

# The Basics of Radiotherapy

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# Outline

- Radiotherapy:
  - Radical
  - Palliative
- Side effects:
  - Acute
  - Late
- Indications for Palliative Radiotherapy
- Case studies

# What is radiotherapy?

- High energy x-ray treatment
- Delivered using a linear accelerator
- X-rays cause DNA damage and induce cancer cell death
- Effects of radiotherapy take days to weeks to become apparent

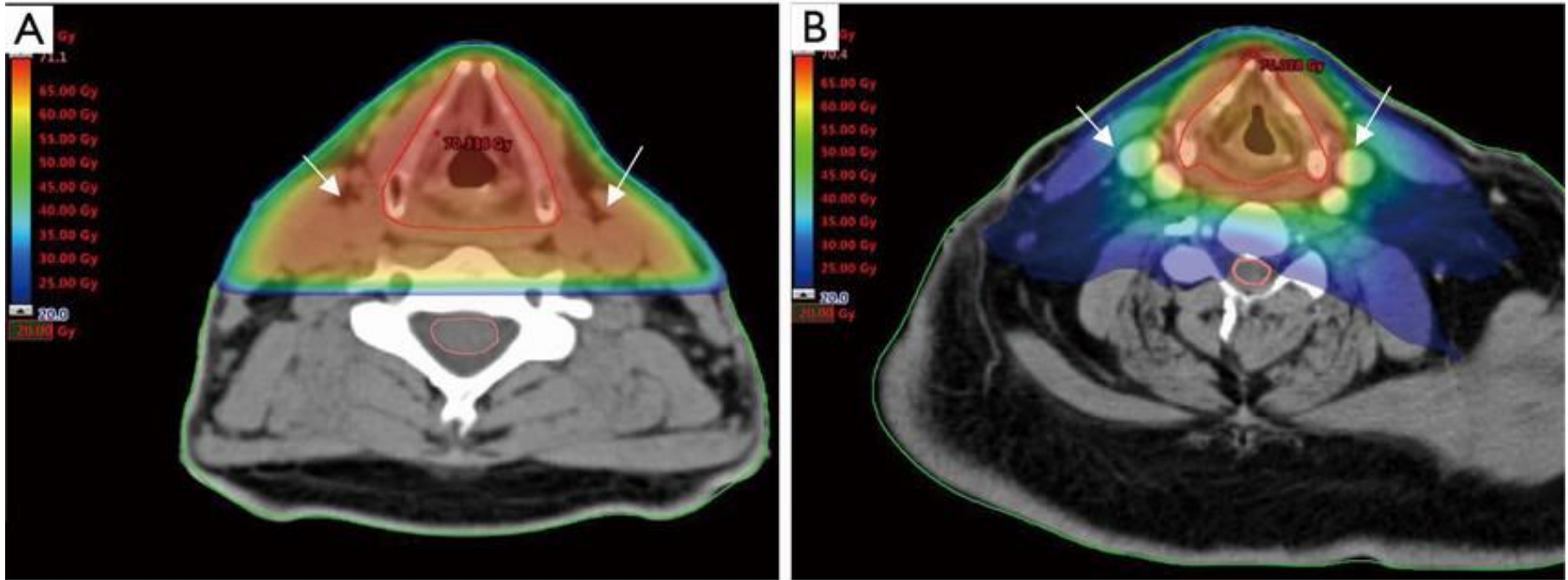
# Linear accelerator



# What is radiotherapy?

- Unit of measurement = **Gray (Gy)**
- Total dose is split into treatments = **fractions (#)**
- **Radical radiotherapy** is given over several weeks and can be combined with chemotherapy
- **Palliative-intent radiotherapy** usually given in a single day or over a few days

