

Incidence Trends in the Anatomic Location of Primary Malignant Brain Tumors in the United States: 1992–2006

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Key words

- Astrocytoma
- Brain neoplasm
- Epidemiology
- Glioma
- Glioblastoma multiforme
- Incidence
- Location

Abbreviations and Acronyms

AA: Anaplastic astrocytoma

AAIR: Age-adjusted incidence rates

APC: Annual percent changes

CCR: California Cancer Registry

CNS: Central nervous system

GBM: Glioblastoma multiforme

ICDO-3: International Classification of Disease for Oncology, Third Edition

LAC: Los Angeles County Cancer Surveillance Program

SEER: National Cancer Institute's Surveillance, Epidemiology, and End Results

WHO: World Health Organization



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INTRODUCTION

Over the last 3 decades, several population-based studies have reported an overall increase in the incidence of malignant primary brain tumors (1, 4, 6–9, 11, 14). Although it has been generally accepted that this phenomenon is at least in part accounted for by higher detection rates associated with the increasing frequency and sensitivity of diagnostic imaging, it remains to be determined whether the true incidence of primary central nervous system (CNS) tumors is independently increasing as a result of environmental factors (1, 11, 18).

■ **BACKGROUND:** This study sought to determine incidence trends of the anatomical origin of primary malignant brain tumors.

■ **METHODS:** Incidence data for histologically confirmed brain tumors were obtained from the Los Angeles County Cancer Surveillance Program (LAC), the California Cancer Registry (CCR), and the National Cancer Institute's Surveillance, Epidemiology, and End Results (SEER) program for 1992 to 2006. Age-adjusted incidence rates (AAIR) and annual percent changes (APC) were calculated by histologic subtypes and anatomic subsites. Statistical analyses were performed using the SEER*Stat analytic software and SAS statistical software.

■ **RESULTS:** Increased AAIRs of frontal (APC +2.4% to +3.0%, $P \leq 0.001$) and temporal (APC +1.3% to +2.3%, $P \leq 0.027$) lobe glioblastoma multiforme (GBM) tumors were observed across all registries, accompanied by decreased AAIRs in overlapping region GBMs (–2.0% to –2.8% APC, $P \leq 0.015$). The AAIRs of GBMs in the parietal and occipital lobes remained stable. The AAIR of cerebellar GBMs increased according to CCR (APC +11.9%, $P < 0.001$). The AAIR of all gliomas, which includes all anatomical subsites, decreased (–0.5% to –0.8% APC, $P \leq 0.034$). Low-grade and anaplastic astrocytomas demonstrated decreased AAIRs in the majority of brain regions.

■ **CONCLUSIONS:** Data from 3 major cancer registries demonstrate increased incidences of GBMs in the frontal lobe, temporal lobe, and cerebellum, despite decreased incidences in other brain regions. Although this may represent an effect of diagnostic bias, the incidence of both large and small tumors increased in these regions. The cause of these observed trends is unknown.

Although many previous reports have analyzed trends in the overall incidence of gliomas and various glioma subtypes, few recent studies have examined these trends according to the anatomical subsites of primary malignant brain tumors over the last several decades (2, 10). Furthermore, no recent studies have analyzed population-based incidence trends by both tumor grade subtype and anatomic location. Given the increasing trends of primary malignant brain tumors, we sought to determine whether any notable trends in the anatomical topography of primary CNS tumors have occurred. Data from 3 major population-based cancer registries were reviewed to identify any trends in the incidence of primary malignant brain tumors, their loca-

tion of origin, and various demographic risk factors. The current study is the first to analyze population-based incidence trends of malignant brain tumors according to anatomical parameters.

