8. Raghunath A, Adamus G, Bodurka DC, et al. Cancer-associated retinopathy in neuroendocrine carcinoma of the fallopian tube. *J Neuroophthalmol* 2010;**30**:252–4.
9. Braithwaite T, Vugler A, Tufail A. Autoimmune retinopathy. *Ophthalmologica* 2012;**228**:131–42.
10. Eltabbakh GH, Hoogerland DL, Kay MC. Paraneoplastic retinopathy associated with uterine sarcoma. *Gynecol Oncol* 1995;**58**:120–3.
11. Adamus G, Amundson D, MacKay C, et al. Long-term persistence of antirecoverin antibodies in endometrial cancer-associated retinopathy. *Arch Ophthalmol* 1998;**116**:251–3.
12. Peek R, Verbraak F, Coevoet HM, et al. Muller cell-specific autoantibodies in a patient with progressive loss of vision. *Invest Ophthalmol Vis Sci* 1998;**39**:1976–9.
13. Salgia R, Hedges TR, Rizk M, et al. Cancer-associated retinopathy in a patient with non-small-cell lung carcinoma. *Lung Cancer* 1998;**22**:149–52.
14. Harmon JP, Purvin VA, Guy J, et al. Cancer-associated retinopathy in a patient with advanced epithelial ovarian carcinoma. *Gynecol Oncol* 1999;**73**:430–2.
15. Kashiwabara K, Nakamura H, Kishi K, et al. Cancer-associated retinopathy during treatment for small-cell lung carcinoma. *Intern Med* 1999;**38**:597–601.
16. Yoon YH, Cho EH, Sohn J, et al. An unusual type of cancer-associated retinopathy in a patient with ovarian cancer. *Korean J Ophthalmol* 1999;**13**:43–8.
17. Katsuta H, Okada M, Nakauchi T, et al. Cancer-associated retinopathy associated with invasive thymoma. *Am J Ophthalmol* 2002;**134**:383–9.
18. Yamada G, Ohguro H, Aketa K, et al. Invasive thymoma with paraneoplastic retinopathy. *Hum Pathol* 2003;**34**:717–9.
19. Ohguro H, Odagiri H, Miyagawa Y, et al. Clinicopathological features of gastric cancer cases and aberrantly expressed recoverin. *Tohoku J Exp Med* 2004;**202**:213–9.
20. Hayashi M, Hatsukawa Y, Yasui M, et al. Cancer-associated retinopathy in a child with Langerhans cell histiocytosis. *Jpn J Ophthalmol* 2007;**51**:393–6.
21. Ejma M, Misiuk-Hojlo M, Gorczyca WA, et al. Antibodies to 46-kDa retinal antigen in a patient with breast carcinoma and cancer-associated retinopathy. *Breast Cancer Res Treat* 2008;**110**:269–71.
22. Kim SJ, Toma HS, Thirkill CE, et al. Cancer-associated retinopathy with retinal periphlebitis in a patient with ovarian cancer. *Ocul Immunol Inflamm* 2010;**18**:107–9.
23. Tanaka A, Takase H, Adamus G, et al. Cancer-associated retinopathy caused by benign thymoma. *Br J Ophthalmol* 2010;**94**:526–8.
24. Sakamori Y, Kim YH, Okuda C, et al. Two cases of cancer-associated retinopathy combined with small-cell lung cancer. *Jpn J Clin Oncol* 2011;**41**:669–73.
25. Ohguro H, Yokoi Y, Ohguro I, et al. Clinical and immunologic aspects of cancer-associated retinopathy. *Am J Ophthalmol* 2004;**137**:1117–9.
26. Weleber RG, Watzke RC, Shults WT, et al. Clinical and electrophysiologic characterization of paraneoplastic and autoimmune retinopathies associated with antienolase antibodies. *Am J Ophthalmol* 2005;**139**:780–94.
27. Adamus G. Autoantibody targets and their cancer relationship in the pathogenicity of paraneoplastic retinopathy. *Autoimmun Rev* 2009;**8**:410–4.
28. Adamus G, Aptsiauri N, Guy J, et al. The occurrence of serum autoantibodies against enolase in cancer-associated retinopathy. *Clin Immunol Immunopathol* 1996;**78**:120–9.
29. Ferreyra HA, Jayasundera T, Khan NW, et al. Management of autoimmune retinopathies with immunosuppression. *Arch Ophthalmol* 2009;**127**:390–7.
30. Whitcup SM, Vistica BP, Milam AH, et al. Recoverin-associated retinopathy: a clinically and immunologically distinctive disease. *Am J Ophthalmol* 1998;**126**:230–7.
31. Murphy MA, Thirkill CE, Hart Jr WM. Paraneoplastic retinopathy: a novel autoantibody reaction associated with small-cell lung carcinoma. *J Neuroophthalmol* 1997;**17**:77–83.

