Deep Brain Stimulation for Parkinson’s Disease

Exceptional healthcare, personally delivered
Deep Brain Stimulation

Having been seen by a consultant neurologist and one of the specialist nurses at North Bristol NHS Trust, members of the Functional Neurosurgical team, and been told that you may be a suitable candidate for Deep Brain Stimulation, you might be left wondering what is ahead of you. We do not want to overload you with too much information, but will give you relevant information at each stage of your journey. This is a brief guide of what to expect.

1. Funding will be sought from your Primary Care Trust for your pre-surgical assessment and surgery.

2. Providing funding is approved, your inpatient assessment will then be arranged.

3. This assessment will involve being admitted to hospital for 1 to 2 nights and a decision will usually be made at this time as to whether you are suitable for surgery.

4. If you are considered suitable for surgery and you wish to go ahead, you will be added to the waiting list.

5. You will then be given an admission date for your operation.

6. It will be necessary to make regular visits to hospital following surgery. The frequency of your visits will depend on your individual condition. However, it is most likely that you will be seen:

- At 8 weeks as an outpatient by your Surgical Movement Disorder Nurse Specialist and at 4 months by your consultant and nurse specialist.
- At 6 and 12 months as an inpatient for a full assessment.
- After the first year you will be reviewed at regular intervals as an outpatient by your consultant and specialist nurse. Further inpatient assessments will be performed at 2 and 5 years.
Pre Surgical Assessment for Deep Brain Stimulation

The purpose of this admission is to assess your suitability for surgery. This information is designed to inform you about the process.

Day 1

You will be admitted to a neurosciences ward where you will be examined and asked questions by a doctor and a ward nurse.

Some routine observations and blood tests will be performed.

- You will meet your Surgical Movement Disorder Nurse Specialist, who will endeavour to answer any queries you have. Please have your questionnaires and diary ready at this time.

- You will need to stop taking all of your Parkinson’s medication at 6 pm to enable us to perform a full assessment of your Parkinson’s disease the following morning. We appreciate that this may cause you to have an uncomfortable night. However, sleeping tablets and painkillers will be prescribed if you require them.

Day 2

- A protein free breakfast will be provided, which is usually two bananas. Alternative fruit may be requested. Protein can delay the absorption of your medication, and therefore should be avoided in order to optimise the effectiveness of your medication during your assessment.

- At approximately 9.00 am you will be taken to another part of the hospital for a detailed assessment of your Parkinson’s disease. This will be carried out by your Specialist Nurse.

Some parts of the assessment will be videoed, for which you will need to give your consent. This will entail “time tested” assessment of your ability to perform certain tasks and movements, both off and on medication. This process will take approximately 3 hours.
It is important that you take your glasses and walking aid if appropriate. It may also be advisable for you to take a snack, as you may want to eat once your medication has started to work. Once the assessment has been completed, you will be able to resume your usual medication.

Your Specialist Nurse will discuss the motor diary and questionnaires you will have completed prior to admission. She will also ask you questions about your non-motor symptoms and perform a short test to assess your memory and cognition.

Your Consultant Neurologist will see you on the ward during the afternoon or the following morning, and discuss the outcome of the assessments. Your Specialist Nurse will be available to discuss any further issues. You will also have the opportunity to discuss the surgery if you are a suitable candidate.

What is deep brain stimulation?

It is a surgical procedure to treat some of the symptoms of Parkinson’s disease such as tremor, slowness of movement and stiffness.

The procedure involves

- The implantation of 2 leads each with 4 electrodes (otherwise known as “contacts”) into structures deep within the brain called the basal ganglia.
- An extension lead is positioned under the skin of the head, neck and shoulder.
- This wire is finally connected to a small unit called an Implantable Pulse Generator (IPG), which is placed under the skin just below the collarbone (Figure 1).

