

CASE REPORT

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Traumatic origin of a meningioma?

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Abstract The case of a 41-year-old pregnant woman is reported who was found dead in her apartment 5 months after she had suffered a severe head injury due to a car accident. At autopsy, a meningioma (4 cm in diameter) was found localized in the right parieto-temporal region which had probably caused an epileptic seizure leading to central dysfunction and to death. The criteria concerning the diagnosis of a traumatic meningioma are discussed. In the present case, a causal connection between a former head trauma and the development of the tumor had to be refuted.

Key words Meningioma · Trauma · Causal connection · Pregnancy

Introduction

The question whether severe head injury can induce the development or enhance the growth of intracranial tumors is still of considerable forensic importance. According to Zülch [15] a causal connection can be assumed under the following conditions:

1. Well-being of the patient before trauma
2. Relevant head injury in the past history
3. Correspondence in localization of violence and tumor
4. Adequate time-relationship between violence and development of the tumor
5. Histological differentiation of the tumor from meningeal scars
6. Trauma as a case of injury in definition of insurances

In spite of these clearly defined criteria the forensic assessment of a causal connection can be problematic as the following case report shows.

Case report

A 41-year-old pregnant woman (4th month of pregnancy) was driving a car which veered from the road and collided with a tree. She suffered fractures of the facial bones, of ventral and lateral parts of the right maxillary sinus and of the superior parts of the right orbita. The evaluation of the cranial computer tomography (CCT) which was performed immediately after the accident revealed no signs of intracranial bleeding or a tumor but diffuse edema of the brain. After 7 days of unconsciousness she recovered and was discharged approximately 1 month later with intact pregnancy but residues of an adult respiratory distress syndrome. She was found dead in her apartment 5 months later without any preceeding clinical symptoms.

Autopsy findings

- Granular osseous depositions at the tabula interna in parieto-temporal areas of the skull, at the base of the skull and at the left coronary suture typical for healed fractures
- Plum-sized meningioma in the right parietal region immediately adjacent to the granular osseous depositions of the skull (Fig. 1)
- Considerable atrophy of the right hemisphere obviously caused by tumor growth (Fig. 2)
- Signs of increased brain pressure
- Bite mark at the left margin of the tongue, dilatation of urinary bladder and rectum
- No evidence of old brain contusions
- Extensive petechial hemorrhages in both eyelids and the conjunctiva
- Pregnancy with a male stillborn in utero

An unambiguous cause of death could not be established but the brain findings, the bite mark of the tongue, the dilatation of urinary bladder and rectum, and the extensive petechial hemorrhages indicated that a central dysregulation due to epileptic seizure was probable. The neuropathological examination of the tumor revealed the diagnosis of a meningioma showing calcified central parts and development of a tumor-induced local atrophy in the corresponding parts of the brain with resulting diffuse edema and ischemic lesions of the neurons. Histologically, the thickened parieto-temporal areas of the skull showed considerably enlarged lamellar trabeculae of spongiosa. Near the dura mater, an additional layer of newly-formed incompletely differentiated bone including small infiltrates of tumor cells was observed as it occurs following osseous reaction to meningioma. The histological examination of the tumor revealed no indication for malignancy. Furthermore, no signs of a healed fracture could be detected.

Fig. 1 Meningioma with a maximum diameter of approximately 4 cm and adjacent parts of the dura mater

