Brain Tumor/Cancer

This piece is meant to be a very general overview of adult brain tumors at the patient level. Further details and references will be provided upon request. Thank you.

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What is Cancer?

Each cell in our body contains a complete copy of our individual genome. The information of our genome is encoded in DNA which may accumulate errors while being reproduced or from insults we sustain over the course of our lifetime. The growth and division of every cell in the human body is tightly regulated by a molecular system of checks and balances. When our DNA acquires errors that allow for the unbridled proliferation and invasion of a population of cells the result is often a tumour. If a tumour grows very fast with poorly delineated boarders and/or invades nearby structures or colonises distant sites it is referred to as malignant. In contrast, tumors which have clearly defined boarders and do not invade other tissues are referred to as benign. In general terms both malignant and benign tumours that arise from the brain do not invade beyond it. Nonetheless, malignant brain tumors invariably result in patient death whereas benign tumours usually respond very well to surgery and/or radiotherapy.

Brain Cancer:

Causes:

More than 1400 Australians will be diagnosed with a brain cancer each year and the vast majority of these cancers arise sporadically. That is, these patients have no risk factors before their diagnosis for the development of a brain cancer. A notable exception is the positive correlation with exposure to high energy radiation and the development of more aggressive brain cancers. In addition, several inherited syndromes predispose to the development of certain brain tumours. These two risk factors make up only a minority of brain cancer patients and there are generally no proven measures to prevent brain cancer nor are there any screening programmes currently in use.

Clinical Features and Diagnosis:

There are a variety of ways in which a brain tumor may first present. Non specific features include headache, nausea, vomiting, weakness or paralysis in a limb, disturbance in walking, personality changes or the onset of dementia. In addition, seizures may also be a sign of a lesion in the brain. In situations where tumours (example: lung, breast, prostate) from other sites in the body have migrated to the brain (secondary brain tumours) it is common to see weight loss, fatigue, anorexia and fever in addition to the above clinical features. Unfortunately, at the moment there are no blood tests available for the diagnosis of brain cancer and clinicians must use brain imaging studies when they suspect a tumour. Specifically, magnetic resonance imaging (MRI) and computed tomography (CT) imaging are widely used and powerful means of determining what type of tumor a patient likely has and what treatment options are feasible.

Types of brain tumors:

The Gliomas:

1) Astrocytomas: Arising from the structural support cells of the brain, astrocytomas are the most common primary brain tumour. There are four grades of the disease as outlined by the World Health Organisation (WHO). Which grade an astrocytoma falls into is determined by how aggressive the tumor looks under a microscope as determined by a pathologist. The lowest grade (WHO I) tends to occur more commonly in children and has an excellent clinical outcome following surgical removal. The highest grade (WHO IV), also referred to as glioblastoma multiforme, is mainly found in the adult population and is the most common of all brain tumors. It invariably recurs within a year of surgical removal and eventually leads to patient death. In addition to surgery, radiotherapy and chemotherapy also increases the survival of patients with high grade astrocytomas. Moreover, in spite of the generally good prognosis of the lower grade astrocytomas it is possible for them to transform into more malignant higher grade astrocytomas after removal.

2) Oligodendrogliomas: These tumors comprise approximately 15% of gliomas in adults and are less aggressive than the high grade astrocytomas with greater than 50% of patients surviving beyond 5 years after diagnosis. Generally, these tumours are less invasive making it easier for surgeons to adequately excise the tumour. In addition, there are broader chemotherapy treatment options available also contributing to the better clinical outcomes relative to the astrocytomas.

3) Ependymomas: In adults, these tumours typically arise in the lower back region of the spine. As such they are not true brain tumours per se; however, they are capable of migrating up the fluid in which the spinal cord and brain are bathed and eventually seeding in the brain itself. Patients generally do well with greater than 80% survival at 5 years following surgical removal of the tumour. In situations where the location and/or orientation of the tumour makes complete removal difficult, radiotherapy can be used to destroy any remaining tumour.

Meningiomas: These tumours are not derived brain tissue itself but rather from the tissue layers which cover the brain (meninges). They may invade the skull but only rarely invade into the brain itself and therefore are largely considered to follow a benign clinical course. Meningiomas are more common in women and are tumours of middle age. Total surgical removal of the meningioma is curative with radiotherapy being used if any tumour cannot be removed. There is no role for chemotherapy in the treatment of meningiomas.

Schwannomas: They arise from the nerve fibres that communicate with the rest of the body, exiting and entering the brain. The most common is called a vestibular schwannoma (also known as an acoustic neuroma) and is derived from the fibres that carry information pertaining to balance and hearing to and from the inner ear. As such, patients may present with disturbances in balance and/or hearing (deafness or ringing). These tumours are almost always benign and surgical removal is curative.