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Intracranial Injury with Severe Shaking Trauma: Spinal Subarachnoid Hemorrhage and Simon-bleeding of the Cervical Spine

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Abstract Nine-month-old baby girl has been a huge shock ambulance to the emergency room introduced. Radiological examination revealed evidence of spinal subarachnoid except hemorrhage (SAH) intracranial hemorrhage. Already in the examination were bruises on the face and torso. 4 days after the death of a child traumatic brain edema results. An unusual combination of weight change in the autopsy by the representative of the brain, spinal cord hemorrhage and Simon before cervical posterior longitudinal ligament bleeding made.

Keywords: Child abuse, Not Akzidentelles, Trauma in children, Postmortem Diagnosis, Spinal injury, Simon hemorrhage, Forensic Science.

In everyday life, the forensic pathologist is sometimes confronted with reservations on the part of doctors towards a comprehensive radiological diagnosis of suspected child endangerment (KWG). In suspected Shaken but may be a magnetic resonance imaging (MRI) allow -Investigating the skull including the craniocervical junction valuable information. If there is evidence a nichtakzidentelles traumatic brain injury, particularly in a Shaken despite the lack of externally visible injuries, the diagnosis should be in addition to the classical imaging techniques [computed tomography (CT) / MRI of the head] in principle also include the untersuchung of the spinal canal.

Basics

Shaken ("shaken baby syndrome", SBS) is a particularly serious form

of child abuse in infancy and early childhood. Since nichtakzidentelle injury in traumatic brain region may generally have many causes, beat the American Academy of Pediatrics in 2009 the term of maltreatment related craniocerebral trauma to the description at ("abusive head trauma", AHT;^[3]). For a comprehensive historical overview of nichtakzidentellen craniocerebral trauma in infancy and toddlerhood published Matschke^[15]. the specific case will be used in accordance with the German-speaking countries still largely conventional concept of shaken baby In the present work. In addition to the typical constellation of findings of intracranial injuries with subdural / Subarachnoidblutungen (SAB) and diffuse brain damage, retinal bleeding and occasional fractures is the involvement of the spinal canal with corresponding injuries possible^[2,9,16]. A literature review of published cases of

abuse was by Kemp et al.^[13] published; striking here was the significant delay in the diagnosis of spinal injury after initiation of treatment.

Case Report

Case history

The 9-month-old female infant was supervised by the friend of the child's mother and placed in the evening to sleep. Shortly after 22.00 the infant was screaming; the friend lifted the child out of bed. Here, a cloth fell off, which he would bend down with the child in her arms. The child had knocked back while back had slipped out of his hands and come up with his head first on the floor (carpet). The infant had "gaspd" "geroechelt" and. According to the friend he had then noticed a "convulsions" and placed the child on a sofa. He had found no longer breathing; muscle tone was flabby. Then he had

the child shaken vigorously in his own words, bitten and defeated, "to wake it". He carried out a mouth-to-nose resuscitation and informed by phone the child's mother and the paramedics.

Clinical findings

Upon arrival of the emergency doctor was a deep unconsciousness with apnea; it made the immediate bag ventilation and chest compressions. In the emergency room the infant was intubated immediately and resuscitation measures were continued. The circulatory situation was stabilized. Using the cranial CT scan emergency (emergency CCT), which was created in the primary hospital, a Subduralblutung and cerebral edema were diagnosed.

The child was transferred by rescue helicopter to the University Hospital Dresden for further treatment. During the investigation at the hospital admission discreetly visible hematoma in the left cheek (Fig.1), forehead, centered over both clavicles (Fig.2) and in the neck region found just below the hairline. Occipital scalp was a marked swelling of about 4 cm diameter with hemorrhage without further external injuries.

Diagnostic

Each non-accidental head injury, especially in Shaken, the investigation strategy should be interdisciplinary ^[4].

