Editorial

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Journal of Surgery and Emergency Medicine

2017
Vol.1 No.1:e105

Treatments of Common Brain Tumors

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Received date: January 02, 2017; **Accepted date:** January 03, 2017; **Published date:** January 05, 2017

Citation: Ninh BD, Mohit P, Ha SN, et al. (2017) Treatments of Common Brain Tumors. J Surgery Emerg Med 1:1.

Abstract

World Health Organization (WHO) published an updated article regarding the classification of tumors of the brain. In this updated classification, brains tumors are not only classified based on their histology but molecular parameters are also incorporated in its classification. In this manuscript, we primarily focus on astrocytoma, meningioma, metastatic tumors, and pituitary tumors, providing a broad overview of some of the more common central nervous system (CNS) tumors. With a lot of clinical studies currently being pursued using immunotherapy, viral therapy, and molecular genetic studies, we expect to see significant changes within the next decade. To provide evidence-based management, it is extremely important to continually review the literature to provide the optimized patient care.

Keywords: Astrocytoma; Pituitary adenoma; Glioblastoma; Meningioma

Editorial

In January 2016, World Health Organization (WHO) published an updated article regarding the classification of tumors of the brain. In this updated classification, brains tumors are not only classified based on their histology but molecular parameters are also incorporated in its classification [1]. The 2016 CNS WHO differentiates tumors in these categories: diffuse astrocytic and oligodendroglial, other astrocytic, ependymal, other gliomas, choroid plexus, neuronal and mixed neuronal-glial, pineal gland, embryonal, cranial and paraspinal nerves, meningiomas, mesenchymal, melanocytic, lymphomas, histiocytic, germ cell, sellar region, and metastatic. In this review, we will primarily focus on astrocytoma, meningioma, metastatic tumors, and pituitary tumors, providing a broad overview of some of the more common CNS tumors.

Astrocytic Tumors

Astrocytomas are the most common type of primary CNS lesions. These tumors are subdivided into different variants such as diffuse astrocytoma, anaplastic astrocytoma, and glioblastoma, for example. High-grade lesions such as glioblastoma are more common than low-grade lesions, and the average annual incidence was deemed at 5.17 per 100,000 between 2006-2010 [2]. Of note, the 2016 CNS WHO further classifies WHO grade II diffuse astrocytoma and Grade III astrocytoma into IDH-mutant or wildtype. Similarly, the 2016 CNS WHO also divides glioblastoma into IDH-wildtype or mutant as well [1]. Most cases of glioblastoma are deemed to be IDH-wildtype and the average age of the patient is over 55 years of age, while IDH-mutant associated glioblastoma are more common in patients aged less than 55 years of age [1]. Low-grade lesions usually do not display any enhancement or mass-effect. In contrast, high-grade lesions have complex enhancement and some even have presence of necrosis on imaging [2]. Gliomas can also spread by tracking through the white matter, particularly the corpus callosum, which is also termed the “butterfly glioma”.

There is no consensus regarding the best treatment approach for patients with low-grade astrocytoma. Options vary from no treatment to combining treatment modalities [2]. While there is a lack of agreement regarding any treatment for patients with low-grade glioma, there appears to be a consensus that patients who are young, patients who have large tumors, patients who are symptomatic, or patients with evidence of progression of the lesion on imaging should undergo treatment. Surgical resection is usually the first mode of treatment for patients with low grade lesions [2]. Early radiation therapy is also recommended as an adjuvant therapy because of some promising results in previous studies [2]. Of note, however, radiotherapy does not affect overall survival in these patients. For high-grade lesions, surgical resection is first conducted, and then further radiotherapy and chemotherapy is introduced. Currently, this is the gold-standard for the treatment of malignant astrocytomas. There are also multiple other clinical trials including immunotherapy that are undergoing to evaluate various treatment regimens for the treatment of glioblastoma. The median survival for patients with astrocytomas has not altered significantly within the last

decade as grade I, II, III, and IV lesions have median survival of 8-10, 7-8, 2-3, and <1 years, respectively [2]. Significant research has been conducted to prolong the overall survival for patients with glioblastoma, including vaccine therapy and angiogenesis inhibitor. Unfortunately, these studies have not demonstrated clinical significance in altering the overall survival [3,4].

