

# Palliative Radiation

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# Indications for Palliative Radiation

## Pain Control

- Bone Metastases
- Pressure of tumour on nerves

## Relief of Superior Vena Obstruction

## Spinal Cord Compression

## Bleeding

- Most commonly hemoptysis
- May also be from other sites
  - Gyne
  - Rectal
  - Bladder
  - Prostate

## Brain Metastases

- Whole brain radiation
- Stereotactic (Gamma Knife)

## Relief of Obstruction

- Airway/Bronchus
- Esophageal

## Subcutaneous Metastases

- Lung primary
- Lymphoma
- Leukemia

# Radiation

- Xrays from:
  - Linear accelerator
  - Cobalt<sup>60</sup>

## Accelerators generates higher energy

- Useful to get penetration

## Cobalt used if :

- Superficial
- Brain mets

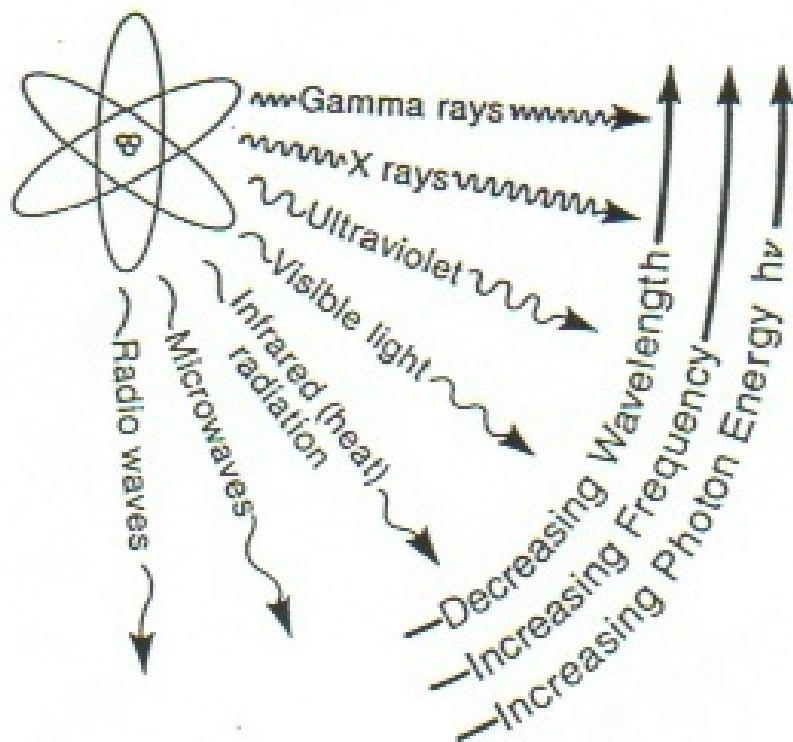
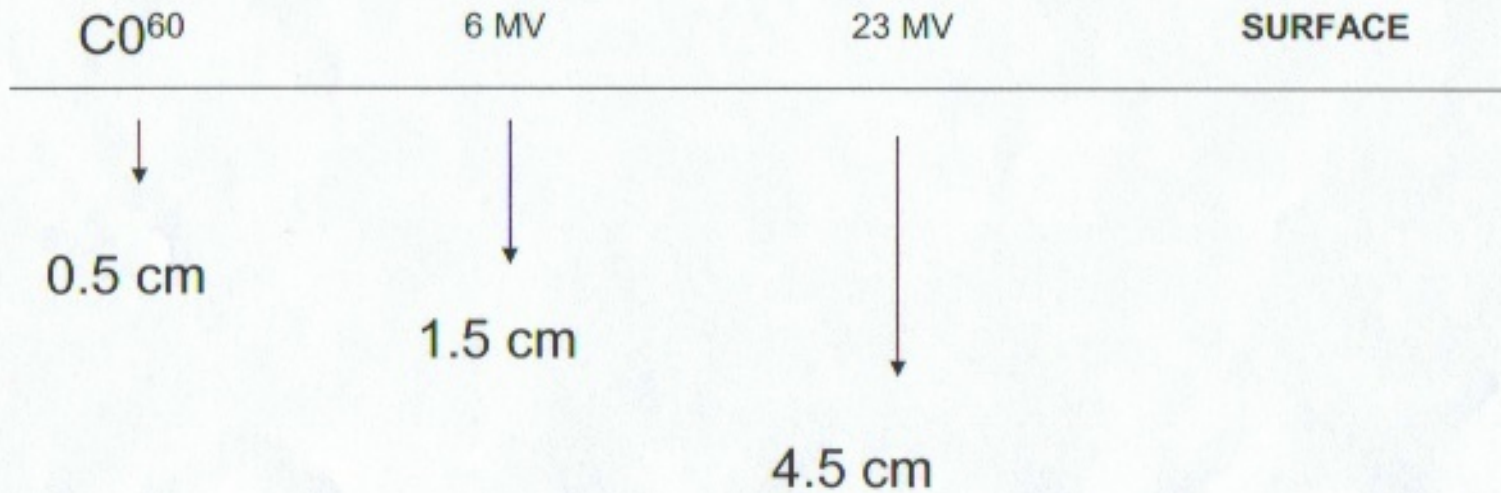


Figure 1.3. Illustration of the electromagnetic spectrum. X-rays and  $\gamma$ -rays have the same nature as visible light, radiant heat, and radio waves; however, they have shorter wavelengths and consequently a larger photon energy. As a result, x- and  $\gamma$ -rays can break chemical bonds and produce biologic effects.

