



# The Swedish model of STEMI treatment



Professor Eva Swahn

# Linköping!



# Single centre model



- One hospital started (1995)
- Special education for all; ambulance staff, ER, CCU, doctors
- ECG by mobile Fax to Cardiologist on call
- Patients far away > 40 km from hospital (=low volume)
- Thrombolytics to very well defined patient group
- Voices: "Too dangerous", "Not scientific"
- Special follow-up forms
- Good results!

# Our model 2000

A purple ECG (heart rate) line graphic is positioned in the upper right corner of the slide, extending horizontally across the top.

- New high fashion mobile ECG units in all 25 ambulances in the region
- ECG to ER and CCU at 3 hospitals
- European prehospital **study** with prehospital thrombolysis (ASSENT III Plus)!  
**One of the keys for success!**
- Prehospital reperfusion (thrombolytics) for all STEMI patients since 2000.

# Next step 2003 - changing treatment strategies, keys for success

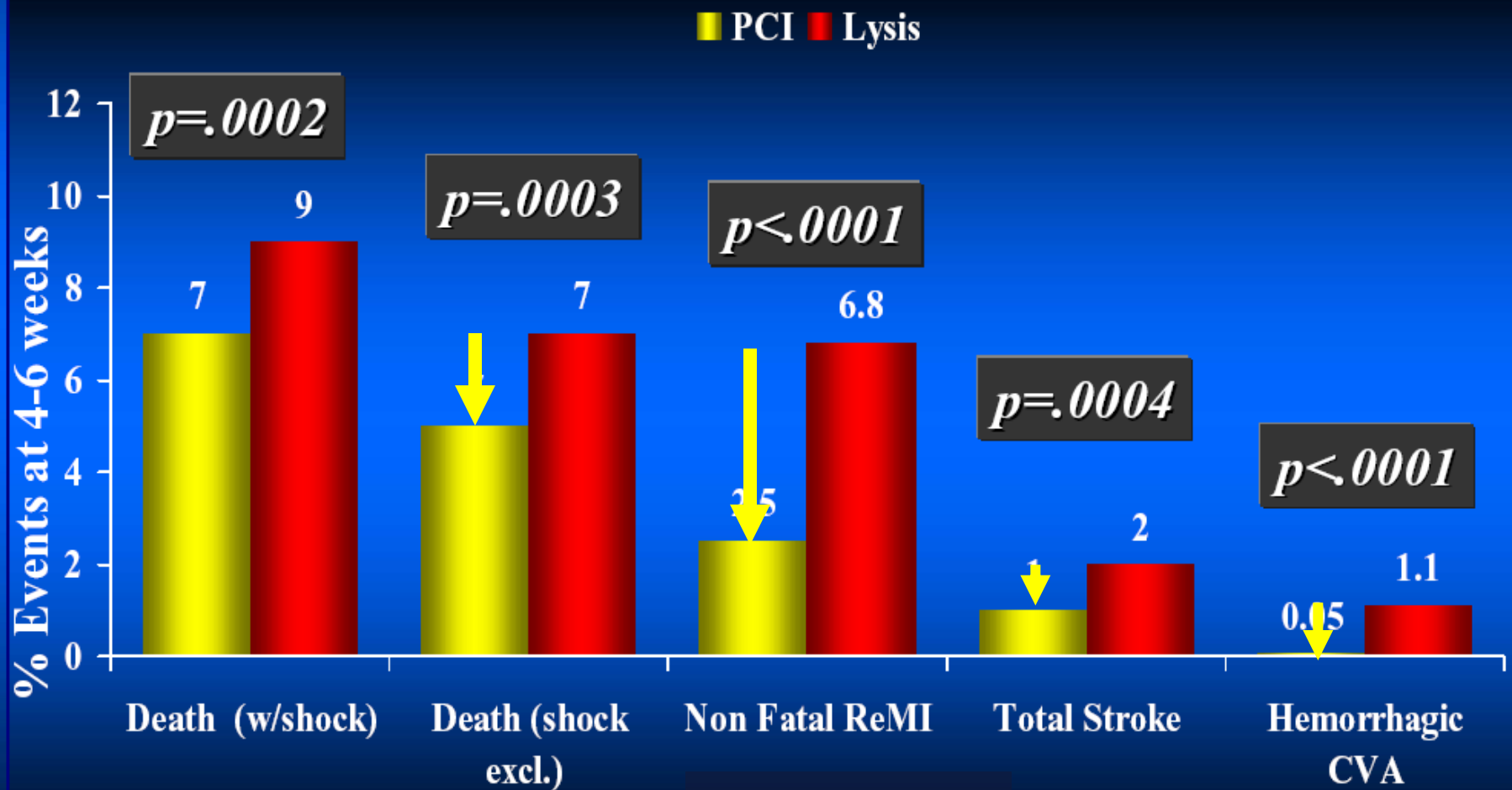
- Discussions with colleagues in all hospitals
- Discussions with ambulance
- Small group; PM and checklists
- Contact with Eli Lilly. Refrigerator discussions.
- **STEPWISE** start – Linköping Primary PCI 2004
- Education of ambulance staff 2004
- **First prehospital Reopro bolus was given June 2004**
- All patients in our region primary PCI January 2005
- Log sheet for follow up/EUROTRANSFER Registry
- Minor changes in the program until today – September 2010, e.g. centrally evaluated ambulance-ECG since 2009.

The background features a faint, light blue illustration of a human heart with its major arteries and veins. A purple ECG (heart rate) line is overlaid on the right side of the image, extending from the top right towards the center.

