Gamma Knife®
Radiosurgery for the
treatment of tremors
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What is Gamma Knife

Gamma Knife radiosurgery is a safe, effective and non-invasive procedure that uses radiation to treat conditions in and around the brain. It is sometimes used as a replacement for conventional surgery, but at other times it may be effective in situations where there is no conventional surgical alternative available.

Not actually a “knife” at all, the Gamma Knife is a machine that emits hundreds of powerful, highly focused gamma radiation beams. Gamma Knife uses approximately 200 beams of radiation from many angles to target 1 specific area in the brain that is causing your tremor. Where the beams meet, the combined radiation is strong enough to treat the area. The dose of each individual beam is low enough, so they don’t damage the brain tissue whilst travelling to the target.

The Gamma Knife allows for a more precise and concentrated treatment than do other radiation treatment options. This helps the doctors target the diseased area of the brain while sparing the healthy areas surrounding it.

Only 1 side of your body can be treated with Gamma Knife surgery. This is due to the potential severe side-effects when treating both sides of the brain (and therefore both sides of the body) with Gamma Knife.

Benefits of Gamma Knife surgery

- It’s a non-invasive alternative to neurosurgery
  - The risks of infection, bleeding and spinal fluid leakage are eliminated, as is the scarring and potential disfigurement that results from conventional neurosurgery.
- The small risk associated with general anaesthesia is also eliminated
  - A mild sedative is occasionally used.
- Gamma Knife surgery is a day procedure except in some cases.
- Gamma Knife is a treatment option available for those that cannot tolerate the medications available or their tremor is unresponsive to medications.
- Unlike DBS surgery, Gamma Knife treatment does not need any cutting or shaving of your hair.
- Gamma Knife treatment does not cause you to lose your hair.
- The Gamma Knife rays used in the treatment do not remain in your body and you will not be radioactive.

Website: metrosouth.health.qld.gov.au/services/all/movement-disorders
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Movement disorders phone: (07) 3176 4246
Monday to Friday, 8am to 4.30pm, excluding public holidays
• Most patients do not suffer from any serious side effects related to Gamma Knife treatment.
• If you feel well enough you can return to work and travel almost immediately after you have finished your treatment, however, any driving restrictions already in place will continue to apply.
• Even though you remain in the Gamma Knife treatment suite for 5 to 6 hours the actual radiation treatment usually takes less than an hour.

**Gamma Knife risks and complications**

As with all types of surgery, Gamma Knife surgery involves some degree of risk and the chance of complications. Because of possible side-effects with bilateral treatment only one side of your brain (and therefore your body) can be treated.

• About 75 per cent of patients have a good response to the Gamma knife treatment with little or no side effects.
• 5 per cent of patients or hyper-responders show excess reactions to the Gamma Knife treatment and can develop side effects such as weakness and numbness affecting 1 side of their body. In most cases these are not permanent.
• 20 per cent of patients or hypo-responders developed no or only little response to Gamma knife treatment causing no or only minor improvement.
• There is a chance that the surgery will not benefit you as much as you would like, and it is not possible to be certain before the operation how much benefit you will obtain.

**Early complications - common but usually mild**

• Some local discomfort of the scalp relating to the pin sites which are used to fix the frame - resolves within a few hours, almost certainly by the following morning.
• Numbness of the scalp around pin sites may occur which generally resolves after 48 hours.
• Headache - again usually mild, resolving rapidly
• Mild nausea

**Delayed complications - uncommon**

• Radiation effects on surrounding brain tissue causing weakness and/or numbness.
• Hair loss which is very localised next to treated area
• Epileptic seizures are very rare

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Psychiatric risks and complications following Gamma Knife surgery

- Expectations versus reality – often patients may feel low in mood as they are expecting a cure or complete change of their tremor symptoms following surgery.
- Gamma Knife surgery is not a cure. It is used to relieve your tremor symptoms.
- Adaptation – often patient’s struggle to adapt to changes in their functionality following Gamma Knife surgery. This can sometimes lead to relationship breakdowns between patients and their loved ones and/or carer and or cause other psychiatric issues.

Deep Brain Stimulation (DBS) surgery versus Gamma Knife surgery

DBS surgery can be a very effective therapy to tremors, although some patients cannot undergo this type of surgery. For example, some people taking anti-coagulation drugs can’t go without their medicine even for a short period of time or others are too unwell to undergo DBS surgery. For these people, a non-invasive surgical approach, like Gamma Knife surgery, may be beneficial.

The effects of your treatment on your condition will occur over time. In case of Gamma Knife surgery for tremors the delay from treatment until any improvement is observed is usually between 3 and 6 months but can vary widely from several days to one year.

