Radiotherapy in patients with implanted Cardiac Pacemaker

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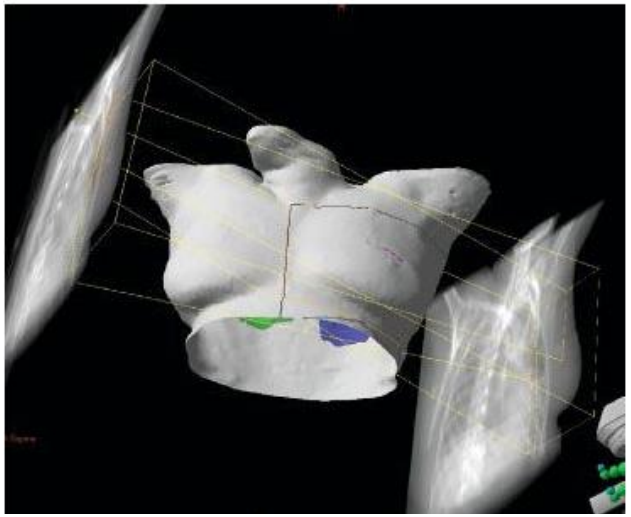
Introduction

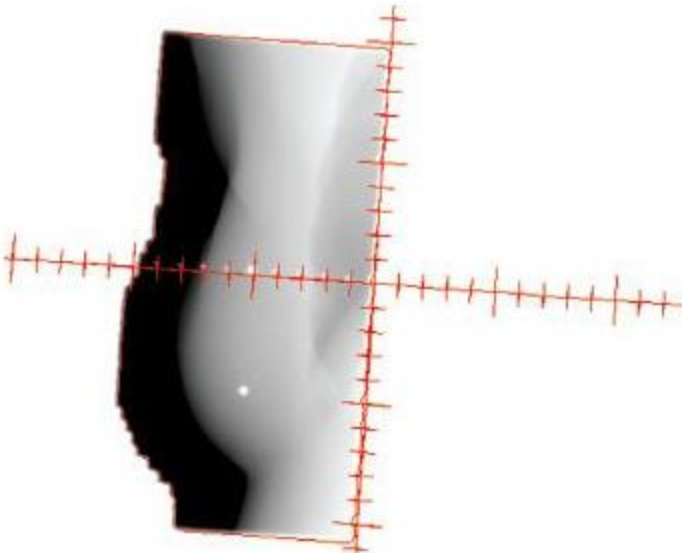
- Breast cancer is the most frequently diagnosed cancer in women and the leading cause of cancer death worldwide.
- RT reduces local recurrence rate and improves OS.
- With the increasing prevalence of cardiac morbidity, patients with pacemakers requiring radiotherapy has increased.
- RT may cause pacemaker malfunction due to the effect of ionizing radiation or electromagnetic interference.

RT Planning in Breast Cancer

- Treatment volumes during adjuvant radiotherapy is breast/Chest wall and supraclavicular fossa when indicated.