**Scientific support?**

**Comparisons  
Thrombolysis vs Primary PCI**

# Results of meta-analysis of 23 studies with comparisons thrombolysis and PCI (n= 7739)



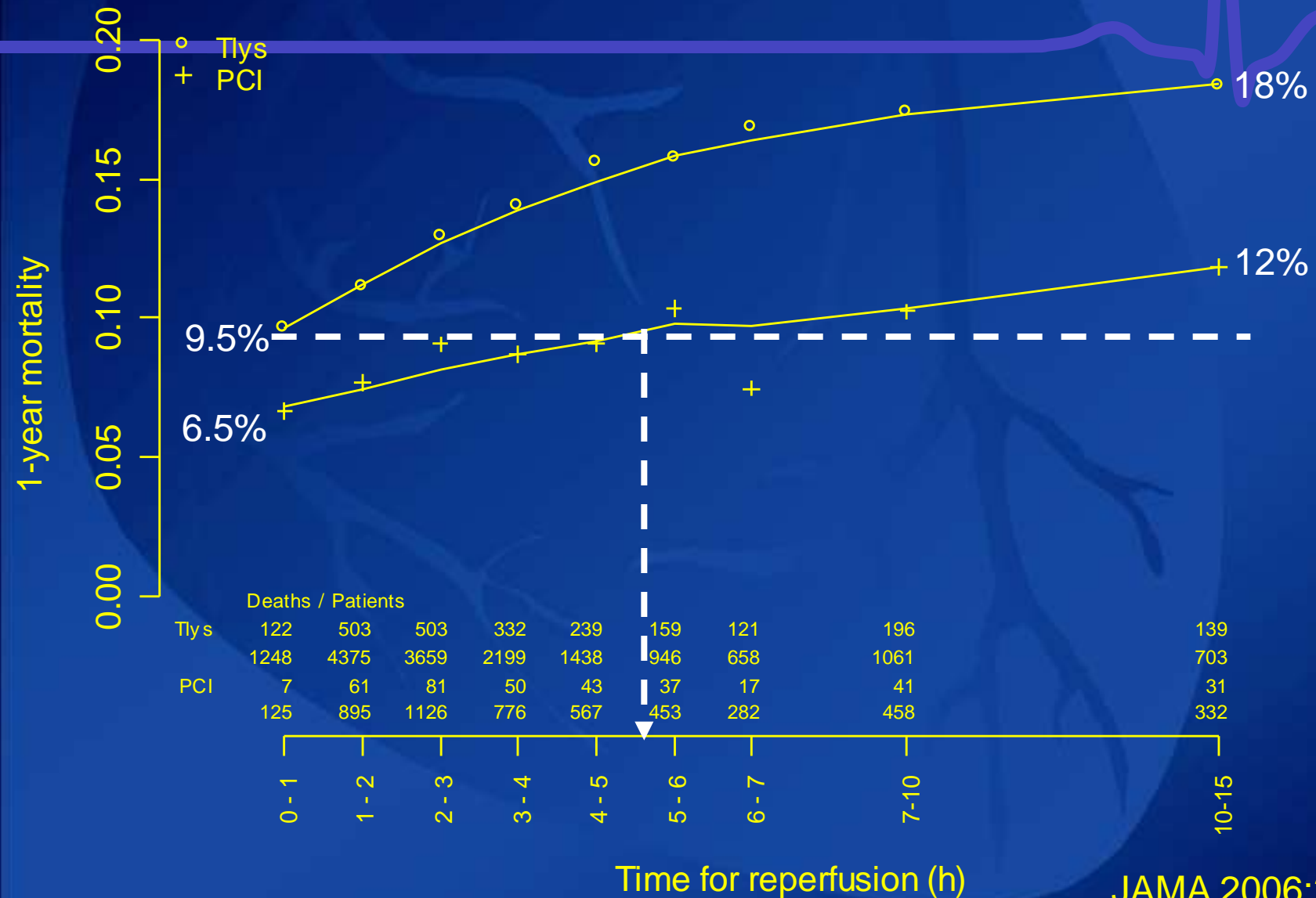
# Registry data



26 205 consecutive STEMI patients given reperfusion therapy were included between 1999-2004 and followed until Dec 31, 2005.

*(this is over 3 times as many patients as in the largest meta-analysis)*

# Age adjusted 1-year mortality for primary PCI versus thrombolysis in relation delay time

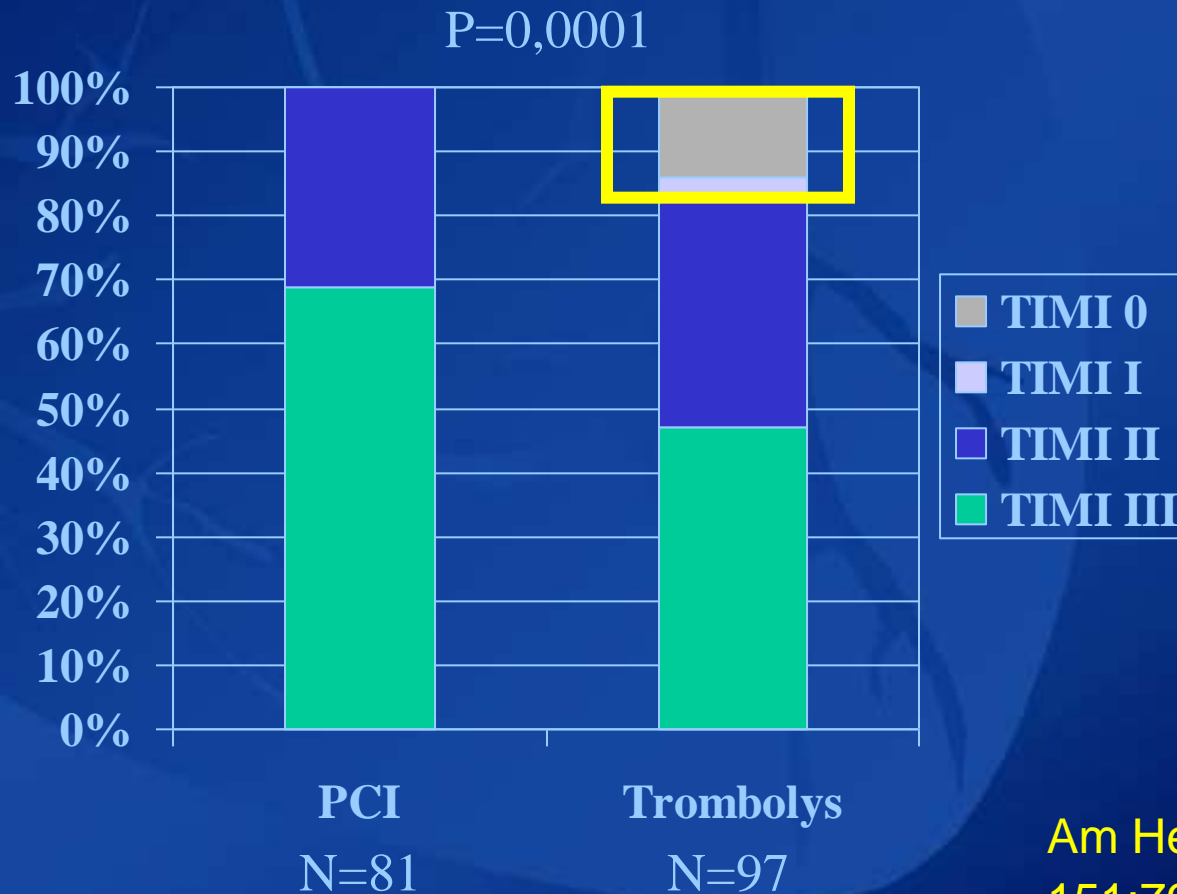




# SWedish Early DEcision reperfusion Strategy study SWEDES

A prospective open randomised study  
comparing prehospital thrombolysis  
and prehospital facilitated (abciximab)  
PCI for STEMI patients

# Proportion with open vessel (control angiography after 5 days)

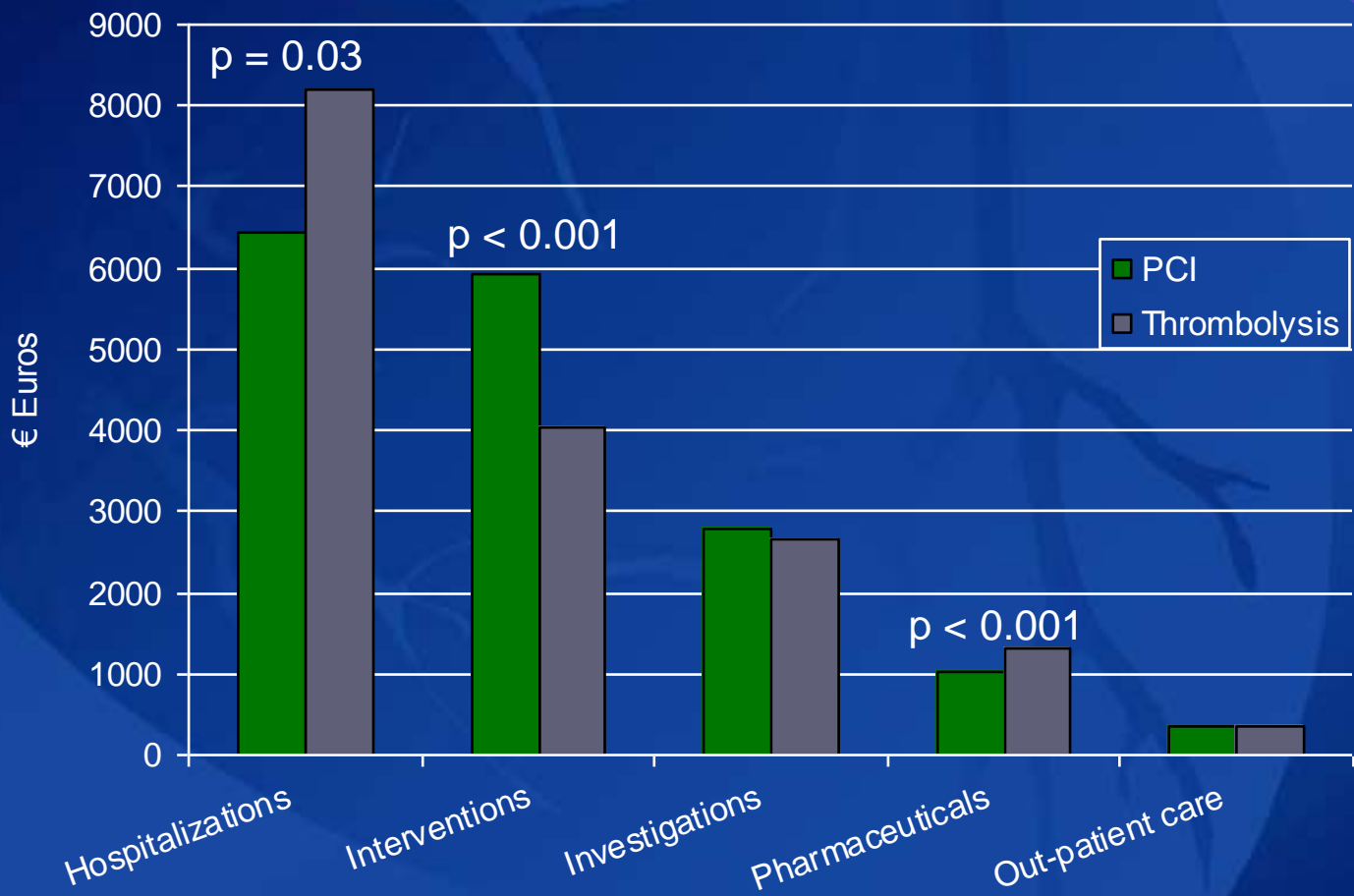


# 1 year follow-up



- Mortality was 5.0 % in the PCI group and 7.7 % in the thrombolytic group, n.s.
- Costs?

