Disclosure Information

I hereby declare that I have had business or personal interests in the following industrial enterprises since 1 September 2016:

Name of the enterprise / Nature of the interest

<table>
<thead>
<tr>
<th>Enterprise</th>
<th>Interest</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td></td>
</tr>
</tbody>
</table>
“Suspicious death” in neuropathology

B. Kubat
Questions asked

• Are there traumatic injuries
• Are the injuries inflicted or accidental
• When did the injury occur
• Have the findings contributed to or caused the death
• Do the findings support a cause of death
• Analysis of pre-existing disease (e.g. infection, dementia)
Basics

• Preferably whole fixed brain (spinal cord)
• Standard samples – hippocampus (2 levels), cerebellum, dentate nucleus, pons
• Other sampling – based on macroscopy and differential diagnosis
• Autolysis
Traumatic injuries

- Epi- and subdural hematoma (SDH)
- Subarachnoid hemorrhage (SAB) lesions / traumatic vascular lesions
- Disruption
- Contusion
- Intracerebral hematoma (ICH)
- Traumatic axonal injury
Epidural hematomas

• Mostly underlying temporal fracture → tearing of the medial meningeal artery
• Usually fresh blood
• Ca. 50-70 ml can cause fatal herniation
• No validated age estimation method

Measure the volume
SDH

• Rupture of a bridging vein
• Up to 250 ml in fatal herniation
• Evolution from fresh blood to neo-membrane

• Age estimation by histologic examination
• Analysis of additional aspects, e.g. vascular malformation, bleeding tendency
Infant, admitted to a hospital in deep coma and died short after

Brain MRI: bilateral SDH
SAB / traumatic vascular lesions

- Contusional bleeding
- Rupture – aneurysm or artery
- Dissection & thrombosis (vertebral a.)

Histologic investigation aiming at:
- Differentiation aneurysm – rupture – dissection $\rightarrow$ removal of blood clots and inspection prior to fixation
- Assessment of cerebellar/brainstem/spinal cord infarction
- Exclusion or diagnosis of vascular pathology, vasculitis, vasculopathy $\rightarrow$ sampling of intra- and extracranial arteries
Interpretation problems

• Trauma and rupture of saccular aneurysm – trauma induced or ‘spontaneous’?

  We do not know
  (the shorter the interval between trauma and symptoms the more likely caused by trauma)

• Trauma and vascular lesion in the presence of vasculopathy

  Ellers Danlos, Marfan, Fibromuscular dysplasia, Segmental arterial mediolysis, Novel mutations??
Female 48 years, stab injuries
intubation → right-sided brain infarction

- Moderate atherosclerosis
- 2 foci of dissection and thrombosis of the right carotid siphon

SAM ?

Stab wound
Male 44 years, blunt head trauma died on scene, SAB

Collagenosis?
Disruption

• Stab & gunshot wounds, bone fragments → macroscopic evaluation
  – Gunshot causes more damage than stabbing due to the shockwave
  – Only lesions of the (caudal) brain stem are always deadly (C1/C2 level)

• Compression/hyperextension of spinal cord → microscopic evaluation – subtle findings!
Male 54 years, motorbike accident
Contusion

- Hemorrhagic necrosis of the superficial brain tissue
- Location → coupé and coupé/contre-coupé lesions
- Histological age estimation is possible
  (Forensic Neuropathology and Associated Neurology, Oehmichen, Auer, Konig)
Traumatic ICH

• Often in the vicinity of a contusion
• Occurs often after a lucid interval of ca. 48 hours
• Differentiation from spontaneous ICH problematic ➔ histologic exclusion of intracerebral vascular pathology (small vessel disease and congophilic angiopathy)
• ‘Gliding contusions’ – small traumatic bleedings
Axonal injury (AI) in trauma

- Traumatic AI – long tracts (c. callosum, internal capsule, cerebellar peduncles)
- Hypoxic AI – ‘global’ in white matter
- Hypoxic neuronal changes (hippocampus, Purkinje cells and dentate nucleus, depth of sulci, basal ganglia, brain stem)
Microscopy of AI

- HE, Perls Fe, silverstain
- ICH – B-APP, NF, CD68
The concept of axonal injury
B-APP patterns

- Localized groups in predilection locations indicate trauma
- Wavy strands in the white matter indicate hypoxia
Contribution to the death

- Loss of brain function due to trauma – brain stem lesions
- Herniation – space occupying lesions or brain edema of any causes (e.g. trauma, hypoxia, intoxication)
- Long term functional disturbance – post trauma state
Herniation

- Brain weight is variable, the diagnosis of herniation must be based on weight and/or macroscopic findings
- Greenhall line – supratentorial herniation
- Cerebellar tonsils – variable anatomy
- Brainstem distortion and bleedings
Changes in non-cerebral CODs

- Exsanguination – hypoxic changes
- Strangulation – hyperemia
- Intoxications
Intoxications

- Usually only edema and nerve cell hypoxia
- Macroscopic red discoloration in carbon monoxide poisoning
- Occasionally symmetrical necrosis of the cerebral deep nuclei
Casus pro diagnosi

Diver – quick ascend from 45 m depth
Caisson disease
Thank you for your attention.