Centrum pro mechanickou náhradu oběhu má být v každém PCI centru - proti

Němec P.

CKTCH

Centrum kardiovaskulární a transplantační chirurgie

Proč ?

- Zvládnutí KŠ u pacientů s IM
- Bezpečné provedení rizikové PCI

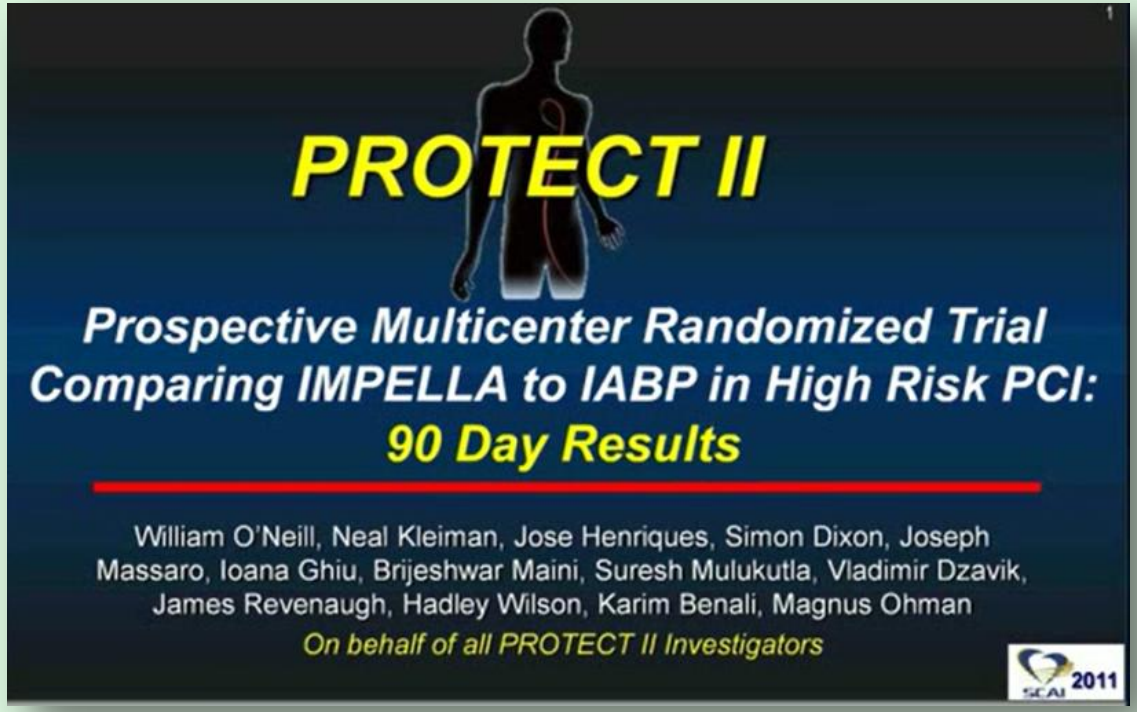
Současné možnosti podpory oběhu

	Farmakologická	IABK	Tandem-heart	Impella	ECLS/ ECMO	LVAD
Výhody						
Průtok (L/min)	< 0,5	0,5	3-5	2,5-5	4-6	4-8
Koronární perf	↑	↑↑	↑↑	↑↑	↑↑	↑↑
LVEDP	↑	↓	↓↓	↓↓	↑↑↑↑	↓↓↓↓
Limitace						
Arytmie	*	-	-	-	-	-
CMP	-	**	*	*	**	***
Ischemie DK	NA	*	**	*	***	NA
Krvácení	NA	**	***	*/**	****	****
Cena	**	***	****	*****	*****	******

Impella, Tandem-heart

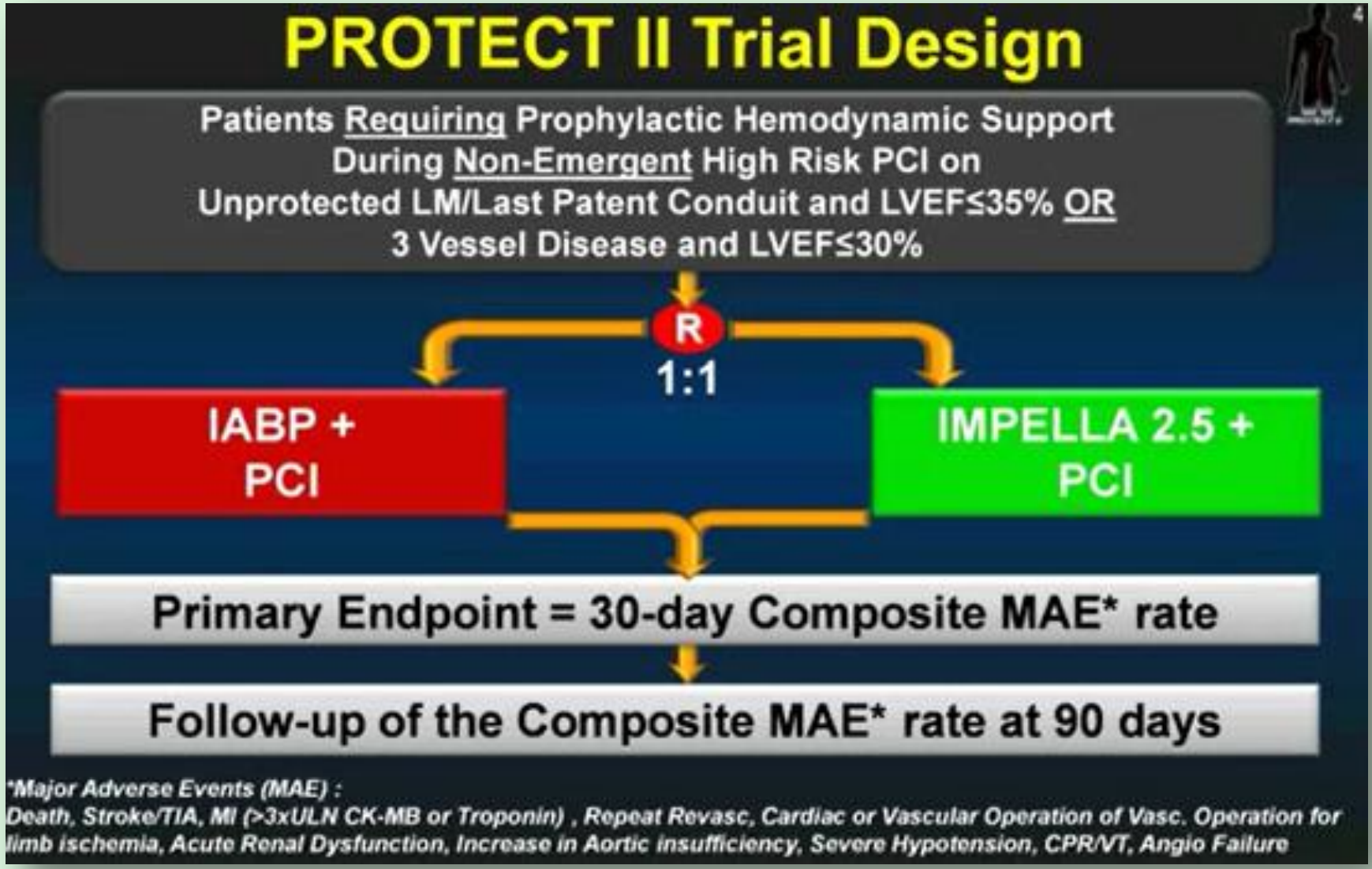
- Je tento typ podpory účinnější než IABK?

PROTECT II



- První prospektivní randomizovaná studie se svolením FDA
- Pacienti vyžadující hemodynamickou podporu během rizikové PCI
- Srovnání IABK a Impella 2,5

