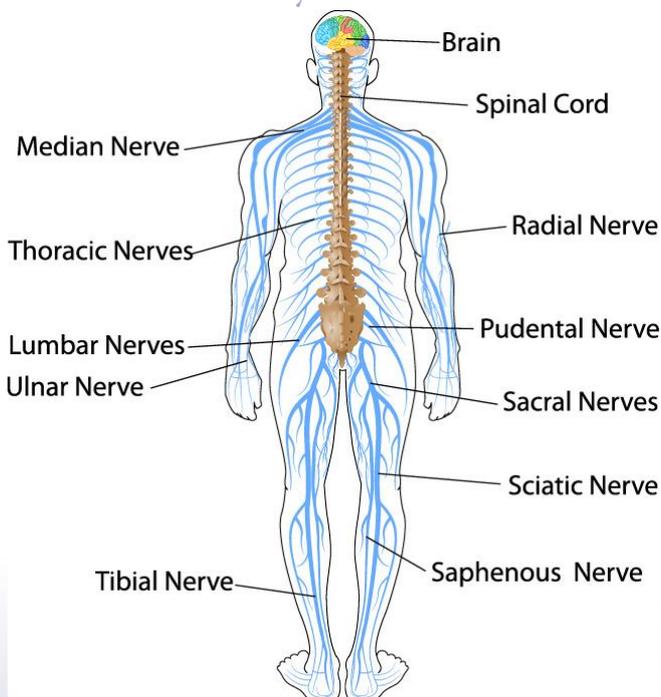


Brain cancer

What is brain cancer?

Brain cancer occurs when cells in the brain or the spinal cord start to grow out of control, forming a tumour or mass. The spinal cord is the thick bundle of nerves that carries messages between the brain and different parts of the body. Together the brain and the spinal cord make up the central nervous system (CNS) (see graphic below). Both are enclosed in a tough protective outer layer of connective tissue called the dura, but between the brain or spinal cord and the dura is a special fluid called cerebrospinal fluid (CSF) which acts as a cushion to protect these sensitive tissues from harm. The CSF also flows through special channels called ventricles deep inside the brain.

The central nervous system



Tumours (cancers) in the brain or spinal cord rarely spread to other parts of the body, but most of them can spread within the brain. The types of brain tumours that form in adults are different from the ones that occur in children: they arise in different areas of the brain from different cell types, and they are not treated in the same way.

There are a range of different tissues and cells in the brain and spinal cord, including neurons, glial cells, and glands. Glial cells are the supporting cells in the brain, which hold the neurons in place and supply them with nutrients. Most

brain and spinal cord tumours develop in glial cells; these tumors are collectively called *gliomas*, and account for about 3 in every 10 brain tumours.

There are 3 types of glial cells:

- **Astrocytes** support neurons, and help to form scar tissue when injuries occur. A number of tumours may start in astrocytes; the main ones are astrocytomas or glioblastomas.
- **Oligodendrocytes** make myelin, a fatty substance that surrounds and insulates nerve cells, helping the neurons to transmit the electrical signals from one end to the other. Tumors that develop from these cells are called oligodendrogliomas, but they are quite rare and account for only about 2% of brain tumours.
- **Ependymal** cells line the ventricles in the centre of the brain, and form part of the channel that carries the CSF around the brain. When tumours arise in these cells, they are called ependymomas. Only 2% of brain tumours are ependymomas, so these are also not very common.

Sometimes, a tumour arises from more than one type of glial cell. This type of tumour is called a mixed glioma.

Neurons generally don't develop tumours, because, unlike most other types of cells that are constantly replacing themselves, neurons in the brain and spinal cord largely stop dividing during early childhood. Although they don't form tumours, neurons may be damaged by tumours that grow nearby.

Brain cancer in New Zealand

About 300 cases of brain cancer are diagnosed each year.¹

Who is at most risk of getting brain cancer?

Most brain tumours have no known cause and very few risk factors have been identified. Some rare forms of brain tumour (such as neurofibromatosis or tuberous sclerosis) run in families, but this is not the case with most forms of brain cancer. Rarely, a person may develop a brain tumour after they have been exposed to radiation (usually when they've received radiation treatment for some other condition some years before).

Some research has suggested that high use of mobile phones (for more than 30 minutes a day) may put people at risk for developing brain cancer. However, the scientific information is not clear about this, and more research is needed before mobile phone use can be considered a risk factor for brain cancer. Other than that, there are no known causes of brain tumours related to lifestyle or the environment.

What are the symptoms of brain cancer?

