La Radiologia Medica
Nardone, Valerio, et al. "Adjuvant modern radiotherapy in resected pN2 NSCLC patients: results from a multicentre retrospective analysis on acute and late toxicity on behalf of AIRO thoracic oncology study group: the RAC-TAC study." *La radiologia medica* (2024): 1-10.

This is a multicenter retrospective study that evaluates acute and late toxicity in pN2 NSCLC patients who underwent post-operative radiotherapy (PORT) with advanced techniques such as Volumetric Modulated Arc Therapy (VMAT) and Intensity Modulated Radiation Therapy (IMRT). The study, spanning six Italian centers, aims to provide insights into the safety, toxicity, and outcomes of modern radiotherapy.

Background

The landscape for treating pN2 NSCLC patients has evolved significantly, particularly with the results from the LUNG-ART and PORT-C trials. These trials raised concerns about the role of PORT due to mixed outcomes in overall survival and increased toxicity rates. In response, this study investigates PORT's impact using modern radiotherapy technologies

The study included 212 patients (142 males and 70 females), with a median age of 68 years, all of whom underwent surgery for NSCLC followed by PORT.

Patients were treated using VMAT (74.8%) and IMRT (25.2%). The study specifically focused on analyzing radiation-induced toxicity in the heart, lungs, and esophagus.

Acute Toxicity:

- Lung Toxicity: A total of 93 patients (43.9%) experienced lung-related side effects, graded as G1 in 70 patients, G2 in 17, and G3 in 4.
- Esophageal Toxicity: Esophageal side effects were common, with 114 patients affected (53.7%); most were mild (G1 in 89 patients), but 23 experienced G2 toxicity, and 1 patient had severe G3 toxicity.
- Cardiac Toxicity: Cardiac issues were rare, observed in only 4 patients (1.9%), two of whom developed G3 toxicity

Late Toxicity:

- Pulmonary and Esophageal Side Effects: 28.3% of patients developed late toxicity, mainly in the lungs and esophagus.
- Cardiac Effects: There were no reported severe late cardiac complications

Clinical Outcomes

- Disease Recurrence: Over a median follow-up of 54 months, 22.6% of patients had locoregional recurrence, while 50% developed distant metastases, underscoring the persistent challenge of disease control despite effective local management.
- Survival Rates: At the time of follow-up, 66 patients (31.1%) had died. The median overall survival was 51 months

Correlation with Toxicity: The study found significant correlations between dosimetric parameters and toxicities:

- Lung Toxicity: Pre-existing cardiac disease, heart dose (Dmax), and lung radiation volume (V20) were significant predictors.
- Esophageal Toxicity: Female patients and the number of lymph nodes removed were correlated with higher rates of esophageal toxicity

Conclusions

This study demonstrated that modern PORT, when conducted using advanced techniques like VMAT and IMRT, is associated with low rates of severe toxicity (G3 or higher). However, distant metastasis remains a major challenge, with 50% of the patients experiencing disease recurrence outside the irradiated field. These findings underscore the importance of personalized treatment plans that minimize toxicity while addressing the risk of systemic disease progression.

https://link.springer.com/article/10.1007/s11547-024-01885-w

Red Journal

Rodin, Danielle, et al. "Early-Stage Breast Cancer: A Critical Review of Current and Emerging Practice." International Journal of Radiation Oncology* Biology* Physics (2024).

The article provides an in-depth review of recent advancements in the radiotherapeutic management of early-stage breast cancer (ESBC).

Advances in Fractionation:

- Hypofractionation: Traditional RT schedules involved daily treatments over 5-7 weeks. However, clinical trials such as the UK START trials and Canadian studies have established the safety and efficacy of hypofractionated RT, where higher doses are delivered over a shorter time frame (3-4 weeks). This improves patient convenience without compromising long-term outcomes.
- Ultra-hypofractionation: Building on hypofractionation, the FAST-Forward trial introduced even shorter RT schedules (1 week). The trial showed that ultra-hypofractionated RT (delivered in 5 fractions over one week) was non-inferior to conventional regimens. This approach is gaining traction, though long-term follow-up is needed to fully assess late toxicities.

Personalization of Treatment:

- Partial Breast Irradiation (PBI): PBI targets only the lumpectomy site, sparing surrounding tissues. Trials like the UK IMPORT LOW and Danish DBCG PBI studies demonstrated that PBI could effectively reduce recurrence with fewer side effects compared to whole-breast irradiation (WBI). This approach is especially beneficial for older women with low-risk tumors, improving cosmetic outcomes and reducing radiation exposure.
- Radiation Omission: For certain low-risk patients, particularly older women with hormone receptor-positive (HR+) tumors, research has explored omitting RT altogether. Trials such as PRIME-II and CALGB 9343 have shown that, in combination with endocrine therapy (ET), RT omission in low-risk older women results in a modest increase in recurrence risk but has no impact on overall survival.

Boost Radiation for High-Risk Disease

For patients with higher-risk disease, such as young women or those with aggressive tumor features, delivering a radiation boost to the tumor bed post-WBI lowers recurrence rates. The EORTC 22881/10882 trial confirmed that administering a boost significantly reduces local recurrence, especially in younger patients. However, it also increases the risk of fibrosis and other cosmetic side effects, underscoring the need for careful patient selection.

