

# GAMMA KNIFE

B98901197 嚴俊  
軒

B98901046 盧柏  
瑞

B97207003 張貝  
如

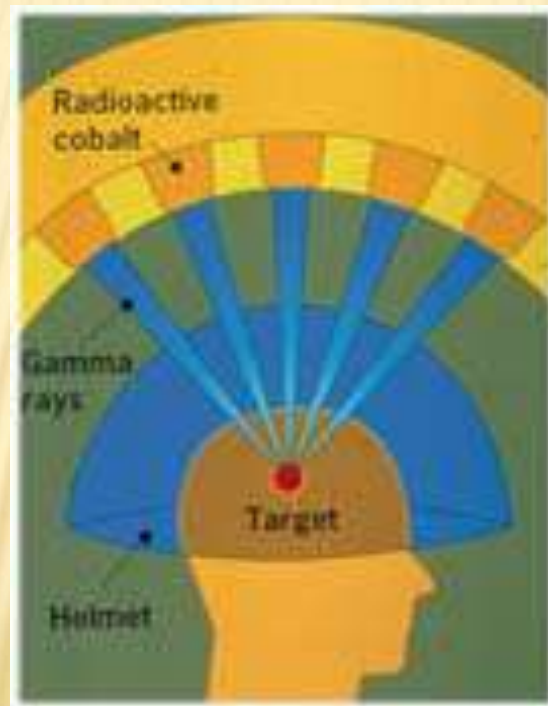
# HISTORY

---

- ✘ Leksell and Borje Larsson built the first Gamma Knife in Sweden in 1968.
- ✘ More than **60,000 patients** have been safely treated with focused gamma rays world-wide.

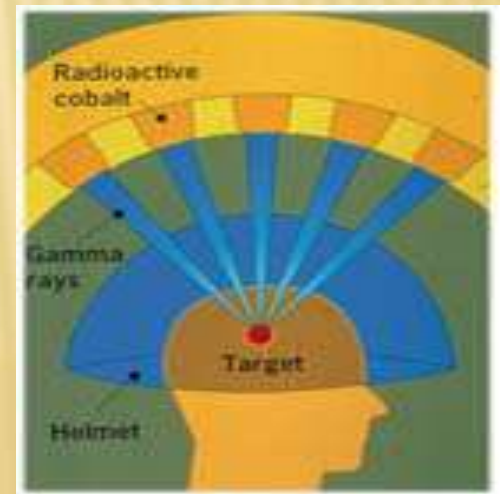
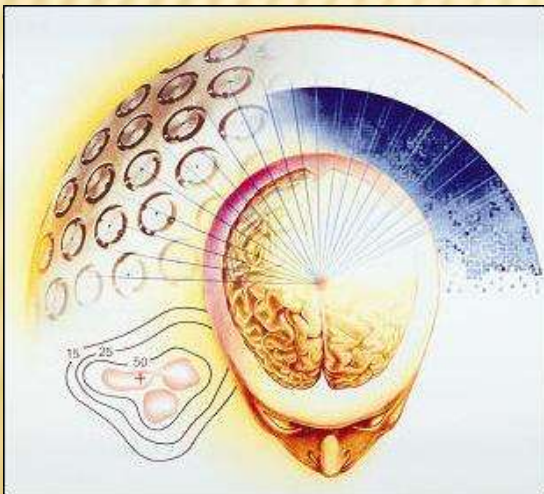
# RADIATION SOURCE

- ✘ Gamma Knife contains 201 small **Cobalt(C60)** sources of gamma rays arrayed in a hemisphere.



# THEORY

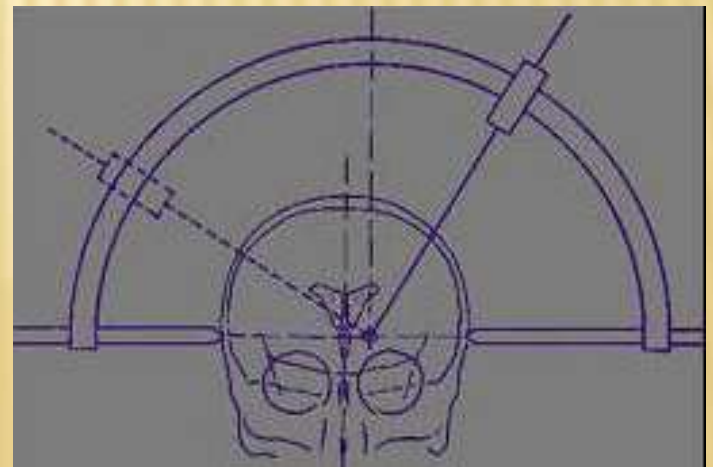
- ✘ The device aims gamma radiation through a target point in the patient's brain.
- ✘ The patient wears a **specialized helmet** that is surgically fixed to their skull so that the brain tumor remains stationary at target point of the