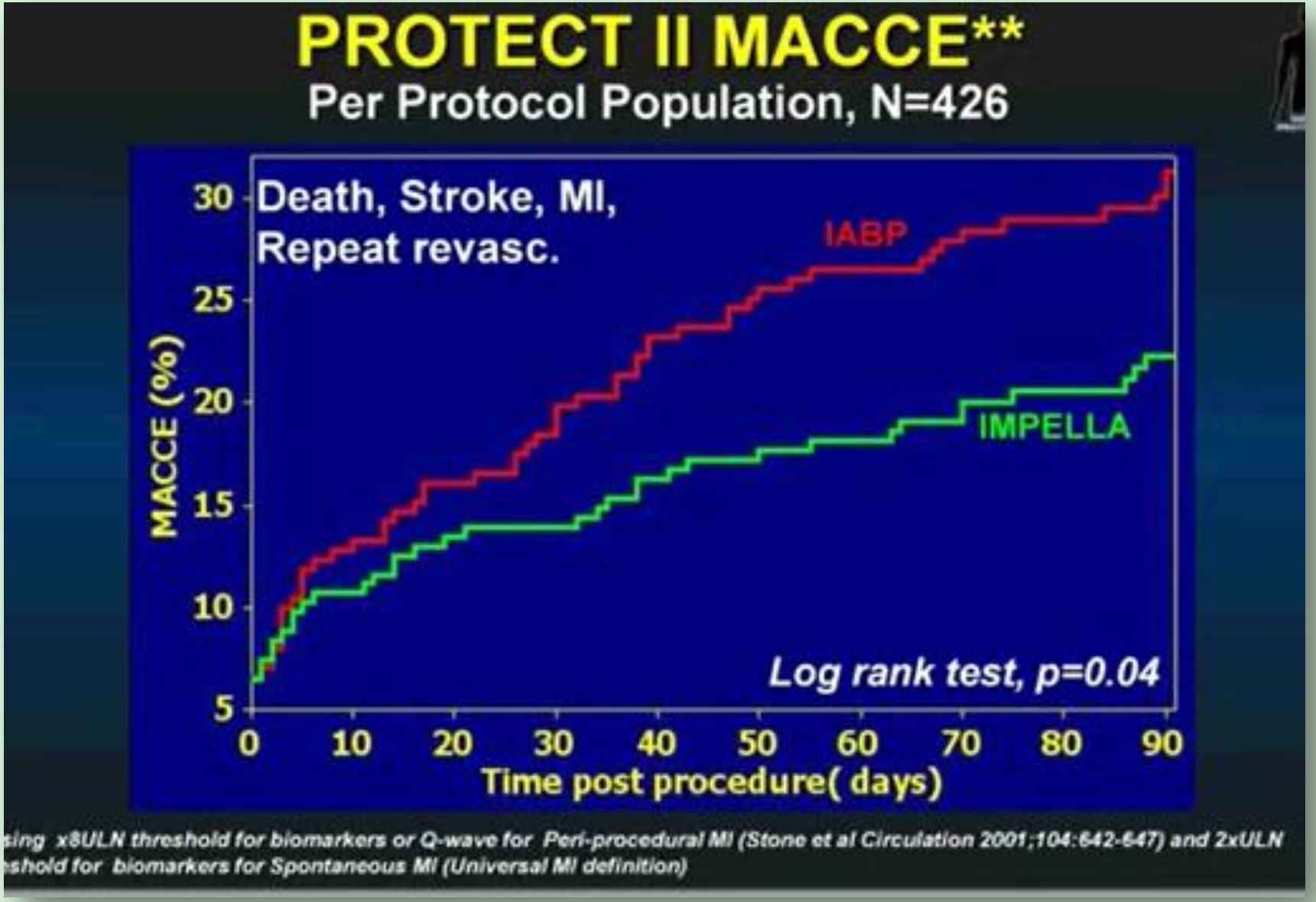
PROTECT II


PROTECT II Trial Design
Patients Requiring Prophylactic Hemodynamic Support
During Non-Emergent High Risk PCI on
Unprotected LM/Last Patent Conduit and LVEF≤35% OR
3 Vessel Disease and LVEF≤30%
R
1:1
IABP + PCI
IMPELLA 2.5 + PCI
Primary Endpoint = 30-day Composite MAE* rate
Follow-up of the Composite MAE* rate at 90 days
*Major Adverse Events (MAE) :
Death, Stroke/TIA, MI (>3xULN CK-MB or Troponin) , Repeat Revasc, Cardiac or Vascular Operation of Vasc. Operation for limb ischemia, Acute Renal Dysfunction, Increase in Aortic insufficiency, Severe Hypotension, CPR/VT, Angio Failure

Charakteristika

	IABK (223)	Impella (224)	p
IIb/IIIa inhibitory	26,1	13,5	0,001
SVG nebo RA	17,5	25,4	0,41
Doba podpory (h)	8,2	1,9	0,001
Na podpoře po výkonu (%)	37,7	5,7	0,001

Výsledky


PROTECT II MACCE**
Per Protocol Population, N=426
Death, Stroke, MI,
Repeat revasc.
IABP
IMPELLA
Log rank test, p=0.04
MACCE (%)
30
25
20
15
10
5
0
10
20
30
40
50
60
70
80
90
Time post procedure(days)
sing x8ULN threshold for biomarkers or Q-wave for Peri-procedural MI (Stone et al Circulation 2001;104:642-647) and 2xULN
shold for biomarkers for Spontaneous MI (Universal MI definition)

Výsledky

- Použití Impelly je bezpečné
- Vyšší hemodynamická účinnost
- Klinický profit
- Nižší MACCE

Impella CP

Journal of the American College of Cardiology

October 2016>
DOI: 10.1016/j.jacc.2016.10.022
Just Accepted

PDF Article

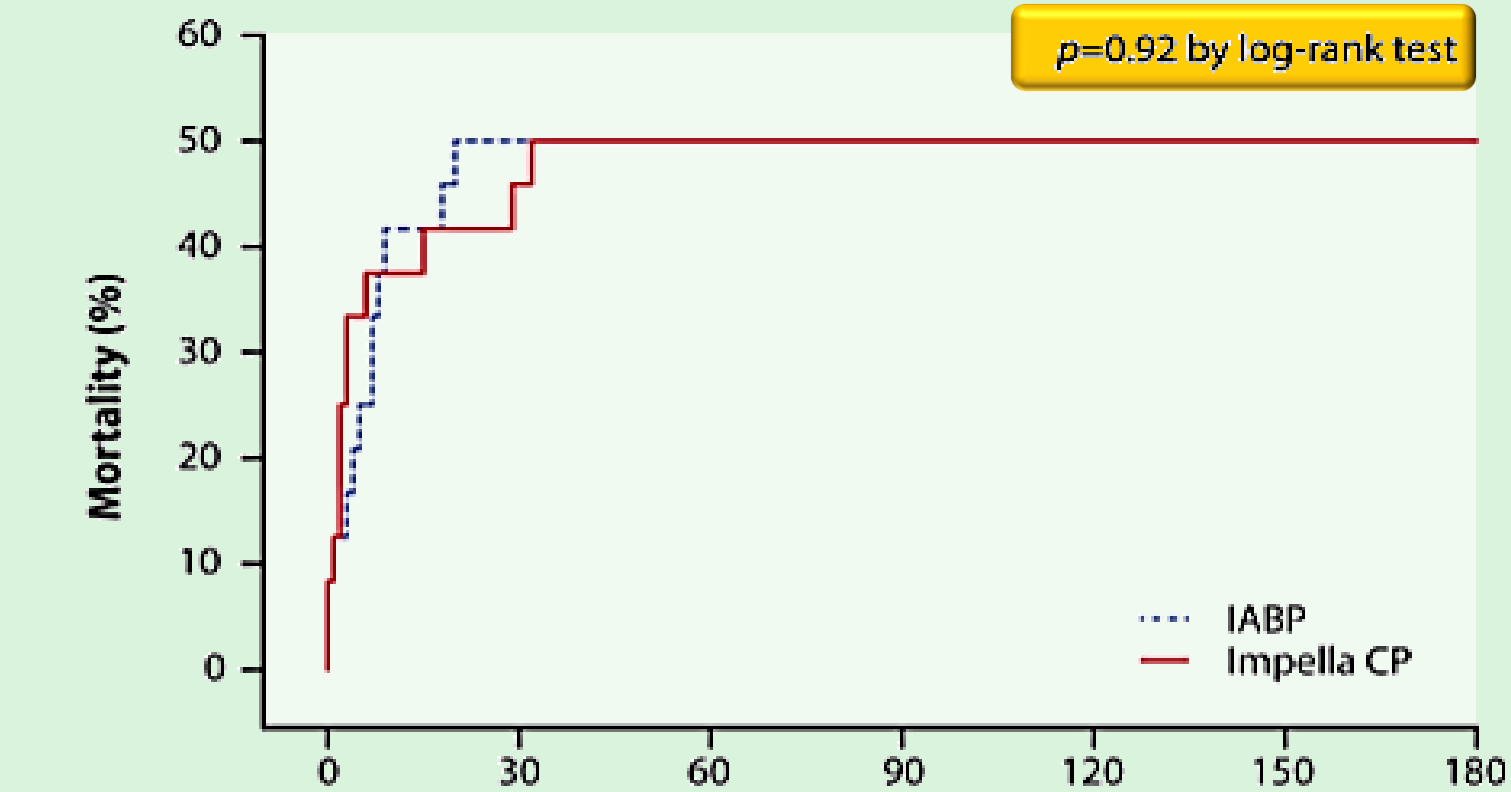
Impella CP Versus Intra-Aortic Balloon Pump in Acute Myocardial Infarction Complicated by Cardiogenic Shock: The IMPRESS trial

Dagmar M. Ouweneel, Erlend Eriksen, Krischan D. Sjauw, Ivo M. van Dongen, Alexander Hirsch, Erik J.S. Packer, M. Marije Vis, Joanna J. Wykrzykowska, Karel T. Koch, Jan Baan, Robbert J. de Winter, Jan J. Piek, Wim K. Lagrand, Bas A.J.M. de Mol, Jan G.P. Tijssen, José P.S. Henriques

- Multicentrická, prospektivní, randomizovaná studie
- AIM komplikovaný KŠ, všichni na ÚPV
- Porovnání mortality při použití IABK nebo Impella CP
- Trvání podpory IABK 48h, Impella 49h

CKTCH

Výsledky



Number at risk							
IABP	24	12	11	11	11	11	11
Impella CP	24	13	12	12	12	12	12

- Není rozdíl ve výsledcích

Impella

- Použití
  - Riziková PCI
  - Akutní srdeční selhání, KŠ
- Výsledky jsou závislé na:
  správná indikace, včasné nasazení

PCI centra - proč ne ?

