

Clinical case: My patient with chest pain stays in a Chest Pain Unit!

ACCA Masterclass 2017

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Acute
Cardiovascular
Care Association
ACCA
A Registered Branch of the ESC



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Disclosures

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- **Nothing to disclose**

Structure - overview

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- **1st part**
 - Clinical scenario of a patient with chest pain admitted to our emergency department before introducing chest pain unit pathways
- **2nd part**
 - Current developments of chest pain unit certification in Germany and benchmarks from the German chest pain unit registry

Clinical case

Anamnesis and body check

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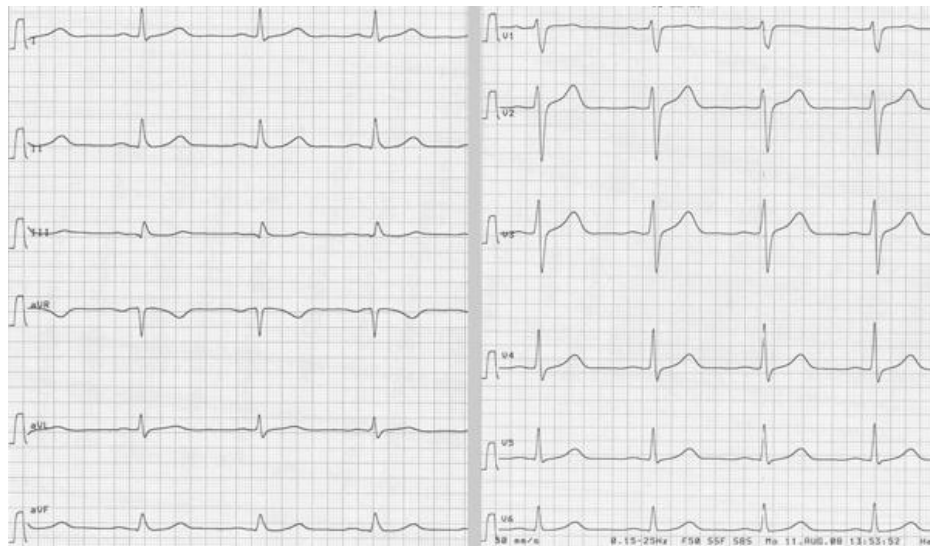
- **Age:** 53 years
- **Gender:** male
- **Actual complaints:** sudden onset of atypical chest pain (retrosternal discomfort) 2 hours before admission
- **Risk factors:** arterial hypertension
- **Medication:** diuretics
- **Pre-existing diseases:** long-lasting infection of the upper respiratory tract 2 months before
- **Vital signs:** blood pressure 135-80mmHg, heart rate 95bpm, oxygen saturation 98%

Clinical case

Initial work-up

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- **ECG at admission**
 - Signs of left ventricular hypertrophy
 - Non-significant ST-elevation in the anterior leads

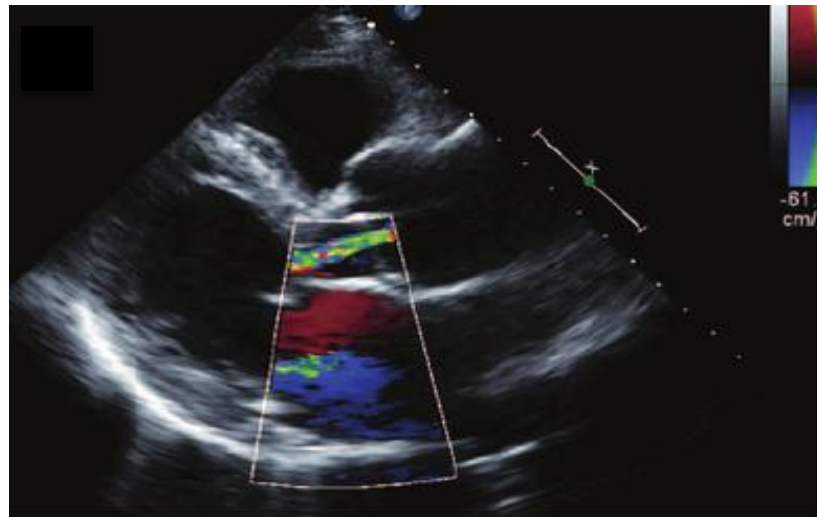


Clinical case

Initial work-up

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- ECG at admission
- TTE at admission
 - Left ventricular hypertrophy
 - Normal ejection fraction without any wall motion abnormalities
 - Mild insufficiency of the aortic valve
 - Aneurysm of the ascending aorta of 5.2cm in diameter



