Intraoperative Radiotherapy in Early-Stage Breast Cancer: Long-Term Survival and Real-World Outcomes from Community Hospitals in Baltimore

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Introduction

- **Whole Breast Radiation (WBRT) following** Breast-conserving surgery remains the **standard for most localized early-stage breast cancer**.
- WBRT requires 3-5 weeks of daily treatment, which can be a barrier to completion and adherence; it is also associated with higher cost.
- **Intraoperative radiation therapy (IORT)** delivers a single, targeted dose during surgery as a **partial breast irradiation (PBI)** technique limited to the lumpectomy cavity avoiding radiating the heart and the lung.
- **Clinical trials have demonstrated that IORT achieves efficacy comparable to WBRT** in appropriately selected patients with slight increase in local recurrence rate.
- **IORT is appropriate for patients who meet PBI eligibility criteria or** may struggle to complete multi-week radiotherapy, including rural, elderly and other underserved communities.
- **Real-world data on long-term outcomes in community hospital settings remain limited**; **this study evaluates 5-year overall survival (OS) and progression-free survival (PFS)** among IORT-treated patients at MedStar community hospitals in Baltimore.

Eligibility Criteria for Partial Breast Irradiation

ASBrS Guidelines	
Age	≥45–50 years
Tumor type	Invasive ductal carcinoma (IDC) or Ductal carcinoma insitu (DCIS) ≤3 cm
Margins	Negative (≥2 mm)
Receptors	HR-positive preferred
Nodes	Node-negative (pN0)
Focality	Unifocal disease.

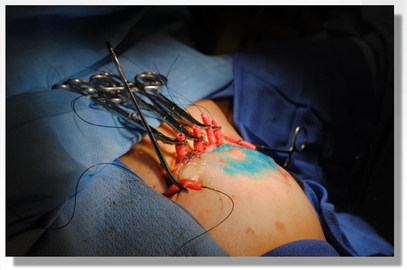
ASTRO Guidelines	
Age	≥50 years
Tumor type	IDC or low/intermediate grade DCIS ≤3 cm
Stage	pT1–T2 (≤2 cm) and node-negative (pN0)
Margins	Negative (≥2 mm preferred)
Receptors	ER-positive
Histology	No lymphovascular invasion
Focality	Unifocal disease.

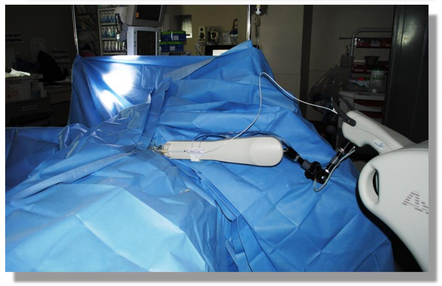
Methods

- **Design**: Prospective cohort across four MedStar community hospitals in Baltimore (enrollment 2013–2019; follow-up through March 2025).
- **IORT Procedure**: Single 20 Gy dose delivered with the Xoft eBx™ electronic brachytherapy system. Minimum ≥10 mm skin-to-balloon spacing confirmed intraoperatively; shielding used when indicated.
- **Eligibility Criteria:** Patients selected according to ASTRO and ASBrS "suitable" criteria for partial breast irradiation (PBI).
- **Expanded Inclusion (<5%):** A small subset who did not fully meet PBI criteria were treated due to anticipated non-completion of postoperative WBRT (e.g., travel distance, socioeconomic barriers, limited support, or expected nonadherence).
- **Endpoints**: Overall survival (OS) and progression-free survival (PFS) estimated via Kaplan–Meier analysis.

IORT delivery during breast-conserving surgery





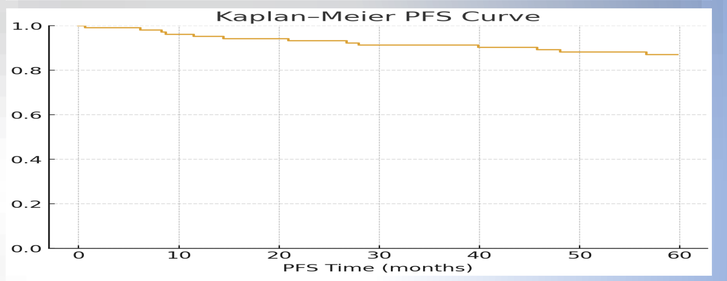


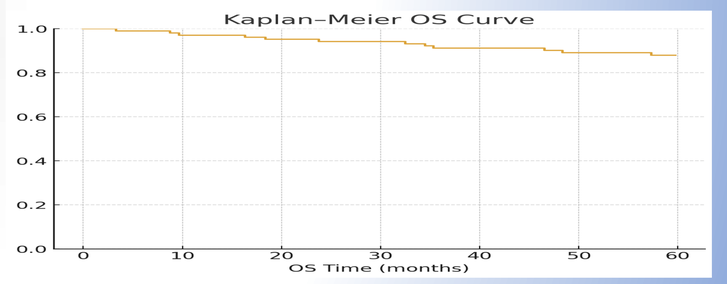


Procedure description: A cavity to accommodate the radiation delivery balloon is prepped following lumpectomy and Intraoperative specimen assessment. Balloon size and fill volume depend on the specimen size. Electronic brachytherapy is delivered to the tumor cavity over the span of 8-15 minutes. Patients with positive sentinel lymph nodes not needing additional surgery received and tolerated whole breast radiation. Skin necrosis necessitating excision and closure occurred in one patient. Cosmesis and skin quality compared favorably with whole breast radiation.

Results

- **Median age:** 65 years (range 45–82).
- **Tumor type:** Predominantly HR+/HER2−; tumor size 0.4–3 cm.
- **PFS** 5-year: 88%
- **OS:** 5-year OS: 88%
- **Toxicity:** No severe late toxicities or unexpected adverse events.





Conclusions

- IORT provided durable local control with survival outcomes comparable to historical WBRT data.
- **Reduced treatment time and improved accessibility make IORT feasible in community hospitals.**
- IORT may mitigate disparities in radiotherapy completion for socioeconomically disadvantaged populations.
- Further studies with larger cohorts and longer follow-up are warranted to refine patient selection and protocols.

References

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