



**Sudden death rescued with the
help of a pump.
Extracorporeal CPR for
OHCA**

ACCA Masterclass 2017

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Complex cardiovascular center
General University Hospital, 1st Medical Faculty
Charles University in Prague

**WE
ARE THE
ESC**



Acute
Cardiovascular
Care Association
ACCA
A Registered Branch of the ESC



**EUROPEAN
SOCIETY OF
CARDIOLOGY®**

Relevant Financial Relationship(s)

**„Prague OHCA study“ supported by:
Ministry of Health grant IGA NT13225-4/2012**

MAQUET – provided PLS system for ECLS and custom-made circuits

Covidien – provided INVOS device

Benechill – provided Rhinochill devices and cooling liquid for a reduced price

Received honoraria from Maquet, Covidien and Physio-Control

Off Label Usage : None

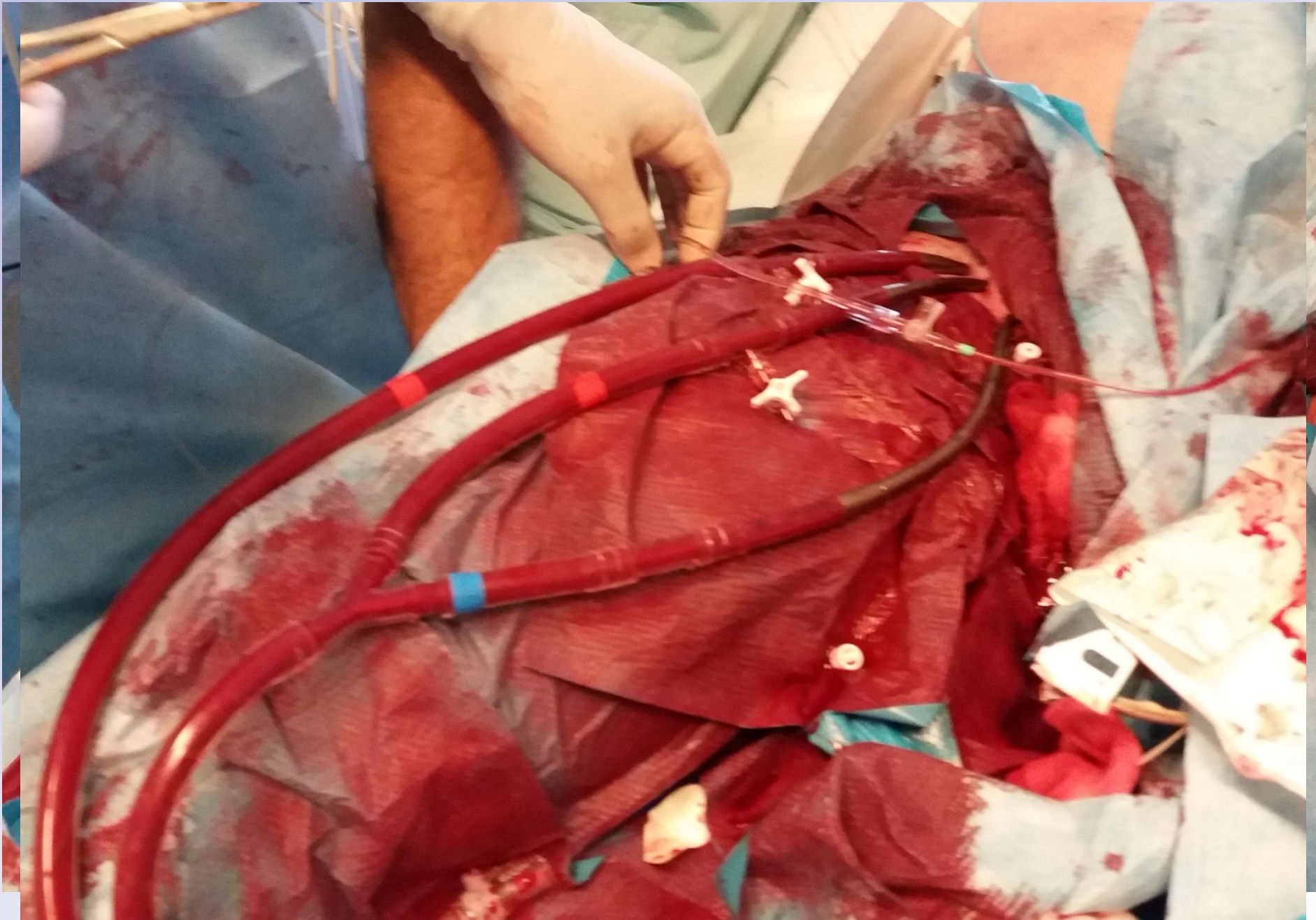
WE
ARE THE
ESC

ECPR is a struggle...

www.escardio.org/ACCA

Everybody, Everywhere, all the time





Cardiac arrest in OHCA

50-70/100.000 annually

- CPR registries
- INTCAR registry
- TTM trial

successful ROSC patients !!!
30-40%

Where are the 60-70% remaining?

Dying...

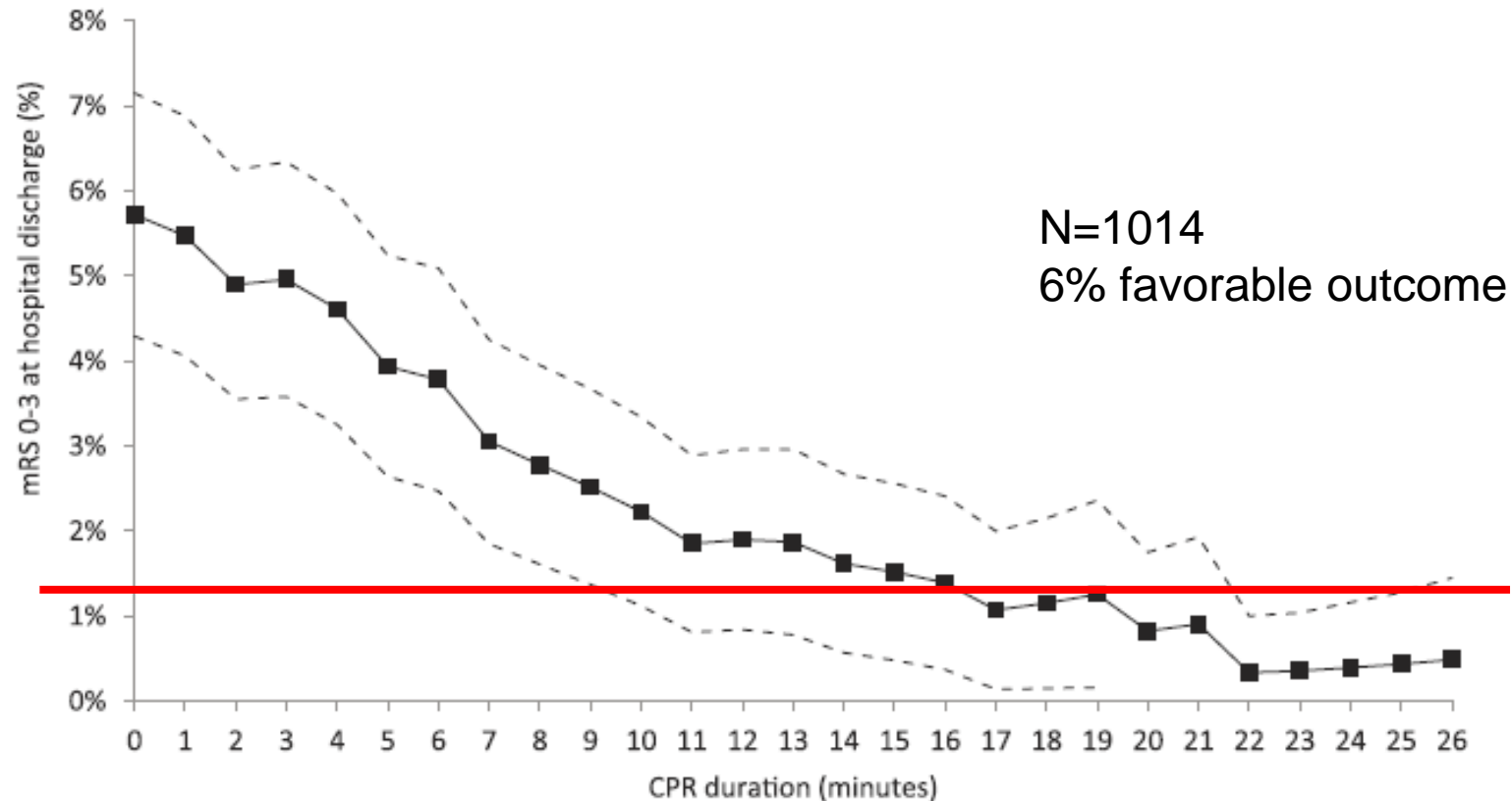
Refractory cardiac arrest 10...16...30 minutes ???

