:1287-96

New Concept: Unloading

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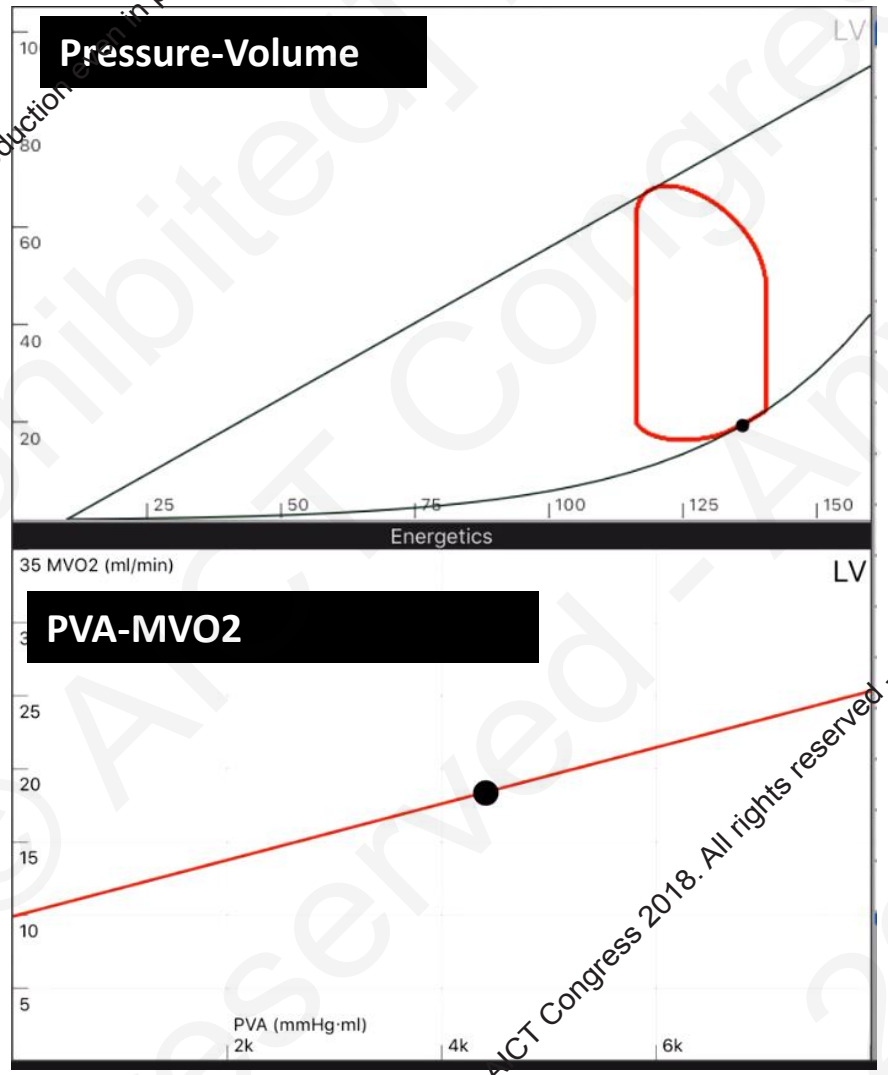
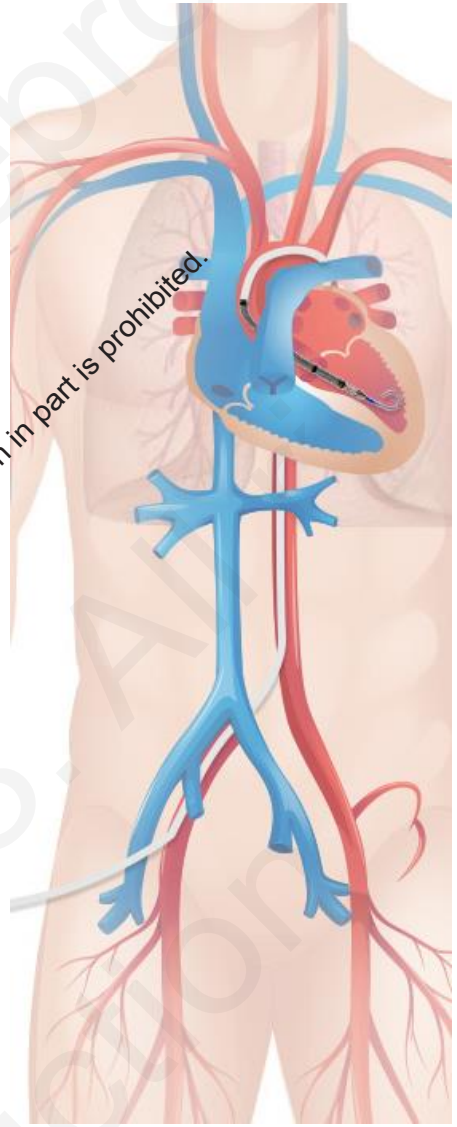
Impact of MCS on Hemodynamics and Energetics

