

Granular cell meningioma. A case report

Boleslaw Lach¹, Imaduddin Kanaan²

¹Department of Pathology and Laboratory Medicine, Hamilton General Hospital, Hamilton, Canada; ²Department of Neurosciences, King Faisal Specialist Hospital and Research Centre, Riyadh, Saudi Arabia

Folia Neuropathol 2007; 45 (1): 19-22

Abstract

We describe a granular cell tumour developing in clear cell meningioma of the falx. Granular and clear cells showed immunoreactivity for vimentin, epithelial membrane antigen and progesterone receptors. This is the first case documenting arachnoid origin of neoplastic granular cells in meningioma.

Key words: granular cell meningioma, progesterone receptors, immunohistochemistry, brain tumours, clear cell meningioma

Introduction

Intracranial granular cell tumour (GCT) is an uncommon, usually asymptomatic, benign neuroectodermal neoplasm incidentally found in the hypophyseal area [1]. Some GCT show morphological and immunohistochemical patterns of astrocytic differentiation [1,2,9]. However, since only a few cases of meningeal GCT have been reported [4,5,7,11] and its relation to the arachnoid cell is uncertain, the granular cell variant of meningioma is not recognised in the present WHO classification of brain tumours [6]. We describe a diagnostically challenging case of GCT arising in clear cell meningioma.

Clinical history

An 88-year-old gentleman was admitted with a history of generalised seizure, confusion and

vomiting. CT and MRI demonstrated a large enhancing tumour with wide basal attachment to the falx, compatible with meningioma. The patient underwent frontal craniotomy and excision of the tumour. He made complete clinical recovery and follow-up MRI 14 months later showed no lesion.

Methods

The tumour tissue was routinely processed for formalin fixation, paraffin embedding and customary H & E and Periodic Acid Schiff staining methods. Frozen sections were stained for neutral lipids with oil red O. The automated Ventana immunostainer and antibody kits were used for localisation of the following antigens: epithelial membrane antigen (EMA), vimentin (VIM), glial fibrillary acidic protein (GFAP), neurofilament, desmin, cytokeratins (AE3/AE1 and CAM 5.2), S-100 protein (S100), trypsin-antitrypsin

Communicating author:

Boleslaw Lach, MD, PhD, FRCP, Hamilton Health Sciences and McMaster University, Department of Pathology and Laboratory Medicine, Hamilton General Hospital, 237 Barton Str East, Hamilton, Ontario, Canada, L8L-2X2, tel.: 905 527 43 22 ext 461 68, fax: 905 524 26 81, Email: boleklach2@hotmail.com

(TAT), gamma-globulins IgG, IgA and IgM, alpha-B-crystalline, ubiquitin (UBQ), oestrogen (ER) and progesterone (PR) receptors as well as for CD45, CD20, CD3, CD68, CD31, CD34 and MIB-1.

Multiple fragments of tissue were fixed in 1.6% glutaraldehyde and processed for routine electron microscopy.

Results

Approximately 50% of the tumour displayed nests of plant-like, large, clear cells with granular cytoplasm (Fig. 1A-C). The nuclei showed only minimal pleomorphism and hyperchromasia. Mitoses were absent. Most of the remainder of the tumour displayed classical appearance of clear cell meningioma (CCM) (Fig. 1D) with areas of gradual transition to granular cell tumour. There were also foci of arachnoid cells and

psammoma bodies intermingled with thick-walled vessels, consistent with an additional component of a typical angiomatous meningioma (Fig. 1E).

The granular cells were very strongly positive for PAS (Fig. 1C), VIM, TAT, NSE and focally for EMA, PR and IgG (Fig. 1F-2H). Occasional cells were also positive for crystalline and cytokeratins. MIB-1 immunostained approximately 1% of cell nuclei. Granular cells were S-100 negative, while the arachnoid cells within the CCM and angiomatous portion were strongly S-100 positive. The infiltrating part of the tumour contained few GFAP-immunoreactive astrocytes. Electron microscopy of the CCM portion revealed interdigitating processes and occasional desmosomes (Fig. 2), confirming the diagnosis of meningioma. The granular cell component was not present in the material submitted for electron microscopy.