Favorable outcome of \approx 2-4%

Duration of Resuscitation Efforts and Functional Outcome After Out-of-Hospital Cardiac Arrest

When Should We Change to Novel Therapies?

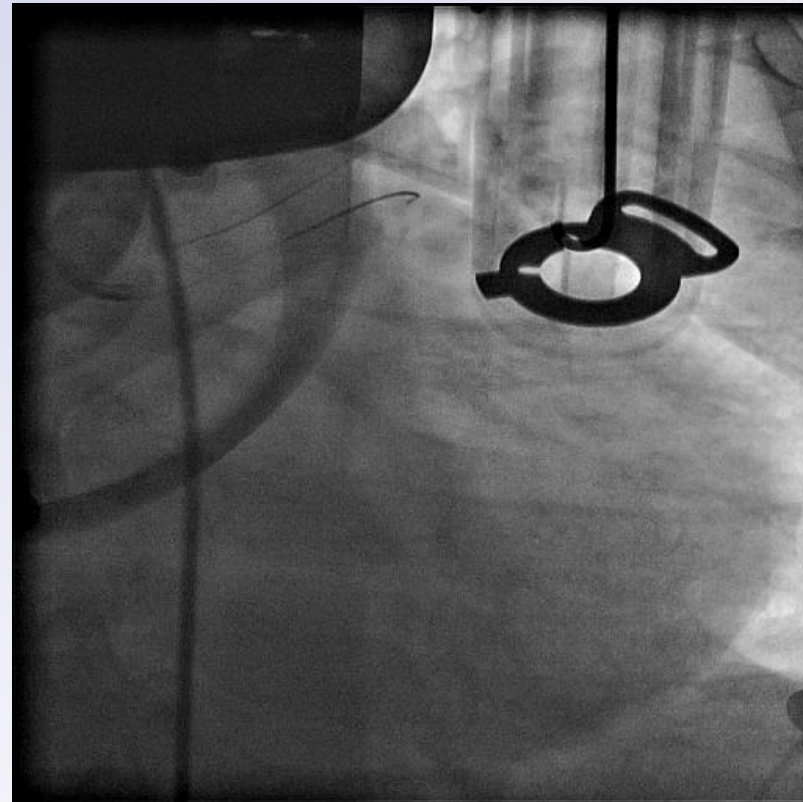
Joshua C. Reynolds, MD, MS; Adam Frisch, MD, MS; Jon C. Rittenberger, MD, MS;
Clifton W. Callaway, MD, PhD



(*Circulation*. 2013;128:2488-2494.)

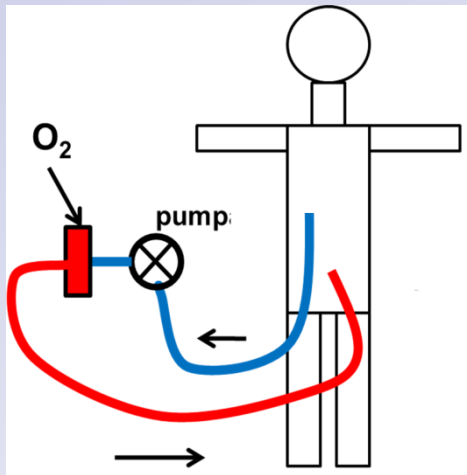
Acute myocardial ischemia

typical cause of treatable refractory cardiac arrest



Extracorporeal CPR

- continuation in CPR using mechanical circulatory support
- always VA-ECMO



Source: GUH Prague

ECPR studies in OHCA

Author	Year of publication	N	Time to ECMO (min)	Survival
Nagao	2000	36	67	25 %
Haney	2012	26	70	15 %
Kagawa	2012	42	59	24 %
Nagao	2010	171	66	12 %
Le Guen	2011	51	120	4%
Avalli	2012	18	77	6 %
Fagnoul	2013	53	66	21 %
Maekawa	2013	53	49	32 %
Leick	2013	28	44	39 %
SAVE-J Sakamoto	2014	260	-	12 %
CHEER	2014	11	Impl. 20	27%
Choi	2016	320	54	9%

An „Optimal“ patient for ECPR

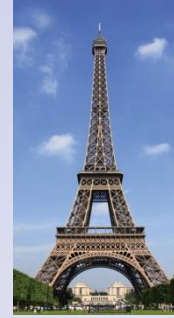
- refractory cardiac arrest (>16 min)
- no comorbidities
- witnessed cardiac arrest
 - EMS
 - public place
- assumption of correctable cause (ACS)
- shockable rhythm (VF/VT)
- intermittent ROSC

Prerequisites for ECPR

- resuscitation team
- 24/7 (15 min) available ECMO team
(intensivist/cardiologist/perfusionist/surgeon?)
- close cooperation with EMS in cases of OHCA
- early alert system for ECMO/cathlab teams
- be able to admitt and cath under ongoing CPR
(mechanical CPR)
- monitor brain tissue saturations (NIRS)
- immediatelly available ABG/ECHO/vascular US
- primed ECMO device on cathlab/ER 24/7

„Stay and play strategy“

ECMO



Refractory OHCA

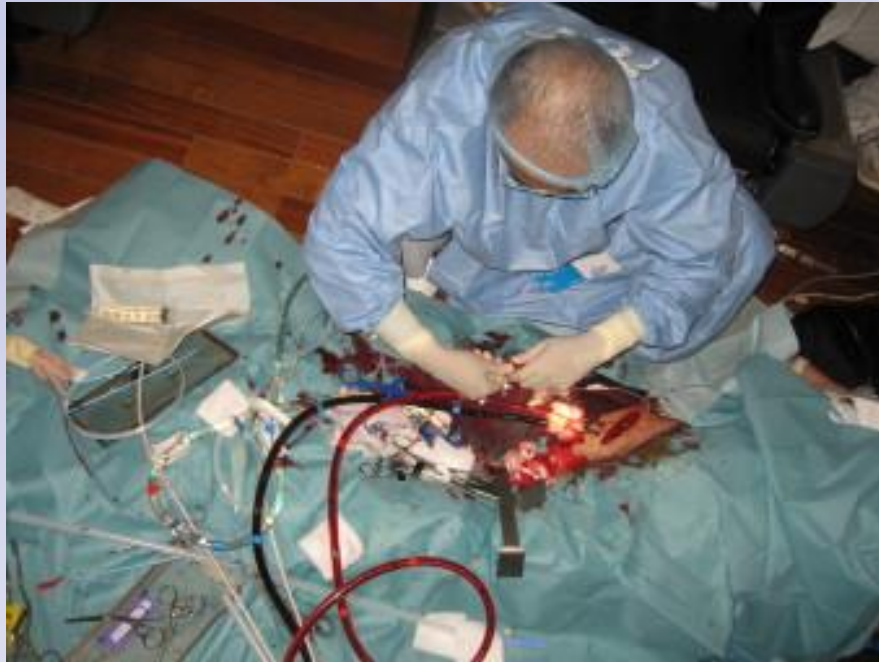
„Load and go strategy“



ECMO center

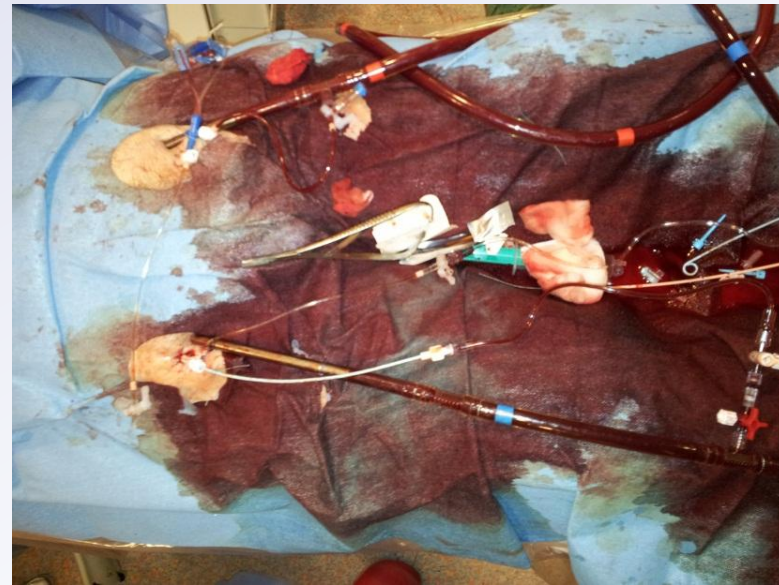
Not for everybody...

