

RADIATION THERAPY IN CANCER PATIENTS

Cancer Nursing

Prepared by: Maher Battat

RN in hemato-oncology ward AVH

Infection control officer

High diploma of cancer nursing



OUTLINE:

- ✘ What is radiation therapy?
- ✘ How does radiation therapy kill cancer cells?
- ✘ Does radiation therapy kill only cancer cells?
- ✘ Why do patients receive radiation therapy?
- ✘ How is radiation therapy planned and given for an individual patient?
- ✘ When will a patient get radiation therapy?
- ✘ Does radiation therapy make a patient radioactive?
- ✘ What are the potential side effects of radiation therapy and its management?
- ✘ Gamma Knife Therapy.

WHAT IS RADIATION THERAPY?

- ✘ Radiation therapy uses **high-energy radiation** to shrink tumors and kill cancer cells .
- ✘ X-rays, gamma rays, and charged particles are types of radiation used for cancer treatment.
- ✘ The radiation may be delivered by a machine outside the body (external-beam radiation therapy), or it may come from radioactive material placed in the body near cancer cells (internal radiation therapy, also called brachytherapy).
- ✘ Systemic radiation therapy uses radioactive substances, such as radioactive iodine, that travel in the blood to kill cancer cells.

WHO INVOLVE IN RADIATION TEAM?

- **Oncologist**—Diagnosis and treatments
- **Nurse**—Nursing care (pre-radiation, during radiation and post-radiation)
- **Physics**—Calculation on the amount of dose in radiation
- **Radiologist**—Providing radiation regarding the physician's order



HOW DOES RADIATION THERAPY KILL CANCER CELLS?

- ✘ Radiation therapy kills cancer cells by **damaging their DNA.**
- ✘ Cancer cells whose DNA is damaged beyond repair stop dividing or die. When the damaged cells die, they are broken down and eliminated by the body's natural processes.

DOES RADIATION THERAPY KILL ONLY CANCER CELLS?

WHY DO PATIENTS RECEIVE RADIATION THERAPY?

- ✘ Radiation therapy is sometimes given with curative intent.
- ✘ Radiation therapy may also be given with palliative intent, as examples:
 1. Spinal cord compression.
 2. Pain relief.
 3. Bone Mets.

SOME EXAMPLES OF PALLIATIVE RADIATION THERAPY ARE:

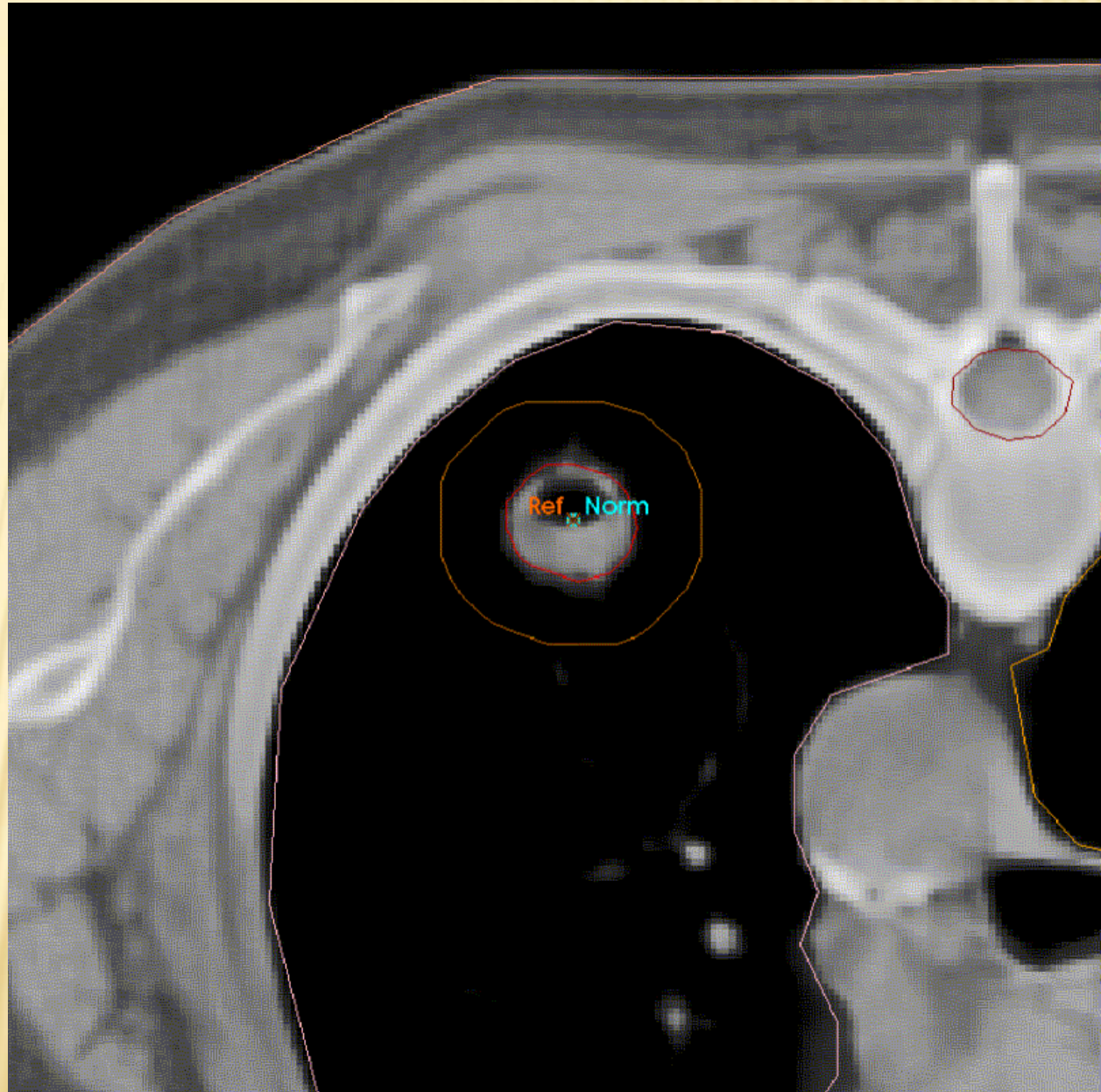
- + Radiation given to the brain to shrink tumors formed from cancer cells that have spread to the brain from another part of the body (metastases).
- + Radiation given to shrink a tumor that is pressing on the spine or growing within a bone, which can cause pain.
- + Radiation given to shrink a tumor near the esophagus, which can interfere with a patient's ability to eat and drink.

HOW IS RADIATION THERAPY PLANNED FOR AN INDIVIDUAL PATIENT?

During simulation, detailed imaging scans show the location of a patient's tumor and the normal areas around it.



Before treatment can begin, scans are taken to accurately locate the tumour.