CLINICAL MATERIALS AND METHODS

Data used in our analysis were obtained from 3 sources, the largest of which is the National Cancer Institute's Surveillance, Epidemiology, and End Results (SEER) Program (16). A signed limited-use data agreement was obtained to access these data. This program includes incidence and population data associated by age, gender, race/ethnicity, and year of diagnosis. Thirteen

Table 1. Demographic Characteristics of Patients Harboring Gliomas in 3 Major Tumor Registries, 1992 to 2006

| | LA County | | CCR | | SEER 12 Registries | |
|-------------------------------------|-----------|-------|--------|-------|--------------------|-------|
| | Number | % | Number | % | Number | % |
| Total number | 5736 | 100.0 | 10,412 | 100.0 | 22,419 | 100.0 |
| Sex | | | | | | |
| Male | 3154 | 55.0 | 5864 | 56.3 | 12,651 | 56.4 |
| Female | 2582 | 45.0 | 4548 | 43.7 | 9768 | 43.6 |
| Age | | | | | | |
| 0–19 | 476 | 8.3 | 711 | 6.8 | 1477 | 6.6 |
| 20–64 | 3141 | 54.8 | 5880 | 56.5 | 12,386 | 55.2 |
| 65+ | 2119 | 36.9 | 3821 | 36.7 | 8556 | 38.2 |
| Ethnicity | | | | | | |
| Non-Hispanic white | 3410 | 59.4 | 6776 | 65.1 | 18,658 | 83.2 |
| Hispanic white | 1514 | 26.4 | 2057 | 19.8 | 1288 | 5.7 |
| Black | 402 | 7.0 | 603 | 5.8 | 1161 | 5.2 |
| Asian/other | 410 | 7.1 | 976 | 9.4 | 1312 | 5.9 |
| Location | | | | | | |
| Frontal lobe | 1434 | 25.0 | 2653 | 25.5 | 5781 | 25.8 |
| Temporal lobe | 1045 | 18.2 | 1938 | 18.6 | 4548 | 20.3 |
| Parietal lobe | 766 | 13.4 | 1449 | 13.9 | 3125 | 13.9 |
| Occipital lobe | 147 | 2.6 | 291 | 2.8 | 762 | 3.4 |
| Overlapping | 1238 | 21.6 | 2238 | 21.5 | 3897 | 17.4 |
| Cerebellum | 124 | 2.2 | 203 | 1.9 | 344 | 1.5 |
| Brainstem | 249 | 4.3 | 437 | 4.2 | 934 | 4.2 |
| Ventricle | 97 | 1.7 | 151 | 1.5 | 263 | 1.2 |
| Cerebrum | 277 | 4.8 | 470 | 4.5 | 1129 | 5.0 |
| Brain NOS | 359 | 6.3 | 582 | 5.6 | 1636 | 7.3 |
| Histology | | | | | | |
| Astrocytoma, NOS (WHO I and II) | 706 | 12.3 | 1091 | 10.5 | 2260 | 10.1 |
| Anaplastic astrocytoma (WHO III) | 599 | 10.4 | 993 | 9.5 | 1792 | 8.0 |
| GBM (WHO IV) | 3094 | 53.9 | 5868 | 56.4 | 12,714 | 56.7 |
| Protoplasmic/fibrillary Astrocytoma | 87 | 1.5 | 137 | 1.3 | 421 | 1.9 |
| Unique astrocytoma variants | 34 | 0.6 | 48 | 0.5 | 96 | 0.4 |
| Ependymoma | 172 | 3.0 | 298 | 2.9 | 563 | 2.5 |
| Mixed glioma | 226 | 3.9 | 412 | 4.0 | 720 | 3.2 |
| Glioma, NOS | 369 | 6.4 | 662 | 6.4 | 1570 | 7.0 |
| Oligodendroglioma | 325 | 5.7 | 653 | 6.3 | 1714 | 7.6 |
| Anaplastic oligodendroglioma | 124 | 2.2 | 250 | 2.4 | 569 | 2.5 |
| Laterality | | | | | | |
| Ipsilateral | 5673 | 98.9 | 10325 | 99.2 | 22,291 | 99.4 |
| Bilateral | 35 | 0.6 | 48 | 0.5 | 64 | 0.3 |
| Paired, unknown laterality | 28 | 0.5 | 39 | 0.4 | 64 | 0.3 |

CCR, California Cancer Registry; GBM, glioblastoma multiforme; LA, Los Angeles County; NOS, not otherwise specified; SEER, National Cancer Institute's Surveillance, Epidemiology, and End Results; WHO, World Health Organization.

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