Profile of a Malignant Brain Tumour in Jamaica: An Eight-year Review, 2005 to 2012

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ABSTRACT

Objective: *Glioblastoma multiforme (GBM) is the most malignant and most common primary brain tumour worldwide. This study was undertaken to investigate the demographics of this tumour in Jamaica as there is to date no such published data. Data from the recently started Intracranial Tumour Registry (ITR) at the University Hospital of the West Indies was used.*

Methods: *All cases of GBM entered into the ITR between 2005 and 2012 were gathered. Of these, only patients with pathologically proven diagnoses were entered into the study. Demographic data, including age and gender, were recorded. The distribution of the tumours by anatomic location was also documented.*

Results: *Of the 602 patients entered into the ITR up to that time, 42 were found to have histologically proven GBM with a male to female ratio of 2.2:1. There was an age range of 8–92 years with a mean age of diagnosis of 48 years. The majority of the tumours (66.7%) occurred in the left cerebral hemisphere with the most common lobe being the temporal lobe. Two patients (4.8%) had lesions spanning both hemispheres.*

Conclusions: *This preliminary study reveals that there is a similar gender distribution of GBM within our population compared with the rest of the world. It, however, revealed that the mean age of diagnosis in our population (48 years) is lower than that quoted in the worldwide literature (53 to 64 years). One possible explanation for this is the possibility that many of our GBMs are actually secondary tumours which are thought to arise from less malignant, undiagnosed precursors. The percentage of GBMs occurring in the paediatric population was similar to the rest of the world.*

Keywords: Brain, glioblastoma, malignant, tumour

Perfil de un Tumor Cerebral Maligno en Jamaica: una Revisión de Ocho Años, de 2005 a 2012

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RESUMEN

Objetivo: *El glioblastoma multiforme (GBM) es el tumor cerebral primario más maligno y más común en todo el mundo. Este estudio fue emprendido para investigar la demografía de este tumor en Jamaica, ya que hasta la fecha no existen datos publicados al respecto. Se utilizaron datos del Registro de Tumores Intracraneales (ITR, en inglés) en el Hospital Universitario de West Indies.*

Métodos: *Se recogieron todos los casos de GBM registrados en el ITR entre 2005 y 2012. De éstos, sólo pacientes con diagnóstico patológico probado participaron en el estudio. Se registraron los datos demográficos, incluyendo la edad y el género. La distribución de los tumores según la localización anatómica también fue documentada.*

Resultados: *De los 602 pacientes registrados en el ITR hasta aquel momento, se halló que 42 tenían GBM histológicamente probado, GBM con una proporción hombre:mujer de 2.2:1. El rango de edad fue de 8 – 92 años con una edad promedio de diagnóstico de 48 años. La mayoría de los tumores (66.7%) ocurrían en el hemisferio cerebral izquierdo, siendo el lóbulo temporal el lóbulo más común. Dos pacientes (4.8%) tenían lesiones que abarcaban ambos hemisferios.*

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Conclusiones: *Este estudio preliminar revela que en nuestra población existe una distribución de GBM por género, similar al resto del mundo. Sin embargo, se puso de manifiesto que la edad promedio de diagnóstico en nuestra población (48 años) es menor que la referida en la literatura mundial (53 a 64 años). Una posible explicación para esto es la posibilidad de que muchos de los GBM, son en realidad tumores secundarios, los cuales se piensa que surgen de precursores menos malignos, no diagnosticados. El porcentaje de GBM que ocurre en la población pediátrica fue similar en el resto del mundo.*

Palabras claves: Cerebro, tumor maligno, glioblastoma

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INTRODUCTION

Gliomas are the most common brain tumours worldwide and constitute a group of heterogenous tumours inclusive of astrocytomas, oligodendrogliomas, ependymomas and choroid plexus tumours. Of all of these, glioblastoma multiforme (GBM) represents the most malignant end of the astrocytoma spectrum, being a World Health Organization (WHO) grade 4 tumour. It the most frequently occurring primary brain tumour in the United States of America (USA) and worldwide, accounting for 12 to 15% of all intracranial neoplasms (1, 2). Similarly, GBM at the University Hospital of the West Indies (UHWI) is the most common primary malignant brain tumour according to preliminary data coming out of the newly formed Intracranial Tumour Registry [ITR] (3). The ITR, which is the first of its kind in the English-speaking Caribbean, was implemented at the UHWI in March 2010. Of 99 patients who had histological assessment of intracranial masses removed at the UHWI between 2006 and 2010, 10 patients (10%) had been diagnosed with GBM.

