Meningioma with Rhabdoid Transformation

S Kesavan

ABSTRACT

A 29-year-old man was operated on for an intracranial tumour with the gross features of a meningioma. Histology showed features of a rhabdoid tumour. The tumour recurred in 1997, 17 months after the first operation, and was re-excised and showed identical histology. Meningiomas with rhabdoid change are very rare. The clinicopathologic features are presented and the differential diagnoses discussed.

Keywords: Meningioma, Rhabdoid change, Atypical Teratoid Tumour, Immunohistochemistry

Singapore Med J 2000 Vol 41(9):464-467

INTRODUCTION

Meningiomas are common intracranial neoplasms and may show a variety of histologic patterns which are familiar to practicing pathologists. The occurrence and significance of rhabdoid change in meningiomas has only been recently described[17,21]. It is associated with aggressive clinical behaviour and a poor prognosis, in contrast to the classical meningioma. It has to be distinguished from the intracranial atypical teratoid/malignant rhabdoid tumour found in infants and young children and from meningeal metastases from a malignant rhabdoid tumour outside the intracranial cavity eg. kidney and soft tissue.

MATERIALS AND METHODS

The case presented represents material from the surgical pathology files from the Departments of Pathology in Singapore General Hospital and Mount Elizabeth Hospital. All slides were stained for hematoxylin-eosin. Immunohistochemistry using antibodies against keratins (AE 1/3, Dako), vimentin (Dako), desmin (Dako), smooth muscle actin (Dako), synaptophysin (Boehringer-Mannheim), chromogranin (Boehringer-Mannheim), neurofilaments (Immunotech), neuron specific enolase (Dako), myoglobin (Dako), S-100 (Dako), glial fibrillary acidic protein (Dako), MIB-1 (Immunotech) and epithelial membrane antigen (Dako) was performed on the relevant sections from the tumour. Electron microscopic examination was performed on material removed from the paraffin block.

Department of Pathology
Singapore General Hospital
Outram Road
Singapore 169608

S Kesavan, MBBS (NUS), FRCPA
Senior Registrar

HISTORY

A 29-year-old Chinese male was admitted to a local hospital in May 1996 with severe vomiting, headache and drowsiness. Clinical examination showed that he was drowsy and he had a left 6th cranial nerve palsy and left homonymous hemianopia. There was no limb weakness. MRI scan showed a 4.5 cm intracranial tumour in the right infratemporal region, with extension through the temporal hiatus into the posterior cranial fossa. It was compressing the midbrain and right temporal lobe. Scans of the thorax and abdomen showed no abnormalities. No soft tissue masses were found. On operation (2/5/96), the tumour was seen to arise from the tentorium and had the gross appearance of a meningioma. It was the opinion of the attending neurosurgeon that a gross total resection was achieved.

The patient improved post-operatively. Radiotherapy was given via a pair of wedged pair ports, with a total dose of 5686 cGy delivered in 31 treatments over 44 days. No post-op chemotherapy was given. A follow up MRI scan done 4 months later showed no residual or recurrent tumour.

The patient was lost to follow up until November 1997 when an MRI scan showed an enhancing mass lesion at the base of the right middle cranial fossa, close to the site of the original tumour. A second surgery (13/3/98) was done in a different hospital. Intra-operatively, a 1.5 cm tumour mass was identified. A separate 3 mm nodule was noted a short distance away from the main tumour mass. Both nodules were excised completely. No diffuse leptomeningeal spread was present. Follow up scans, to date, show no tumour recurrence.

PATHOLOGY

The tumour histology from both resections (1996 & 1998) show similar features. There are sheets of tumour cells arranged in a vague lobular pattern in areas around variably sized blood vessels. The nuclei are

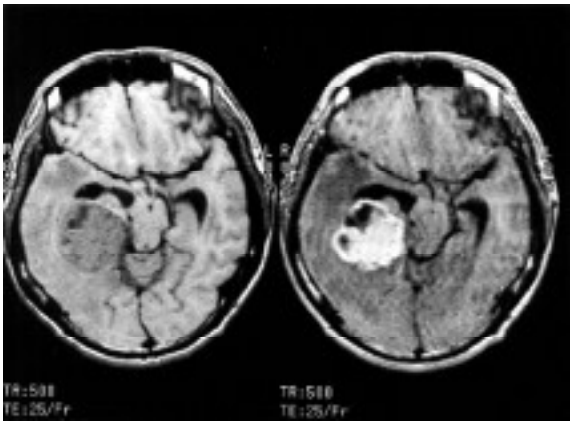

Fig. 1 T2 weighted Gadolinium enhanced MRI scan showing enhancing intracranial tumour mass.