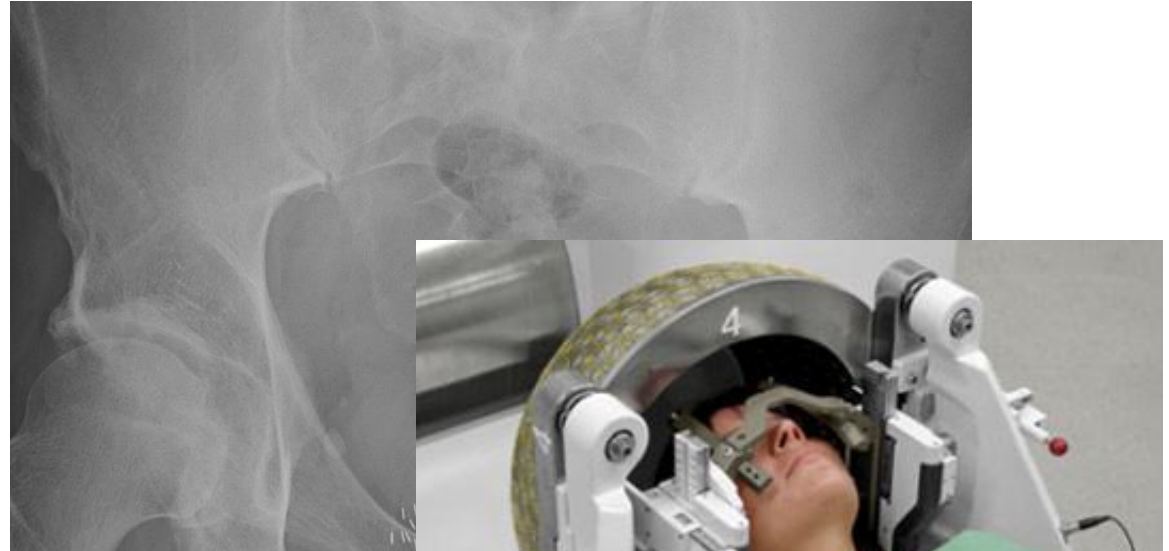
# Techniques: Conformal vs. IMRT/VMAT



- Intensity modulated radiotherapy for head-and-neck cancer: discussing safety of modern radiation techniques
- Julie van der Veen, Sandra Nuyts; [Vol 6, Supplement 6 \(August 2017\): Translational Cancer Research](#)
- <http://tcr.amegroups.com/article/view/15083/html>

# Techniques

- Brachytherapy
- Radio-Iodine
- SBRT/ SABR
- Gamma Knife
- CyberKnife
- Proton Beam
- Nano-knife/ RFA



# Radiotherapy Toxicity

Acute



# Case BW

- 52 year old M
  - Ex-smoker, no comorbidities
  - Recently completed radical RT for laryngeal cancer
  - 10/7 later acute admission via A+E with odynophagia and dysphagia, feels “shivery+shaky”
- **What is the most appropriate management plan?**
- A: IVF + Refer to ENT
- B: IVF, IV abx, NBM, SALT assessment, Dietetic input, analgesia
- C: IVF, analgesia and Laryngoscopy
- D: Analgesia, CT head and neck
- E: PO abx, analgesia, d/c home with ENT follow up

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# Case YH

- 63 year old F
  - Ex-smoker, COPD, PVD
  - Completed high dose palliative radiotherapy for lung cancer 6 weeks ago
  - Acutely attends A+E with worsening SOB, productive cough and low grade fever
  - CXR: air space opacification in line with radiotherapy field
  
  - **What is the most likely diagnosis?**
- A: PE
- B: Community Acquired Pneumonia
- C: Atypical Pneumonia
- D: Radiation Induced Pneumonitis
- E: Cardiac Failure

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# Acute Radiotherapy Toxicities

- “Region” specific
- Develop 1-2 weeks into treatment
- Intensify and peak 1-2 weeks post treatment completion
- Expected to resolve 4-6/52 post treatment, can become permanent
- Education/ Information booklets/ Specialist nurses

# Radiotherapy Toxicity

Late

# Case AJ

- 48 yr old M
  - Ex-smoker, PS1
  - Completed Chemo-Radiotherapy for HPV +ve cancer of the tonsil 3 years ago
  - Attends GP c/o fatigue, vague headaches and low mood, normal clinical exam
  - Bloods: Hb 153, Free T4 2.5 (4.0-11.0 ug/dL), TSH 10 (0.5-6.0 uU/mL)
  - **What is the most appropriate next step?**
- A: MRI brain ? mets
- B: Probable lab error, repeat in 4 weeks
- C: Endocrinology Referral
- D: Thyroid US and CT neck/chest/abdo/pelvis
- E: Commence Levothyroxine and organise follow up with repeat TFTs

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# Case EW

- 68 yr old completed radical RT for high risk prostate cancer 20 months ago, PSA 0.07, Hb 135
  - Comorbidities: TIAs, diet controlled T2DM
  - DHx: Zoladex, Clopidogrel
  - Presents with intermittent fresh PR bleeding for the past 4 months
  - Colonoscopy – radiation proctitis, nil else
  