Clinical case

Initial work-up

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- **ECG at admission**
- **TTE at admission**
- **Laboratory tests**
 - High-sensitive troponin T: 0.035ng/ml
 - D-dimers:
0.7mg/ml



Clinical case

Differential diagnoses

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- **Acute aortic syndrome**

- Pro: aneurysm of the ascending aorta, non-ischemic pain, D-dimers

positive

- Contra: no severe pain, no neurological signs, no malperfusion

- **Acute coronary syndrome**

- Pro: therapy resistant chest pain, high-sensitive troponin T within the observation zone

- Contra: atypical discomfort, no specific ischemic signs on ECG, normal EF, no regional wall motion abnormalities

Clinical case:

1. assumption: acute coronary syndrome

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- **Coronary angiography**

Clinical case:

1. assumption: acute coronary syndrome

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- **Normal coronary tree**
 - No stenosis, no obstruction, no culprit lesion

Clinical case

2. assumption: acute aortic syndrome

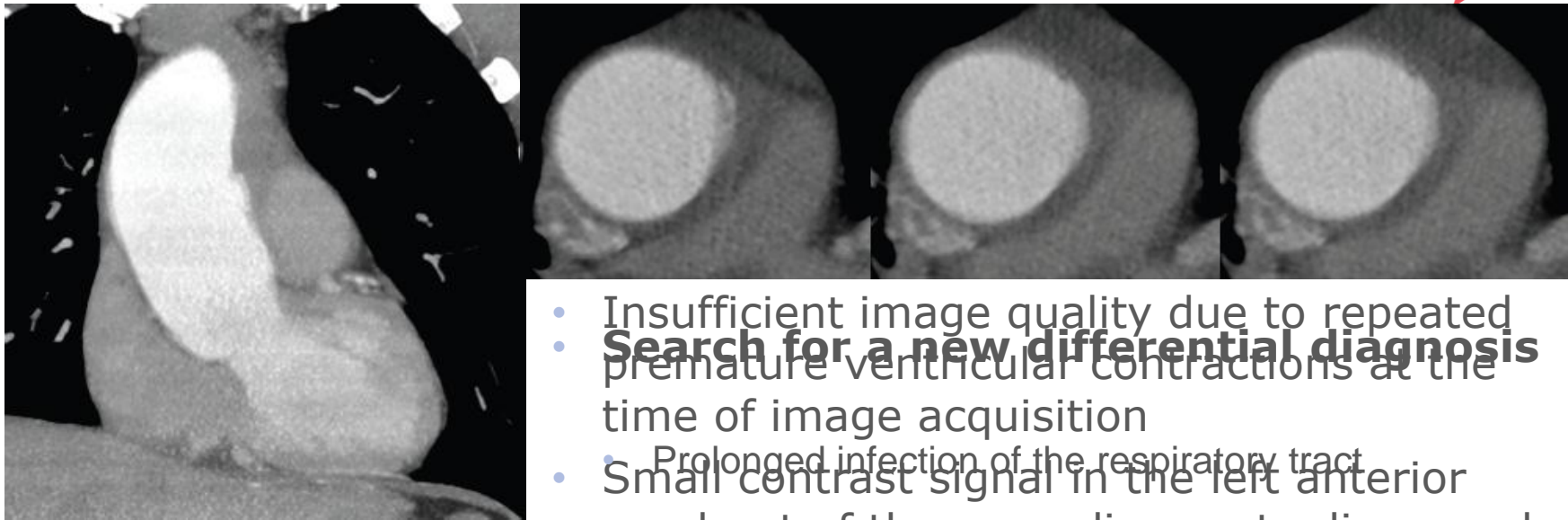
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- **Computed tomography of the aorta**



Clinical case

2. assumption: acute aortic syndrome



- Insufficient image quality due to repeated premature ventricular contractions at the time of image acquisition
- **Search for a new differential diagnosis**
- Prolonged infection of the respiratory tract
- Small contrast signal in the left anterior quadrant of the ascending aorta diagnosed as motion artifact

Clinical case:

3. assumption: myocarditis

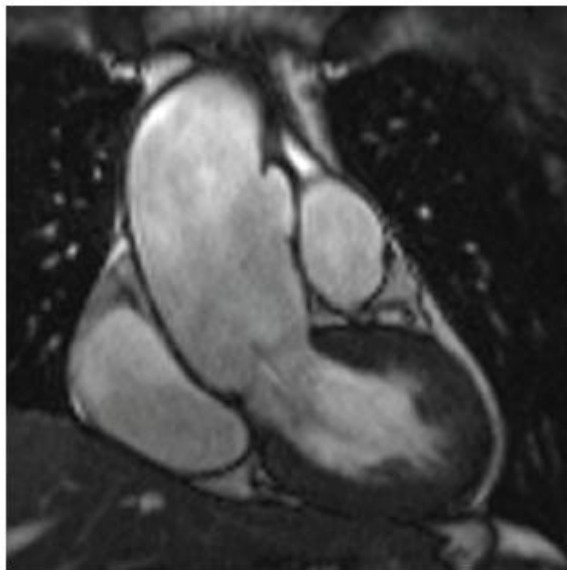
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- **Cardiac magnetic resonance imaging**

Clinical case:

3. assumption: myocarditis

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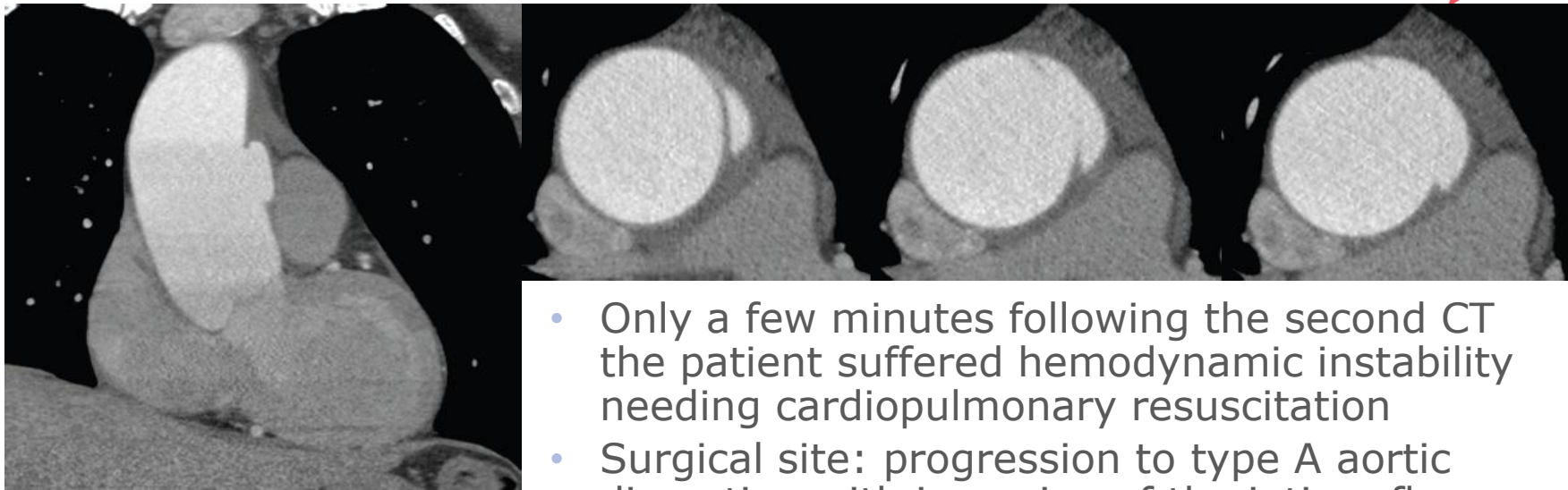


- **Double-oblique view of the cine-CMR**
 - Ulcer-like lesion superior to the aortic root (left anterior aortic quadrant)
 - Same location as within the initial suspicious CT
- **Confirmed by a repeated CT angiography of the complete aorta before surgery**

Clinical case

Final diagnosis: penetrating aortic ulcer

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- Only a few minutes following the second CT the patient suffered hemodynamic instability needing cardiopulmonary resuscitation
- Surgical site: progression to type A aortic dissection with inversion of the intima flap resulting in an occlusion of the supra-aortic limbs