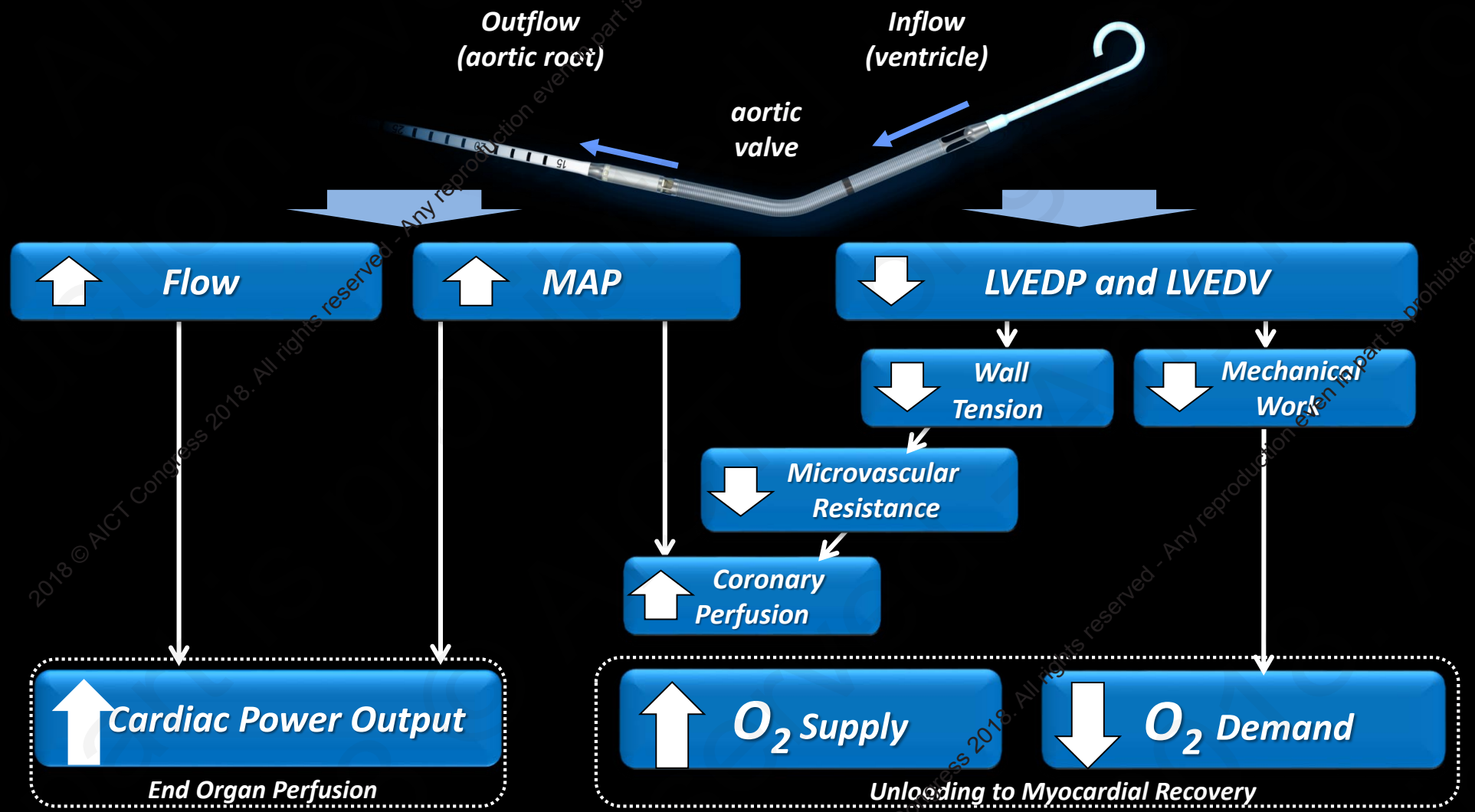
↓ Peak LVP
↓ Preload

↓ PVA
↓ MVO2





Hemodynamic Effects of Impella Support



Fincke J, et al. Am Coll Cardiol 2004
den Uil CA, et al. Eur Heart J 2010
Mendoza DD, et al. AMJ 2007
Torgersen C, et al. Crit Care 2009
Torre-Amione G, et al. J Card Fail 2009

Suga H. et al. Am J Physiol 1979
Suga H, et al. Am J Physiol 1981
Burkhoff D. et al. Am J Physiol Heart Circ 2005
Burkhoff D. et al. Mechanical Properties Of The Heart And Its Interaction With The Vascular System. (White Paper) 2011

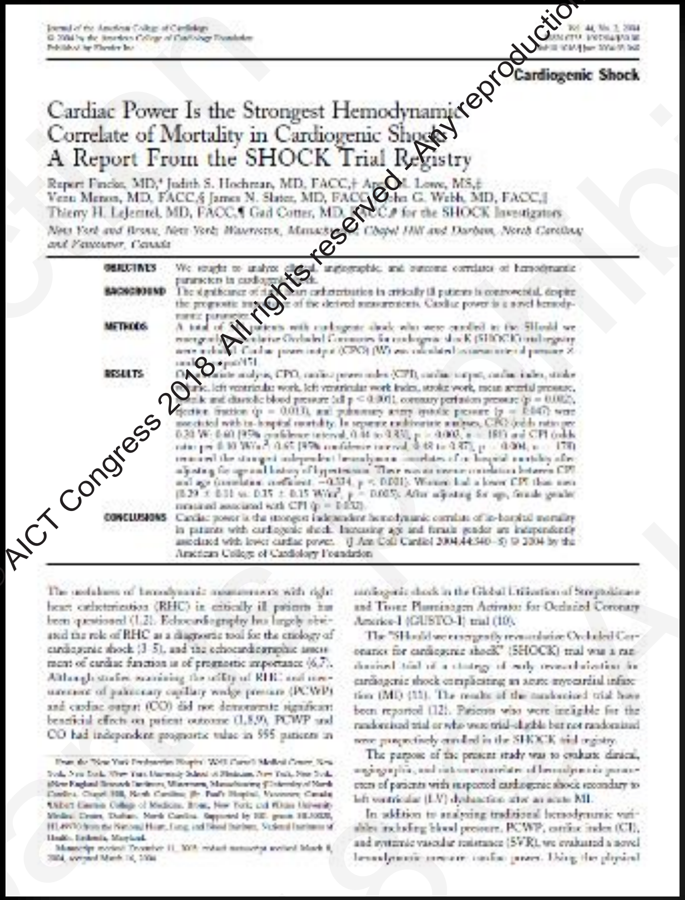
Sauren LDC, et al. Artif Organs 2007
Meyns B, et al. J Am Coll Cardiol 2003
Remmelink M, et al. atheter.Cardiovasc Interv 2007
Aqel RA, et al. J Nucl Cardiol 2009
Lam K,. et al. Clin Res Cardiol 2009

Reesink KD, et al. Chest 2004
Valgimigli M, et al.Catheter Cardiovasc Interv 2005
Remmelink M. et al. Catheter Cardiovasc Interv 2010
Naidu S. et al. Novel Circulation.2011
Weber DM, et al. Cardiac Interventions Today Supplement Aug/Sep 2009

USA Impella Acceptance

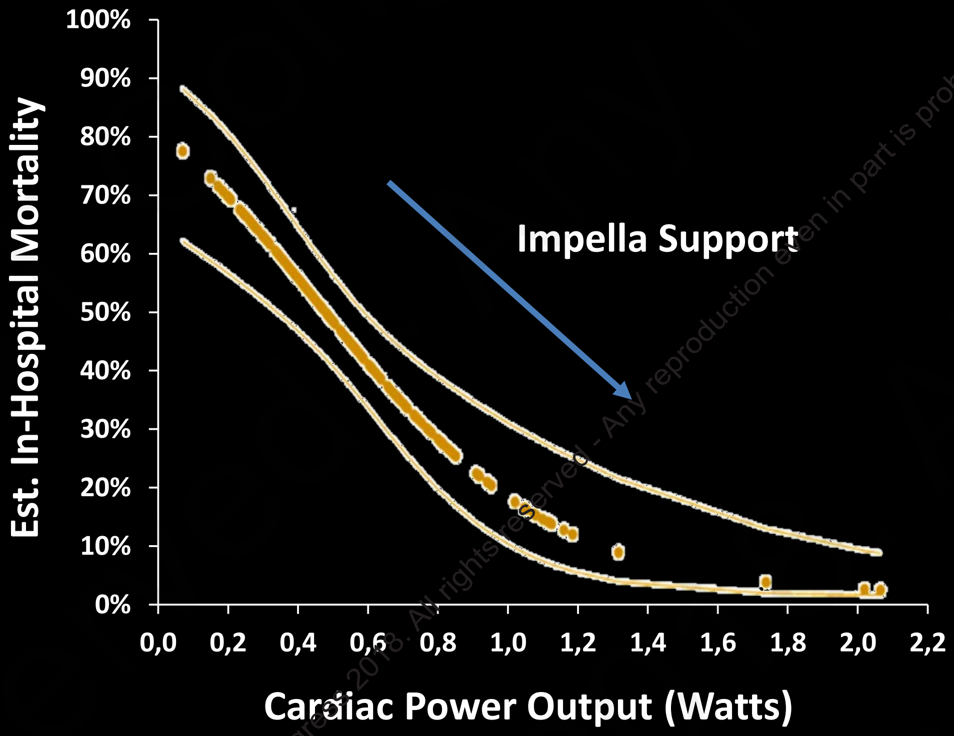
- **Only FDA *PMA* approved MCS Device for Temporary Hemodynamic Support**
  - **Cardiogenic Shock (AMI/PCCS) [cVAD Registry]**
  - **High Risk PCI [PROTECT II Study]**
  - **Cardiomyopathy/Peripartum/Myocarditis [cVAD Registry]**
- **Guideline Recommended**
  - **Multiple PCI, Shock, Heart Failure Guidelines**