  - **What is the best next step in management?**
- A: Stop Clopidogrel + Topical Steroids
- B: Stop Clopidogrel and refer to Neurology
- C: Commence Tranexamic Acid
- D: Reassure and see back in 6 weeks with repeat PSA
- E: Help! Gastro/ Surgical Referral

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# Long term toxicity of RT

- Neurocognitive Impairment
- Cataracts
- Xerostomia
- Lymphoedema
- Hypothyroidism
- Carotid Artery Stenosis
- Coronary Artery Disease
- Brachial Plexus Injury
- Angiosarcoma
- Pneumonitis/ Lung Fibrosis
- Oesophageal Stricture
- Colitis
- Proctitis
- Urethral stricture
- Pelvic Insufficiency fractures
- Impotence
- Vaginal Dryness
- Secondary Malignancy!

# Palliative Radiotherapy

What do you need to know?

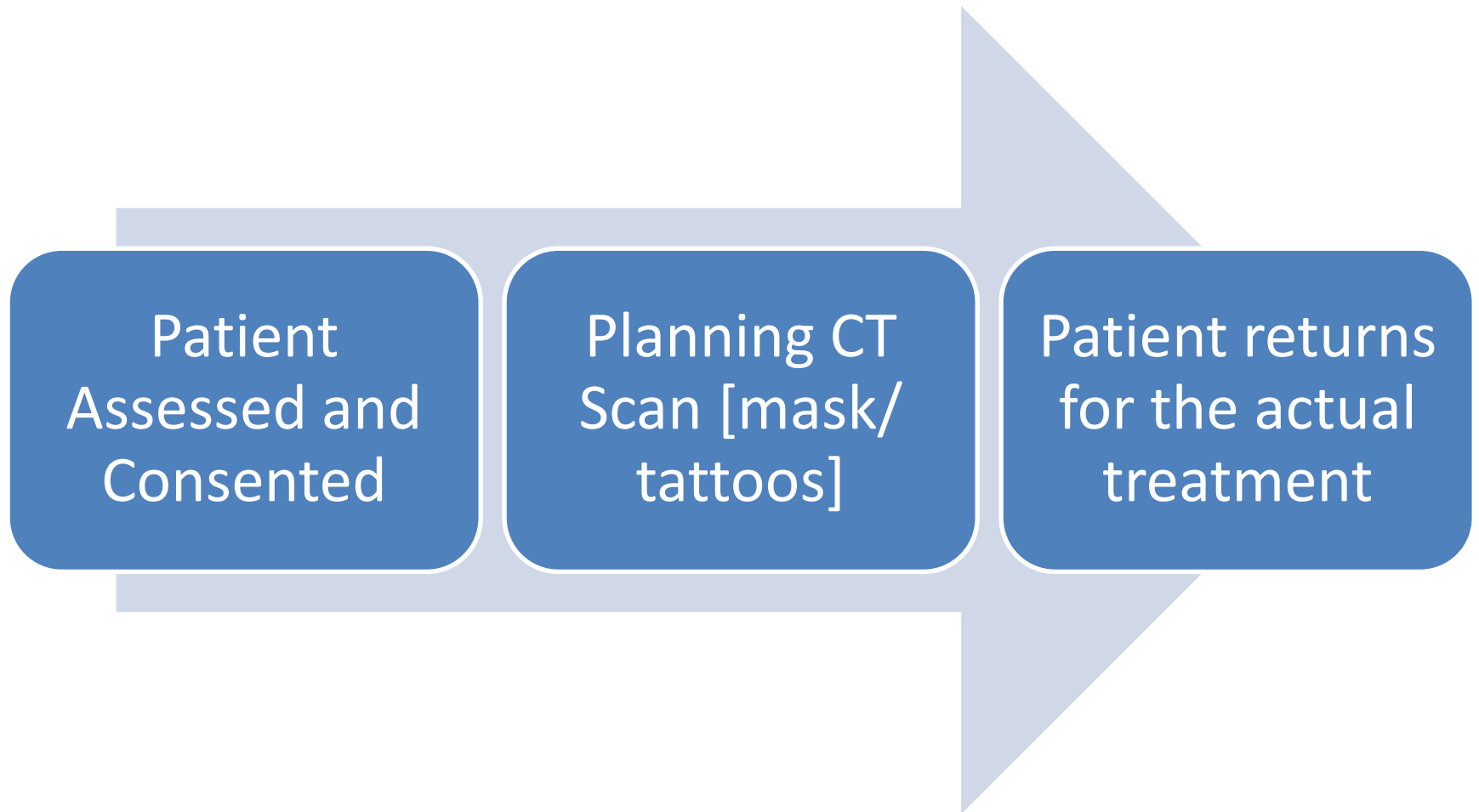
# Palliative Radiotherapy

- Main aim is to **improve symptoms**
- Can take **several weeks** to work/may not work at all
- May help **control** cancer in the area treated but rarely improves survival
- Part of **holistic care** alongside community support services, palliative care and any specialist oncology treatments

