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FRED HUTCHINSON CANCER RESEARCH CENTER
A LIFE OF SCIENCE

Seattle Cancer Care Alliance

The Role of Radiotherapy in Metastatic Breast Cancer

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Indications for Palliative Radiation

- Pain Control
  - Bone Metastases
  - Pressure of tumor on nerves
- Spinal Cord Compression
- Brain Metastases
  - Whole brain radiation
  - Stereotactic
- Bleeding/Ulceration

Radiation

- Therapeutic Radiation ---- X-rays from:
  - Linear accelerator
  - Cobalt 60 machines

Radiation

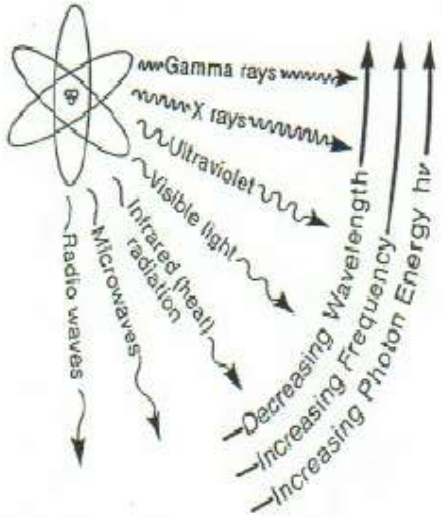


Figure 1.3. Illustration of the electromagnetic spectrum. X-rays and γ-rays have the same nature as visible light, radiant heat, and radio waves; however, they have shorter wavelengths and consequently a larger photon energy. As a result, x- and γ-rays can break chemical bonds and produce biologic effects.

Radiation Physics (SI Units)

- Dose:
  - Gray = Joule/Kg
  - Rad = 1/100 Gray

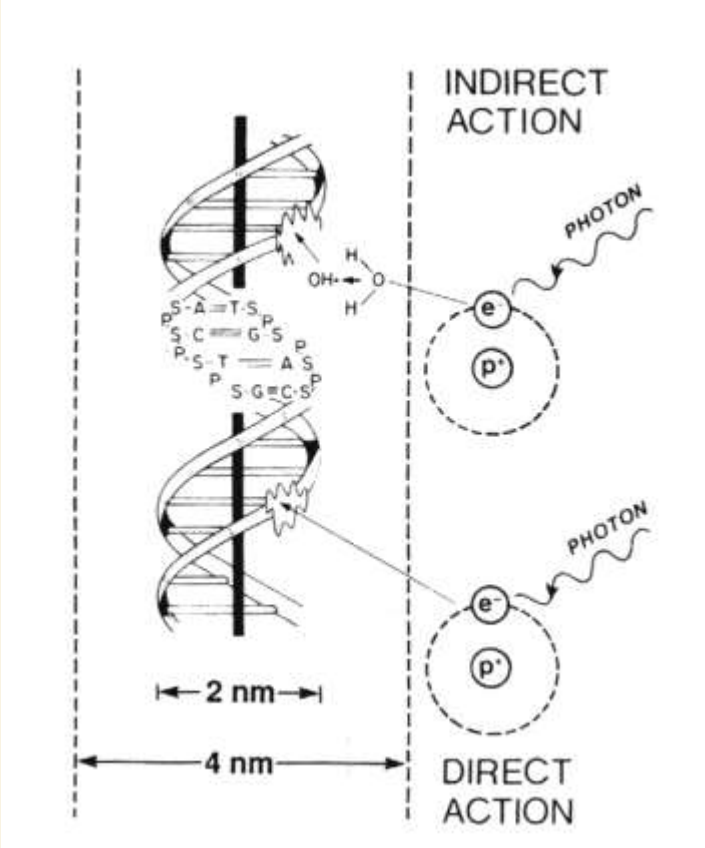
- Exposure:
  - Roentgen = 2.58 x 10-4 Coulombs/Kg air
  - Not defined for x-ray energies > 3 MV