Basir MB: Am J Cardiol. 2016

ECMO

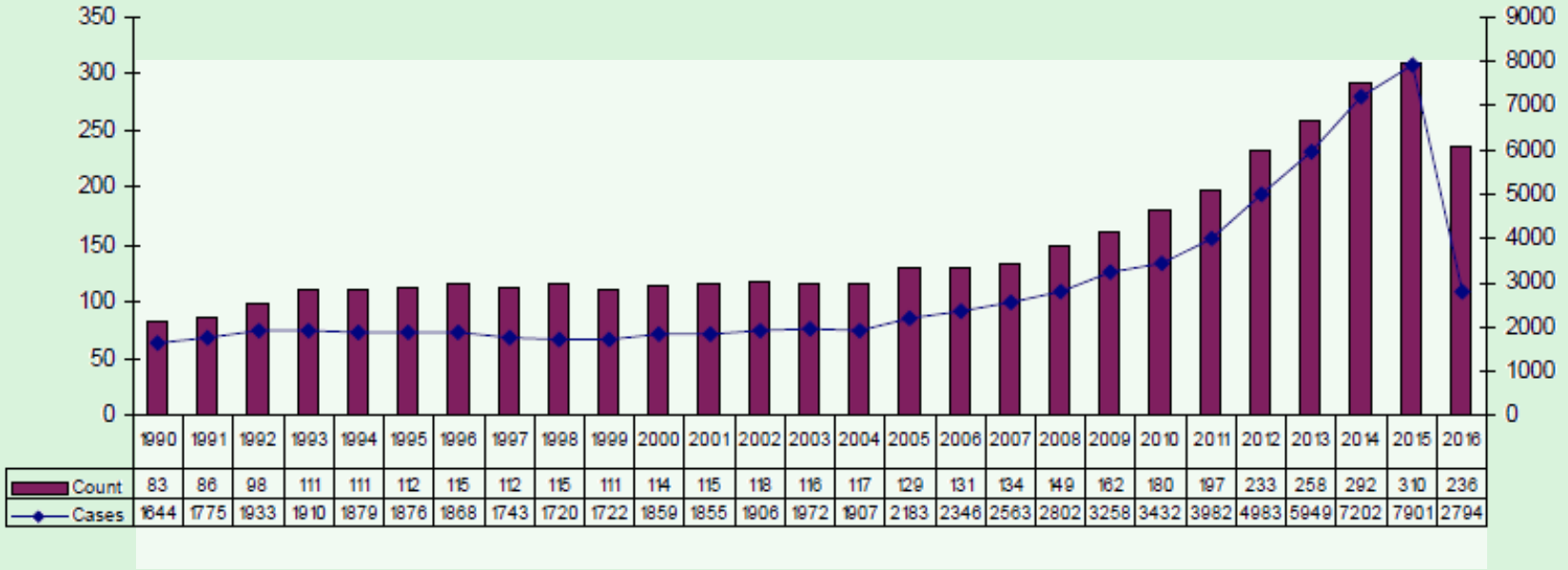
- Složitější technologie
- Oxygenace
- Multioborový tým
- Komplikace

Výsledky

- registr ELSO

(dospělí)

Selhání	n	Odpojení	Propuštění
Kardiální	9025	56%	41%
Respirační	10601	66%	58%
Po KPR	2885	39%	29%

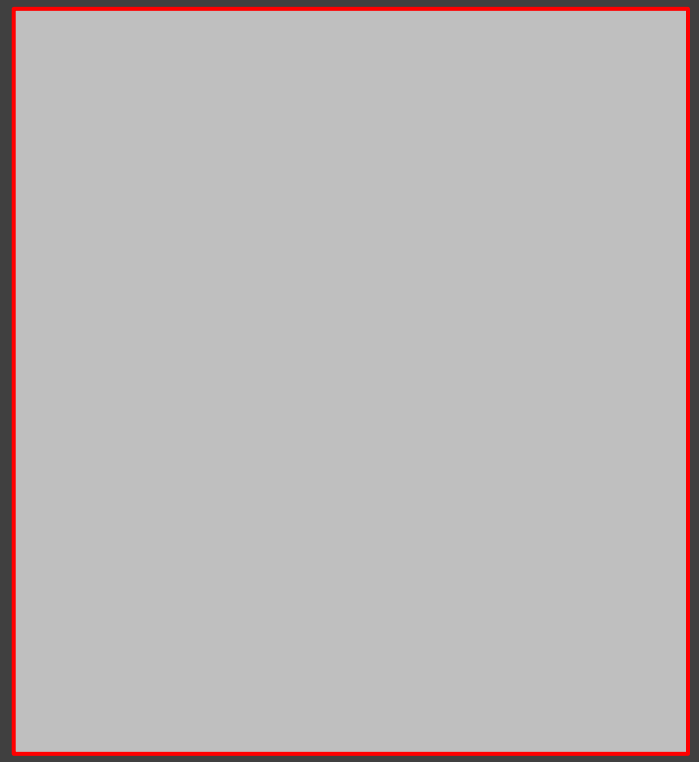


Výsledky v-a ECMO

Table. Summary of Recent Studies With Survival to Discharge Results After VA ECMO

Study	Indication	Study Period	Number of Patients	Survival to Discharge (%)	30-day Survival
Bakhtiary et al[30]	Cardiogenic shock	2003-06	45	28.9	47%
Belle et al[31]	Cardiogenic shock; Cardiac arrest	2006-10	51	27.4	NA
Chamogeorgakis et al[32]	Cardiogenic shock	2006-11	61	14.8	36.1%
Formica et al[33]	Cardiogenic shock	2002-09	42	38.1	52.4%
Kim et al[34]	Cardiogenic shock	2006-10	27	59.3	63%
Lamarche et al[35]	Cardiogenic shock	2000-08	32	44	43.8%
Lin et al[36]	Cardiac arrest	2004-06	55	29.1	34.5%
Liu et al[37]	Cardiac arrest	2007-10	10	40	40%
Smedira et al[38]	Cardiogenic shock	1992-99	202	38	24%
Doll et al[39]	Cardiogenic shock	1997-2002	219	24	24%
Beurtheret et al[40]	Cardiogenic shock; Cardiac arrest	2005-09	87	36.8	NA

Pujara D. Semin Thorac Cardiovasc Surg. 2015 Spring;27(1):17-23.



American Journal of Respiratory and Critical Care Medicine

Position Paper for the Organization of Extracorporeal Membrane Oxygenation Programs for Acute Respiratory Failure in Adult Patients

Alain Combes[1], **Daniel Brodie**[2], **Robert Bartlett**[3], **Laurent Brochard**[4], **Roy Brower**[5], **Steve Conrad**[6], **Daniel De Backer**[7], **Eddy Fan**[8], **Niall Ferguson**[8], **James Fortenberry**[9], **John Fraser**[10], **Luciano Gattinoni**[11], **William Lynch**[3], **Graeme MacLaren**[12], **Alain Mercat**[13], **Thomas Mueller**[14], **Mark Ogino**[15], **Giles Peek**[16], **Vince Pellegrino**[17], **Antonio Pesenti**[18], **Marco Ranieri**[19], **Arthur Slutsky**[4], and **Alain Vuylsteke**[20]; The International ECMO Network (ECMONet)

+ Author Affiliations

ECMO centra

- Lokalizace – nemocnice terciálního typu
- Dostatečná oblast – 6 pts/centrum/rok
- Multidisciplinární ECMO tým (6 členů… specialista na ECMO 24h denně,…)
- Nelékařský personál (JIP, koordinátor,)
- Existence protokolu (indikace, KI, systém péče, údržba přístrojů, ukončení léčby,…)
- Vzdělávací kurz (min. 64h)

CKTCH

Guidelines

- For ECMO centres
- For training and continuing education of specialists

ČESKÁ KARDIOLOGICKÁ SPOLEČNOST

ELSEVIER

European Journal of Cardio-thoracic Surgery 40 (2011) 676–681

EUROPEAN JOURNAL OF CARDIO-THORACIC SURGERY

www.elsevier.com/locate/ejcts

Guideline

Position article for the use of extracorporeal life support in adult patients

Andreas Beckmann [a], Christoph Benk [b], Friedhelm Beyersdorf [b,*], Gerd Haimerl [c], Frank Merkle [d], Carlos Mestres [e], John Pepper [f], Alexander Wahba [g] and on behalf of the ECLS Working Group [1]

[a] German Society for Thoracic and Cardiovascular Surgery, Berlin, Germany
[b] Department of Cardiovascular Surgery, University Hospital Freiburg, Hugstetter Str. 55, 79106 Freiburg, Germany
[c] Centre for Applied Simulation, University of Applied Sciences Furtwangen, Villingen-Schwenningen, Germany
[d] German Heart Center Berlin, Berlin, Germany
[e] Department of Cardiovascular Surgery, Hospital Clinico, University of Barcelona, Barcelona, Spain
[f] Royal Brompton Hospital, Department of Surgery, London, UK
[g] St. Elisabeth Department of Cardiac-thoracic Surgery, Trondheim, Norway

Received 24 January 2011; accepted 2 May 2011; Available online 17 June 2011

CKTCH

- Týmová spolupráce
- Lékař má prokázat zkušenost
  - Indikace, KI
  - Kanylace tepen i žil včetně kanylací pro omezení periferní ischémie
  - Řešení cévních komplikací
  - Možnosti dekomprese LK
  - Znalost monitorace parametrů k zabránění ischemie CNS, myokardu ..
- Perfuzionista
  - 100 MTO a/nebo 2 roky praxe

ECMO centrum - UK, Itálie, Rakousko

- ECMO centrum má být v nemocnici III. typu (populace 2-3 milióny)
- Doporučený objem 20-25 pacientů ročně, ne méně než 10, learning curve 20 pacientů
- Týmová spolupráce – 24h denně
- Standardizované protokoly - lepší výsledky
- Přístrojové vybavení