# DEPTH FOR 100% DOSE



**“SKIN SPARING”**

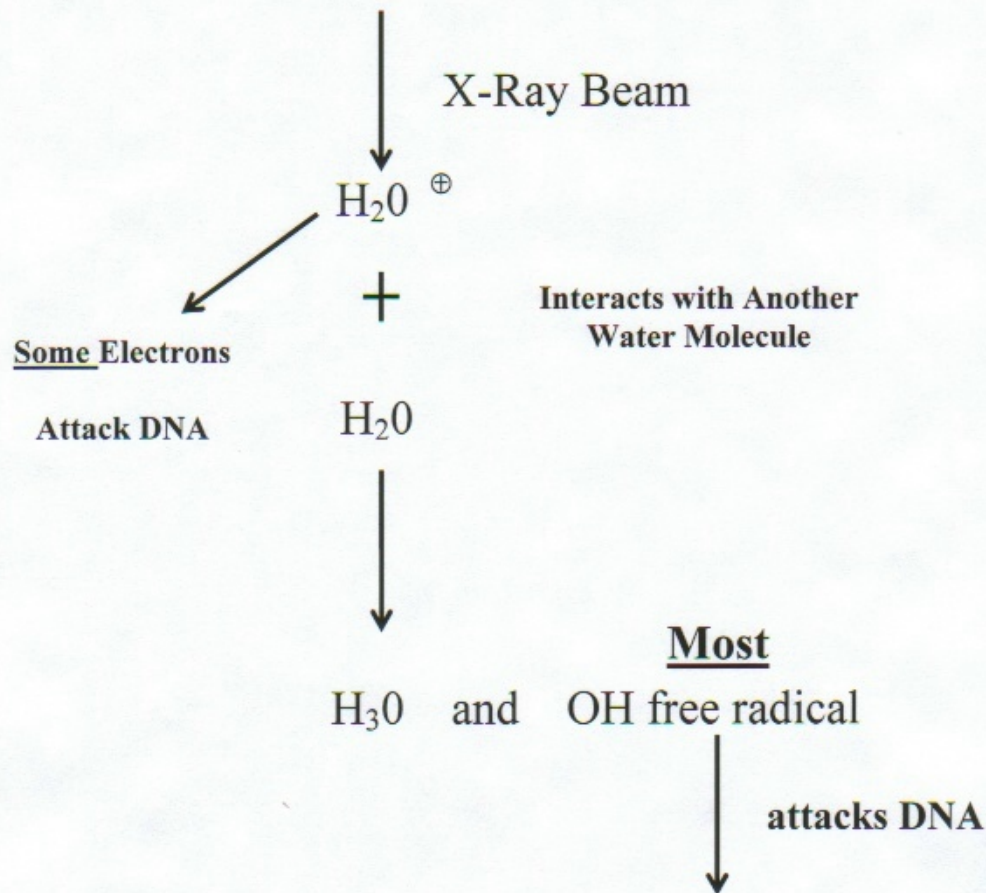
## Why Depth for 100% Matters

- Depth from surface where maximum dose is
- Superficial tumours use  $CO^{60}$  because if used 23 MeV, maximum dose could be beyond tumour
- However, if target, tumour is deep, eg. Prostate, use 23 MeV because then surface is spared

① and ② are where radiation acts

- Generates free radicals and some fast electrons that attack and damage the DNA in the tumour making it shrink

## What Radiation Does



- Radiation does not “stay in the body” unless permanent brachy implant
- Effects stay in body, but the radiation itself is gone

# To do Radiation

- Assess
- Simulate
  - CT or Fluoro images used to determine where radiation is to be directed
- May do “Clinical Set Up”
  - Anatomic landmarks only
  - No simulation
- Treatment follows Simulation or at time of Set up

# CT Simulator



## Conventional Simulator



## For Skin Cancers – (DXT)



# Linear Accelerator



# Cobalt 60



# Indications

## Pain

- Bone Metastases: Most common cause

## Causes of Pain

- Stimulation of nerve endings in endosteum by release of neuropeptides
- Stretching of periosteum
- Tumour growth into surrounding nerves and tissues

## ■ Pain Patterns

- Symptoms often intermittent
- Tends to be worse at night and may be partially relieved by activity