Radiological investigations

Cranial emergency CT of erstversorgenden device (about 1? Hours after the event). Bilateral supratentorial parietookzipitale subdural hematomas of about 0.5 cm wide and up in the interhemispheric fissure in reaching subdural hematoma. Suspected skull base fracture with intracranial air. A fracture or a busted seam can not be proved.

Magnetic resonance imaging of the skull and the brain, University



Figure 1. Hematoma of the left cheek



Figure 2. Hematoma of the left clavicle

Hospital (about 6? H after the event). Höchstgradiges supra- and infratentorial general edema. Reduced flow in the arterial intracranial vessels. Severe SAB supra- and infratentorial. Narrow subdural hematoma supra- and infratentorial to about 0.5 cm width. Narrow ventricular septum with small-pellucidum cyst (Fig.3).

Magnetic resonance imaging of the spine, University Hospital (about 6? H after the event). Findings: In the sagittal T2W MRI veritable signal intensity distribution throughout the spinal cord. Contrast reversal with hypointense representation of surrounding the spinal cord fluid from the upper cervical posterior sacral

up. Mitdargestellt: inconspicuous area of cervical vertebrae 1 to coccyx. Inconspicuous intervening intervertebral discs (Fig. 4).

Beurteilung: ausgeprägte SAB mit Blut im fast gesamten Duralsack. Kein Nachweis von Wirbelkörperfrakturen oder einer Myelopathie.

Ophthalmologic council

Anterior section on both sides inconspicuously. Papilla on both sides can not be seen because of central vitreous hematoma. Retinal right> left with severe hemorrhage, retinal but fitting. Suspected slight Terson syndrome.

Legal Medical Consilium

Hematoma in the facial area, on

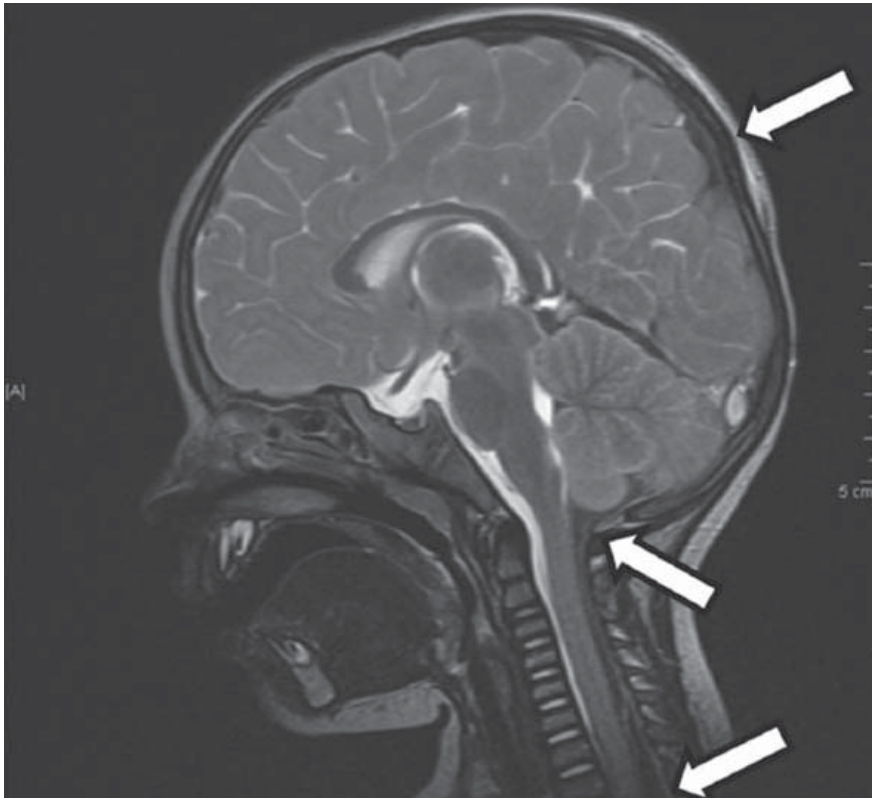


Figure 3. T₂ weighted magnetresonanztomogramm with presentation of the supra - and infratentoriellen subarachnoidblutungen (arrow), „abtropfen“ in foramen occipitale magnum (arrow), bleeding in cervical spinalkanal (arrow)