In a previous study looking at the occurrence of tumours of the central nervous system (CNS) at the UHWI between the years 1970 and 1984 by Char *et al* (4), gliomas, at that time, represented approximately 33% of all the tumours documented. Of these, GBM was the most frequently occurring glioma (44%) and the overall most common primary brain tumour (16.4%).

The survival rates for GBM remain dismal, being approximately 3–5% at five years (5, 6). According to the most recent report from the Central Brain Tumour Registry of the USA (CBTRUS), GBMs are more common in males and have a peak incidence between 75 and 84 years of age (1).

This study was undertaken to investigate the demographics of this tumour in Jamaica as there is to date no such published data. Data from the recently started Intracranial Tumour Registry at the University Hospital of the West Indies was used.

SUBJECTS AND METHODS

A review of all cases entered in the ITR was done using the search strings "glioblastoma", "glioblastoma multiforme", "WHO grade IV glioma/astrocytoma" and "GBM". Only patients with a pathologic diagnosis of a WHO grade IV glioma/GBM were included. Patients who had not yet had pathologic confirmation of an imaging diagnosis were excluded. Demographic data, including age and gender, were recorded. The distribution of the tumours by anatomic location was also documented. Retrieved data were anonymized. No patient consent was necessary.

RESULTS

There are 602 patients registered in the ITR to date. Of these, the total number of patients histologically confirmed to have GBM is 42. There are 29 males and 13 females, giving a male:female (M:F) ratio of 2.2:1. The age range of patients diagnosed with GBM is 8–92 years with a mean of 48 years (Figs. 1 and 2). Four patients (9.5%) were diagnosed between the ages 0 and 19 years with a M:F ratio of 3:1 in this age group.

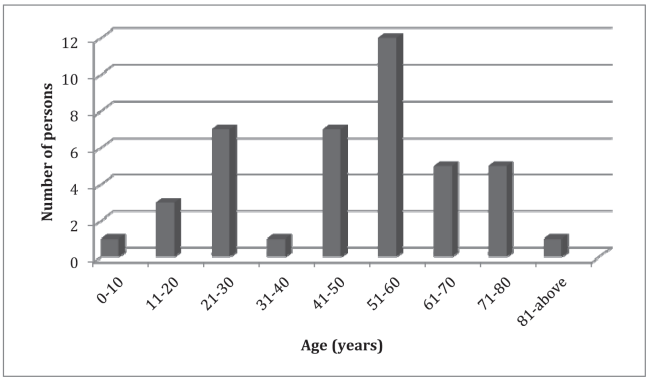

Fig. 1: Age distribution of persons with glioblastoma multiforme at the University Hospital of the West Indies, 2005 to 2012.

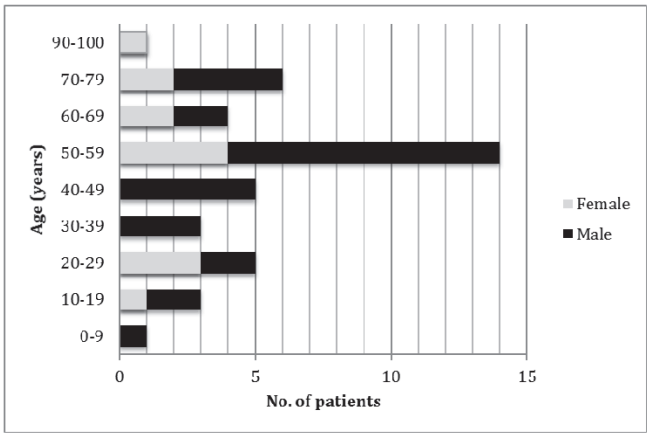

Fig. 2: Age by gender for patients with glioblastoma multiforme at the University Hospital of the West Indies, 2005–2012.

Most of the tumours occurred on the left side of the cerebral hemisphere [66.7%] (Table). The most common lobe was the temporal lobe (23.8%). No GBM was seen in the infratentorial compartment or within the ventricles. Two patients (4.8%) had lesions spanning both hemispheres (butterfly lesions).

