Complications/Adverse Effects of Radiotherapy

Dr Omar Din
Consultant in Clinical Oncology

An Introduction to Acute Oncology
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Outline

• Background
• History of radiotherapy
• Classification of radiotherapy
• Acute side effects
• Late side effects
Background

- Radiation has been an effective tool for treating cancer for more than 100 years
- 40% of cured patients have received RT as part of or all of their treatment
- Radical or Palliative
- >65,000 patient attendances per year at WPH
- Acute toxicity, rarely life-threatening
- Late toxicity can be severe, but well understood due to long history of RT
Wilhelm Rontgen, Marie & Pierre Curie

• Wilhelm Rontgen
• German mechanical engineer and physicist
• Nov 1895 discovered X-rays (Rontgen rays)
• 2 weeks later produced 1st X-ray picture

• In 1898 Marie and Pierre Curie discovered radioactivity (polonium and radium)
Emil Grubbe 1875-1960

• 1\textsuperscript{st} to use X-rays for treatment of cancer
• 1896 treated 1\textsuperscript{st} patient with recurrent carcinoma of breast
• Had 90 operations to remove cancers due to radiation exposure
What Is the Biological Basis for Radiation Therapy?

- Radiation therapy works by damaging the DNA of cells and destroys their ability to reproduce.

- Both normal and cancer cells can be affected by radiation, but cancer cells have generally impaired ability to repair this damage, leading to cell death.

- All tissues have a tolerance level, or maximum dose, beyond which irreparable damage may occur.
Classification of Radiotherapy

• Radical or Palliative
• External Beam (EBRT)
• Brachytherapy
• Radioisotope Therapy
• Stereotactic Cranial Radiosurgery (Gamma-knife)
• Proton Beam Therapy
Radical v Palliative EBRT

• Radical
  • High dose to cure cancer
  • Kill residual microscopic disease left after surgery or chemotherapy
  • Usually multiple fractions (3 weeks to 8 weeks)
  • Needs high degree of accuracy to reduce damage to adjacent structures

• Palliative
  • Improve symptoms caused by cancer
  • Lung cancer causing haemoptysis
  • Alleviate pain or neurological symptoms from metastatic bone disease
  • Few fractions, typically 1 to 5
  • Simple fast technique
Brachytherapy

- Low-Dose-Rate (LDR)
  - Radiation delivered over days and months
    - Prostate

- High-Dose-Rate (HDR)
  - High energy source delivers the dose in a matter of minutes rather than days
    - Gynecological, prostate

[Image: Radiograph post - Implant. LDR prostate implant]
Radioisotope Therapy

- Radioiodine (beta) for thyroid cancer
- Radium 223 (alpha) for metastatic prostate/breast cancer
- Who to contact? Nuclear Medicine Dept
  - Radiation Protection Supervisors (Colleen Brown/Steve Hill STH)
  - Radiation Protection Advisors (Mark Singleton/Tracy Soanes STH)
  - Responsible Clinician

- Side effects
  - Inflammation of the salivary glands, dry mouth, nausea
  - Nausea, diarrhoea, myelosuppression
Acute Side Effects of Radiotherapy

• Depends on the part of the body treated
• The effects are cumulative with most significant side effects occurring near the end or just after the treatment course
• Side effects usually resolve over the course of a few weeks
Skin/Breast

- Grading RTOG
- E45/Diprobase
- 1% Hydrocortisone
- Flamazine/Intrasite
- Analgesia
- Non-adherent dressing
- Tissue Viability
Brain

• Headache
  • Dexamethasone, 5HT3 antagonist

• Nausea & vomiting
  • Dexamethasone, 5HT3 antagonist

• Skin reaction
  • E45, diprobase

• Hair loss

• Fatigue
Head and Neck

- Skin reaction
- Mucositis
  - Mouthwashes
    - Difflam
    - Oral balance
    - Oxetacaine in antacid
    - Gelclair
  - Analgesia
    - WHO ladder
    - Alcohol free oromorph
- Xerostomia (dry mouth)
  - Avoid dose to salivary glands during planning process
Lung/Upper GI

- Pneumonitis
  - Dyspnoea, cough, fever
  - 1-6 months post RT
  - Corticosteroids
  - O2 if severe

- Oesophagitis
  - Sharp, burning pain or food getting stuck in the chest when swallowing
  - Analgesia
  - Oesophageal lubricant eg mucilage
  - Maintain hydration and nutrition
Pelvis - Urinary

• Cystitis
  • Hydration
  • Analgesia

• Reduced Flow
  • Alpha blocker eg Tamsulosin MR

• Urgency
  • Oxybutynin, Solifenacin
  • Catheterise
Pelvis - GI

- Diarrhoea
  - Resuscitate
  - Rehydration
  - Replace Electrolytes
  - Reduce Transit (Loperamide/Codeine) – unless Campylobacter, Shigella, E Coli, Salmonella

- Tenesmus
  - Steroid Enema

- PR Bleeding/Mucus
  - Steroid Enema
Bone

• Acute pain flare after large fraction (palliative) RT for bone metastases
• Invariably self limiting
• Analgesia
• Dexamethasone
• Other side effects related to nearby structures
Radiation Recall Reaction

• Use of chemotherapy after radiotherapy
• Acute inflammatory reaction confined to previously irradiated areas
• Mechanism poorly understood
• >7 days – years later
• anthracyclines, taxanes, gemcitabine and capecitabine
Late Effects of Radiotherapy

- Not usually the cause of admission
- May not be related to the degree of acute side effects
- Can occur several months/years post treatment
- Related to the dose received and organs treated
- Small risk of second cancer
Late Effects of Radiotherapy

• CNS/Head and Neck
  • Dry mouth, difficulty swallowing, stiffness in the jaw, skin fibrosis, cataracts, cognitive impairment, hair loss

• Lung/Upper GI
  • Lung Fibrosis, Oesophageal stricture, radiation myelitis

• Breast
  • Lymphoedema, fibrosis

• Pelvis
  • Rectal proctopathy, urethral stricture, impotence, vaginal stenosis
New Age of Radiotherapy

• SABR
• Stereotactic Body Radiotherapy
• 3-5 fractions
• High dose
• Highly conformal so needs to be highly accurate
• Lung, prostate, oligometastatic disease
New Age of Radiotherapy
Questions?