

Neurosurgery for brain tumours (adults)

Neurosurgery is surgery performed on the brain or spinal cord and is conducted by a highly specialised health professional called a neurosurgeon.

This fact sheet gives an overview of neurosurgery for brain tumours and gives an idea of the processes and procedures you may experience. It is important to remember that every hospital or surgeon may have slightly different practices, so what you experience may be different from those described in this fact sheet. Your health team will be able to explain what will or won't happen.

In this fact sheet:

- Biopsy
- Craniotomy
- Insertion of chemotherapy into the brain
- Shunts
- Answers to some common questions you may have about neurosurgery

This fact sheet is relevant to brain tumours in adults - for fact sheets and other resources for children, please see www.thebraintumourcharity.org

Why is neurosurgery performed for brain tumours?

For brain tumours, surgery can have several purposes:

- diagnosis of tumour type
- whole or partial removal of the tumour
- insertion of chemotherapy drugs directly into the brain
- reduction of associated conditions, such as hydrocephalus (a build-up of cerebrospinal fluid, increasing pressure in the skull).

Biopsy

A biopsy is a small sample of tumour tissue taken from a site of disease which is then analysed under a microscope by a neuropathologist. (For further information, see the *Multidisciplinary team fact sheet*). A biopsy is often used to help give an exact diagnosis of the type of tumour you have. This helps your health team to decide on the best course of treatment for you.

Biopsies may also be used to identify your suitability for certain clinical trials.

(For more information about clinical trials, please see our *Clinical trials fact sheet*. See also our *clinical trials database*, to access the most accurate and up-to-date information about trials for brain tumours).

<http://www.thebraintumourcharity.org/about-brain-tumours/clinical-trials>

The biopsy procedure:

- You will first have an MRI scan or CT scan. (For further information, see the *Scans fact sheet*). The purpose of the scan is to show exactly where in the brain the tumour is. The surgeon may put the scan image into a computer, which can then be used to help decide the best route into the tumour. This technique is called 'stereotactic' or 'image guided' biopsy. (Stereotactic means using a 3D map of the brain).
- After the scan, you will be given a general anaesthetic before your neurosurgeon drills a very small hole called a 'burr hole' into your skull. Although this may sound frightening, you will not be able to feel anything because you will be asleep due to the anaesthetic.

- The neurosurgeon will then pass a needle through the burr hole and take a small sample of the tumour. The sample is sent to a laboratory to be analysed by a pathologist, who will give a diagnosis of the exact tumour type you have.
- A burr hole can usually be closed by staples or stitches.
- A biopsy usually takes around 2 to 3 hours, including the time it takes for you to have an anaesthetic.
- You may be given steroids to help with any swelling. (For further information, see the *Steroids fact sheet*).
- As a general anaesthetic is used, you will normally stay in hospital for a few days, though some hospitals may do the surgery as a day case.

Biopsies are not always taken through a burr hole, but are often taken during the larger craniotomy procedures.

Craniotomy

'Craniotomy' literally translates as 'making a hole in the skull' and is a medical procedure that has been carried out for hundreds of years in basic forms. The purpose of a craniotomy is to allow the neurosurgeon access to your brain. It is the most common type of surgery for brain tumour patients and it is used to remove all or part of the tumour. (Partial removal is known as debulking).

A craniotomy can be performed when you are awake (known as an 'awake craniotomy') or when you are asleep. An awake craniotomy may be performed if the tumour is close to, or involving, areas of the brain that control important functions, such as speech, movement or breathing. By being awake, the surgeon can first map out where these areas are in the brain by stimulating them with a tiny electrical probe. Then they can continue to test these areas of the brain as the operation goes on to make sure they are still working by. This can be done, for example, by asking you questions or asking you to move your arms. The aim is to remove as much of the tumour as possible, whilst minimising the risks of causing any harm to these functions.

This can sound rather scary, but if this is thought to be the best option for you, your health team will discuss it with you in detail, explain what is done to prevent you feeling any pain and help you prepare for it psychologically.

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The craniotomy procedure:

- If you are having a standard craniotomy, you will be given a general anaesthetic to make you sleep. If you are having an awake craniotomy, you may be put to sleep for the first part of the operation and woken later, or you may be given a local anaesthetic only and be awake for the whole procedure.
The local anaesthetic will be given to any areas involved that feel pain (skin and muscle), so normally the procedure will not be painful. It is important to know that the brain itself has no pain sensors, so cannot feel pain.
- A small area of your head may be shaved and the area will be cleaned. Shaving used to be done for what was thought to be hygiene reasons, but there is little evidence that shaving reduces infections, so many surgeons do not shave the head.
- Even if you are having a standard craniotomy, you may be given an local anaesthetic to the part of your scalp that the neurosurgeon will need to cut into. This is done to reduce pain after the surgery.
- Once the anaesthetic (local or general) takes effect, an incision (cut) is made in your scalp.
- After the skin has been cut, your neurosurgeon will proceed to remove a section of your skull. This is called a 'bone flap' and it allows the neurosurgeon to reach your brain. In a standard craniotomy, you will not be able to feel anything as you will be asleep.
- If you are having an awake craniotomy and have been put to sleep for the first part of the operation, you will be woken at this point. This is to allow your neurosurgeon to map the areas of the brain and to check that your brain is functioning correctly, for example, by asking you to read something. You may feel pulling as the neurosurgeon works, but you should not feel pain due to the local anaesthetic to your scalp and the fact that the brain itself has no pain sensors.
- After your neurosurgeon has accessed your brain, they will remove all or part of the tumour. Very often, it is not possible to safely remove the whole tumour. This will depend on where in the brain the tumour is and how close it is to vital areas. In such cases, the neurosurgeon will remove as much as possible.

Partial removal is known as 'debulking' or 'partial resection' and even though this does not remove all of the tumour, it can help reduce symptoms caused by pressure from the tumour. It may also make the remaining tumour cells more responsive to other treatments, such as chemotherapy and radiotherapy. *(For further information, see the Chemotherapy and Radiotherapy fact sheets).*

- Once the surgery is complete, your neurosurgeon will replace the bone flap and seal the wound using stitches or metal clips. If you are having an awake craniotomy, you may be put back to sleep before this happens. The clips or stitches will usually be removed a week or two after surgery. If you have dissolvable stitches there will be no need for them to be removed.
- The length of time a craniotomy takes depends on the part of the brain being operated on. As a very general guide, neurosurgery may take around 4-6 hours. However, in complex cases, it could take significantly longer.

Insertion of chemotherapy drugs directly to the brain

During the neurosurgery following a craniotomy, you may have chemotherapy drugs inserted directly to the brain. Some chemotherapy drugs are not able to cross the blood-brain barrier. *(See the Human brain fact sheet).* Insertion during surgery allows your health team to get round this. A further advantage of having chemotherapy in this way is that the dose can be more concentrated and more effective.

The types of ways in which you may have chemotherapy drugs delivered directly into the brain are:

- **Wafer implants**
After whole or partial removal of the tumour, the neurosurgeon may place chemotherapy wafer implants into the space where the tumour was. The wafers, which are impregnated (coated) with the chemotherapy drug carmustine, gradually dissolve over the next couple of weeks, releasing chemotherapy as they do so. The purpose of wafer implants is to get rid of any remaining tumour cells at the site of surgery. You may also hear these implants referred to as Gliadal® wafers.

At the moment, the use of these wafers is subject to NICE recommendations. (NICE is the National Institute for Health and Care Excellence). As such, they are only licensed for people with high grade gliomas, or with glioblastomas (GBM) that have returned after treatment. *(See What is a brain tumour? fact sheet).* Also the surgeon must be confident that at least 90% of the tumour has been removed before they can be used.

- **An Ommaya reservoir**

This is a dome-shaped device, inserted during surgery, that sits underneath the scalp and delivers chemotherapy directly into the cerebrospinal fluid (CSF), the clear fluid within the brain and spinal cord. By doing this, chemotherapy is delivered directly to the brain, which increases its effectiveness.

Shunts

Another reason you may have surgery is to have a shunt fitted. Headaches are a common symptom of brain tumours. They can occur because of a build-up of cerebrospinal fluid (CSF) caused if the tumour is blocking its circulation. As the CSF builds up in one area, pressure rises, causing headaches. A build-up of CSF is known as hydrocephalus (sometimes called 'water on the brain').

To reduce this pressure, neurosurgeons can insert a tube, called a 'shunt', through your skull and into your brain to drain some of the excess fluid away. You may hear the term 'ventricular catheter' - this is the top part of the shunt that runs through the brain and into the CSF in the ventricles. (The ventricles are spaces in the brain that are filled with CSF).

The shunt has valves to ensure that it takes fluid in the correct direction, away from the brain and towards other parts of the body that can easily absorb it, such as the abdominal body cavity. It is important to know that it does not go into your stomach, so does not interfere with how you eat and digest food.

A shunt is not a cure for a brain tumour, but it can help to improve symptoms related to increased pressure in your skull.

The length of time a shunt stays in for varies. If you need to have a shunt for a long period of time, you may have regular

check-ups to ensure that it is still working as it should and that it has not become infected. Regular check-ups are not always necessary once the shunt has been assessed as working well.

You cannot see a shunt from outside the body, so other people will not know that it is there unless you tell them. However, you may be able to feel your shunt running down behind your ear.