## ■ Diagnosis

- Plain X-ray most specific
- May not show anything early. Will show lytic

## ■ Bone Scan

- Positive if sclerotic or blastic, but not if purely lytic

## ■ MRI

- Earliest detection, not very practical

## Is there an Impending Fracture?

- Very important to consider, especially for weight bearing

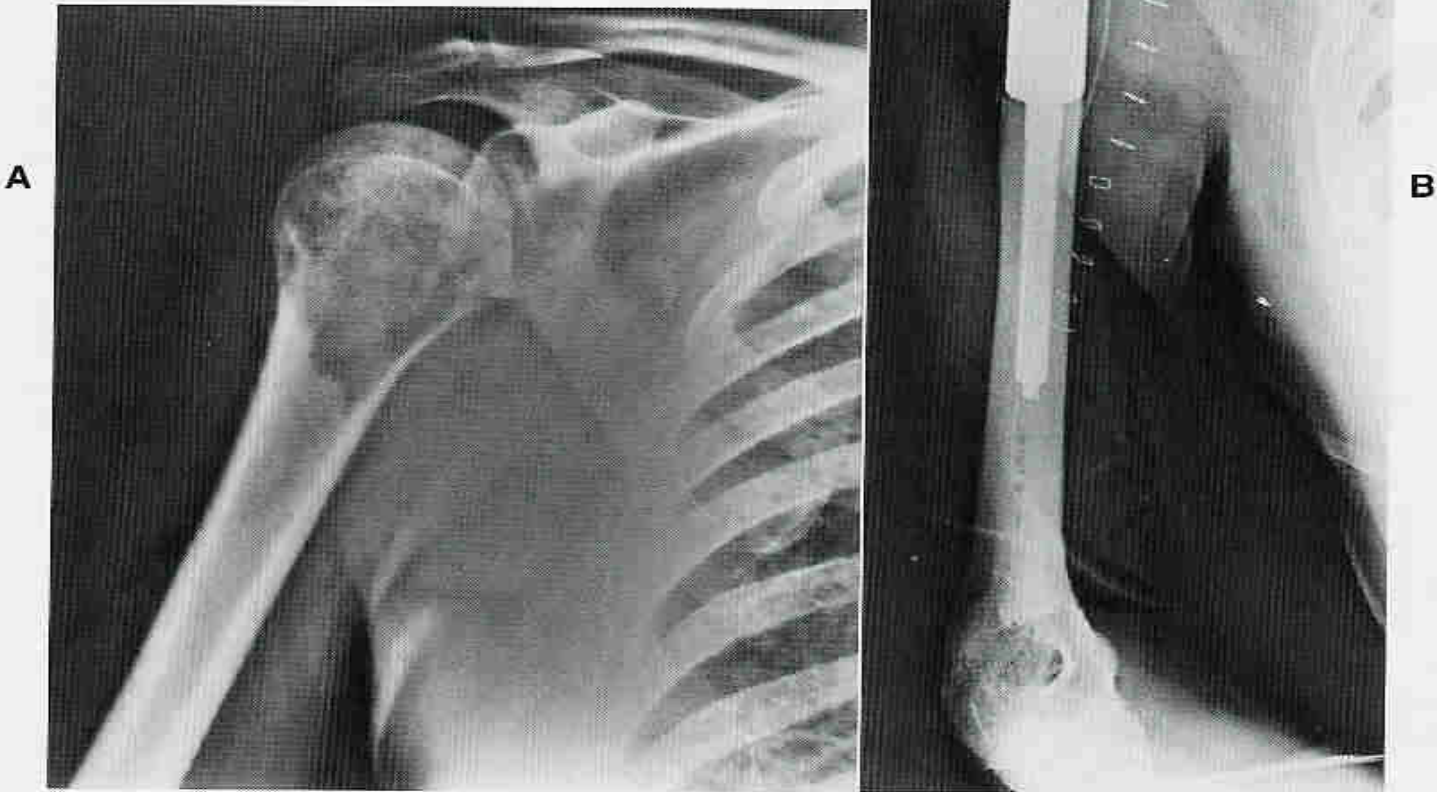
### Memorial Sloan Kettering System

- 1) Painful lytic lesion occupying more than 50% of cross sectional bone diameter
- 2) Lytic lesion involving 50% of the cortex
- 3) Painful cortical lesion more than 2.5 cm in length
- 4) Mechanical pain after radiation therapy

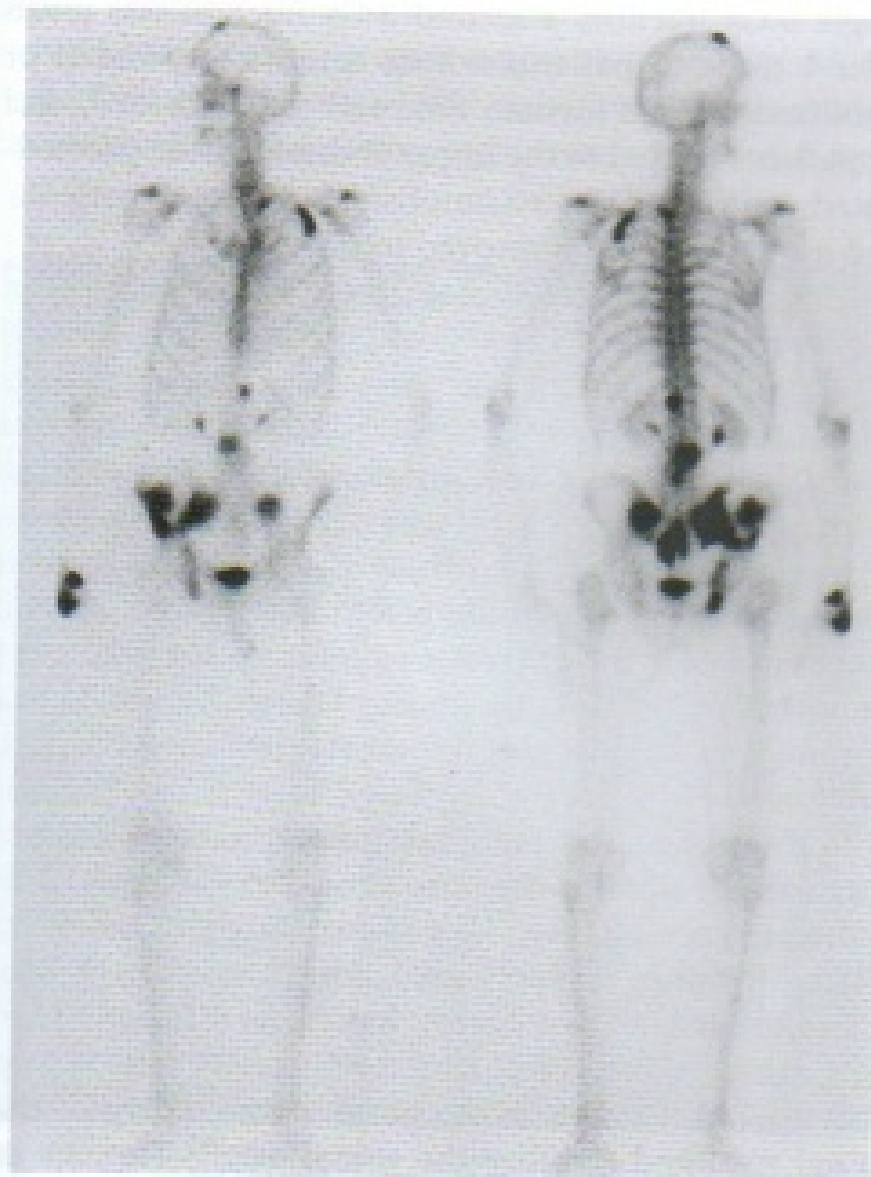
- All indications that a fracture is impending
- May fracture as a result of radiation because turgor of tumour holding bone together
- Ortho consult indicated before radiation

**Lytic Lesion  
Impending  
Fracture**





**Fig. 38-1** A, Plain radiograph showing an extensive lytic lesion in the proximal humerus. B, Prophylactic internal fixation was performed to prevent pathologic fracture. The patient, who experienced pain primarily in the hip, would have been put on crutches to reduce stress on the involved femur. A bone scan and x-ray films obtained to exclude other sites of metastatic involvement identified this lesion in the humerus. The humerus would certainly have fractured if all of the patient's weight had been displaced to the upper extremities with crutches.



**Fig. 38-3** Bone scan demonstrating multifocal metastatic disease. Involvement of weight-bearing areas such as the pelvis and lower lumbar area significantly affects mobility.



Radiograph showing pathological fracture of the femur

# Radiation for Bone Mets

## Different schedules used

- 800 cGy (centi-Gray) in one fraction (treatment)
  - 2,000 cGy in five fractions
  - 3000 cGy in ten fractions
- 
- Still argued in trials which is best
  - In general by reducing fraction size long term toxicity reduced
  - Usually not relevant

## Multiple Wide Spread Bone Mets

- Most common for breast and prostate primaries
- May consider Hemi-Body Irradiation (HBI)
- Shown on diagram
  - Dose for upper 600 cGy
  - Dose for lower 800 cGy
- Done in one fraction

