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Pilocytic astrocytoma as a predominant component of a recurrent complex type DNT

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Abstract

Dysembryoplastic neuroepithelial tumour (DNT) is a benign lesion of the cerebral hemispheres usually presenting minimal biological activity after surgical excision. We report an unusual case of a 7-year-old girl with a temporal lobe DNT, which recurred four years after subtotal resection of the tumour. In the recurrent lesion we identified pilocytic astrocytoma (PA) as a predominant component of the tumour. Small pieces of the removed tissues also disclosed remnants of DNT. Clinical presentation of the primary tumour consisted of partial simple seizures, while the recurrent tumour manifested with headache and vomiting. Likewise, the radiological appearance of both tumours was different. We conclude that patients with incompletely removed DNT may suffer local recurrence of that tumour. In rare cases development of a secondary, histologically different neoplasm may also occur.

Key words: *brain tumour, dysembryoplastic neuroepithelial tumour, paediatric, pilocytic astrocytoma, seizure.*

Introduction

Dysembryoplastic neuroepithelial tumour (DNT) is a benign glial-neuronal neoplasm of the cerebral hemispheres occurring in children and young adults. Patients with DNT usually present with seizures, which in some cases result in a long-standing and intractable epilepsy [1,2,5]. Although DNT used to be referred to as a non-neoplastic hamartomatous lesion by some pathologists, reports on its recurrence support an alternative view indicating its truly neoplastic nature [9,10,12]. Malignant transformation of DNT has also been reported [4,13,14]. We present a unique case of a child with subtotal resection of DNT that recurred four years later with predominant pilocytic astrocytoma and only small remnants of otherwise typical DNT.

Case presentation

In July 1999, a 7-year-old girl with a 6-month history of partial simple seizures (clonic convulsions of the left facial muscles) was admitted to the hospital. CT scans revealed a hypodense lesion within the right temporal lobe. Neither other complaints nor abnormalities on the neurological examination were disclosed at that time. On magnetic resonance imaging (MRI) scans, the lesion was 5.5 × 5 × 5 cm in

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diameter and appeared hypointense on T1-weighted images. Post-contrast scans revealed only small focal enhancement (8 mm in diameter) in the postero-lateral part of the lesion. On T2-weighted images the lesion was hyperintense with preserved gyrus-like configuration. Neither mass effect nor brain shift was noted, although the temporal bone covering the lesion was deformed, thinned and bulging (Fig. 1).

The lesion was removed by a standard right temporal craniotomy. The tumour was poorly vascularized. As the border between the lesion and the normal brain was not clearly demarcated, subtotal resection was achieved. The postoperative course was uneventful.

The microscopic evaluation showed typical complex form of DNT. It was composed of a specific glioneuronal element with floating neurons within the small mucoid lakes (Fig. 2). Oligodendrocyte-like cells (OLCs) showed expression of S100 protein and OLIG2, whereas the neurons expressed synaptophysin. The glial component surrounded the specific glioneuronal component in a diffuse manner. It was composed of OLCs, but in contrast to typical oligodendroglioma, no branching network of capillaries was present. No piloid cells were identified. The clinical result of the surgery was satisfactory. Anti-epileptic drugs were gradually withdrawn in the following 3 months. No seizures have been observed during the 4-year follow-up. Taking into account the minimal biological activity of DNT second-look surgery was not performed, and the residual tumour has been controlled by periodic MRI scans (Fig. 3).

Four years later the patient started to complain of periodic headache, vomiting and numbness of left limbs. The neurological examination did not reveal any abnormalities. On MRI, a new lesion in the area of previous surgery was identified. The tumour was cystic with a small peripheral irregular solid part. It