Cardiac Power Output


Cardiogenic Shock

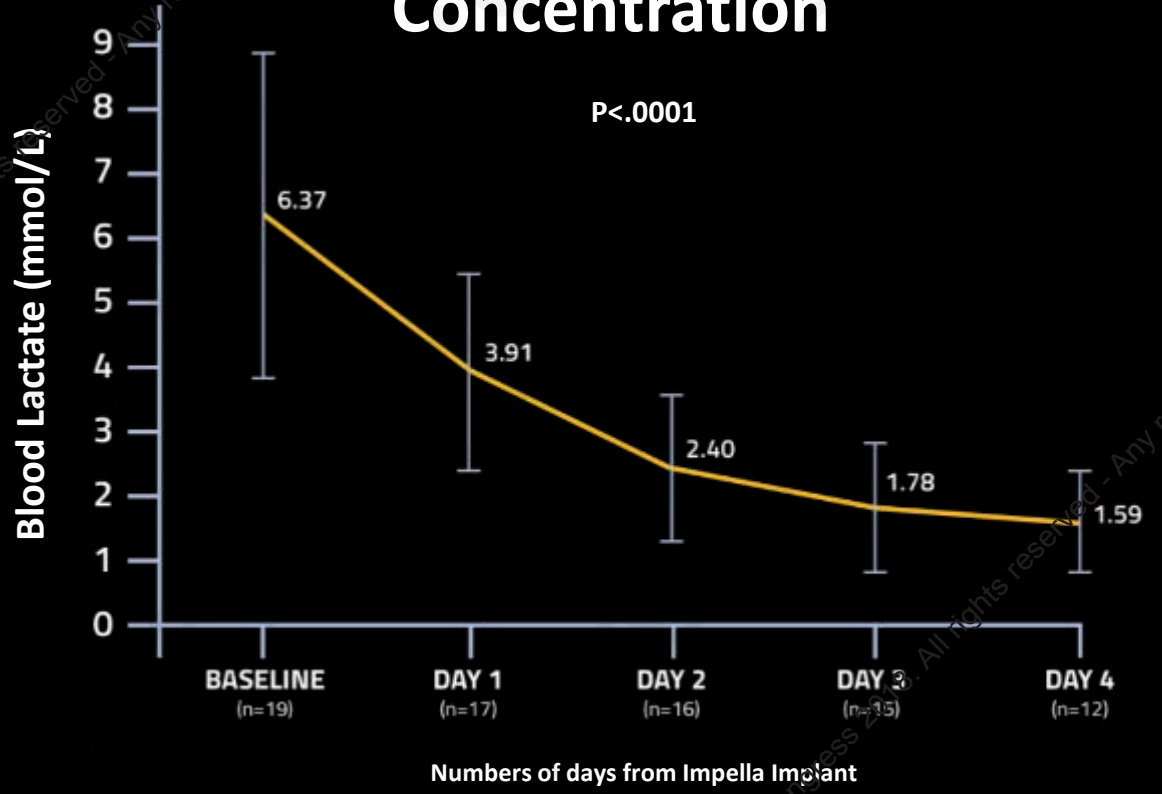
Cardiac Power Is the Strongest Hemodynamic Correlate of Mortality in Cardiogenic Shock: A Report From the SHOCK Trial Registry

MAP x Cardiac Output x .0022 = Cardiac Power Output



Improved End Organ Perfusion With Impella

Reduction of Blood Lactate Concentration



Casassus, et. al, J Interven Cardiol, 2015

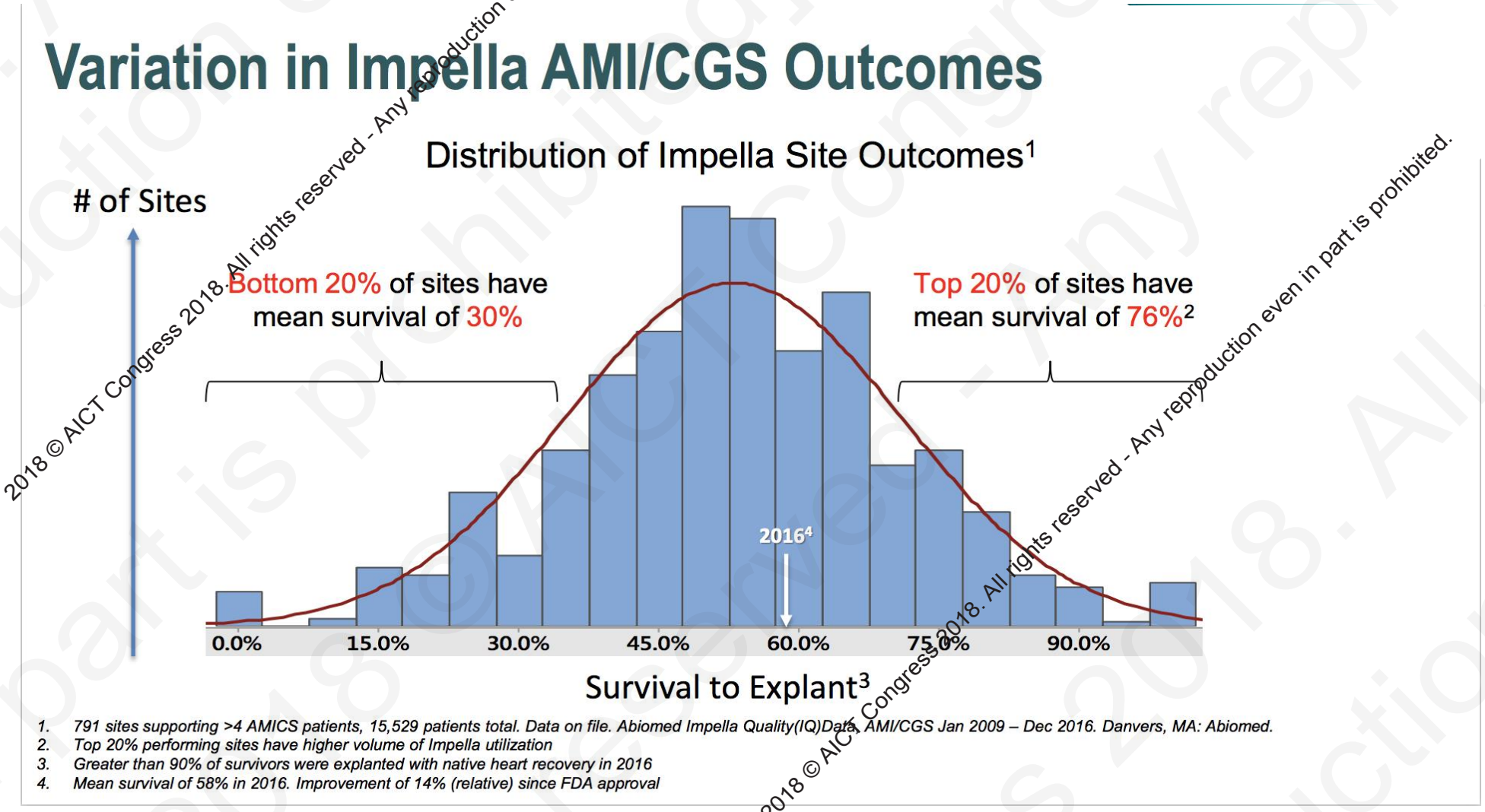
ACC.17
66th Annual Scientific Session & Expo

Outcomes for 15,259 US Patients With Acute MI Cardiogenic Shock (AMICS) Supported With Impella

William O'Neill, MD, FACC
Medical Director
Structural Heart Disease at Henry Ford Hospital, MI

WASHINGTON, DC
FRI • SAT • SUN
MARCH 17 – 19, 2017

IQ Database Demonstrates Major Variation in MI/Shock Outcomes



William O'Neill ACC 2017

Factors Associated Better Outcomes

- **Fewer Inotropes**
- **Use of Right Heart Catheterization**
- **Impella Insertion before PCI**