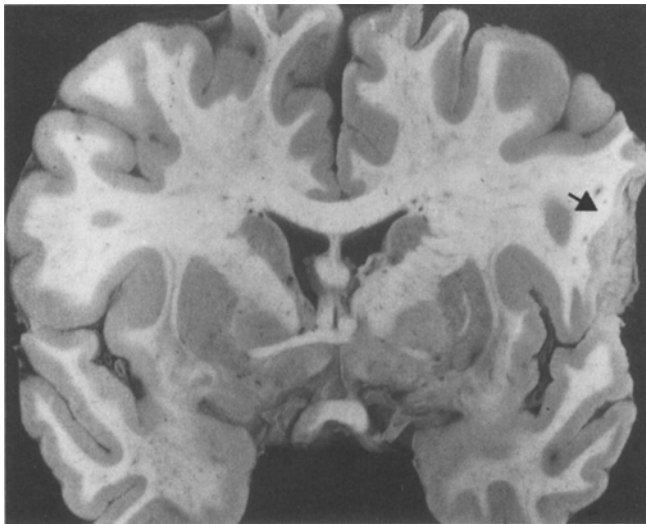
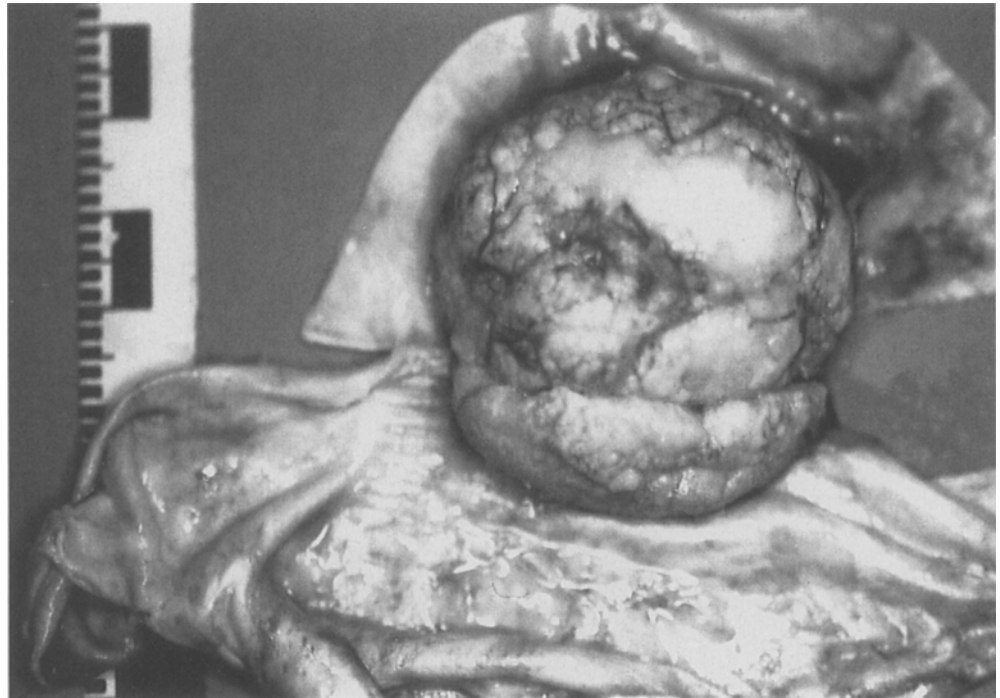


Fig. 2 Tumor-induced atrophy of the right hemisphere (see arrow)

Discussion

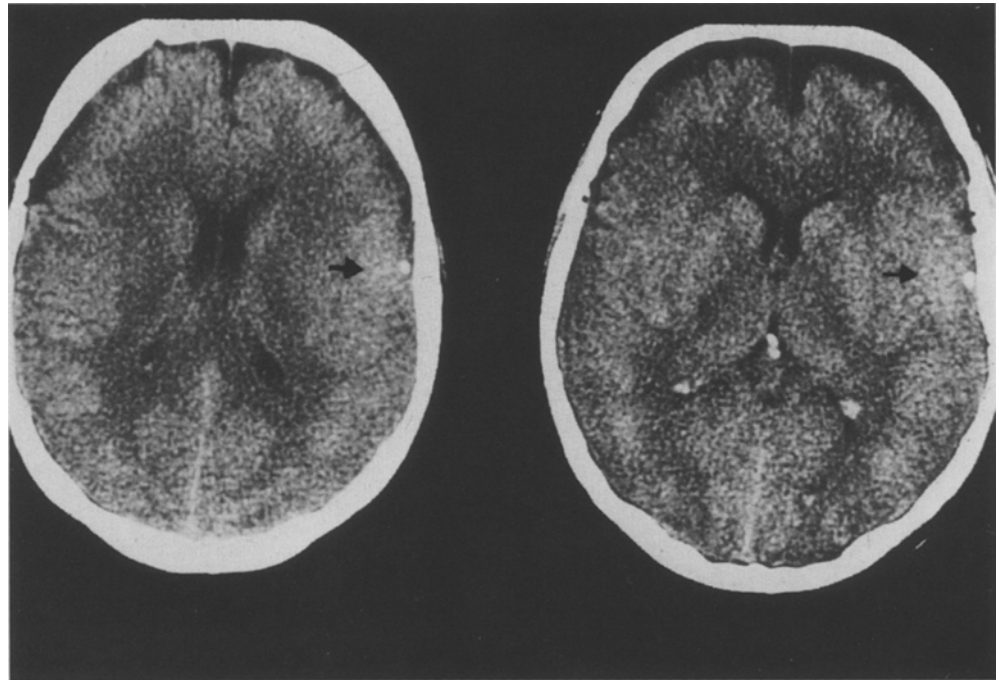
Besides chromosome abnormalities [14], viral infections [3, 6, 11], intracranial foreign bodies [10] and radiation [12, 13], severe head injury is assumed to be a rare but possible cause of meningioma development [1, 9]. In particular a traumatic event in the past history can result in a forensic assessment of a causal connection with considerable financial consequences for insurances or the patient's relatives.

