

Functional neurosurgery

Treating essential tremor with magnetic resonance-guided focused ultrasound (MRgFUS for ET)

Information for patients, relatives and carers

What is essential tremor?

Essential tremor is a neurological condition. It causes your arms and hands to shake without you being in control. It usually happens when you move. The tremor can also affect the head, voice, or legs.

What is magnetic resonance-guided focused ultrasound (MRgFUS)?

Magnetic resonance-guided focused ultrasound is a treatment for essential tremor. It uses focused ultrasound waves. It is called MRgFUS for short.

We use magnetic resonance imaging (MRI) to guide the treatment to ensure precise targeting of the affected brain area. We only treat **one arm** at a time. This because of the potential risks of speech and balance problems associated with treating both arms at the same time.

Before the treatment

First, the MRgFUS consultants will analyse your referral. Then you'll be contacted by one of the neurosurgeons. They will ask for details about your medical and surgical history. This helps them decide if treatment is likely to be safe and effective for you.

When is MRgFUS **not** a suitable treatment?

This treatment is **not** suitable for you if you have any type of **metal** implants that are **not MR compatible**. This can include neurostimulators, cardiac pacemakers or spinal or bone replacements

This treatment **might not** be suitable if you have:

- a brain tumour
- severe scars or cancer in the scalp

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- an active blood or brain infection or other acute disease
 - fear of enclosed or confined spaces

Also, you **must** be able to

- lie down for about four hours
- stop your blood thinners for the recommended period (See How do I prepare for MRgFUS?)

If you're unable to do these, MRgFUS is not suitable for you.

What is done to prepare for MRgFUS?

Once it is confirmed that you can be treated with MRgFUS:

- the team will arrange brain scans (MRI and computerised tomography, CT)
- the team will arrange a memory test, called neuropsychometry
- you may need blood tests and an electrocardiogram (ECG). These will be arranged
- you will have a planning MRI scan. This MRI scan helps plan the area of the brain the treatment will target. It also works out the **skull density ratio** (SDR). This is a measure of the thickness of the skull bone in relation to the bone marrow. A SDR of more than 0.4 has a higher success rate and less complications.

Strong tremors can affect image quality. So, if your tremors are significant, you may need general anaesthesia for the scan.

You'll get your admission details from the MRgFUS coordinator shortly before the date.

How do I prepare for MRgFUS?

It's important you follow these steps. They reduce the risk of complications during or after treatment.

- you need to have your **head fully shaved** at your local hairdressers one to two days before the treatment. This is because hair traps bubbles which interfere with the ultrasound waves
- you must **stop taking blood thinners seven days before** the treatment. This includes aspirin, clopidogrel, warfarin, apixaban, and dabigatran, or any other type of blood thinner
- you must **stop taking painkillers five days before** the treatment. The only exception is paracetamol, which you can take

If you have any concerns about stopping your painkillers or blood thinners, please contact your GP first

- on the morning of your treatment, you can have a light breakfast before 9am. From then, you can have **clear fluids until 11am**. Do not eat or drink anything after 11am
- get some **thermal underwear or fleece pyjamas** to wear during the treatment. You'll want to avoid feeling cold in the MRI room, which is kept at a low temperature. Also, shivering can affect the neurological assessment of your tremor

What happens during treatment?

Key points

- the treatment usually takes **three to four hours**
- you will be **awake** and able to communicate with the team all the time during the procedure
- you will move in and out of the MRI machine during the treatment
- you will have an MRI scan of less than 30 minutes after the treatment
- you can have a relative or friend with you during treatment. They must complete an MRI safety checklist to ensure they can stay in the MRI suite safely

Getting ready

1. First, we will give you medication to ease any discomfort and nausea. It will also reduce brain swelling caused by treatment.
2. Your neurologist will review your medical history. They do a physical examination.
3. We will shave off any new head hair that has grown since your visit to the hairdressers.

Fitting the head frame

We will give you a local anaesthetic. This lets a neurosurgeon secure a **lightweight frame** to your head using four pins. This can be very uncomfortable for some people. Though you will feel some pressure at first, you should not feel any sharp pain. Please tell the team if you do.

The frame targets the area in the brain responsible for ET. The head frame is attached to a special helmet. Together, they keep your head still as you lie on a bed in the MRI machine.

Ultrasound pulse (sonication)

High-frequency ultrasound pulses called sonications focus on the area of the brain causing the tremor. These sound waves heat the target tissue and destroy it.

We start delivering the ultrasound pulse at a **lower temperature** and energy. This allows the neurologist to check for possible side effects.

After each pulse, the **neurologist will examine you**. They will look for possible side effects. They will also check if your tremor has improved.

We will then deliver a sound wave at higher temperature and energy. This creates a **permanent scar or lesion**. You may feel dizzy. This can happen several times during sound waves. It lasts for about 10 to 15 seconds.

What are the benefits of MRgFUS?