Clinical case

Critical review

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- **Critics**

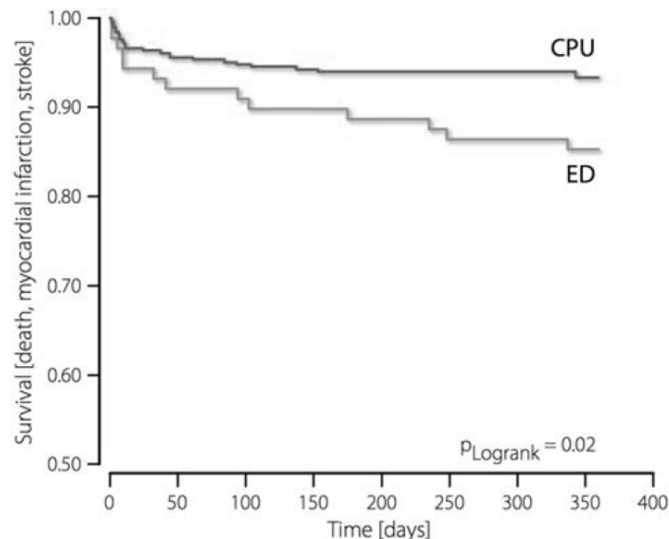
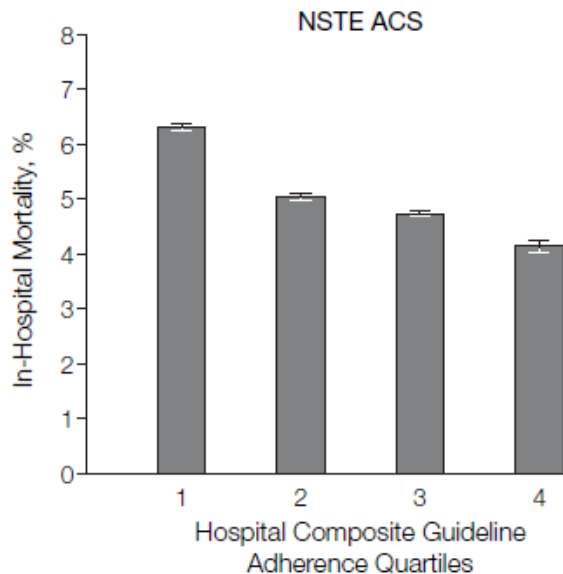
- Wrong initial triage with a life-threatening delay of therapy
- No risk scoring for acute aortic syndromes used, no further clinical evaluation (e.g. differences in blood pressure)
- A localized dissection membrane or ulcer-like lesion should have been assumed, but diagnosis failed by insufficient interpretation
- Second imaging study should have been performed at the time the first imaging was non-diagnostic (or alternative diagnostic measures) if the clinical suspicion remains high

- **Main problem**

- No dedicated pathway on AAS in place at this time teaching the aforementioned points

Process improvement Effects in chest pain patients

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ACS-Patienten sollten bevorzugt in ausgewiesenen „Chest Pain Units“ oder spezialisierten Intensivseinheiten aufgenommen werden.

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CPU pathways

Now we are better...

Chest Pain Unit (STEMI (ohne Vorankündigung))

Chest Pain Unit (Tropinoppe (LNI))

Chest Pain Unit (Stabile Angina pectoris)

Chest Pain Unit (Akute Lungenembolie)

Chest Pain Unit

Akutes Aortensyndrom



Klinik: stärkster Thoraxschmerz mit Ausstrahlung zwischen die Schulterblätter, plötzlicher Beginn mit starker Schmerzintensität und reißend/stechend/schneidendem Charakter

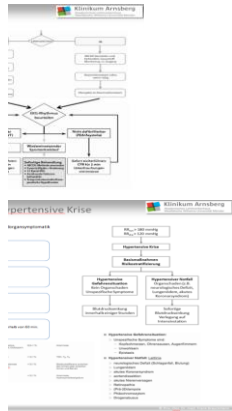
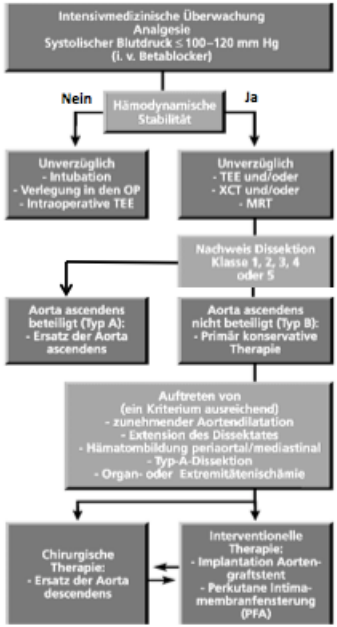
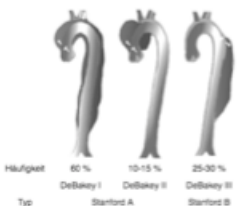
- Anamnese**
- Marfan-Syndrom/Erkrankungen des Bindegewebes
 - Positive Familienanamnese für ein Aortenaneurysma
 - Vorbekannte Aortenklappenkrankung
 - Vorbekanntes thorakales Aortenaneurysma

- Risikofaktoren**
- Pulsdefizit/Blutdruckdifferenz >20mmHg?
 - Fokal neurologisches Defizit in Kombination mit Schmerzereignis?
 - Herzgeräusch über der Aortenklappe?
 - Hypertensive Entgleisung oder Zeichen der Hypotension/Schock/Synkope?