Fractionation

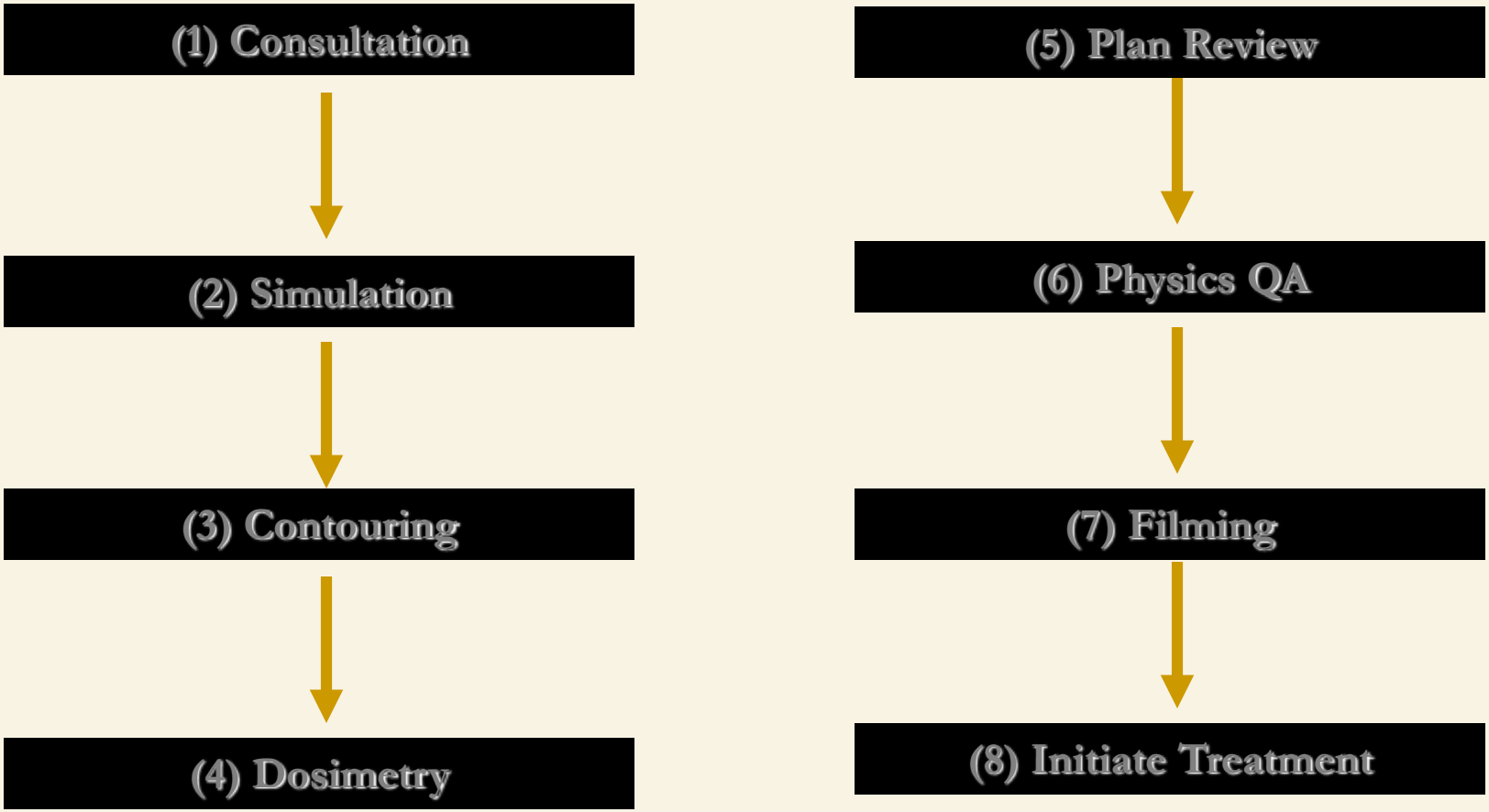
- Conventional Fractionation:
  --1.8-2 Gray, 5 days per week
- Hyperfractionation:
  - Size of fraction decreased
  - Number of fractions increased
  - Overall time relatively unchanged
- Accelerated Fractionation:
  - Size and number of fractions unchanged
  - Overall time decreased
- Hypofractionation:
  - Size of fractions increased
  - Number of fractions and overall dose reduced

Radiobiology

- Direct Damage (1/3): Recoil electron interacts directly with DNA.
- Indirect Damage (2/3): Recoil electron interacts with H2O, to produce a hydroxyl radical, which diffuses to target molecule (DNA).