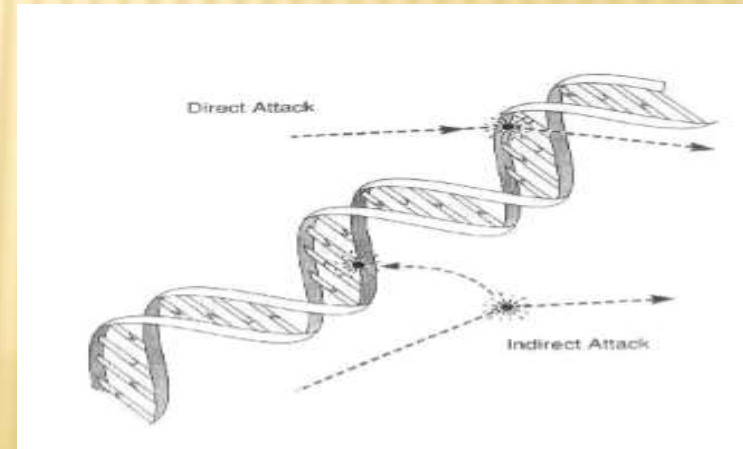
# CENTER OF ARC PRINCIPLE

- ✘ Tumor is at the center of the circular arc
- ✘ Each individual gamma ray is too weak to cause much harm to a brain tumor.
- ✘ But , 201 beams of radiation energy are gathered together, the focused target will receive an enormous amount of radiation.



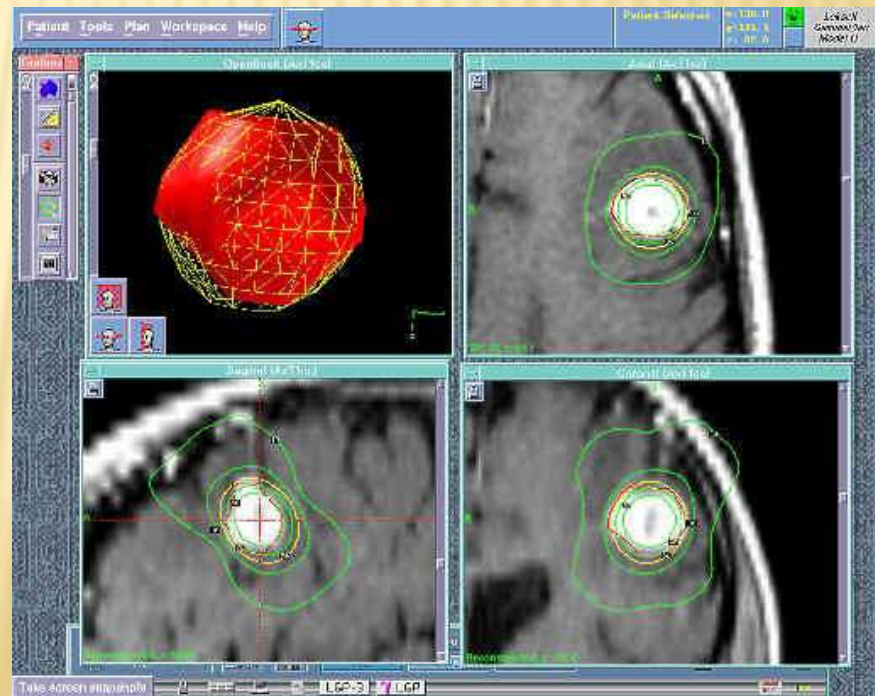
# GAMMA KNIFE VS DNA

- ✘ A focused dose of radiation is used to stop or reduce the growth of abnormal tissue.
- ✘ The Gamma Knife radiation distorts the DNA mapping of the cells and make them unable to divide.



# THEORY

- ✘ Only at the point where the narrow beams converge is the radiation at its most powerful, therefore preventing injury to surrounding healthy tissue



# COMPARISON

---

✘ 影片連結

<http://Orz.tw/8h1K5>



# ADVANTAGES

---

- ✘ Gamma Knife radiosurgery also is safer than many existing procedures because patients need not undergo risky, open-skull procedures, and adult patients do not require **anesthesia**.
- ✘ It's nearly 90 percent effective at killing or shrinking brain tumors or stopping their growth.
- ✘ **Patients can return to normal activities the next day**

# ADVANTAGES

---

- ✘ virtually painless, no loss of hair
- ✘ The cost of a Gamma Knife procedure is often 25% to 30% less than traditional neurosurgery.

