

Cardiac care after out-of-hospital cardiac arrest

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Background

- ✓ Improvements in out of hospital emergency care have increased the number of patients admitted to hospitals after CPR
- ✓ Nowadays about 30-50 % of patients will have return of spontaneous circulation (ROSC) after CPR

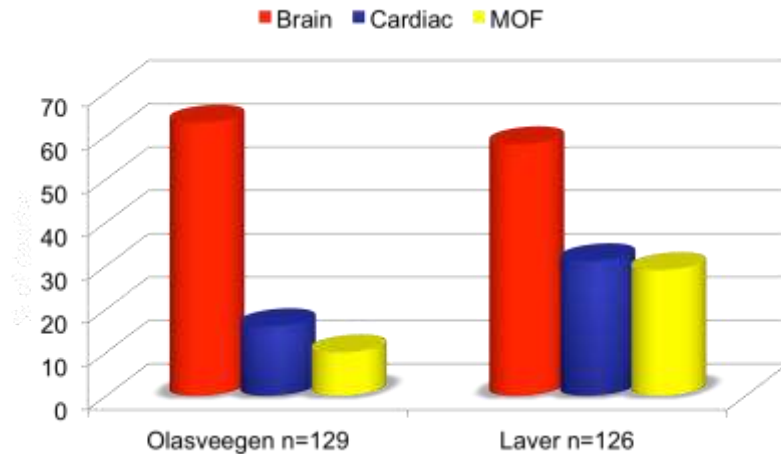
Main questions after CPR

- ✓ What is the main cause for CPR ?
- ✓ What will determine the prognosis ?

Myocardial ischemia as cause of CPR

- ✓ In over 70 % of cases significant stenoses of coronary arteries are found in autopsies after unsuccessful CPR
- ✓ A cardiac cause is assumed in about 2/3 of patients after CPR
- ✓ However the data with respect to myocardial ischemia as primary cause for CPR are conflicting

Causes of death after CPR



Ethical issues after CPR

- ✓ Neurological prognosis after delayed and prolonged CPR
- ✓ Concomitant diseases
- ✓ Age (biological versus numerical)
- ✓ Patient wish

The problem after CPR

- ✓ To select the right patient for invasive and interventional procedures
- ✓ Ethical and economical issues in the allocation of resources in this high risk patient population

Diagnostic tools after CPR

- ✓ ECG
- ✓ Cardiac enzymes
- ✓ Echocardiography
- ✓ CT-scan (pulmonary embolism, aortic dissection, coronary stenosis)
- ✓ CT of the brain (whole body CT ??)
- ✓ No readily available tool to determine neurological outcome

Not all patients are equal

- ✓ 56-year old smoker, witnessed cardiac arrest, immediate bystander CPR, ventricular fibrillation, ECG after ROSC: ST elevations V2-V5
- ✓ 82-year old women, diabetes, endstage renal disease on dialysis, cardiac arrest, no bystander CPR, asystole, ROSC after 30 minutes of CPR, ECG: negative T-waves

STEMI-Guidelines

- ✓ If in the post-CPR ECG STEMI is present follow the guidelines

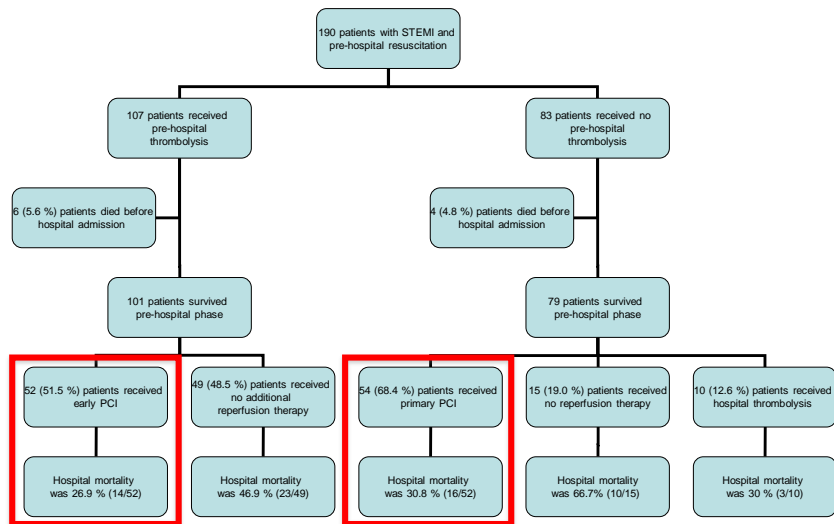
Immediate angiography with a view to primary PCI is recommended in patients with resuscitated cardiac arrest whose ECG shows STEMI.