ECMO to OHCA



*Lamhaut L et al.,
Resuscitation 2013*

OHCA to ECMO



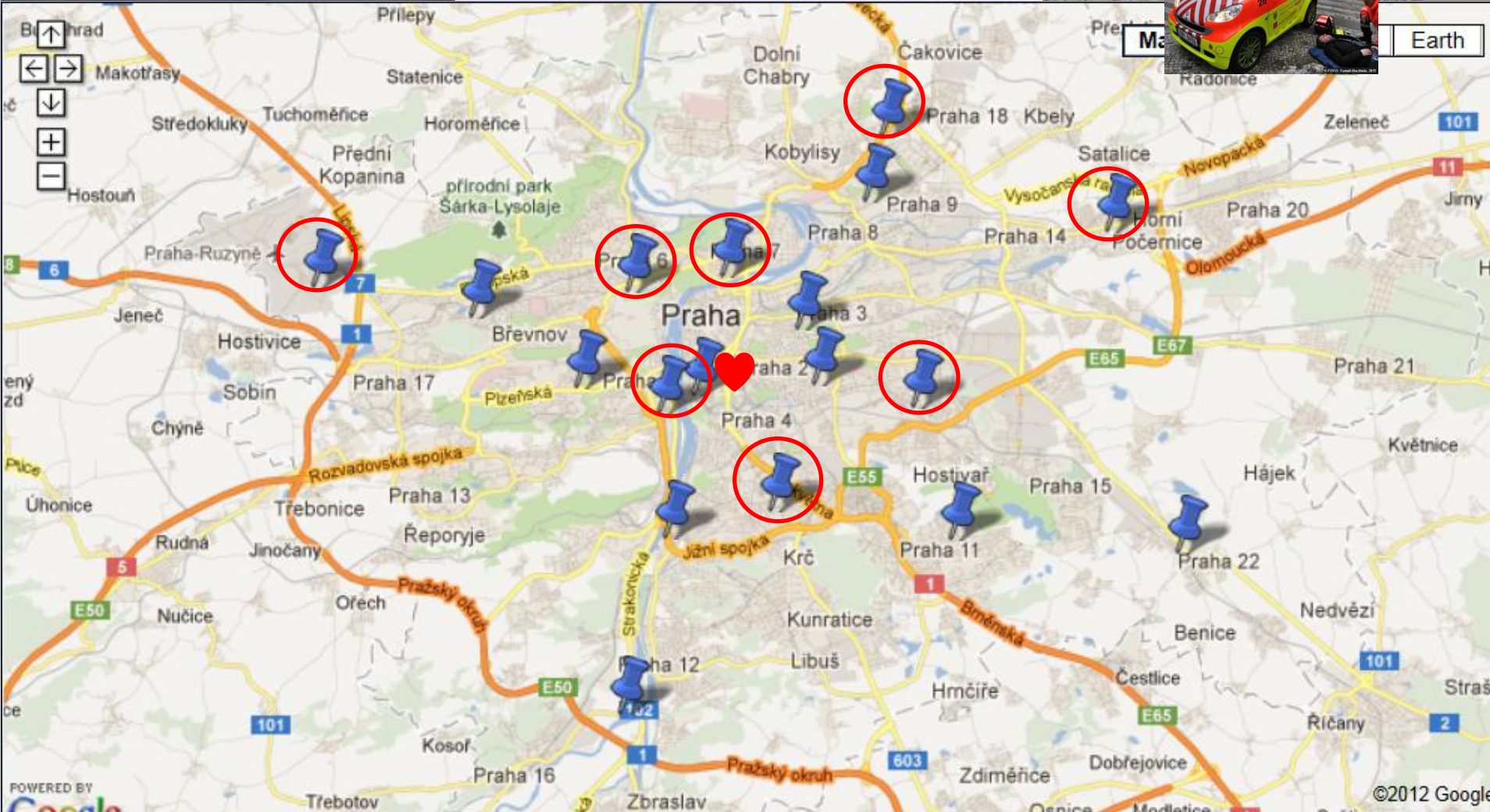
„Load and go“/OHCA to ECMO strategy

- in hospital selection (team)
- freely available specialists - cathlab/ER
- all cathlab equipment (wires) available, no space/personal restrictions
- immediate angiography
- early ECHO diagnostics available
- ECMO may be postponed if mechanical CPR adequate
- may immediately proceed with PCI