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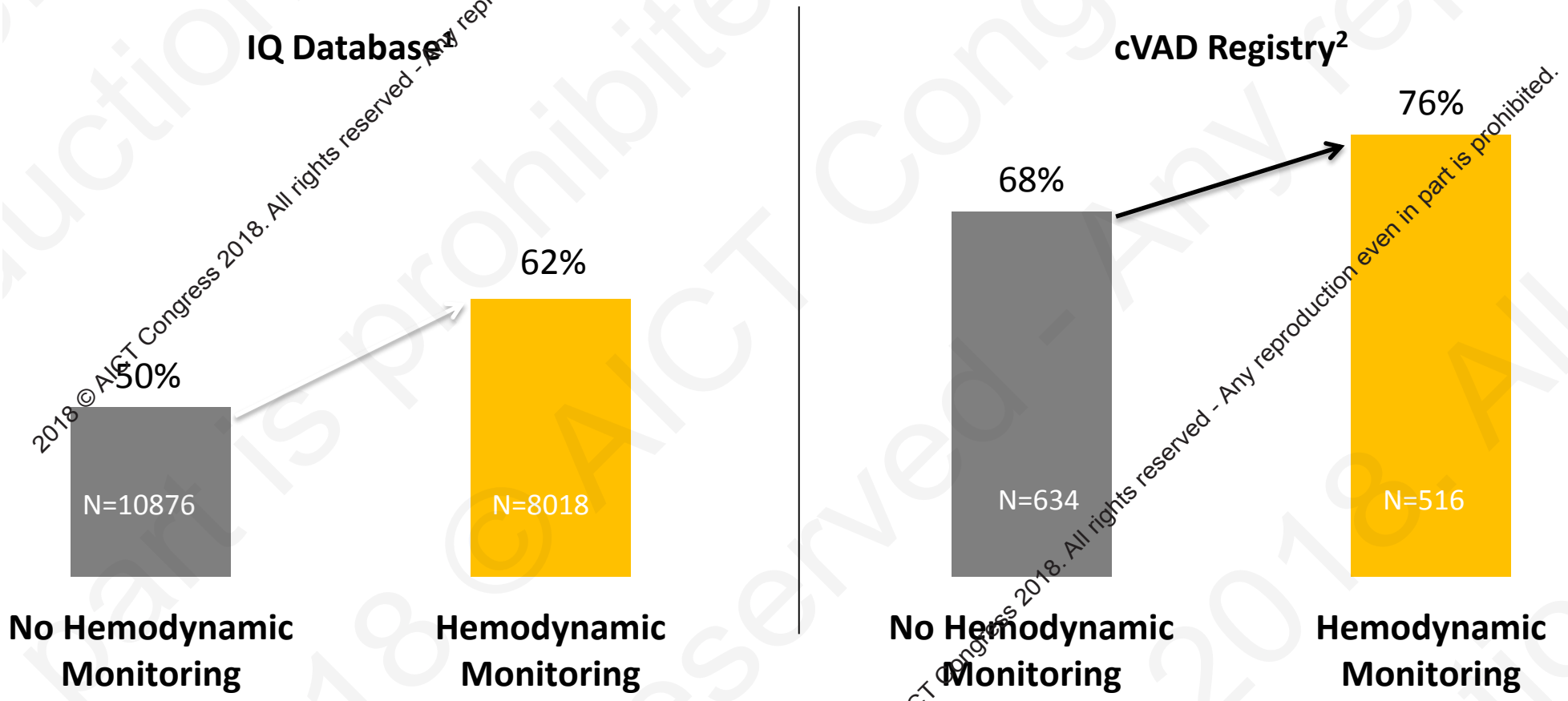
Hemodynamic Monitoring associated with Improved Survival in AMI/CGS



1. *Abiomed Impella Quality (IQ) Database, US AMI/CGS Apr 2009– Oct 2017. Survival to Explant. Danvers, MA: Abiomed.*
2. *cVAD survival to explant 2009-2016*

Unloading *before* Reperfusion

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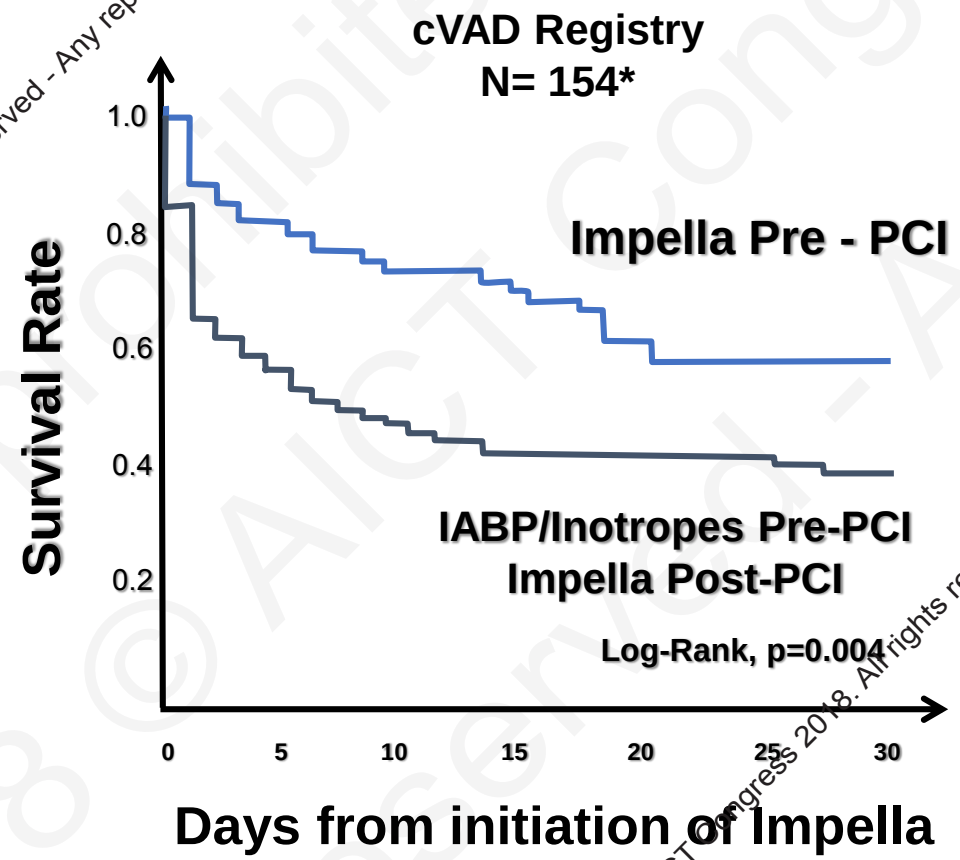
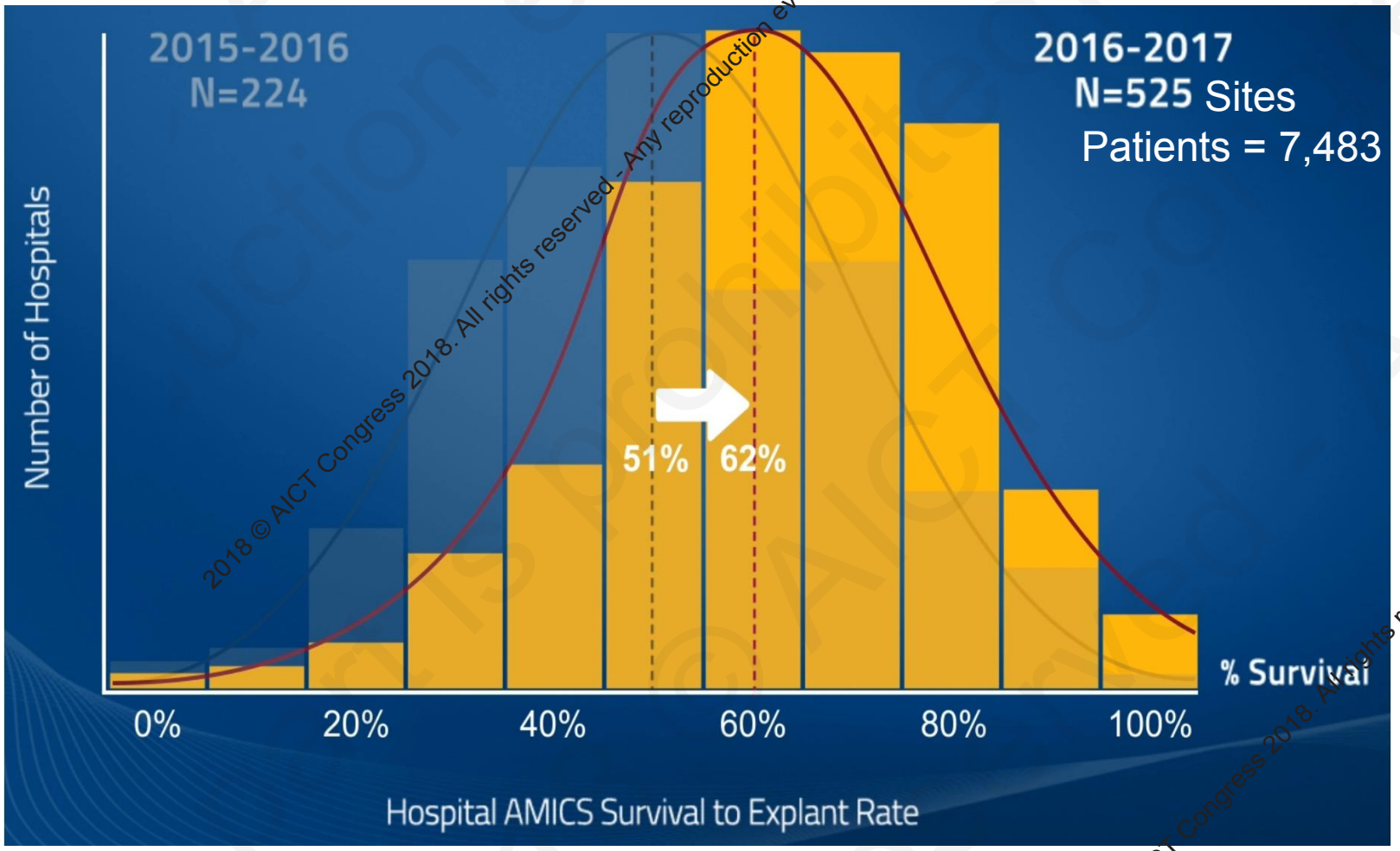
Timing of Support in AMI CGS Impacts Outcomes: Early is Better

