SHORT REPORT

Gliomyosarcoma: an immunohistochemical analysis

S R Stapleton, W Harkness, P R Wilkins, D Uttley

Abstract
Tumours of mixed glial and sarcomatous elements occurring in intracranial neoplasms are well recognised and have been termed gliosarcomas. These tumours account for up to 8% of all glioblastomas. The sarcomatous elements are thought to derive from the neoplastic transformation of mesenchymal cells in the adjacent to the tumour. This transformation usually has the appearance of a fibrosarcoma or angiosarcoma. Alternative mesenchymal neoplastic differentiation may occur, however, giving rise to the appearances of chondrosarcoma and osteosarcoma. In 1969 Goldman described a case in which the sarcomatous elements of a mixed gliosarcoma appeared, on the basis of light microscopy alone, to differentiate towards skeletal muscle having the features of a rhabdomyosarcoma. He coined the term gliomyosarcoma. In 1986 Barnard et al reported a second case and demonstrated the features of rhabdomyosarcoma using the electron microscope. A further case characterised with both light microscopic and immunohistochemical techniques is reported.

Histology
Paraffin wax sections showed a tumour with a biphasic pattern. Discrete islands of pleomorphic glial fibre producing tumour cells that stained positively for glial fibrillary acidic protein (GFAP) (fig 2a) and vimentin were surrounded by a spindle cell sarcomatous component that was rich in reticulin fibres and positive for vimentin but negative for GFAP. Within the sarcomatous element were elongated strap-like cells and rounded, intensely eosinophilic cells with the appearance of rhabdomyoblasts. Cross striations were readily identified (fig 2b). These cells were strongly positive for the markers desmin (fig 2c) and myoglobin (fig 2d) as well as vimentin. The appearances were those of a gliosarcoma showing rhabdomyoblastic differentiation.

Discussion
The term gliosarcoma was first used by Stroebel in 1895 to describe sarcomatous change in a glioblastoma. Since then the entity has been well described by Feigin et al and by Rubinstein.7 The tumour is said to account for 8% of all glioblastomas.1 Light microscopic and immunohistochemical exam-

Case report
A 73 year old left handed man with a history of bronchial carcinoma treated with radiotherapy four years before admission, presented with a two week history of confusion and drowsiness. He had otherwise been well but smoked heavily and required bronchodilators. On examination he was not fully orientated but obeyed commands and his eyes opened spontaneously. There was bilateral papilloedema but normal visual acuity and external ocular movements. There was no focal neurological deficit in the limbs and his gait was normal. There was no evidence of recurrent bronchial carcinoma. CT scan revealed a well circumscribed enhancing mass in the left temporal lobe with considerable surrounding oedema and shift of the midline structures (fig 1). Craniotomy was performed with macroscopic resection of a firm, well demarcated tumour but with an infiltrating deep surface. Post-operatively he made a good recovery with a resolution of his symptoms, although his short term memory remained poor. He was treated further with radiotherapy.

Figure 1 Contrasted CT scan showing a moderately well demarcated enhancing mass in the left temporal lobe.
Gliomyosarcoma: an immunohistochemical analysis

Figure 2a. Islands of glial fibrillary acidic protein (GFAP) positive tumour cells (arrows) amongst immunonegative sarcomatous tissue. (original objective magnification × 20); b Areas of rhabdomyoblastic differentiation with elongated cells showing cross-striations. (Haematoxylin and eosin, original objective magnification × 40); c Strap-like cells showing immunopositivity for desmin. (arrows) (original objective magnification × 20); d Strap-like cells showing immunopositivity for myoglobin. (arrows) (original objective magnification × 20).

In 1969 Goldman described a case of gliosarcoma with light microscopic evidence of rhabdomyoblastic differentiation and coined the term gliomyosarcoma.7 In 1971 a case of a mixed tumour containing both astrocytic and mesenchymal elements, with light microscopic features of rhabdomyoblasts was described by Shuangsho and Netsky.9

In 1986 Barnard et al reported another case with electron microscopic features of striated muscle11 and recently rhabdomyoblastic differentiation has been described in a subependymoma.9 We have identified a case of gliosarcoma with rhabdomyoblastic differentiation using light microscopic and immunohistochemical techniques.

The occurrence of rhabdomyoblastic differentiation in various neuroepithelial tumours is well recognised as in the medulloepiblastoma10 and the medulloepithelioma of childhood,11 and is a feature of malignant schwannoma (malignant Triton tumour)12 and ganglioneuroma or malignant eletomesenchymoma.13 Primary cerebral rhabdomyosarcoma has also been described.1417 An explanation for such divergent differentiation in these tumours may lie in the pleuripotential potency of the proposed cells of origin in the primitive medullary epithelium and hence their tendency to occur in childhood.