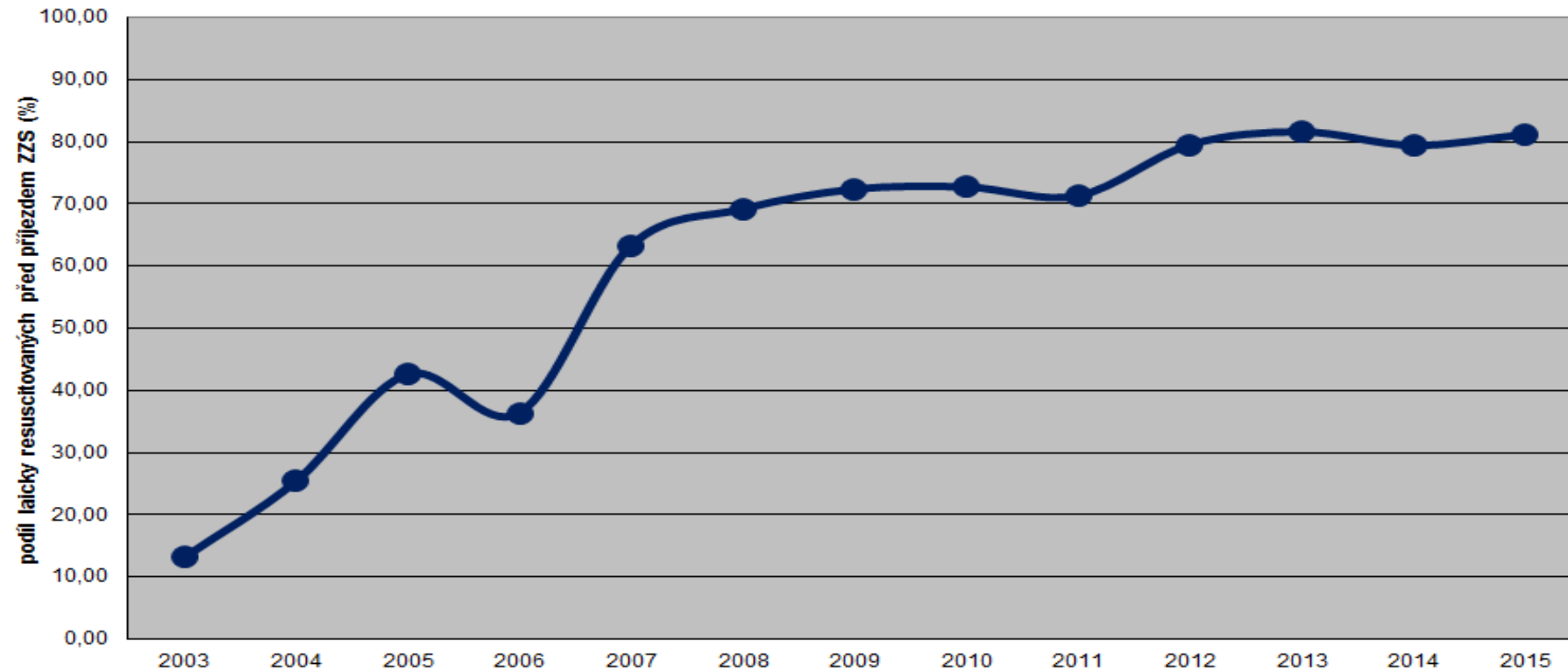
Prague EMS

1.25 milion people
one dispatch center
„rendez-vous“ system
„Smart car“

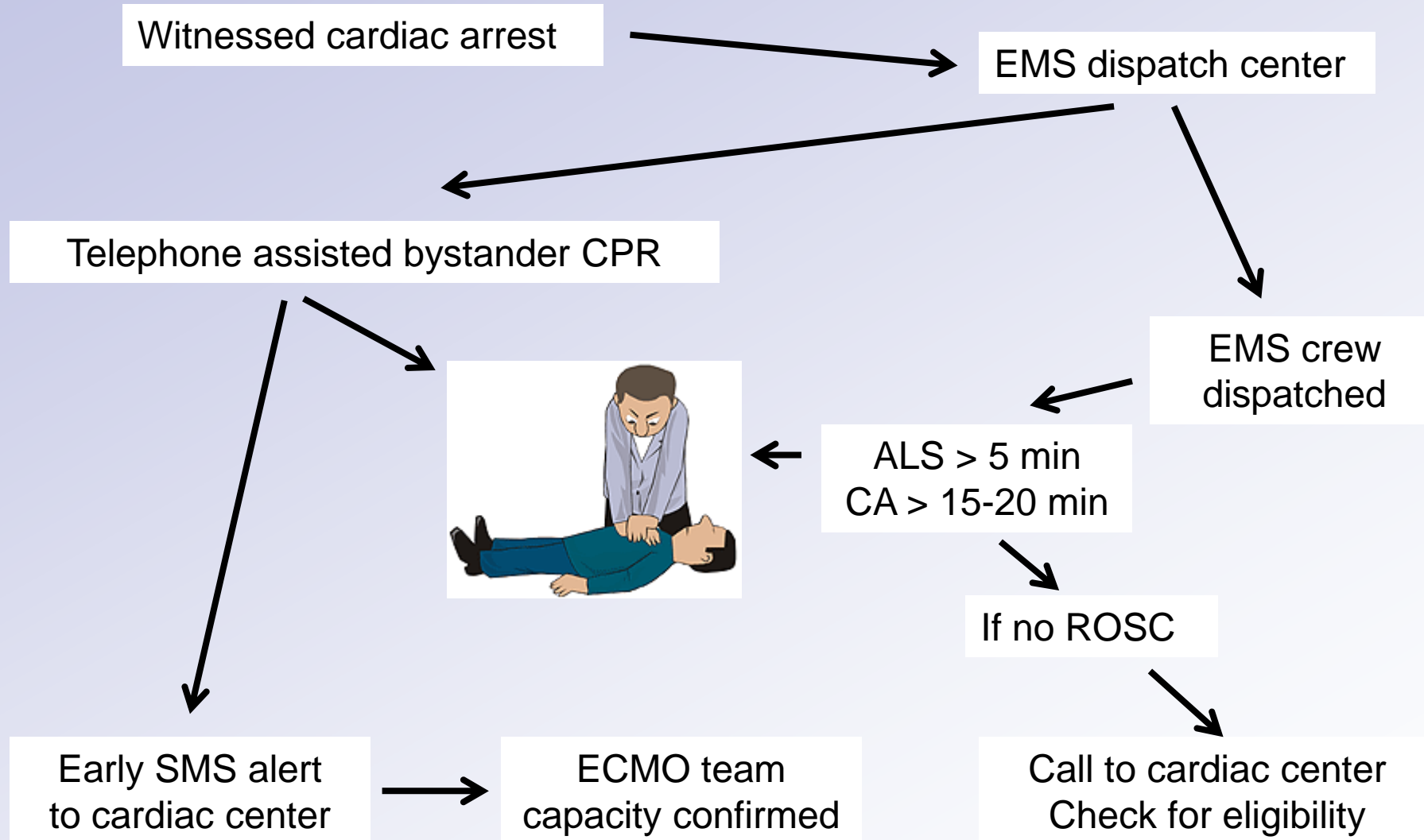


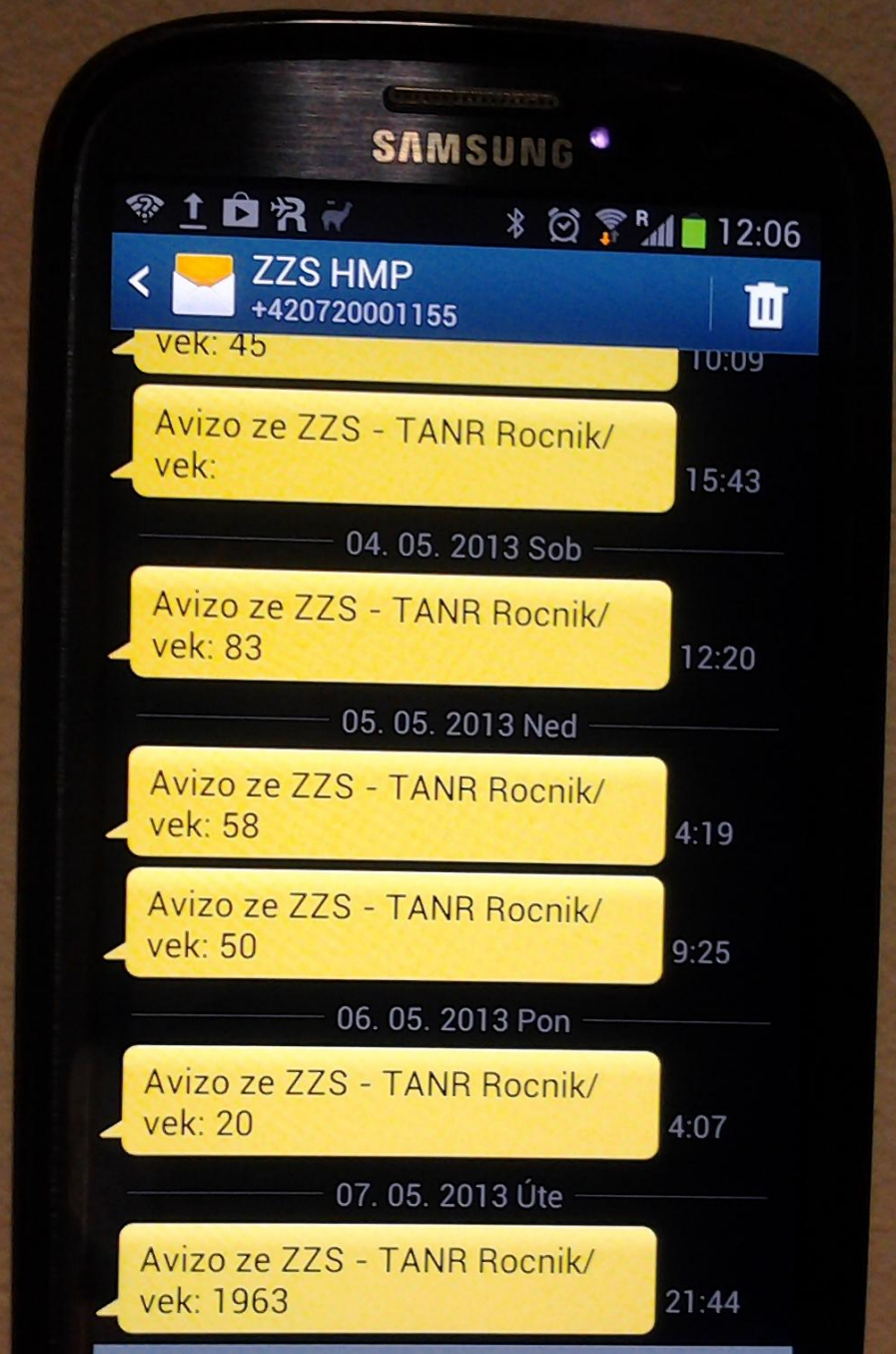
Bystander CPR in OHCA in Prague 2003-2015

Courtesy of dr. Franěk – Prague EMS



Initial prehospital care





Early SMS alert to cardiac center

Telephone assisted
CPR
Age
Time

„Prague hyperinvasive“ approach to refractory OHCA

- early alert to cardiac center
- mechanical chest compressions
- intra-arrest cooling
- extracorporeal life support
- neuromonitoring
- immediate invasive assesment and treatment

SMS

LUCAS

RhinoChill

ECMO

NIRS-INVOS

CAG/PCI
PuAG



PROTOCOL

Open Access

Hyperinvasive approach to out-of hospital cardiac arrest using mechanical chest compression device, prehospital intraarrest cooling, extracorporeal life support and early invasive assessment compared to standard of care. A randomized parallel groups comparative study proposal. "Prague OHCA study"

Jan Belohlavek^{1*}, Karel Kucera², Jiri Jarkovsky³, Ondrej Franek², Milana Pokorna², Jiri Danda², Roman Skripsky², Vit Kandrna³, Martin Balik⁴, Jan Kunstyr⁴, Jan Horak¹, Ondrej Smid¹, Jaroslav Valasek², Vratislav Mrazek¹, Zdenek Schwarz² and Ales Linhart¹

Supported by grant of Ministry of Health IGA NT13225-4/2012

ClinicalTrials.gov identifier: NCT01511666.