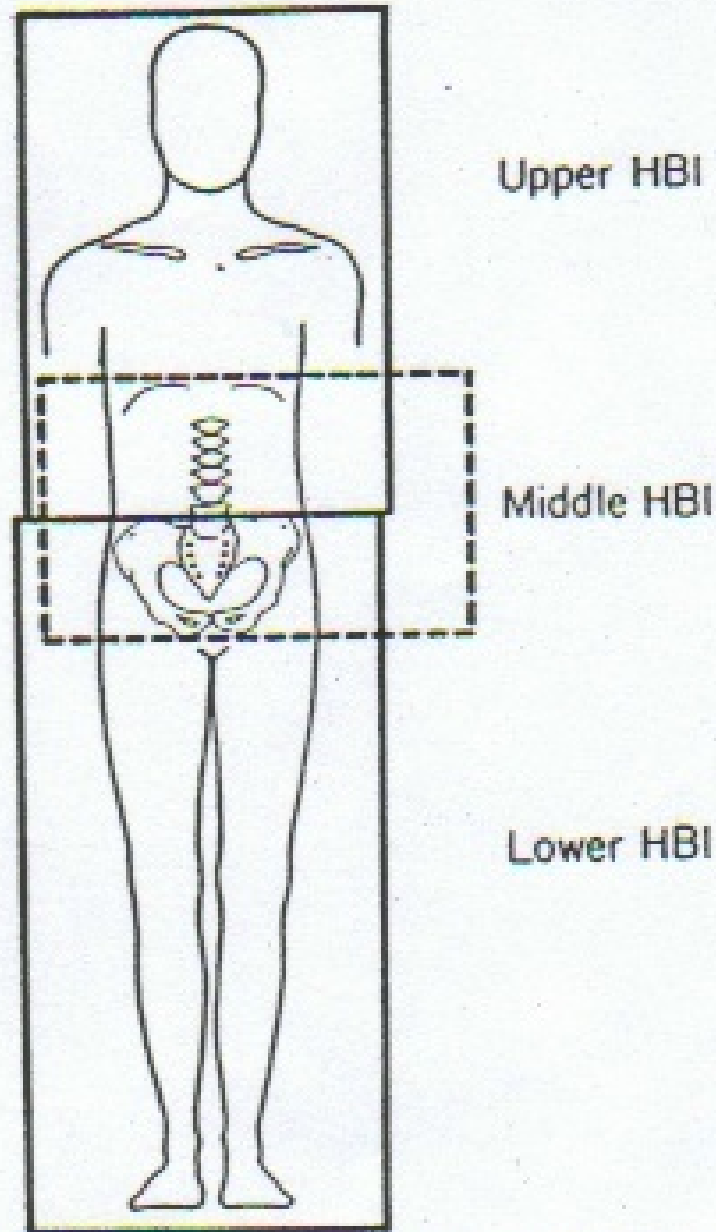


FIGURE 11-2. The most commonly used HBI fields.

## Dose

- Upper body dose limited by lung tolerance

## Toxicity

- Nausea, vomiting
  - Diarrhea (lower)
  - Fatigue
  - Bone marrow suppression
  - Chills
- Upper in general most toxic
  - Can get systemic effect, treat the pelvis/lower, there is often relief in upper as well

## Premedicated

- IV fluids
- Anti-emetic (Kytril)
- Imodium
- Tylenol PRN for chills

# Spinal Cord Compression

- May be pressing on the cord
  - 1) Collapsed vertebral body
  - 2) Soft tissue mass in spinal canal

## OR

- In the cord
- Intramedullary mets

# Symptoms

- Back pain usually of several weeks duration
- Worse lying down, usually:
  - Sleeps in Lazy Boy Chair
  - Pain when leaning back against hard back chair
- Unsteady gait
  - Most in thoracic spine get upper motor neuron problems
- Urinary obstruction
- Numbness, tingling

## Signs

- Muscle weakness
- Sensory level
  - 70% are in thoracic spine
  - Need to test sensation all the way up to neck

## Most useful screening tool

- Broken tongue depressor
- Check sensation
- “Tell if it changes”
- Gold Standard                      MRI
- Most common                      CT/Myelogram

