Neurocardiogenic Interaction

Elevated Troponin Levels and Takotsubo Cardiomyopathy Following Cerebral Seizure

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Disclosure Statement of Financial Interest

I, Frank Schneider, DO NOT have financial interest-/arrangement or affiliation with one or more organizations that could be perceived as a real or apparent conflict of interest in the context of the subject of this presentation.
Patient 55 years old, female, was admitted to the emergency room after experiencing a cerebral seizure:

- Epilepsy was known for years and treated with anticonvulsive medication
- Troponin was slightly elevated
- Patient did not complain about angina or dyspnea before or after the seizure
Case report – ECG

ECG Day 1

ECG Day 1
Case report – Coronary angiography
Case report – Ventriculography

Ventriculography, Diastole

Ventriculography, Systole
Diagnosis:
Takotsubo Cardiomyopathy after cerebral seizure

There are only few case reports describing cardiac complications or Takotsubo Cardiomyopathy after cerebral seizure
The interaction between heart and brain has been known for many years (especially in subarachnoid hemorrhage). The Takotsubo Cardiomyopathy is a new phenomenon which is most probably caused by an excessive release of catecholamines. It is also known that cerebral seizures coincide with an increased activation of the sympathetic nervous system.
Neurocardiogenic Interaction

Objective:
Are cerebral seizures responsible for inducing cardiac complications or even Takotsubo Cardiomyopathy?
Methods

- In 20 months 279 patients with cerebral seizures were admitted to our emergency room.
- In all patients troponin levels were quantified and an ECG was performed.
- This was done irrespective of any cardiac symptoms.
- In case of pathological findings, further diagnostic investigations as:
  - Echocardiography and
  - Coronary angiography were obtained.
Results

279 patients with seizure

Troponin negativ: 261 patients

Troponin positiv: 18 patients

No pathologic findings: 10 patients

Acute coronary syndrom: 3 patients

Takotsubo Cardio-myopathy: 5 patients
# Results

- **Troponin positive patients**

<table>
<thead>
<tr>
<th>No pathological findings</th>
<th>Acute coronary syndrom</th>
<th>Takotsubo Cardiomyopathy</th>
</tr>
</thead>
<tbody>
<tr>
<td>▪ 10 of 18 patients</td>
<td>▪ 3 of 18 patients</td>
<td>▪ 5 of 18 patients</td>
</tr>
<tr>
<td>▪ No pathological findings in echocardiography/coronary angiography</td>
<td>▪ Relevant stenosis in coronary angiography</td>
<td>▪ Postmenopausal women</td>
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<td>▪ PCI was performed</td>
<td>▪ Apical ballooning</td>
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<td>▪ Full recovery</td>
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Results – Troponin positive patients

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  - No pathological findings in echocardiography/coronary angiography

- Acute coronary syndrom
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- Takotsubo Cardiomyopathy
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  - Postmenopausal women
  - Apical ballooning
  - Prolonged QTc interval
  - Full recovery
Pathophysiology of elevated troponin

<table>
<thead>
<tr>
<th>Patients without further pathological findings (10/18):</th>
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<tbody>
<tr>
<td>▪ A combination of increased oxygen demand due to:</td>
</tr>
<tr>
<td>▪ Increased heart rate</td>
</tr>
<tr>
<td>▪ Increased myocardial contraction</td>
</tr>
<tr>
<td>▪ Elevated blood pressure</td>
</tr>
<tr>
<td>▪ Increased left ventricular afterload</td>
</tr>
<tr>
<td>▪ Mismatched with a</td>
</tr>
<tr>
<td>▪ Reduced oxygen supply due to the significantly</td>
</tr>
<tr>
<td>limited respiration during seizure</td>
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</tbody>
</table>
Pathophysiology of elevated troponin

Patients with acute coronary syndrom (3/18):

- Rupturing of coronary plaques as a result of the increased shear stress during seizure
- Seizure is a result of the acute coronary syndrome and is caused by a relevant arrhythmia
- Mismatch between oxygen demand and supply in patients with pre-existing stenosis of the coronary arteries
Pathophysiology of elevated troponin

Patients with Takotsubo Cardiomyopathy (5/18):

- Excessive catecholamine overload is induced by cerebral seizure
- Catecholamine overload refers to ventricular dysfunction (apical ballooning)
- Postmenopausal women are affected because of low estrogen levels
## Cases of Takotsubo Cardiomyopathy after cerebral seizure with complications:

<table>
<thead>
<tr>
<th>Author(s)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lemke et al.</td>
<td>reported on three women who had suffered from a cardiogenic shock</td>
</tr>
<tr>
<td>Weeks et al.</td>
<td>reported on a case with initial pulmonary edema</td>
</tr>
<tr>
<td>Wakabayashi et al.</td>
<td>showed a large left ventricular thrombus in one patient</td>
</tr>
<tr>
<td>Stöllberger et al.</td>
<td>reported a rupture of the left ventricle which the patient did not survive</td>
</tr>
</tbody>
</table>
Take home message

Cerebral seizures can induce cardiac complications.

Patients do not typically experience symptoms of angina pectoris or dyspnea so these cardiac complications can easily be overlooked.

It is possible to detect neurocardiogenic interaction and Takotsubo Cardiomyopathy by using routine ECG and quantitative analysis of troponin levels in patients with cerebral seizure.
Thank you
Back up
SUDEP (Sudden unexpected death in epilepsy patients)

- 1 case / 1000 patients with seizure
- Death during or shortly after cerebral seizure

- Pathomechanism is not understood
- Possible explanations:
  - Autonomic disturbance (catecholamine overload)
  - Hypoxia
  - Side effect of anticonvulsive medication
Cardiac pathology of status epilepticus

- Comparison of autoptic results Mayo Klinik Rochester (1975–2003, 54 patients)

- Significant increase of contraction band necrosis after Status epilepticus

- Contraction band necrosis is induced by excessive catecholamine overload and following hypercontractibility

Manno et al, Ann Neurol 2005, 58; 954–9
Literature