

CASE REPORT

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Proof of a gunshot wound and its delayed effects 54 years post injury

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Abstract In 1945 a 6-year-old girl received a tangential gunshot injury to the left posterior inferior skull. After hospitalisation because of septicemia she was unable to walk for several months. Since 1967 she had been repeatedly applying for compensation because of pseudoneurasthenia and residual ataxia and many medical examinations were performed including X-ray, CT and MRI. Although certain objective findings (e. g. cerebellar atrophy) could be verified, a causal connection between the gunshot injury and the clinical findings could not be established. Therefore previous investigators concluded on a vascular origin of the disease. During the present re-examination of the patient, the authors found patch-like scars at the left posterior inferior skull base and behind the left ear, a cord-like scar formation in the subcutaneous tissue, connecting both skin scars, a gutter-like defect in the left occipital base of the skull and an indentation of the left mastoid process, both again in line between the skin scars and a large defect of the left cerebellar hemisphere. It could be concluded with certainty that the anatomical findings and the clinical symptoms were the direct result of a gunshot injury. Previous investigations had failed because of deficient investigations and techniques. In addition to an anatomical reconstruction, three dimensional reconstructions from CT scans proved most helpful.

Keywords Gunshot wound · Radiology · Computed tomography · Reconstruction

Introduction

In legal medicine, a major task can be the establishment of a causal connection between an old trauma and more

recent disease (Dorandeu et al. 1999; Kondo et al. 1999; Dreßler et al. 1999; Hausmann and Betz 2000). Old gunshot wounds to the head can be of importance if a neurological disease is present (Schrader 1941; Holzer 1943; Wölkart 1947). An extraordinary case is presented where the connection between an old gunshot wound to the head and a severe health damage was resolved 54 years post-injury.

Case report

A woman suffering from pronounced pseudoneurasthenia and residual ataxia had applied several times for recognition of a gunshot injury as a war wound. In May 1945, the then 6-year-old girl, her mother and sister had tried to hide from the advancing Soviet troops in the vicinity of Dresden and had found shelter in a basement together with other persons. After discovery, an exchange of fire had

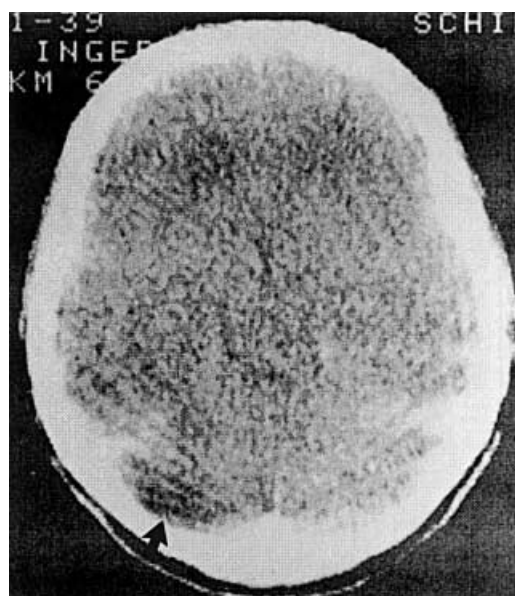


Fig. 1 First cranial computer tomography (CCT) in 1979 showing a hypodense lesion of the left cerebellum (arrow) not originally diagnosed. The left hemisphere is visualised on the left side of the picture, the poor quality is due to the original reproduction

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Fig.2 Recent CCT showing a large defect in the left cerebellar hemisphere



Fig.3 Recent CCT (bone window) showing an irregularly shaped defect in the left occipital bone

started which resulted in the death of all refugees except for her sister, who sustained a tangential gunshot wound and the girl herself. The residual records of the hospital she was admitted to several weeks after the incident only stated that she was treated from May to July 1945 for two gunshot wounds to the neck region and for wound infection and resulting sepsis.