Gamma Knife pre-operative work-up

At PA Hospital we require our patients to undergo pre-operative work up which includes:

- Neurological assessment – to confirm the underlying condition and evaluate whether you would be a good candidate for Gamma Knife®
- Neurosurgical evaluation - to assess for surgical contraindications
- Neuropsychiatric evaluation - to evaluate mental health
- Neuropsychological assessment – to identify potential cognitive and emotional contraindications to Gamma Knife®, or to identify risks for adverse outcomes
- Nursing assessment – assess your baseline motor assessments. This includes video recordings of you during various activities.
- MRI Brain scan – to plan the procedure and to rule out structural brain abnormalities. You may need a general anaesthetic for the MRI scan as any movements during the scanning procedure can worsen the image quality.
Depending on your circumstances this workup will be organised as a planned admission to the Princess Alexandra Hospital, usually for about 3 days or through separate outpatient appointments. This pre-operative information establishes a baseline against which to evaluate post-surgery.

The final decision for each patient is then determined by the collective agreement of the multidisciplinary team during a patient management conference.

If the team recommends Gamma Knife surgery, then we will talk to you about what this involves. We will give you the opportunity to ask questions about the operation and your care afterwards. There are some things that you will need to be aware of in terms of your lifestyle after Gamma Knife surgery and you will also be able to discuss what this will mean for you personally.

You will be asked whether you wish to go ahead with the surgical treatment, but you may want to go away and think about whether you feel it would be right for you. We will not put you under pressure to decide on the day of your appointment.

If, after the assessments, we feel that Gamma Knife would not be appropriate, the surgery will not be offered. If this is the case, you will have the opportunity to discuss this decision with the team.

Gamma Knife surgery is a day procedure except in some cases.

**Patient selection for Gamma Knife surgery**

Proper selection of patients who will reliably benefit from DBS is critical to its success. The most suitable tremor surgical candidates are those that have an upper limb tremor that interferes with their quality of life. The tremor is not adequately controlled with optimised medical therapy, or those with medication-refractory tremor. Patient expectations, cooperation, and family support are also important considerations. The decision of whether a patient would make a good Gamma Knife candidate is determined by the outcome of their Gamma Knife pre-operative work-up assessments.
Gamma Knife treatment day

Gamma Knife surgery will only be done as an outpatient appointment. You would need to arrange your own accommodation if that is required.

Arrival
On the day of your Gamma Knife treatment, you will report to the Radiation Oncology reception. From here, a nurse will greet you and take you through to the Gamma Knife treatment suite where they will verify your personal details, complete a short check list and take your vital signs. If you have not yet completed an informed consent, this will also be obtained at this time.

We recommend that you do not wear any make-up, jewellery, hair pieces or pins on the day of your treatment. You may be asked to remove your contact lenses, eyeglasses, and dentures before fitting the head frame. The doctor will insert a small needle, into a vein in your arm.

Planning
Neurosurgical staff will fit the head frame for Gamma Knife treatment under local anaesthetic. The head frame helps to ensure the Gamma Knife beams are focused accurately on the target area to be treated. The frame is light weight and can cause discomfort. This frame will remain in place for the duration of the Gamma Knife treatment.

Following the fitting of the head frame, you will undergo a magnetic resonance imaging (MRI) and computed tomography (CT) scan. These scans provide the Gamma Knife team with a road map from which they can precisely plan your treatment, which can take 1 to 2 hours. During this time, you will rest in the waiting room.

Treatment
After planning is completed, your treatment on the Gamma Knife machine begins. You will proceed to the treatment room where you will be positioned on your back on the treatment couch. At this point, treatment staff will then leave the room to administer your treatment. The room is fitted with cameras which allow the treatment staff to see you throughout the entire treatment. You will also be able to communicate with your team through an audio connection in the room. The couch moves into the circular dome and commences your silent and painless treatment, which can last anywhere from a few minutes to an hour depending on the size of the treatment target.

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Following the completion of the treatment, the head frame will be removed by the
neurosurgical team. In some instances, patients have complained of a mild headache,
some nausea or minor swelling after the frame has been removed, however, this should
only be temporary. You will be asked to remain in the Gamma Knife treatment suite so
that the nurse can monitor you for a short period following the removal of the head frame.
You will then be allowed to go home, however, someone will need to escort you.

Gamma Knife treatment effect and follow-up

You will stay on long term follow-up with the Movement Disorder Team. The Movement
Disorder Team will perform your repeat motor assessments between 6 and 12 months, as
well as organising a repeat MRI scan following Gamma knife surgery to evaluate the
benefit of the therapy.

Our neuropsychiatrist will also see you again within a month after Gamma Knife surgery
to see if you have developed any mental health disturbance after surgery.

Our Neuropsychologists will perform repeat cognitive testing between 6 and 12 months
following your surgery. This will help us determine if you developed any cognitive
problems due to the Gamma Knife surgery.

The effects of your treatment on your condition will occur over time. In case of Gamma Knife surgery for tremors the delay from treatment until any improvement is observed is usually between 3 and 6 months, but can vary widely from several days to 1 year.

Contact us:
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