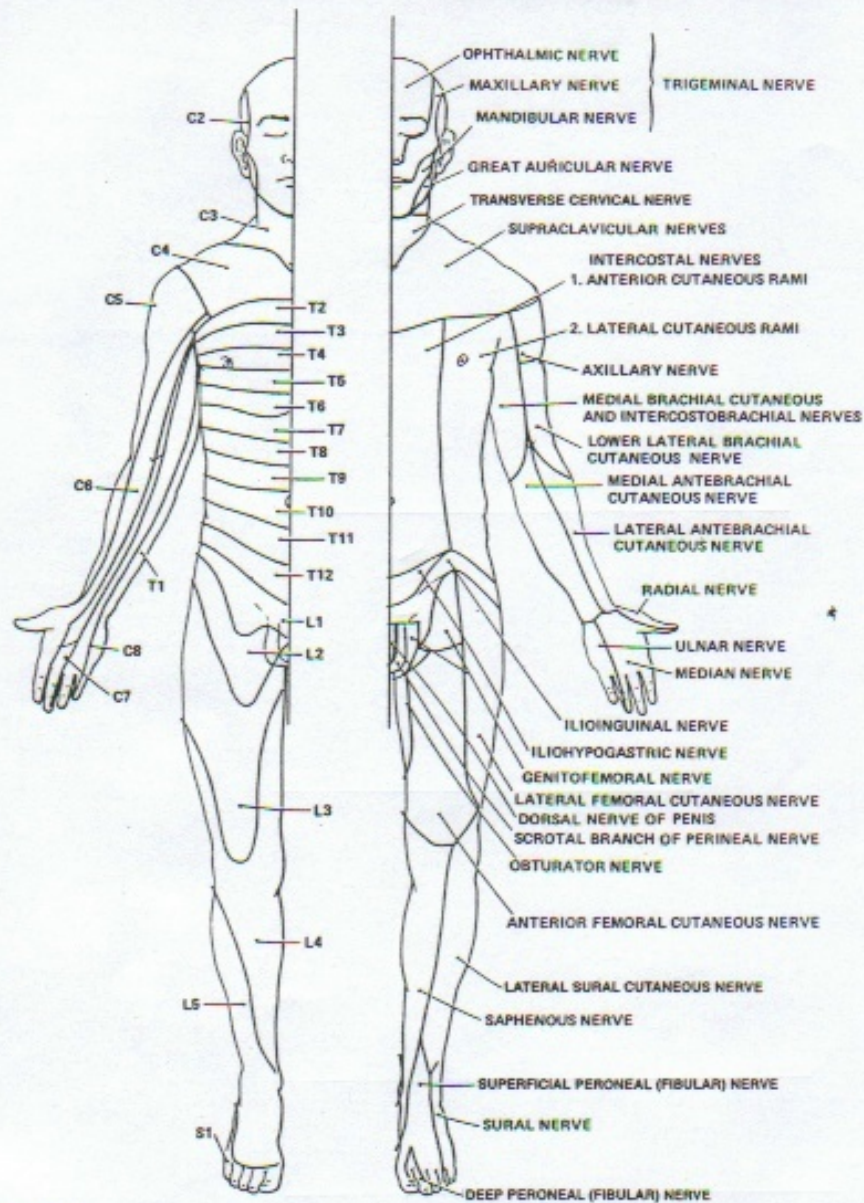
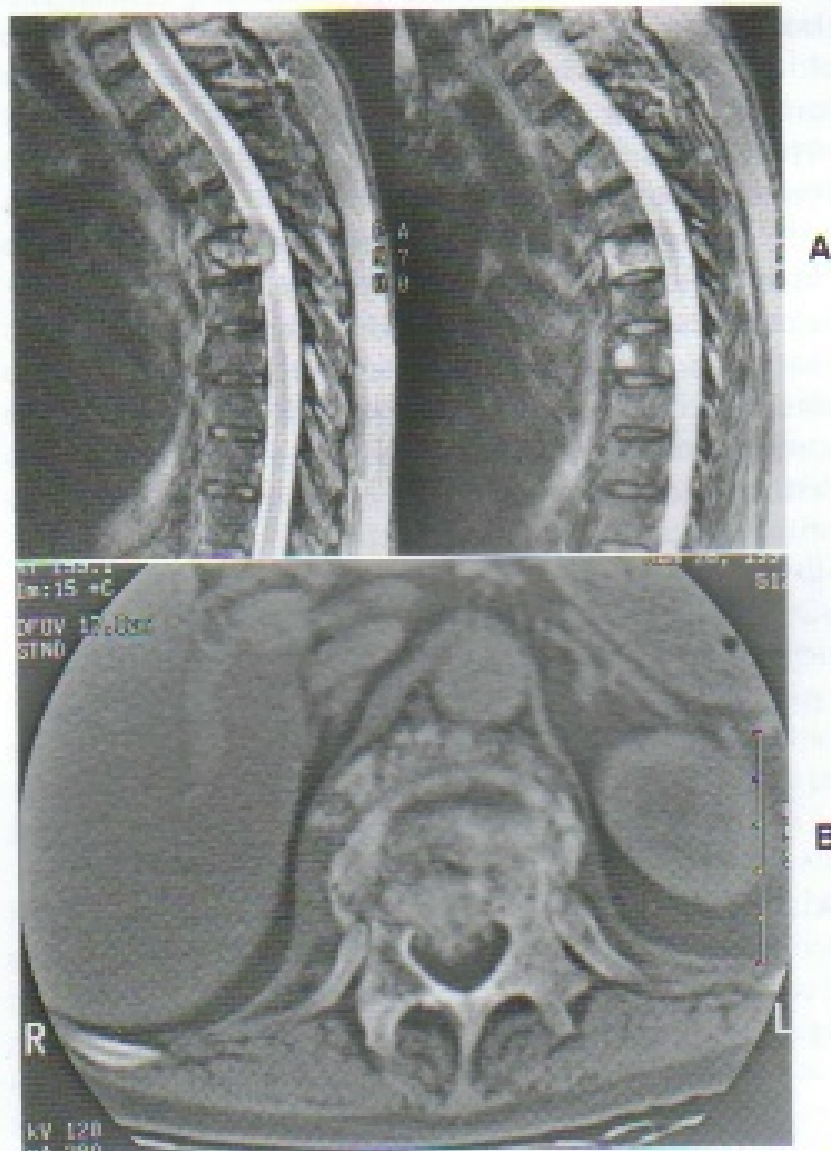


FIGURE 17

The innervation of the anterior surface of the body by dorsal roots (*left*) and peripheral nerves (*right*).



**Fig. 38-4** A, Sagittal magnetic resonance image of the thoracic spine showing involvement of the posterior aspect of the vertebral body resulting in partial spinal cord compression. B, Axial computed tomography scan showing direct impingement on the spinal cord.

# Treatment

- Dexamethasone; relieves edema; gets pressure off cord
  - If it is lymphoma in canal this can be extremely effective
- Dose controversial
  - Usually recommend 10 mg IV and then 4 mg IV/PO q6h
- Radiation
  - 2000 cGy in five treatments
  - 3000 cGy
- Consider surgical intervention
  - Bone protruding into canal
  - Radio-resistant primary; melanoma, kidney
  - Recurrence after radiation

# Superior Vena Cava Obstruction

Benign and malignant causes

## ■ Benign

- Thrombosis (usually catheter related)
- Fibrosing mediastinitis
- Goiter
- Aortic aneurysms