IMET2000-Pal

www.imet2000-pal.org



IMET2000-Pal
www.imet2000-pal.org



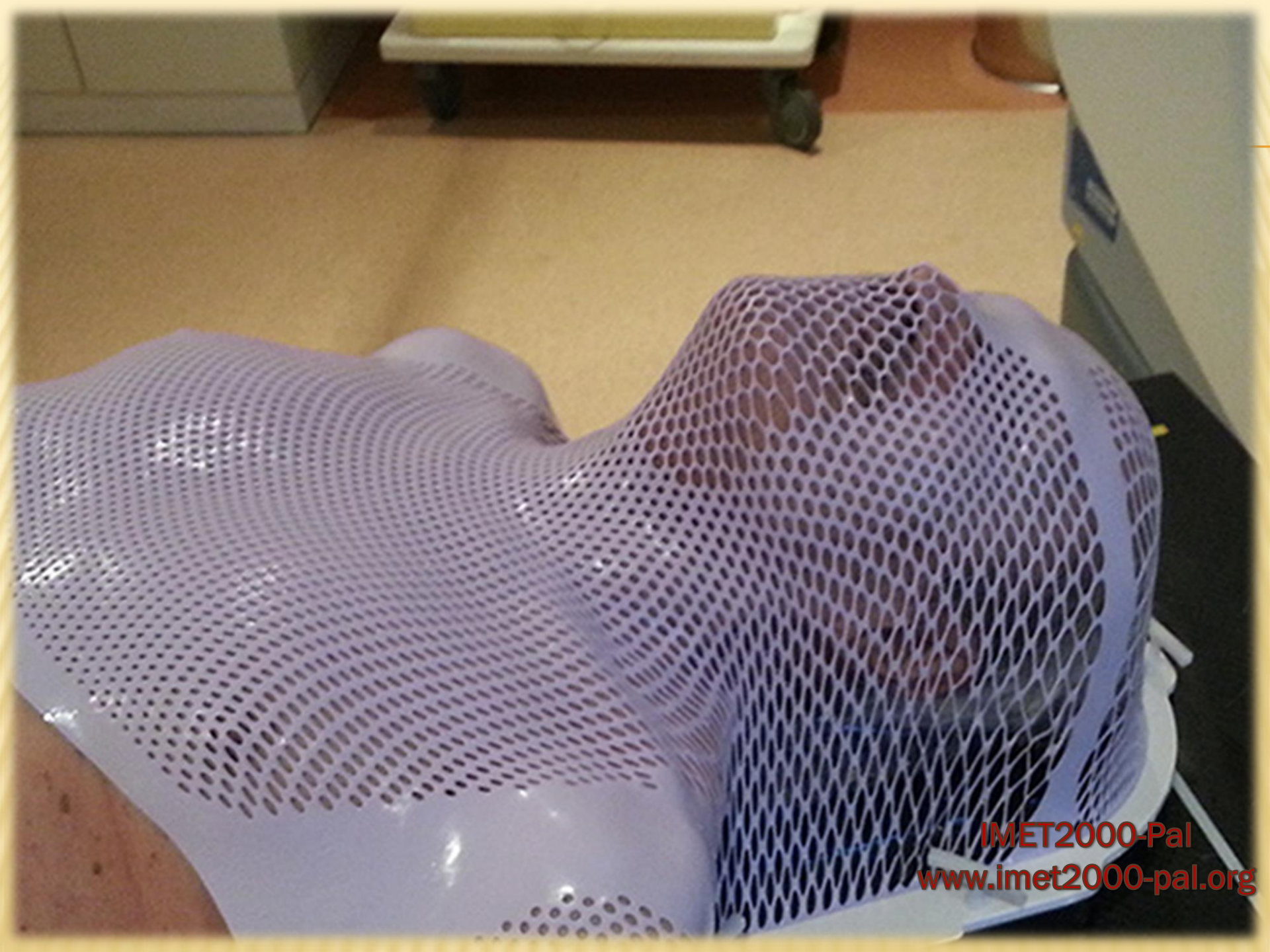
IMET2000-Pal
www.imet2000-pal.org

- ✘ Patients getting radiation to the head may need a mask. The mask helps keep the head from moving so that the patient is in the exact same position for each treatment.



IMET2000-Pal

www.imet2000-pal.org



IMET2000-Pal
www.imet2000-pal.org

IMMOBILISATION



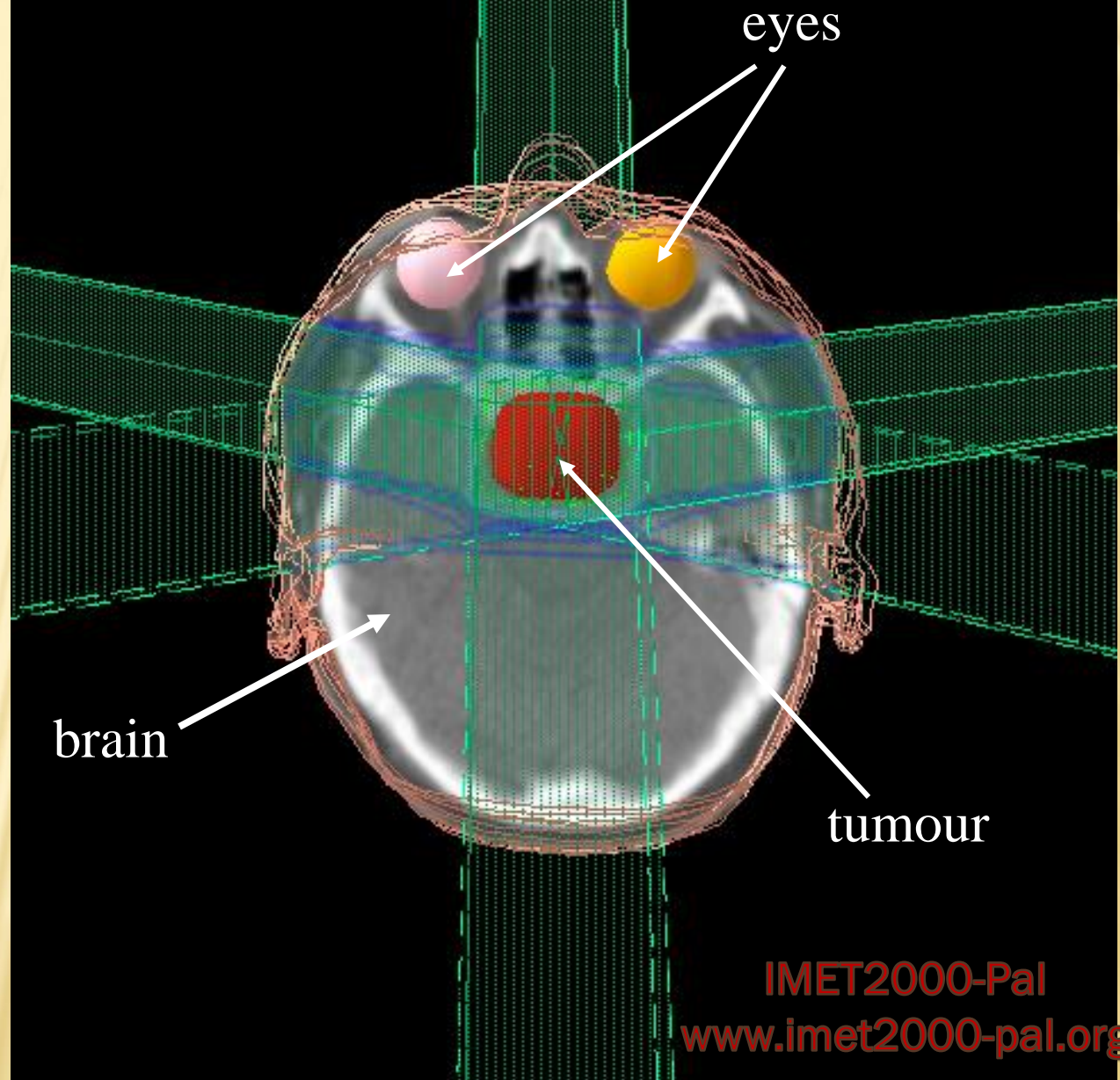
IMET2000-Pal
www.imet2000-pal.org





- ✘ Radiation doses for cancer treatment are measured in a unit called a **gray** (Gy), which is a measure of the amount of radiation energy absorbed by 1 kilogram of human tissue.
- ✘ Radiation can damage some types of normal tissue more easily than others. For example, the reproductive organs (testicles and ovaries) are more sensitive to radiation than bones. The radiation oncologist takes all of this information into account during treatment planning.

Sensitive areas such as the eyes and spinal cord must be avoided.



THE AREA SELECTED FOR TREATMENT USUALLY INCLUDES THE WHOLE TUMOR PLUS A SMALL AMOUNT OF NORMAL TISSUE SURROUNDING THE TUMOR.

The normal tissue is treated for two main reasons:

- + To take into account body movement from breathing and normal movement of the organs within the body, which can change the location of a tumor between treatments.
- + To reduce the likelihood of tumor recurrence from cancer cells that have spread to the normal tissue next to the tumor (called microscopic local spread).

THE TYPE OF RADIATION THERAPY PRESCRIBED BY A RADIATION ONCOLOGIST DEPENDS ON MANY FACTORS, INCLUDING:

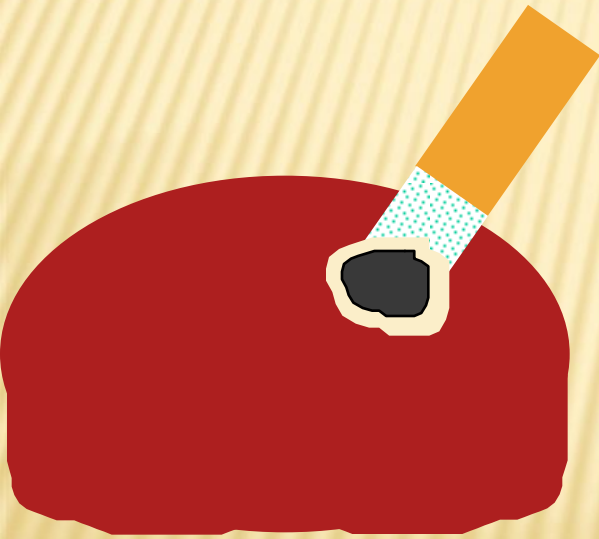
- + The **type** of cancer.
- + The **size** of the cancer.
- + The cancer's **location** in the body.
- + How close the cancer is to normal tissues that are **sensitive** to radiation.
- + **How far** into the body the radiation needs to travel.
- + The patient's **general health** and medical history.
- + Whether the patient will have other types of cancer treatment.
- + Other factors, such as the patient's **age** and other medical conditions.

