Are You Ready When Patients Undergoing Radiotherapy Have Such Implanted Devices?

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This talk provides you with the essential information on managing commonly seen implanted devices for patients under radiotherapy.

Identifying Implanted Devices (ID)

Risk-based Classification

No relevant conflict of interest

Commonly seen implanted devices in Radiation Oncology

- Pacemaker
- ICD
- Hepatic Pump
- Intrathecal Pump
- Neurostimulator
- Cardiac Loop Recorder
- Central Stent
- Medi-Port

Devices shown in Eclipse treatment planning

- Cardiac Loop Recorder
- Central venous access devices (CVADs)
- Tissue Expanders

Intrathecal Pump in DRR

Implantable Cardiac Defibrillator

(c) Right Vascular Port; (a) Pacemaker

(c) Peripheral Artery Stent; (c) Infusion Drug Pump
Patients with Cardiac Implantable Electronic Devices (CIEDs)

- Cardiac Pacemaker, CRT-P
- Implantable Cardiac Defibrillator, CRT-D
- Cardiac Loop Recorder
- Left Ventricular Assist Device (LVAD)

Under the same labeling of cardiac rhythm devices - all have CMOS circuitry.


Relative size to a penny Implanted in the right ventricle CBCT blended in TPS w/ 2Gy color wash

Patients with Non-CIEDs Implanted Devices

- Neurostimulator
- Programmable Hepatic Pump
- Intrathecal Pump
- Watchman Device
- Central Shunt
- Medi-port

Factors Impacting Implanted Devices

- Device Type
- How far to RT
- Energy/Modality
- Beam Orientation
- Total Dose
- Shielding
- Patient Anatomy/Physiology
- Frequency of RT
- Concurrent Therapy

Management of radiotherapy patients with implanted cardiac pacemakers and defibrillators: A Report of the AAPM TG-203


AAPM TG-203 on CEIDs

Sample of Checklist on CIEDs in Radiation Oncology Dept.

Credit: MSKCC Rad Onc Policy on Pacemakers & ICDs adapted from the AAPM TG-203

Management of RT patients with CIEDs in a pandemic

Risk-based CIEDs management can minimize -

Patient time in the Department

Contact between patients and staff

Number of visits for patient

Low Risk

• < 2 Gy
• CIED-independent

Medium Risk

• Cardiology expert present
• Monitor before/after RT

High Risk

• Monitor every fraction
• Follow up 1,3,6 months


Patients undergoing Proton Therapy

If the patient is pacing-depending, it is usually not recommended to treat them with proton therapy, especially in standalone centers with limited resources.

Left Ventricular Assist Device (LVAD) (<10MV photons)

LVAD is a life-sustaining device.

Neurostimulators (5 Gy Limit*)

Deep Brain Stimulator (DBS)
Spinal Cord Stimulator (SCS)

*Dosage limits depending on the device/model
Spinal Cord Stimulator
20 mL reservoir
Battery life 4-7 years
Intrathecal drug infusion system
*Dose tolerances depending on the device/model

Intrathecal Pump (28.5 Gy Limit*)

Programmable Hepatic Pump (10 Gy Limit*)
10 Gy isodose color-wash display in Eclipse TPS
*Dose tolerances depending on the device/model

No Electronic Circuitry (No Dose Limit)

Brain Shunt
Medi-port
Central Venous Access Devices

Watchman Device™ (No Dose Limit)
Left atrial appendage closure (LAAC) therapy to prevent blood clots from forming and causing a stroke.

A sample workflow to handle implanted devices

In summary, proper policies on implanted devices should be made so you will be ready when your patients have such devices

- Life-dependent
  - Pacemaker, Implantable Cardiac Defibrillator, CRT-P, CRT-D, LVAD
- Adverse
  - Loop recorders, Neurostimulators, Programmable Hepatic Pumps, Intrathecal Pumps
- No electronic
  - Brain Shunt, CVAD, Medi-port, Watchman Device, Tissue Expander, Peripheral Artery Stent

Questions?