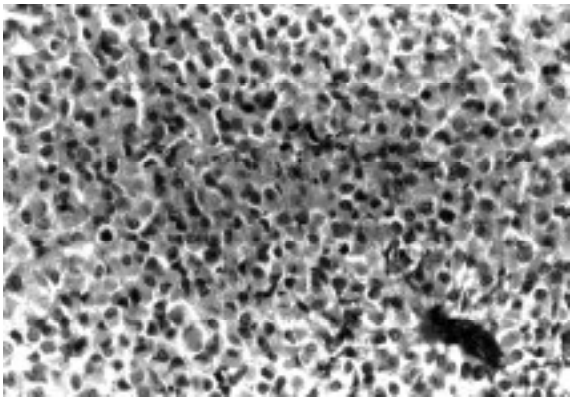

Fig. 2 Tumour cells with rhabdoid inclusions. H&E stain (x400).

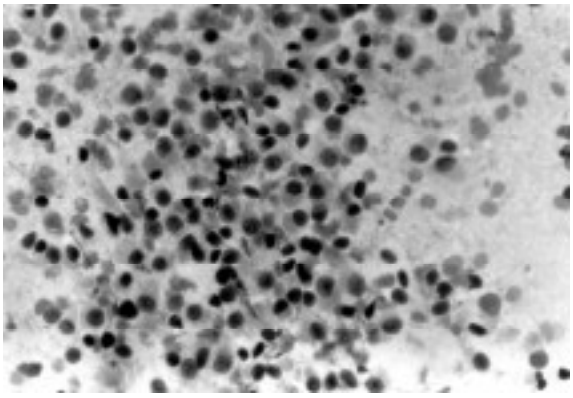

Fig. 3 Touch preparation showing disassociated clusters of tumour cells with rhabdoid morphology. PAP stain (x400).

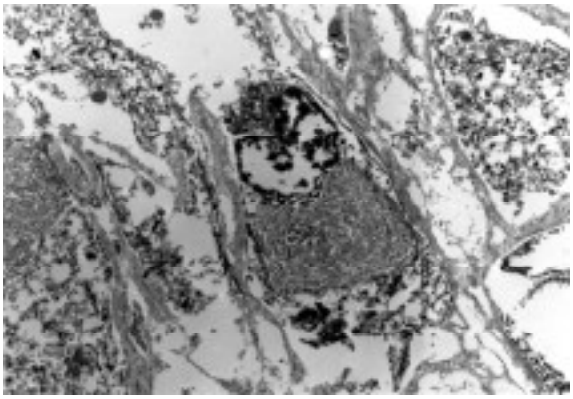

Fig. 4 Rhabdoid inclusions on electron microscopy. (x1000).

medium sized to large with small rather inconspicuous nucleoli. Within the cytoplasm are large globular eosinophilic inclusions which displace the nuclei to the periphery. These eosinophilic inclusions form the distinctive cytologic feature of the tumour. No strap cells or rhabdomyoblasts are seen. There are also groups of cells which show rather ample pale eosinophilic cytoplasm with well defined intercellular borders. Globular cytoplasmic inclusions are not present in these cells. Occasional small foci of necrosis are identified. Mitotic figures are seen in both tumour samples, the highest count being 9 per 10 hpf's. No mesenchymal areas, squamous areas, gland formation or small undifferentiated cells resembling Primitive Neuroectodermal Tumours (PNET) are present. A separate 3 mm nodule with identical histology is present in the dura mater very close to the main tumour mass. No invasion into brain tissue is seen. No features of a classical meningioma are identified in either case.

Immunohistochemical stains show diffuse and strong cytoplasmic positivity for AE 1/3 (keratins) and Desmin. Vimentin stains show only a patchy moderate cytoplasmic positivity. In all 3 cases, reactivity is localised to a paranuclear position and corresponds to the globular eosinophilic inclusions which displace the nuclei to the periphery. The MIB-1 index was 20%. The MIB-1 (Ki-67) antibody is often used as a marker of actively proliferating cells. There was no staining for smooth muscle actins, neurofilaments, chromogranin, synaptophysin, S-100, myoglobin, glial fibrillary acidic protein (GFAP), neuron-specific enolase (NSE) and epithelial membrane antigen (EMA).

Electron microscopy shows that the cytoplasmic inclusions are composed of a whorled complex meshwork of intermediate filaments. No specific differentiating features were identified although cell preservation was suboptimal. Luse bodies were noted but are by themselves nonspecific.

DISCUSSION

Meningiomas are relatively common intracranial neoplasms in Singapore. The majority occur in an elderly population although sporadic cases occur in adults below the age of 30[1]. Meningiomas are generally benign neoplasms and although they exhibit a variety of well described histologic patterns, none of these have any bearing on prognosis. Instead, prognosis is influenced by completeness of excision and location within the intracranial cavity.

A minority of meningiomas that behave in a aggressive fashion with significant morbidity and mortality invariably show one or more of the following histologic features: excess mitotic activity (>4 per 10 hpf's), necrosis, prominent cytologic atypia, 'small cell'

change and infiltration into adjacent brain tissue[2].

The case presented here is unusual in that while the gross features with its meningeal attachment were highly suggestive of a meningioma, histology showed a pattern which was very rarely seen in intracranial tumours. The cells showed large eosinophilic globular cytoplasmic inclusions with enlarged nuclei. There were areas of tumour necrosis with high mitotic activity. No histologic features commonly associated with meningiomas were identified.