EXTERNAL RADIOTHERAPY

- ✘ Treatment of cancer using high energy x/rays and other ionising radiation.
- ✘ Radiation is applied as a beam from **outside the body**.
- ✘ Beams can be directed from several angles to one point inside the body.

SINGLE BEAMS

A single beam may be used to treat a tumour which is near enough to the body surface for sufficient dose to be received without overdosing overlying and underlying tissues within the treatment beam

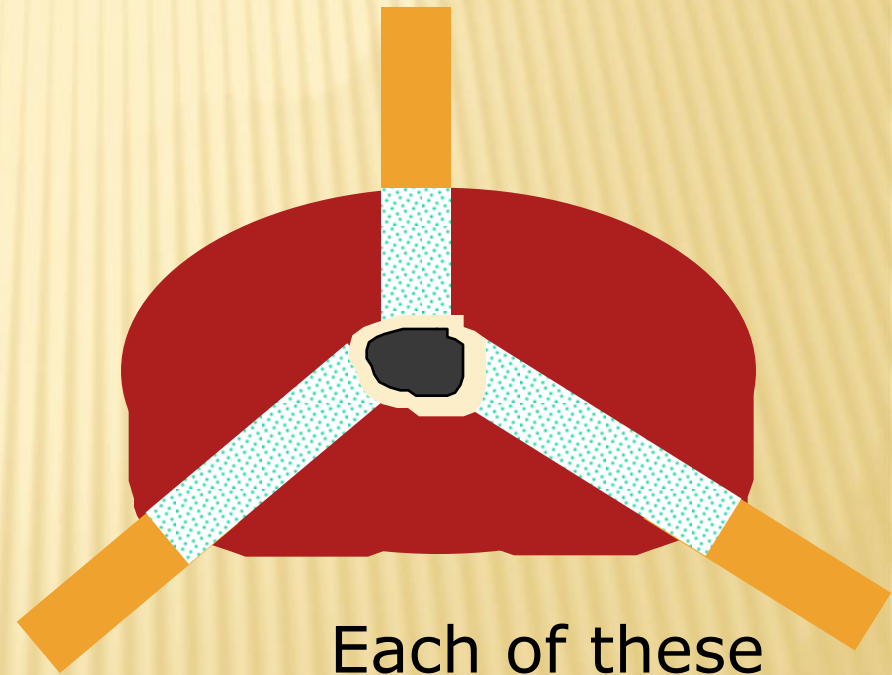


Most tumours require a different method...

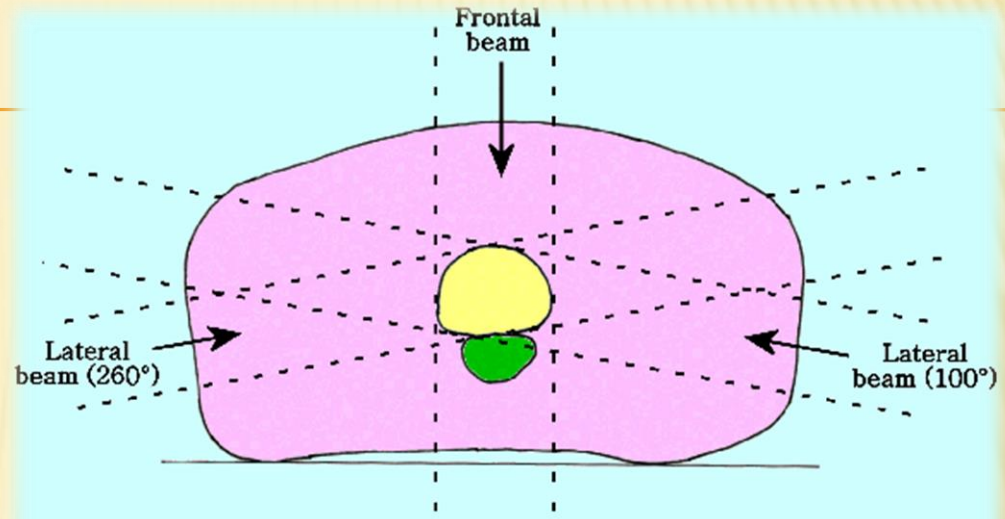
MULTI-BEAM TREATMENTS

- Used if a high dose is required to kill tumours deeper in the body.
- Several beams used.
- Beams only overlap in the tumour area.
- **Tumour receives fatal dose but healthy cells receive a lower, safer dose.**

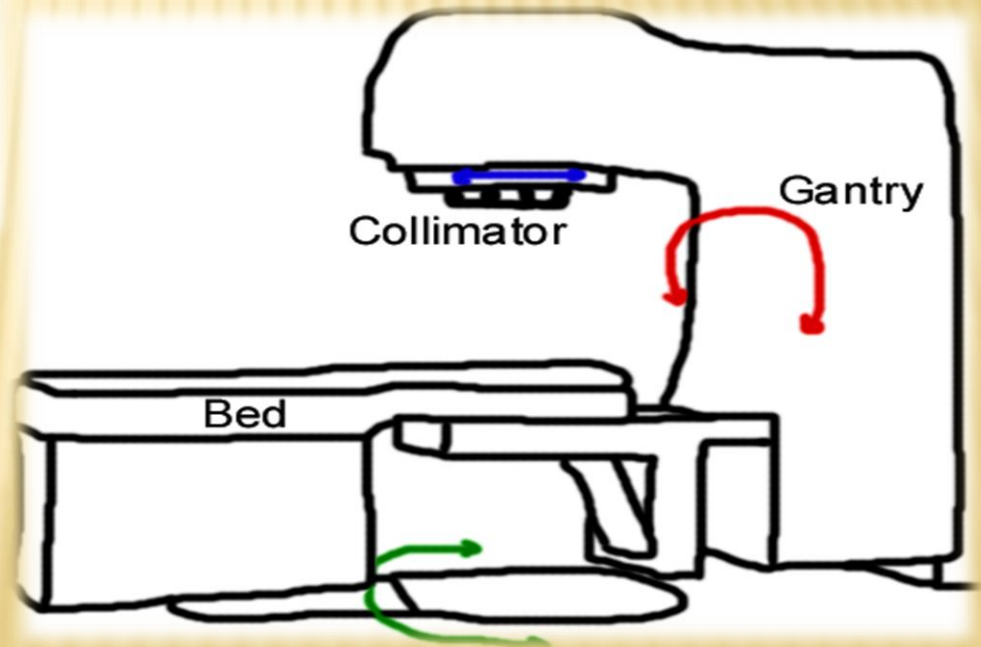
IMET2000-Pal
www.imet2000-pal.org



Each of these beams delivers 1/3 of the required dose.



A sketch of a simple 3-beam conformal radiotherapy geometry.



IMET2000-Pal

www.imet2000-pal.org

MULTI LEAFLET COLLIMATORS(MLC)



No more
IMET2000-Pal
lead blocks!
www.imet2000-pal.org

MANY OTHER METHODS OF EXTERNAL-BEAM RADIATION THERAPY ARE CURRENTLY BEING TESTED AND USED IN CANCER TREATMENT THESE METHODS INCLUDE:

- × Intensity-modulated radiation therapy (IMRT).
- × Image-guided radiation therapy (IGRT).
- × Tomotherapy.
- × Stereotactic radiosurgery.
- × Stereotactic body radiation therapy.
- × Proton therapy.

- **Other charged particle beams:** Electron beams are used to irradiate superficial tumors, such as skin cancer or tumors near the surface of the body, but they cannot travel very far through tissue . Therefore, they cannot treat tumors deep within the body.

INTERNAL RADIATION THERAPY

- ✘ Internal radiation therapy (brachytherapy) is radiation delivered from radiation sources (radioactive materials) placed inside or on the body .
- ✘ Several brachytherapy techniques are used in cancer treatment;
 1. Interstitial brachytherapy uses a radiation source placed within tumor tissue, such as **within** a prostate tumor.
 2. Intracavitary brachytherapy uses a source placed within a surgical cavity or a body cavity, such as the chest cavity, **near** a tumor.