- Diagnostik**
- Aufnahmeroutine-labor inklusive D-Dimer
 - Notfall-TTE (Dissektionsnachweis? AI? PE?)
 - Notfall-CT (EKG-getriggert, ggf. TAVI-Protokoll)
 - Notfall-TEE bei hämodynamischer Instabilität

- Primärtherapie**
- Hämodynamische Stabilisierung/Blutdruckmanagement
 - Abgrenzung von Typ-A- zur Typ-B-Dissektion sowie der Unterentitäten
 - Nach Diagnosesicherung: Sofortige Kontaktaufnahme zum Aortenzentrum, Westdeutsches Herzzentrum Essen
 - Organisation des Transports nach Schema

- Klasse 1** Klassische Dissektion mit enty und Membran
- Klasse 2** Mediaspaltung mit intramuraler Blutung
- Klasse 3** Intramurales mit diskreter Aussackung
- Klasse 4** Aortenriss nach Plaqueruptur
- Klasse 5** Iatrogene oder traumatische Dissektion



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CPU movement in Germany

Principles and timeline

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- **Main target:**
 - To ensure a systematic protocol-driven uniform standard-of care
- **Start:**
 - Dedicated certification criteria were worked out by the German Cardiac Society (GCS) in 2008
 - Key elements of certification include characteristic locations, equipment, diagnostic and therapeutic strategies, cooperations, staff education, organization
 - First update 2015

CPU certification

Elements of accreditation

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Table 1 Spatial requirements for the establishment of a CPU

Criterion	Minimum requirement
Rooms	Table 2 Technical requirements
Bed capacity	12-lead ECG
Access	Blood pressure measurement
Catheterization laboratory	TTE
Resuscitation/emergency concept	Rhythm monitoring Resuscitation

Table 6 Education and training of the CPU

Criterion	Minimum requirements	Additional recommendation
Physicians	At least 2 years internal medicine/cardiology experience, adequate intensive care experience, echocardiography training	Continuous presence of a specialist in the CPU "CPU Nurse" title
Consultant	Cardiologist	
Nurses	Special CPU training	Participation in the CPU registry
Training	Emergency training at least twice a year, case conferences	
Quality control	Feedback mechanisms for the quality of the diagnosis and therapy	

Additional recommendation

Additional algorithms

Table 5 Cooperations and partners of a CPU

Criterion	Minimum requirement
General emergency room	Available 24/7
Emergency outpatient clinic	Integration of the CPU in the existing emergency structures
Emergency physician	Preclinical STEMI program with direct transfer of the patient to the catheterization lab
Intensive care unit	Available 24/7; transfer time <15 min
Catheterization laboratory	Available 24/7, transfer <15 min
Radiology	Chest X-ray (available 24/7) CT (available 24/7)
Additional cooperations	Cardiovascular and thoracic surgery

MRI magnetic resonance imaging

Table 7 Organization of a CPU

Criterion	Minimum requirement	Additional recommendation
Supervision	Specialist in cardiology	Shift system guaranteeing the continual presence of a qualified staff member
Physician	Continual presence	
Consultants (cardiologists)	On call 24/7; response time <30 min	Continual presence
Nurses	Present 24/7; maximally a 4:1 patient-to-nurse ratio	

