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Original Article

Factors Influencing Overall Survival Specific to Adult Low-grade Astrocytoma: A Population-based Study

A. Sahgal [*†], S.A. Ironside [‡], J. Perry [§], T. Mainprize [¶], J.L. Keith [||], N. Laperriere [†], M. Tsao [*], L. Paszat [*,**]

[*] *Department of Radiation Oncology, Sunnybrook Health Sciences Centre, University of Toronto, Toronto, Ontario, Canada*
[†] *Department of Radiation Oncology, Princess Margaret Cancer Centre, University of Toronto, Toronto, Ontario, Canada*
[‡] *Division of Neurology, Hospital for Sick Children, University of Toronto, Toronto, Ontario, Canada*
[§] *Division of Neurology and Medical Oncology, Sunnybrook Health Sciences Centre, University of Toronto, Toronto, Ontario, Canada*
[¶] *Division of Neurosurgery, Sunnybrook Health Sciences Centre, University of Toronto, Toronto, Ontario, Canada*
[||] *Department of Anatomic Pathology, Sunnybrook Health Sciences Centre, University of Toronto, Toronto, Ontario, Canada*
[**] *Institute for Clinical Evaluative Sciences, University of Toronto, Toronto, Ontario, Canada*

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Abstract

Aims: We report a population-based overall survival and prognostic factor analysis specific to adult patients diagnosed with low-grade astrocytoma (LGA).
Materials and methods: All histologically confirmed cases of LGA diagnosed between 1992 and 1996 in the province of Ontario, Canada, were identified from the Ontario Cancer Registry and reviewed.
Results: In total, 182 patients were identified; the mean age was 50 years and the mean survival time was 4.1 years (standard deviation = 5.1 years). Fifty-four per cent of patients had a surgical excision and 46% were biopsied alone. Both univariate and multivariate analyses showed that patients aged <30 years were significantly more likely to undergo an excision as compared with a biopsy alone (odds ratio = 4.26, 95% confidence interval 1.54–11.77). For the entire cohort, we observed a significant relationship between decreasing survival as a function of increasing age at diagnosis. In the biopsy sub-group, relative to patient's age <30 years, the hazard of dying increased significantly according to age when stratified by decade. However, in those patients having had a primary surgical excision, the hazard of dying relative to patient's age <30 years was similar for those aged 30–49 years and then significantly greater as patient age surpassed 50 years.
Conclusions: Age is a significant prognostic factor for LGA. Our analysis suggests that in those patients amenable to a primary tumour excision, a survival benefit may be confined to those under age 50 years.

Key words: Glioma; low-grade astrocytoma; low grade glioma; overall survival; population-based study; prognostic factors

Introduction

Low-grade gliomas (LGG) comprise a rare and clinically challenging group of central nervous system tumours to manage [1]. The median survival time ranges from a few years to over 20 years [2–4], which is a reflection of the heterogeneity of the diagnostic sphere of LGG and selection bias in case series.

The most common LGG subtypes include astrocytoma, oligodendroglioma and mixed oligo-astrocytoma. Astrocytic morphology typically confers a worse prognosis [1–4]. However, few long-term data have been reported specific to low-grade astrocytoma (LGA) with respect to survival, prognostic factors and patterns of practice. We report on these outcomes based on patient data collected by the provincial population-based Ontario Cancer Registry (OCR), which ascertains cases probabilistically based on the linkage of: (1) hospital records, (2) pathology reports, (3) hospital discharge abstract diagnoses, and (4) death certificates, from all Ontario (Canada) cancer centres.

Author for correspondence: A. Sahgal, Sunnybrook Health Sciences Centre and Princess Margaret Cancer Centre, 2075 Bayview Avenue, Toronto, Ontario M4N 3M5, Canada. Tel: +1-416-480-5329; Fax: +1-416-480-6002.
E-mail address: Arjun.Sahgal@sunnybrook.ca (A. Sahgal).

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Materials and Methods

From the copy of the OCR database held at the Institute of Clinical Evaluative Sciences (ICES), we identified all cases of LGA diagnosed between 1992 and 1996. All patients were at least 18 years of age. Cases were required to have an International Classification of Diseases (ICD) Version 9 (ICD9) diagnosis code of brain tumour, ICD-O histology code consistent with LGA and at least one confirmatory histopathology report. Those with oligodendroglial, mixed oligoastrocytoma and pilocytic ICD-O histology codes were explicitly excluded.