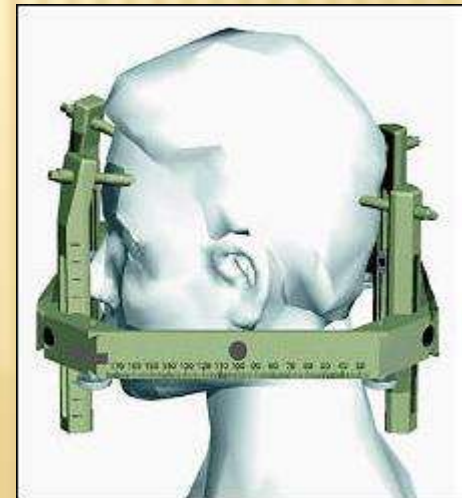
# THERAPY

---

- ✘ **Step 1: Headpiece Frame Placement**
- **Step 2: Diagnostic Imaging**
- **Step 3: Treatment Planning**
- **Step 4: Gamma Knife Procedure**
- **Step 5: Recovery**

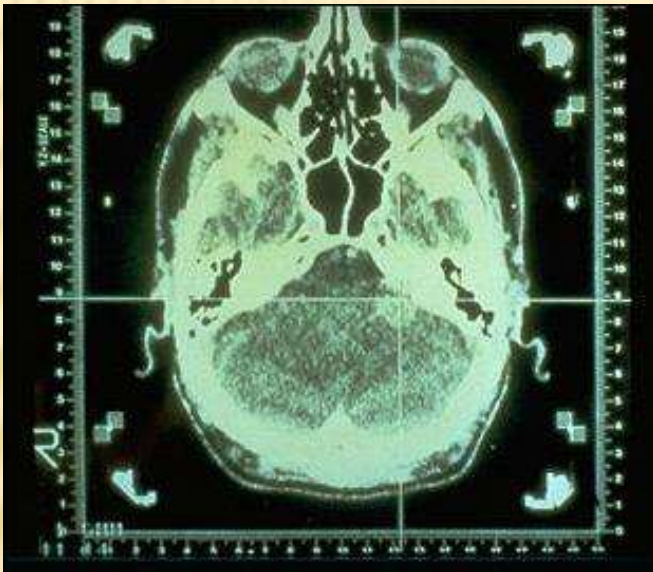
# STEP 1: HEADPIECE FRAME PLACEMENT

- ✘ Attached to the head with four pins.
- ✘ The radiation beams can be directed to the target.
- ✘ prevents the head from moving