# Costs 1 year follow-up

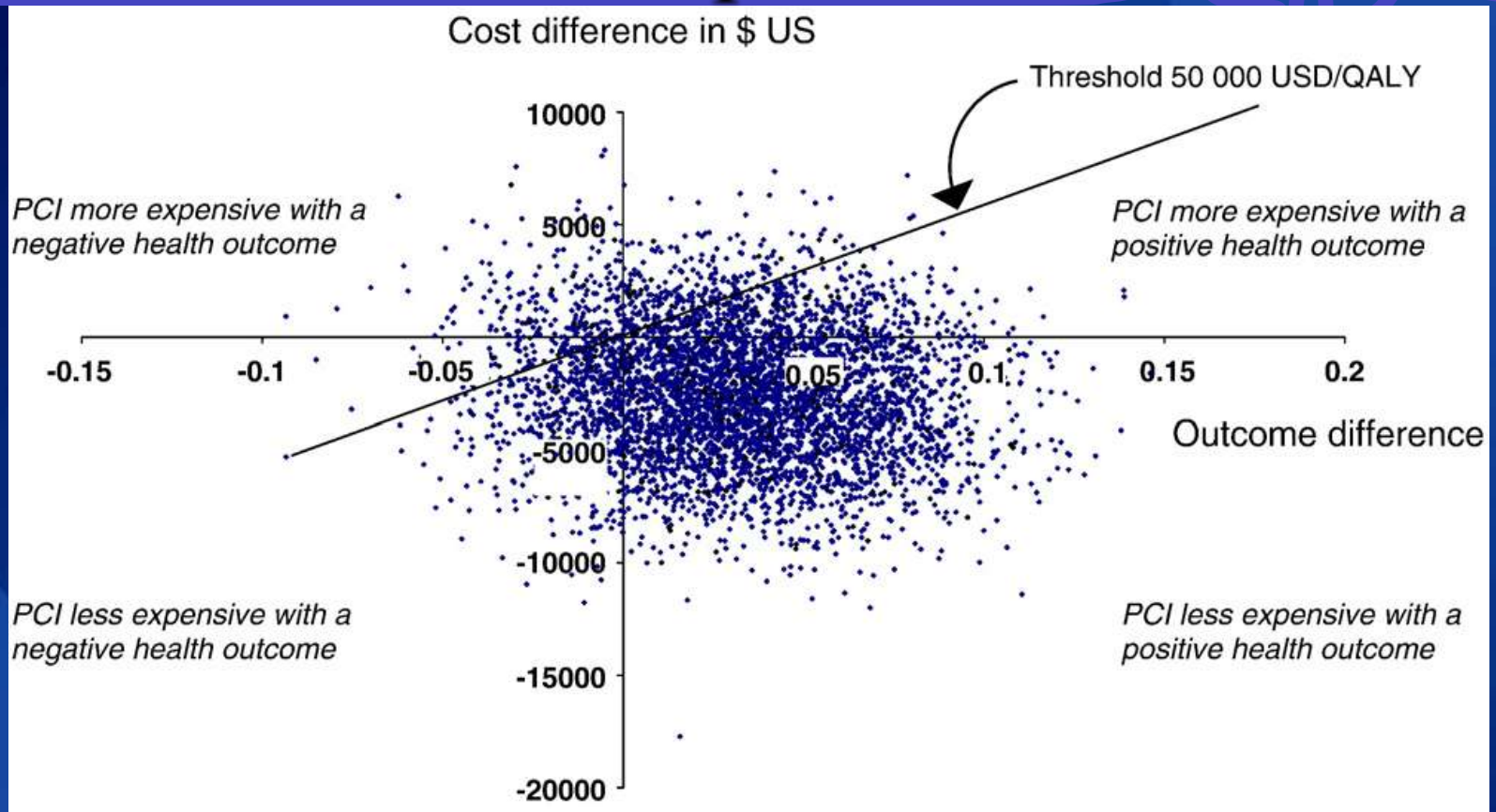


# 1 year follow-up



- Mortality was 5.0 % in the PCI group and 7.7 % in the thrombolytic group, n.s.
- The total health care cost for the PCI group was 16 507 € and 16 569 € for the thrombolytic group, n.s.
- The average QALY during first year was 0,76 in the PCI group and 0,73 in the thrombolytic group, n.s.

# Cost-effectiveness plane

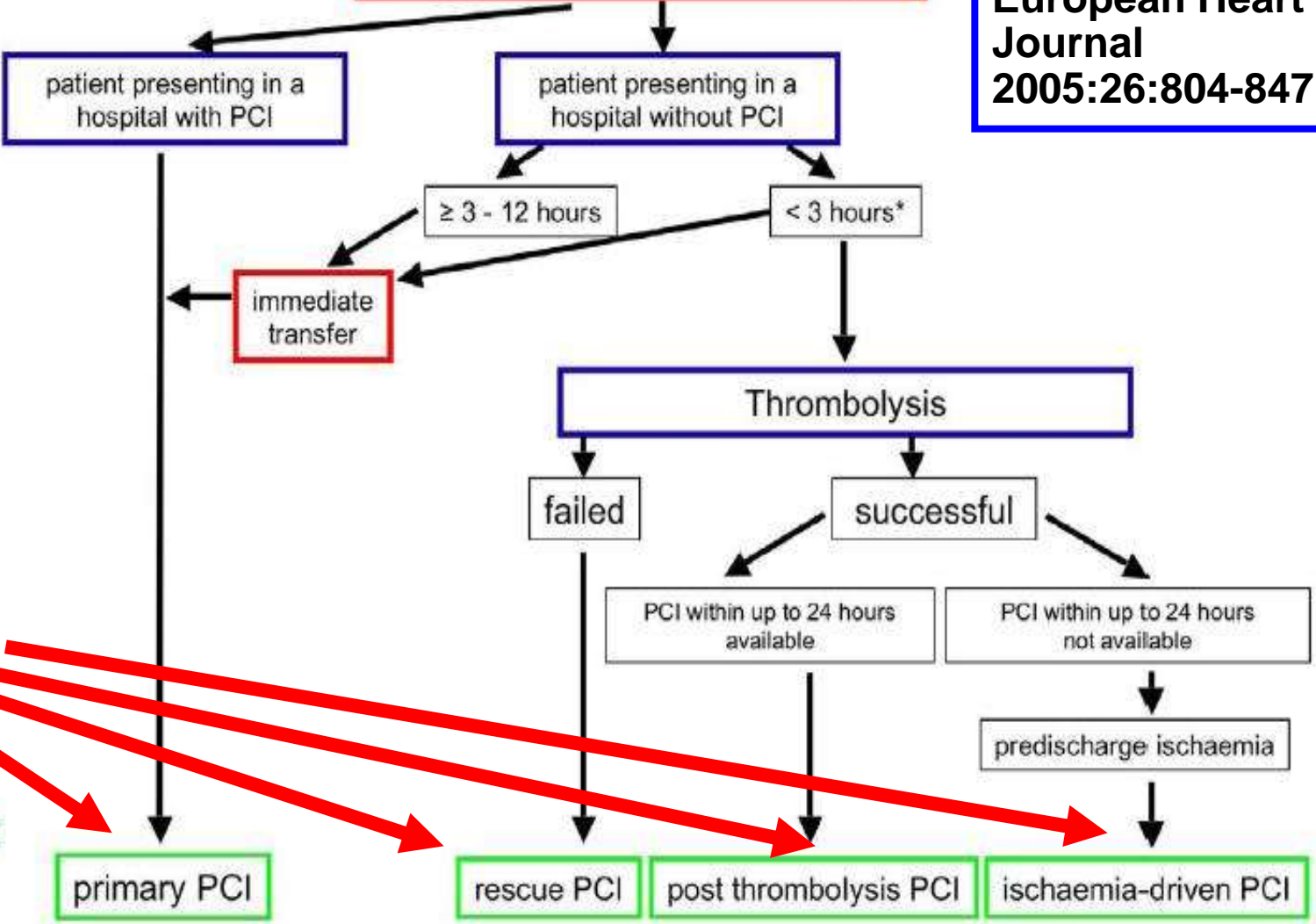


**Conclusions:** "An analysis of total cost combined with quality-adjusted survival makes an invasive strategy likely to be cost-effective compared with thrombolysis"



European guidelines?