Treatment Planning



Indications

- Pain- Bone Metastases: Most common cause
- Causes of Pain
  - Stimulation of nerve endings in endosteum by release of neuropeptides
  - Stretching of periosteum
  - Tumor growth into surrounding nerves and tissues

Bone Mets

- 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

Bone Mets

Bone Mets

- 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

Bone Mets

- May fracture as a result of radiation because turgor of tumor holding bone together
- If a fracture is impending….Surgical consult if available before radiation

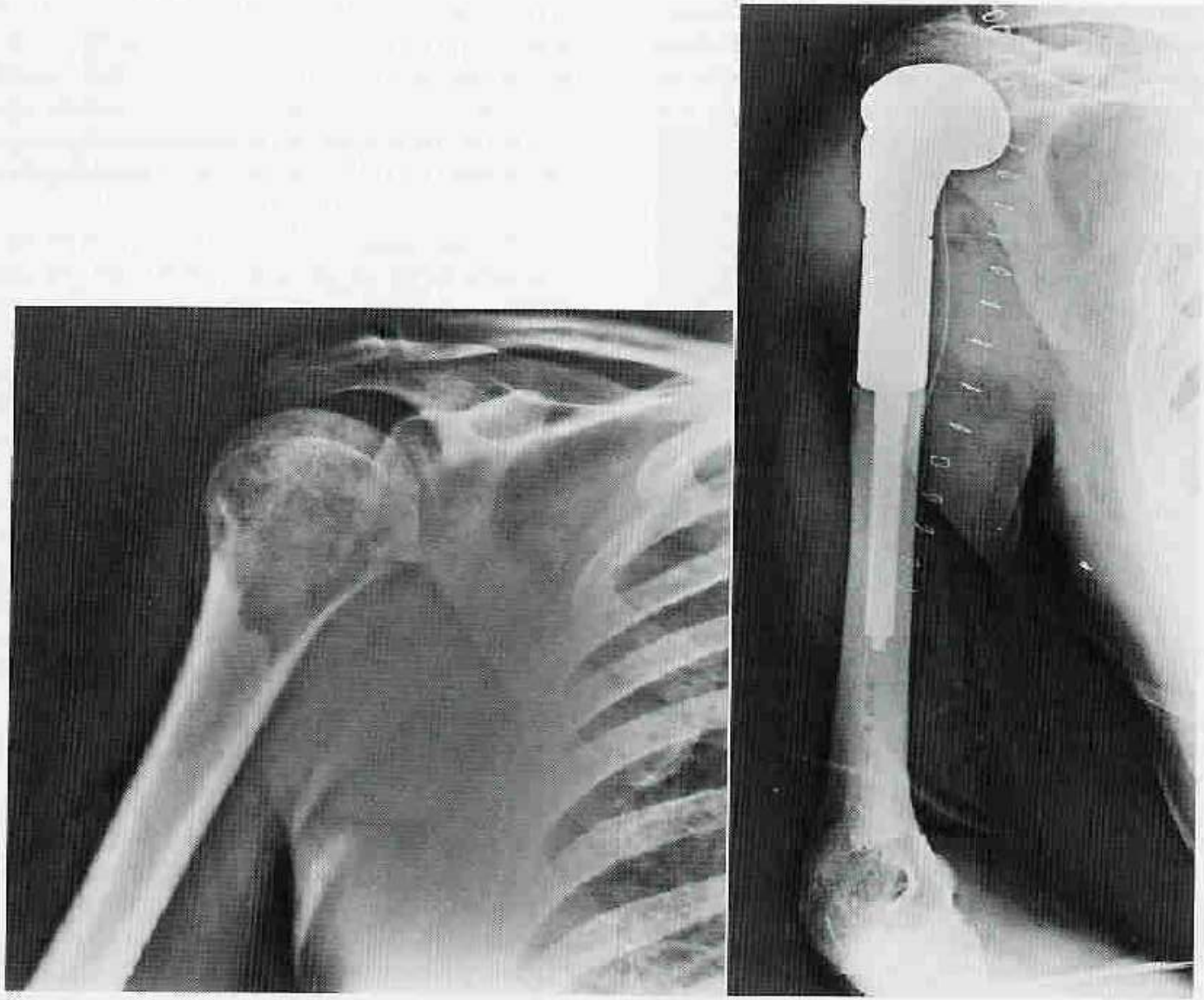


Fig. 38-1 A, Plain radiograph showing an extensive lytic lesion in the proximal humerus. B, Prophylactic internal fixation was performed to prevent pathologic fracture. The patient, who experienced pain primarily in the hip, would have been put on crutches to reduce stress on the involved femur. A bone 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.