Kaplan Meier Survival Analysis[1]



O'Neill et al, J Interven Cardiol 2014;

USA National Outcomes Improving



22% relative improvement in overall outcomes since FDA PMA in March, 2016 (p<0.0001)[2]

Data on file. Abiomed Impella Quality(IQ)Data. AMI/CGS Apr 2016 – Sept 2017. Danvers, MA: Abiomed.

525 sites supporting >6 AMICS patients, 7,483 patients total since March 2016

Detroit CSI

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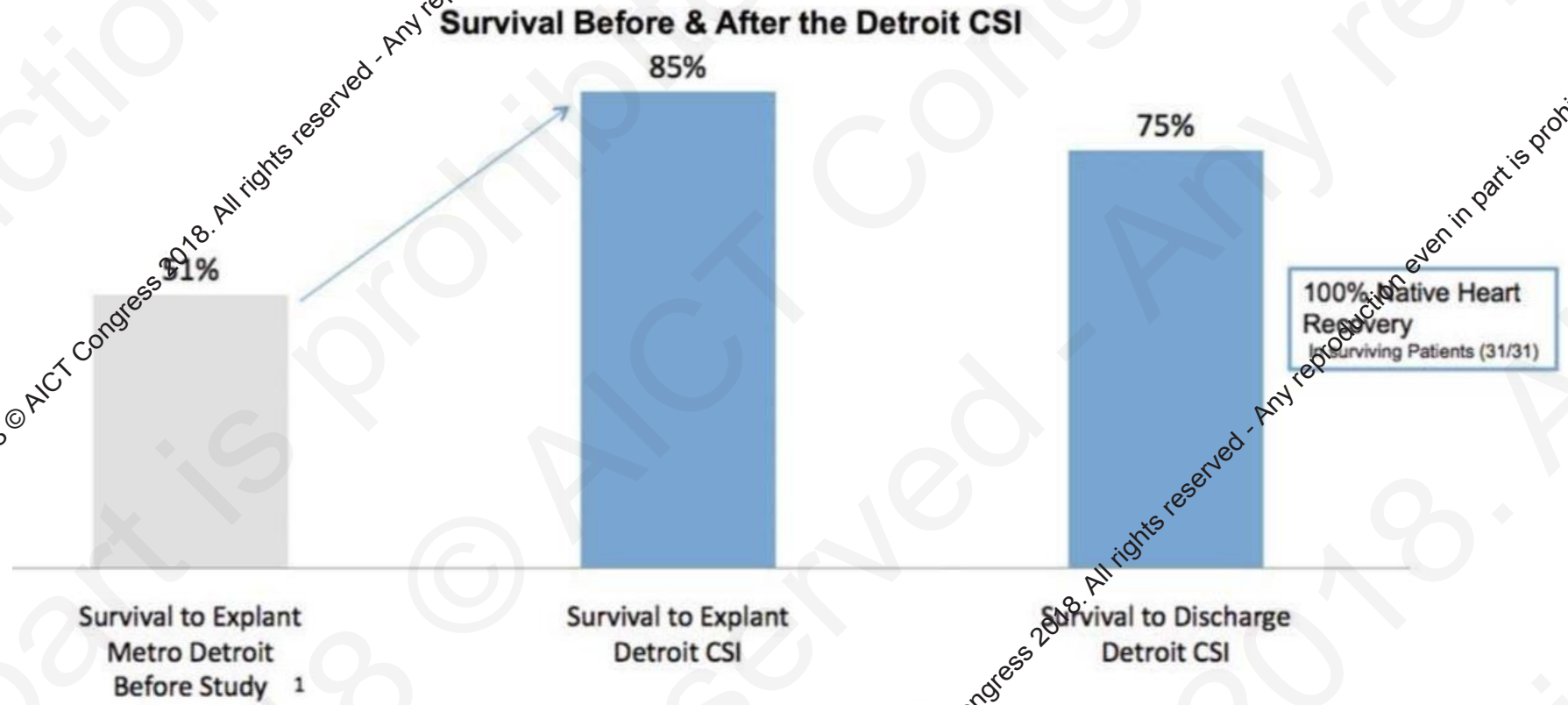
Baseline Survival vs. Detroit CSI



1. Abiomed Impella Quality (IQ) Database , Jan 2015 to July 2016 for Aggregate DTW Metro Hospitals, all-comers who presented with AMICS, Survival to Explant

Catheter Cardiovasc Interv. 2018;91:454–461

The National Cardiogenic Shock Initiative

88 Forms Completed

Excluded

23 patients
- ***4 unwitnessed arrest w/ delay CPR***
- ***2 Septic Shock***
- ***1 Aortic Stenosis***
- ***1 massive PE***
- ***5 patients without evidence of shock***
  - ***Procedural complication***
  - ***Decompensated Heart Failure (2)***
  - ***Hypertensive Emergency***
- ***9 patients with IABP prior to MCS***