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Patients with STEMI and prehospital CPR - Results of the PREMIR Registry



Koeth,, Zeymer, Am J Cardiol 2012

Initial rhythm and mortality after prehospital CPR for STEMI

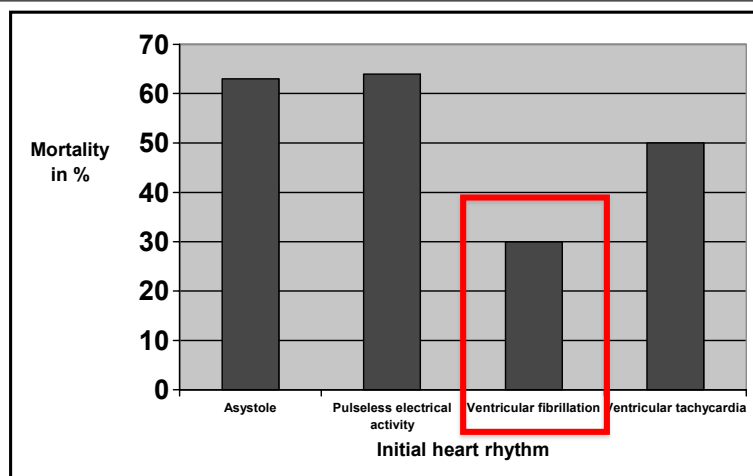


Figure 2. Mortality according to initial heart rhythm.

Koeth,, Zeymer, Am J Cardiol 2012

Exceptions for STEMI fast track to PCI

- ✓ Unknown or long duration to start of CPR
- ✓ Long CPR until ROSC (> 30 min)
- ✓ Advanced biological age
- ✓ Severe (life-limiting) co-morbidities
- ✓ Non-shockable initial rhythm

- ✓ Ongoing CPR ????? Lucas-Device, ECMO, Impella

Assist device or angiography first ?

- ✓ IABP did not show any benefit in the IABP-Shock II trial, regardless of the timing relative to PCI
- ✓ Theoretical advantages for Impella or ECMO
- ✓ But will prolong ischemic time
- ✓ Not available in many centers

Cooling and PCI

- ✓ In STEMI patients primary PCI should not be delayed
- ✓ But cooling should be started simultaneously (cool packs, ice)
- ✓ Cooling could be beneficial both for the brain and the heart

Coronary angiography after CPR

- ✓ 85 patients
- ✓ 93 % ventricular fibrillation or tachycardia
- ✓ Mean interval cardiac arrest to CPR 3 mins
- ✓ ECG : ST elevation or LBBB 63 %
- ✓ Significant stenoses in 71 %
- ✓ PCI in 40 %
- ✓ Mortality 62 %

Spaulding, N Engl J Med 1997;336:1629-33.

ESC-Guidelines

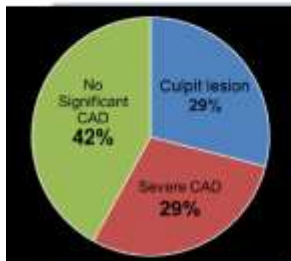
Immediate angiography with a view to primary PCI should be considered in survivors of cardiac arrest without diagnostic ECG ST-segment elevation but with a high suspicion of ongoing infarction.