Tumours with similar features occurring in diverse sites such as the kidney[3], liver[4], soft tissue[5], exocrine glands[6], gastrointestinal tract[7] and urogenital tract[8] have long perplexed pathologists. Difficulties have arisen as to the histogenesis, classification and treatment of this group of tumours. The most well-known category is the paediatric renal "Rhabdoid tumour"[9] for which Beckwith et al have established strict criteria for diagnosis. Unfortunately, similar strict criteria have not been established for "rhabdoid" tumours occurring outside the kidney, possibly because of their rarity and their heterogeneity. In one extensive survey of extrarenal rhabdoid tumours, only 12 out of 42 cases[10] had the histologic features of "classic" malignant rhabdoid tumour of the kidney. The remainder were shown to display a variety of neural, epithelial, glial or ependymal patterns. The authors came to the conclusion that the term "extrarenal rhabdoid tumour" was not valid as representing a specific diagnostic entity. They prefer the term "poorly differentiated neoplasm with rhabdoid features" for these group of tumours. The rhabdoid pattern is merely a common phenotype marked by an overproduction of intermediate filaments shared by a group of poorly differentiated tumours and does not imply a common genotype. This view is supported by the observation that many tumours from epithelioid sarcoma[11] to melanoma[12] may rarely show areas with rhabdoid features. So, which category should our tumour belong to?

The vast majority of intracranial rhabdoid tumours (which have also been called atypical teratoid tumours)[13-16] and renal "rhabdoid" tumours occur in infants and young children and are located within the brain and kidney respectively. An unequivocal leptomeningeal origin is very rare. In approximately 15% of renal rhabdoid tumour cases, a second tumour which may have either a rhabdoid pattern or small cell embryonal-medulloblastoma pattern is found in the brain which is most likely of independent origin. It is currently not clear to what extent the intracranial rhabdoid/atypical teratoid tumour relates to the renal rhabdoid tumour or to rhabdoid tumours at non-CNS sites. Obviously, our patient does not fit the common clinical profile. He is a 29-year-old male with a recurrent leptomeningeal mass, a site which is typical for a meningioma. The tumour does not show immunostaining for EMA, GFAP and smooth muscle actin in contrast to atypical rhabdoid tumours[13]. It is thus more consistent to assume that this tumour started off as a meningioma and then underwent rhabdoid change throughout the tumour so that at clinical presentation, it had become difficult to separate it from other "rhabdoid tumours". A suitable analogy would be that of oncocytic tumours which tend to resemble each other very closely irrespective of the site of origin (eg. thyroid, parathyroid, salivary glands, kidneys and pituitary anterior lobes). In a recent paper[17], Kepes et al summarised 4 cases of meningeal tumours in adults aged 28-84 years. All tumours had gross appearances of typical meningiomas. In 3 tumours, there were areas of meningothelial and fibroblastic patterns which showed transition to cell groups of the rhabdoid type. In the 4th case, identical to our discussed case, only rhabdoid cells were seen. This was also interpreted as complete replacement of a meningioma by rhabdoid elements.

Immunohistochemistry provides no help in answering the question of histogenesis as many such tumours are polyphenotypic. These groups of tumours show a complex and often bewildering array of immunoreactivities and may stain positively for keratins, vimentin, epithelial membrane antigen, glial fibrillary acidic protein, actin, desmin, neurofilaments, synaptophysin and chromogranin. Our case, in contrast to the usual findings in typical meningiomas, stained only focally for vimentin with no staining for epithelial membrane antigen. However, this anomalous staining pattern has been described in a minority of meningiomas[18]. As mentioned above, in contrast to atypical teratoid tumours, our tumour does not stain for EMA, GFAP and smooth muscle actin. A few reports have commented on the fact that neurofilaments have been identified immunohistochemically in primary rhabdoid tumours of the brain[13,19] but not in meningiomas. Our case showed no staining for neurofilaments.

Cytogenetic studies would not be helpful in distinguishing a meningioma with rhabdoid features from a pure rhabdoid tumour because the most characteristic chromosomal abnormality detected in meningiomas, monosomy 22, has also been found in primary rhabdoid tumours of the brain[16,20].

The complexities and debate about extrarenal rhabdoid tumours notwithstanding, all authors are agreed on the fact that the phenotypic changes to cells with a rhabdoid morphology is associated with aggressive biologic and clinical behaviour and hence a poor prognosis for the patient. In this case report,

we present what we believe is a very rare case of a meningioma with rhabdoid transformation. This tumour has recurred once, 17 months after the first operation, despite the patient being given a course of radiotherapy. The role of chemotheraphy is controversial and none was offered to the patient as it was felt that gross total resection was achieved in both operations.

ACKNOWLEDGEMENTS

The Author would like to thank Dr Ivy Sng (Dept of Pathology, SGH) for her help and advice, Dr Anjula Thomas (Dept of Pathology, Mt. Elizabeth Hospital) and Dr LC Ang (Dept of Pathology, University of Toronto) for reporting on the histology of the first tumour resection (1996) and Dr John J Kepes (University of Kansas Medical Center) for his review of the histology of the second tumour resection.

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