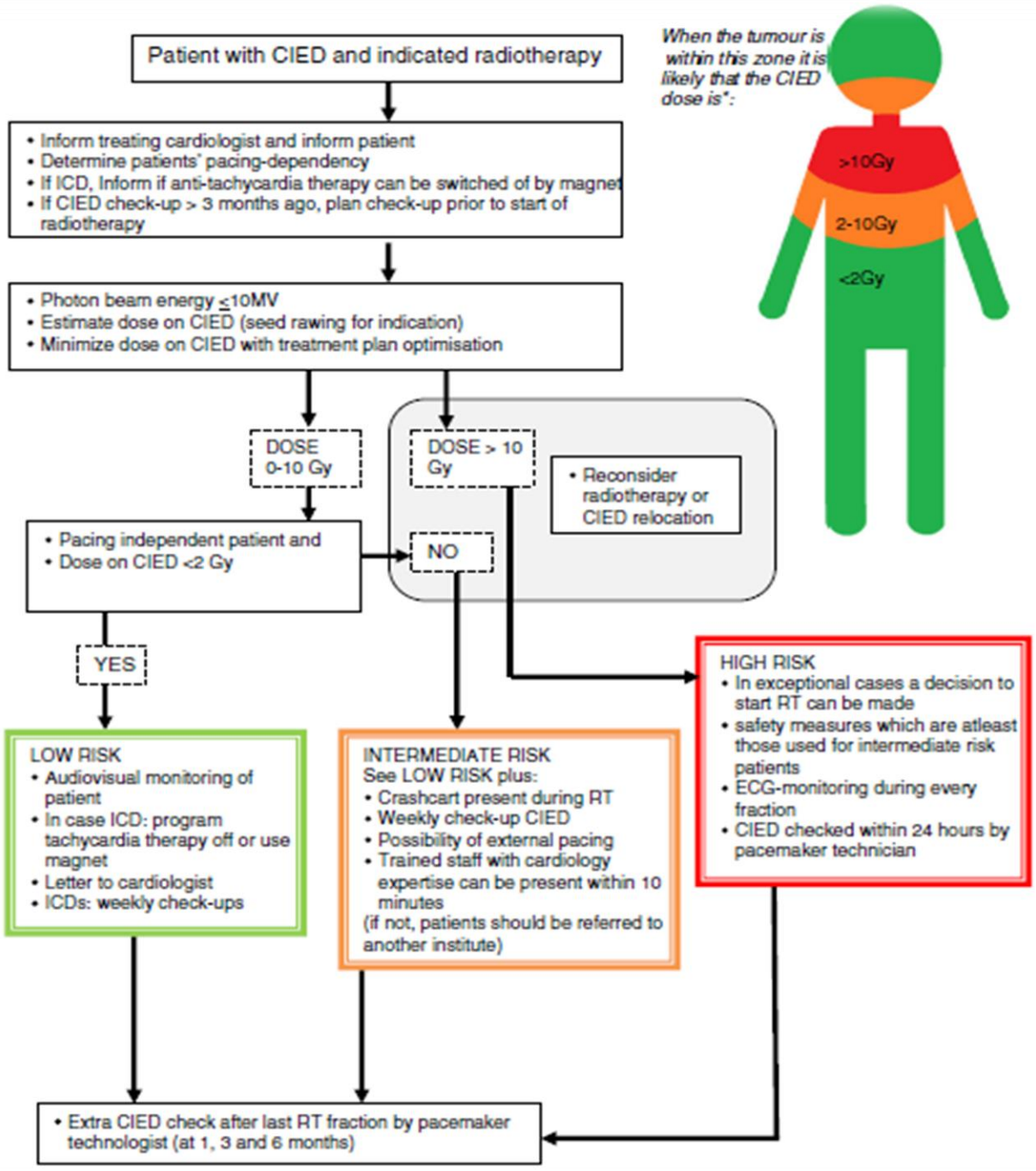


- Modern RT techniques utilize 3D CRT & IMRT to conform dose to target volume and minimize dose to critical structures with the use of MLCs.



Management Guidelines

- Most cited guidelines for the management of radiation oncology patients are American Association of Physicists in Medicine (AAPM) guidelines
  - Patients should not be treated with a betatron
  - pacemakers should not be in the direct treatment field
  - limit the accumulated dose to the pacemaker to 2 Gy
  - If the total estimated dose to the pacemaker >2 Gy, check pacemaker function prior to therapy and possibly at the start of each following week of therapy.



Total & abrupt failure of pacemakers has been seen at cumulative doses between 10 and 30 Gy

Significant functional changes observed between 2 - 10 Gy

Early changes in pacemaker parameters could signal a failure in the 2-10 Gy region

Case Summary- Case I

41yr old lady

- Permanent pacemaker placement in Dec 2012, pacemaker dependent.