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Angiography after OHCA without ST elevations

Angiographic Findings – OHCA No ST-Elevation



First Author, Year (Ref. #)	Acute Occlusion	Culprit Lesion*	Significant CAD†
Merchant et al., 2008 (55)	6/17 (35)	–	10/17 (55)
Reynolds et al., 2009 (14)	–	–	31/54 (57)
Anyfantakis et al., 2009 (56)	–	–	27/44 (61)
Radsel et al., 2011 (31)	4/54 (7)	13/54 (24)	32/54 (59)
Bro-Jeppesen et al., 2012 (30)	–	–	43/82 (52)
Dumas et al., 2010 (3)	–	–	176/301 (58)
Hollenbeck et al., 2014 (25)	44/163 (27)	–	–
Kern et al., 2015 (52)	23	33	–
Total (%)	23	29	58

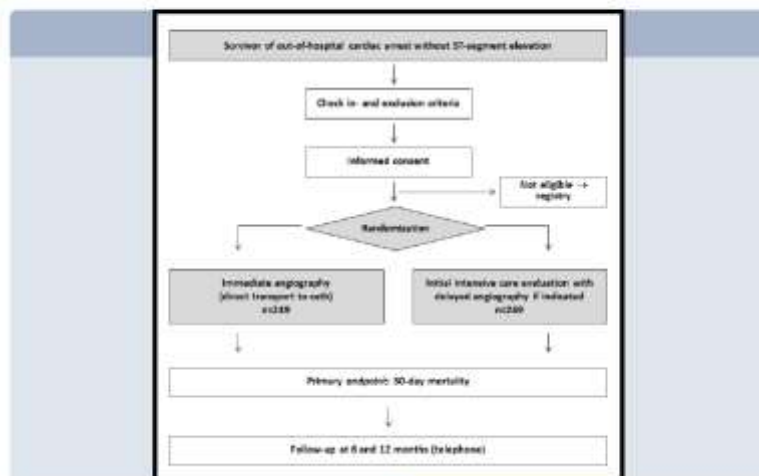
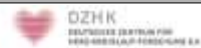
Patients without STEMI in the post-CPR ECG

- ✓ Assess likelihood of NSTEMI as primary cause for CPR (repeat ECG and enzymes)
- ✓ Assess other causes for CPR
- ✓ In hemodynamic stable patients cooling and assessment of neurological prognosis might be more important
- ✓ In patients with shock most likely due to NSTEMI immediate angiography

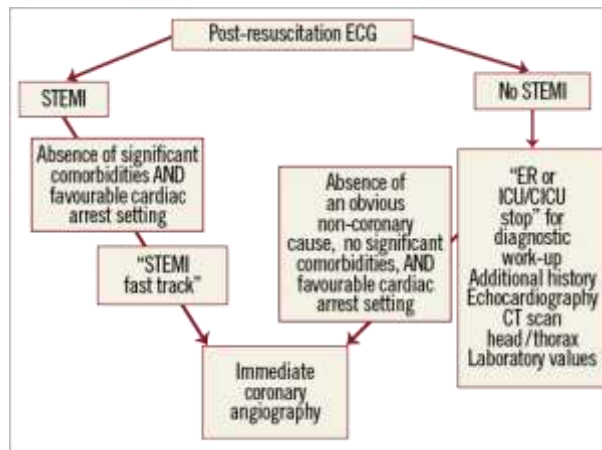
TOMAHAWK Randomized Trial



TOMAHAWK Trial Flow



EAPCI-Algorithm



EuroIntervention 2014;10:31-37

Invasive coronary treatment strategies for out-of-hospital cardiac arrest: a consensus statement from the European Association for Percutaneous Cardiovascular Interventions (EAPCI)/Stent for Life (SFL) groups

Conclusion

- ✓ More data are needed to determine the appropriate diagnostic and therapeutic strategy after CPR
- ✓ Younger age, shockable initial rhythm and STEMI, immediate primary PCI
- ✓ In most patients without STEMI initial assessment and cooling to improve neurological outcome most important
- ✓ Treat the whole patient, not only the coronaries
- ✓ Angiography in selected cases, especially in hemodynamic unstable patients
- ✓ Don't be too aggressive