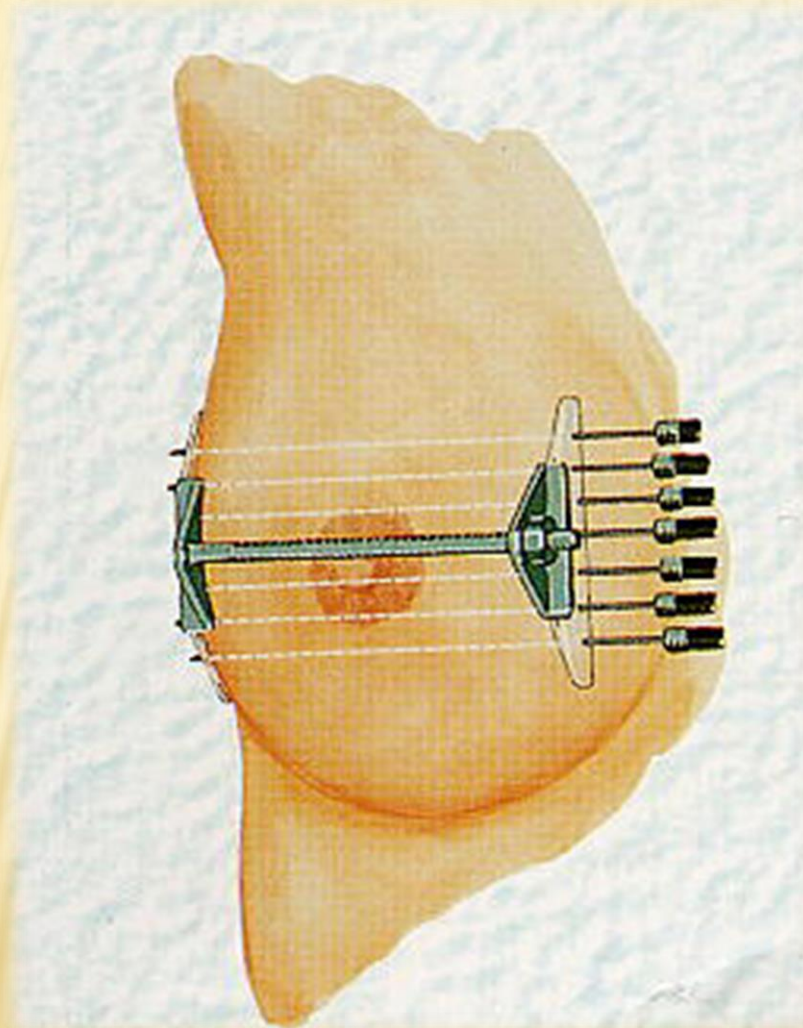
- ✘ In brachytherapy, radioactive isotopes are sealed in tiny pellets or “seeds.” These seeds are placed in patients using delivery devices, such as needles, catheters, or some other type of carrier. As the isotopes decay naturally, they give off radiation that damages nearby cancer cells.

- ✘ The placement of brachytherapy sources can be temporary or permanent .

BRACHYTHERAPY CAN BE GIVEN AS A LOW-**DOSE-RATE** OR A HIGH-DOSE-RATE TREATMENT:

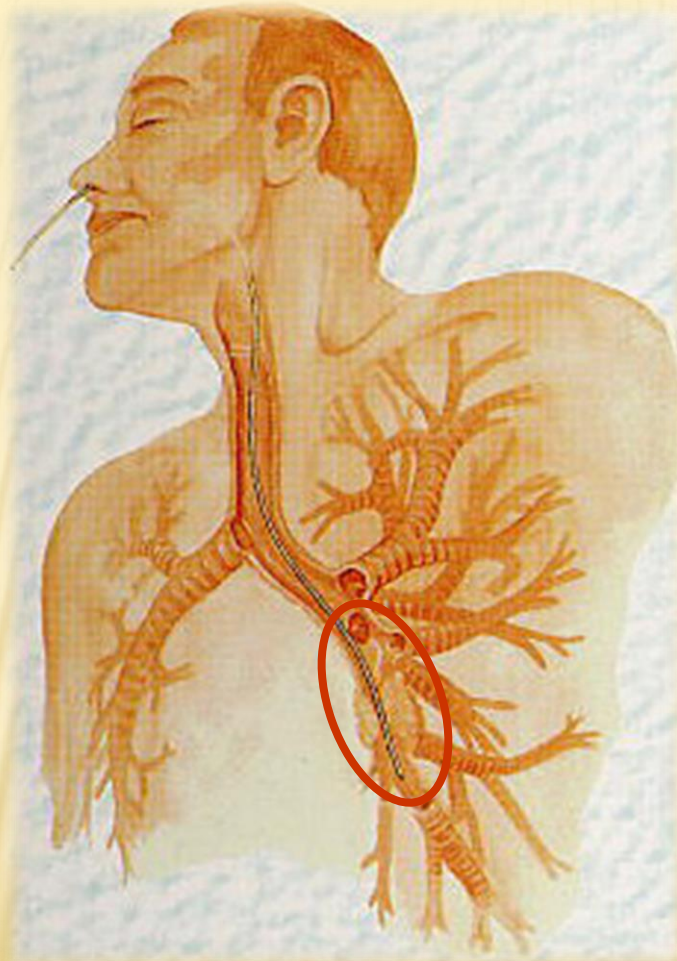
- + In low-dose-rate treatment, cancer cells receive continuous low-dose radiation from the source over a period of several days .
- + In high-dose-rate treatment, High-dose-rate treatment can be given in one or more treatment sessions.

