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ORIGINAL ARTICLE

A retrospective analysis of meningioma in Central Texas

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Abstract Documented meningioma cases in Central Texas (USA) from 1976 to 2013 were studied utilizing the Scott & White Brain Tumor Registry. All the cases examined were histologically diagnosed as meningiomas. Of the 372 cases, most were benign tumors ($p < 0.05$). A majority of the patients were females ($p < 0.05$). Elderly individuals (>45 years of age) superseded the younger patients in meningioma incidence ($p < 0.05$). Previous data regarding meningioma epidemiology in Texas showed a higher incidence in black patients when compared to white patients. By contrast, this study's findings of Central Texas meningioma demographics show increased incidence of meningiomas in white patients ($p < 0.05$). This interesting find in meningioma prevalence warrants further investigation with a larger sample size, in order to establish validity and further parse out possible causes of meningioma development among white individuals.

1. Introduction

Meningiomas are the most common primary brain tumors in adults, constituting a third of all diagnosed primary neoplasms of the brain [1]. It has been reported that the age-adjusted incidence rate of meningioma is 7.61/100,000 individuals per year [2]. Although most meningiomas are considered histologically benign and many are clinically silent,

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the potential impact of morbidity these tumors have on society can be huge [3,4]. Many patients diagnosed with a meningioma live with devastating clinical symptoms that vary depending on the size and location of the growth [4,5]. Symptoms include, but are not limited to: vision loss, seizures, neurological deficits, speech dysfunction, difficulty in concentration, and motor weakness to name several [4]. Additionally, open microsurgical resection (the treatment of choice for meningiomas) has the potential to induce morbidity in and of itself, due to its complexity and time burden, especially in older patients with preexisting medical conditions. This is attributable to the benign and slow-growing nature of most meningiomas, resulting in many patients developing of large lesions over several years and thus requiring more invasive procedures. These large resections increase the risk of morbidity, particularly in older individuals with preexisting conditions [6]. Yet, despite its high prevalence rate and increased risk of morbidity, relatively little knowledge exists in the literature regarding the epidemiology of meningiomas [7]. Only recently has the Senate Appropriations Committee recognized this paucity of knowledge and subsequently made recommendations to increase attention on brain tumor research.

Recent research has led to the discovery of possible genetic and environmental risk factors for meningiomas. Genetically, it has been shown that meningiomas are the second most frequently occurring tumors in patients with neurofibromatosis type II, and to a lesser degree, can occur in the setting of multiple endocrine neoplasia type I [1].

Most nongenetic risk factors are environmental and are associated with economic development. To date, studies assessing the involvement of hair dye, cell phone use, allergens, agricultural chemicals, petrochemicals, rubber and solvent contacts, loud noise, infection, passive and active smoke exposure, and exogenous hormone use with meningioma occurrence have given rise to inconclusive or mixed results. By contrast, ionizing radiation exposure has been proven to be a definite risk factor for meningiomas, as well as for other lethal carcinomas [4,8].

The aim of this study is to undertake an analysis of meningioma occurrence in the Central Texas region (USA). Previous reports have alluded to the presence of a relatively high amount of radiation in Texas drinking water, specifically radium 226 and radium 228 [9,10]. Additionally, the Central Texas region has seen a massive increase in economic development over the past few decades. As a result, exposure to many of the risk factors previously alluded to, such as exogenous hormones, cell phones, hair dye, allergens, petrochemicals, agriculture, loud noise, and radiation, have increased and are now widespread in Central Texas at varying degrees [8—10]. According to a 2012 Centers for Disease Control and Prevention (CDC) report, 27.7% of Texas residents were obese (body mass index $\geqslant$30), thus increasing this group's risk of meningioma [11]. Therefore, the data accrued will also facilitate the assessment of the cumulative contribution of the aforementioned possible environmental risk factors on the occurrence of meningioma. To achieve our objectives, we evaluated cases from the Scott & White Health Care Tumor Registry ranging from 1976 to 2013. This study meets the Scott & White Health Care Central Texas institutional review board (IRB) guidelines, as well as those of the National Institutes of Health (NIH).

2. Materials and methods

Patient details were obtained from the Scott & White Brain Tumor Registry which is a SW Temple, Texas hospital-based tumor registry. Our data are based on cerebral and spinal meningioma. For the purposes of this study, meningioma diagnoses were considered to be definitive when obtained through surgical biopsy and/or resection. As such, 372 cases in the tumor registry, ranging from 1976 to 2013, which had undergone surgical procedures where the final histological diagnoses were confirmed as meningiomas, were examined. The data were stratified according to sex, age group (0—19 years of age, 20—34 years of age, 35—44 years of age, 45—54 years of age, 55—64 years of age, 65—74 years of age, 75—84 years of age, > 85 years of age), ethnicity (white, black, Hispanic), and histology (benign or malignant). Factorial analysis of variance was utilized (general linear models; Statistica version 8.0, Statsoft — Tulsa, OK, USA). *Post hoc* assessments were conducted with the Duncan's multiple range tests and a p value <0.05 qualified as statistically significant.

3. Results

3.1. Age group

Five of the eight age groups were compared with each other (0—19 years, 20—34 years, 35—44 years, 45—54 years, 55—64 years, 65—74 years, 75—84 years, >85 years). The number of patients between the ages of 45 years and 84 years (84%)