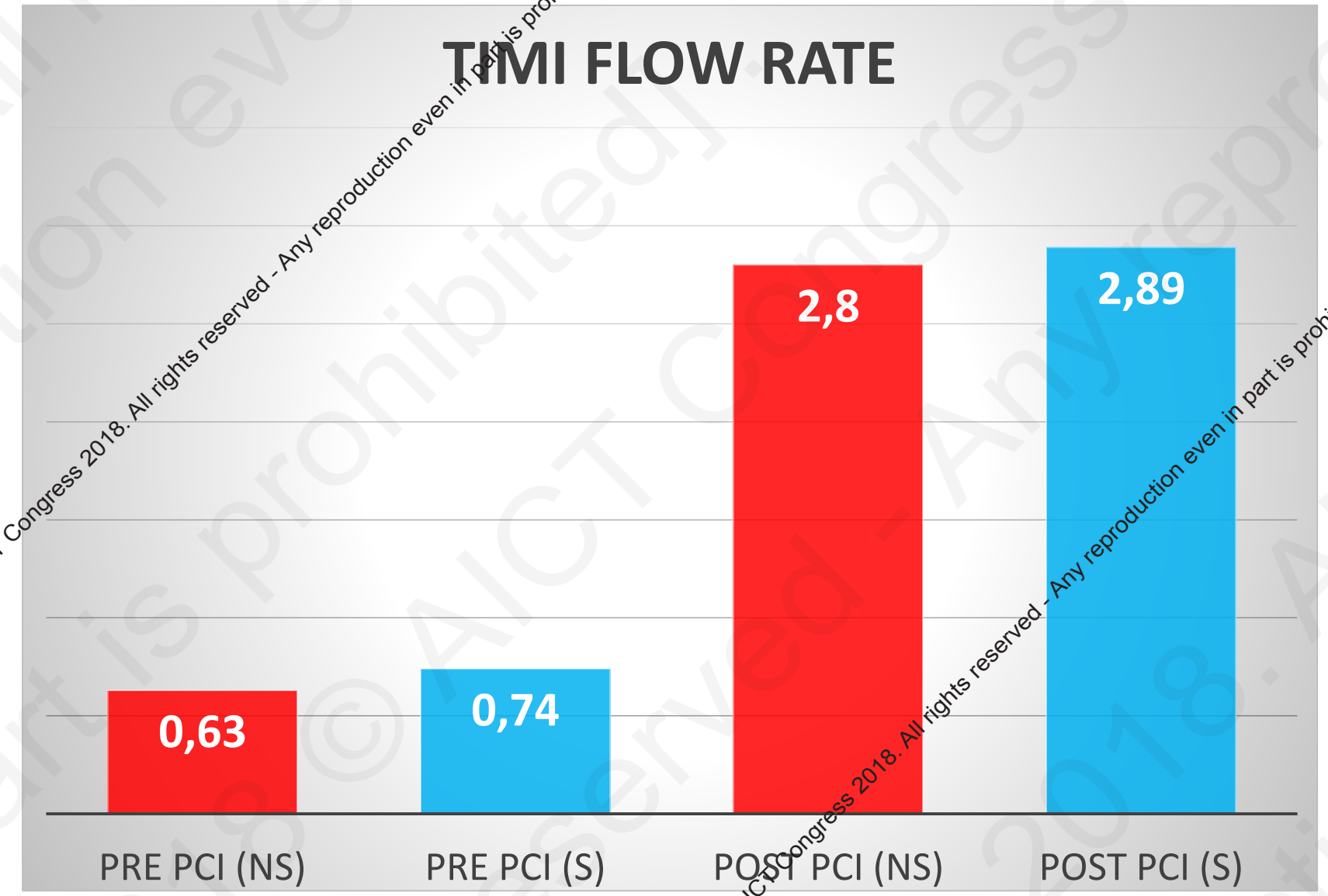
65 AMICS w/ Early MCS Support

Out of Hospital Cardiac Arrest – 10/65 (15%)
In Hospital Cardiac Arrest – 17/65 (31%

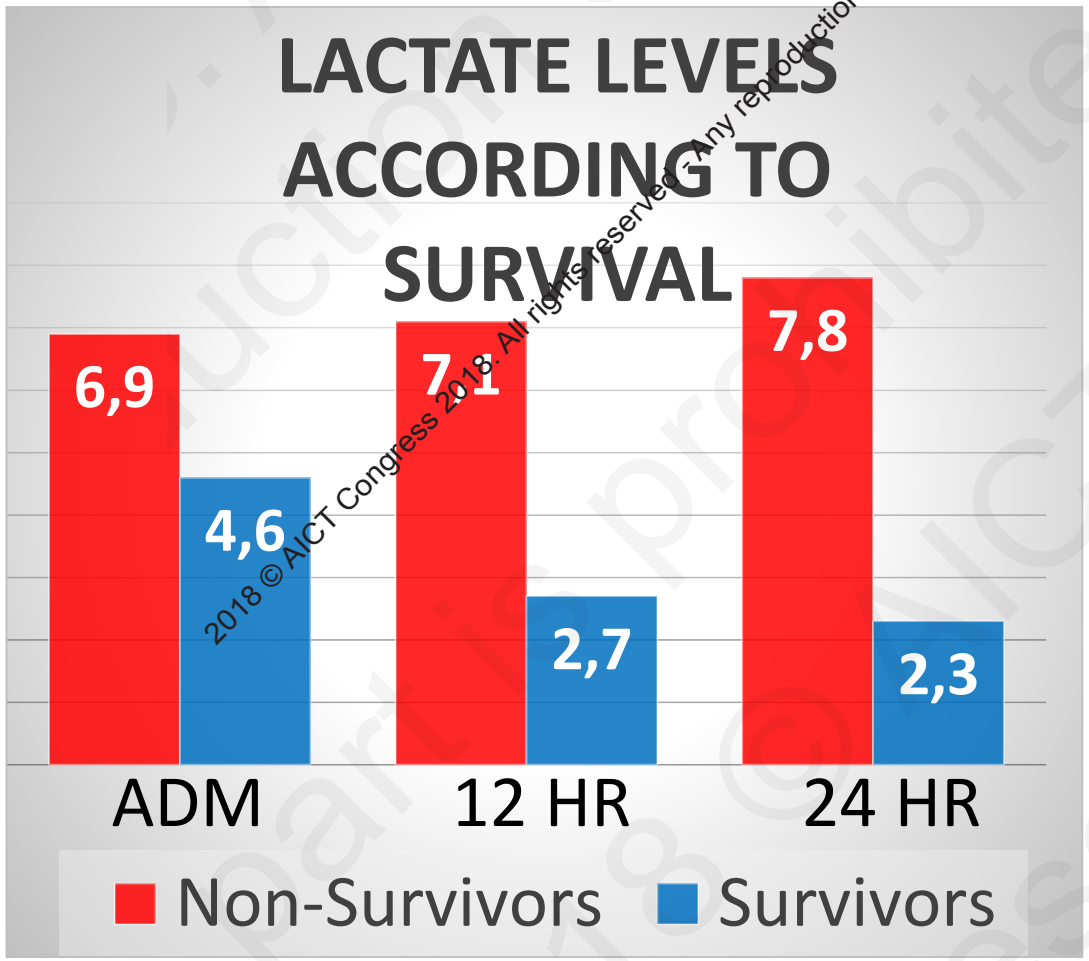
Pre-PCI Impella 48/65 (74%)
IP/Post Impella 17/65 (26%)