Additional information extracted from the OCR for each case included: age at diagnosis, gender, date of last contact, vital status on the date of last contact and cause of death. Each case record is labelled with a numerically encrypted version of the unique health insurance identifier so that each case can be linked to other population-wide databases, including the physician billing claims database of the Ontario Health Insurance Plan held at ICES. For each case, billing claims for biopsy, resection of brain tumour and radiation oncology consultation were extracted, and the procedure code and the date of the procedure were linked to the case records. Surgical biopsy, surgical excision and radiation oncology consultation records were considered to be part of the upfront care for LGA if these services occurred $<$ 365 days after the diagnosis date in the OCR. Patients having had a biopsy alone were confirmed to have no additional surgical codes specific to excision within that time period. The study was approved by the Research Ethics Board of Sunnybrook Health Sciences Centre, Toronto, Ontario, Canada.

Statistical Analysis

Survival time was calculated based on the date of diagnosis (date of tissue confirmation of LGA) to the date of death (any cause), or last follow-up, which included up to 31 December 2009 for surviving patients. Univariate and multivariate analyses using the Cox proportional hazards model were used to estimate hazard ratios and 95% confidence intervals. Predictors included in the adjusted model were age at diagnosis ($<$30, 30–39, 40–49, 50–59, $\geq$60 years), gender, histology and primary surgical procedure (tumour excision versus tumour biopsy). The likelihood of patients undergoing a surgical excision as opposed to a surgical biopsy and the likelihood of having a consultation with a radiation oncologist were calculated using logistic regression. Data analyses were carried out using SAS software (version 9.2).

Results

Baseline Patient and Treatment Characteristics

Between 1992 and 1996, 182 patients were diagnosed with LGA. Baseline characteristics are described in Table 1. Most patients had an ICD-based diagnosis of astrocytoma not otherwise specified (NOS). Ninety-eight (54%) patients had a primary surgical excision compared with 84 (46%) biopsied alone. Figure 1 shows that an increasing patient age was correlated with an increased likelihood of receiving a biopsy alone. Nevertheless, only age $<$30 years was associated with a higher odds ratio of undergoing a primary excision in both univariate (odds ratio = 4.29, 95% confidence interval 1.55–11.84) and multivariate analyses (odds ratio = 4.26, 95% confidence interval 1.54–11.77), relative to older patients (Table 2). In our cohort, 73.1% (133/182) of the 182 patients had been seen in consultation with a radiation

Table 1
Baseline patient and treatment characteristics for the entire 182 low-grade astrocytoma cohort

Mean age at diagnosis (standard deviation)	50 years (±17)
Age at diagnosis (years)	
<30	27 (14.8%)
30–39	39 (21.4%)
40–49	27 (14.8%)
50–59	34 (18.7%)
≥60	55 (30.2%)
Male/female	102/80 (56%/44%)
Histology	
Astrocytoma not otherwise specified	142 (78%)
Protoplasmic astrocytoma	4 (2.2%)
Gemistocytic astrocytoma	21 (11.5%)
Fibrillary astrocytoma	15 (8.2%)
Year of diagnosis	
1992	46 (25.3%)
1993	30 (16.5%)
1994	33 (18.1%)
1995	35 (19.2%)
1996	38 (20.9%)
Primary surgical biopsy	98 (54%)
Primary surgical excision	84 (46%)
Consultation with a radiation oncologist	133/182 (73.1%)

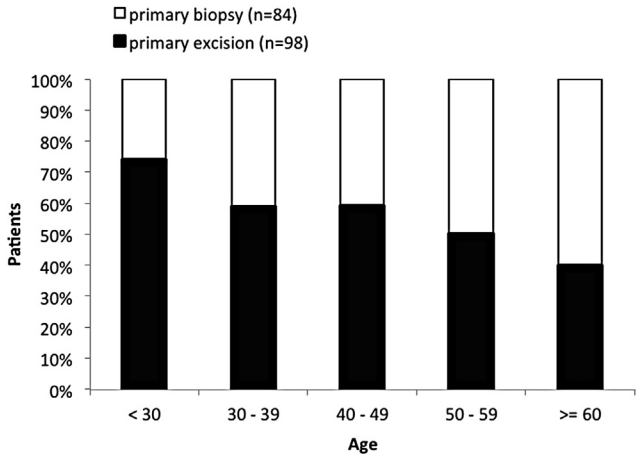

Fig 1. Percentage of patients in each age category undergoing a primary excision.