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Unusual patterns of recurrence in low grade gliomas

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ABSTRACT

Some of the more unusual patterns of recurrence in previously treated low grade gliomas are demonstrated. As treatment choices develop and life expectancy is prolonged, patterns of tumour recurrence are likely to change within such a heterogeneous group of tumours, including metastatic spread via cerebrospinal fluid pathways.

1. Introduction

Diffuse grade II gliomas are slow growing, highly infiltrative, have a propensity to migrate along white matter tracts and almost inevitably undergo malignant transformation. Even with gross total resection surgical cure is not possible and infiltrative tumour cells appear to be particularly resistant to adjuvant cytotoxic therapy.[1,2] Although tumour recurrence typically occurs within the resection margins or treatment fields, here three patients are reported to illustrate more atypical patterns of recurrence in these tumours.

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2. Case reports

2.1. Patient 1

A 36-year-old man with a right frontotemporal grade II oligodendroglioma underwent biopsy and adjuvant radiotherapy in 1998 (Fig. 1a). Annual MRI revealed local recurrence in 2006, and a biopsy confirmed recurrence but not malignant transformation (Fig. 1b). He received procarbazine, lomustine and vincristine (PCV) chemotherapy and showed a partial response on MRI (Fig. 1c). In 2009 he presented with acute paraplegia and MRI revealed tumour recurrence in the spine (Fig. 1d) without evidence of recurrent intracranial disease. Due to his poor performance status, a tissue diagnosis was not obtained and he died 5 months later.