A causal connection may be assumed if all criteria described by Zülch [15] are realized. In our case, neurological symptoms were absent before the day of the accident

and before death, excluding the time-interval necessary for complete recovery, suggesting that the first criterium was fulfilled. On the other hand, it must be taken into consideration that the unexplained deviation from the road leading to the accident could have been caused by an epileptic seizure especially with respect to a 7-day interval of unconsciousness without apparent brain injury or intracranial hemorrhage and even without neurological residues. An adequate head injury was unambiguously given in form of fractures of the facial bones but a topographical relationship to the localization of the meningioma in the right parieto-temporal skull was not realized. However, it could not be excluded that a small fracture line was not noticed and then a relationship between violence and the diagnosed meningioma could not be refuted without further information. The careful evaluation of the CCT from the day of the accident, however, revealed a suspicious hyperdense area with a central calcification corresponding to the location of the subsequently detected tumor. Furthermore, the CCT showed – in contrast to the contralateral part – no typical gyral pattern but distinct ossifications at the site of the meningioma (Fig. 3) which were not described in the original examination. Therefore, it must be concluded that the tumor was already present on the day of the accident and so a causal connection has to be refuted. Additionally, the histological examination of the thickened parts of the skull provided no evidence of healed fractures. The granular osseous depositions must be interpreted as a typical reaction to meningioma development and therefore, a relationship between violence and tumor can also not be established.

In the reported case, however, the discrepancy between the CCT findings and evidence of a meningioma with a maximum diameter of 4 cm 5 months later was astonish-

Fig. 3 CCT, immediately performed after accident: hyperdense area with central calcifications, thickened parts of the skull and absence of typical gyral pattern in the right parieto-temporal region (see arrow)



ing. But it must be emphasized that the real size of a tumor cannot exactly be determined by CCT without application of a contrast medium. A further aspect is that a connection between trauma and tumor seems questionable since it is not easily conceivable that a meningioma with a maximum diameter of 4 cm has developed in only 5 months. On the other hand, a considerable growth of the meningioma must have taken place which was probably induced by pregnancy. It is well known that meningiomas are predominantly observed in females and are often characterized by estrogen- and/or progesterone-receptors [5, 7] and mainly induce neurological symptoms during pregnancy due to hormonal stimulation [4, 8]. In this context, tumor growth seems to be mediated in particular by fluid retention and enhanced angiogenesis [2]. Even though an estrogen-/progesterone stimulated proliferation could not unambiguously be established in our case it seemed to be most probably that the volume increase of the meningioma was influenced by hormonal stimulation during pregnancy.

In summary, it must be emphasized that a causal connection between severe head injury and development of a meningioma can only be assumed if all criteria described in the literature are realized and if the time-interval between violence and tumor development seems to be adequate particularly with regard to type and size of the tumor.

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