BREAST HDR BRACHYTHERAPY

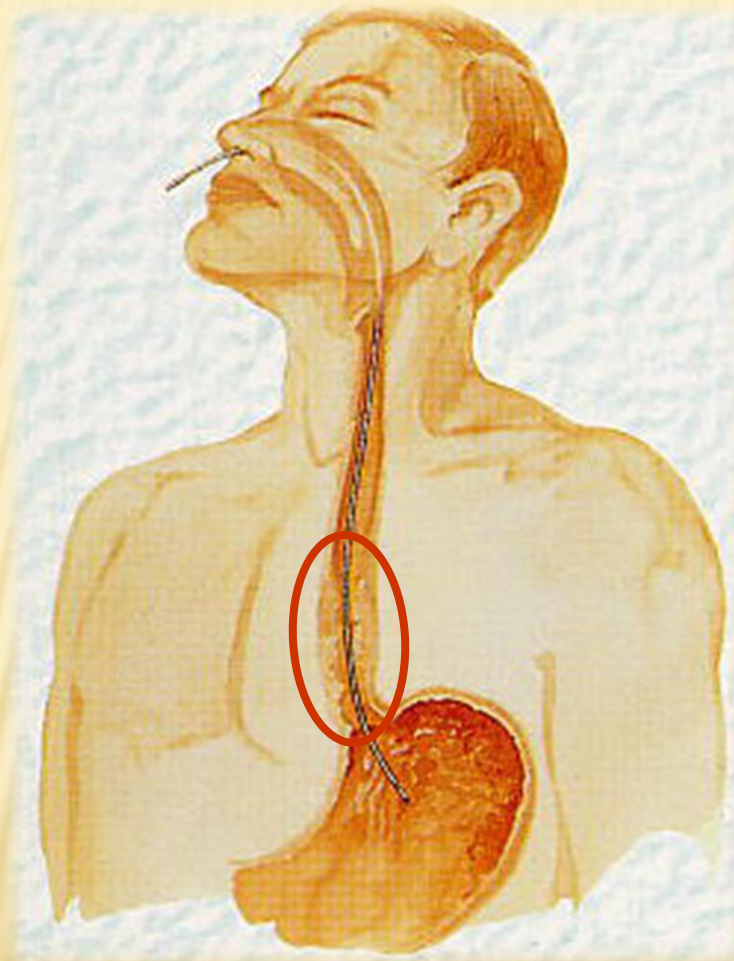


IMET2000-Pal
www.imet2000-pal.org

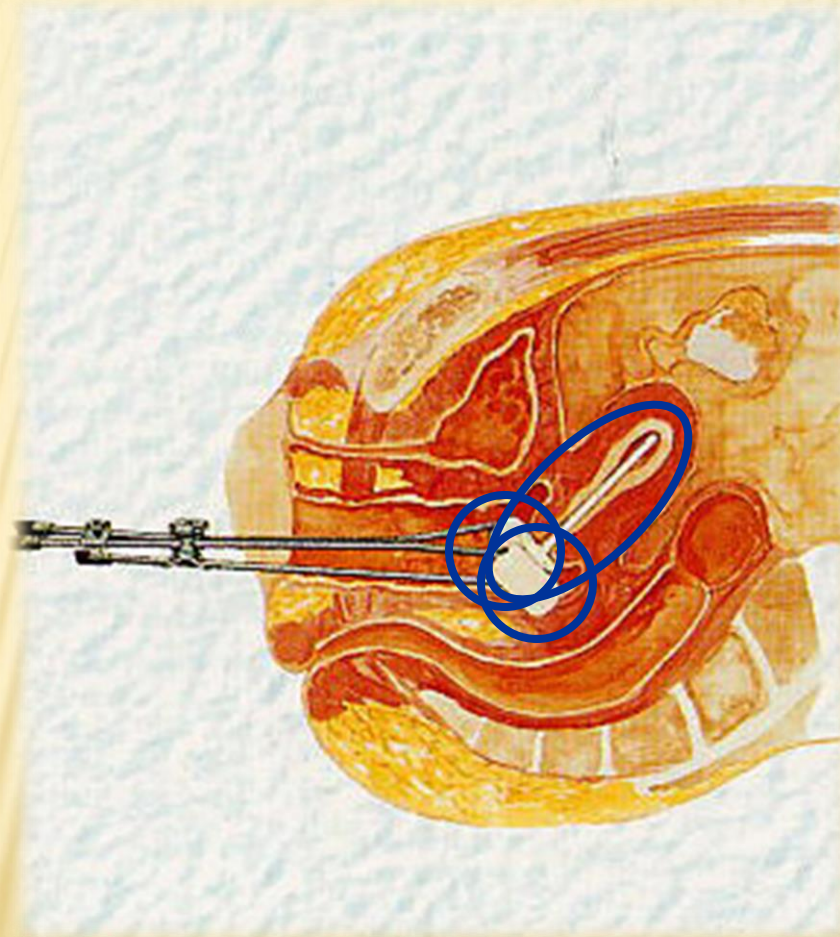
LUNGS HDR BRACHYTHERAPY



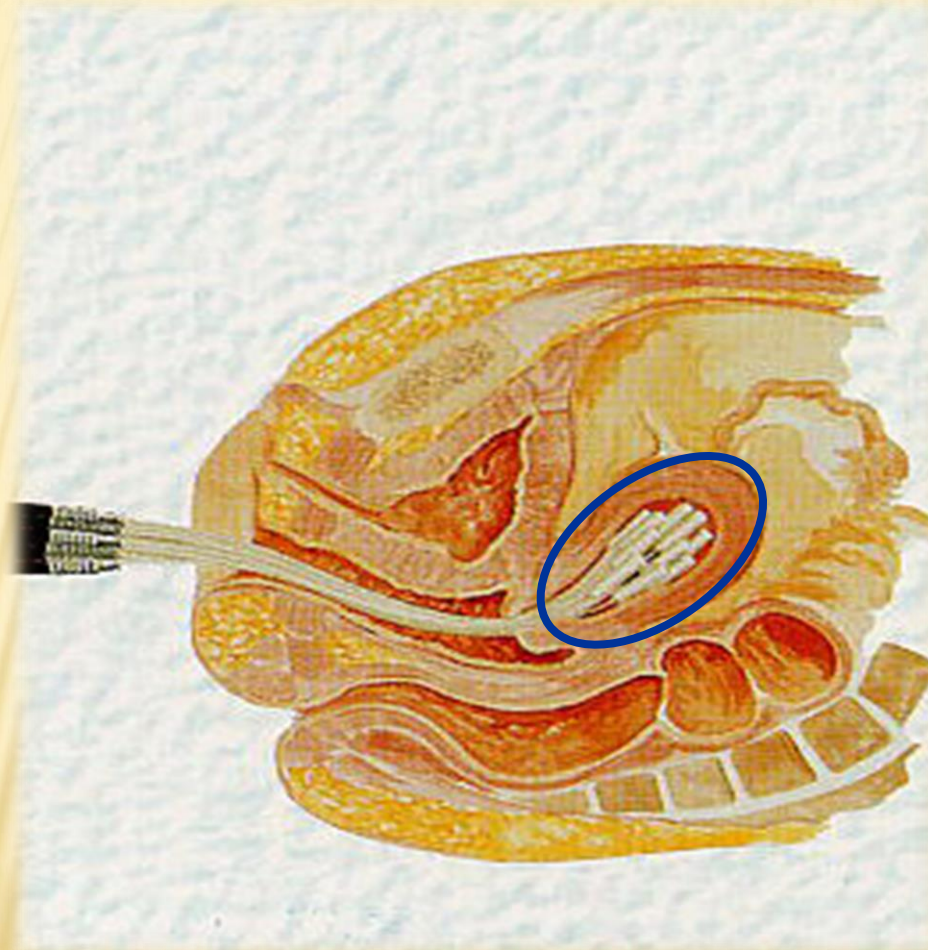
ESOPHAGUS HDR BRACHYTHERAPY



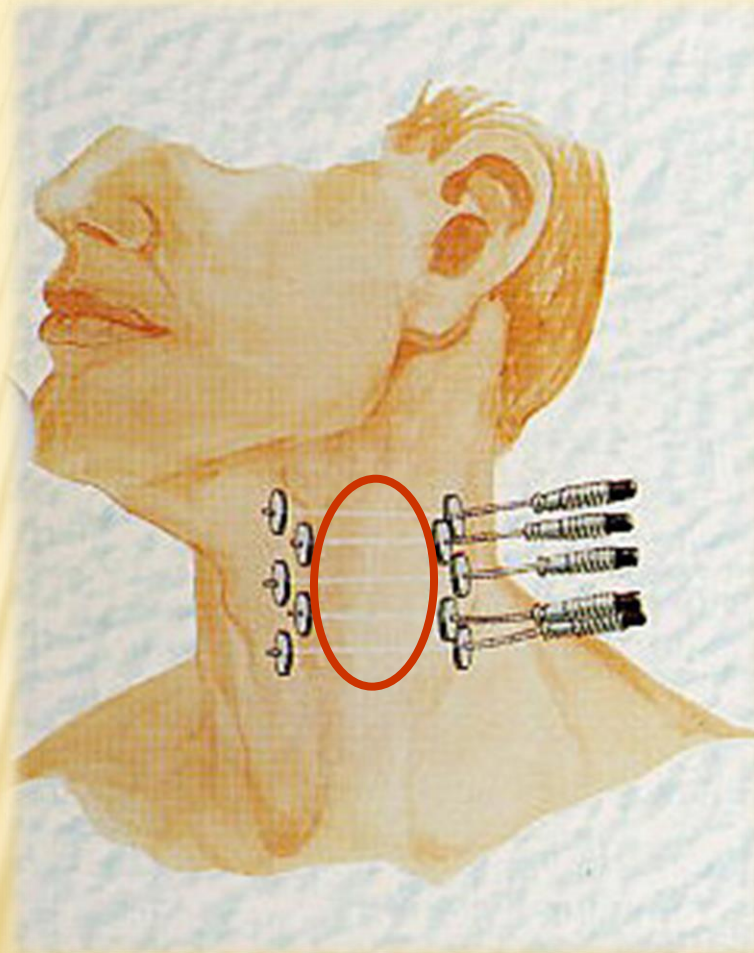
CERVIX HDR BRACHYTHERAPY



