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

ACCA Masterclass 2017

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Disclosures

- Nothing to disclose
Structure - overview

• **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

• 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

- ECG at admission
  - Signs of left ventricular hypertrophy
  - Non-significant ST-elevation in the anterior leads
Clinical case
Initial work-up

• 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

• ECG at admission

• TTE at admission

• Laboratory tests
  • High-sensitive troponin T: 0.035ng/ml
  • D-dimers: 0.7mg/ml
Clinical case
Differential diagnoses

- **Acute aortic syndrome**
  - Pro: aneurysm of the ascending aorta, non-ischemic pain, positive D-dimers
  - 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

- Coronary angiography
Clinical case:
1. assumption: acute coronary syndrome

- Normal coronary tree
  - No stenosis, no obstruction, no culprit lesion
Clinical case
2. assumption: acute aortic syndrome

• 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
- 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

- Cardiac magnetic resonance imaging
Clinical case:
3. assumption: myocarditis

- 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

- 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

• 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

![Bar chart and survival curve showing effects of hospital composite guideline adherence on in-hospital mortality and cardiac events.](chart)

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

ACS patients should be preferentially admitted to designated "Chest Pain Units" or specialized intensive care units.

[www.escardio.org/ACCA](http://www.escardio.org/ACCA)  ACCA Masterclass 2017
CPU pathways
Now we are better...
CPU movement in Germany
Principles and timeline

- **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

<table>
<thead>
<tr>
<th>Table 1: Spatial requirements for the establishment of a CPU</th>
<th>Table 6: Education and training of the CPU</th>
</tr>
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<tbody>
<tr>
<td><strong>Criterium</strong></td>
<td><strong>Minimum requirement</strong></td>
</tr>
<tr>
<td>Rooms/n</td>
<td>Table 2: Technical requu</td>
</tr>
<tr>
<td>Bed capacity</td>
<td><strong>12-lead ECG</strong></td>
</tr>
<tr>
<td>Access</td>
<td><strong>Blood pressure measurement</strong></td>
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<td>Catheterization laboratory</td>
<td><strong>TTE</strong></td>
</tr>
<tr>
<td>Resuscitation/ emergency concept</td>
<td><strong>Rhythm monitoring</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Resuscitation</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 5: Cooperations and partners of a CPU</th>
<th>Table 7: Organization of a CPU</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Criterium</strong></td>
<td><strong>Minimum requirement</strong></td>
</tr>
<tr>
<td>General emergency room</td>
<td>Available 24/7</td>
</tr>
<tr>
<td>Emergency outpatient clinic</td>
<td>Integration of the CPU in the existing emergency structures</td>
</tr>
<tr>
<td>Emergency physician</td>
<td>Preclinical STEMI program with direct of the patient to the catheterization lab</td>
</tr>
<tr>
<td>Intensive care unit</td>
<td>Available 24/7; transfer time &lt;15 min</td>
</tr>
<tr>
<td>Catheterization laboratory</td>
<td>Available 24/7, transfer &lt;15 min</td>
</tr>
<tr>
<td>Radiology</td>
<td>Chest X-ray (available 24/7)</td>
</tr>
<tr>
<td></td>
<td>CT (available 24/7)</td>
</tr>
<tr>
<td>Additional cooperations</td>
<td>Cardiovascular and thoracic surgery</td>
</tr>
<tr>
<td></td>
<td>Other medical specialties</td>
</tr>
</tbody>
</table>

*MRI*: magnetic resonance imaging

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CPU certification
Process of accreditation

• **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

• 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

- 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

- Absolute number less decisive than the identification of critical gaps and support of mostly nonacademic interventional hospitals
- High number of CPUs and CPU bed capacities within the big cities and academic hospitals
- Certain undersupply in rural areas and some of the former eastern federal states

### CPU bed per state inhabitants

<table>
<thead>
<tr>
<th>State</th>
<th>CPU bed per state inhabitants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thuringia</td>
<td>134,797</td>
</tr>
<tr>
<td>Saxony</td>
<td>84,485</td>
</tr>
<tr>
<td>Saarland</td>
<td>82,420</td>
</tr>
<tr>
<td>Mecklenburg-West Pomerania</td>
<td>79,957</td>
</tr>
<tr>
<td>Saxony-Anhalt</td>
<td>74,518</td>
</tr>
<tr>
<td>Brandenburg</td>
<td>74,481</td>
</tr>
<tr>
<td>Baden-Württemberg</td>
<td>72,902</td>
</tr>
<tr>
<td>North Rhine-Westphalia</td>
<td>61,243</td>
</tr>
<tr>
<td>Lower Saxony</td>
<td>60,206</td>
</tr>
<tr>
<td>Schleswig-Holstein</td>
<td>54,440</td>
</tr>
<tr>
<td>Berlin</td>
<td>54,216</td>
</tr>
<tr>
<td>Bavaria</td>
<td>52,662</td>
</tr>
<tr>
<td>Rhineland-Palatinate</td>
<td>48,922</td>
</tr>
<tr>
<td>Hesse</td>
<td>42,319</td>
</tr>
<tr>
<td>Hamburg</td>
<td>34,565</td>
</tr>
<tr>
<td>Bremen</td>
<td>19,467</td>
</tr>
</tbody>
</table>
German CPU-Registry
A unique benchmarking tool

- 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

- **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 NSTE-ACS

- **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 NSTE-ACS**
  - Hospital admittance to intervention: 5h
  - Guideline-adherent timing of coronary angiography: 88% (especially in patients at very high risk)
CPU registry
Troponin-negative NSTE-ACS

• **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 NSTE-ACS**

<table>
<thead>
<tr>
<th>Outcome</th>
<th>High risk $^*$ (n=792)</th>
<th>Low risk $^*$ (n=366)</th>
<th>Overall guideline adherence (n=1158)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>guideline-conform (PCI)</td>
<td>undetreatment (conservative)</td>
<td>p-value</td>
</tr>
<tr>
<td>Death</td>
<td>15.2%</td>
<td>53.2%</td>
<td>0.47</td>
</tr>
<tr>
<td>Stroke</td>
<td>1.1%</td>
<td>1.9%</td>
<td>0.23</td>
</tr>
<tr>
<td>MI</td>
<td>0.7%</td>
<td>1.0%</td>
<td>0.74</td>
</tr>
<tr>
<td>MACCE</td>
<td>2.0%</td>
<td>4.1%</td>
<td>0.21</td>
</tr>
<tr>
<td>PCI</td>
<td>19.9%</td>
<td>6.9%</td>
<td>&lt;0.0001$^*$</td>
</tr>
<tr>
<td>CABG</td>
<td>0.7%</td>
<td>4.6%</td>
<td>&lt;0.05$^*$</td>
</tr>
<tr>
<td>Revascularisation</td>
<td>20.5%</td>
<td>11.0%</td>
<td>&lt;0.01$^*$</td>
</tr>
<tr>
<td>CV rehosp</td>
<td>29.1%</td>
<td>24.5%</td>
<td>0.25</td>
</tr>
<tr>
<td>Total rehosp</td>
<td>35.8%</td>
<td>35.8%</td>
<td>1.00</td>
</tr>
</tbody>
</table>

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CPU registry
Community outreach and awareness

- **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

- 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 NSTE-ACS and low-risk patients
The formation of dedicated chest pain units improved and improves quality-of-care in chest pain patients.
Closing remark

Thank you very much for your attention!