Table: Location of glioblastoma multiforme at the University Hospital of the West Indies, 2005–2012*

Location (radiological)	Right (n)	%	Left (n)	%
Frontal	3	7.1	3	7.1
Frontoparietal	1	2.4	5	11.9
Fronto-temporal	0	0	1	2.4
Parietal	2	4.8	2	4.8
Temporo-parietal	2	4.8	5	11.9
Temporal	3	7.1	7	16.7
Occipital	1	2.4	0	0
Occipito-parietal	0	0	3	7.1
Thalamic/ basal ganglia	0	0	2	4.8
Posterior fossa	0	0	0	0
Total (n): 40	**12**	**28.6**	**28**	**66.7**

*Butterfly lesions (across the midline) not included in the table: anterior (bifrontal): 1 (2.4%); posterior (bioccipital): 1 (2.4%)

DISCUSSION

Glioblastomas are the most common primary brain tumours and the most common primary intracranial malignancy (1–3). They are classified as WHO grade IV tumours, making them the most malignant gliomas. They were first identified in 1863 by Virchow as a tumour of glial origin (7). The first comprehensive description of this tumour was made by Strauss and Globus in 1925 (8) when they coined the name spongioblastoma multiforme. In 1926, Bailey and Cushing changed the name to glioblastoma multiforme (9).

They can be classified into two subtypes in terms of pathogenesis: primary and secondary, terms that were first used by Scherer in 1940 (10). The primary or *de novo* glioblastomas are thought to differentiate from an astrocytic precursor cell directly into a glioblastoma. They account for the majority of GBMs (95%) and tend to occur in older persons (older than 50 years) with a short clinical history and no clinical or histopathological evidence of a pre-existing less malignant lesion (11). The less common secondary subtype (5%) involves a pathway of differentiation of an astrocytic precursor cell to a diffuse astrocytoma (WHO grade II), then to an anaplastic astrocytoma (WHO grade III), then finally to a GBM (WHO grade IV). These tend to occur in younger patients (less than 45 years) with a longer clinical history and the less malignant precursor lesion can be identified histologically. There is increasing evidence that primary and secondary GBMs constitute distinct disease entities that evolve through two different pathways (11, 12) [Fig. 3]. Most glioblastomas are sporadic but may rarely be associated with tumour syndromes such as neurofibromatosis type 1, Li-Fraumeni syndrome, Turcot syndrome and Ollier disease (13).

Glioblastomas can occur at any age but preferentially affect adults, with a peak incidence in the sixth and seventh decades; the mean age at diagnosis varies from 53 to 64 years (1, 14). The mean age of diagnosis of glioblastoma in this study is lower, occurring at 48 years. The percentage of GBMs occurring in the paediatric population (less than 19 years) in this study is similar to those quoted in the worldwide literature, which is between 5 and 10% (15, 16). The gender distribution is also similar with just over twice as many males compared to females.

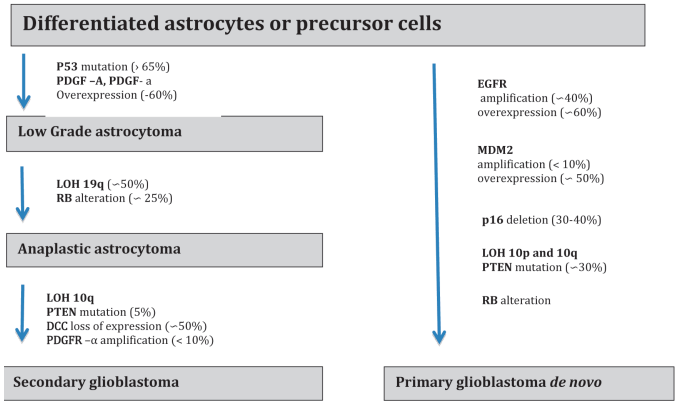

Fig. 3: Genetic pathways in the evolution of glioblastomas [modified from Kleihues and Ohgaki; 1997 (12)].

In this study, there were only two documented cases (4.7%) in which a lower grade glioma was identified histologically either in a previous biopsy or at the time of diagnosis of GBM. These patients, by definition, therefore, would be diagnosed with secondary GBMs. The patients included a 43-year old man and a 28-year old woman; in keeping with the genetic basis of secondary GBMs, they were both less than 50 years old at the time of diagnosis. This is in keeping with figures quoted in the literature stating that the majority of GBMs turn out to be the more aggressive primary types. Unfortunately, genetic studies were not yet available.