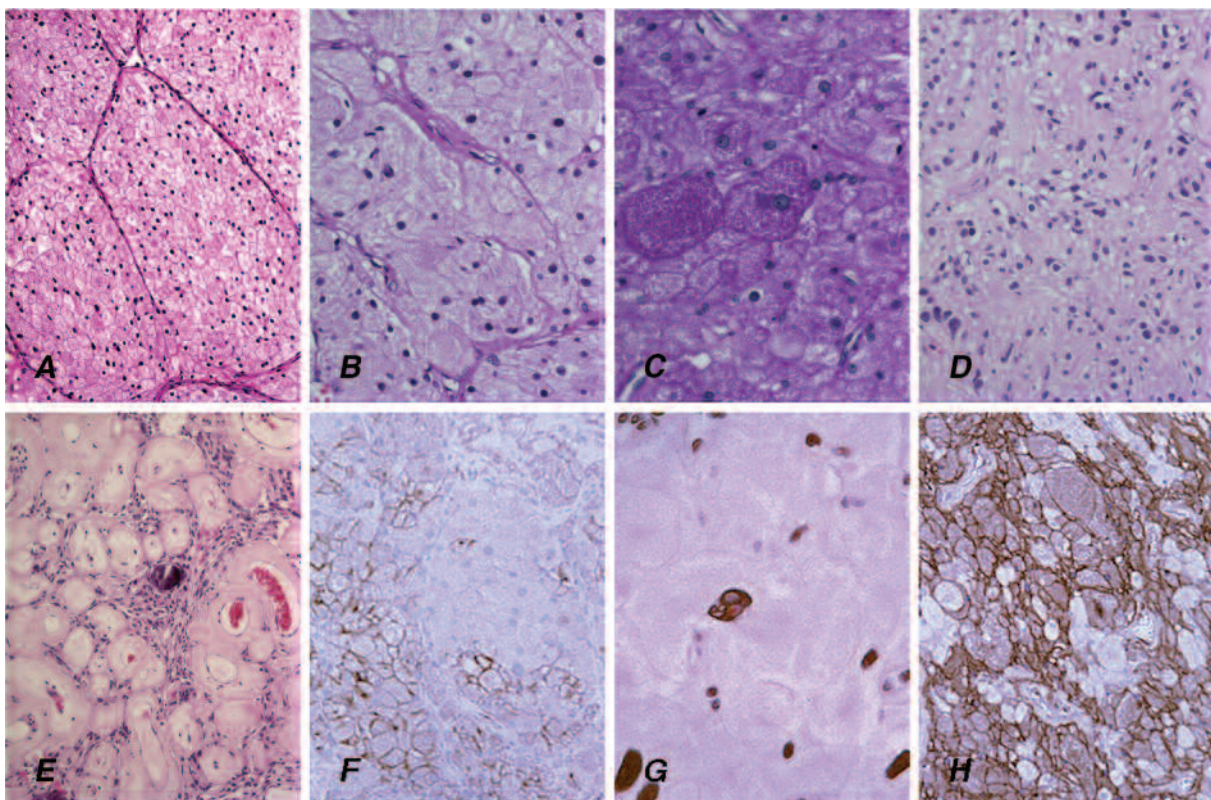


Fig. 1. Morphological patterns and immunohistochemical profile of the tumour: Large nests of plant-like cells with clear cytoplasm (A). Higher power granular cell component (B) displaying strong PAS reaction (C). Other areas of the tumour show a pattern of clear cell meningioma (D) and angiomatous meningioma (E). Immunoreactivity for EMA (F), progesterone receptors (G) and IgG gamma globulin (H). Magnifications: approx.100x for A, B, D, E and H, 150x for C and 300x for G

Discussion

GCT is a characteristic phenotypic change in tumours of heterogeneous derivation [9]. Among the intracranial GCTs, the nature of the cell depends on the location: infundibular GCTs are related to subspecialized astrocytes [1], extra-hypophyseal GCTs arise on the background of astrocytomas of different grades [2], while examples associated with the cranial nerves show Schwann cell differentiation [3]. Although GCTs of meninges are common in laboratory rats [8], only a few cases have been reported in human beings. The tumours were located in the falx [5], cervical spinal cord [7], suprasellar area [4], cerebellum [11] and in unspecified intracranial locations [9]. Only one case was symptomatic [4].