Figure 4. T₂ weighted magnetresonanztomogramm with representation of the subarachnoidblutungen (arrows) in the thoracic and the lumbar section of the spinalkanals

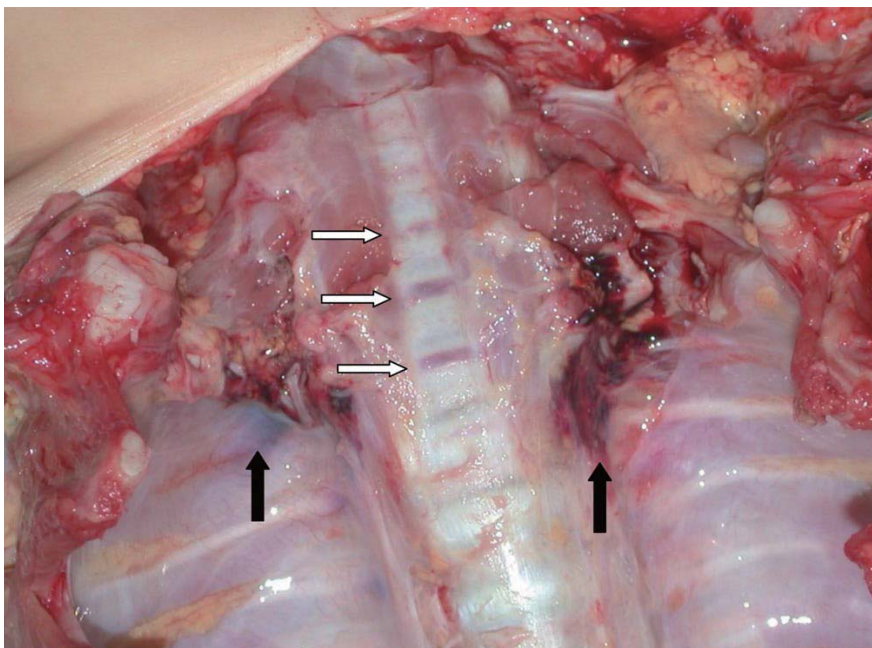


Figure 5. Simon - bleeding in the anterior längsband (white arrows) and pleurale unterblutungen the kostovertebralgelenke (black arrows)



Figure 6. Düralsack opened with subarachnoid bleed

both clavicles and neck and occipital swelling according to the clinical description.

Course

The child death 4 days after the event at clinically basis of the level of brain death as a result of a traumatic malignant brain edema.

Post-mortem findings

Ray of the skeletal system

Significant expansion of the cranial sutures at distinctive cerebral edema. In addition, a 2 to 3-month-old left-sided distal radius fracture. No evidence of further fractures.

Autopsy reports

In degradation of its sub bleeding skin of the forehead and the cheeks, the skull parietookzipitalen rind inside and the skin and the subcutaneous tissue over both clavicles. Strong lower bleeding pleura concerning

mutual Kostovertebralgelenken 1-2 and Simon hemorrhage (Fig.5) at the same height. Subdural hemorrhage and SAB SAB Intracranial and in the spinal canal, massive cerebral edema with Aufspaltung of the cranial sutures.

Neuropathological examination

Intra Vitaler brain death in severe multifocal hemorrhagic infarctions and occipital right-sided and two-sided frontobasal contusions with extensive brain edema. Cerebral and spinal SAB (Fig. 6, 7 and 8). Terson syndrome

both eyeballs (combination of corpus vitreous-retinal hemorrhage and bleeding).

Findings

In a Tatrekonstruktion the accused demonstrated the course of events described in a doll. Here, the description of the action by the Accused could assign the findings raised. The described initial fall of the infant from a height of about 130 cm upside down on the floor appeared to be appropriate for children surgical point of view, to

generate an initial loss of consciousness that had the accused then made to carry out the actions described (shaking, hitting, biting). At the hearing before the District Court in charge of negligent injury resulting in death, the accused was sentenced to a prison term.