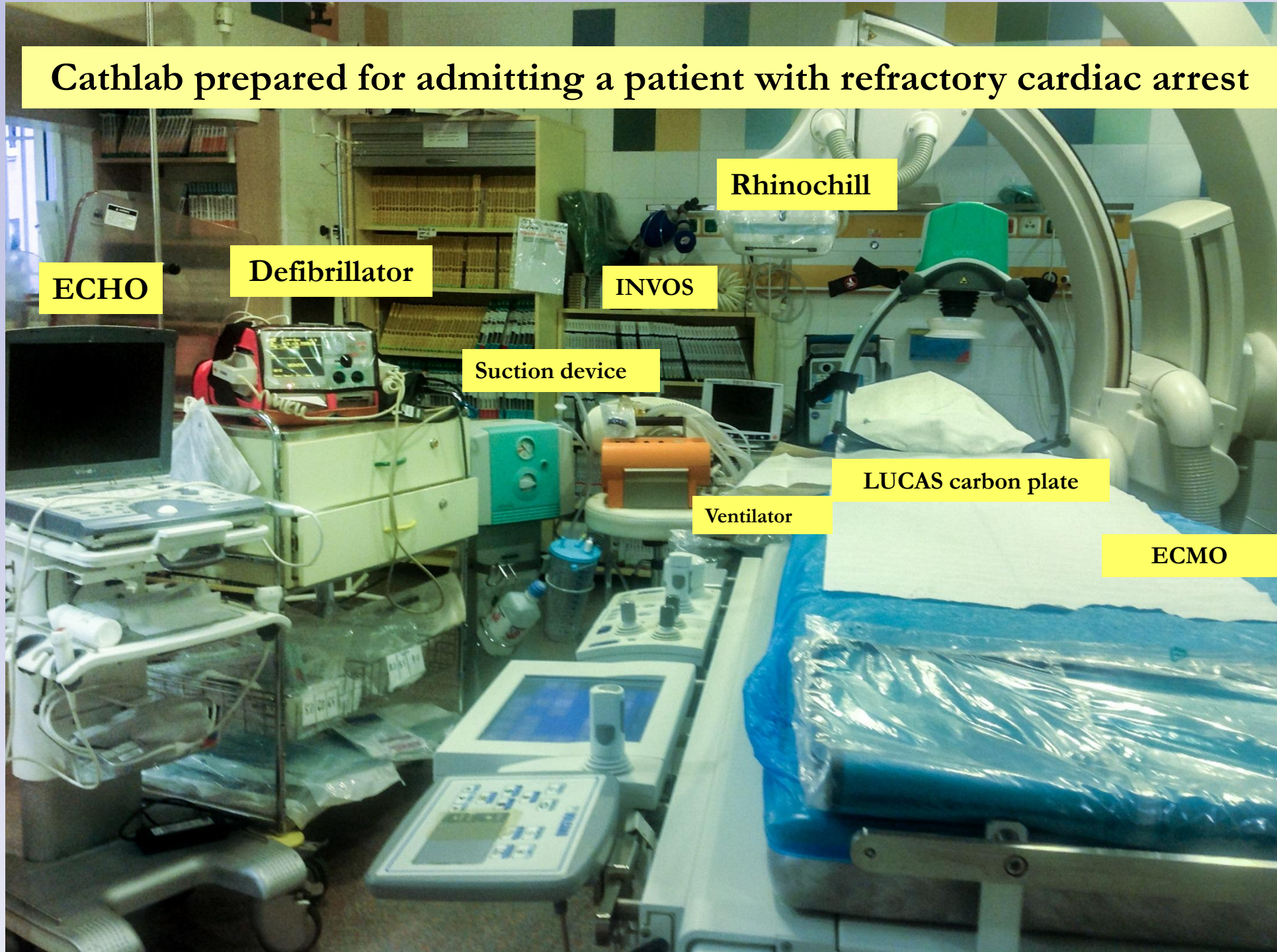
Guidelines ERC 2015

Extracorporeal CPR (ECPR) should be considered as a rescue therapy....

There is an urgent need for randomised studies of eCPR...

**Hyperinvasive approach uses ECPR
as a one of several stepwise interventions
within changed
prehospital and early hospital logistics**