**STEMI**  
 < 12 hours after onset of chest pain



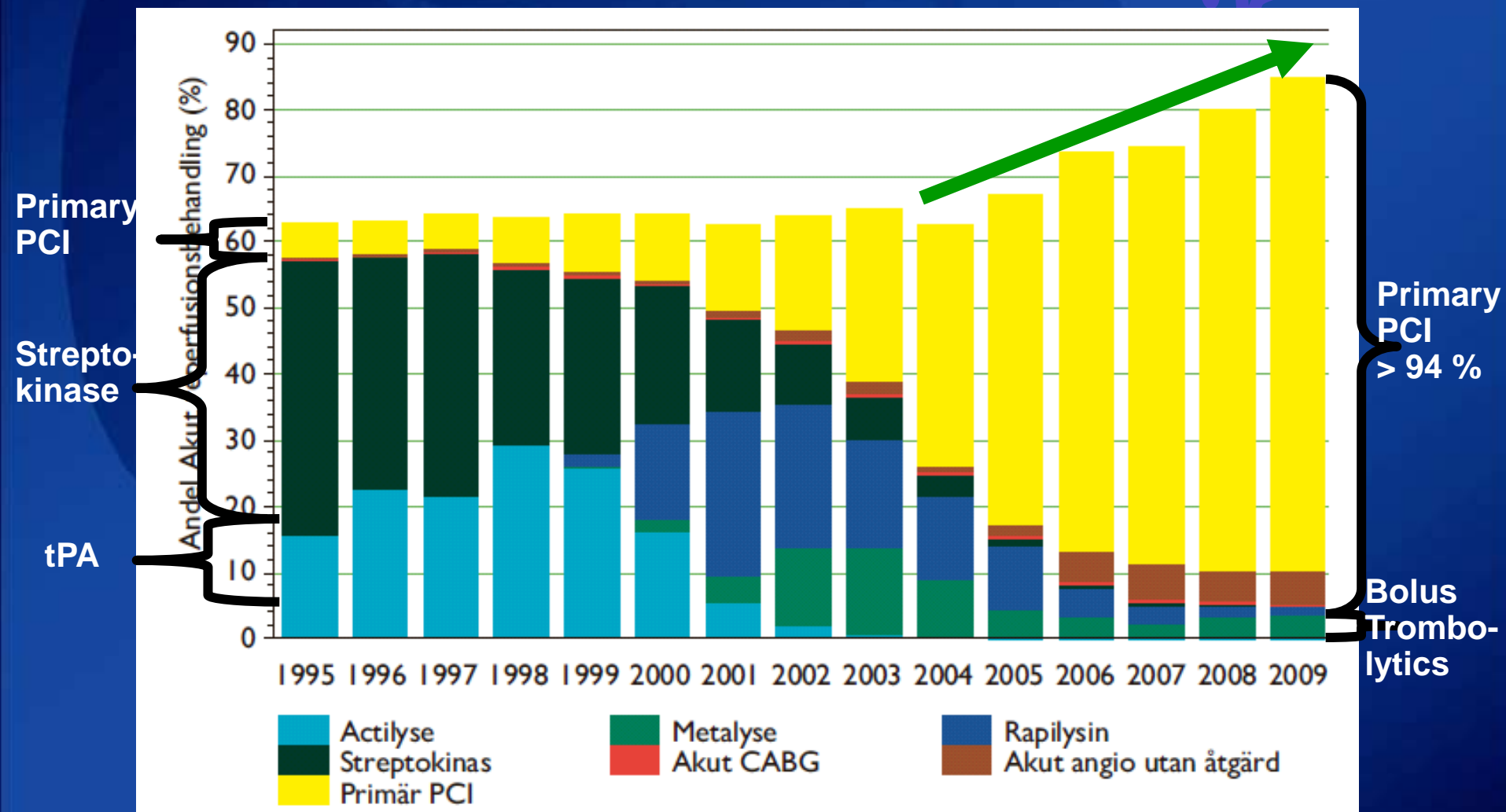
**PCI!**

**Figure 2:**





# SWEDEHEART 2009



# Treatment of STEMI, history Linköping, in summary



- 1985 first thrombolysis
- 1989 first PCI
- 1994 first primary PCI
- 1995 first prehospital thrombolysis
- 2000 all 25 ambulances in the county of Östergötland equipped with ambulatory ECG (Zoll-Dansjö)
- Dec 2000 Predominantly prehospital thrombolysis
- 2004 Predominantly prehospital Reopro and Primary PCI - Linköping
- 2005 Predominantly prehospital Reopro and Primary PCI – Östergötland
- October 2005 New Ambulance-ECG-(full monitoring!) system (Ortivus MobiMed 300) in all 30 ambulances
- 2009 centrally evaluated ambulance-ECG at CCU Linköping

The background features a large, semi-transparent illustration of a human heart with its coronary arteries, set against a dark blue gradient. A white ECG (heart rate) line is positioned horizontally across the upper right portion of the image.

# Linköping University Hospital STEMI model 2010

# STEMI-treatment 2010



- **Prehospital abciximab (Reopro<sup>®</sup>) and unfractionated heparin + Primary PCI** (even if transport is needed to another hospital)
- Outside office hours *and* when time from symptom onset to start of treatment is very short (< 2 hours) **hospital thrombolysis** can be considered.

Guidelines Östergötland Heart Centre,  
University Hospital Linköping  
since 1st of January 2005

# Linköping University Hospital STEMI Model Catchment area



420 000 inhabitants

3 hospitals:

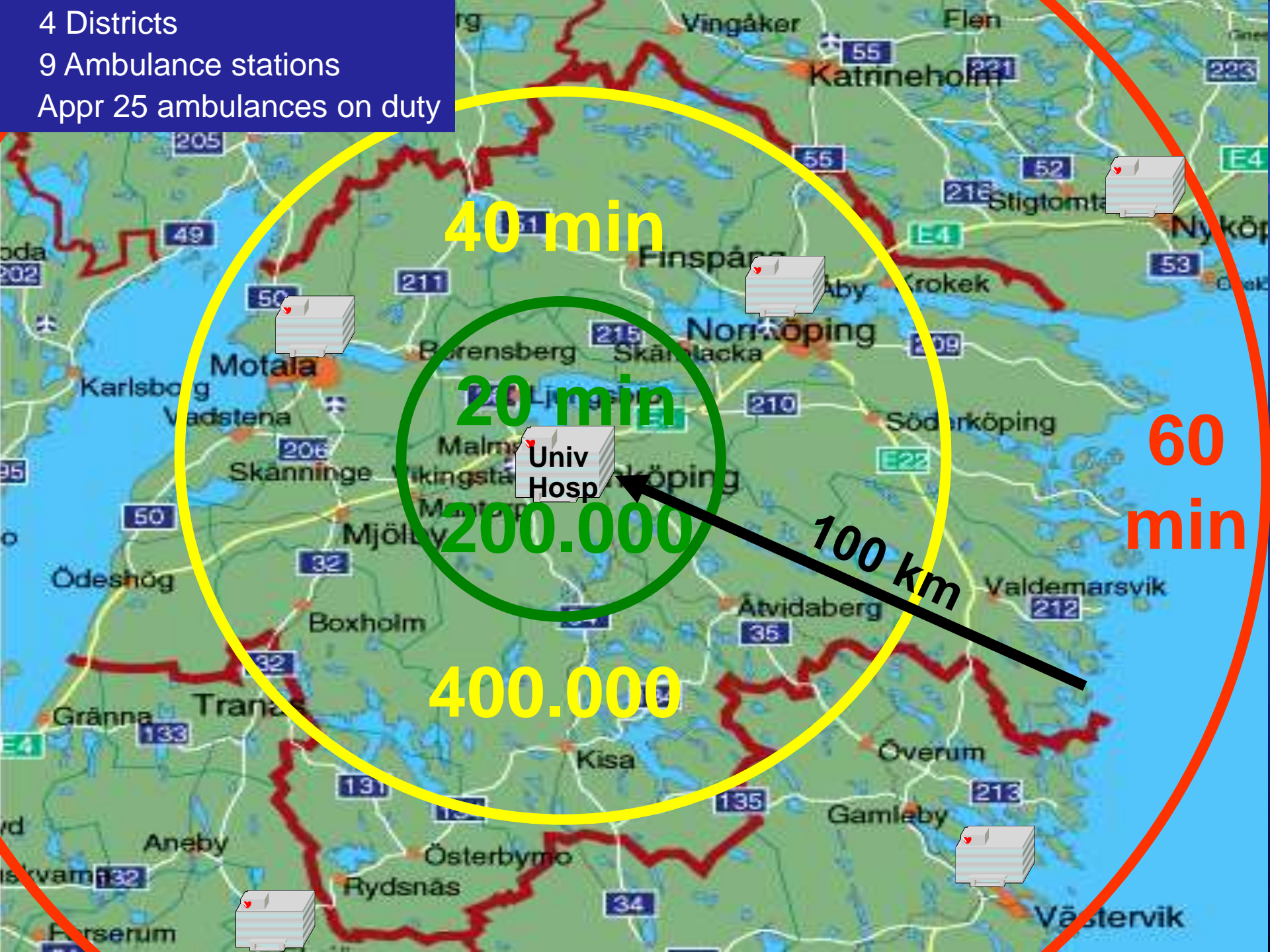
Motala, Norrköping county  
(primary) hospitals

Linköping University hosp.

Ambulances: 30

STEMI patients arriving  
with ambulance: 75-80 %

4 Districts  
9 Ambulance stations  
Appr 25 ambulances on duty



40 min

20 min

200.000

400.000

60 min

100 km

Univ Hosp

# Ambulance service organisation in Östergötland



- 2 private ambulance organisations.
- For both organisation, 1 Medical Director.
- 180 nurses and assistant nurses/EMT's (Emergency Medical Technicians)
- With extra-ambulances 30 vehicles.  
2 can handle ICU equipment. 1 certified for airtransportation.
- Appr 40 000 missions/year

# The ambulance staff - Education



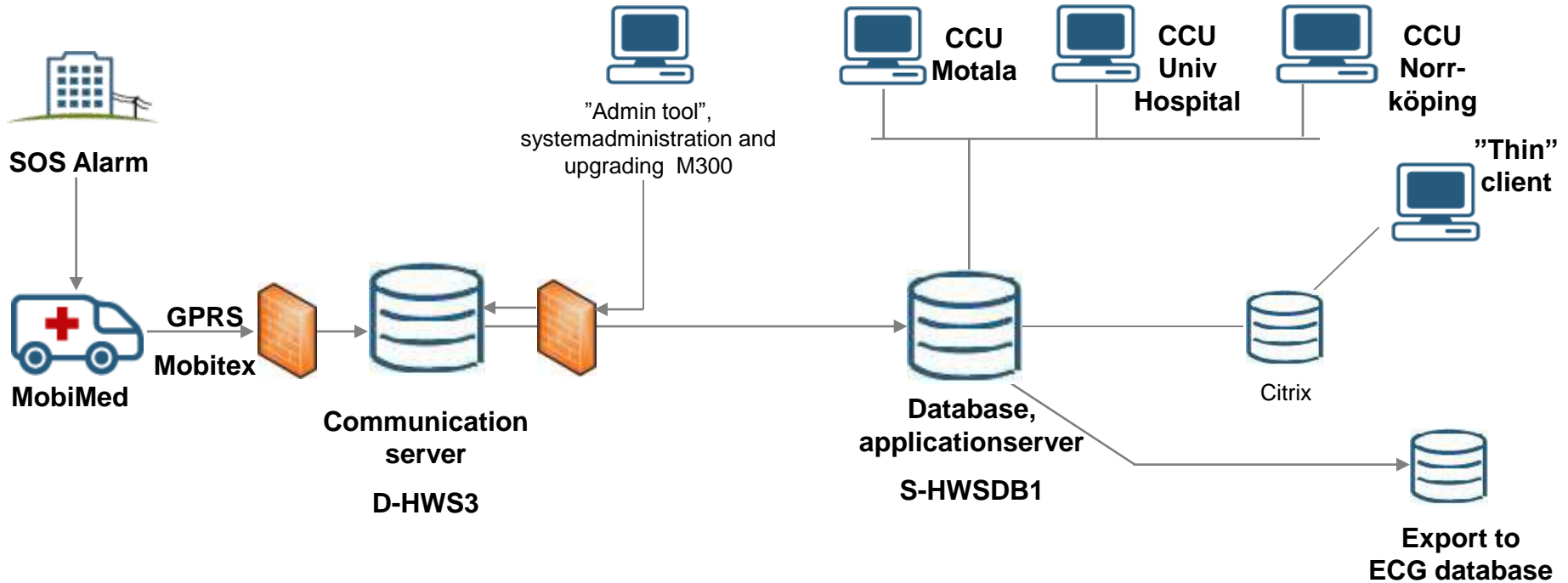
- Nine-year compulsory school
- Three-year upper secondary school (assistant nurse)
- Three-year higher education, at university level (nurse)
- One-year specialist education (advanced nurse)
- 2 weeks of internal theoretical education and 2 weeks practical education (in the ambulance)

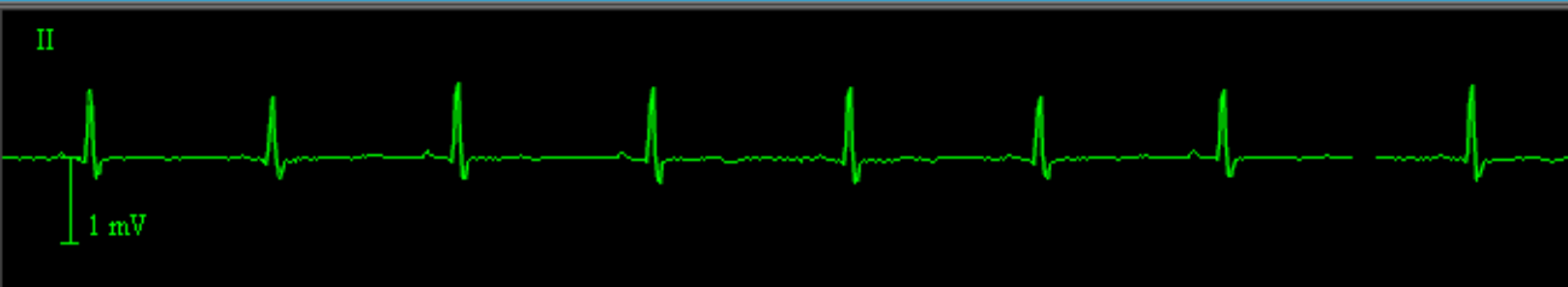
# The ambulance staff



- At least one nurse in every ambulance
- Assistant nurse/EMT
- Since 2005, only the nurse has the right to administer/give drugs to a patient.
- Before that the assistant nurse/EMT also had this possibility.