Acute echocardiography, ACS acute

CPU certification

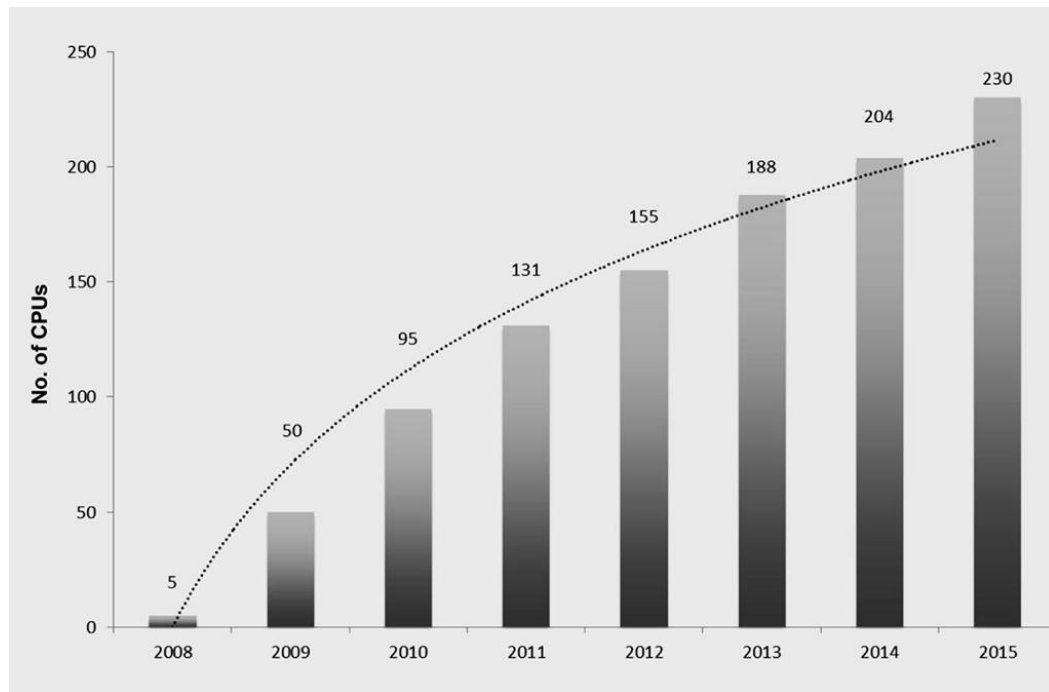
Process of accreditation

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- **Formal steps**
 - Application by the institution
 - Formal checkup of the pre-submitted documentation
 - Assessment of minimum requirements by an expert committee of the GCS
 - Review of the facility's application, infrastructure, patient care, and each of the requirements according to the consensus document by an audit team on site
- **Certification**
 - An expert committee of the GCS finally awards certification with or without further conditions

CPUs in Germany Development since 2008

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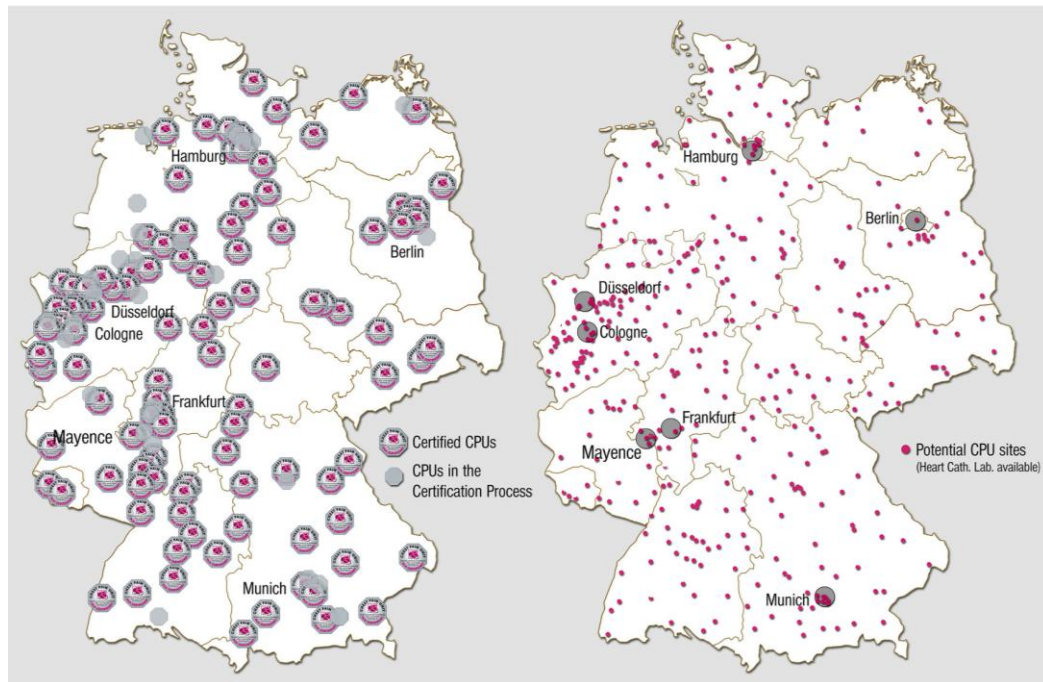