## ■ Malignant

### ■ Primary

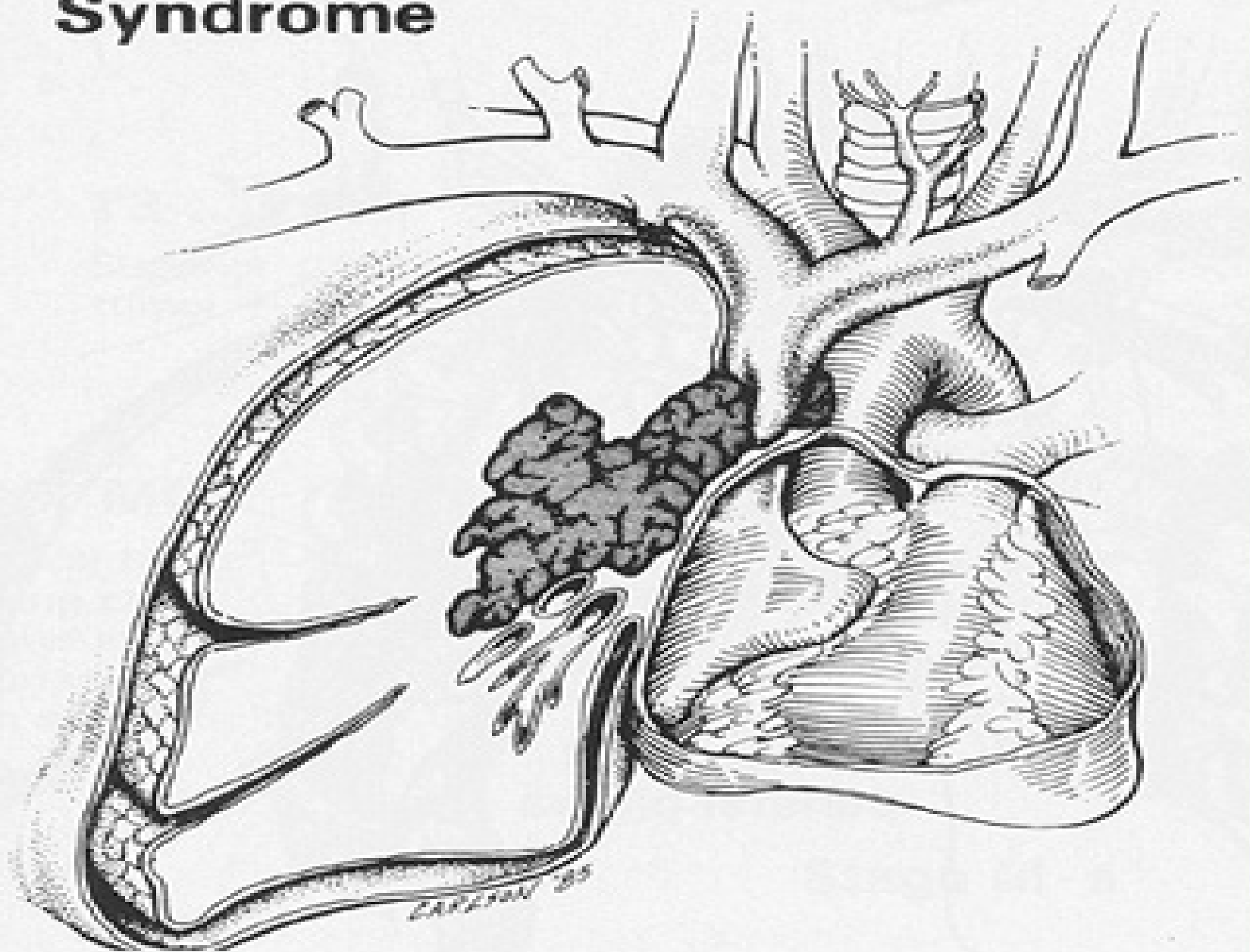
- Lymphoma
- Lung cancer

### ■ Metastatic

- Nodal mets

# Superior Vena Cava Syndrome

*MASS COMPRESSING SVC*

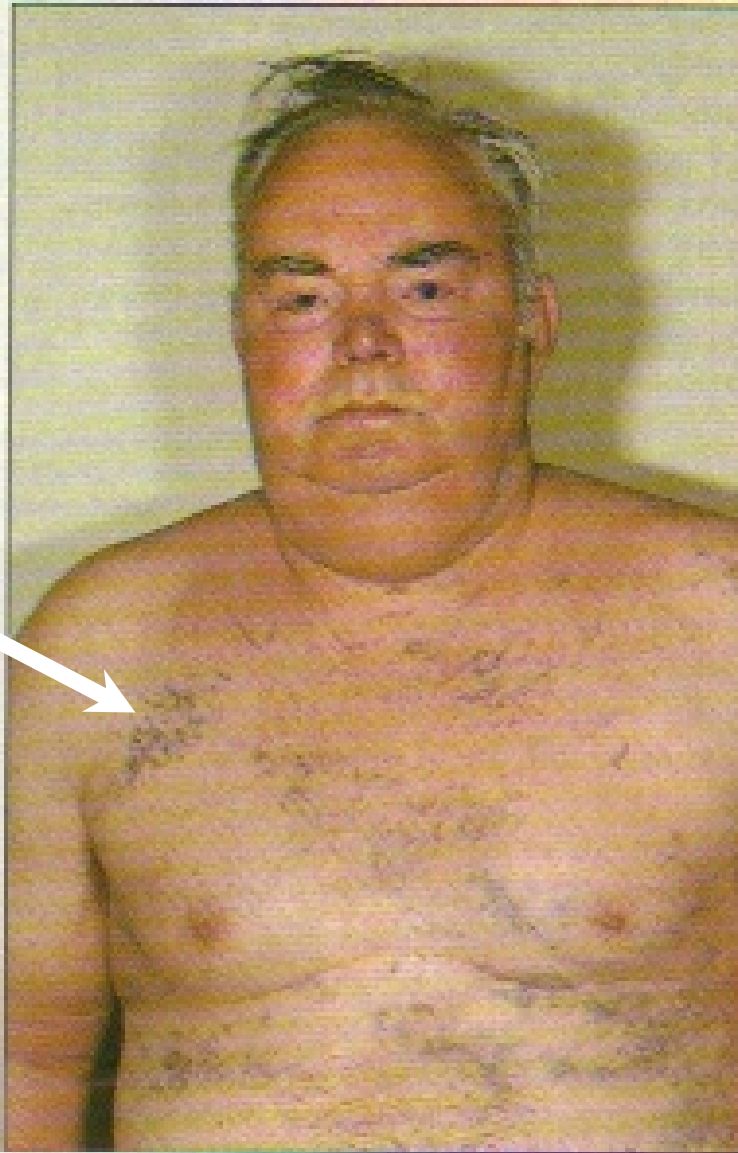
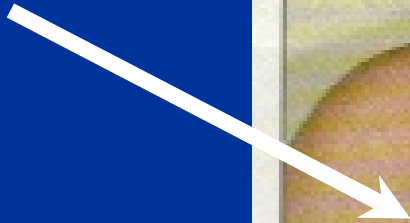


# Presentation

## Typical

- Result of venous congestion
  - Flushed face
  - Distended neck veins
  - Dyspnea
  - Appearance of collaterals on chest to bypass obstruction
  - Worse lying down