## Step 2: Diagnostic Imaging



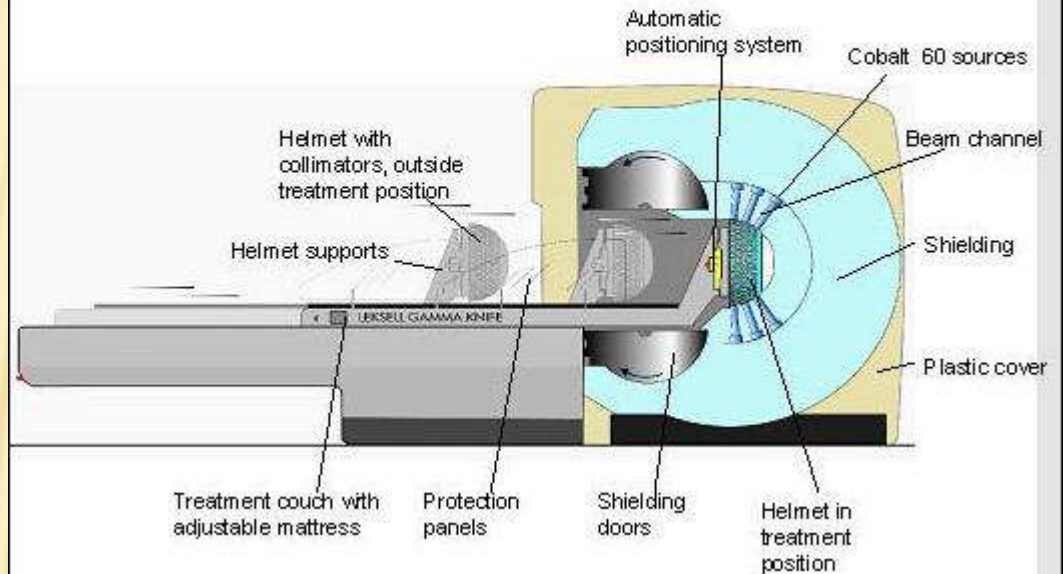
# Step 3: Treatment Planning



# Step 4: Gamma Knife Procedure



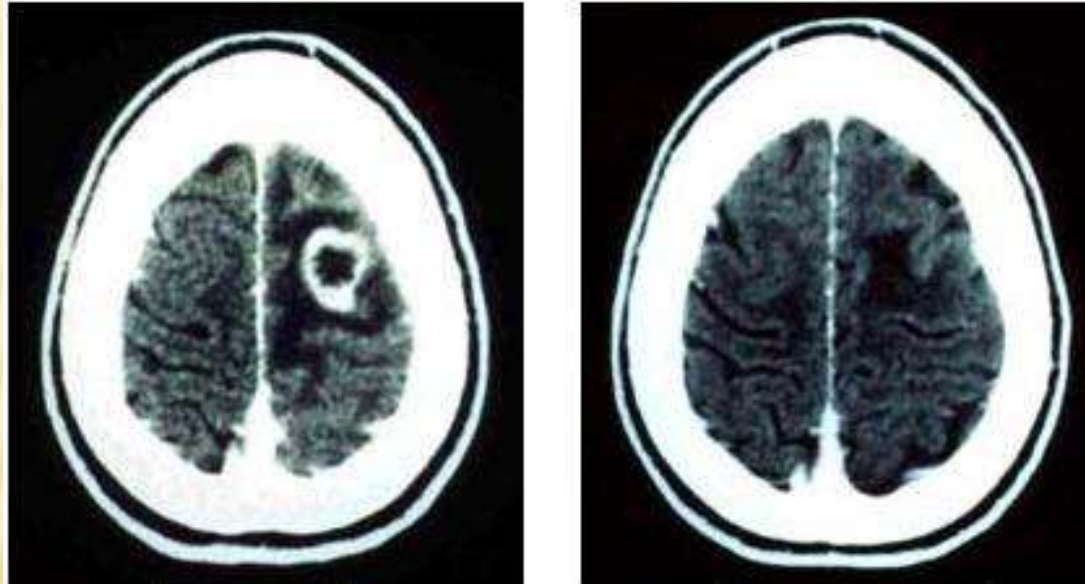
## A Cross-Section Diagram of Gamma Knife