Meningiomas

Meningiomas are usually slow-growing tumors that are often benign in character [2]. They arise from the arachnoid cells and are thus often found in any place where arachnoid cells are located [2]. Meningiomas are most often localized to the parasaggital region [2,5]. However, meningiomas can also be found in other areas. Due to its very common occurrence, Greenberg reports that up to 3% of the autopsies conducted in patients over the age of 60 years of age have a meningioma [2]. These tumors are also much more common in women in a close to a 2:1 ratio with average age of presentation at 45 years of age [2]. In terms of the pathological classification for meningiomas, WHO 2016 CNS did not make any significant revisions. Meningiomas are graded WHO I to WHO III [1]. There is a trend toward the use of Ki-67 in the grading of meningiomas because of its strong correlation with the prognosis. Higher mean Ki-67 is associated with higher recurrence rate. For example, a WHO grade III anaplastic meningioma with mean Ki-67 index of 11% has a recurrence rate of 50% [2].

Due to its varied possible locations for potential growth, the clinical presentation for meningiomas varies as well. Radiographic imaging involves CT scan and MRI. In today's age with the increased use of imaging, a lot of times meningiomas are often found incidentally on imaging. It can appear calcified on CT imaging, and if the patient is asymptomatic, there is a high likelihood that these tumors will have minimal growth at follow-up. In a study conducted by Kuratsu et al, 63 patients with asymptomatic meningiomas were followed, and only 32% had an increase in the size of the tumor at a follow-up >1 year [2,6].

Similar to astrocytic lesions, the primary choice of treatment for symptomatic meningiomas is surgical resection. Meningiomas that are incidentally found on imaging can be followed periodically until patients display symptoms at which point resection should be considered. Stereotactic radiosurgery has also become an integral part in the treatment of meningiomas, especially as an adjuvant treatment in cases where gross total resection is unattainable [7]. The routine use of angiography for preoperative embolization of feeders is often considered during the treatment of meningiomas as tumor resection is often encountered significant bleeding. In comparison to other tumors, total surgical resection has a very good prognosis with a 5-year survival for patients at 91% [2].

Metastases

Metastases to the brain are the most common brain tumors that are encountered clinically. Up to 25% of the patients with cancer will have cerebral metastases [8]. In addition, up to 70% of these patients will have multiple brain metastases during their initial presentation. The annual incidence of cerebral metastases compared to primary intracranial lesions is in the ratio of 10:1 [2]. These tumors often metastasize to the brain hematogenously, and the most common primary tumors that metastasize to the brain is lung cancer, which is followed by breast cancer, renal carcinoma, GI malignancy, and melanoma [2,8]. Both CT imaging and MRI imaging should be conducted because a solitary lesion on CT imaging often shows multiple lesions on MRI imaging.

The treatment for cerebral metastases varies based on the etiology of the primary cancer. While small-cell lung cancer is radiosensitive, non-small lung cancer is not radiosensitive and requires surgical resection. Although multiple lesions are often common, if a patient with extra-cranial cancer presents with a solitary lesion, then it is very important to biopsy the lesion even because up to 11% of these lesions could be a primary brain tumor [2]. In addition, whole brain radiation therapy is rarely pursued today for the treatment of widespread metastases; instead, stereotactic radiosurgery is recommended [8]. In addition, metastatic disease work-up should be pursued with CT, mammograms, PSA, and PET scan where extra-cranial disease is suspected. Even with the increased technology in diagnosing cerebral metastases, the average age of survival with treatment is less than 1 year [2,8].

Pituitary Tumors

Most pituitary adenomas are benign tumors that arise from adenohypophysis. These tumors represent approximately 10-15% of the intracranial lesions that are clinically encountered. These tumors can be micro (<1 cm) or macro (>1 cm), and can also be functional or non-functional. Functional tumors secrete hormones, and are thus diagnosed earlier compared to non-functional tumors because of the symptoms associated with over-secretion of the hormones. The most common secreting hormone is prolactin, which is followed by growth hormone and adrenocorticotropic hormone. An extensive work-up including visual field testing and an endocrine screening is recommended for any patient with a pituitary adenoma. Surgical resection is often a primary treatment modality for pituitary tumors; however, medical treatment with dopamine agonist is first-line recommendation for prolactinomas. Furthermore, transsphenoidal microscopic surgery is usually the mainstay treatment but recently the use of endonasal endoscopic surgery has become prevalent, and it can be of more benefit in larger adenomas [9]. With a recurrence rate of approximately 15% at 4-8 years post first surgical resection, another surgical resection should be attempted. Radiation therapy can also be attempted if gross total resection has not occurred [2].

Conclusion

In summary, we discussed some of the most common intracranial lesions that are clinically encountered. As described in our discussion of these tumors, there have been

several notable changes in characterization of the tumors recently. With a lot of clinical studies currently being pursued using immunotherapy, viral therapy, and molecular genetic studies, we expect to see significant changes within the next decade. To provide evidence-based management, it is extremely important to continually review the literature to provide the optimized patient care.

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