Molecular Profiling for Personalized RT Decisions:

Molecular profiling is revolutionizing treatment by helping stratify patients based on their tumor biology. Trials like LUMINA and the IDEA study have shown that certain patients with favorable genomic profiles can safely avoid RT without compromising long-term outcomes. Genomic assays such as Oncotype DX and PAM50 are now being used to guide decisions on de-escalation of RT, particularly in patients with luminal A-like breast cancer.

Emerging Practices and Future Directions:

- Primary Radiotherapy for Inoperable Patients: For patients who cannot undergo surgery due to comorbidities or unresectable tumors, stereotactic body radiation therapy (SBRT) is being explored. SBRT delivers high doses of radiation in fewer fractions, showing promising results in local control and symptom management, though more research is needed.
- Reirradiation for Recurrence: In cases of local recurrence after initial BCS + RT, reirradiation is emerging as a feasible option to avoid mastectomy. Techniques like partial breast reirradiation (rPBI) using advanced modalities (e.g., 3D-conformal RT and brachytherapy) have demonstrated good local control and acceptable toxicity profiles. The NRG/RTOG 1014 trial confirmed that reirradiation, particularly using partial breast techniques, offers an effective and safe option for managing recurrences.

Conclusion:This review emphasizes the ongoing shift towards personalized radiotherapy in early-stage breast cancer. Advances in hypofractionation, PBI, molecular profiling, and reirradiation are enhancing patient outcomes by minimizing treatment burdens, reducing toxicity, and improving cosmetic results.

https://www.redjournal.org/article/S0360-3016(24)03293-0/fulltext

GREEN JOURNAL

Hurkmans, Coen, et al. "A joint ESTRO and AAPM guideline for development, clinical validation and reporting of artificial intelligence models in radiation therapy." Radiotherapy and Oncology 197 (2024): 110345.

Here are the key points of the joint ESTRO and AAPM guidelines for the development, clinical validation, and reporting of artificial intelligence (AI) models in radiation therapy, along with the associated statements:

Objective: To provide a cohesive guideline for the development, validation, and reporting of AI models to facilitate their adoption in clinical radiation therapy practices.

Delphi Process: The guideline was developed using a Delphi process with expert consensus on relevant topics, including decision-making, image analysis, volume segmentation, treatment planning, and ethics.

Validation: AI models must undergo rigorous validation using real-world data, including external validation. Standardized metrics should be reported to enable consistent benchmarking across models.

Quality Assurance (QA): AI models must be subject to regular QA, including patient-specific QA and periodic updates or upgrades, to ensure their safety and efficacy over time.

Ethics: Ethical and legal considerations, such as patient privacy, liability, and transparency, are critical. Guidelines from the European Union and the United States address these challenges, and AI products must meet specific regulatory requirements.

Clinical Applications: AI can enhance various aspects of radiation therapy, including decision-making, volume segmentation, treatment planning, and adaptive therapy, but requires careful validation to ensure clinical utility.

Conclusion: The guideline serves as a reference for developing transparent, safe AI models, but given the rapid advancements in AI, periodic updates to the guidelines will be necessary.

Key Statements:

1.Decision-Making:

- Statement 1: Decision-making should rely on models created following published guidelines for development and in silico validation (highly recommended).
- Statement 2: Models used for decision-making should be validated through monitoring patient conditions and in prospective clinical trials (highly recommended).

2. Image Analysis:

- Statement 3: When deep learning (DL) reconstruction algorithms are used, there should be formal documentation of the method, software version, and reconstruction parameters (recommended).

3. Volume Segmentation:

- Statement 4: Plan quality metrics should encompass dose, robustness, and complexity metrics with defined acceptance criteria (highly recommended).
- Statement 5: Qualitative scoring should be performed before and during initial clinical deployment (recommended).

4. Patient-Specific QA:

- Statement 6: Models should be validated for specific combinations of patient group, technique, and equipment before clinical use, preferably using multi-institutional data (highly recommended).
- Statement 7: Results should include clinically relevant metrics such as sensitivity and specificity (highly recommended).

5. Adaptive Treatment:

- Statement 8: Auditing patient outcome data by the interdisciplinary care team is an important quality safeguard (highly recommended).
- Statement 9: Collection and standardization of minimal common data sets is important for building interpretable prediction models (optional).

6.Training, Validation, and Testing of AI Parameters:

- Statement 10: Checklists should be used to ensure reproducible AI development (highly recommended).

7. Model Availability for Others to Verify:
    - Statement 11: Externally developed models can be used in other institutions after careful implementation (highly recommended).
    - Statement 12: The end user should verify that the model is trained and validated on the intended population (highly recommended).

8. Model QA/Updates and Upgrades:
    - Statement 13: Ethical standards from EU and North American regulatory bodies must be considered when deploying AI products (highly recommended).
    - Statement 14: AI tools should undergo periodic QA and be prepared for updates and upgrades before clinical introduction (highly recommended).
9. Trustworthiness:
    - Statement 19*: Trustworthy AI is key to safe and beneficial implementation in radiotherapy (recommended).

https://www.thegreenjournal.com/article/S0167-8140(24)00615-7/fulltext

Bianca Santo

UOC Radioterapia, Ospedale “Vito Fazzi”, Lecce