You may have a 'programmed' or 'variable shunt'. This only allows fluid to drain when pressure becomes too high. If you have this type of shunt fitted, it is important to know the settings, as after each MRI scan, the programmed shunt will need to be re-set, due to the effect of the magnet on the shunt setting.

Where will I wake up after surgery?

Following surgery, you are likely to wake up in the recovery room of the operating theatre, where there will usually be other patients waking from their operations. Different hospitals have different systems, however - some have specialist post-operative neurosurgery wards where you may be taken for observation. In others, you may wake up in either a high dependency unit (HDU) or occasionally an intensive care unit (ICU).

Whilst there, you will have one-to-one personal care and attention. In the first few hours, you will be given frequent neurological observations ('neuro-obs'). They include checking how alert you are; testing your reflexes; checking that your pupils react to light; checking your pulse, blood pressure, the amount of oxygen in your blood, and number of breaths you take each minute. You may also be linked to a machine that controls your breathing (a ventilator) to give your brain a chance to recover.

The amount of time it takes to wake up after surgery varies. Many people wake up very soon afterwards, but some people remain unconscious for a number of hours or a few days.

Why are there tubes in my body after surgery?

When you wake up after surgery, you will have a number of tubes coming in and out of your body. This unfamiliar experience can be upsetting, particularly if you do not know what the tubes are for. You may be linked to the following devices:

- **Drips.** These are tubes that give you water and nutrients until you are able to eat normally. They may also deliver medicines in to your blood stream.
- **External ventricular drain (EVD).** This drains fluid from the brain to prevent the build up of cerebrospinal fluid (CSF), which can cause hydrocephalus.
- **Tubes from your wound** that drain excess blood and fluid.
- **An intracranial pressure (ICP) monitor,** which monitors the pressure in your brain.
- **A urinary catheter.** This goes into your bladder and gives a measure of how much urine you are producing. It is used to monitor whether you have an appropriate amount of fluid in your body and also drains urine.
- **A nasogastric tube.** This tube goes down through your nose to your stomach and provides liquid food.
- **Blood pressure monitors.**

Will I have a dressing on my wound?

When you wake up after surgery, you may have a dressing or bandage on your wound. If a dressing is used, this usually stays on for up to about five days after surgery.

Will my wound become infected?

Although infection is a possibility, it is very uncommon. Your health team will check your wound after surgery and give you advice on preventing infection. They may also give you antibiotics to prevent infection.

How will I feel after surgery?

Many factors will influence how you feel after surgery, including the type of surgery you have had, and the size and location of

your tumour. When you first wake up after brain surgery, you may have swelling and bruising on your face. You may also feel some temporary worsening of the symptoms you had before the surgery. This is not unusual and is usually due to the swelling in the brain following the surgery.

You may experience some or all of the following temporary effects:

- Sickness and nausea due to the anaesthetic (anti-sickness tablets can be given to help with this).
- Sore throat due to the tube used during surgery to regulate your breathing and oxygen levels.
- Headaches caused by swelling in your brain. The swelling should die down within a couple of days and painkillers can be used to help relieve the headaches.
- Momentary phases of feeling dizzy or confused.
- Difficulty swallowing. You may have your swallowing checked by a speech therapist before you are allowed to eat or drink anything.
- New symptoms, which might include personality changes, poor balance and co-ordination, speech problems, weakness and epileptic seizures (fits).

You may also continue to feel tired.

The above list may be overwhelming, but it is important to remember that such effects usually disappear fairly soon after surgery and that a team of health professionals will be taking care of you. Before surgery, your consultant will discuss with you what to expect. You should not feel awkward about asking as many questions as you would like to.

How long will it be after surgery before I am back on my feet?

Neurosurgery is a major operation and you will need to rest for a number of days afterwards.

For the first few days, one of the top priorities for your health team will be ensuring that the pressure in your head does not increase. Nurses will help to ensure this by checking that you are lying in a suitable position.

They will also ensure that you are moving your arms and legs around enough to allow blood flow and to prevent thrombosis (blood clots) or your muscles from stiffening up.

You will not be kept in bed any longer than is necessary and hospitals are always keen for their patients to get up and get moving as soon as is safe.

How will I know if the surgery has been successful?

You are likely to have a brain scan a few days after surgery. This will give your health team a good idea whether any of the tumour remains and how much swelling of the brain you have. The success of surgery is measured on what the aim of the surgery was and not on curing a tumour. Even if all of the visible tumour is removed, this may or may not mean that all of the actual tumour has been removed.

Will surgery cure my tumour?

Before surgery, your consultant will discuss with you what to expect from surgery and whether they are hoping to remove all or part of the tumour.

Often, surgery does not cure a tumour completely, but removing part of it can make any remaining tumour cells more responsive to other treatments, such as radiotherapy and chemotherapy.

I've had brain surgery – what's next?