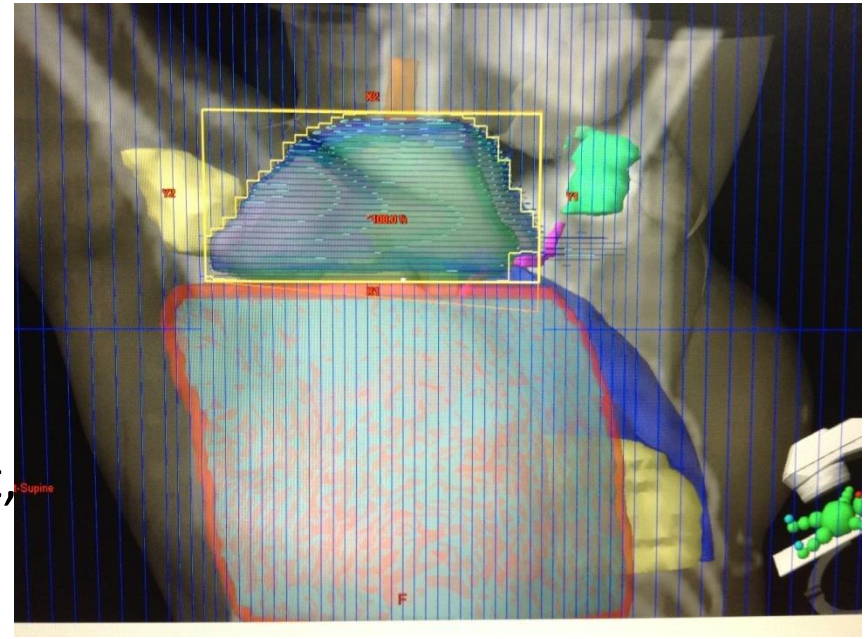
- Ca Rt breast, post MRM- Apr 2013, T2N2M0, post chemotherapy.

- Cardiology consultation taken, 2D Echo & pacemaker reprogramming done before starting RT.

- Emergency resuscitation equipments were arranged in the RT treatment room

Treatment Plan

- RT by 3DCRT to Rt chest wall & SCF, 2Gy/fr,25 fr/50 Gy.



- Dose to pace maker could be restricted to 0.6 Gy mean & max of 1.8 Gy, as it was not in the direct radiation field.

- Patient seen daily by cardiologist, monitored with daily ECG & weekly programming.

- RT completed uneventfully & pt doing well on follow up.

Case summary – Case II

68 yr lady

- Pacemaker implantation 2007, for sick sinus syndrome. Patient on 6 monthly pacemaker programming.

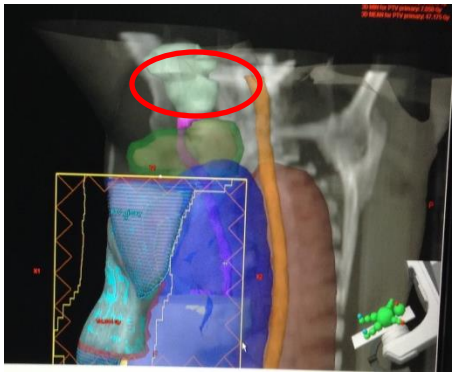
- Ca Lt breast in Jan 2014, Post MRM, Post Chemo T2N2M0.

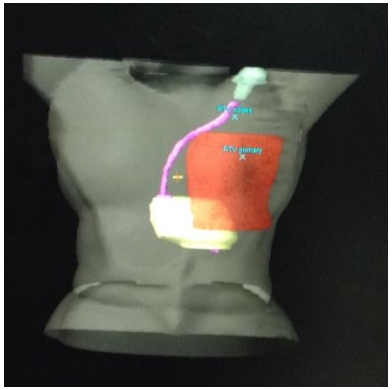
- Pre RT ECG showed incomplete RBBB and 2DEcho was normal.

- More challenging in view of left sided disease and pacemaker was abutting the radiation field.

Treatment Plan

- RT by 3DCRT to left chest wall & SCF, 2Gy/fr,25 fr/ 50 Gy.
- Dose to pace maker was restricted to 0.7Gy mean & max of 2.9Gy by adjusting the field and MLC placement
- Patient was monitored regularly & completed RT uneventfully
- Patient doing well on follow up





Conclusion & Recommendations

1. Liaise with cardiologist to establish level of pacemaker-dependence.

2. Plan radiotherapy to minimize total dose received by pacemaker.
   - Ideally aim for a dose of less than 2 Gy,
   - certainly less than 10 Gy.

3. Institute appropriate level of patient monitoring during radiotherapy. Be aware that minor malfunctions may predict more significant failure.

4. Liaise with cardiologist after completion of radiotherapy to ensure appropriate follow-up.

References:

- 1.Marbach, J. R., Sontag, M. R., Van Dyk, J., & Wolbarst, A. B. (1994). Management of radiation oncology patients with implanted cardiac pacemakers: Report of AAPM Task Group No. 34. *Medical physics*, *21*(1), 85-90.
- 2.Last, A. (1998). Radiotherapy in patients with cardiac pacemakers. *The British journal of radiology*, *71*(841), 4-10.

Acknowledgement

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