**COLLATERALS**



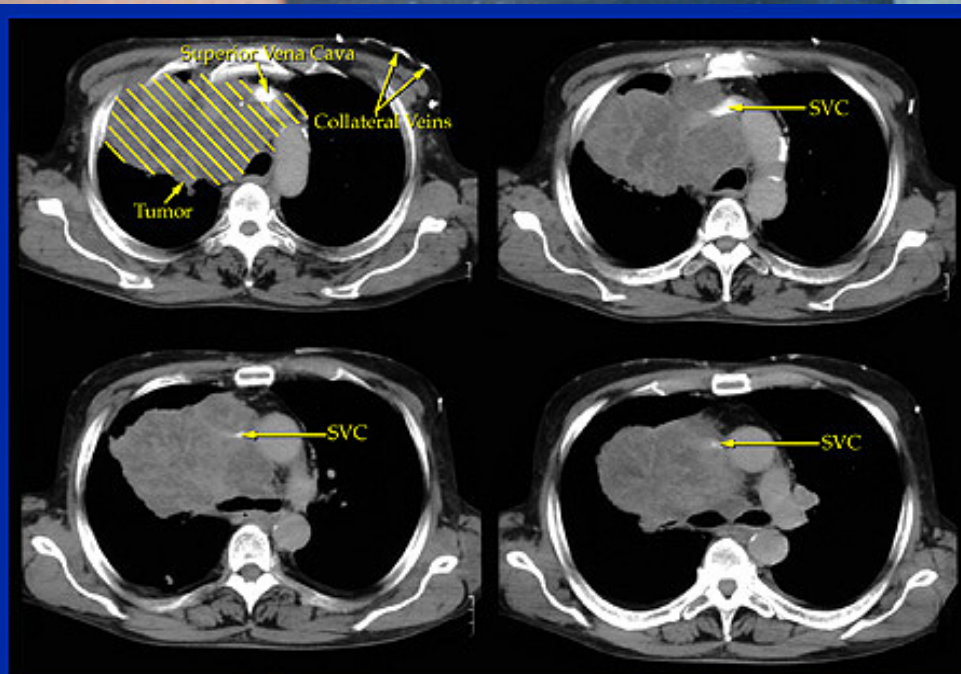
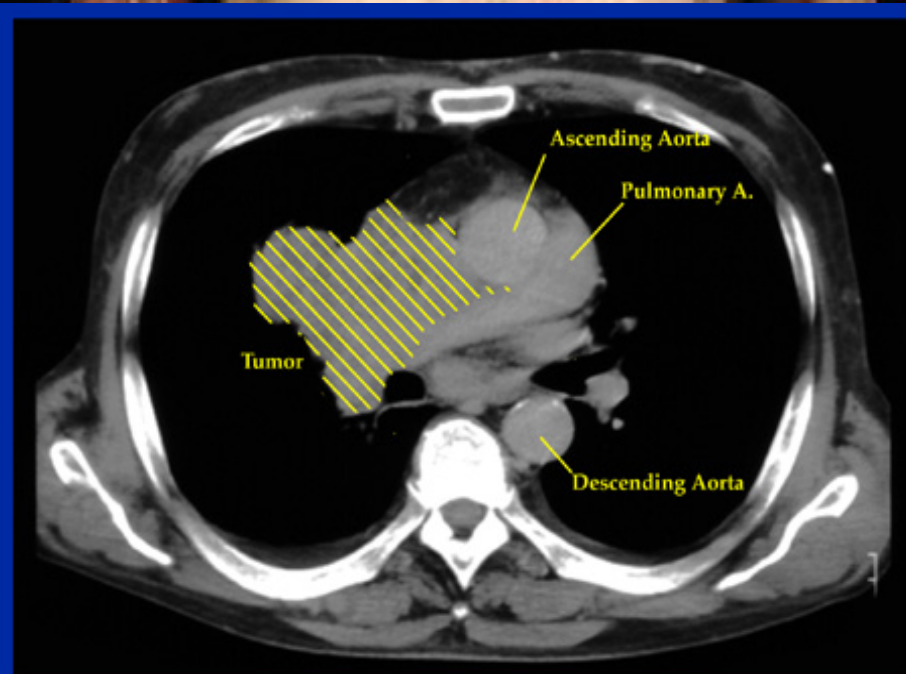
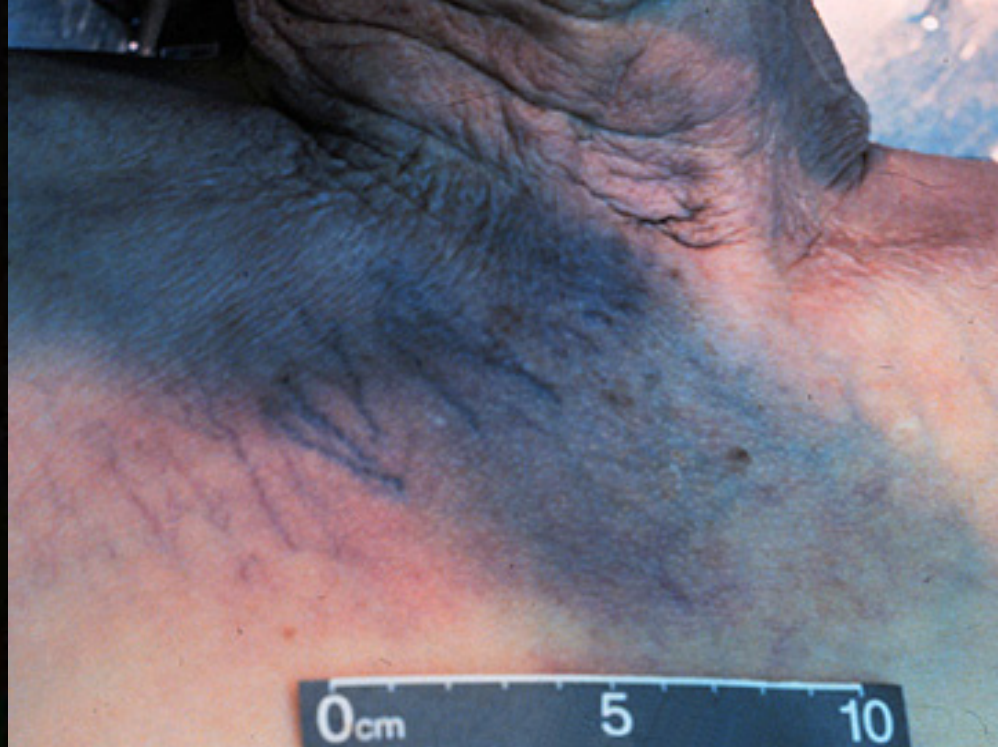
**Puffy flushed  
face and eyelids**

Patient with superior vena caval obstruction showing typical signs (reproduced with patient's permission)

**SVC COMPRESSED**



R  
2  
0  
3



## Treatment

- Dexamethasone may help
- Radiation
- Sometimes chemo if very responsive
  - Small cell lung
  - Lymphoma
- May give short course radiation and start chemo