In 1967, the woman first applied for a war pension. Scars to the neck and the left ear lobe and a bony defect of the left mastoid

process were diagnosed as resulting from an old gunshot wound restricted to soft tissues and a superficial part of the mastoid process. The application was rejected because of the lack of signs of brain injury. Numerous conventional x-ray images did not show any other bony injury. In 1979, a first cranial computer tomography (CCT) was performed (Fig. 1), which, according to the investigator, yielded no findings compatible with injury to the brain or the occipital base of the skull. In 1984, 1986 and 1988, several CCT and MR investigations showed a pronounced defect in the left cerebellar hemisphere. However, a non-traumatic vascular origin was postulated because this defect was judged to have been absent in 1979. Also, the investigators felt that the topographic correspondence of the defect with the supply of the posterior inferior cerebellar artery supported a vascular ischemic origin. The base of the skull was always described to be without pathological findings. In 1993, a radiological expert was instructed to re-examine the images produced so far. The cerebellar defect was verified but the expert was able to recognise this defect on some of the scans originating from the first investigation in 1979 (Fig. 1). He concluded that an occlusion of the posterior inferior cerebellar artery was present, which possibly was of traumatic origin. However, it was explicitly stated that the scans did not show a corresponding defect at the base of the skull and several experts subsequently denied the possibility of traumatic gunshot effects because of the lack of bony injury. Recently, we were instructed to reinvestigate the case.

Major complaints. Unsteady walk and frequent falls, vertiginous attacks, headache similar to migraine, sleep disorder, panic attacks including sparkling in the eyes.

Neurological findings. End position nystagmus, lateropulsion in the Romberg test, minor ataxia in pointing tests, intense vegetative stigmatisation including hyperhidrosis and positive dermographism.

Physical findings. A round flat scar of approximately 1 cm in diameter left of the midline in the upper back of the left neck; a star-shaped scar on the left earlobe and the postauricular region, approximately 2 cm in diameter; a palpable bony indentation of the dorsal aspect of the mastoid process.

CCT findings. A duct-like subcutaneous scar formation connecting the scar at the back of the neck and that of the left postauricular region; a large and irregularly shaped defect of the left cerebellar hemisphere reaching from basal aspects to the tentorium (Fig. 2); a gutter-like defect in the occipital base of the skull (Fig. 3); a bony indentation of the dorsal aspect of the left mastoid process with a surrounding increase of bone density.

A three-dimensional reconstruction of the CT-scans (Fig. 4 a, b) demonstrated that the cerebellar defect corresponded exactly to the bony defect in the occipital base of the skull. The CT scans originally produced in 1979 were also re-examined. Not only was the cerebellar defect visible as a zone of hypodense lesion (Fig. 1) but the defect at the base of the skull could also be assumed, at least in retrospect. Extensive neurological investigations had yielded no findings which could have caused ischemia of the brain by natural causes, e.g. stenosing arteriosclerosis or thrombosis of vessels.

Discussion

The old gunshot injury and its effects were disputed for more than 30 years. After examination of the patient, re-examination by CCT and re-evaluation of previous CCT and MR scans, it was obvious that the shot channel of the perforating gunshot to the head involved the subcutaneous tissue below the base of the skull (channel-like scar formation), the occipital base of the skull (gutter-like defect) and the basal aspects of the left cerebellar hemisphere.

