IORT: is one stop shopping best

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Disclosures

• Honoraria from Varian
• Non-disclosure agreement with Varian Brachytherapy
Learning Objectives

• To review past and current clinical trials for IORT
• To discuss lumpectomy-scan-plan-treat workflow for IORT
History of IORT for breast

- Targit-A trial
- Eliot trial
- Xoft trial
Risk-adapted targeted intraoperative radiotherapy versus whole-breast radiotherapy for breast cancer: 5-year results for local control and overall survival from the TARGIT-A randomised trial

Lancet 2014; 383: 603–13
Targit-A Trial

- 50 kV x-ray source
- Prescribe 20 Gy to the surface of the applicator
- Dose at 1 cm ~5-7 Gy
- No imaging
- No treatment plan
- No pathology
Targit-A Trial results

Figure 1: Kaplan-Meier analysis of breast cancer and non-breast cancer deaths.

(A) Breast cancer deaths:
- TARGIT 20 events
- EBRT 16 events

Log-rank p = 0.56

(B) Non-breast cancer deaths:
- TARGIT 17 events
- EBRT 35 events

Log-rank p = 0.0086

Number at risk:
- TARGIT: 1721, 1285, 706, 514, 309, 1721, 693, 496, 302
- EBRT: 1730, 1272, 693, 514, 309, 1730, 693, 496, 302

Local recurrence:
- TARGIT 23 events
- EBRT 11 events

Log-rank p = 0.042
The Targit-A trial prescription depth was….

- 55% a. The surface of the applicator
- 15% b. 0.5 cm from the surface of the applicator
- 23% c. 1 cm from the surface of the applicator
- 4% d. The distance to the skin
- 4% e. 2 mm within the skin surface
Answer: A

Risk-adapted targeted intraoperative radiotherapy versus whole-breast radiotherapy for breast cancer: 5-year results for local control and overall survival from the TARGIT-A randomised trial

*Lancet* 2014; 383: 603–13
Eliot Trial

Intraoperative radiotherapy versus external radiotherapy for early breast cancer (ELIOT): a randomised controlled equivalence trial (*Lancet Oncol.* 2013)

21 Gy to the tumor bed using 6-9 MeV electrons
Xoft Trial

Safety and Efficacy Study of the Xoft® Axxent® eBx™ IORT System

iCAD Announces More Than 500 Patients Treated In Study of Intraoperative RadiationTherapy (IORT) For Early-stage Breast Cancer
IORT at UVa
“Dosimetric comparison of 192Ir high-dose-rate brachytherapy vs. 50 kV x-rays as techniques for breast intraoperative radiation therapy: Conceptual development of image-guided intraoperative brachytherapy using a multilumen balloon applicator and in-room CT imaging”
How is UVa different

- Lumpectomy/re-excision performed in brachy suite
- Imaging of sample prior to applicator placement
- Patient is imaged with CT scan (can check placement)
- Multicatheter approach (Contura balloon)
- Volume optimization of dose
- Ir-192 vs 50 kV source
Brachytherapy suite at UVa

CT on Rails

Anesthesia equipment

Slave monitor at treatment console
Hologic Trident Specimen Radiography System
Typical Image from Trident system
Why Ir-192 instead of 50 kV source

- 50 kV dose at surface is 20 Gy
- Dose at 1 cm 5-7 Gy

Is that dose at 1 cm high enough?
- Ir-192 dose at 1 cm (PTV_eval) is 12.5 Gy
- Dose at surface of balloon is still ~20 Gy
“A Pilot, Single Arm Study of the Safety and Feasibility of Single Fraction IORT with CT-on-Rails Guided HDR Brachytherapy for the Treatment of Early Stage Breast Cancer”

- Lumpectomy or re-excision performed in brachy suite
- Contura balloon placed (scan-plan-treat workflow)
- Balloon removed, final closure of wound
- 12.5 Gy to PTV_eval (1cm from surface of applicator)
- Protocol Goal: initial CT scan to completion of brachy in 90 minutes
What to do if placement could be suboptimal?

What if the balloon to skin distance will be < 5 mm?

Wet gauze between balloon and skin
Correction of Balloon Placement

Air between balloon and tissue

Air removed
Results of trial

- Dosimetric parameters recorded: PTV_eval, ptv_1mm, max skin, mean heart, max rib,

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The UVa IORT trial prescription depth is…?

18%  a. The surface of the applicator
11%  b. 0.5 cm from the surface of the applicator
61%  c. 1 cm from the surface of the applicator
d. The distance to the skin
3%   e. 2mm within the skin surface
Dosimetric comparison of 192Ir high-dose-rate brachytherapy vs. 50 kV x-rays as techniques for breast intraoperative radiation therapy: Conceptual development of image-guided intraoperative brachytherapy using a multilumen balloon applicator and in-room CT imaging

Brachytherapy 13 (2014) 502-507
Phase I complete, phase II recently initiated

- “A prospective single arm Phase II study to investigate the efficacy of single fraction IORT with CT on rails guided HDR brachytherapy for the treatment of early stage breast cancer”
- ~240 patients to be studied
Conclusions

There have been weaknesses in previous IORT studies, such as the lack of pathology, imaging, or a true treatment plan, along with low dose away from the applicator, that may have led to poor long term results.

The UVa study using Ir-192, Contura applicators, an optimized treatment plan, and higher dose to the PTV_eval may lead to better long term results.

To date we have shown it is possible to perform this treatment within an acceptable time scale and patient satisfaction has been high.
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