Bone Mets

- Different schedules used
  - 800 cGy in one fraction
  - 2000 cGy in five fractions
  - 3000 cGy in ten fractions
  - 3750 cGy in fifteen fractions
- Still argued in trials which is best

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

Spinal Cord Compression

Symptoms

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

Spinal Cord Compression

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

Spinal Cord Compression

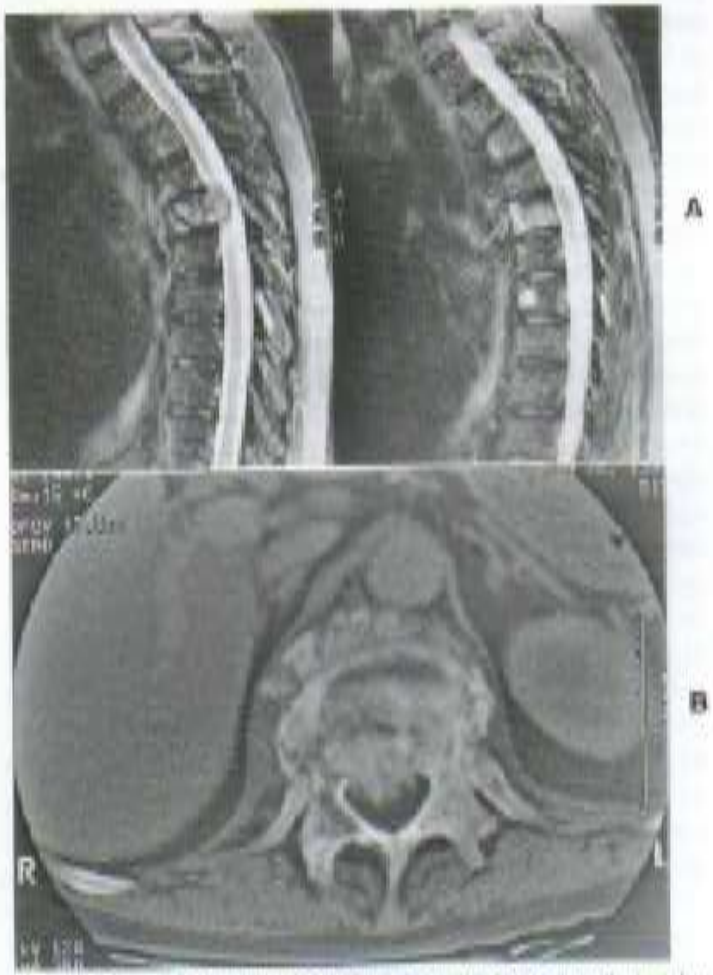


Fig. 38-4 A, Sagittal magnetic resonance image of the thoracic spine showing involvement of the posterior aspect of the vertebral body resulting in partial spinal cord compression. B, Axial computed tomography scan showing direct impingement on the spinal cord.