CKTCH

Přítomnost specialisty

Cardiac Intensivists Improve Clinical Outcomes for Patients with Cardiogenic Shock

Association Between Presence of a Cardiac Intensivist and Mortality in an Adult Cardiac Care Unit

A

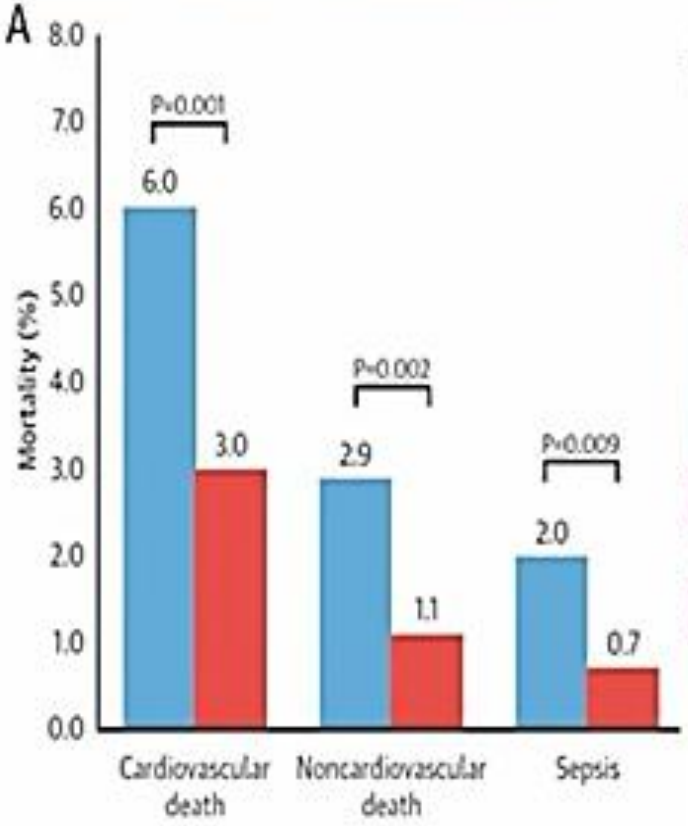


TABLE 2 Treatment Characteristics

	Total Patients			
	Low-Intensity (n = 616)	High-Intensity (n = 1,815)	p Value	Standardized Difference (%)
Inotropes or vasopressors	203 (33.0)	506 (27.9)	0.02	−9.5
Dopamine	117 (19.0)	170 (9.3)	<0.001	−21.5
Norepinephrine	125 (20.3)	321 (17.7)	0.15	−5.7
Dobutamine	99 (16.1)	248 (13.7)	0.14	−2.2
Vasopressin	25 (4.1)	51 (2.8)	0.12	−3.3
Epinephrine	12 (2.0)	104 (5.7)	<0.001	8.2
Milrinone	4 (0.7)	29 (1.6)	0.08	2.4
Intra-aortic balloon pump	52 (8.4)	53 (2.9)	<0.001	−21.6
Extracorporeal membrane oxygenation	33 (5.4)	102 (5.6)	0.81	0.6
Mechanical ventilation	115 (18.7)	289 (15.9)	0.11	−5.3
Continuous renal replacement therapy	69 (11.2)	136 (7.5)	0.004	−9.5

Na and Yang et al. JACC 2016

Komplikace

- Kanylace
  - Malpozice kanyl (zejména venózní)
  - Disekce tepny
  - Končetinová ischemie (12,5% to 22,6%), compartment sy nebo fasciotomie 10,3%
- Porucha koagulace
  - Krvácení 26,8% to 56,6%, DIC 5%
  - Hemolýza 18%
  - Stáza krve v LK, aortě – tromby
  - Trombóza systému 10%
- Neurologické komplikace (8-50%)

Komplikace

- Selhání levého srdce, plicní edém
- Renální selhání (35,5% to 74,0%), nutnost RRT (36,7% to 55,5%)
- Infekce 19,5% to 44,0% (25% sepse, 36% pneumonie)
- SIRS (systémová zánětlivá odpověď) – reakce na ne-endotelizovaný cizí povrch systému (vasodilatace, poruchy koagulace, trombocytopenie)

Další osud pacienta

- Úspěšné odpojení
- Řešení komplikací
- Přechod na jiný typ podpory

Další osud pacienta

- Úspěšné odpojení
- Řešení komplikací
- Přechod na jiný typ podpory

Je to v silách každého PCI centra ?

Ne

Transport

- ## Transport je rizikový

  514 transportů, u 31,4% komplikace (65% pacientských – ztráta objemu, 15% personálních – nedostatečná kontrola vybavení, 13% se vztahovalo k vozidlu – energie, místo)

  nikdo neumřel

- ## Transport je bezpečný

  review 1481 pacientů, přežití 68%, 2 úmrtí během transportu

CKTCH

Ericsson A., Prehosp Emerg Care. 2017 Feb 6:1-8
Mendes PV, Ann Intensive Care. 2017 Dec;7(1):14.

Důvody omezit počty pracovišť

≠ Snížit dostupnost a kvalitu péče

= Zabezpečit kvalitní péči, omezit riziko komplikací

Jak zlepšit kvalitu

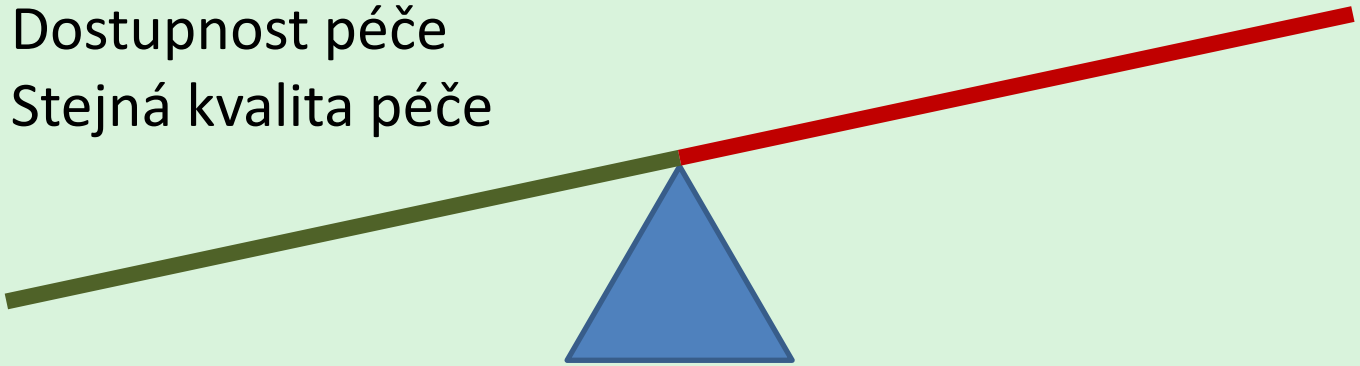
- Zkušenost
  - Týmový přístup
  - Časnější intervence
  - Jasná indikační kritéria
  - Selekce pacientů
- Lepší technologie
  - Biokompatibilita
  - Dekomprese LK
- Perioperační péče
  - Protokol
  - Menší kanyly
  - Kanylace třísel ?
  - Současná IABK

