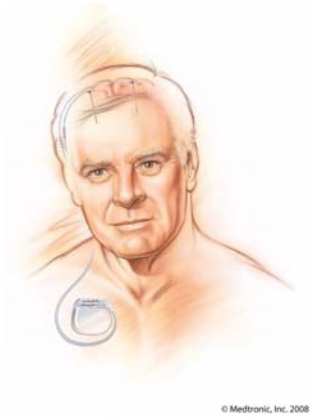
DEEP BRAIN STIMULATION

Deep brain stimulation involves inserting electrodes into the deep parts of the brain in an attempt to modify the activity of the nerve cells in the area. An electrode in the left side of the brain will control the right side of the body and one in the right side of the brain will control the left side of the body. The target depends on the condition being treated.

- Thalamus – tremor due to Parkinson's disease (PD), essential tremor (ET)
- Globus pallidus – dystonia, dyskinetic Parkinson's disease
- Subthalamic nucleus (STN) – Parkinson's disease with motor fluctuations

The surgery has 2 parts. The first part is performed with the patient awake and the head supported in a special frame. During this time, the electrodes are inserted into the brain and the neurologist will test regularly to determine the best position for the electrode to give maximum effect. The second part is performed under a general anaesthetic and involves inserting the battery into the anterior chest wall on the right, just below the collarbone.



PRE-OPERATIVE CONSIDERATIONS

Patients will require pre-operative work-up to determine their suitability for surgery. This will vary depending on the condition treated. It may involve

- assessment by the DBS clinic nurse with regards to disease severity
- neuropsychological testing
- psychiatric assessment
- MRI scan
- review by the neurosurgeon with regards to suitability for surgery

RISKS OF SURGERY

As with all surgery, there are risks associated with this procedure. These risks include

- stroke or haemorrhage
- infection
- electrode movement
- seizures
- hardware malfunction
- general surgical risks – anaesthetic complications, heart or lung problems, clots in the legs (DVT) or lungs (PE)
- death
- persistent or recurrent symptoms

HOSPITAL ADMISSION

Day before surgery

Patients are admitted to hospital the evening before the surgery and undergo pre-operative blood tests, CXR and ECG if necessary. Parkinson's disease patients will cease their medications the evening before surgery.

Day of surgery

On the morning of the surgery you will be taken to the Radiology department for the pre-op CT scan. Here, a frame is attached to your head using 4 screws under local anaesthetic and some sedation if needed. This can be a little uncomfortable although it should not be painful. The frame will remain in place for the CT scan and the first part of the procedure and is used for localising the surgical target. After the CT scan, you will be transferred to the operating theatre for the surgical procedure. The head frame is secured to the operating table so that during the procedure there is no movement of the head and you will be made comfortable. The anaesthetist is present during the surgery for monitoring.

The worst side is done first and then the other side. The surgery involves shaving a small area of hair and cleaning the skin with antiseptic before putting the drapes on. Your face is left free of drapes so you can see. Two small incisions are made after using local anaesthetic and then two small holes are drilled into the skull. This is not painful but does cause a vibration which can be unsettling. The noise and vibration only lasts for a short time. A small electrode is inserted into the brain slowly to allow recording from the nerve cells to help determine the location of the target. Based on the imaging and the recordings taken from the electrodes, the best position is identified. At this position, impulses are passed through the electrode at varying strengths, and clinical testing carried out by the neurologist to determine the effectiveness of the stimulation and the potential side-effects. Rarely, a second attempt has to be made because of inability to locate a good position or unacceptable side-effects. Once the best position is confirmed, the permanent electrode is inserted with the use of X-ray to ensure there is no deviation. The wounds on the head are closed and then the frame is removed.

You will be given a general anaesthetic for the second part of the surgery. This involves tunnelling the extension leads down behind the ear and over the collarbone to attach to the battery pack which will be placed into the anterior chest wall. The total surgery time is 4-5 hours but does depend on the extent of surgery. After the surgery is completed, the anaesthetic is stopped and you are woken up and transferred to the high dependency unit overnight.

After surgery

A CT scan is performed the day after surgery to enable confirmation of the electrode position.

DISCHARGE

The hospital stay depends on the condition being treated. Those patients with Parkinson's disease will usually remain in hospital for up to two weeks while their medications are adjusted and the stimulator turned on. Other patients will remain in hospital for only 2 or 3 days prior to discharge. In most cases, the stimulator will be turned on prior to discharge. You must also be able to eat, drink and go to the bathroom prior to discharge. Any pain should be easily controlled with tablet pain killers. You should discuss with Dr McMaster when to resume any blood thinning medications which have been stopped for the surgery.

At home, you should continue with daily regular exercise, slowly building up your tolerance. You should avoid heavy lifting or straining for the first couple of weeks to allow the chest wound to heal.

WOUND CARE

The wounds on your head will be closed with stitches which will need to be removed after one week. This may be done in hospital if you are still there or by your family doctor if you have already been discharged.

The wound on the chest will be closed with a dissolving stitch under the skin and reinforced with some sticky paper strips. It should remain covered for one week by a sterile dressing which should be changed daily. After one week, it can be left off. The paper strips will slowly fall off over 1-2 weeks.

If there is any redness, tenderness, swelling or discharge of the wounds, you should see your family doctor immediately.

FOLLOW-UP

You will need to be seen by Dr McMaster six weeks after the surgery.

Around 1-2 months after discharge, you will be required to return to the DBS clinic for a lengthy appointment. This is to enable complete testing of all the electrode contacts for benefit and side-effects. For PD patients this may require stopping your medications overnight. You will be given a remote control to allow you to adjust the system appropriately and will be shown how to do so by the neurologist. The DBS system will require regular review and adjustments as necessary. It can sometimes take up to 6 months for the systems to have its full effect. Of importance is that the DBS system is not designed to cure the movement disorder but to improve symptoms. Thus if there is progression of the disease, the benefit may decrease although the system allows adjustment to try and compensate for this.

BATTERY CHANGE

At some stage, the battery in the anterior chest wall will start to fail and need to be replaced. The time taken for this depends on the settings of the stimulator but on average is between 3-5 years. Battery exchange needs only a short procedure which can often be done with some sedation and local anaesthesia. Only the wound on the chest needs to be opened and the hospital stay is overnight. The system is turned off for the procedure and turned back on immediately after the battery is replaced.