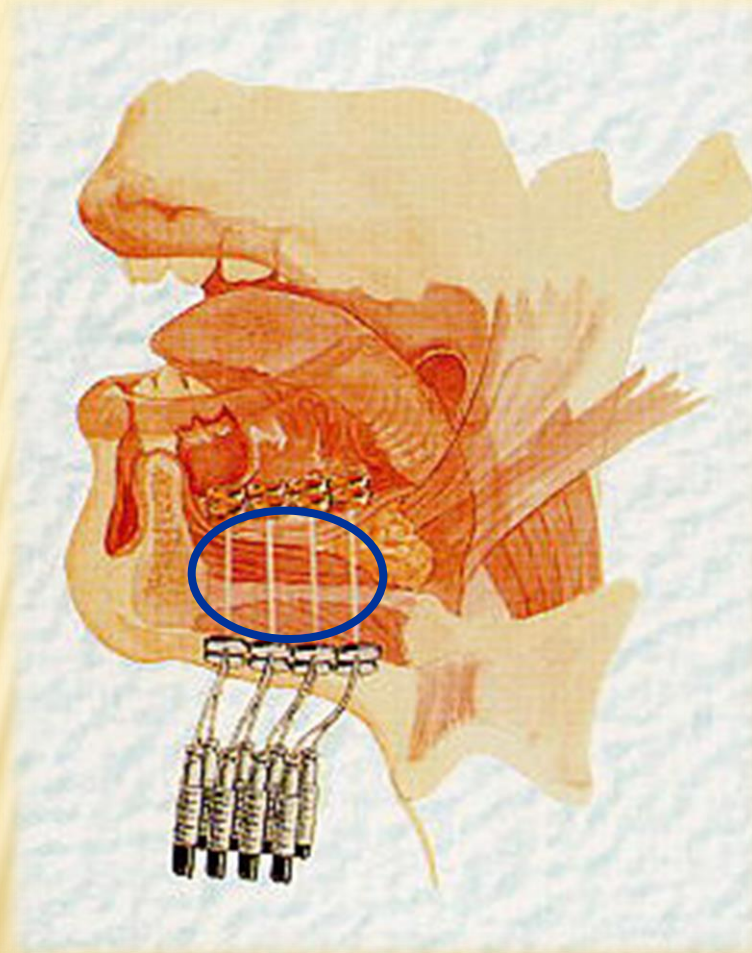
UTERUS HDR BRACHYTHERAPY



H&N HDR BRACHYTHERAPY



H&N HDR BRACHYTHERAPY



RECTAL BRACHYTHETAPY

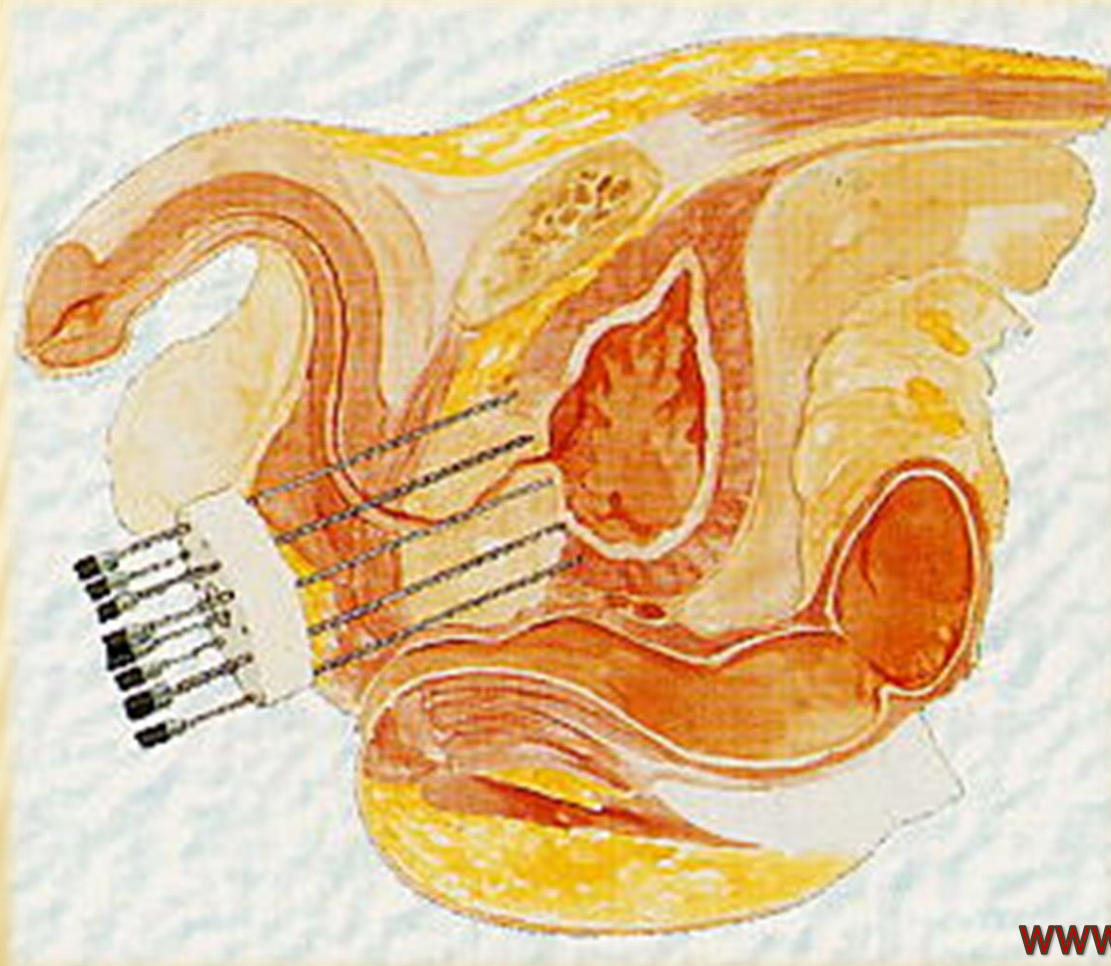


RECTAL BRACHYTHERAPY



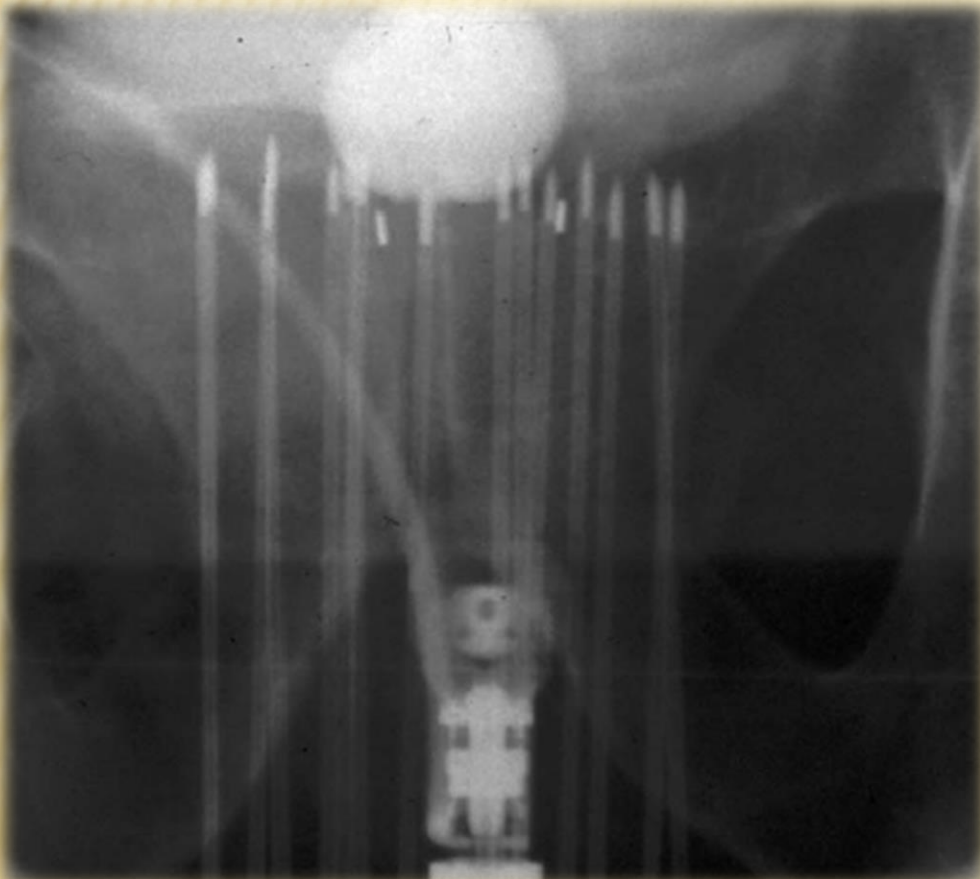
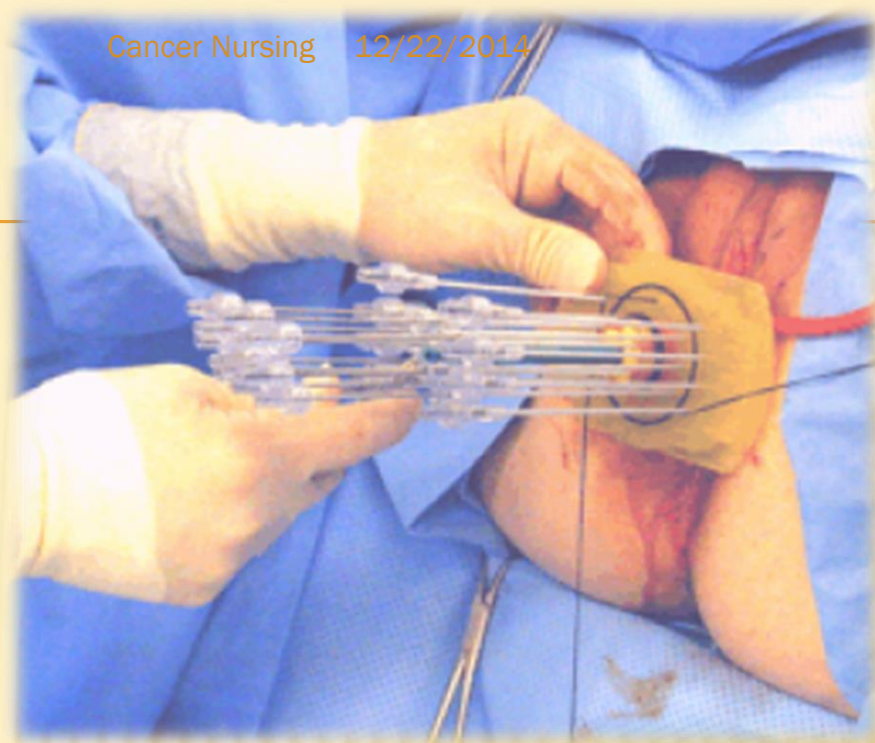
IMET2000-Pal
www.imet2000-pal.org