SCC-Treatment

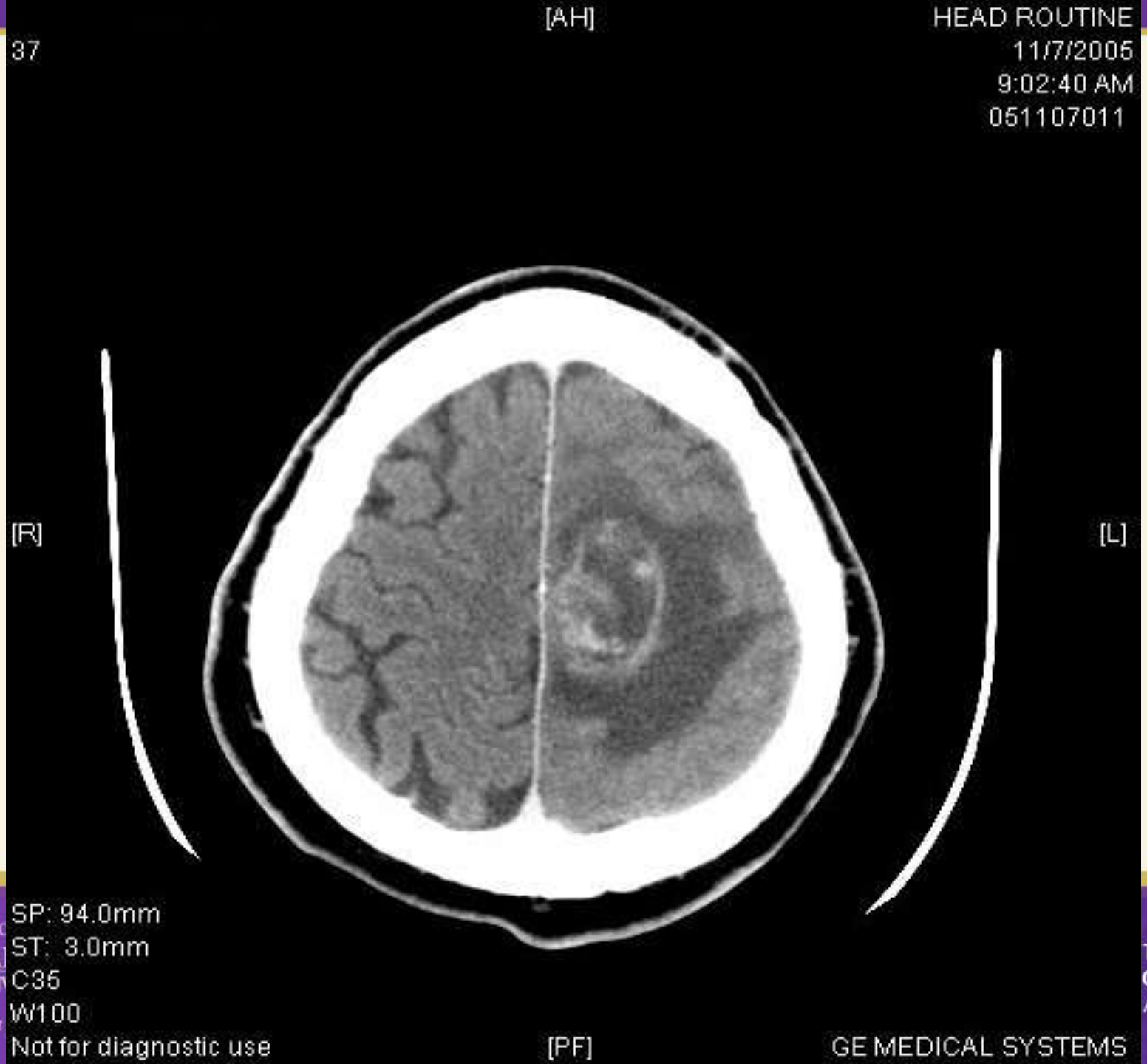
- Steroids; relieves edema; gets pressure off cord
  - If it is lymphoma in canal this can be extremely effective
  - Dose controversial- Usually recommend 10 mg IV and then 4 mg IV/PO q6h
- Consider surgical intervention
  - Bone protruding into canal
  - Any symptom (Patchell)
  - Recurrence after radiation

Brain Metastases

- Most common tumor 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
  - Consider surgical consult if no known primary

Brain Mets: Treatment

- Dexamethasone relieves edema; can often lead to dramatic improvement
- Consider Surgical consult if
  - No known primary
  - Mass effect
  - Large causing midline shift
  - Hydrocephalus
- Can be suitable for resection because usually peripheral, accessible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HEAD ROUTINE
37
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SP: 94.0mm
ST: 3.0mm
C35
W100
Not for diagnostic use
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GE MEDICAL SYSTEMS

Brain Mets

- Side effects:
  - Skin Changes
  - Hair Loss
  - Fatigue
  - Neurocognitive changes

Stereotactic Radiosurgery

- 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. Neurocognitive changes not seen as much
- Used for “Boost” or for recurrent brain mets or stand alone

Bleeding

- Hemoptysis
  - Nodes or tumor eroding into airway
- Ulcerating lesion
- Many tumors cause bleeding; can use radiation to stop it

Conclusion

- Radiation useful for palliation of:
  - Bone pain
  - Tumor causing pain by size
  - Obstruction
  - Bleeding
  - Brain mets
  - Slow the growth of a tumor
  - Spinal cord compression
- Short courses of radiation can be used with a dramatic impact on quality of life

Questions?