By contrast, the gliosarcoma is a tumour with an age distribution more akin to the purely glial tumours of the CNS. The debate on such tumours relates to the origin of the sarcomatous element. As in the childhood tumours, the gliosarcoma may represent one manifestation of a bimodal differentiation potential along neuroepithelial and mesenchymal lines. Rhabdomyoblastic cells would then be present as a result of an extension of the pleuripotential nature of these neoplastic mesenchymal cells. An alternative explanation is that the sarcomatous elements of the gliosarcoma arise by metaplasia of the connective tissue stroma and ultimately malignant transformation, possibly under the influence of transforming growth factors or oncogene activating factors elaborated by the malignant glial component; the process is termed "horizontal malignant transformation".18 In view of the age distribution of the cases described this latter mechanism seems the most plausible explanation for the gliosarcoma.

We have demonstrated the presence of rhabdomyoblasts within a gliosarcoma both under the light microscope and immunohistochemically, using the muscle cell markers desmin and myoglobin.1920 The expanding use of such immunohistochemical markers will no doubt reveal that this type of cellular differentiation occurs more frequently than previously appreciated.

We thank Mrs G Thompson for preparation of the manuscript and Miss P Philpott for the photographs.

2 Goldman RL. Gliomyosarcoma of the cerebrum. Am J Clin...
Stapleton, Harkness, Wilkins, Utley

3 Barnard RO, Bradford R, Scott T, Thomas DGT. Gliomyo-
sarcoma. Report of a case of rhabdomyosarcoma arising
4 Stroebe H. Ueber Enstehung und Bau der
Gehirngliome. Beitr Pathol Anat Allg Pathol
1895;18:405-86.
5 Feigin IH, Gross SW. Sarcoma
arising in glioblastoma
of the brain. Am J Pathol
6 Rubinstein U. The development of contiguous
sarcomatous and gliomatous tissue
in intracranial tumours. Pathol
7 Sarmiento J, Ferrer K, Pons L, Ferrer
E. Cerebral mixed
tumour: osteochondrosarcoma-glioblastoma
multiforme. Acta
Neurochir 1979;50:335-41.
8 Shuangshoti S, Netsky MG. Neoplasms of mixed
mesenchymal and neuroepithelial origin. J Neuropath Exp
9 Tomlinson FH, Scheithauer BW, Kelly PJ, Forbes GS.
Subependymomas with rhabdomyosarcomatous differ-
eniation: report of a case and literature review. Neuro-
10 Chowdhury C, Roy S, Mahapatra AK, Bhatia R. Medullo-
11 Auer RN, Becker LE. Cerebral medullopeithelioma with
bone, cartilage and striated muscle. Light microscopic
and immunohistochemical study. J Neuropath Exp
12 Woodruff JM, Chernik NL, Smith MC, Millet WB, Foote
FW. Peripheral nerve tumours with rhabdomyosarcoma-
tous differentiation (malignant "Triton" tumours). Can-
13 Kawamoto EH, Weidner N, Agostini RM, Jaffe R. Malign-
ant ectomesenchymoma of soft tissue. Report of two
cases and review of the literature. Cancer 1987;59:
1791-802.
14 Leedham PW. Primary cerebral rhabdomyosarcoma and
the problem of medulloblastoma. J Neurol Neurosurg
15 Man K-W, Gyorkey F, Halpert B. Primary rhabdomyo-
16 Russell DS, Rubinstein LJ. Pathology of Tumours of the
Nervous System. 5th ed. Baltimore: Williams and Wilkins,
1989.
17 Enzinger FM, Weiss SM. Soft Tissue Tumors. 2nd ed. St
18 Goldenberg DM, Pavia RA. In vivo horizontal oncogenesis
by a human tumour in nude mice. Proc Natl Acad Sci USA
19 Altmannsberger M, Weber K, Droste R, Osborn M. Desmin
is a specific marker for rhabdomyosarcomas of human
20 Corson JM, Pinkus GS. Intracellular myoglobin, a specific
marker for skeletal muscle differentiation in soft tissue
sarcomas. An immunoperoxidase study. Am J Pathol
Gliomyosarcoma: an immunohistochemical analysis.

S R Stapleton, W Harkness, P R Wilkins and D Uttley

*J Neurol Neurosurg Psychiatry* 1992 55: 728-730
doi: 10.1136/jnnp.55.8.728

Updated information and services can be found at:
http://jnnp.bmj.com/content/55/8/728

Email alerting service

Receive free email alerts when new articles cite this article. Sign up in the box at the top right corner of the online article.

Notes

To request permissions go to:
http://group.bmj.com/group/rights-licensing/permissions

To order reprints go to:
http://journals.bmj.com/cgi/reprintform

To subscribe to BMJ go to:
http://group.bmj.com/subscribe/