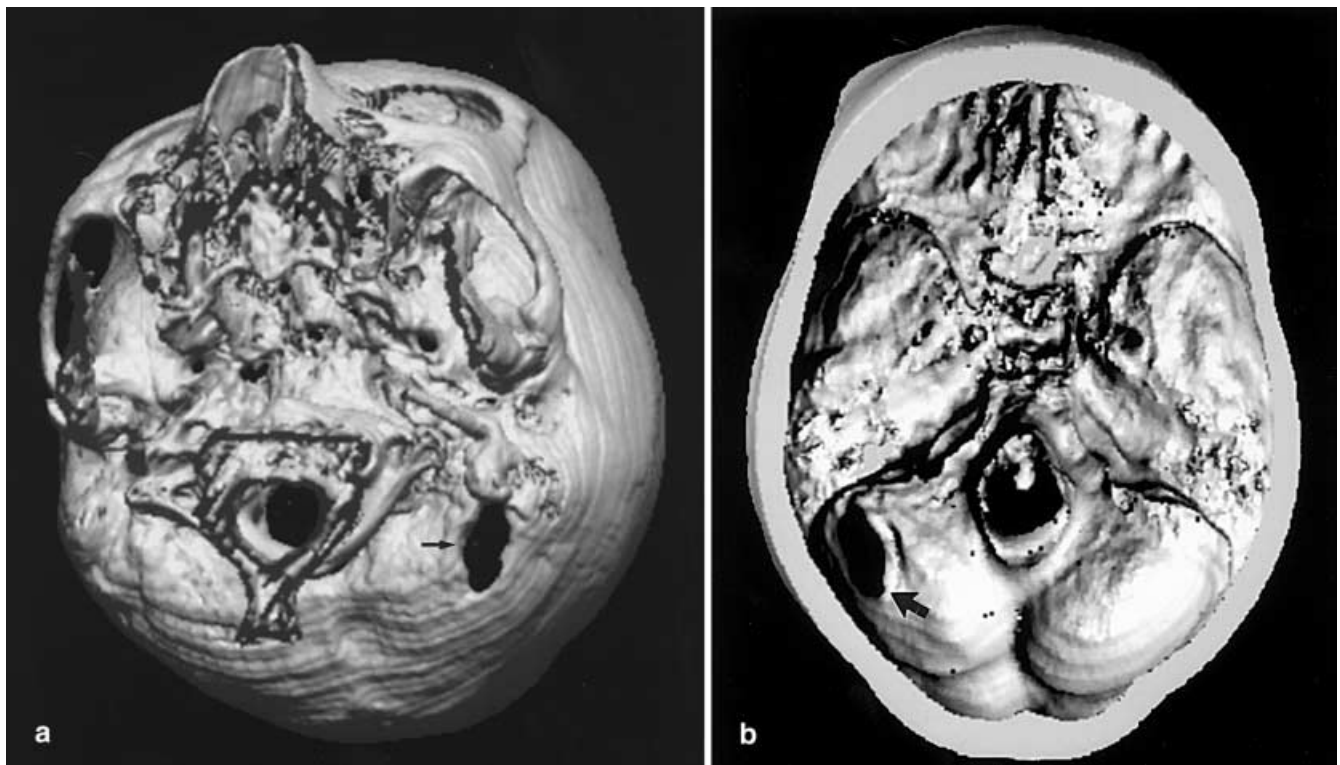


Fig. 4 Three-dimensional reconstruction of CT-scans (*bone window*) showing a channel-like defect (*arrows*) in the occipital base of the skull resulting from the gunshot, **a** exterior view, **b** interior view

This conclusion had also been possible from connecting the entrance wound in the neck and the exit wound at the ear because the connecting line passed through these structures. The direct crush of tissue by the bullet and the stretching and contusion of the surrounding tissue by the temporary cavity (Karger et al. 1998) may have been supported by injury to the posterior inferior cerebellar artery and resulting ischemia. Also, wound infection had been present according to the hospital records, which resulted in a zone of hypodensity still visible in the mastoid process. Discharge from the infected wound had possibly expelled any bone or bullet fragments, which may have been originally present.

So there is the following indisputable evidence:

- That there was an old perforating gunshot wound to the head involving a channel-like defect to the left occipital base of the skull
- That the basal cerebellar defect documented in several CCT investigations was produced by this very gunshot and
- That the long-existing pseudoneurasthenia and the residual ataxia were a result of this brain injury.

The absence of pronounced neurological symptoms, especially ataxia, is due to powerful compensation mechanisms in children – the patient remembered that she was unable

to walk and had to be carried along in a pram for several months post-injury. The progress in imaging techniques made it possible to prove the traumatic origin of the neurological disease and the woman was granted a war pension.

References

- Dorandeu A, Perie G, Jouan H, Leroy B, Gray F, Durigon M (1999) Histological demonstration of haemosiderin deposits in lungs and liver from victims of chronic physical child abuse. *Int J Legal Med* 112:280–286
- Dreßler J, Bachmann L, Koch R, Müller E (1999) Estimation of wound age and VCAM-1 in human skin. *Int J Legal Med* 112: 159–162
- Hausmann R, Betz P (2000) The time course of the vascular response to human brain injury – an immunohistochemical study. *Int J Legal Med* 113:288–292
- Holzer FJ (1943) Zur Beurteilung von Hirnsteckschüssen mit zwei kasuistischen Beiträgen. *Dtsch Z Ges Gerichtl Med* 37:136–143
- Karger B, Puskas Z, Ruwald B, Teige K, Schueirer G (1998) Morphological findings in the brain after experimental gunshots using radiology, pathology and histology. *Int J Legal Med* 111: 314–319
- Kondo T, Oshima T, Eisenmenger W (1999) Immunohistochemical and morphometrical study on the temporal expression of interleukin-1 α (IL-1 α) in human skin wounds for forensic wound age determination. *Int J Legal Med* 112:249–252
- Schrader G (1941) Zur Begutachtung plötzlicher Spättodesfälle nach Kopfverletzungen im Weltkriege. *Monatsschr Unfallheilkd* 48:161–171
- Wölkart N (1949) Eine bemerkenswerte alte Schädelschußverletzung. *Beitr Gerichtl Med* 18:73–79