Důvody

Pro

Proti

Dostupnost péče
Stejná kvalita péče



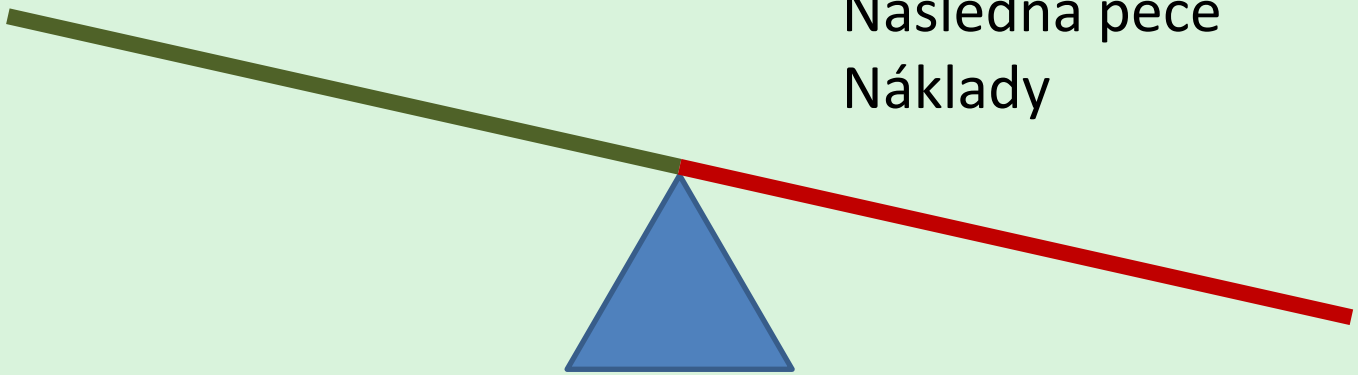
Důvody

Pro

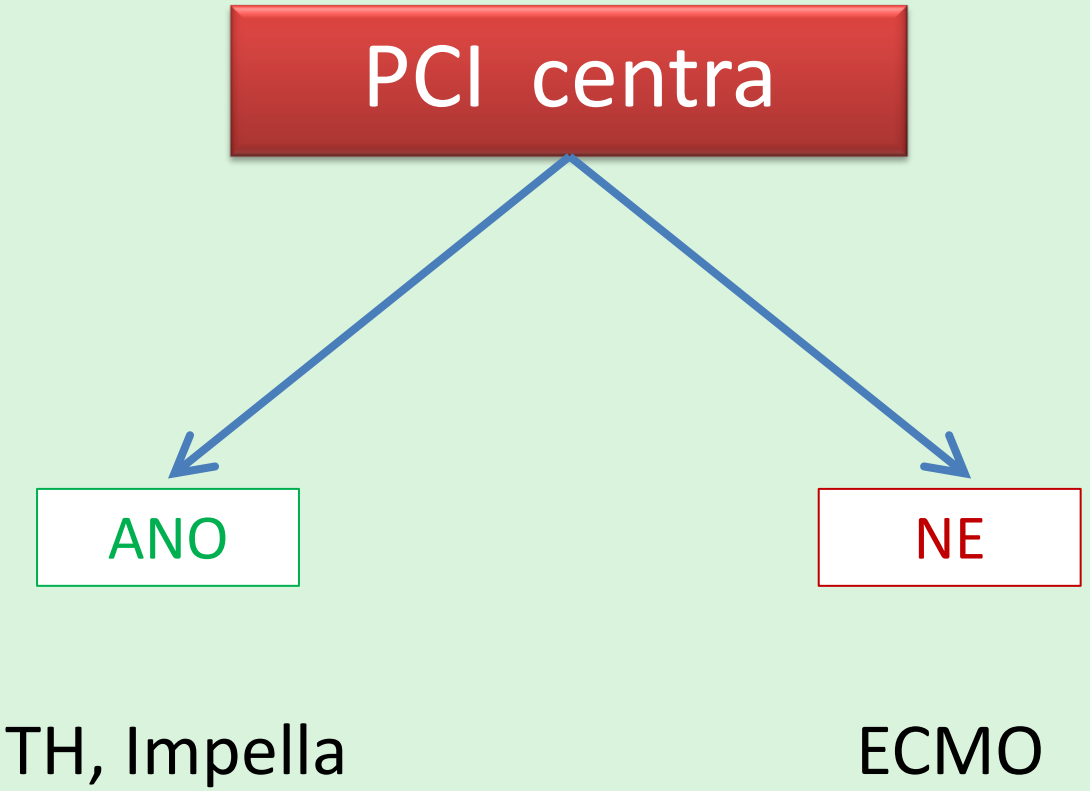
Dostupnost péče
Stejná kvalita péče

Proti

Multidisciplinární přístup
Řešení komplikací
Následná péče
Náklady



Závěr



ECMO - NE

- Multidisciplinární přístup – faktory patient-related, logistické a institucionální (personál, technologie)
- Finančně náročná metoda – zdroje je třeba spotřebovat efektivně
- Komplikace – časté a obtížně řešitelné