Your consultant should talk through your treatment plan with you so that you know what to expect. Often, after brain surgery, you will have another treatment, such as chemotherapy or radiotherapy, to get rid of any remaining tumour cells.

Due to the swelling in the brain after surgery, it is common to be given steroids. You may be prescribed a type of steroid called 'Dexamethasone'. Steroids help to reduce the swelling and increased pressure in your head. Under the guidance of your consultant, you will gradually be able to stop taking steroids. (For further information, see *Steroids fact sheet*).

Some people experience seizures (or 'fits') after brain surgery due to increased pressure in the head. You may be given anti-epileptic medication as a preventative measure. The length of time people take this for varies from person to person, but it is not uncommon to take anti-epileptics for up to a year after brain surgery.

Will my hair grow back?

If you have had an area of your hair shaved before surgery, it normally grows back relatively quickly.

Will I be able to fly after brain surgery?

If you wish to travel by plane after brain surgery, you should seek advice from your health team. Normally, you would not be able to fly for a little while after neurosurgery.

The Civil Aviation Authority, which is responsible for air travel safety, states that because neurosurgery may leave gas trapped within the skull, which may expand at altitude, it is advisable to avoid air travel for approximately 7 days following this type of procedure.

Travel insurance may also be more expensive or difficult to obtain following neurosurgery. It is essential that you ensure you are fully covered to travel before you do so to prevent incurring heavy costs if you fall ill when away. There are some specialist insurers who may insure you to travel. (For further information, see the *Travelling and brain tumours fact sheet*).

Will I be able to play sport after brain surgery?

If you wish to play sport after your surgery, seek advice from your doctor. Once you have recovered from surgery, there should be no problem with you playing sport, though you should avoid sports that involve significant physical contact between players ('contact sports'), such as rugby and wrestling. Your health team will be able to advise you on when you can begin playing sport again after brain surgery.

Are there any long-term difficulties associated with surgery?

Before you have surgery, a health professional from your health team will talk you through what to expect and what risks are involved. It is important that you fully understand the level of risks, so you can make an informed decision about whether to agree to the surgery. The exact level of risk depends on the exact procedure to be performed, but any surgery on the brain does carry risks, some of them serious. You should feel free to ask them as many questions as you wish, at any point.

Long-term difficulties after surgery are possible. Nerves or the brain itself can be damaged during surgery affecting the functions that they control within our bodies. The nature of these will depend on which part of the brain has been operated on, or which nerve has been affected. The result of this damage is sometimes called a "deficit" and can be permanent or temporary. Such difficulties could include problems with speech and movement or problems with thought processes.

If this happens to you, professionals, such as speech and language therapists, physiotherapists and clinical psychologists, will work with you to improve these functions. Do not be afraid to ask for such support if you feel it is necessary. (For further information, see the *Cognition and brain tumours and Communication difficulties and brain tumours fact sheets*).

What if I am told I can't have surgery?

Surgery is not always the preferred option to treat a brain tumour - it depends where in the brain the tumour is. Sometimes, it would be too risky to operate as the tumour may be very close to, or wrapped around, an important structure in the brain and the benefits of surgery would be outweighed by the dangers.

If your consultant does not think surgery is appropriate for you, you may like to ask them to talk you through their decision

to explain it to you. If you are still unhappy with their decision, you could ask for a second opinion from another consultant. Your current consultant or your GP can help to arrange this.

What if I have further questions?

If you require further information, any clarification of information, or wish to discuss any concerns, please contact our Support and Information Team:

Call: 0808 800 0004

(free from landlines and most mobiles:
3, O2, Orange, T-mobile, EE, Virgin and Vodafone)

Email: support@thebraintumourcharity.org

Join our online forums at:
thebraintumourcharity.org/forums

About us

The Brain Tumour Charity makes every effort to ensure that we provide accurate, up-to-date and unbiased facts about brain tumours. We hope that these will add to the medical advice you have already been given. Please do continue to talk to your health team if you are worried about any medical issues.

We are the UK's pre-eminent brain tumour charity. We fund scientific and clinical research into brain tumours and offer information and support to those affected, whilst raising awareness and influencing policy.

We rely 100% on charitable donations to fund our vital work. If you would like to make a donation, or want to find out about other ways to support us including fundraising, leaving a gift in your will or giving in memory, please visit us at thebraintumourcharity.org, call us on 01252 749043 or email fundraising@thebraintumourcharity.org

About this fact sheet

This fact sheet has been written and edited by The Brain Tumour Charity's Support and Information Team. The accuracy of medical information has been verified by leading

neurosurgeons. Our fact sheets have been produced with the assistance of patient and carer representatives and up-to-date, reliable sources of evidence. If you would like a list of references for any of the fact sheets, or would like more information about how we produce them, please contact us.



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Your notes

Saving lives through research, information, awareness & policy



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