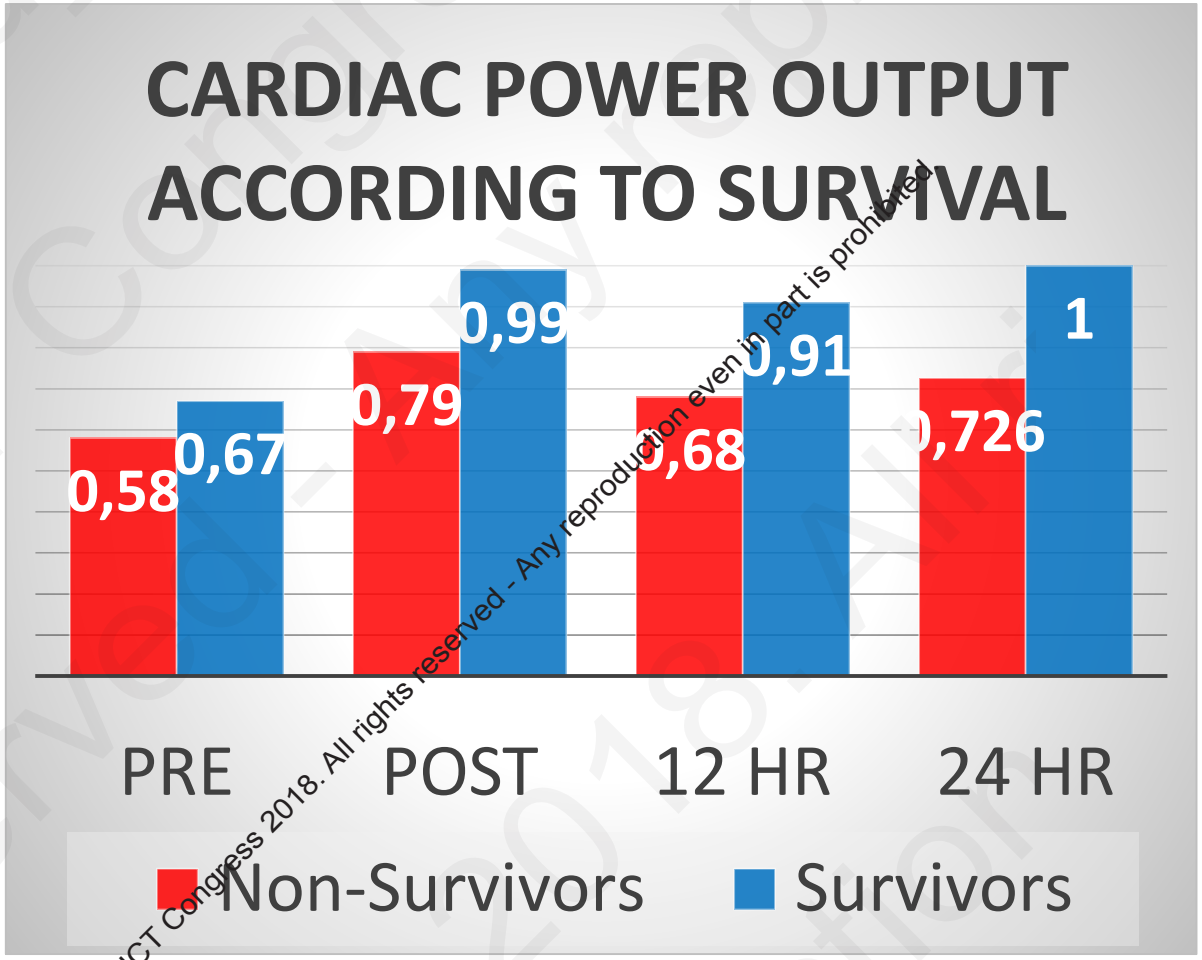
Door to Balloon (STEMI) 98.3 min
Door to Support 91.5 min

74% Survival (N=48/65)



Strategic Outcomes





Predictors of Survival CPO & Lactate @ 12-24 Hrs

Lactate < 3 & CPO < 0.8	**Lactate > 3 & CPO < 0.8**
83% Survival	**36% Survival**
Lactate < 3 & CPO > 0.8	**Lactate > 3 & CPO > 0.8**
95% Survival	**66% Survival**

Basir, O'Neill et al (Unpublished, National CSI)

www.henryford.com/cardiogenicshock

The Power of a Shock Team

Emphasis on *TEAM*

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Protocols: A Guide to Consistent Practice

Encourages Door to Support

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Impella® Best Practices in AMI Cardiogenic Shock

Identify[1-3]

- *SBP < 90 mmHg or on inotropes/pressors*
- *Cold, clammy, tachycardia*
- *Lactate elevated > 2 mmol/L*

Cardiogenic etiology evaluation

- *EKG (STEMI / NSTEMI)*
- *Echocardiography[4]*
- *If available, PA catheter, cardiac output, CPO, CI, PCWP, SvO_2[5-7]*

Stabilize Early

Reduce Door to Unloading Time (DTU)

- *Impella Support pre-PCI[8-10]*
- *Reduce Inotropes/Pressors[11,12]*

Appropriate Revascularization

- *Per Guidelines[13,14]*

Assess for Myocardial Recovery
(Weaning and Transfer Protocols)

- *↑ Cardiac Output*
- *↑ Cardiac Power Output*
- *↑ Urine Output*
- *↓ Lactate*
- *↓ Inotropes*

Myocardial Recovery[15,16]

No Recovery
Escalate (and Ambulate) or Transfer[17]

- *Ongoing Left Heart Failure*
- *Assess for Right Heart Failure*

1. Reyentovich A, et al. Nat Rev Cardiol. 2016;13(8):481-492.
2. Hochman JS, et al. N Engl J Med. 1999;341(9):625-634.
3. Rihal CS, et.al. J Am Coll Cardiol. 2015;65(19):e7-e26.
4. Picard MH, et al. Circulation. 2003;107(2):279-284.
5. Cohen MG, et al. Am J Med. 2005;118(5):482-488.
6. Kahwash R, et al. Cardiol Clin. 2011;29(2):281-288.
7. Chatterjee K. Circulation 2009;119(1):147-152.
8. O'Neill WW, et al. J Interv Cardiol. 2014;27(1):1-11.
9. Joseph SM, et al. J Interv Cardiol. 2016 Jun;29(3):248-56.
10. Schroeter MR, et al. J Invasive Cardiol. 2016 Aug 15. [Epub ahead of print]
11. Samuels LE, et al. J Card Surg. 1999;14(4):288-293.
12. De Backer D, et al. N Engl J Med. 2010;362(9):779-789.
13. O'Gara PT, et al. J Am Coll Cardiol. 2013;61(4):e78-e140.
14. Steg PG, et al. Eur Heart J. 2012;33(20):2569-2619.
15. Casassus F, et al. J Interv Cardiol. 2015;28(1):41-50.
16. Lemaire A, et al. Ann Thorac Surg. 2014;97(1):133-138.
17. Anderson MB, et al. J Heart Lung Transplant. 2015;34(12):1549-1560.

Strategic Points

Current Strategies in Management of Cardiogenic Shock

- **Door to Unload First. TIME is MUSCLE!**
- **Reperfuse**
- **Hemodynamic Monitoring**
  - **Increase Cardiac Power**
  - **Reduce peripheral lactate**
  - **Improve Coronary Perfusion/Reduce myocardial work**

This is a “First” Strategy- Not a Last Resort!