Discussion

The typical finding combination of shaken baby has been widely described [9, 16]. In addition, it was reported on the incidence of epi- and subdural bleeding in the transition region C0-C1 and of vascular lesions of the extracranial segments of the vertebral arteries [6, 8]. Gruber u. Rozzelle [7] described the case a 4-month-old infant with subdural bleeding in the thoracolumbar region as a result of shaken baby. A comprehensive overview of spinal injuries to child abuse found in Knox et al. [14].

In the presented casuistry a heavy shaking trauma was present with an unusual combination of Terson syndrome-typical changes in both eyes, intracerebral hemorrhage, SAB in the spinal canal and Simon hemorrhage.

The mention of Simon-bleeding due to shaken baby found himself known to the authors of this paper yet in the literature. The first description by Simon in 1968 refers to haemorrhage of intervertebral discs at the front longitudinal ligament in the lumbar region due to Strangulationsprozessen [18]. The specificity of the finding was verified by other authors. Gserick et al. [5] found in a prospective study in approximately 10% of the observed 328 control cases Simon bleeding in various parts of the spine. This was caused primarily for a postmortem putrefaction and other vital over-stretching of the spine; only in 2 cases without awareness of acts of violence against

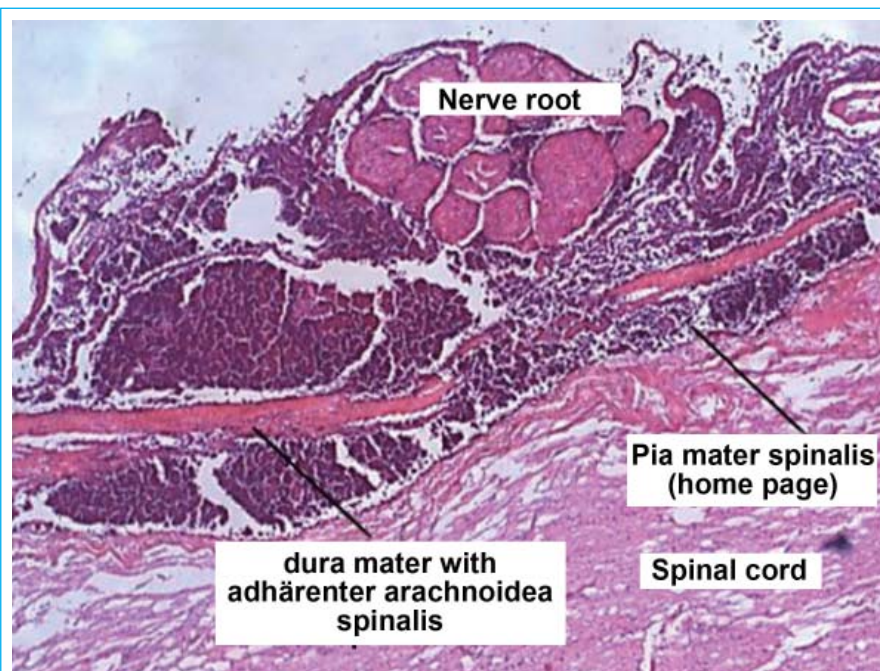


Figure 7. Hematoma of the left clavicle

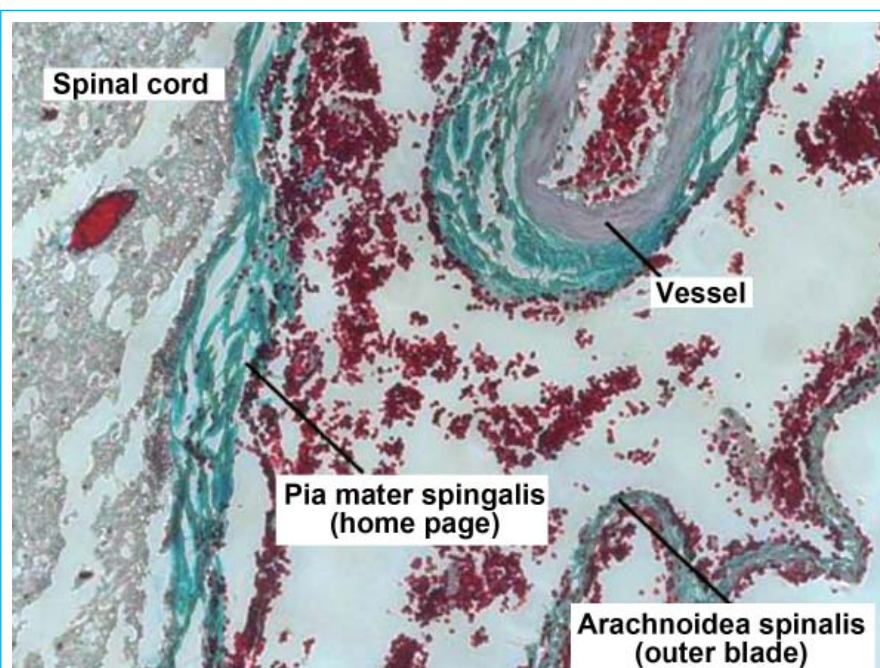


Figure 8. Hematoma of the left clavicle

the spine also Simon hemorrhage could be secured. Nikolić et al. [17] also investigated the occurrence of Simon hemorrhage in different causes of death. Noteworthy is the established relationship between the age of the deceased and the likelihood of occurrence of bleeding. As the cause of the occurrence of bleeding Simon-overstretching of the spine are considered, in cases of natural causes of death, they are considered to be extremely rare. The accused admitted a violent shaking of the infant with a touch on the upper body. About two clavicles were found corresponding handle violations (thumbprint tracks).