CKTCH

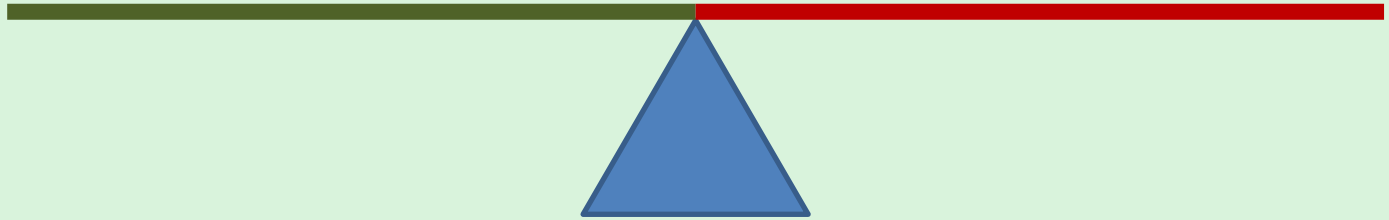
Děkuji za pozornost

Důvody

Pro

Proti

Dostupnost péče
Stejná kvalita péče

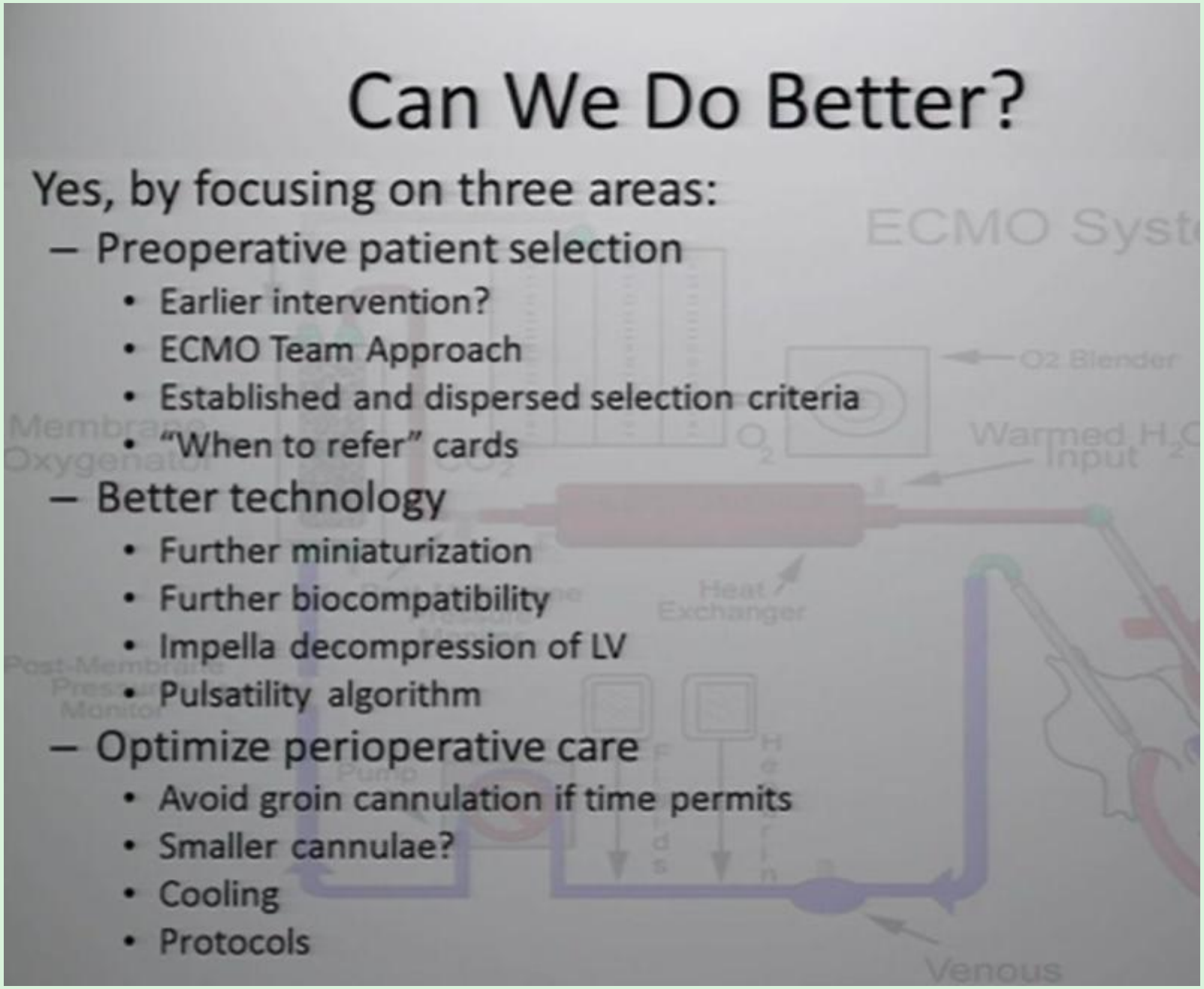


ecmo

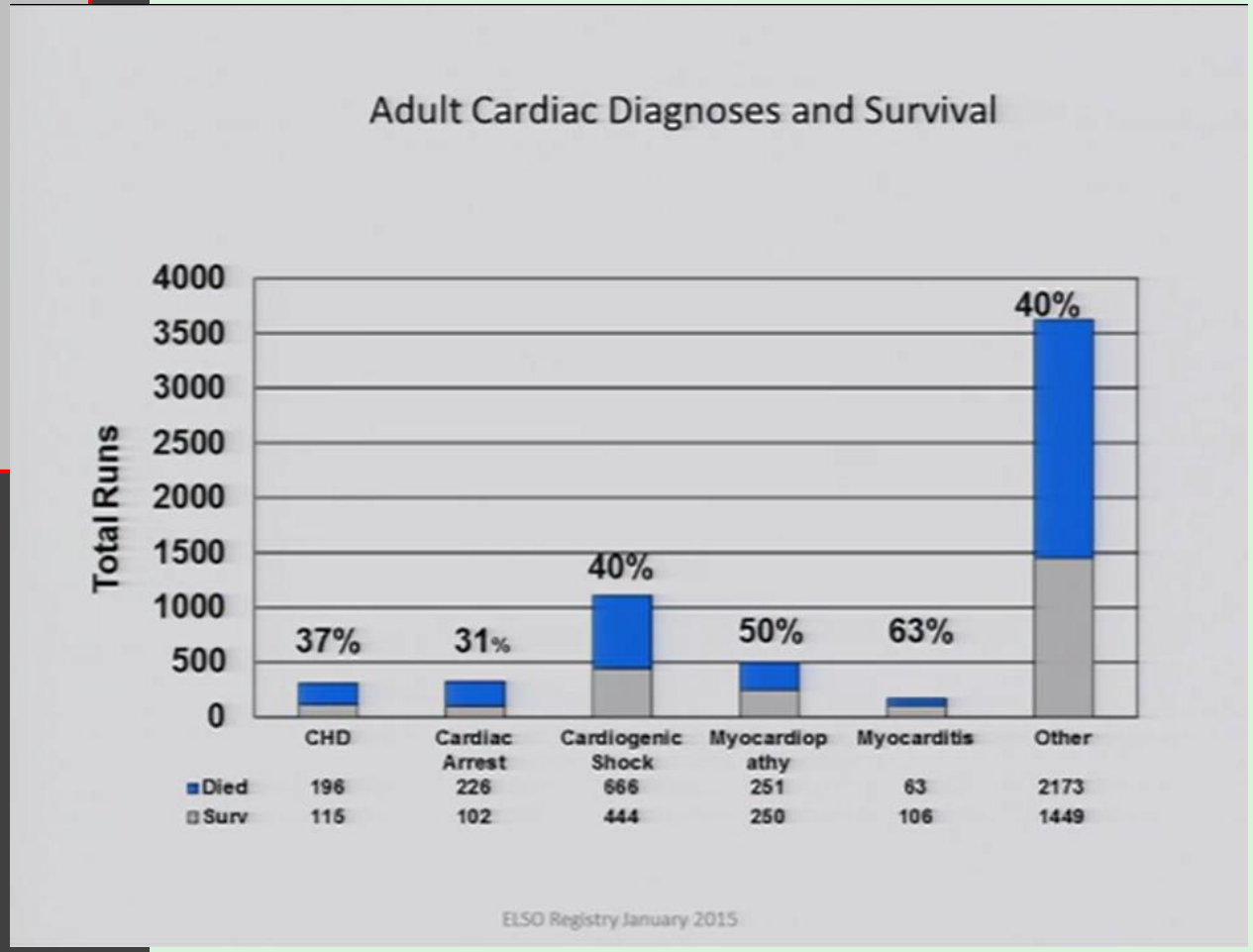
Can We Do Better?

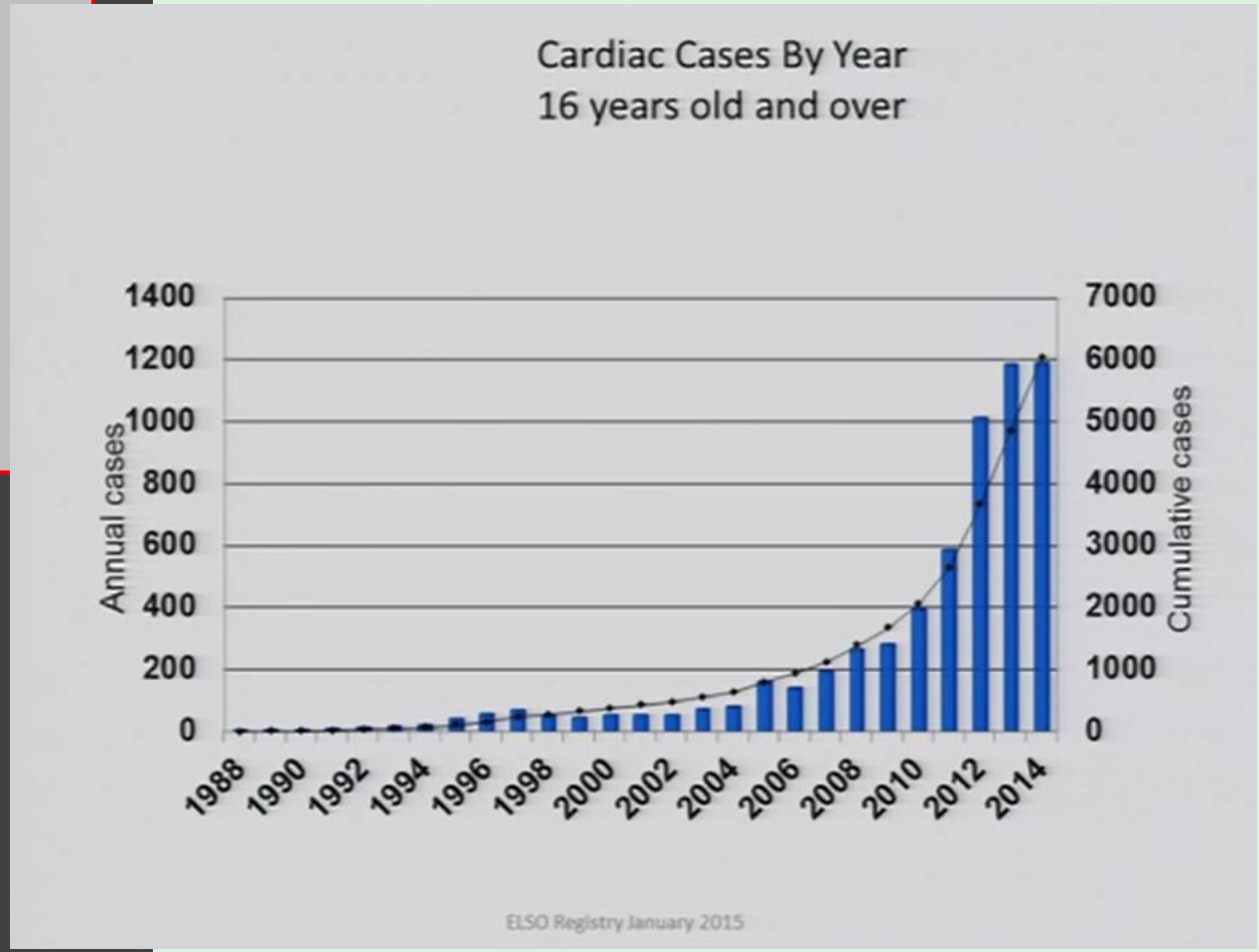
Yes, by focusing on three areas:

- Preoperative patient selection
  - Earlier intervention?
  - ECMO Team Approach
  - Established and dispersed selection criteria
  - "When to refer" cards
- Better technology
  - Further miniaturization
  - Further biocompatibility
  - Impella decompression of LV
  - Pulsatility algorithm
- Optimize perioperative care
  - Avoid groin cannulation if time permits
  - Smaller cannulae?
  - Cooling
  - Protocols



Registr ELSO




Cardiac Cases By Year
16 years old and over
Annual cases
Cumulative cases
1400
1200
1000
800
600
400
200
0
7000
6000
5000
4000
3000
2000
1000
0
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
ELSO Registry January 2015

Rizikové faktory pro ECMO

- Věk

  – nad 70 let – přežití 30,5% x 43,1% (pod 70 let)

Lorusso R., Ann Thorac Surg. 2017 Jan 25. pii: S0003-4975(16)31471-0. doi: 10.1016/j.athoracsur.2016.10.023. [Epub ahead of print]

ECLS Wash U/BJH

	2013	2014	2015
N	86	86	106
Male %	63	64	66
Survival %	46.5	43	40
ICU stay (d)	22±29	20±37	20±37
Total Hospital stay(d)	42±56	33±46	30±32
ECMO to LVAD(n)	17	12	14
Transfer on ECMO(n)	4	8	14

Itoh A. https://www.vumedi.com/video/extracorporeal-life-support-ecls-in-the-era-of-percutaneous-ventricular-assist-device/- týká se všech černých obr.

ECLS is a resource-intense treatment

- Hospital Resources
  - ECMO system ($$$$$$)
  - Cannulas ($$$)
  - ICU
  - Cath lab, OR
  - Transfusion service
- Human Resources
  - Multidisciplinary decision making call team (Cardiology/Pulmonology/Surgery)
  - Operator and assistants
  - Perfusionists
  - Intensivists
  - Consulting service(Vascular, GI, Neuro, ID, Gen sx etc.)
  - Social/financial services
- Next Steps
  - VAD, HTx, Lung Tx
  - Multidisciplinary LVAD/Htx/Lung Tx team

Indication ECLS

- Acute Cardiac Failure
  - Acute coronary syndrome
  - Myocarditis
  - Acute on chronic CHF
  - Post heart transplant graft failure, rejection
  - Post cardiotomy shock
  - Unknown etiology
- Respiratory shock
  - ARDS
  - Acute exacerbation of chronic pulmonary disease
  - Pulmonary emboli
- ? Septic shock
- ? Social indication ? (Young, someone's patient, etc.)