# What *not* to tell a patient about palliative radiotherapy

- They will be radioactive afterwards/need to avoid contact with other people
- The radiation will burn their skin or inside their body
- The experience is frightening or painful
- The radiation might cause another cancer
- They cannot have radiotherapy if they have a pacemaker, stoma, stent, joint prosthesis or catheter in situ

# What happens to a patient coming for Palliative Radiotherapy?



# Case BF

- 80 year old Metastatic Prostate Cancer
- PS 3, nursing home resident, multiple comorbidities
- Received 8Gy/# RT to thoracic spine (T5-T9) for MSCC 2 weeks ago
- Re-admission with worsening pain and weakness
- **What do you do?**
  - A: Restart steroids
  - B: Repeat MRI + restart steroids
  - C: Repeat MRI and refer to neurosurgery
  - D: Refer straight to neurosurgery
  - E: Repeat Radiotherapy



# Case BF

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# Case EW

- 86 year old M, PS 1
  - Metastatic Prostate Cancer on Enzalutamide
  - Received RT to painful L humeral met
  - GP contacting on call team, as concerned the patient is in severe pain 3 days later
- **What is the most appropriate next step in management?**
- A: Refer to Orthopaedics
- B: X-Ray humerus + Refer to orthopaedics
- C: Increase analgesia
- D: Repeat Radiotherapy the 1<sup>st</sup> dose was not adequate
- E: Bone scan and Refer back to oncology

# Case EW

- 86 year old M, PS 1
  - Metastatic Prostate Cancer on Enzalutamide
  - Received RT to painful L humeral met
  - GP contacting on call team, as concerned the patient is in severe pain 3 days later, range of movement intact
  - **What is the most appropriate next step in management?**
- A: Refer to Orthopaedics
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# Painful bone metastases

- Radiotherapy (at least partially) effective in most patients
- Usually given as a single fraction
- Increasing analgesia important prior to radiotherapy/until improvement seen
- Other treatments for bone metastases
  - Intravenous bisphosphonates/denosumab may improve pain/reduce fracture risk
  - In prostate cancer, radium 223 can help widespread pain from multiple bone metastases

# Prophylactic surgical fixation for bone metastasis

<b>Mirel's criteria</b> score > 8 suggests prophylactic fixation			
<b>Score</b>	<b>1</b>	<b>2</b>	<b>3</b>
<b>Site</b>	upper limb	lower limb	peritrochanteric
<b>Pain</b>	mild	moderate	functional
<b>Lesion</b>	blastic	mixed	lytic
<b>Size</b>	< 1/3	1/3 to 2/3	> 2/3

- Palliative radiotherapy can be given around 4 weeks after surgery

# Case TR

- 88 year old smoker, PS 3
  - Presents with Haematuria
  - Anticoagulated due to metallic heart valve
  - Cystoscopy – locally advanced, muscle invasive bladder cancer
  - Dropping Hb and requiring regular blood transfusions
- What is the best management strategy?
- A: Discontinue anticoagulation bleeding risk outweighs clotting risk
- B: Add tranexamic Acid
- C: Palliative Radiotherapy 8Gy/#
- D: Intra-vesical BCG
- E: Discharge to Hospice for BSC

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# Bleeding

- Tranexamic acid may help (note VTE risk and not recommended for haematuria)
- Continuous haematuria/clot retention requires bladder wash out/three-way catheter irrigation
- Transfusion if Hb <80 or if symptomatic
- Stop any antiplatelet/anticoagulant medications



# Side effects

- Fatigue common with any radiotherapy
- Occasionally a mild erythematous skin reaction seen
  - This is not a ‘burn’!
- Irradiation of bowel may cause nausea, vomiting and diarrhea
- Irradiation of bladder may cause dysuria, urgency and frequency

# Palliative radiotherapy



# Repeat treatments

- Can usually repeat palliative radiotherapy treatments, depending on previous dose(s) received
- Likely benefit depends on extent and duration of response to initial radiotherapy
- Repeat treatments might be less effective or have shorter duration of benefit

Thank you

**ANY QUESTIONS ?**