Glioblastomas in this study were twice as frequent on the left side of the brain, with the left temporal lobe being the most common. This has implications for surgical management given that most individuals are left-side dominant. It is commonly believed that gliomas develop in lobes relative to the volume of glial tissue. These results seem to differ from other studies looking at gliomas in general where the right side was more common and most tumours occurred in the frontal lobe (1, 17, 18). Interestingly, in our study, no GBMs occurred in the cerebellum or brainstem region.

In this retrospective review, we were not able to establish median survival time after diagnosis. However, it is well known that despite multimodal aggressive therapy even in the best of treatment centres, the median survival time after diagnosis remains approximately 12 months (19, 20).

REFERENCES

1. Dolecek TA, Propp JM, Stroup NE, Kruchko C. CBTRUS statistical report: primary brain and central nervous system tumors diagnosed in the United States in 2005–2009. Neuro Oncol 2012**; 14 (Suppl 5):** v1–v49.
2. Zulch KJ. Brain tumors. Their biology and pathology. 3rd ed. Berlin Heidelburg: Springer Verlag; 1986.
3. Campbell J, Jaggon JR, Johnson P, Bruce C, Eldemire-Shearer D. The establishment of an intracranial tumour registry at the University Hospital of the West Indies: the first of its kind in the Caribbean. West Indian Med J 2012; **61:** 254–7.
4. Char G, Cross JN, Persaud V. Tumors of the central nervous system. Analysis of 476 cases on observed at the University Hospital of the West Indies. West Indian Med J 1987; **36:** 140–9.
5. Black PM, Loefler J. Cancer of the nervous system. Cambridge, UK: Blackwell; 1997: 464–91.
6. Scott JN, Rewcastle NB, Brasher PM, Fulton D, MacKinnon JA, Hamilton M et al. Which glioblastoma multiforme patient will become a long term survivor? A population based study. Ann Neurol 1999; **46:** 183–8.
7. Virchow R. Die krankhaften geschwulste. Berlin: Hirschwald; 1863.
8. Globus JH, Strauss I. Spongioblastoma multiforme. Arch Neurol Psychiatry 1925; **14:** 139–51.
9. Bailey P, Cushing H. A classification of tumors of the glioma group on a histogenetic basis with a correlation study of Prognosis. Philadelphia: Lippincott; 1926.
10. Scherer HJ. Cerebral astrocytomas and their derivatives. Am J Cancer 1940; **40:** 159–98.
11. Kleihues P, Ohgaki H. Primary and secondary glioblastomas: from concept to clinical diagnosis. Neuro Oncol 1999; **1:** 44–51.
12. Kleihues P, Ohgaki H. Genetics of glioma progression and the definition of primary and secondary glioblastoma. Barin Pathol 1997; **7:** 1131–6.
13. Farrell CJ, Plotkin SR. Genetic causes of brain tumors: neurofibromatosis, tuberous sclerosis, von Hippel-Lindau, and other syndromes. Neurol Clin 2007; **25:** 925–46.
14. Ohgaki H, Kleihues P. Population-based studies on incidence, survival rates, and genetic alterations in astrocytic and oligodendroglial gliomas. J Neuropathol Exp Neurol 2005; **64:** 479–89.
15. Dohrmann GJ, Farwell JR, Flannery JT. Glioblastoma multiforme in children. J Neurosurg 1976; **44:** 442–8.
16. Pollack IF. Current concepts: brain tumors in children. N Engl J Med 1994; **331:** 1500–7.
17. Larjavaara S, Mäntylä R, Salminen T, Haapasalo H, Raitanen J, Jääskeläinen J et al. Incidence of gliomas by anatomic location. Neuro Oncol 2007; **9:** 319–25.
18. Ali Kahn A, O'Brien DF, Kelly P, Phillips JP, Rawluk D, Bolger C et al. The anatomical distribution of cerebral gliomas in mobile phone users. Ir Med J 2003; **96:** 240–2.
19. Smith JS, Jenkins RB. Genetic alterations in adult diffuse glioma: occurrence, significance, and prognostic implications. Front Biosci 2000; **5:** D213–31.
20. Bruce JN, Kennedy B, Shephard RC, Talavera F, McKenna R, Harris J. Glioblastoma multiforme [monograph on the internet]. eMedicine 2013 [Updated 2013 Sep 9; cited 2013 Oct 25]. Available from: http://emedicine.medscape.com/article/283252-overview