- **Goal:**
 - to implement a broad network in a minimum of time
- **Estimations of sites needed:**
 - initial: 300-400 sites
 - adapted: 250 sites
 - latest: 300 sites

CPUs in Germany

Certified sites and total cath lab locations

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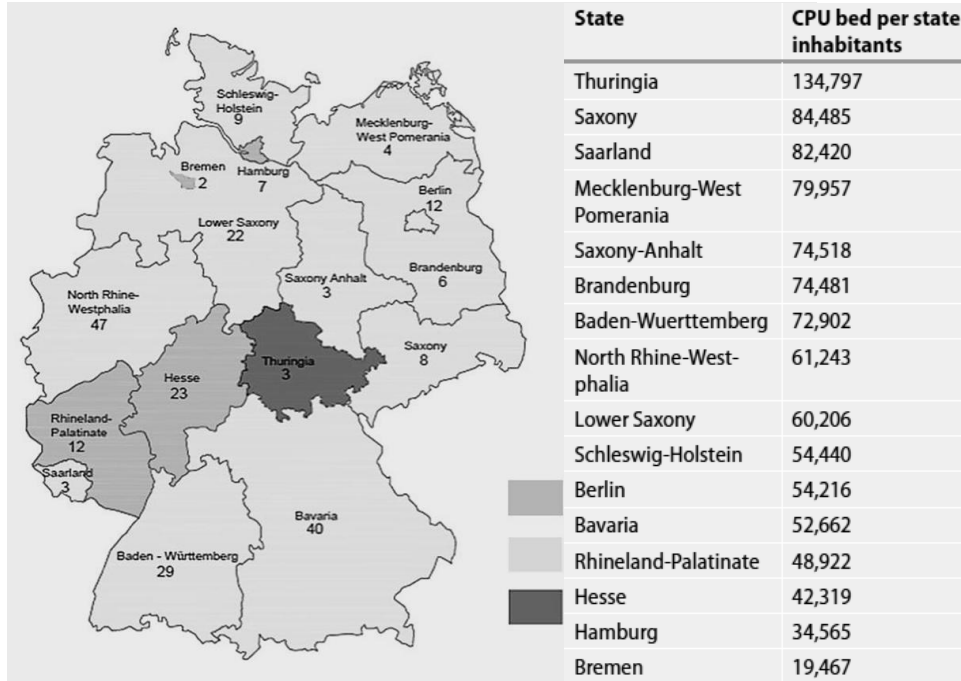


- **Current status end of 2016:**
 - 250 certified CPUs across Germany
 - first certified CPUs outside Germany (Switzerland, Austria)



CPUs in Germany

Local distribution and gap analysis



- **2008-2016 (230 identified sites)**
 - absolute number less decisive
 - 1392 designated CPU beds across Germany
 - than the identification of critical gaps and support of mostly average: 1 CPU bed per 65,000 nonacademic interventional hospitals
 - high number of CPUs and CPU bed capacities with the big cities and identification process
 - most CPUs in university and academic hospitals
 - certain undersupply in rural areas and some of the former eastern federal states

German CPU-Registry

A unique benchmarking tool

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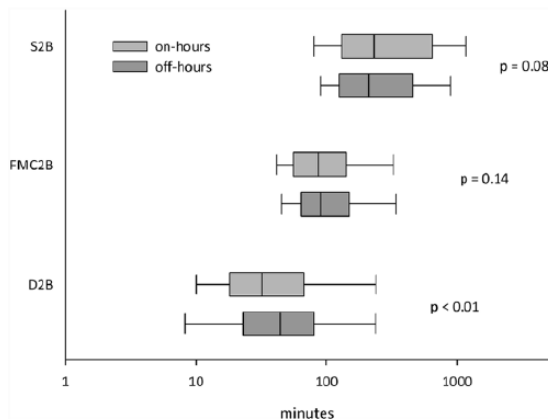
- **Established in December 2008**
 - Non-obligatory
 - Central data collection by the Institute for Myocardial Infarction Research Foundation Ludwigshafen (IHF), Germany
- **Data collection on**
 - Demographics, clinical presentation, laboratory and diagnostic testings, diagnoses, time frames and a 3-months follow-up interview
- **Data from 40 centers from 32 cities**
 - Real-world database on the diagnosis and therapy of ACS in Germany
 - Selection bias, only about 20% of the certified centers
- **To present, approximately 35,000 patients included**