Deep brain stimulation (DBS) works by sending electrical stimulating pulses to the selected area of the brain, which improves the abnormal brain signals that arise as a result of the disease. The amount of stimulation provided by the IPG is adjusted using a hand held device to optimise therapy and minimise side effects (Figure 2). It does not destroy brain tissue and therefore you could have further treatment in the future if required.
The Risks related to surgical implantation include:

- Stroke.
- Seizures.
- Wound infection.
- Meningitis or abscess (inflammation or infection of the brain or spinal cord).
- Changes in thinking such as confusion.
- Psychological changes such as depression or anxiety.
- Medical and other complications from general anaesthesia [1,2].
- Unsteadiness and possible falls.
- Speech and swallowing problems.
How will it help me?
Deep brain stimulation is not a cure for Parkinson’s disease.
However it can:
- Increase “on” time.
- Reduce severity and amount of “off” time.
- Improve tremor.
- Enable a reduction in anti-parkinsons medication, and thus minimises duration and severity of dyskinesia.

What is the success rate?
The outcome of surgery depends on target selection and the accuracy of lead placement in the brain. Different targets in the brain achieve different results. At North Bristol NHS Trust our success rate with improving the overall condition of patients is between 40-70%.

What are the risks of treatment?
There are some risks associated with the surgery. Though the incidence is small, the doctor will discuss this fully with you prior to consenting for surgery.

Over time after surgery the following problems can occur with the device:
- Generator or “pacemaker” battery depletion (the battery life of a generator is usually 3-5 years) when driving two electrodes. The generator battery runs down with time (typically after 3-5 years) and will need to be replaced. This, however, is a relatively simple procedure performed under general anaesthetic which does not require further brain surgery.
- Breakage of electrode or extension leads.
- A reaction to the implanted materials (guide tubes, electrodes or generator). N.B. these materials have been previously tested for toxicity and are approved for implantation. If the above occurs the implanted kit may need to be removed or replaced.
Stimulation related side effects:

These are side effects related to the high frequency electric current spreading to areas other than the planned target area. However, these side effects will disappear completely on reducing the electric current or stopping it completely.

- Paraesthesias (sensation of pins and needles on your arms and legs).
- Changes in speech or language such as difficulty in speaking or speaking softly.
- Facial contractions.
- Problems with eyelid opening.[1,2]
- Balance impairment and possible falls.
- Speech and swallowing problems.

At North Bristol NHS Trust, based on our complication rates, we consent for the following:

- Seizures (0.3%).
- Wound infection (1%).
- Speech deterioration such as slurred speech (up to 5%).
- **Stroke 1%**.
- Post-operative confusion and disorientation (transient) 1%.
- Medical and other complications from general anaesthesia [1,2] (Chest infection, DVT (clot in the leg) or PE (a clot that can lodge in the lungs).
- Balance problems < 1%.
- Breakage of electrodes (<1%).
- Current leak from electrode (<0.5).
How are the stimulating leads accurately placed into the brain?

In order for the surgeon to accurately place the stimulation leads at the desired brain target, 3 steps are required:

1) **Brain localisation:** A reference frame (stereotactic frame) is fixed to the patient’s head and they will have an MRI scan. (Figure 3) Using specially designed surgical planning software, the target site in the brain is identified on the scan and its position relative to the stereotactic frame is measured and recorded as 3 dimensional coordinates. The software is then used to plan a safe trajectory through the brain, avoiding critical / vascular structures.

2) **Guided surgical implantation:** The patient is transferred to the operating theatre and the 3D coordinates are set in an instrument-aiming device that in turn is fixed to the stereotactic frame. This enables the surgeon to guide the stimulation leads with millimetre precision to the brain target through a drill hole made in the skull.

3) **Confirmation of accurate targeting:** Placement of stimulating leads with millimetre precision at the desired target is necessary to optimise the treatment and avoid side effects. Because the brain floats in fluid it can move during surgery and result in suboptimal lead placement and treatment outcome.

What can I expect if I have DBS surgery?