The combination of morphological features of clear cell and angiomatous components, EMA and PR immunoreactivity as well as demonstration of desmosomes is diagnostic of meningioma in this case. Although the GCT component was by itself very difficult to diagnose as meningioma, the evidence for gradual transitions from the clear neoplastic cells to GCT, and especially the shared reactivity for EMA, PR and PAS, strongly support arachnoid origin of the granular cells. The histogenesis of granular cells has not been clearly defined in previously described meningeal tumours. Immunohistochemical studies are limited only to a single case [11], which was negative for EMA as well as for S-100, GFAP, Keratins and CD68, and lacked morphological features of arachnoid cell differentiation. A relationship of the GCT component to the meningeal Schwann cell or "neurofibroma" has been proposed by others [5,7]. Friede [4] suggested derivation of GCT within the meningioma from a "small mesenchymal cell" or cell sharing a common origin with the arachnoid cell. None of the previously reported human cases of GCT of meninges was associated with CCM. In animals, meningotheial meningioma is the most common variant undergoing metamorphosis to GCT [8]. Electron microscopy studies indicate that cell degeneration and autophagia lead to lysosomal overload and the granular cell appearance [2]. The abundance of intracellular IgG in the presented tumour also points to significant exogenous lysosomal content.

Although this tumour displayed angiomatous and CCM pattern, the granular change occurred only in the



Fig. 2. Electron micrograph showing desmosomal junction between the meningioma cells. Mag. Approx. x 65 000

clear cells. This variant of meningioma is a relatively new clinico-pathological entity characterised by a clear, glycogen-rich PAS positive cytoplasm, young age at presentation, predominant spinal canal location (61%), and a high rate of recurrence and intra-axial dissemination [12].

Despite the small number of MIB-1 positive nuclei in this case, radiological studies indicated deep brain infiltration, confirmed by the presence of entrapped astrocytes within the tumour. However, two years after the gross total resection, the patient is alive without radiological signs of a tumour. Since the granular cell change was almost certainly a secondary phenomenon, the prognosis in this case is more likely dependent on the CCM component and the completeness of removal.

Case report was presented at the 45th Annual Meeting of the American Association of Neuropathologists, Cleveland, Ohio, 23-27 June 2004.

Acknowledgement

The authors would like to thank Miss Fernalyn Minas and Bruna Capretta for assistance in the word processing of this manuscript.

References

1. Bigner DD, McLendon RE, Bruner JM. Russell and Rubinstein's Pathology of Tumors of the Nervous System. 6th Edition. Oxford University Press Inc., New York; pp. 93-94.
2. Brat DJ, Scheithauer BW, Medina-Flores R, Rosenblum MK, Burger PC. Infiltrative astrocytomas with granular cell features (granular cell astrocytomas): a study of histopathological features, grading, and outcome. *Am J Surg Pathol* 2002; 26: 750-757.
3. Carvalho GA, Lindeke A, Tatagiba M, Ostertag H, Samii M. Cranial granular-cell tumor of the trigeminal nerve. Case report. *J Neurosurg* 1994; 81: 795-798.
4. Friede RL, Yasargil MG. Suprasellar neoplasm with a granular cell component. *J Neuropathol Exp Neurol*. 1977; 36: 769-782.
5. Lapresle J, Netsky MG, Zimmerman HM. The pathology of meningiomas; a study of 121 cases. *Am J Pathol* 1952; 28: 757-791.
6. Louis DN, Scheithauer BW, Budka H, von Deimling A, Kepes JJ. Meningiomas. 2000. WHO Classification of Tumours. Pathology and Genetics Tumours of the Nervous System. Kleihues P, Cavenee WK (eds.); pp. 176-184.
7. Markesbery WR, Duffy PE, Cowen D. Granular cell tumors of the central nervous system. *J Neuropathol Exper Neurol*. 1973; 32: 92-109.
8. Mitsumori K, Dittrich KL, Stefanski S, Talley FA, Maronpot RR. Immunohistochemical and electron microscopic study of meningeal granular cell tumors in rats. *Vet Pathol* 1987; 24: 356-359.
9. Rickert CH, Kuchelmeister K, Gullotta F. Morphological and immunohistochemical characterization of granular cells in non-hypophyseal tumours of the central nervous system. *Histopathology* 1997; 30: 464-471.
10. Rickert CH, Paulus W. Genetic characterization of granular cell tumours. *Acta Neuropathol (Berl)* 2002; 103: 309-312.
11. Vang R, Heck K, Fuller GN, Medeiros LJ. Granular cell tumor of intracranial meninges. *Clinical Neuropathol* 2000; 19: 41-44.
12. Zorludemir S, Scheithauer BW, Hirose T, Van Houten C, Miller G, Meyer FB. Clear cell meningioma. A clinicopathologic study of a potentially aggressive variant of meningioma. *Am J Surg Pathol* 1995; 19: 493-505.