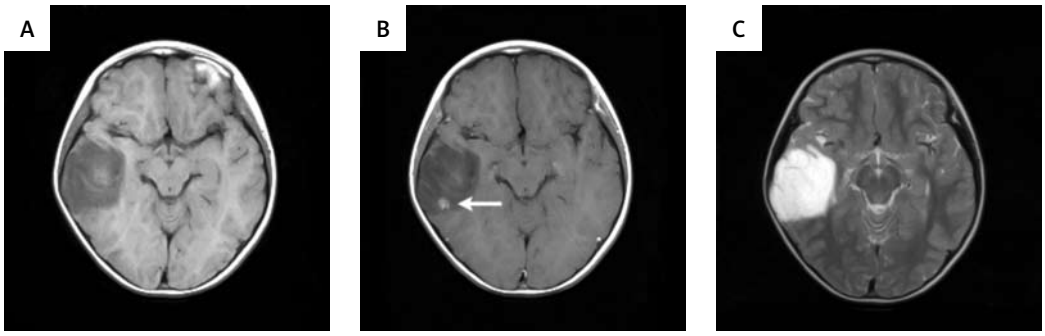

Fig. 1A-C. Preoperative MRI of dysembryoplastic neuroepithelial tumour of the right temporal lobe. T1-weighted image shows a hypointense inhomogeneous mass (A). After gadolinium administration focal contrast enhancement in the postero-lateral part of the tumour is visible (B). T2-weighted image reveals hyperintense mass retaining a gyrus-like configuration (C).

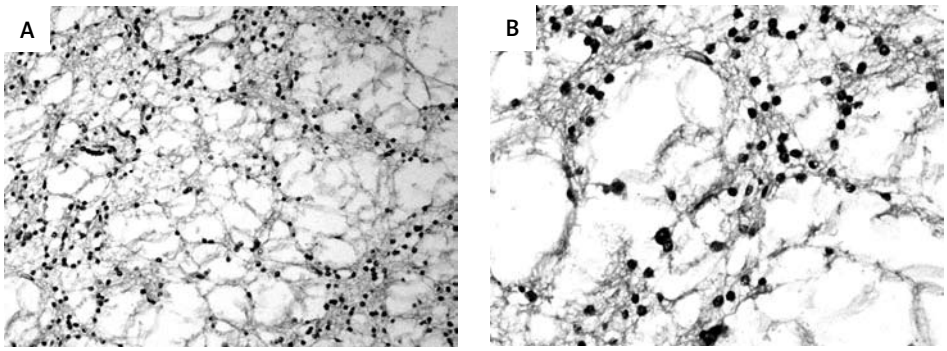

Fig. 2A-B. Histological appearance of the specific glioneuronal element in DNT (H&E) (A). Note small mucoid lakes with floating neurons surrounded by the neuropil background with oligodendroglial-like cells (B).

was 7 × 6 × 5 cm in diameter, and appeared slightly hypointense on T1-weighted images and hyperintense on T2-weighted images. Post-contrast scans revealed intense enhancement of the cyst wall and the solid part of the tumour. Moderate mass effect and brain shift were also noted (Fig. 4).

The patient underwent surgery via the same route as for the previous operation. This time, the tumour was well demarcated and highly vascularized. Gross total resection was achieved and the postoperative course was uneventful.

The microscopic evaluation of the recurrent lesion disclosed two distinct morphological patterns. The prevailing one was typical for pilocytic astrocytoma (PA) and showed elongated, "piloid" cells dispersed within the mucoid stroma (Fig. 5A). Some of those cells had a hyperchromatic, enlarged nucleus, but mitotic activity was basically absent. Scattered eosinophilic granular bodies were present (Fig. 5A). Some areas were composed of oligodendroglioma-like cells (Fig. 5B). Piloid cells had cytoplasmic expression of GFAP, whereas oligodendroglioma-like cells were GFAP-negative. Synaptophysin-positive cells were not identified in this portion of the tumour. The second component was identified only in a small portion of the tumour (approximately 10% of the total tumour bulk). It shared the same histological features with the primary lesion (glioneuronal element of DNT). However, hypercellularity and slight anisonucleosis of oligodendroglioma-like cells were striking (Fig. 6). No mitotic activity was found in that component. Immunohistochemical analysis of that part was not performed due to the lack of this component in the subsequent slide sections.

Five years after the second operation the patient was in a good condition, with no complaints or neurological disorders. No recurrence or residual tumour was visible on the control MRI scans.