PROSTATE HDR BRACHYTHERAPY



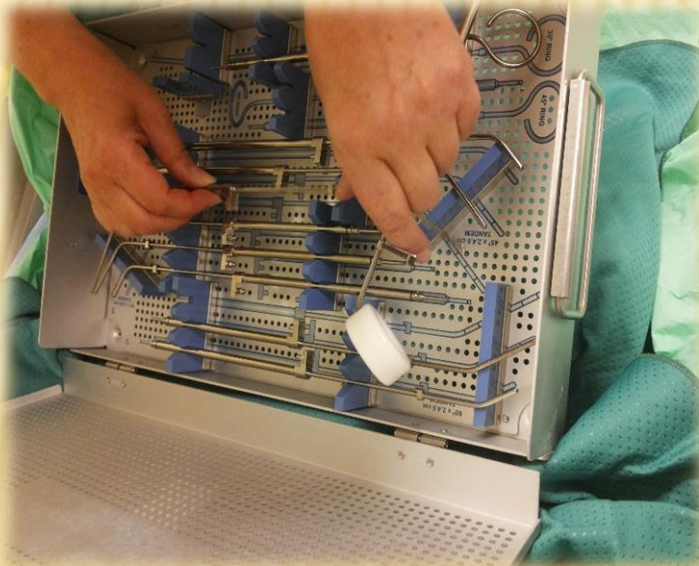
IMET2000-Pal
www.imet2000-pal.org

INTERSTITIAL BRACHYTHERAPY



Radium Needles

IMET2000-Pal
www.imet2000-pal.org



PROSTATE BRACHYTHERAPY

Adverse effects

- ✘ Urinary symptoms common
 - ✘ Dysuria, frequency, urgency, nocturia
- ✘ Acute urinary retention 1-14%
- ✘ Urinary incontinence 5- 6%
- ✘ Proctitis 1-3%

But...

- ✘ Sexual potency preserved 86 -96%
 - ✘ At 2 - 3 years

SYSTEMIC RADIATION THERAPY

- ✘ In systemic radiation therapy, a patient **swallows** or receives an **injection** of a radioactive substance.
- ✘ Radioactive iodine (^{131}I) is a type of systemic radiation therapy commonly used to help treat some types of thyroid cancer. Thyroid cells naturally take up radioactive iodine.

MOST TYPES OF EXTERNAL-BEAM RADIATION THERAPY ARE GIVEN IN ONCE-DAILY FRACTIONS.

There are two main reasons for once-daily treatment:

- + To minimize the damage to normal tissue.
- + To increase the likelihood that cancer cells are exposed to radiation at the points in the cell cycle when they are most vulnerable to DNA damage .

WHEN WILL A PATIENT GET RADIATION THERAPY?

- ✘ Pre operation :neoadjuvant
- ✘ Post operation :adjuvant .
- ✘ With chemotherapy :chemoradiotherapy .
- ✘ And most of times used alone .

DOES RADIATION THERAPY MAKE A PATIENT RADIOACTIVE?

- ✘ For external therapy :it **not** become radio active .
- ✘ In brachytherapy (internal therapy):temporary or permanent material :**yes** pt becomes radioactive .

Pt's fluids also become radioactive :blood ,urine ,sweat,...stool.

WHAT ARE THE POTENTIAL SIDE EFFECTS OF RADIATION THERAPY?

- ✘ Radiation therapy can cause : (acute) and (chronic) side effects.
- ✘ The side effects that develop depend on the **area** of the body being treated, the **dose** given per day, the total dose given, the patient's general **medical condition**, and other treatments given at the same time.

- ✘ Acute radiation side effects are caused by damage to **rapidly dividing normal cells** in the area being treated. These effects include **skin irritation or damage at regions exposed to the radiation beams**.
- ✘ Common side effects include **sore skin, tiredness** and **hair loss**. These tend to get better within a few days or weeks of treatment finishing.

- ✘ **Fatigue** is a common side effect of radiation therapy regardless of which part of the body is treated.
- ✘ **Nausea** with or without vomiting is common when the abdomen is treated and occurs sometimes when the brain is treated (1).

Nausea and vomiting : antiemetics.

- **Radiodermatitis** : topical emollients .
- **Weight loss:**
- **Myelosuppression.**
- **Alopecia** and ear irritation: avoid sun and cold(2).

- × **Oral mucositis** :isotonic saline and lubricants .
- × **Taste changes**: oral care before meals.
- × **Laryngitis**: avoid tobacco and alcohol, good nutrition and warm fluids (2).

- ✘ Late side effects of radiation therapy may or may not occur. Depending on the area of the body treated, late side effects can include :
 - + **Fibrosis** (the replacement of normal tissue with scar tissue, leading to restricted movement of the affected area).
 - + **Damage to the bowels**, causing diarrhea and bleeding.
 - + **Memory loss.**
 - + **Infertility** (inability to have a child).
 - + Rarely, a **second cancer** caused by radiation exposure.
 - + **Pneumonitis** and ribs fractures (spinal cord radiation) (2).

- ✘ Other side effect is **lymph edema** if pt has LN resection and take radiation (3).

Conclusion

- Radiation treatment accounts for 40% cancer cures achieved
- Is highly effective in shrinking tumours and controlling symptoms even when cure not possible
- New techniques enable us to target treatment with more accuracy and to increase dose for better result

Gamma Knife/Radiosurgery



What is a Gamma Knife?

- The gamma knife is a stereotactic radiosurgical instrument which can deliver a single, high dose of precisely focused radiation with pinpoint accuracy to any part of the brain.



IMET2000-Pal

www.imet2000-pal.org

History

- The gamma knife was developed in Sweden in 1968 for the treatment of brain disorder.
- Neurosurgeon Dr. Lars Leksell developed the gamma knife after years of searching for a non-invasive way to treat functional disorders of the brain.
- The gamma knife wasn't introduced into the United States until 1987.
- There are now over 200 gamma knife centers worldwide.



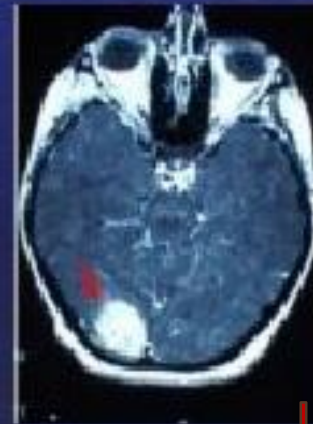
 NORTHWEST HOSPITAL
GAMMA KNIFE
CENTER

Who Can Be Treated?

- Patients that are treated with the gamma knife procedure must meet the standard criteria.
 - Generally, only patients with an acute condition of one of the following are candidates for gamma knife treatment.
 - Malignant Tumors of the brain
 - Metastatic Tumors – Tumors that have spread to the brain.
 - Vascular abnormalities such as aneurisms
 - Functional disorders such as chronic pain



Angiography showing
Aneurism



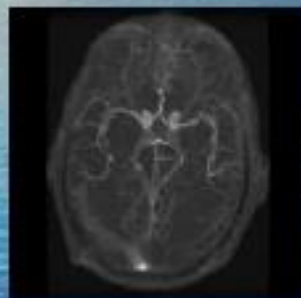
CT Scan Showing
Tumor

IMET2000-Pal

www.imet2000-pal.org

How It Works/The Gamma Knife Procedure

1. Ct scans, MRI's, and angiographies are used cumulatively to produce a 3-D computer image of the brain in which the oncology team can highlight the area to be treated, and formulate a dose treatment plan.



Angiography



CT Scan



MRI



3-D image

IMET2000-Pal
www.imet2000-pal.org

3-D Image of Tumc

Gamma Knife Procedure

2. Before treatment starts, the patient is put on an IV and given intravenous fluids to prevent dehydration because the patient cannot eat or drink until the treatment is complete.

3. The patient may get local or generalized anesthesia.
 - If a localized anesthetic is used, the patient may also be given a sedative through the IV in order to minimize movement during the treatment

Gamma Knife Procedure

4. After the anesthesia, the patient is fitted with a stereotactic frame. The frame is used as a measuring guide that helps to accurately position the patient.



5. Once correctly positioned on the gamma knife bed, the stereotactic frame is attached to a collimator helmet

Steriotactic
frame



IMET2000-Pal
www.imet2000-pal.org

Collimator Helmet

Gamma Knife Procedure

6. The patient is slid into the gamma knife cavity which is like a heavily shielded globe containing the radiation source.
7. Treatment begins as the 201 radiation beams intersect at a single point, that being the target area.