CPU registry

Preclinical data

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- **Time intervals in STEMI patients:**
 - Symptom onset to admission: 128min (48-720min)
 - First medical contact to admission: 58min (35-118min)
 - High preclinical delay, low admission rate by EMS



- Better data for off-hours
 - Symptom onset to admission significantly shorter during off-hours, fewer patients waited longer than 4 hours (33.0% vs. 43.1%)
 - Low proportion of self-referrals (15%), first medical contact to admission below 45min

CPU registry

STEMI and troponin-positive NSTEMI-ACS

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- **STEMI - critical time intervals**
 - First medical contact to balloon time: 86min on-hours vs. 90min off-hours
 - Door to puncture time: 31min (11-75min)
 - Door to balloon time daytime: 32min (18-66min)
 - Door to balloon time off-hours: 44min (23-80min)
- **Troponin-positive NSTEMI-ACS**
 - Hospital admittance to intervention: 5h
 - Guideline-adherent timing of coronary angiography: 88% (especially in patients at very high risk)

CPU registry

Troponin-negative NSTEMI-ACS

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- **Time intervals**
 - hospital admittance to intervention: 22h
 - Urgent and early invasive strategy: 4:10h (7.7%)
 - Early elective invasive strategy: 22:34h (16.9%)
 - Late elective invasive strategy: 49:30h (12.4%)
- **Guideline-adherence**
 - Overall guideline-conforming timing of invasive diagnostics: 38.2%



CPU registry

Troponin-negative NSTEMI-ACS

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Outcome	High risk* (n=792)			Low risk** (n=366)			Overall guideline adherence (n=1158)		
	guideline-conform ^s (PCI)	undertreatment (conservative)	p-value	guideline-conform (conservative)	overtreatment (PCI)	p-value	adherent	inadherent	p-value
	[15.2%]	[53.2%]		[23.0%]	[8.6%]		[38.2%]	[61.8%]	
Death	1.1%	1.9%	0.47	0.4%	2.0%	0.12	0.7%	2.0%	0.08
Stroke	0%	1.0%	0.23	0.4%	1.1%	0.50	0.3%	1.0%	0.19
MI	0.7%	1.0%	0.74	0.4%	0%	0.53	0.5%	0.8%	0.60
MACCE	2.0%	4.1%	0.21	1.3%	3.3%	0.25	1.6%	4.0%	<0.05*
PCI	19.9%	6.9%	<0.0001*	2.2%	11.1%	<0.001*	9.3%	7.5%	0.32
CABG	0.7%	4.6%	<0.05*	1.8%	5.6%	0.07	1.3%	4.7%	<0.01*
Revascularisation	20.5%	11.0%	<0.01*	4.0%	16.7%	<0.001*	10.6%	11.9%	0.53
CV rehosp	29.1%	24.5%	0.25	7.5%	31.1%	<0.0001*	16.1%	25.5%	<0.001*
Total rehosp	35.8%	35.8%	1.00	20.0%	32.2%	0.08	29.3%	35.2%	0.13



CPU registry

Community outreach and awareness

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- **Problem**

- Still many patients misinterpret symptoms of ACS
 - Proportion of self-referral of up to one third
 - Self-referrals have a patient-related additional delay of 4h (even though 13% STEMI or NSTEMI patients)
 - Time interval between symptom onset and hospital admission: 4h
- Strengthening community outreach will remain a major emphasis within the CPU certification effort

CPU experience in Germany

Summary

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- **Very fast implementation of a nationwide CPU-network in Germany by the use of a uniform certification process**
 - >250 CPUs in less than a decade
 - Still need for a more balanced distribution across the country
- **Networking as a key step in the management acute chest pain**
 - Outpatient care, GPs, EMS, hospitals
- **Benchmarking necessary for process improvement**
 - Data collection of >35.000 patients in Germany already (CPU registry)
- **Time matters – in STEMI and beyond**
 - Necessity of guideline-adherence and adequate risk assessment for improvement of prognosis
- **Good data on quality-of-care in STEMI and NSTEMI patients**
 - Need for improvement in patients with troponin-negative NSTEMI-ACS and low-risk patients

CPU experience in Germany

Summary

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- **The formation of dedicated chest pain units improved and improves quality-of-care in chest pain patients**

Closing remark

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Thank you very much for your attention!