One of the main advantages of MRgFUS is that it is a **minimally invasive** treatment. This means:

- it does not need cuts (incisions)
- it reduces the risk of complications
- it speeds up recovery times

Other benefits are:

- it is targeted. It focuses specifically on the area of the brain that causes tremors. This reduces the risk of damaging healthy tissue
- it produces **immediate results**. Many patients experience significant improvements immediately after treatment

Possible risks and side effects of MRgFUS

The main side effects of MRgFUS are caused by temporary swelling around the target site in the brain. This is called cerebral oedema. This can lead to:

- speech problems, such as slurring
- poor balance
- weakness or numbness on the treated side of the body, including face, arm and leg
- other sensory phenomena such as unpleasant tingling, called paraesthesia
- involuntary movements on the treated side of the body, including face, arm, and leg. This is called chorea

If these symptoms happen, they will usually have gone in three months. But one or more of these side effects may remain permanently.

Despite being non-invasive, the treatment can cause infection or bleeding of the pin sites. This be managed with a short course of antibiotics.

Also, there is a theoretical risk of brain bleed leading to stroke. This happens in less than 1 in 1,000 cases.

MRgFUS is a new treatment. Neurosurgeons worldwide have only been able to follow up patients for eight years after their operations. This means the long-term effects are not fully understood.

What happens after treatment?

1. The neurosurgeons remove the frame.
2. Four plasters are applied to the pin sites. There may be minor bleeding when the pins are removed. The team may need to use some pressure before applying the plasters.
3. The neurologist will check you for the last time.
4. An MRI is performed to confirm the location of the lesion and identify complications. This takes less than 30 minutes.
5. After the neuro-radiologists review the scan, you will be transferred to the ward.

Important: please **ask for help if you need to go to the toilet**. You will have an increased risk of falling.

What happens the day after treatment?

1. You'll be reviewed by the neurosurgeon or neurologist, with the nurse specialist.
2. A physiotherapist will check if you can move safely. You could be referred to your local **neuro physiotherapy** team for more support if you experience side effects. This is especially for loss of balance or coordination, dizziness, or muscle weakness.
3. You'll get a supply of **oral steroids** with instructions on how and when to take them. If you have **diabetes**, you may notice that your blood sugar levels **increase** while taking this medicine. We advise you to contact your diabetes team or GP if the problem carries on after stopping steroids.
4. Please continue to take your usual tremor medications, unless told otherwise.
5. If you stopped taking blood thinners or painkillers before the procedure, the medical team will tell you when to start taking again
6. When you are ready to leave, we recommend that a relative or friend is there to reduce the risk of falls

After your treatment

You will have follow-up reviews with several members of the treatment team:

- the neurosurgeons will contact you four to six weeks after the treatment

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- the neurology team (neurologists or clinical nurse specialists) will see you at three, six and 12 months after treatment

You'll feel slightly unsteady for at least a month, so please take extra care when you move.

Please do not drive or swim for a month after the procedure, as your coordination and motor reaction may be impaired. When you start swimming again, please do not swim alone and stay in shallow water.

Contact us

Please contact the **functional neurosurgery team** if you have any questions or concerns:

Telephone: 020 3311 5376

Email: imperial.mrgfusenquiries@nhs.net

Find support and advice

Focused Ultrasound (FUS) Foundation ukfusf.org/ and www.fusfoundation.org/for-patients/

Dystonia UK www.dystonia.org.uk

Email: info@dystonia.org.uk

Helpline: 020 7793 3651

Parkinson's UK www.parkinsons.org.uk

Deep brain stimulation www.parkinsons.org.uk/information-and-support/deep-brain-stimulation

Helpline: 0808 800 0303

Free Parkinson's information and support helpline. Monday to Friday, 9am to 6pm and Saturday, 10am to 2pm

Text relay: 18001 0808 800 0303

Email: hello@parkinsons.org.uk

The National Tremor Foundation www.tremor.org.uk

Deep brain stimulation www.tremor.org.uk/about-tremor-menu/deep-brain-surgery

Focused ultrasound www.tremor.org.uk/about-tremor-menu/focused-ultrasound

Email: enquiries@tremor.org.uk

Helpline: 01708 386399

How do I give feedback about my visit?

We want to hear your **suggestions** or **comments**. Your feedback helps us provide the best service. You can always speak to a member of staff.

You can also contact the **patient advice and liaison service (PALS)** on **020 3312 7777** (10am to 4pm, Monday to Friday excluding bank holidays) or email at imperial.pals@nhs.net. The PALS team will listen to your concerns, suggestions or questions and they can help solve problems.

You can make a complaint by ringing **020 3312 1337 / 1349** or emailing ICHC-tr.Complaints@nhs.net. The address is Complaints department, fourth floor, Salton House, St Mary's Hospital, Praed Street, London W2 1NY.

Other ways to read this leaflet

Please email us at imperial.communications@nhs.net if you need this leaflet in a different format. This could be large print, Easy read, as a sound recording, in Braille or in a different language.

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