Myxopapillary ependymoma of the lateral ventricle with local recurrences: histopathological and ultrastructural analysis of a case

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An exceptional case of a recurrent intracranial ependymoma of myxopapillary type arising from the lateral ventricle is reported in a 37-year-old man. This distinctive morphological variant of ependymoma is virtually restricted to the region of cauda equina and filum terminale or occasionally to pre- or post-sacral soft tissue. The intracranial cases of myxopapillary ependymoma are extremely rare and are generally associated with the primary ependymal tumour at the typical lumbosacral site. This case of intraventricular myxopapillary ependymoma did not demonstrate any MRI evidence of a primary spinal cord tumour. Moreover, the initial diagnosis of this histologically benign tumour was followed by two tumour recurrences during the three-year follow-up period. To our knowledge, this is the third documented case of a primary intraventricular myxopapillary ependymoma and the first one of intracranial localisation associated with local recurrences.

key words: myxopapillary ependymoma, lateral ventricle, local recurrences

INTRODUCTION

The myxopapillary variant of ependymoma represents a distinctive subentity of ependymal tumours of distinct histological pattern that is located almost exclusively in the lumbosacral region [27, 28, 32]. So far, only a few examples of intracranial myxopapillary ependymomas have been reported, of both intraparenchymal and intraventricular localisation. Most of them are thought to be secondary metastasing neoplasms from the typical spinal cord site of a primary tumour [22, 36]. Until now, only two cases of myxopapillary ependymoma arising from the lateral ventricle lacking evidence of spinal cord ependymomas [31, 35] and one case of poorly differentiated primary myxopapillary ependymoma situated intraparenchymally in the right cerebral hemisphere [18] have been documented. The myxopapillary ependymomas are low-grade tumours that reveal a slight tendency to local recurrence after both complete or subtotal resection.

This report describes an unusual case of myxopapillary ependymoma concerning its exceptional supratentorial localisation in the lateral ventricle and aggressive clinical behaviour associated with two local tumour recurrences.

CASE REPORT

A 37-year-old man was admitted to the Neurosurgical Department in 1997 with the history of progressing hemiparesis of left extremities, disturbances of balance and confusion. The MRI of the brain showed a tumour...
mass of heterogeneous structure in the frontal horn of the right lateral cerebral ventricle (Fig. 1A). The MRI of the lumbo-sacral spine showed no changes (Fig. 1B). The frontal craniotomy was performed with total resection of the tumour. The postoperative course was uneventful. The patient underwent fractionated radiotherapy and was discharged as improved. In 1998, the controlled MRI of the brain showed the features of tumour mass regrowth (Fig. 1C). The second operation with total resection was performed. From that time the patient suffered from tonic-clonic epileptic seizures, treated with phenytoin. In 2000, the patient was readmitted again with signs of increased intracranial pressure and MRI evidence of next tumour recurrence. At the third surgery a tumour lesion from the right lateral ventricle and the fragments of the neoplastic infiltration from corpus callosum were once more totally excised. After the last operation the patient required the implantation of Pu- denz’s ventriculoatrial valve because of the symptoms of Hakim’s syndrome. In August 2001, the controlled MRI images of brain did not show signs of tumour recurrence. The cervical, thoracic and lumbo-sacral images did not reveal any spinal lesions. Distant metastases out of the CNS were not detected.

MATERIAL AND METHODS

The fragments of tissue from each surgery were fixed in 10% formalin, embedded in paraffin and routinely stained with haematoxylin-eosin (H&E), Gomori’s method and mucicarmine. Immunohistochemical analyses

Figure 1. Neuroradiological images of a case. A. Sagittal T1-weighted image demonstrates heterogeneously enhanced tumour mass in the frontal horn of the right lateral ventricle; B. Sagittal T1-weighted image shows no changes in the lumbo-sacral spine; C. Axial T1-weighted image shows recurrent tumour mass in the frontal horn of the right lateral ventricle.
were performed on paraffin-embedded specimens according to the labelled streptavidin-biotin complex method with DAB as chromogen using antibodies against glial fibrillary acidic protein (GFAP), vimentin, S-100 protein, epithelial membrane antigen (EMA) and cytokeratin (all antibodies from Dako).

For electron microscopy, the tissue from the first operation was fixed in 2.5% cold glutaraldehyde for 1 hour, washed in cacodylate buffer, postfixed in 1% osmium tetroxide, dehydrated in graded alcohols and embedded in Epon 812. Ultrathin sections were counterstained with uranyl acetate and lead citrate and examined in a JEOL 1500 electron microscope.

**Histological and immunohistochemical findings**

The specimens from three surgeries demonstrated the same distinctive microscopic features consistent with histological diagnosis of myxopapillary ependymoma. The majority of areas displayed pseudopapillary arrangement of neoplastic cells with acellular cores or hyalised perivascular tissue (Fig. 2A). The flat, cuboidal or low-columnar neoplastic cells were frequently associated with microcysts filled with hyaline, mucinous material (Fig. 2B). In more compact regions the tumour cells occasionally formed perivascular pseudorosettes but true ependymal rosettes were not detected. The specimens from the second and third surgery revealed features similar to the primary tumour (Fig. 2C), accompanied by additional degenerative changes. There was no mitotic activity. The central hyaline areas surrounded by the ependymal cells demonstrated positive reaction to mucicarmine. The cells and their processes were moderately immunoreactive for GFAP (Fig. 2D), S-100 protein and vimentin, whereas the reaction for cytokeratin and EMA was negative.