Source of Radiation

CO 60 RADIOSURGERY – “GAMMA KNIFE”



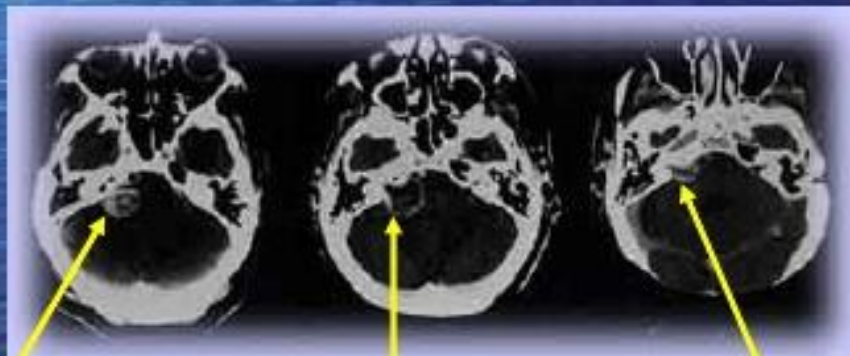
IMET2000-Pal

www.imet2000-pal.org

Effectiveness of Treatment

- The gamma knife is accurate to within 0.3mm
- Usually only one treatment is needed
- Because of continued advances since its development in 1968, gamma knife presently has an overall success rate of 75%

IMET2000-Pal
www.imet2000-pal.org



Before
Treatment

A few months
after
treatment

One year after
treatment

The desired effects of the gamma knife procedure are slow to occur, and can manifest anywhere from a few months to even years depending on what is being treated.

For example: The effects would likely happen quicker when treating a malignant brain tumor, as opposed to a brain lesion, because of the speed at which malignant tumors grow.

Side Effects of Treatment

- New onset of severe headaches.
- Weakness in the arms and/or legs.
- Numbness
- New seizures (rare).
- Vision Changes (rare).

FAQ

Q: How long does the procedure usually take?

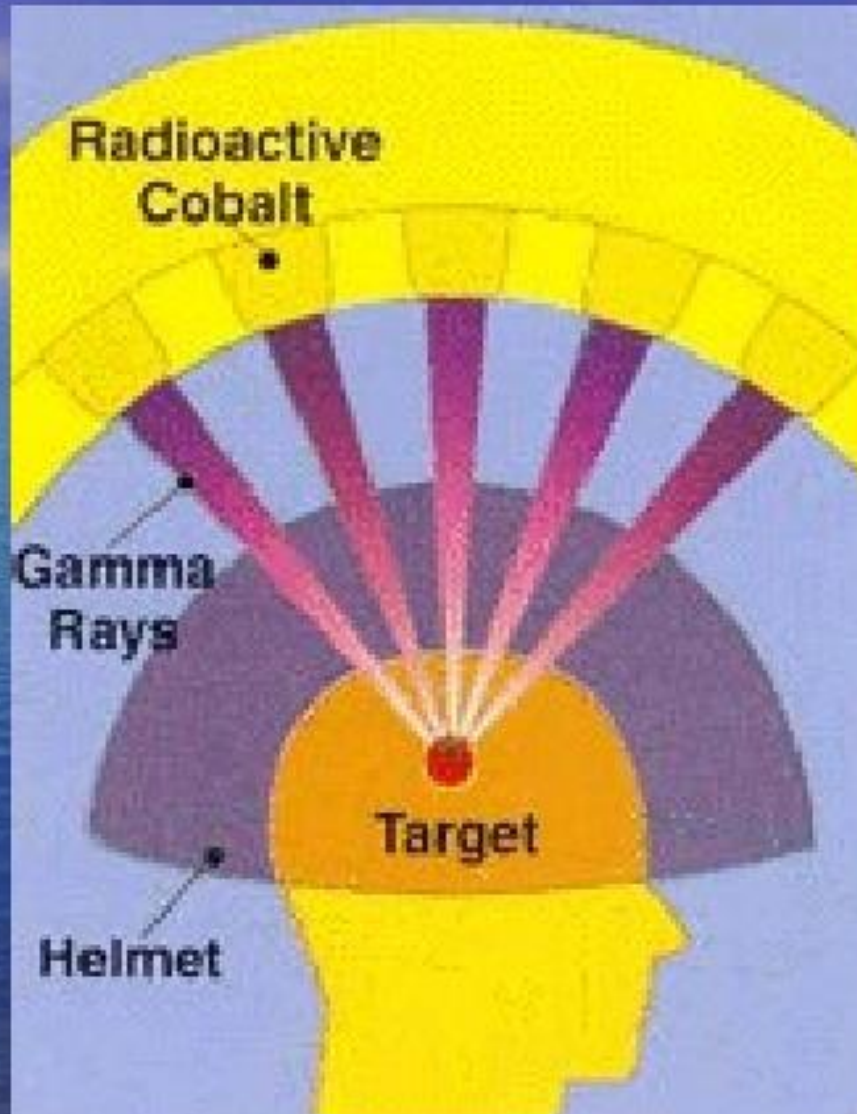
A: Depending on the size of the tumor or malformation, the procedure usually takes between 4 & 8 hours

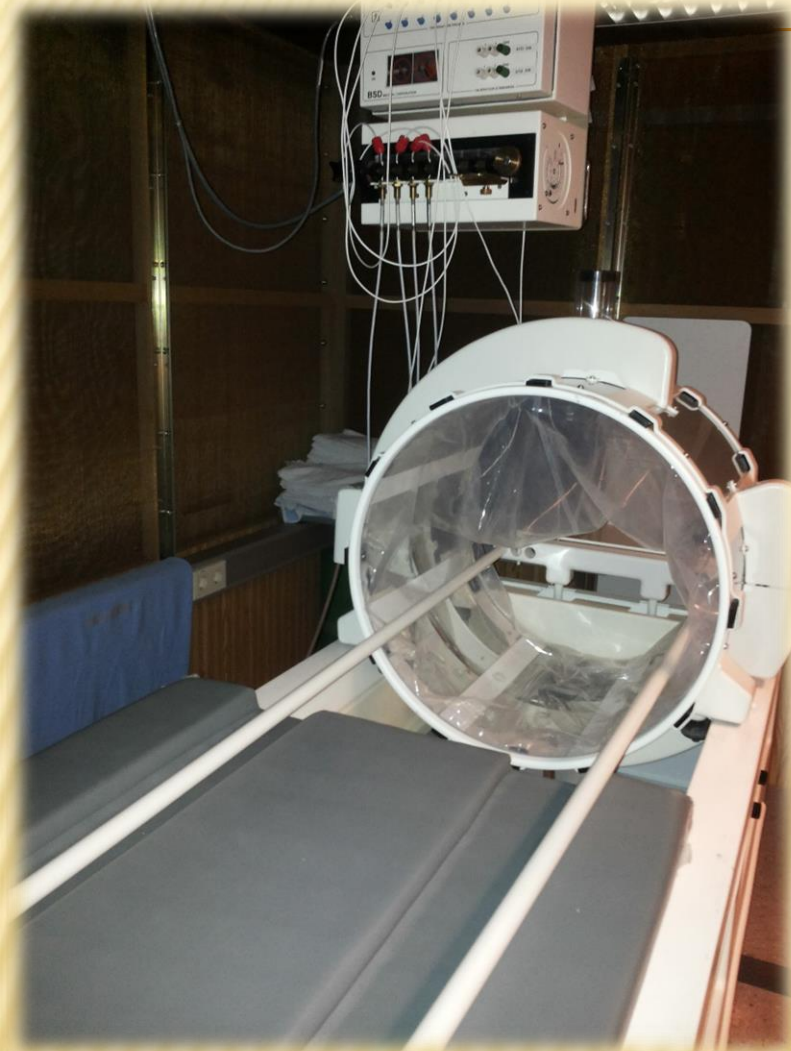
Q: Is there pain after the procedure?

A: No, but there are possible side effects. (see last slide)

Q: Do I have to stay in the hospital or gamma knife center after the treatment

A: A patient can typically be discharged from the hospital the same day. Rarely is a patient asked to stay over to be monitored.





IMET2000-Pal
www.imet2000-pal.org

REFERENCE:

1. <http://www.cancer.gov/cancertopics/factsheet/Therapy/radiation>
2. Connie Henke Yarbrow, Debra Wujcik, Barbara Holmes Gobel (2011:1354-1363) Main book in cancer nursing Cancer Nursing Principles and Practice, Seventh Edition.
3. <http://www.cancer.gov/cancertopics/pdq/supportivecare/lymphedema/healthprofessional>