## Step 5: Recovery

---

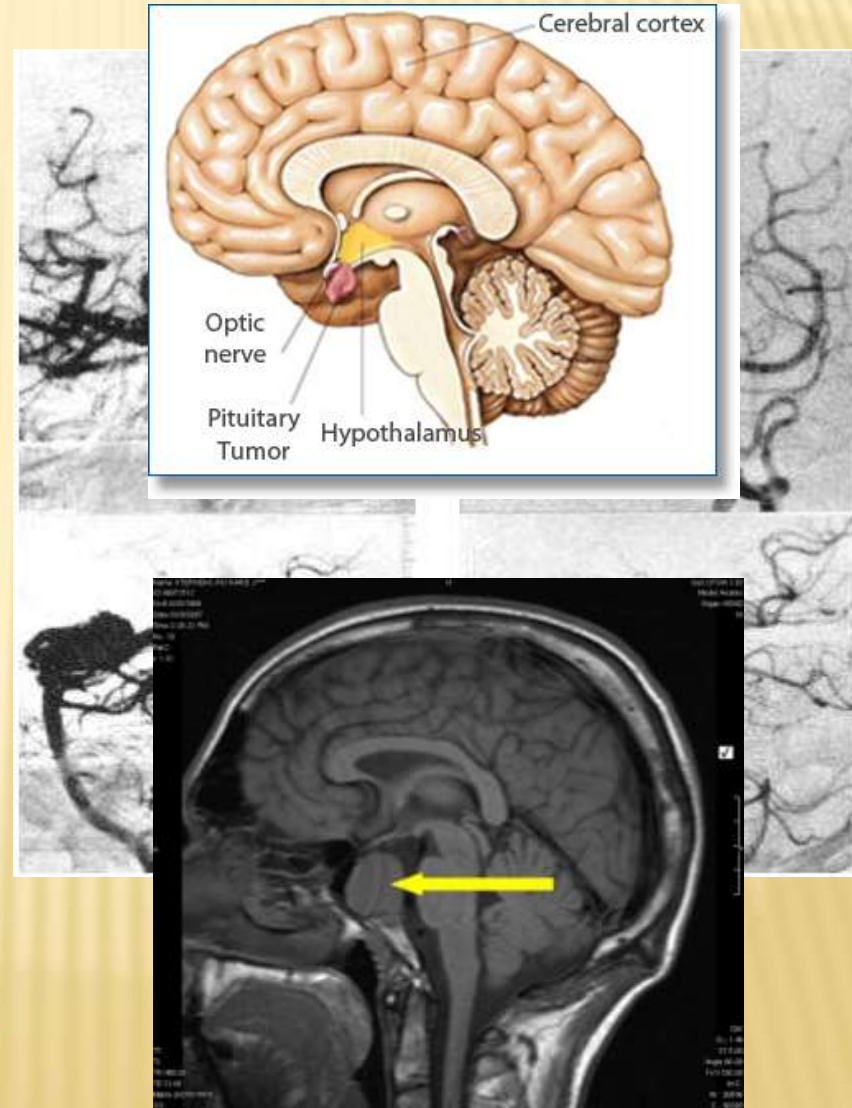


**Very Nice!**



# APPLICABLE DISEASES

- ✘ **Arteriovenous Malformations (AVMs)(腦動靜脈畸形)、Pituitary Tumors(腦下垂體腫瘤)、Acoustic Neuromas(聽神經瘤)**  
**Brain Tumors(直徑小於3公分的腦瘤)。**
- ✘ **Functional problems:**
  - Trigeminal neuralgia (三叉神經痛症)
  - Parkinson's disease (帕金森氏症)



# DISADVANTAGE

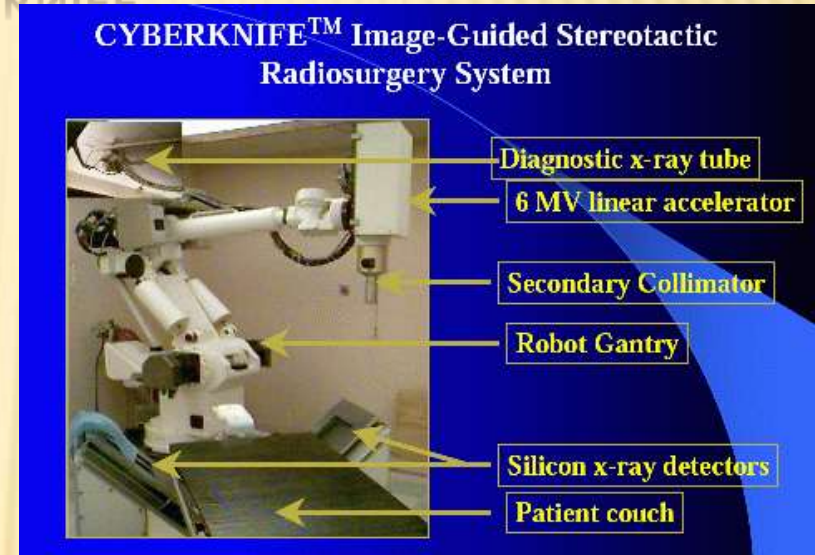
---

- ✗ 4 pins.
- ✗ Essential physiology reaction such as breathing is usually making lots of bias to the treatment.
- ✗ Limit size of tumors is available.
- ✗ Side effect
- ✗ Only suitable to brain disease.
- ✗ Demand for the accuracy of the brain position is very high.
- ✗ Sometime, a mild sedative and a local anesthetic is required.

# CYBERKNIFE

## -THE NEW VERSION OF GAMMA KNIFE

- ✘ Invented by Dr. John Adler at Stanford.
- ✘ The CyberKnife consists of a 6 MV linear accelerator mounted on a robotic arm, along with a diagnostic x-ray tubes.
- ✘ allowing multiple positions and angles to deliver a series of up to 1560 different angles.
- ✘ 單次照射同一方向，每次照射時間約30s~90s。
- ✘ Image guidance by x-ray。
- ✘ <http://Orz.tw/h6hIL>





# CYBERKNIFE

## -THE NEW VERSION OF GAMMA KNIFE

- ✘ refinement;
  - 4 pins → mobile mask
  - brain → whole body
  - low dose → high dose
  - extreme accuracy.
  - No anesthesia required





# COMPARISON WITH OTHER RADIATION SURGERY

---

- × Less side effect
- × Less times of treatment
- × 腫瘤部分定位要精確(1mm誤差以內)
- × high dose

# AFTER SURGERY

- ✘ John Lynch-The first patient who used Gamma Knife for AVM 25 years ago.



**Q & A**

**THANKS FOR ATTENTION**