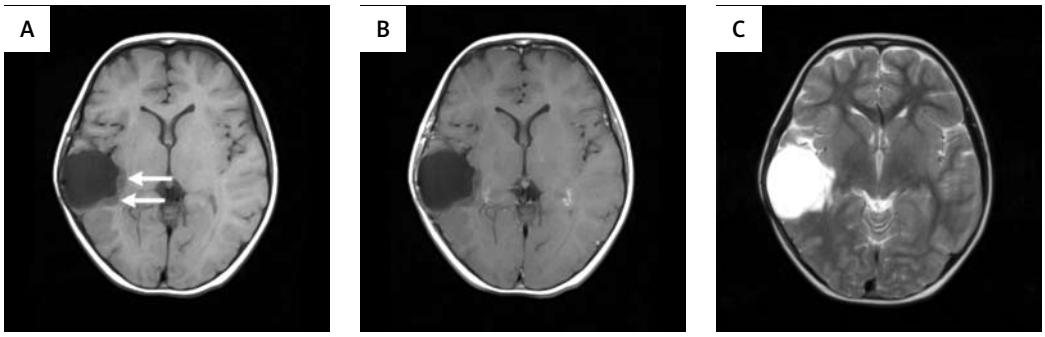

Fig. 3A-C. MRI after subtotal resection of DNT. T1-weighted image reveals small remnants of the tumour (A). After gadolinium administration no contrast enhancement is visible (B). T2-weighted image shows homogeneous hyperintense fluid signal (C).

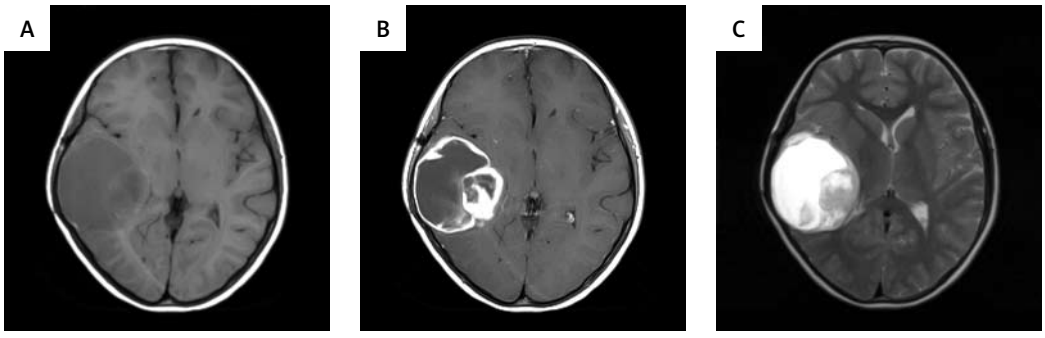

Fig. 4A-C. Preoperative MRI of pilocytic astrocytoma in the site of previous surgery. T1-weighted image shows hypointense inhomogeneous mass (A). After gadolinium administration, intense contrast enhancement of cyst wall and peripheral nodule is visible (B). T2-weighted image reveals highly hyperintense cystic part of the tumour and less hyperintense peripheral nodule (C).

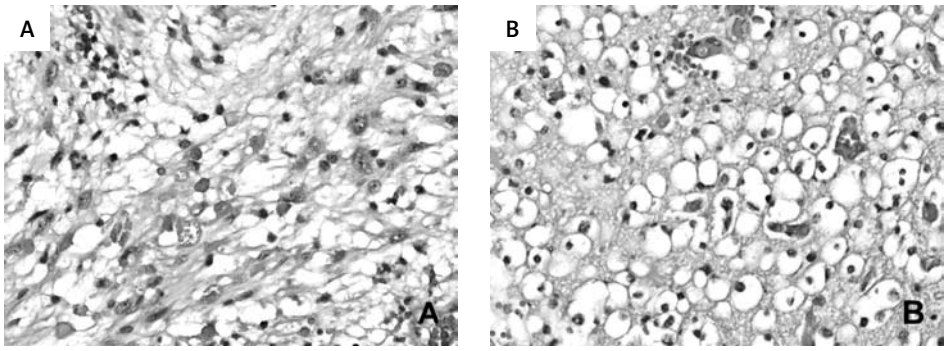

Fig. 5A-B. Histology of the recurrent lesion (H&E). Some areas of pilocytic astrocytoma contain eosinophilic granular bodies dispersed among the piloid astrocytes (A), whereas other areas share similarity with oligodendroglioma (B).