The brain and spinal cord are involved in almost all of the body's functions and senses, so brain tumours can cause a range of different symptoms, depending on where they are. Sometimes tumours inside the skull cause an increase in pressure (called intracranial pressure) which can lead to symptoms such as:

- Headache
- Nausea
- Vomiting
- Blurred vision
- Balance problems
- Personality or behaviour changes
- Seizures
- Drowsiness.

About half of all patients with brain tumours get headaches that worsen over time. In addition, about half of patients with brain tumours will develop seizures during the course of their cancer, and sometimes this is the first symptom they get. However, it's important to remember that most headaches and seizures are not caused by brain tumours.

Depending on which part of the CNS is affected, brain tumours may also cause:

- Weakness or numbness in part of the body, usually just on one side
- Problems with speech or with understanding what people are saying
- Difficulty thinking straight or problem solving
- Problems with movement, such as poor coordination, uncontrolled movements or difficulty walking
- Vision problems
- Loss of hearing
- Difficulty swallowing
- Bladder or bowel problems (if the spinal cord is affected).

Many of these symptoms may have other causes, so it's important to get properly assessed by a doctor if you are experiencing any of these.

How is brain cancer diagnosed?

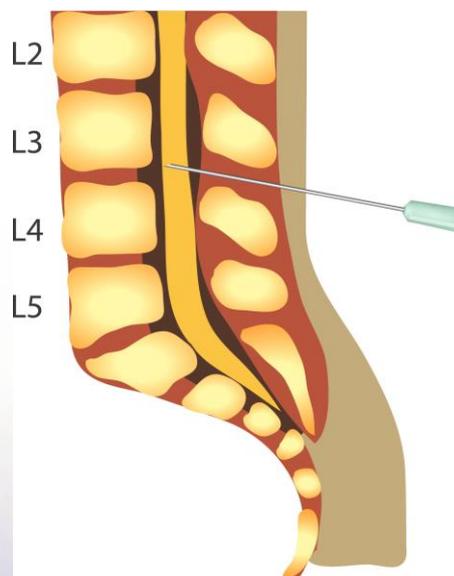
Your doctor will conduct what's called a neurological examination to test how your nervous system is working, and to see if the symptoms are caused by something in your CNS or other parts of your nervous system. If they find something abnormal, your doctor will probably refer you to a neurologist for more detailed assessment.

The best way to diagnose brain cancer is by imaging the brain and spinal cord, usually with a CT (computed tomography) or MRI (magnetic resonance imaging) scan. These procedures are very good at showing up any tumours inside the brain, but usually they are not able to tell what type of tumour it is (what kind of cells it comes from). To do this, doctors must take a sample of the abnormal tissue called a biopsy. This is usually done during surgery to remove the tumour, so the biopsy and treatment occur at the same time.

If a tumour is found, your doctor may also get other parts of your body x-rayed to see if there are other tumours in your body. This is not because brain tumours spread to other parts (they almost never do), but because it is common for other cancers (like lung cancer) to spread to the brain. If the primary tumour is somewhere else, doctors will use a different treatment approach than they would for brain cancer.

Your doctor may also want to take a sample of CSF, the liquid that surrounds the brain and spinal cord, to see if it contains cancer cells. This is called a lumbar puncture (**see graphic below**). To obtain the sample, the doctor inserts a small, hollow needle between the bones of the spine to collect some of the fluid. This is done under local anaesthetic. The fluid is sent to a lab, where a pathologist will examine it under a microscope to see if cancer cells are present.

Lumbar puncture to obtain CSF



How are treatment decisions made in brain cancer?

For most cancers, treatment decisions are based on the extent (stage) of the cancer, but there are currently no recommended staging system for brain cancers. Instead, doctors decide on the best treatment based on the type of cancer and its grade (i.e. how much like normal healthy cells the cancer cells are).

The grades of gliomas are:

- Grade I – the tumour is a special type of slow-growing cancer called a juvenile pilocytic astrocytoma (JPA). “Juvenile” refers to the type of cell it is, not the age of the person who has cancer. JPAs can often be cured by removing the tumour surgically.
- Grade II – the tumour has lots of cells in it (termed ‘hypercellular’) but there are no dead cells in the tumour (patches of dead cells are called ‘necrosis’).
- Grade III – the tumour is hypercellular and contains cells that are actively dividing. This type of glioma is often called an anaplastic astrocytoma.
- Grade IV – this type of tumour is usually a glioblastoma (also called glioblastoma multiforme or GBM). This cancer has characteristics of grade II and III tumours; cells are actively dividing, there are patches of dead cells (necrosis), and the tumour has started to develop its own blood vessels.