Cathlab prepared for admitting a patient with refractory cardiac arrest



Rhinochill

ECHO

Defibrillator

INVOS

Suction device

LUCAS carbon plate

Ventilator

ECMO

Specialized team

Cathlab nurse

ICU nurse

Intensivist

ICU nurse

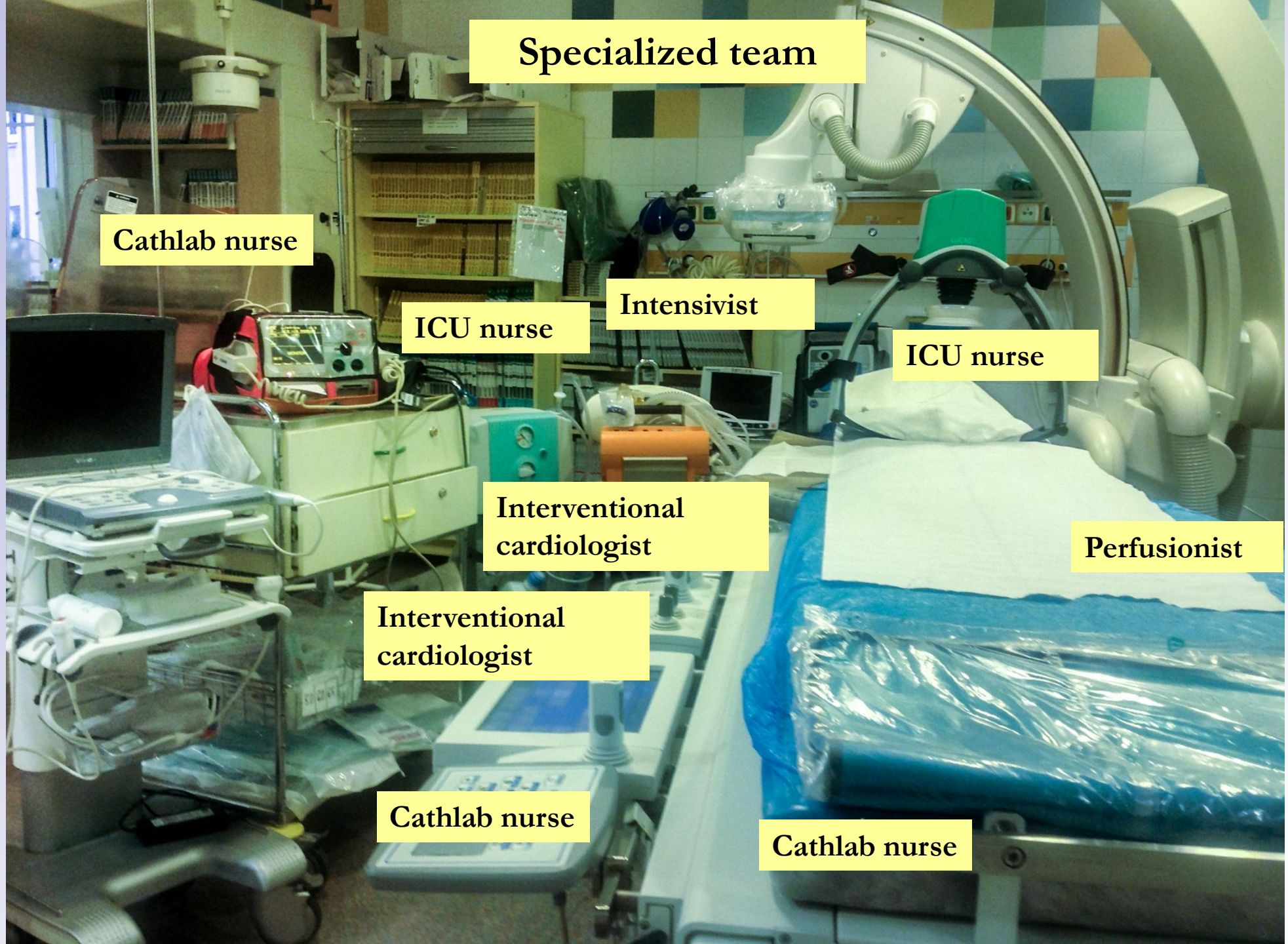
**Interventional
cardiologist**

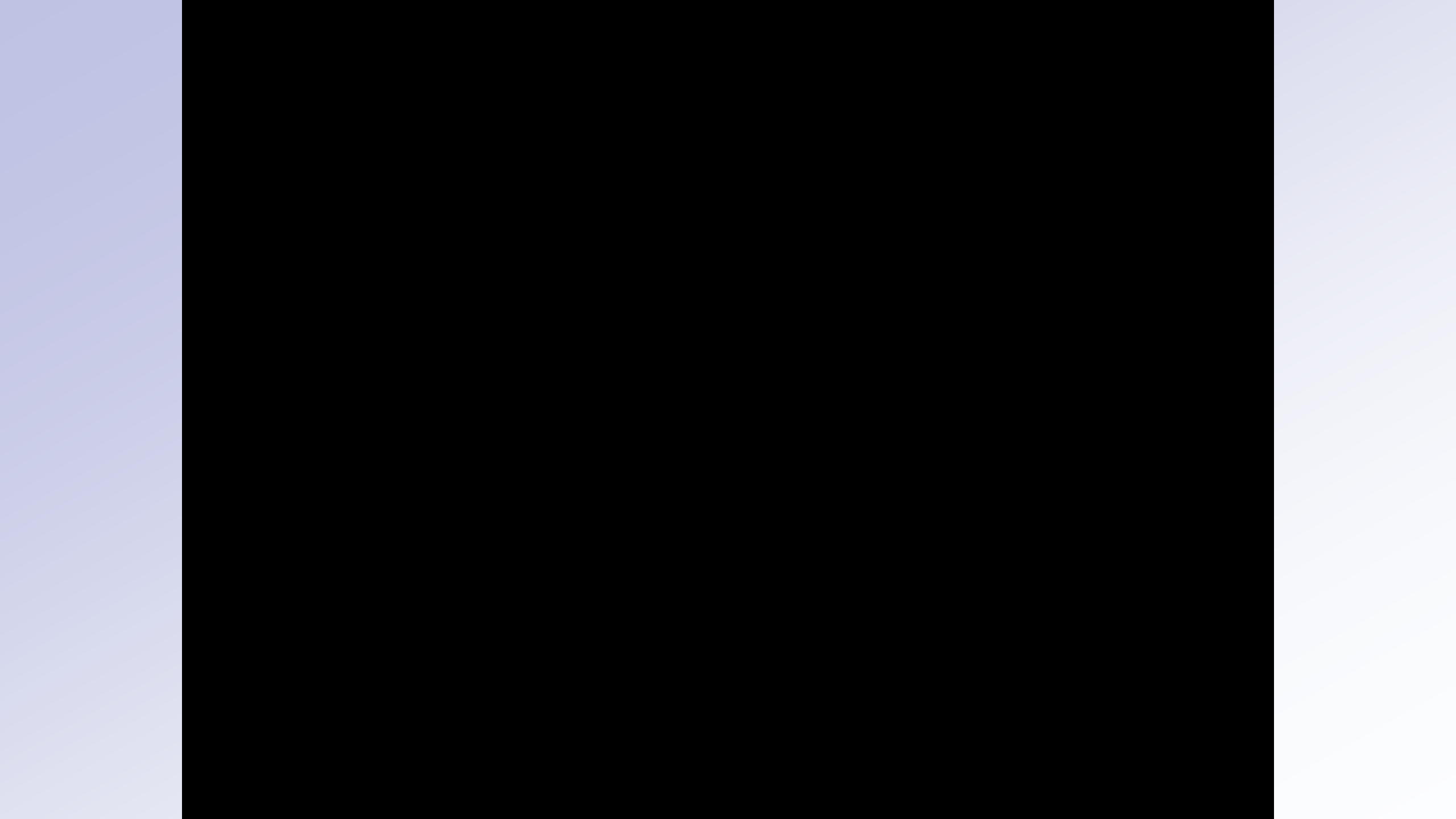
Perfusionist

**Interventional
cardiologist**

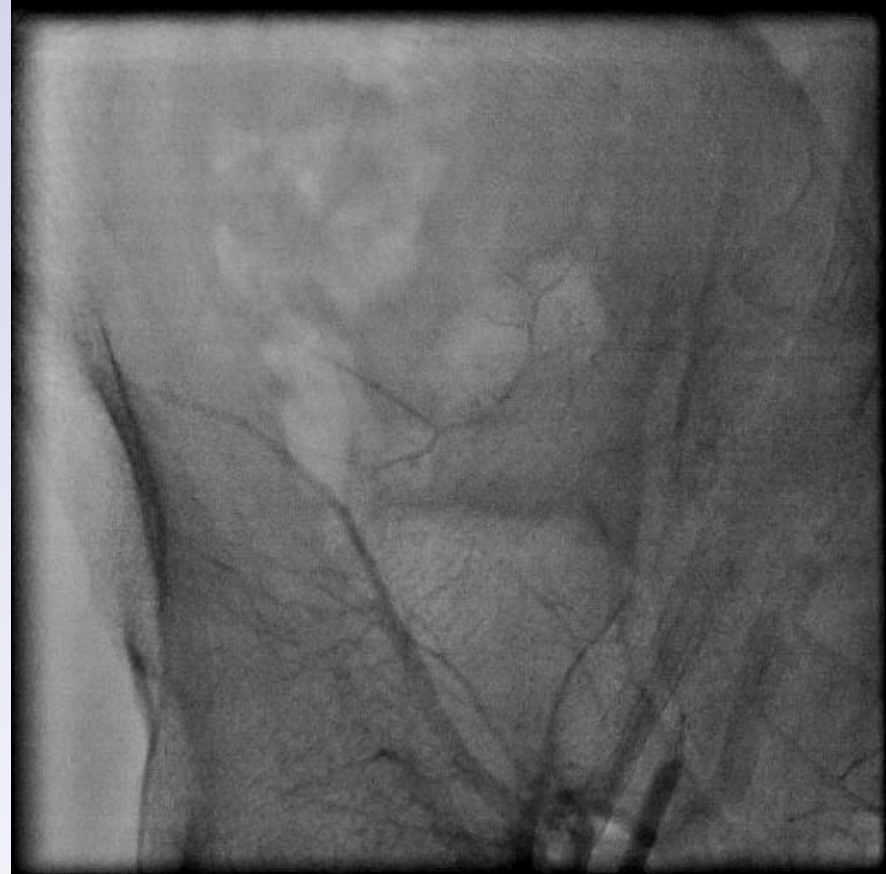
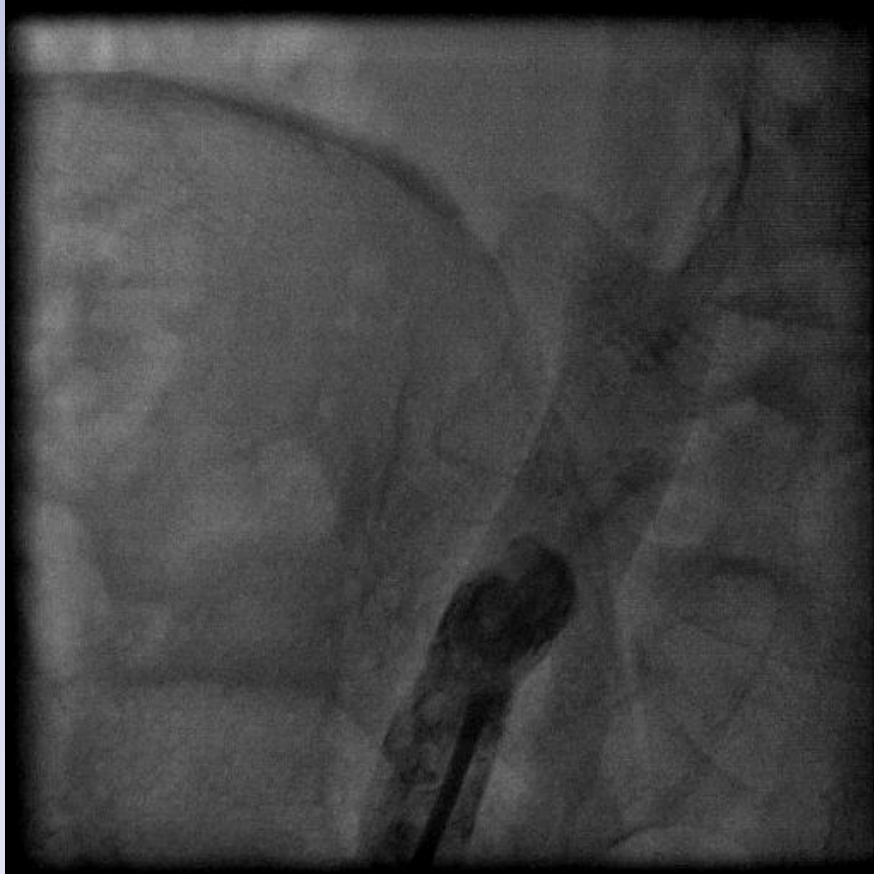
Cathlab nurse