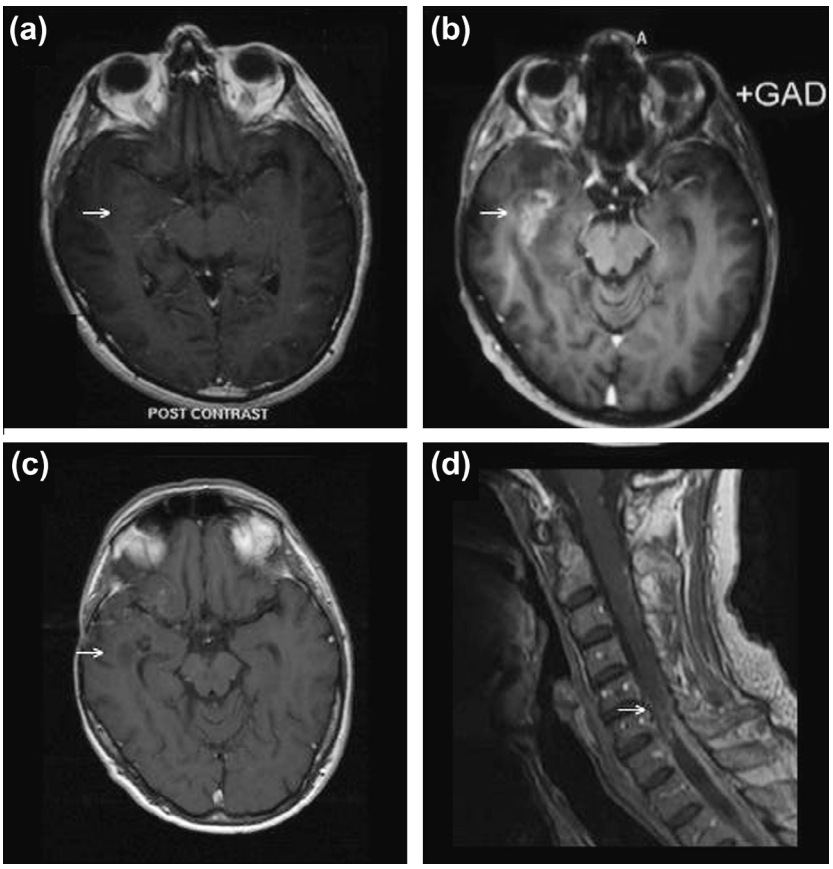

Fig. 1. Patient 1. Axial (a,c) T1-weighted MRI with (b,d) gadolinium (GAD) contrast demonstrating (a) right frontotemporal tumour, (b) local recurrence following radiotherapy treatment, (c) partial response to chemotherapy, and (d) spinal recurrence on sagittal view.

2.2. Patient 2

A 26-year-old woman with a left frontal grade II oligoastrocytoma underwent resection in Australia in 2005. She did not receive any adjuvant therapy. In 2008 MRI demonstrated local recurrence and further surgical resection in Australia revealed histological progression to a World Health Organization grade IV glioblastoma. She returned to the United Kingdom and received adjuvant chemoradiotherapy and the tumour showed a complete response (Fig. 2a). In 2010 she presented with acute paraperesis, paraesthesia of both hands and intractable leg pain. MRI demonstrated intramedullary recurrence with intrathecal "droplet" metastasis throughout her spine without cranial recurrence (Fig. 2b,c). Biopsy of spinal lesions revealed high grade glioma consistent with at least a grade III anaplastic astrocytoma. She was given palliative chemoradiotherapy. She was discharged to the palliative care team and died 1 month later.

2.3. Patient 3

A 28-year-old woman presented with a seizure secondary to a right posterior frontal tumour in 1996. Biopsy revealed a grade II oligodendroglioma. She did not receive any adjuvant therapy and was placed on active surveillance. In 1998 she presented with a progressive left hemiparesis and underwent tumour resection of the grade II oligodendroglioma. She received adjuvant radiotherapy and chemotherapy. Continued MRI surveillance showed stable disease with no evidence of recurrence (Fig. 3a). In 2009, 1 month

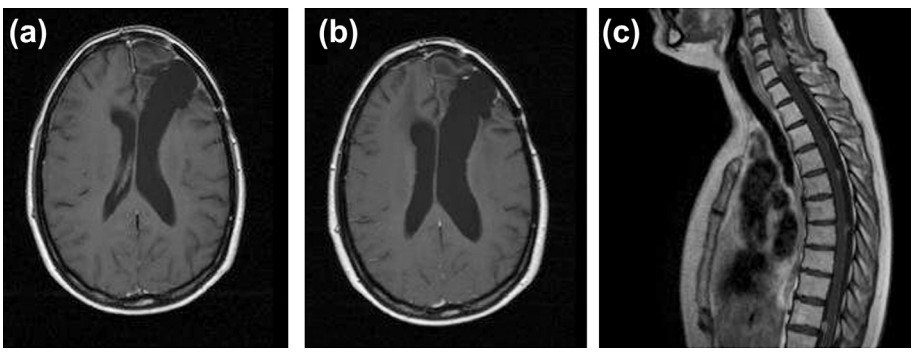

Fig. 2. Patient 2. T1-weighted (a) axial MRI demonstrating complete response of tumour. (b) Axial brain and (c) sagittal spine MRI showing spinal recurrence without evidence of cranial recurrence.