# Ambulance-ECG

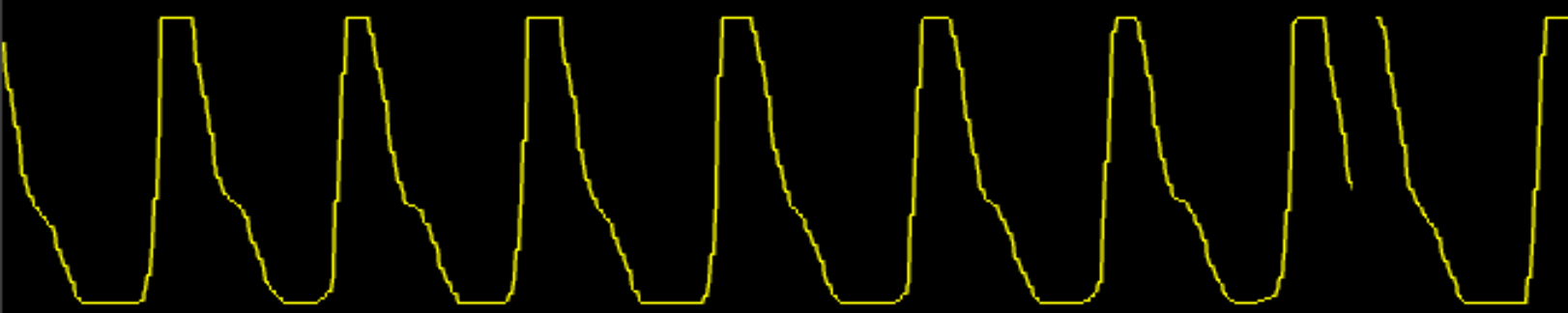




EKG

69

40-150



SpO2

98

P: 68

13:20 110/80 (95)

NIBP

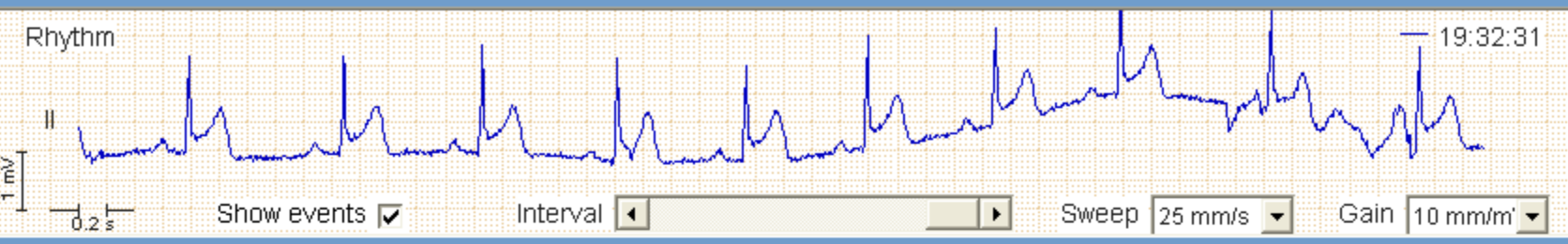
110/80  
(95)

13:20  
Intervall



Resp

15



Rhythm Lead:

Selection (All)

← →

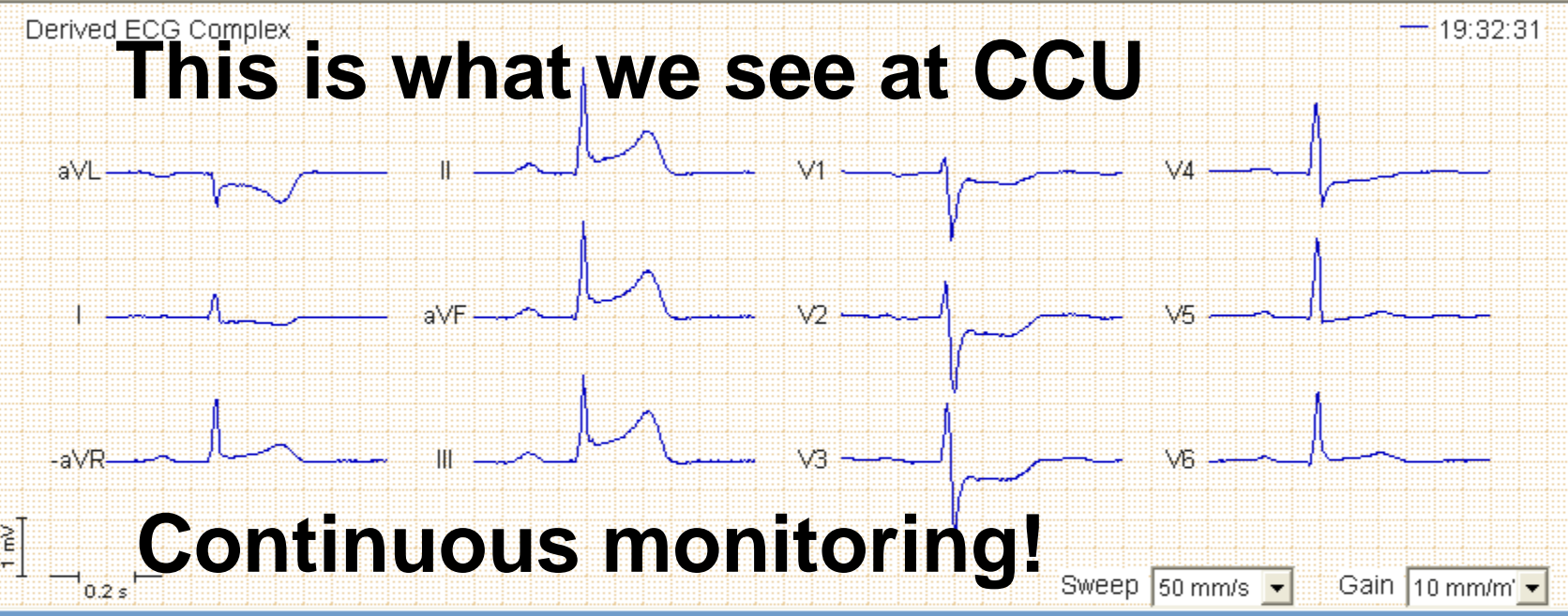
Magnify

Complex

Refer...

Optional

Select



Selection (All)