**Ultrastructural findings**

The neoplastic cells exhibited round or oval nuclei surrounded by ample cytoplasm containing a varied number of intermediate filaments and/or microtubules. The cells were frequently loosely arranged and separated by extracellular spaces (Fig. 3A). The tumour cells displayed distinct surface specialisation including zonulae adherentes and microvilli. Some tumour cells exhibited large extracellular spaces filled with numerous microvilli (Fig. 3B). The cellular borders were often covered by continuous basement membrane, closely attached to the plasma membrane (Fig. 3C). The abundance of cytoplasmic projections formed the complex cellular interdigitation associated with abundant basement membrane or amorphous, electron-dense material (Fig. 3D). Some cells exhibited numerous membrane-bound, spherical, electron-dense bodies and/or secretory granules. Only a few cilia and atypical basal bodies could be detected in the whole examined material.

**DISCUSSION**

The present report describes an unusual case of myxopapillary ependymoma located intracranially in the lateral ventricle without any detectable spinal cord lesion both prior to and three years after the tumour surgery. Myxopapillary ependymomas are tumours of the lumbosacral region arising from the conus medullaris or filum terminale and commonly observed in adults [21, 25, 32], less often in children [3, 23]. Infrequently, the myxopapillary ependymomas occur in the pre- or post-sacral soft tissue as ectopic tumours arising from the residual ependymal rests [1, 2, 4, 10, 11, 13, 14, 17, 19, 25, 29]. So far, only a few reports of myxopapillary ependymomas in supratentorial localisation have been documented. They include two intraparenchymal tumours lacking any relation to the ventricular system, which were secondary from the primary spinal lesion [22, 36]. The third case of intraparenchymal ependymoma of myxopapillary type appeared as a primary but low-differentiated cerebral tumour [18]. There have been only two other reports of primary intracerebral myxopapillary ependymomas arising from lateral ventricle, without the spinal cord lesion [31, 35].

The myxopapillary ependymoma is easily recognised by its light- and electron-microscopic characteristics. The typical histological appearance of myxopapillary ependymoma, originally defined by Kernohan [16], remains still diagnostic. The present case revealed the typical histological pattern of myxopapillary ependymoma, such as pseudopapillary arrangement of tumour cells and perivascular and intracellular mucin deposits. The development of these distinctive morphological characteristics in the ependymal tumours situated in the cauda equina is considered to be related to mucinous changes of the collagenous stroma and mucin secretion by the tumour cells. The mechanism of mucinous changes in the intraventricular ependymomas remains unknown. The fenestrated vessels might be occasionally responsible for myxoid changes in some cases [31].

The present electron microscopic study confirmed the ependymal nature of neoplastic cells, such as cytoplasmic intermediate filaments, numerous microvilli, zonulae adherentes, cellular processes interdigitation or cilia. Apart from these ultrastructural characteristics consistent with ependymomas in general [7, 9, 15, 30], a number of additional features usually appearing in myxopapillary variant, including the presence of relatively few cilia, complex of interdigitating cytoplasmic
Figure 2. Histological and immunohistochemical pattern of myxopapillary type ependymoma in biopsy specimens. 

A. Typical pseudopapillary pattern of tumour cells (first surgery). HE, × 100; B. Pseudopapillary arrangement of tumour associated with microcysts filled with hyaline, mucinous material (first surgery). HE, × 150; C. Loose pseudopapillary arrangement of tumour cells (second surgery). HE, × 100; D. GFAP immunoreactivity of tumour cells. × 100
Figure 3. Ultrastructural features of tumour. A. Neoplastic cell and cell processes exhibit numerous intermediate filaments. Wide extracellular spaces with mucinous material, bar 2 µm; B. Zonulae adherentes (arrowhead) and large extracellular space filled with numerous microvilli (arrow) and delicate, floccular material, bar 500 nm; C. A continuous basement membrane (arrow) surrounds the cytoplasmic membrane of the tumour cell, bar 1 µm; D. Numerous interdigitating tumour cell processes lined by basement membrane or amorphous material, bar 200 nm.
projections and extracellular spaces bordered by basement membranes, were evidenced [26, 33, 34, 37]. The formation of extracellular basal lamina material could be seen in the regions where ependymal cells are opposed to connective tissue [20]. It has been suggested that these unique structural features result from the anatomical relationships of the ependymal cells in the conus medullaris and filum terminale [26]. The formation of basement membrane in the present case of intraventricular ependymoma remains unclear, however it seems possible that ependymal cells in certain circumstances are capable of producing the basal lamina material.

Myxopapillary ependymomas are known as histologically benign (Grade I WHO), slow-growing neoplasms with slight tendency to undergo anaplastic transformation [5, 24, 32]. However, the incomplete resection might be associated with the increasing probability of local recurrences or dissemination within subarachnoidal space [6, 8, 12]. The present case of myxopapillary ependymoma of primary intraventricular localisation with aggressive clinical behaviour is exceptional.

REFERENCES