Gama Knife Surgery

Gamma Knife Surgery (GKS) (or Gamma Knife Radiosurgery GKRS) is worldwide accepted as a preferred treatment option intracranial pathologies such as brain tumours, AV malformations and brain dysfunctions like trigeminal neuralgia. It also called stereotactic radiosurgery, is a very precise form of therapeutic radiology. Gamma Knife systems are Co-60 (cobalt 60) systems, which means they use cobalt as a source for gamma rays. Even though it is called surgery, the procedure does not engage actual surgery. GKS provides a noninvasive alternative for patients for whom conventional brain surgery is not a choice. GKS eliminates surgical trauma and much of the risks which are related to traditional operations. This is an effective single session treatment option and in most of the cases require an overnight hospital stay. GKS is often done in an outpatient surgical setting with serial follow-up. It is a proven procedure with a wide range of case report in literature and is covered by most insurance plans.

Procedure Overview

GKS allows noninvasive intracranial surgical procedure to be performed with exact precision in one session. Based on preoperative radiological CT, MR or angiography imaging, GKS provides extremely accurate irradiation to targets, using a multitude of collimated beams of ionizing radiation.
As a major innovation in brain surgery, GKS has clearly changed the neurosurgery. Its development has enhanced and changed intracranial surgical treatments provided to patients with brain tumours and vascular malformations by offering a safe, accurate and reliable treatment choice. GK makes possible patients to undergo a non-invasive intracranial surgery without risks of conven tional surgery, a long hospital stay or subsequent rehabilitation.

GK makes non-invasive intracranial surgery possible for patients.During procedure with GKS no surgical incision is made, therefore the risk of surgical complications (such as haemorrhage, infection, CSF leak) and side effects of general anesthesia reduced. The “blades” of the GK are the beams of gamma radiation is programmed by a computer software and 201 beams of gamma radiation focus precisely on the lesion. Over time, most lesions slowly diminish in size and maybe dissolve. During the procedure, only the tissue being treated re-

ceives a significant radiation dose, the surrounding tissue remains untouched.

According to many scientific articles, GKS is an alternative to conventional neuro-surgical procedures or it is adjuvant therapy for the residual/recurrent lesions following standard surgery. If patients are not suitable for open surgical techniques due to risky disabling clinical situations or advanced aged, GKS is the only feasible treatment. Conditions for which the GKS is accepted most effective are:

1. Intracranial tumors
2. Vascular malformations
3. Functional disorders (trigeminal neuralgia and OCD etc.)

Additionally, GKS indicated for some other functional disorders such as intractable pain, Parkinson's disease, essential tremors and epilepsy.

ADVANTAGES OF GKS

- GKS is a high-end tool which designed exclusively for the treatment of intracranial pathologies.
- During GKS procedure, the lesion receives a high dose of radiation with minimum risk to adjacent tissue and structures.
- GKS may be used in the brain lesions which can not be reached by standard neurosurgical techniques.
- In most case, the total cost of a GKS procedure is often less than open neurosurgery.
- Patients experience little discomfort.
- The absence of an incision eliminates the risk of surgical complication.
- GKS typically is overnight or an outpatient surgical procedure (means minimum hospital stay). Mostly, patients can immediately start their prior activities.
- GKS radiosurgery offers hope to patients who were formerly considered inoperable or at very high-risk for open neurosurgery or not be able to tolerate a surgical procedure.

Since the therapeutic effects of a GKS procedure occur slowly over a period of time, GKS is not suitable for patients whose condition requires more urgent intervention.

How GKS works?

Gamma Knife Radiosurgery works in the same way with other types of therapeutic radiology: it distorts or destroys the DNA of tumour cells, which resulted by unable to reproduce or grow of tumour cells. The tumour will become smaller in size over time. In intracranial vascular disease (such as AV malformation), the vessels eventually close off after treatment.

GKS procedure generally involves the following steps:

• Placing head frame: For keeping the head from moving during treatment, a specifically designed frame is attached to the head. This frame also is a guide to focus the gamma ray beams to the lesion, precisely.

• Imaging for localization of pathological lesion: After the head-frame placement, the definite site of the lesion will be exactly localized using CT or MRI imaging.

• Planning for radiation dose: After completion of radiological imaging, the treatment team which includes radiation therapy specialists (radiation oncologist), a neurosurgeon and/or a neuroradiologist, medical physicist, and a dosimetrist determine the best treatment plan including appropriate dose. The treatment team may include other healthcare professionals depending on the patient's concomitant diseases (such as a cardiologist, pulmonologist).

• Radiation treatment: A kind of helmet with hundreds of holes in it is placed over the head frame. These holes help to focus the gamma rays on the targeted lesion. The procedure can last in several minutes to several hours, depending on the type and location of the lesion. Usually, only one treatment session is needed for a lesion.

Risks of the Procedure

Exposure to gamma-ray radiation during pregnancy may cause birth defects. Therefore, the physician should be informed in case of pregnancy or pregnancy suspicion.

Following risks (but are not limited to) may include related to GKS treatment;
• brain oedema
• headache
• nausea
• numbness

Following risks and side effects may be related to the location of lesion and size of the area being treated by the GKS:

- temporary hair loss near treated area
- seizures
- weakness
- loss of balance
- vision problems

There may be other risks depending upon the patient's specific medical conditions, such as cardiopulmonary failure.

After the Procedure

The patient is kept under observation for a period of several hours to one day. If a cerebral angiogram has been done before procedure, the patient will need to lie for several hours until the catheter insertion site no longer bleeds.

The patient may experience discomfort such as headache or nausea after the procedure. Once the patient arrived home, he/she may continue a normal diet, medication and activity, unless the doctor instructs differently. The patient may need to avoid strenuous activities such as intense exercise for a while.