The Goal: ***Cardiac Recovery!***

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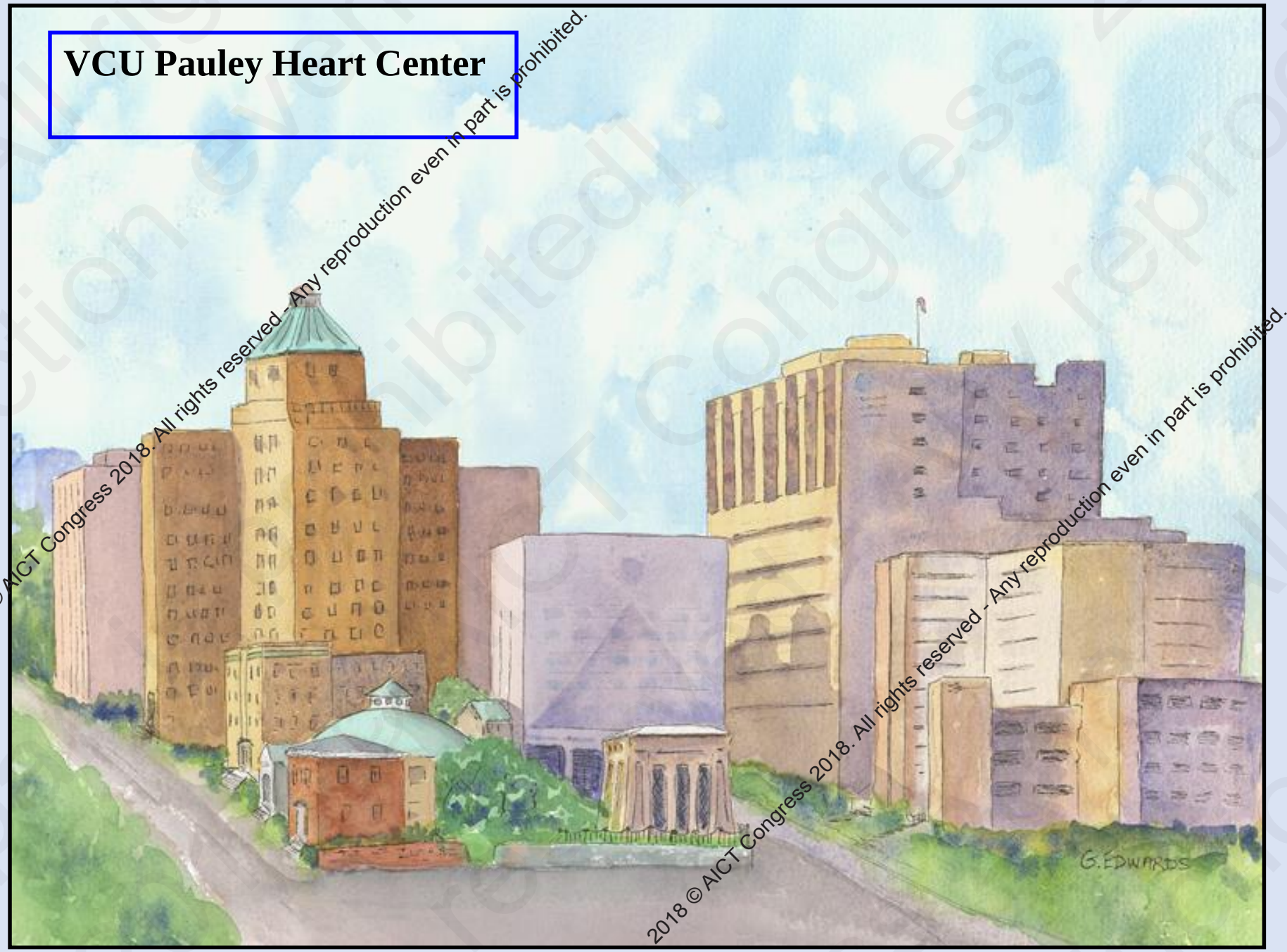
VCU Pauley Heart Center



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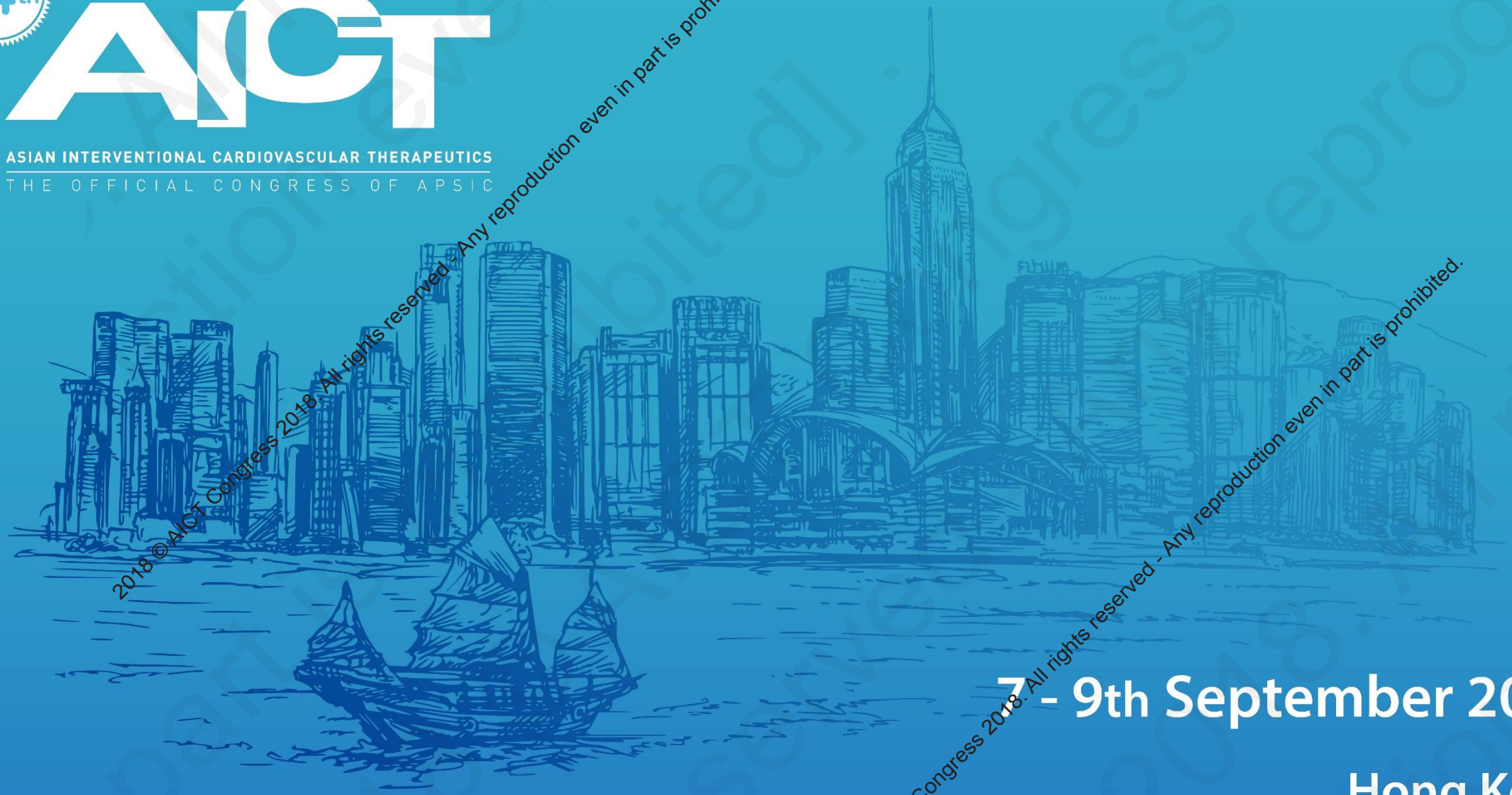

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7 - 9th September 2018

Hong Kong

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