← → →

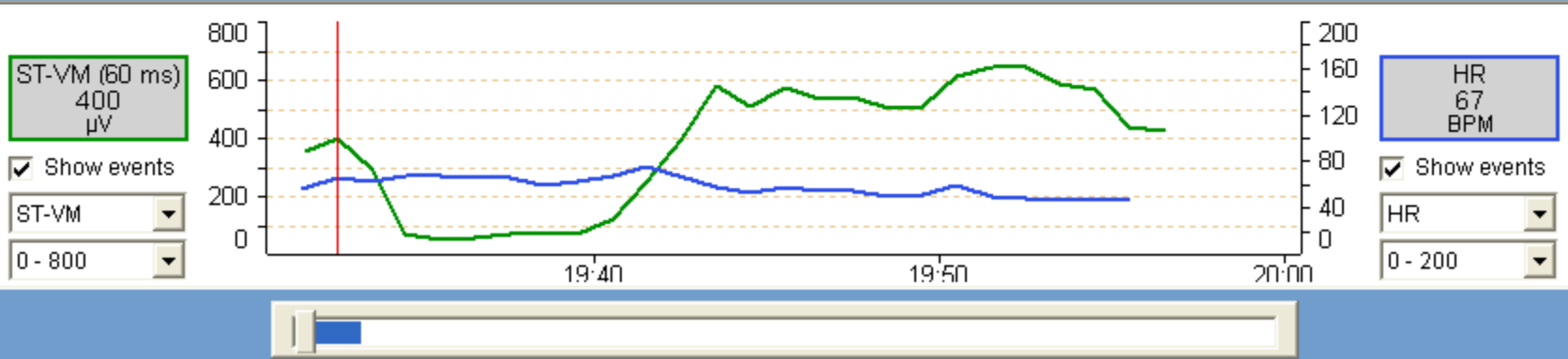
Diagram

ST-VM - HR

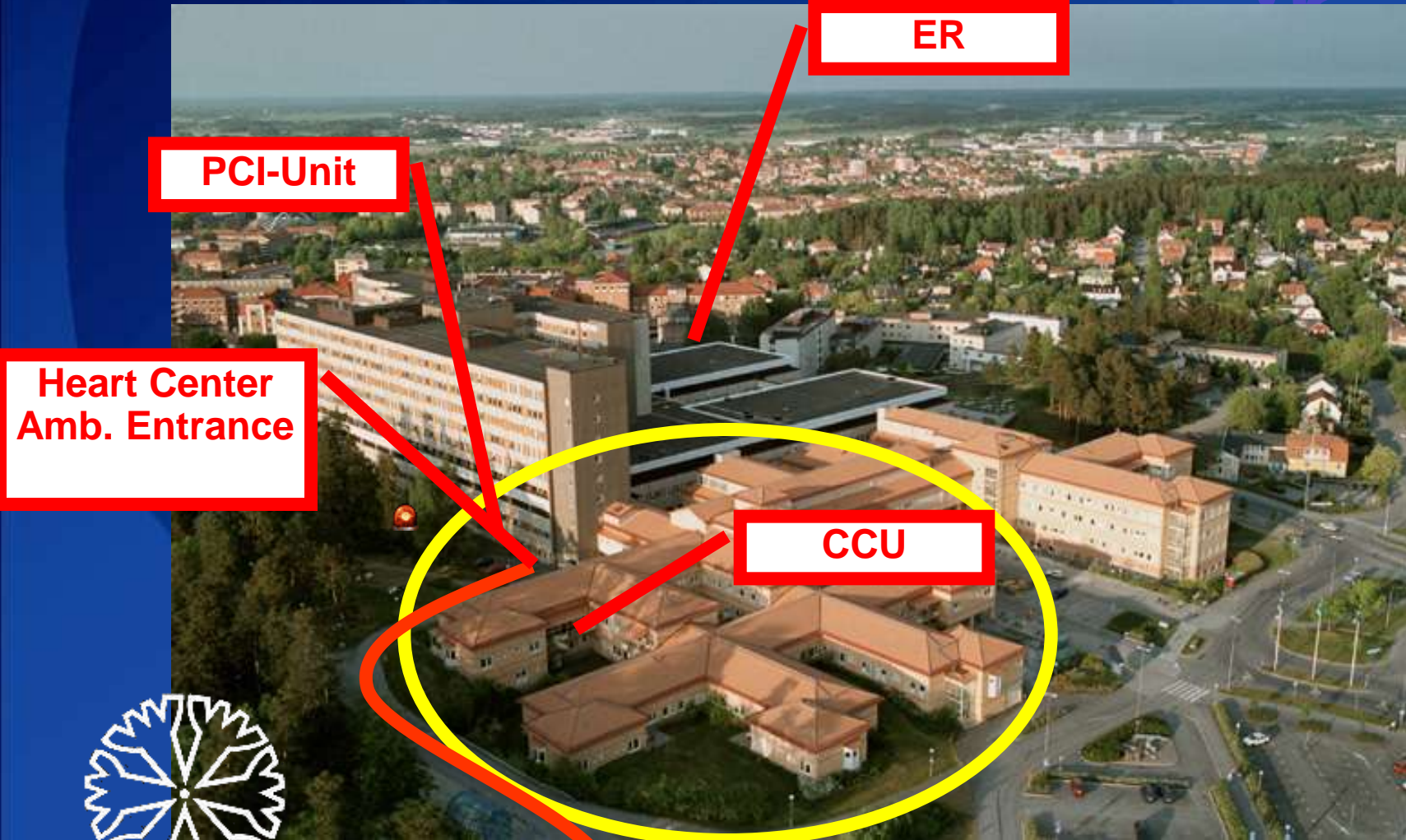
Duration 30 Minutes

Selection (All)

← →



# Heart Center, University Hospital, Linköping



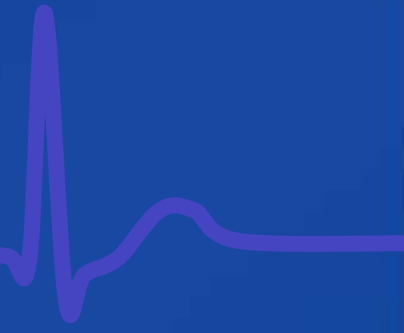
ER

PCI-Unit

Heart Center  
Amb. Entrance

CCU





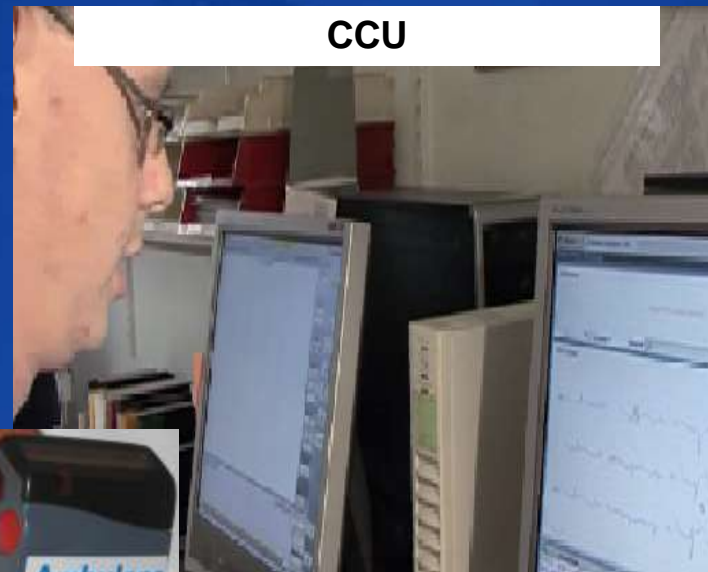
**Thank you for your attention!**



Follow one STEMI patient  
through our network







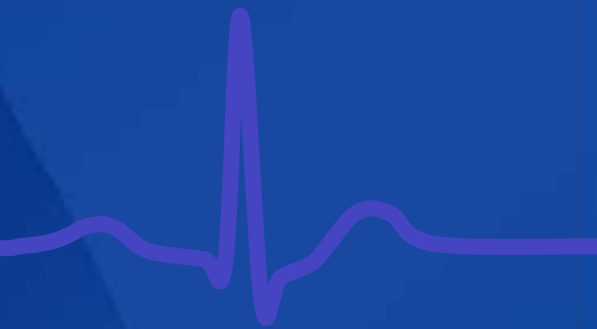
CCU



**CCU**



**Checklist**



## Reperfusion checklist for patients with major threatening myocardial infarction

### Indications for reperfusion treatment

The 2 questions below must be answered Yes for reperfusion treatment to be considered

	Yes	No
<b>1. Symptom(s) that suggest strong suspicion of myocardial infarction?</b> Symptom(s) onset (date/time): _____ / _____	<input type="checkbox"/>	<input type="checkbox"/>
<b>2. ECG-changes:</b> <ul style="list-style-type: none"> <li>• ST-elevation <math>\geq 2</math> mm in at least 2 anterior precordial leads or <math>\geq 1</math> mm in at least 2 extremity leads or 2 lateral precordial leads or</li> <li>• Bundle branch block or</li> <li>• Pronounced ST-depressions over anterior wall indicative of posterior myocardial infarction</li> </ul>	<input type="checkbox"/>	<input type="checkbox"/>

### Case history (basis for choice of treatment)

	Yes	No
<b>1. Known haemorrhaging tendency</b> (e.g. known thrombocytopenia) or ongoing or recent (< 1 week ago) terminated treatment with warfarin (Waran <sup>®</sup> ), Heparin, dalteparin (Fragmin <sup>®</sup> ), enoxaparin (Klexane <sup>®</sup> ), tinzaparin (Innohep <sup>®</sup> ), fondaparinux (Arixtra <sup>®</sup> ) or abciximab (Reopro <sup>®</sup> )?	<input type="checkbox"/>	<input type="checkbox"/>
<b>2. Known hypersensitivity to aspirin, Heparin, tenecteplase (Metalyse<sup>®</sup>) or abciximab (Reopro<sup>®</sup>)?</b>	<input type="checkbox"/>	<input type="checkbox"/>
<b>3. Previous coronary artery by-pass surgery (CABG)?</b>	<input type="checkbox"/>	<input type="checkbox"/>
<b>4. Stroke or cerebral haemorrhage in last 6 months?</b> Head injury after onset of symptoms? Other known CNS-injury? Dementia?	<input type="checkbox"/>	<input type="checkbox"/>
<b>5. Major surgical intervention or major trauma in past 2 months?</b>	<input type="checkbox"/>	<input type="checkbox"/>
<b>6. Gastric haemorrhage in last 2 months?</b>	<input type="checkbox"/>	<input type="checkbox"/>
<b>7. Heart lung resuscitation &gt; 10 minutes in last 2 months?</b>	<input type="checkbox"/>	<input type="checkbox"/>
<b>8. High blood pressure present reading?</b> Systolic > 180 mm Hg or diastolic > 110 mm Hg?	<input type="checkbox"/>	<input type="checkbox"/>
<b>9. Other major illness?</b> E.g. malignant disease with short life expectancy or severe kidney- or liverdisease?	<input type="checkbox"/>	<input type="checkbox"/>
<b>10. Pregnant? Recent delivery/breastfeeding?</b>	<input type="checkbox"/>	<input type="checkbox"/>

After a disturbance free ECG has been transferred and functioning telephone contact established, prescriptions will be made by the on-call cardiologist at University hospital, Linköping.