In the illustrated case report the origin of the observed changes by massive shaking with fixation of the child in the chest area is understandable to explain. The rigidity of the chest skeleton leads the vigorous shaking to hyperextensions in adjacent cervicothoracic and thoracolumbar transition region [7].

In the context of the ophthalmologic examination, the diagnosis of Terson's syndrome was provided, which was also confirmed in the neuropathological workup. The Terson syndrome is a combination of vitreal and retinal bleeding, usually in combination with the hemorrhage Optikuscheiden and intracranial hemorrhage. In general, it is consequences of a ruptured aneurysm. However, traumatic intracranial hemorrhage with brain abrupt increase in pressure can lead to intraocular bleeding [1, 12]. In the case at the massive intracranial pressure led to a widening of the cranial sutures. But it is the view of the authors, also in agreement with the literature, assumed direct traumatic bleeding into the retina and vitreous body [10].

In everyday life, the forensic

pathologist is sometimes confronted with reservations on the part of doctors towards a comprehensive radiological diagnosis of suspected KWG. The guideline of the German Society of Pediatric Radiology "suspected abuse - imaging diagnostics" [11] recommends that in cases of suspected Shaken an MRI scan of the skull, including the craniocervical junction. There the authors appear important principle in references to a nichtakzidentelles traumatic brain injury, particularly in a Shaken despite the lack of externally visible injury diagnosis in addition to classical imaging (CT / MRI of the head) should include an additional examination of the spinal canal.

Conclusion for practice

Each nichtakzidentellen traumatic brain injury, particularly in a Shaken, the investigation strategy should be planned interdisciplinary.

Spinal injuries are less common than intracranial injuries and can be "masked" by disturbances of breathing and / or consciousness; it should therefore be carefully designed in the involvement of the spinal canal.

A special risk of injury is in craniocervical or the thoracolumbar transition region.

The investigation must be based on the current guidelines.

Compliance with ethical guidelines

Conflict of interest. The authors state that there is no conflict of interest exists.

This post contains no studies on humans or animals.

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