# Brain Metastases

- Most common tumour in brain is mets
- May be first presentation

## Presentation

- Looks like a stroke often
- May be asymptomatic finding during staging

## Diagnosis

- Ct
- MRI – More sensitive
- Neurosurgical consult if no known primary

## Treatment

- Dexamethasone relieves edema; can often lead to dramatic improvement

## Consider Neurosurgical consult if

- No known primary
  - Mass effect
  - Large causing midline shift
  - Hydrocephalus
- Can be suitable for resection because usually peripheral, accessible

**Mass Effect Left  
Ventricle Collapsed**

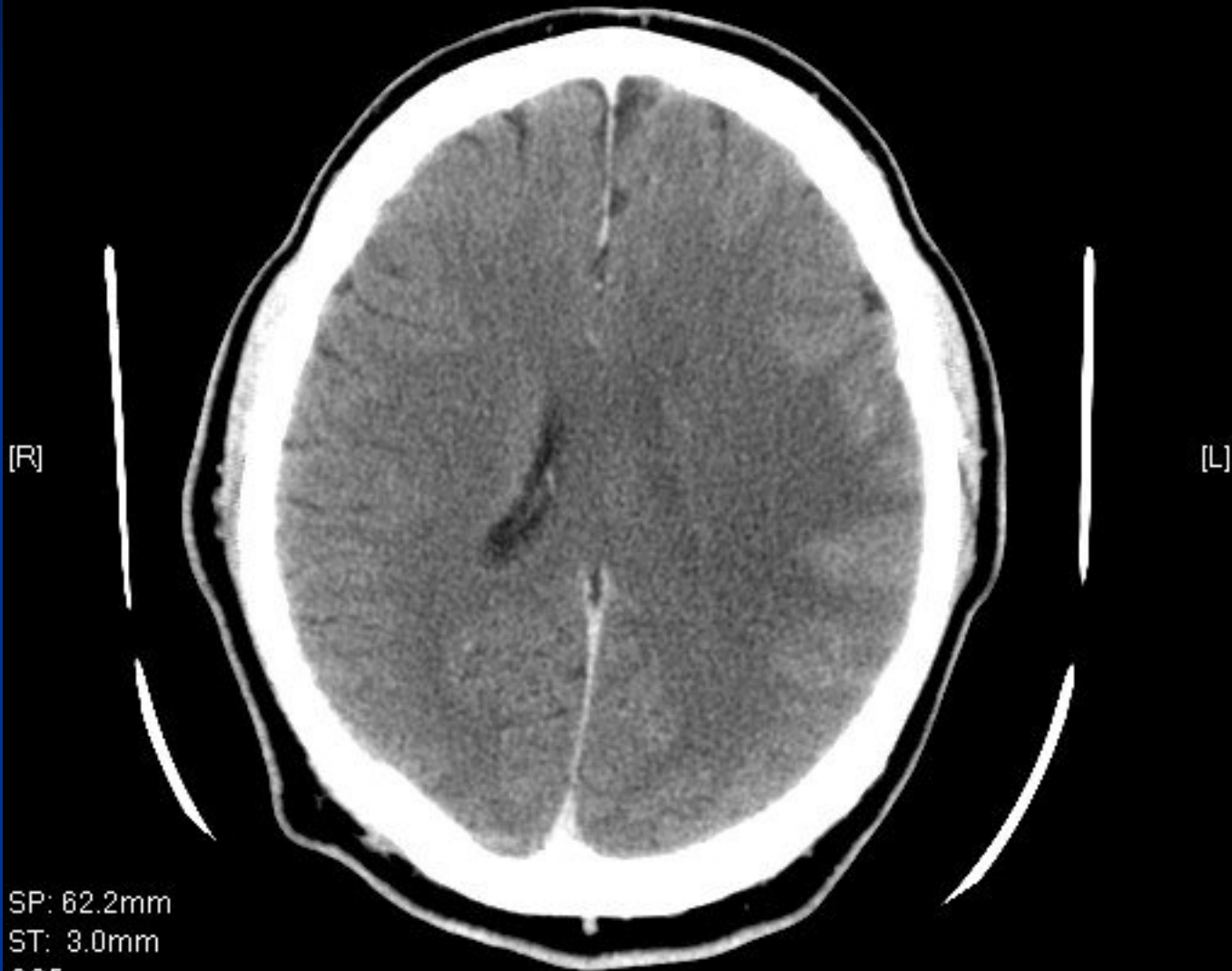
[AH]

HEAD ROUTINE

11/7/2005

9:02:40 AM

051107011



SP: 62.2mm

ST: 3.0mm

C35

W100

Not for diagnostic use

[PF]

GE MEDICAL SYSTEMS

**Ring Enhancing  
Met with Edema**



SP: 94.0mm

ST: 3.0mm

C35

W100

Not for diagnostic use

[PF]

GE MEDICAL SYSTEMS

## Radiation Treatment

- In past only option was whole brain radiation (WBRT)
- 2000cGy in five fractions
- 3000 cGy in ten fractions
- These are very neurotoxic
- Median survival though was only three to six months

## Affects:

- Memory
- Concentration
- Cognition
- If live longer than three to six months

## Modern Radiation

- Reduce fraction size to less than 300 cGy per day
  - 3000 cGy in 12 fractions, 250 a day
  - 3750 cGy in 15 fractions, 250 a day
- Consider Boost radiation with Stereotactic techniques. Gamma Knife here. Novalis on accelerator.
- Whole brain, scan four to six weeks later, consider Boost

## Gamma Knife

- Allows delivery of focused radiation to met only
- Size limit 3.5 – 4.0 cm because over that get a lot of edema
- Spares the rest of the brain. Does not affect cognitive ability, memory or concentration as WBRT does
- Used for “Boost” or for recurrent brain mets

# GAMMA KNIFE

- Directs 201 small beams of radiation to focus point
- No area of the brain receives much radiation, but all focused to one spot





# Gamma Knife Technique

- Head frame put on
  - Local anesthetic
  - Pins into skull
- MRI
- Plan Made
- Treatment Done
- Frame Off
- Go Home

# Bleeding

- Hemoptysis
  - Nodes or tumour eroding into airway
- Bladder Ca
- Prostate
- Cervix
- Rectal
- All commonly cause bleeding; can use radiation to stop it

# Conclusion

- Radiation useful for palliation of:
  - Bone pain
  - Tumour causing pain by size
  - Obstruction
  - Bleeding
  - Brain mets
  - Slow the growth of a tumour
  - Spinal cord compression
- Short courses of radiation used
- Gamma knife for recurrent brain mets