At North Bristol NHS Trust we have developed a technique in which a fine plastic guide tube (Figure 4) is passed to the target and the accuracy of its placement is confirmed with a high definition MRI scan taken during the operation. An electrode is then inserted to the verified target site down the guide tube. This technique typically requires a single pass and is carried out entirely under general anaesthesia.
The plastic guide tubes are an in-house investigational device that has been designed to enable us to perform the operation accurately whilst the patient is anaesthetised (asleep).

Our method is also designed to minimise the risk of bleeding in the brain (stroke). We believe that it is a safer and more accurate technique than the alternatives.

The outcomes from your surgery including the accuracy of lead placement, the benefits and side effects will be recorded and held on a hospital computer database. This information may be used for publications in medical and scientific journals or presented at specialist meetings. If this does happen, your identity will remain anonymous and we will ensure that you cannot be personally identified from any details that we publish.

(Figure 4)

What happens before I come into hospital for surgery?

It is important that you have your ears examined by your practice nurse / GP during the two weeks prior to surgery. If you have excessive build up of wax, you will be referred to the practice nurse for treatment. This is to prevent any temporary hearing impairment due to wax being compacted when the frame is applied.

What happens when I am in hospital before my operation?

**Day 1 - Admission day**

On admission you will have a routine examination by a doctor and routine observations by a ward nurse. At 6 pm you will need to stop taking your Parkinson’s medication for a brief assessment the following morning. We appreciate that you may have an uncomfortable night and will ensure that night sedation and pain relief are prescribed.
Day 2 - Application of frame

- You should have a light breakfast at 8 am and can continue to drink clear fluids until 11 am. Thereafter you will be nil by mouth.
- A short assessment will be carried out by your specialist nurse at approximately 9 am. You will then be able to resume your usual medication, even when you are nil by mouth.
- Late afternoon or early evening you will be taken to the operating theatre for a general anaesthetic. While you are asleep the frame will be applied to your head and you will have a Magnetic Resonance Imaging (MRI) scan, which will be used to precisely locate the target for the deep brain stimulation. When you wake up in recovery, the frame will be secured to your head with 4 rods. It may appear cumbersome but it is not particularly heavy and will not prevent you from moving about.
- It is important to eat later in the evening as you will be nil by mouth again the following morning. You may wish to bring some snacks with you, but a snack box can be provided.

Day 3 - Operation day

- Your operation will take approximately 4 1/2 hours. The entire operation is performed under a general anaesthetic (i.e. with you asleep).
- Your surgeon will place two specially designed plastic “guide tubes” and stylettes to the target area in the brain. The guide tubes will be secured to the skull. You will then be taken for a repeat MRI scan to check that the guide tubes are in the correct position.
- Providing the guide tubes are in the correct position, you will return to the operating theatre and the deep brain stimulating electrodes will be passed down the guide tubes to the target in your brain.
- You will have a generator (“pacemaker”) implanted on your chest, which will be connected to your deep brain stimulating electrodes.
When you wake up, you will be in the recovery room, where you will stay for up to 2 hours. The frame will have been removed and you will not have had any hair shaved. Your stimulator may be turned on after your operation and left at a low setting for 1 - 2 days.

**What happens to me after my operation?**

It is important to get up and mobilise as soon as possible, but you will also need to rest at regular intervals. 2 - 3 days following surgery your stimulator will be programmed and you need to have stopped taking your Parkinson’s medication from 12 midnight. Over the next few days the stimulator will possibly continue to be adjusted and your medication reviewed. You will receive instructions on how to use your own programmer, which will allow you to switch the stimulation on and off, make some adjustments and check the life of the battery in the generator.

Your stitches will be removed from your head and behind your ear after 5 days. The paper stitches will be removed from your chest after 8 - 10 days.

You may feel exceptionally well after your operation. However, this is not maintained to this degree. You may feel very sleepy and the tiredness can last for 4 - 6 weeks.

**How long will I be in hospital?**

The usual length of time spent in hospital is 7 - 10 days. Before you go home, you will be given an information pack and your specialist nurse will discuss follow-up care.
References:


NHS Constitution. Information on your rights and responsibilities. Available at www.nhs.uk/aboutnhs/constitution