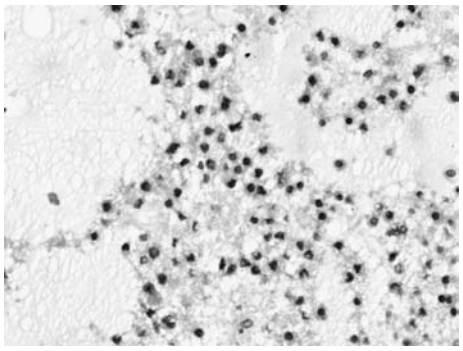

Fig. 6. Histology of the recurrent lesion (H&E). Only a small portion of the tumour tissue has features of DNT. Small mucoid areas are surrounded by a much more cellular population of oligodendroglial cells than in the primary tumour. The cells also show slight pleomorphism and hyperchromasia of the nuclei (compare with Fig. 2).

Discussion

Our case is the first showing development of PA as a main component within a regrowth of DNT. Both tumours had typical clinical and radiological features for the respective nosological entities. The radiological appearance of the primary tumour was characteristic of DNT [6,7,11], whereas that of the second tumour was pathognomonic for PA, the most common neuro-oncological entity in the paediatric population [3,8]. Clinical signs and symptoms of the two lesions also differed. The former, like all DNTs, caused epilepsy, while the latter was revealed due to the symptoms of intracranial hypertension. At the time of the original diagnosis of DNT, there were no radiological signs suggesting unusual clinical course of the disease.

DNT has areas composed of astrocytic, oligodendroglial and neuronal components. Theoretically, overgrowth of any of them may result in an independent tumour, as was disclosed in our case. This hypothetical sequence of events and the histological appearance also support neoplastic or preneoplastic nature of DNT. This was also confirmed by identification of DNT remnants identified within the recurrent lesion (Fig. 6). That component showed increased cellularity in comparison with the primary DNT, and this phenomenon was accompanied by slight cytological atypia of the oligodendroglioma-like cells. "Degenerative" atypia is a well defined phenomenon in "ancient" lesions, e.g., schwannoma or pilocytic astrocytoma. Nuclear atypia was also identified in the PA that recurred at the same location. All those findings may suggest that recurrent tumour developed from the remnants of a similar lesion that was not resected completely at the first surgery. This also suggests that resection of DNT may create a favourable local environment for astrocytic overgrowth, the DNT basically being effaced by the seemingly more vividly growing PA.

Slow radiological progression of untreated DNT as well as tumour recurrence after surgical excision, although rare, are well described [9,10,11]. However, "replacement" of DNT by another type of tumour is extremely rare. Only three cases of such a process have been described, all of them resulting in a malignant tumour. In the first case, the anaplastic astrocytoma in a 14-year-old boy arose at the site of a DNT three years after total resection followed by combined radiation and chemotherapy. Both treatment

modalities seem to be main factors in the process of induction of the malignancy [13].

In the second patient, the 14-year-old girl, a recurrent tumour developed 7 years after subtotal resection of DNT, showing signs of atypia: increased cellularity and pleomorphism, microvascular proliferations, elevated proliferative activity and cellular atypia not typical for WHO DNT [14]. Another case was a 29-year-old man, who developed grade IV glioblastoma 11 years after subtotal resection of DNT. In that case neither radiotherapy nor chemotherapy was applied, and a pure coincidence of two biologically different neoplasms (collision tumours) could explain this phenomenon [4]. Our patient, according to standards, was not treated oncologically after the first subtotal tumour resection. Thus, we think that either collision tumour theory may elucidate the pathogenesis of the recurrent lesion or, hypothetically, we assume that incomplete DNT resection made suitable environmental conditions for overgrowth of the astrocytic component of DNT that resulted in full-blown PA. Another possibility is that the residual astrocytic component had more proliferative potential than the true DNT part of the neoplasm in our case.

Conclusion

Patients with incompletely removed dysembryoplastic neuroepithelial tumour may suffer local recurrence of that tumour. In rare cases development of a neoplasm with a changed morphology may occur.

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