Cathlab nurse





46 45 min
vessel view under X-ray





Cannulation

blind

ultrasound guided

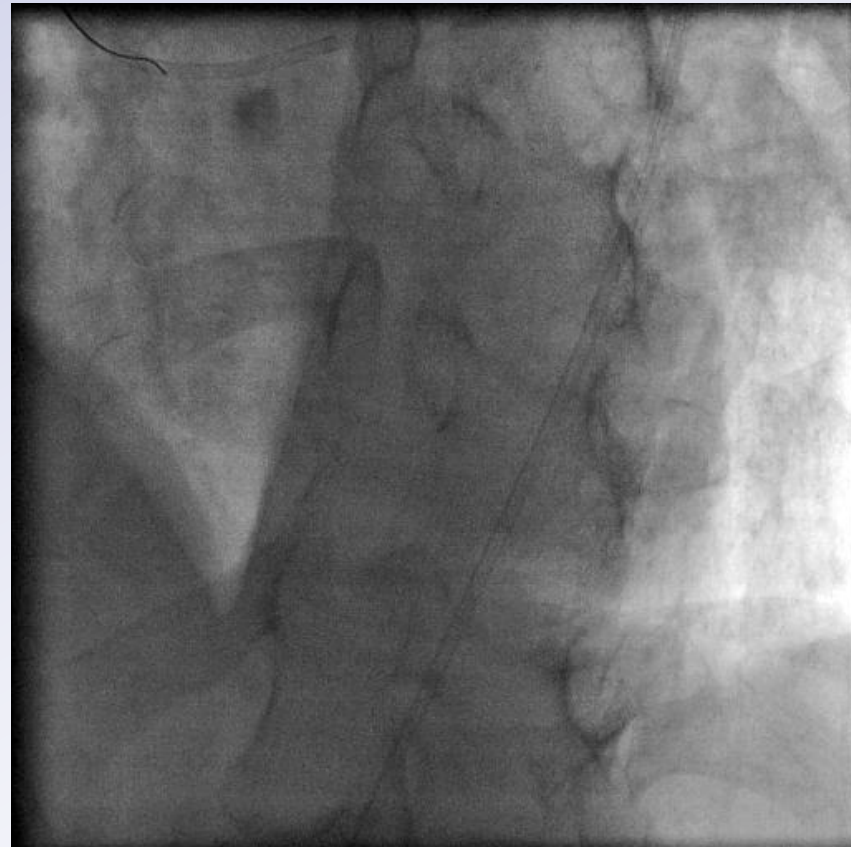
X-ray guided insertion

stiff wire

no dilatation

46 45 min

Acute occlusion?



Is it ethical to put a patient on a device to extend CPR?

- uncertain risk-benefit profile
- inability to obtain informed consent
- high cost
- **G**rave prognosis
- Potential Harms
 - failed recovery....“bridge to nowhere“
 - prolonged ICU stay
 - judge: averting death with ECPR may foreclose the chance for „good death“

ECPR - conclusion

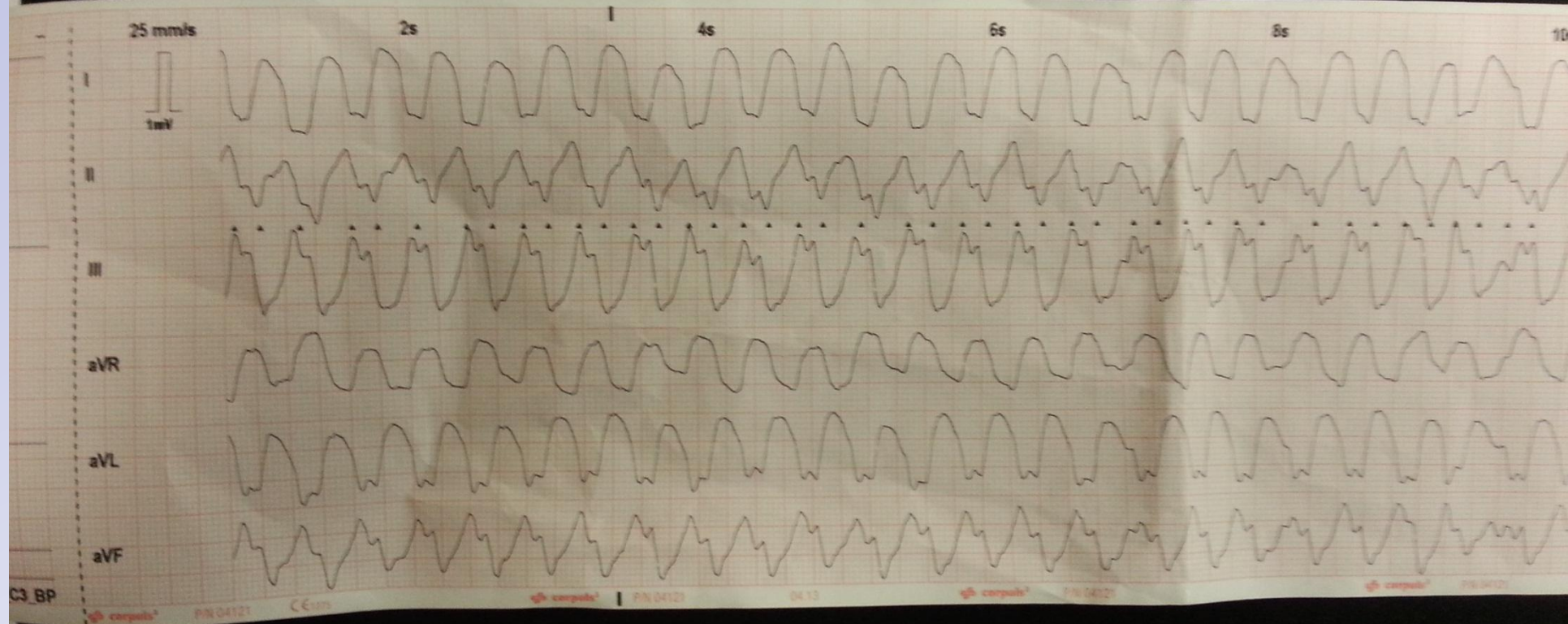
- rescue method for refractory cardiac arrest
 - refractory VF/VT
 - witnessed cardiac arrest
 - intermittent ROSC
 - recommended in ERC 2015 guidelines
- crucial to continue in randomized studies
- ECPR programme may yield additional survivors of cardiac arrest
- cost demanding
- organ donorship as a byproduct

Clinical consequences

- Not ECLS alone,
but „comprehensive approach“ including ECLS may
have an impact on logistics for OHCA patients
- patients who need ECLS for refractory OHCA
have often severe unresolvable cause
- we have technology, now we have to find right
patients and optimize logistics.
- future?
 - EPR – emergency preservation and resuscitation
» *Drabek et al., 2014*