CKTCH

Indication ECLS: Clinical condition

- Circulatory failure (CI<2.2)
- Increasing inotropic/vasopressor support
  - Epi 0.2mcg/kg/min, Norepi 0.2 mcg/kg/min, Vasopressin, Dobutamin 10 mcg/kg/min etc
- Severe acidosis/ elevated lactate)
- Other organ damage(elevated Liver enzymes, creatinine)
- Worsening ventilator setup, prone, bilevel, PaO2/FIO2 ratio <100..
- (Unable to come off CPB)
- Pt is on temporary devices and failing (pVAD, IABP)

CKTCH

(Relative) Contra-indication ECLS

- Age >80
- Unwitnessed cardiopulmonary arrest, possibly anoxic brain injury
- Chest compressions not initiated within 10 min of arrest
- Asystole
- CPR >60 min
- Hemorrhagic shock

- Pre-existing medical conditions:
  - Ischemic/hemorrhagic Stroke
  - COPD severe
  - ESLD
  - ESRD
  - Severe PVD
  - Malignancy with poor prognosis
  - Hypercoagulable state/coagulopathy

- Relative C-I (Poor socioeconomic situation)
  - No insurance will leave a huge financial burden to the patient/family and no options of Advanced MCSD
  - MO Medicaid does not support LVAD unless heart transplant eligible
  - No family support

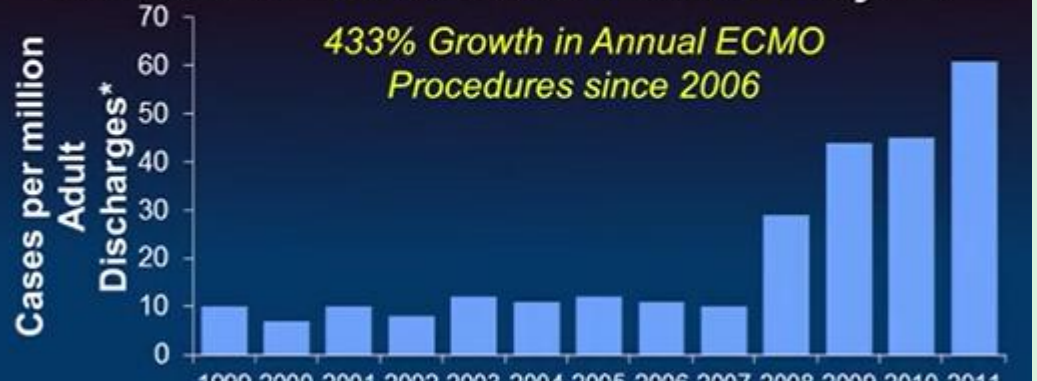
- *"GO" for ECMO or PVAD (Impella) if your patient condition is*

1) Recoverable

or

2) Possibly bridged to LVAD/HTx or Lung Tx?

Nationwide Inpatient Sample from Healthcare Cost and Utilization Project

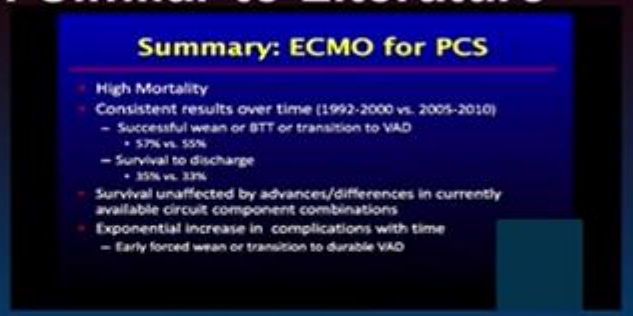


Sauer CM, Yuh DD, Bonde P. ASAIO DOI: 10.1097/MAT.0000000000000160

* Data from NIS from HealthCare cost and Utilization Project (HCUP)

FDA Opinion Similar to Literature

- The literature analysis, the 2 meta-analyses, and this FDA opinion come to similar conclusions



- "Survival unaffected by advances/differences in currently available circuit component combinations."
- "Exponential increase in complications with time; early forced wean or transition to durable VAD."

- Dr. John Laschinger, FDA 515 Panel, 2014

CKTCH

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European Journal of Cardio-thoracic Surgery 40 (2011) 676–681

EUROPEAN JOURNAL OF CARDIO-THORACIC SURGERY

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Guideline

Position article for the use of extracorporeal life support in adult patients

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3.1. Indications

ECLS is an advanced medical treatment option th requires medical expertise and puts substantial pressure hospital resources [5]. The decision to institute ECLS shou be based on a team approach where a physician/surgeon wi experience in the field of extracorporeal circulatory assist a team member.

In the field of ECLS, there should be minimum requir ments in education and experience to run an extracorpore circulation system. The ECLS systems should be applied as teamwork between physicians who have the medic responsibility (including the ability to cannulate the patien set up all necessary monitoring systems, and the ability t cope with all potential complications immediately) ar perfusionists who have the responsibility for the extracor- poreal circulation. The use of ECLS systems should be limited to these occupational groups.

ECLS systems need specific medical and technical knowledge in extracorporeal circulation (ECC). There are different previous experiences in 'cardiovascular engineering' for physicians and even for perfusionists. However, it is agreed upon that physicians operating an ECLS system have to have proven experience in (a) indications and contraindications, (b) cannulation of various arterial and venous vessels for immediate start of the ECLS, (c) handling vascular complications secondary to cannulation procedures, (d) techniques avoiding peripheral ischemia after cannulation, (e) various methods to decompress the right and left ventricle, and (f) all monitoring parameters to avoid severe complications such as cerebral hypoxia, myocardial damage, etc.

Perfusionists have to have experience in more than 100 ECC perfusions and more than 2 years of practical experience in perfusion during cardiac surgery procedures.