In addition to cancer grade, your doctor will take account of where the tumour is located and how far it has spread, your general health, and whether there are any markers on the tumour cells that will provide clues to the likely outcome and best treatment. All these factors are considered before your doctor makes a treatment recommendation.

How is brain cancer treated?

This section provides an overview of treatments for Brain Cancer. Remember each person is different and your doctor will discuss with you the best treatment options for the particular type of cancer you have.

The type of treatment your doctor recommends will depend largely on the type of cancer you have. The main types of treatment that can be used for brain cancer are:

- Surgery
- Radiation therapy
- Chemotherapy
- Targeted therapy

For most types of brain tumour, the first treatment approach is usually surgery to remove as much of the cancer as possible. Radiation and/or chemotherapy are also often given after surgery to kill any cancer cells that were not removed by the surgery. Patients with brain tumours that can't be removed surgically are usually treated with radiation therapy, followed by chemotherapy if the person is healthy enough.

Standard chemotherapy kills cells that are dividing. Because cancer cells divide more quickly than healthy cells, chemotherapy has most effect on these cells, but this form of treatment also kills some healthy cells, causing side effects. Targeted drugs work differently to standard chemotherapy, because they are able to target cancer cells specifically, and mostly leave healthy cells alone. If a person stops responding to chemotherapy, they may be offered targeted therapy.

Avastin® (bevacizumab) is a targeted anti-cancer agent that is approved in New Zealand for use in people with a high grade malignant glioma that has come back (relapsed) after treatment with standard chemotherapy.

References

1. Ministry of Health. 2014. Cancer: New registrations and deaths 2011. Wellington: Ministry of Health. Available from: <http://www.health.govt.nz/system/files/documents/publications/cancer-new-registrations-deaths-2011-v4sept14.pdf> . Accessed April 2015.



Avastin Consumer Panel

Avastin® (bevacizumab), 100 mg/4mL and 400 mg/16 mL vials, is a **Prescription Medicine** used to treat metastatic (spreading) colorectal, kidney, breast, brain, lung and ovarian cancers.

Do not use Avastin if: you have had an allergic reaction to Avastin, any of its ingredients or other antibodies, or if you have been coughing or spitting up blood.

Tell your doctor if: you are pregnant or breast-feeding, or plan to become pregnant or breast-feed; you have any other health problems, especially the following: inflammation of the bowel or stomach ulcers, high blood pressure, a history of blood clots or stroke, bleeding problems, bleeding in the lungs or coughing or spitting up blood, low white blood cell counts, you have/ had a fistula, or have a history of diabetes; you have had major surgery in the last 28 days or a wound that has not healed properly; you have had a blocked lung artery (pulmonary embolism); you have heart disease; you have received anthracyclines (e.g. doxorubicin) for cancer, or radiotherapy to your chest; you are 65 years of age or older, or you are taking any other medicines.

Tell your doctor immediately or go to your nearest Accident and Emergency Centre if you notice any of the following: severe body or stomach pain or cramps; severe headache; severe diarrhoea, nausea and vomiting; coughing or spitting up blood; blood clots in the veins of the legs; pain and/or swelling in the lower legs, feet or hands; severe bleeding or problems with your wounds healing after surgery; seizures; confusion; sleepiness/drowsiness or fainting; abscesses (pus-filled sores); severe infection with high fever, chills, headache, confusion and rapid breathing; feeling of numbness or tingling in feet or hands; dry mouth with thirst and/or darkened urine; increased heart rate; shortness of breath; symptoms of an allergic reaction which may include shortness of breath, wheezing or difficulty breathing, swelling of the face, lips, tongue or other parts of the body, or rash, itching or hives on the skin. **Possible common side-effects may also include:** high blood pressure (symptoms include, headache, dizziness, ringing in the ears, tiredness, blurred vision); body pain, tiredness/ weakness; diarrhoea, constipation or rectal bleeding; sore mouth or mouth ulcers; loss of appetite, being thirsty; shortness of breath; runny, blocked or bleeding nose; dry, scaling or inflamed skin, change in skin colour; taste changes; blurred vision or other eye problems; dizziness; headache; frequent infections with symptoms such as fever, chills or sore throat; changes in your voice or difficulty speaking.

Avastin has risks and benefits. Ask your oncologist if Avastin is right for you. Use strictly as directed. If symptoms continue or you have side effects, see your healthcare professional. For further information on Avastin, please talk to your health professional or visit www.medsafe.govt.nz for Avastin Consumer Medicine Information.

Avastin is not funded by PHARMAC. You will need to pay the full cost of this medicine. A prescription charge and normal oncologist fees may apply.

Consumer panel dated 03 November 2014 based on CMI dated 02 October 2014.

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