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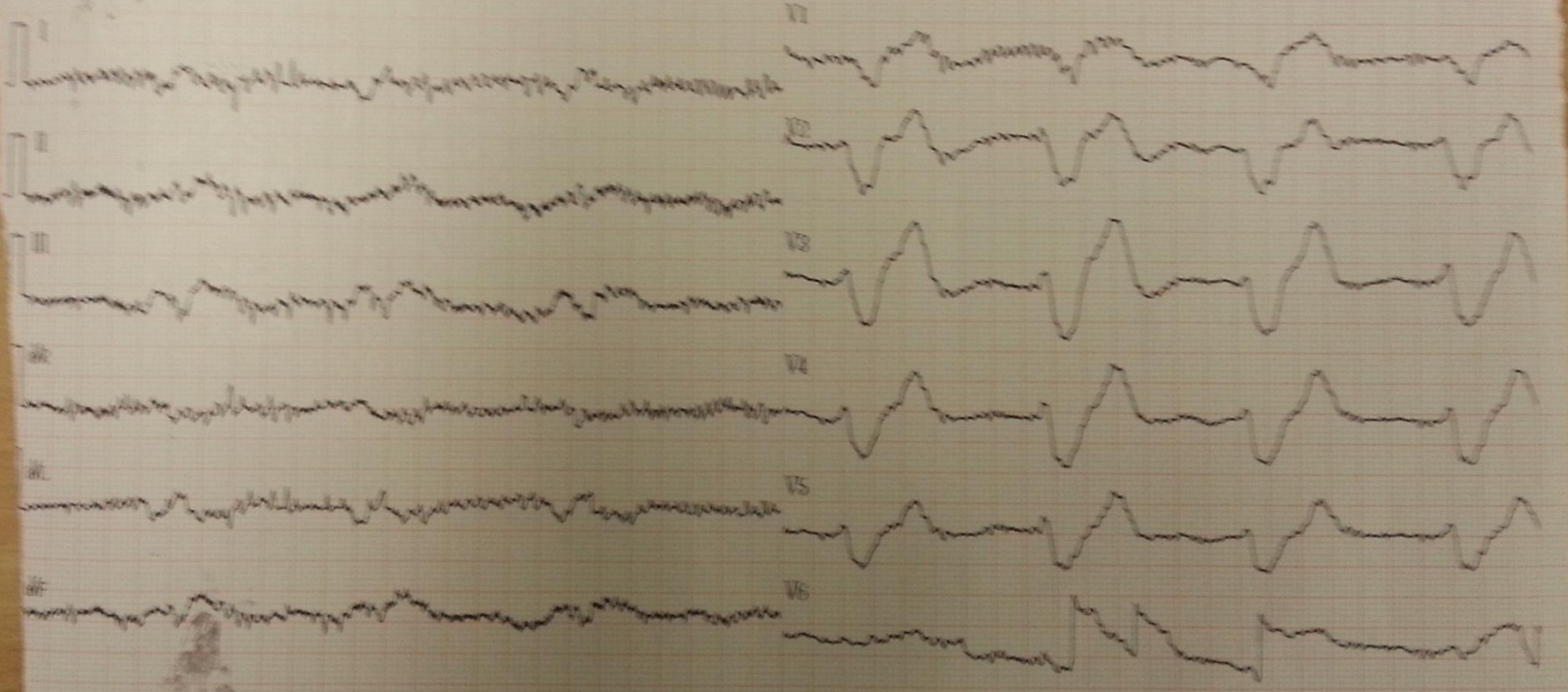
73 minutes of mechanical CPR for refractory arrhythmias before ECMO



26

Comment: Wojtková Martina
7460075183 / 111
VFN Praha 2
NS: 20240 Zi-KJ
DG: 121.9

[MIDESITA ONE]			
HR: 104ppm	AXIS: 11deg	S-T: 7	S-T: 8
P-R: 215ms	QRS: 0.09mV	S-T: 2	S-T: 0
P-R: 110ms	SV1: 0.09mV	S-T: 8-A	S-T: 2-A
QRS: 68ms	Q-T: 243ms	S-T: 1-L	S-T: 0-L
QTc: 412		S-T: 0	S-T: 1
		S-T: 2	S-T: 1
		S-T: 2	S-T: 5



0mm/nV 25mm/s Filter: BC DF 10mm/nV A PRC V:PVC FX-7402-VD2-02-30

SH0615MPA

26



Provided informed consent

48 75 min



Provided informed consent

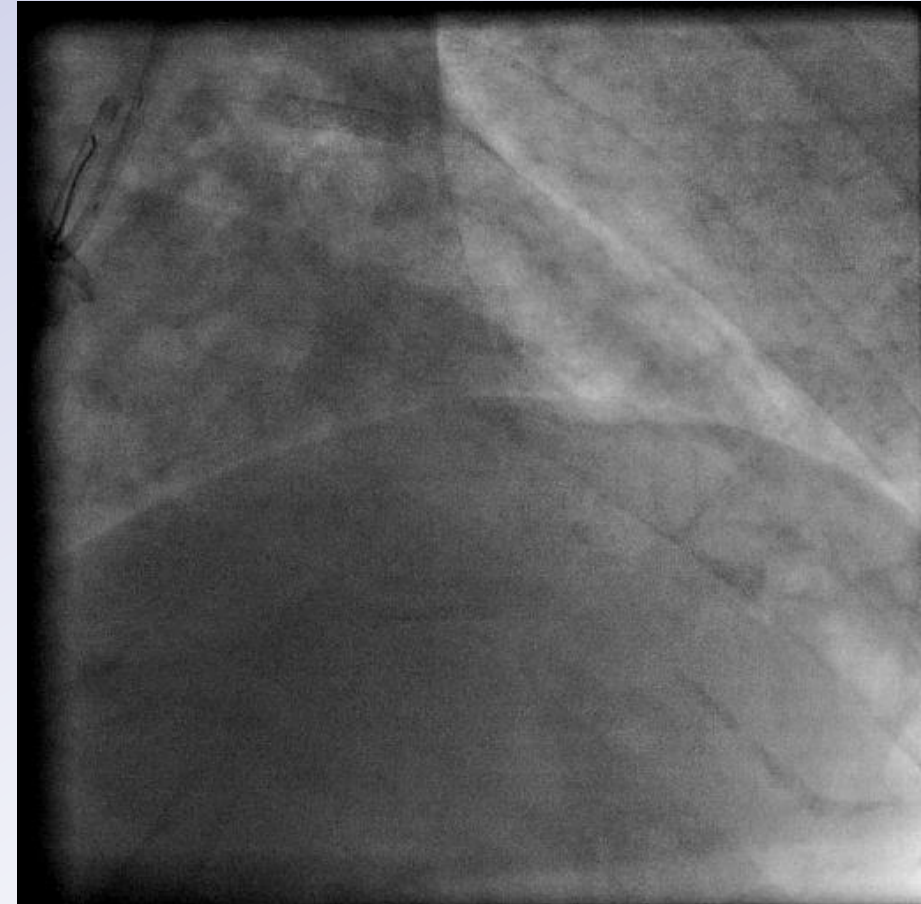
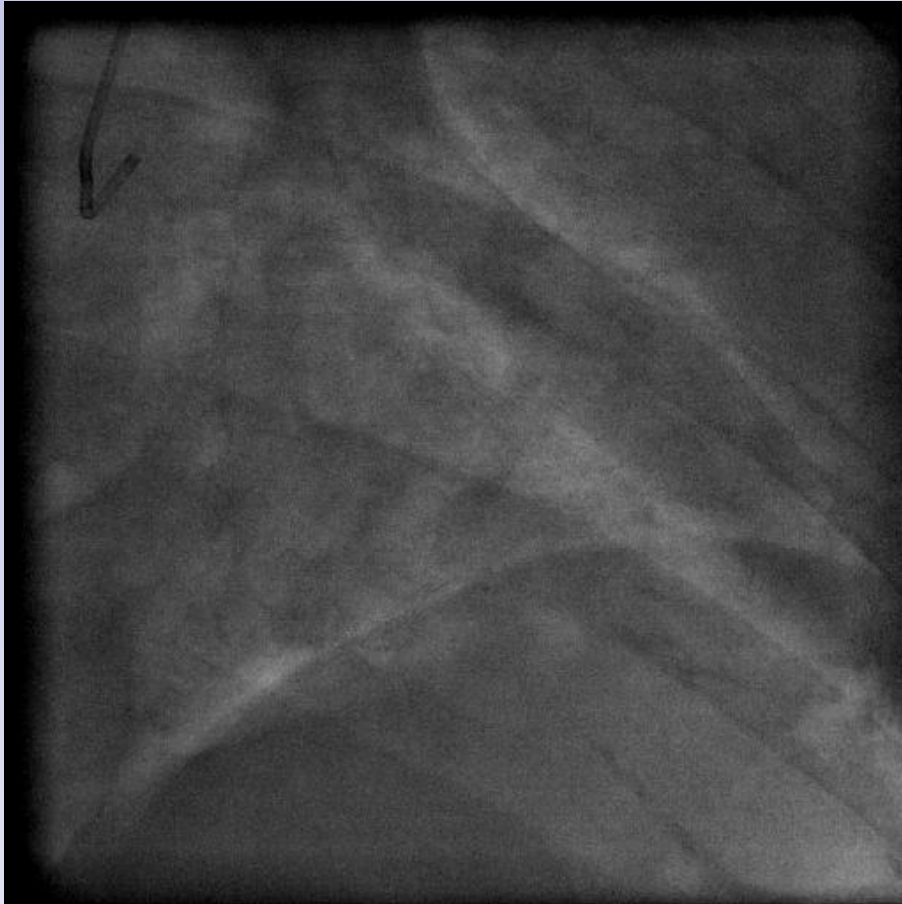
46 45 min



52 51 min



52 51 min



52 51 min



Provided informed consent

52 51 min



Provided informed consent

Zero chance not to have complications





55 78 min

Refractory MODS