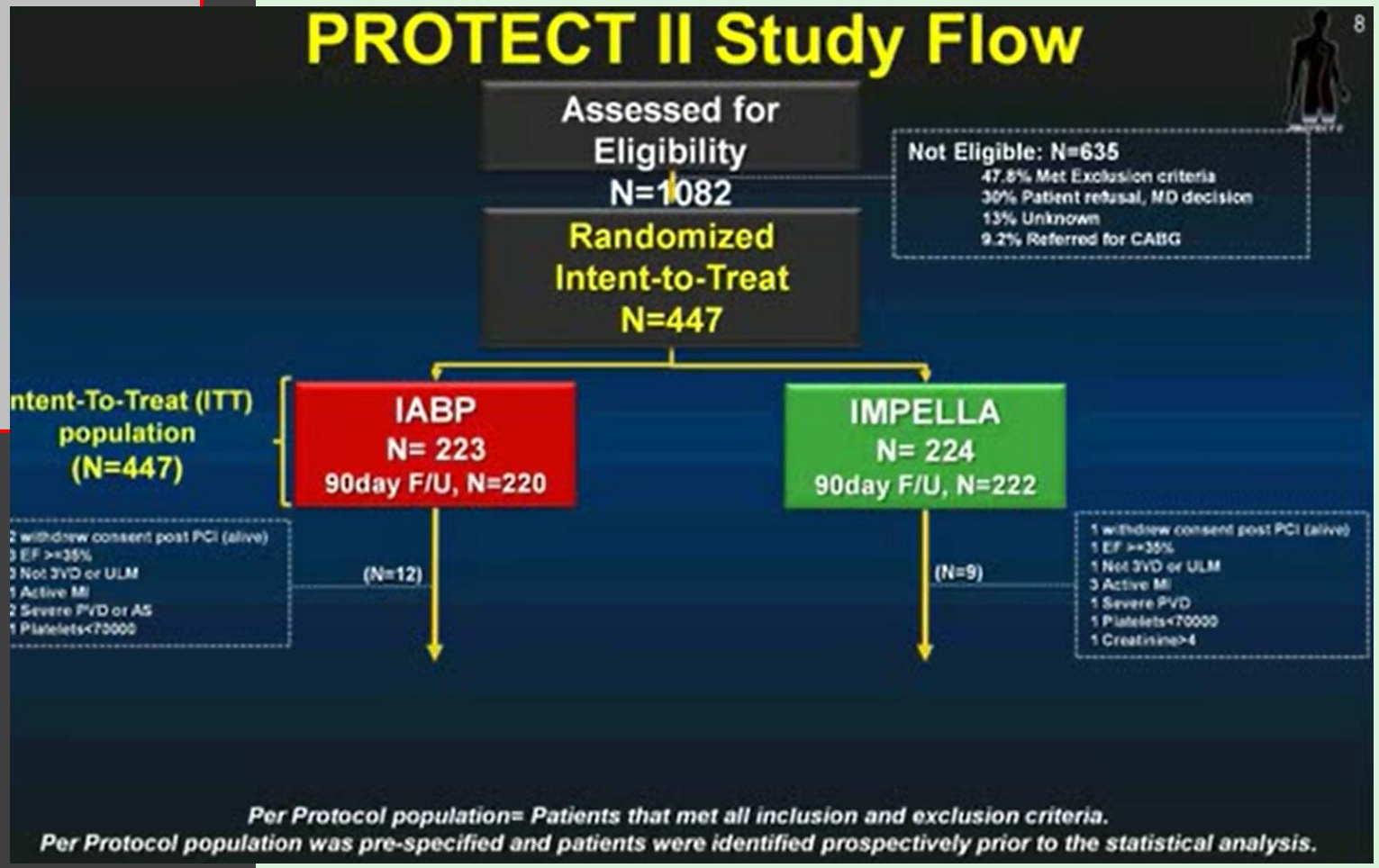
ELSO GUIDELINES FOR TRAINING AND CONTINUING EDUCATION OF ECMO SPECIALISTS

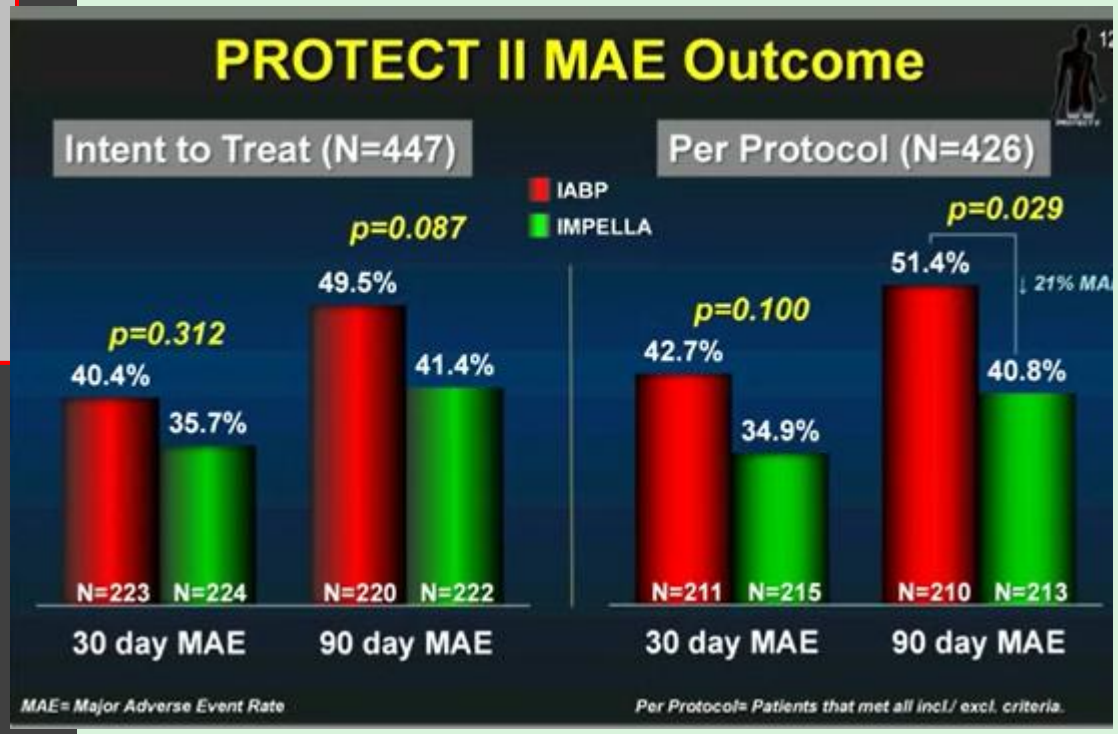
64-140 hodin

Adult					
Respiratory	10,601	6,997	66%	6,121	58%
Cardiac	9,025	5,082	56%	3,721	41%
ECPR	2,885	1,137	39%	848	29%
Total	78,397	54,866	70%	45,345	58%

Current Pharmacology & Devices

	Inotropic	IABP	Tandem-Heart	pVAD (Impella)	ECLS (C-mag)	LVAD (HM2/HVAD)
Advantages						
Flow (L/min.)	<0.5	0.5	3.5	2.5 - 5.0	4-6	4-8
Coronary Perfusion	↑	↑↑	↑↑	↑↑	↑↑	↑↑
LVEDP	↑	↓	↓↓	↓↓	↑↑↑↑	↓↓↓↓
Limitations						
Arrhythmia	+++	-	-	-	-	-
Stroke	-	++	+	+	++	+++
Limb ischemia	N.A	+	++	+	+++	N.A
Bleeding	N.A	++	+++	+ / ++	++++	++++
Cost	$$	$$$	$$$$	$$$$$	$$$$$	$$$$$$


PROTECT II Study Flow
8
Assessed for Eligibility N=1082
Not Eligible: N=635
47.8% Met Exclusion criteria
30% Patient refusal, MD decision
13% Unknown
9.2% Referred for CABG
Randomized Intent-to-Treat N=447
ntent-To-Treat (ITT) population (N=447)
IABP N= 223 90day F/U, N=220
IMPELLA N= 224 90day F/U, N=222
2 withdrew consent post PCI (alive)
3 EF >=35%
3 Not 3VD or ULM
1 Active MI
2 Severe PVD or AS
1 Platelets<70000
(N=12)
(N=9)
1 withdrew consent post PCI (alive)
1 EF >=35%
1 Not 3VD or ULM
3 Active MI
1 Severe PVD
1 Platelets<70000
1 Creatinine>4
Per Protocol population= Patients that met all inclusion and exclusion criteria.
Per Protocol population was pre-specified and patients were identified prospectively prior to the statistical analysis.


PROTECT II MAE Outcome
Intent to Treat (N=447)
Per Protocol (N=426)
IABP
IMPELLA
p=0.312
40.4%
35.7%
N=223
N=224
30 day MAE
p=0.087
49.5%
41.4%
N=220
N=222
90 day MAE
p=0.100
42.7%
34.9%
N=211
N=215
30 day MAE
p=0.029
51.4%
40.8%
↓ 21% MA
N=210
N=213
90 day MAE
MAE= Major Adverse Event Rate
Per Protocol= Patients that met all incl./ excl. criteria.

Conclusion

- The use of Impella for hemodynamic support during high risk PCI is safe.
- The superior hemodynamic support of Impella appears to have led to significant procedural differences between the two arms.
- Impella arm had strong trends towards superior clinical outcomes for the entire intent-to-treat population with a significant reduction of the MAE rate in the pre-specified per protocol population at 90 day follow-up.
- The clinical benefit was more pronounced for patients undergoing high risk PCI without atherectomy with the Impella support.
- There was a strong trend for lower MACCE rate for the entire intent-to-treat population with a significant reduction of the MACCE rate in the pre-specified per protocol population at 90 day follow-up when a more clinically relevant threshold of CK-MB release for peri-procedural MI** is considered.

**Using xULN for biomarkers or Q-wave for Peri-procedural MI (Stone et al Circulation 2001;104:642-647) and 2xULN for Spontaneous MI (Universal MI definition)

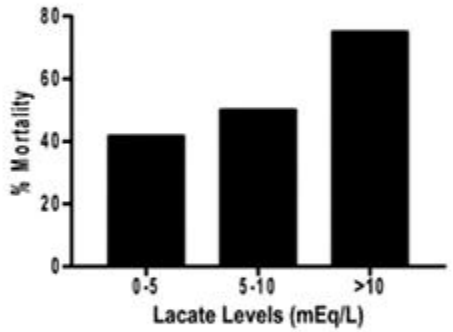
30 day MAE 90 day MAE

Per Protocol= Patients that met all incl./ excl. criteria.

Mortality vs Number of Vasopressors/inotropes Pre-Device Implant Among the Total Cohort

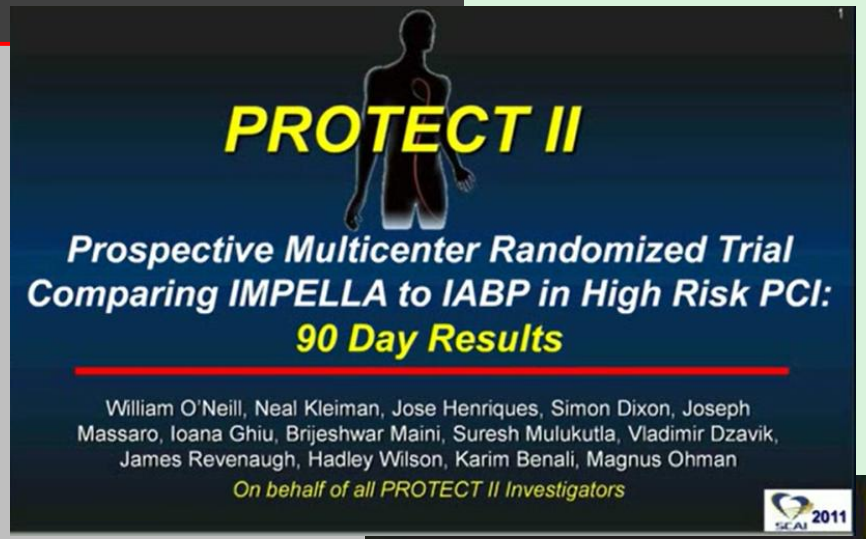
One-way ANOVA p=0.02

One-way ANOVA p=0.08



Early and Effective Device Support is Critical for Survival

Esposito and Kapur et al. TCT 2016



PROTECT II

Prospective Multicenter Randomized Trial Comparing IMPELLA to IABP in High Risk PCI: 90 Day Results

William O'Neill, Neal Kleiman, Jose Henriques, Simon Dixon, Joseph Massaro, Ioana Ghiu, Brijeshwar Maini, Suresh Mulukutla, Vladimir Dzavik, James Revenaugh, Hadley Wilson, Karim Benali, Magnus Ohman

On behalf of all PROTECT II Investigators

2011

Background

- Patients with depressed LV function and complex anatomy have limited treatment
- Prophylactic IAB
  PCI patients ann
- Impella provides
- PROTECT II is th
  for patients requ
  comparing outcc

[1] Health Research International 2009 repo

Procedural Differences

Procedural Characteristics	IABP (N=223)	Impella (N=224)	p-value
Use of Heparin	82.4%	93.5%	<0.001
IIb/IIIa Inhibitors	26.1%	13.5%	0.001
Total Contrast Media (cc)	241±114	267±142	0.037
Rotational Atherectomy (RA)	9.5%	14.9%	0.088
Median # of RA Passes/lesion (IQ range)	1 (1-2)	3 (2-5)	0.001
Median # of RA passes/pt (IQ range)	2.0 (2.0-4.0)	5.0 (3.5-8.5)	0.004
Median RA time/lesion (IQ range sec)	40 (20-47)	60 (40-97)	0.005
RA of Left Main Artery	3.1%	8.0%	0.024
% of SVG Treatment or RA use	17.5%	25.4%	0.041
Total Support Time (hour)	8.2±21.1	1.9±2.7	<0.001
Discharge from CathLab on device	37.7%	5.7%	<0.001

CKTCH