Patient with indications for reperfusion treatment:

- Will preferably be offered Reopro<sup>®</sup> and Heparin (prehospital) + primary PCI (Alt A).
- Outside office hours and when the time from symptoms onset to start of treatment is very short (< 2 hours) thrombolytics (Heparin + tenecteplase Metalyse<sup>®</sup>) can be considered instead (Alt B).
- Certain patients must be taken to the nearest CCU for evaluation before a decision can be taken on type of treatment.
- In occasional cases, the correct course of action can be to totally refrain from reperfusion treatment.

See treatment chart below!

Prescribing doctor on-call cardiologist at University hospital, Linköping): \_\_\_\_\_

<u>Before primary PCI (Alt. A)</u>						Sign/time
1. 4 x Tromblyl <sup>®</sup> (aspirin) 75 mg. As per ambulance paramedic treatment directions.						/
2. Estimated weight of patient Wgt (kg): _____						
3. Reopro <sup>®</sup> (2 mg/ml) assigned as per specific instruction. Given intravenous for one minute weight adjusted as per medical prescription. ( <i>Ring dose given</i> )						
Weight (kg)	Vol (ml)	Wgt (kg)	Vol (ml)	Wgt (kg)	Vol (ml)	
45-49	5.5	70-74	9.0	94-98	12.0	
50-54	6.0	75-77	9.5	99-102	12.5	
55-58	7.0	78-82	10.0	103-106	13.0	
59-61	7.5	83-85	10.5	107-109	13.5	
62-66	8.0	86-90	11.0	110-	14.0	
67-69	8.5	91-93	11.5			/
4. Heparin (5000 E/ml). Given intravenous weight adjusted as per medical prescription. ( <i>Ring dose given</i> )						
Wgt (kg)	Vol (ml)	Wgt (kg)	Vol (ml)			
40-45	0.4	76-85	0.8			
46-55	0.5	86-95	0.9			
56-65	0.6	96-	1.0			
66-75	0.7					/
5. Seloken <sup>®</sup> (metoprolol) 1 mg/ml, 5 mg (= 5 ml) given intravenous per medical prescription at a rate of 1-2 mg/minute. The dose can be repeated at minimum of 5 minute intervals between injections and maximum dosage of 15 mg (= 15 ml).						
Given ml: _____						/
6. Ketogan Novum <sup>®</sup> (ketobemidonhydrochlorid) As per ambulance paramedic treatment directions. Given mg: _____						/

<u>Thrombolytics (Alt. B)</u>						
1. 4 x Tromblyl <sup>®</sup> (aspirin) 75 mg. As per ambulance paramedic treatment directions.						/
2. Estimated patient wgt Wgt (kg): _____						
3. Seloken <sup>®</sup> (metoprolol) and Ketogan Novum <sup>®</sup> intravenous as point 5 and 6 in Alt. A above Medications below given at CCU!						
4. Heparin (5000 E/ml). Given intravenous weight adjusted as per medical prescription. ( <i>Ring dose givens</i> )						
Wgt (kg)	Vol (ml)	Wgt (kg)	Vol (ml)			
40-46	0.5	55-62	0.7			
47-54	0.6	63-	0.8			/
5. Metalyse <sup>®</sup> (tenecteplase) Given intravenous weight adjusted as per medical prescription. ( <i>Ring dose given</i> )						
Wgt (kg)	Units	Quantity (mg)	Vol (ml)			
< 60	6000	30	6			
60 - 69	7000	35	7			
70 - 79	8000	40	8			
80 - 89	9000	45	9			
≥ 90	10000	50	10			/

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50-54	6.0	75-77	9.5	99-102	12.5	
55-58	7.0	78-82	10.0	103-106	13.0	
59-61	7.5	83-85	10.5	107-109	13.5	
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5. Metalyse <sup>®</sup> (tenecteplase) Given intravenous weight adjusted as per medical prescription. <b>(Ring dose given)</b>						
		Wgt (kg)	Units	Quantity (mg)	Vo1 (ml)	
		< 60	6000	30	6	
		60 - 69	7000	35	7	
		70 - 79	8000	40	8	
		80 - 89	9000	45	9	
		≥ 90	10000	50	10	/

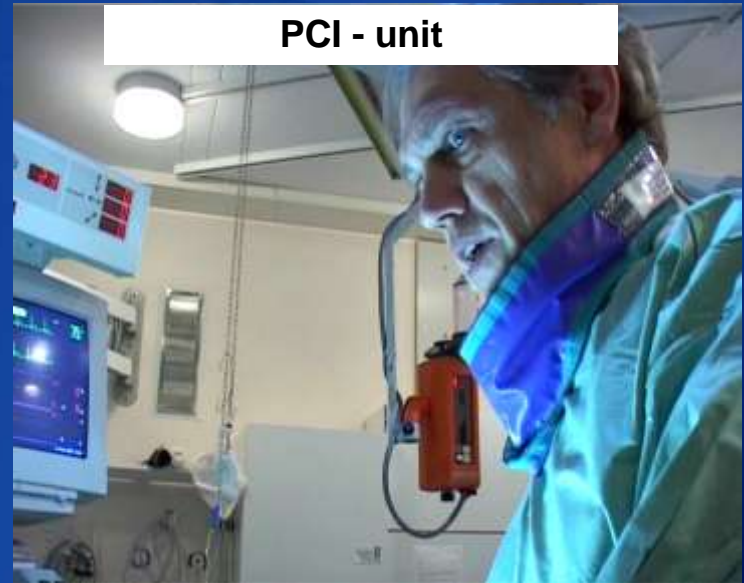
**CCU**



**Checklist**

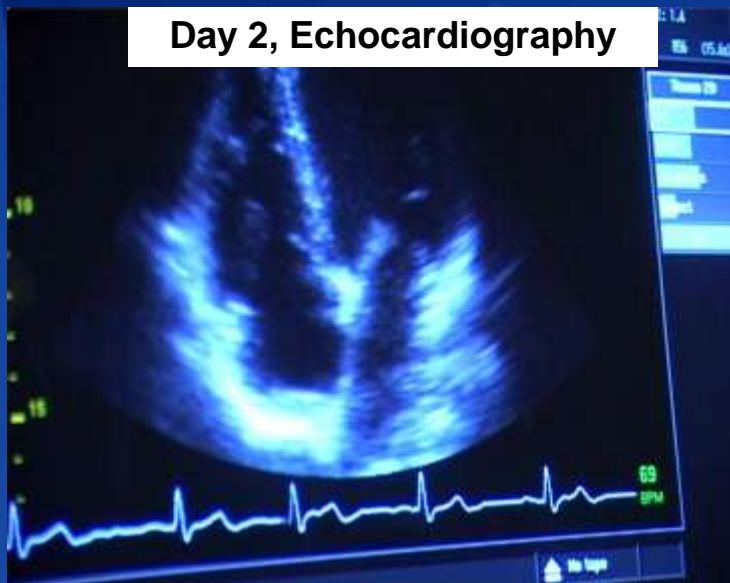


**PCI - unit**





Day 2, Echocardiography



CCU

