Another propensity score analysis compared SBRT with sublobar resection for stage I NSCLC in patients at high risk for lobectomy (8). In 53 matched pairs the difference in overall survival was not significant and the cumulative incidence of cause-specific death was comparable between both groups. Conclusion of this study was that SBRT can be an alternative treatment option to sublobar resection for patients with severe comorbidity who cannot tolerate lobectomy due to functional impairment (8).

In June 2015 the “Comité del’Evolution des Pratiques en Oncologie (CEPO) from Québec, Canada published recommendations regarding the use of SBRT (9). For medically operable patients with T1-2N0M0 NSCLC surgery remains the standard treatment due to the lack of high-level evidence and valid comparative data. For medically inoperable patients with T1-2N0M0 NSCLC or medically operable patients who refuse surgery, SBRT should be preferred to external beam radiotherapy. In the latter cases a biological equivalent dose (BED) of at least 100 Gy should be administered. The choice of using SBRT should be discussed within a multidisciplinary tumor board. Radiotherapy should not be considered for patients whose life expectancy is very limited because of comorbidities. In summary, main points are:

- surgery remains the treatment of choice for operable early-stage NSCLC
- SBRT may be considered for functionally compromised patients who cannot tolerate lobectomy
- further high-level evidence is needed which requires close cooperation between radiation oncologists and thoracic surgeons to design comparative trials with clear inclusion criteria and unequivocal definitions of endpoints.

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Debate: Is brachytherapy the best for partial breast irradiation?

**SP-0305**
IORT is the best for PBI

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Over the past ten years the results of several clinical trials have been published, detailing various approaches of PBI. Among the different techniques used, IORT has increased rapidly in popularity, mainly in Europe, and up to date many thousands of women have been treated in clinical setting. IORT allows to realize a radiation dose to the index quadrant, eliminating the treatment to the tissue remote from the tumour bed, and using only one very high dose (20 Gy or more) in a single session. When single doses above certain thresholds of 10 Gy are given, some additional biological effects on tumor cell killing and from the surrounding microenvironment can be expected. IORT also represents the possibility of overcoming some constraints such as the accessibility to the centres of radiotherapy, the socio-economic impact on the working life and on the personal habits of the patient. Another important advantage is the avoidance of the interactions with the systemic therapy, that may determine delays in the initiation or in the carrying out of the adjuvant treatment. These potential benefits must be balanced with the potential higher risk of recurrence within the untreated gland tissue in the same breast as well as the still unknown long-term results on survival and cosmesis. Two prospective randomized clinical studies establishing the role of IORT in clinical practice have been published up to now. A single-center study, named ELIOT, was performed at the European Institute of Oncology (EIO) in Milan, Italy. Patients with limited size tumor (2.5 cm) and age of 48 years or more were either randomized to a single dose of 21 Gy of IORT with electrons or to standard WBI. The local recurrence rate (LRR) at 5-years was higher in the experimental arm (4.4%...
Versus 0.4%), and just fell within the pre-defined non-inferiority margin of 4.5%. However, in patients with low risk factors like suggested by the ESTRO or ASTRO consensus criteria, there were not statistically different LLRs in both arms, and also in patients with luminal A molecular subtype the LLR was very low in the IORT arm, about 1%. It was also found that there was no significant difference in the 5-year overall survival rate in two arms, that is, 96.8% in the ELIOT arm and 96.9% in the EBRT arm. For patients with higher risk factors, a new strategy has been now developed, which include a hypofractionated WBI to be given after surgery and ELIOT. The TARGIT-A trial was a multicentric trial. The inclusion criteria were stricter than in the ELIOT trial. It includes patients with moderate small breast cancer with axillary histology and tested the concept of risk-adapted single-dose IORT, which was followed by external-beam WBI in patients with additional unfavorable risk factors. The latest published results from the TARGIT-A trial, with a median follow-up of 2 years and 4 months, reported a LRR with IORT of 3.3% and with EBRT of 1.3, meeting the non-inferiority margin of 2.5%, set at the outset. Overall, breast cancer mortality in the IORT arm was 2.6% versus 1.9% in the WBI arm. In addition, non-breast cancer deaths were found to be significantly reduced in the IORT arm: 1.4% versus 3.5%, with p = 0.0086. Toxicity and cosmesis were assessed by patients having been offered an informed choice.

Several clinically controlled randomized trials on accelerated partial breast irradiation (APBI) are currently being conducted and some of these have now published results. The trials have used different strategies, for example different patient selection criteria, doses and number of fractions, treatment time, treatment planning, and radiation techniques. Many trials have compared the APBI treatment to whole breast irradiation (WBI) 50 Gy/25 fr followed by a boost. External beam APBI is an attractive strategy, because every radiation department will be able to offer this treatment option. The benefits for technical skills is in principle not higher than for conventional dose planning. Few randomized trials have reported data, but unfortunately the largest one has not been promising. In the phase III randomized RAPID trial significantly worse cosmetic outcome was reported with median follow up 36 months in 2135 patients randomized 1:1 to APBI based on 3D-CRT with 38.5 Gy/10 fractions, 5 days, versus WBI based on 42.5 Gy/16 fr or 50 Gy/25 fr +/-boost. Adverse cosmesis was higher in APBI-treated patients compared with WBI patients as assessed by trained nurses (29% vs 17%; p=0.001) and by patients (25% vs 18%; p=0.02). Grade 3 adverse events were seen in 1.4% of APBI patients, and not in WBI patients. With median 5 years follow up data from another phase III trial involving 520 patients randomized to APBI with IMRT using 30 Gy/5 fr versus WBI using 50 Gy/25 fr + boost has been reported by Livie and coworkers. Significant cosmetic results were seen in 3% of APBI patients regarding acute (p=0.0001), late (p=0.004) and cosmetic morbidity (p=0.045). Local recurrence was seen in 1.5% of the patients. Thus data from large phase III trials supporting routine use of external beam APBI at the present time are not available. However, it is to be expected that the UK IMPORT LOW Trial will be able to report data from >2000 patients with median 5 years follow up at the Early Breast Cancer Conference (EBCC) Copenhagen, March 2004. In that trial the strategy is based on 40 Gy/15 fr in all 3 arms, where arm 1 is WBI, arm 2 is partial breast irradiation, and arm 3 has a gradual dose using 40 Gy/15 fr to partial volume and 36 Gy/15 fr to residual breast. At EBCC, data on morbidity will also be reported from the DBCG PBI trial, which has included >800 patients and randomized them to APBI versus WBI using 40 Gy/15 fr in both arms. Data from these 2 trials will be presented and discussed at ESTRO 35. If the results from the IMPORT LOW Trial show that PBI using 40 Gy/15 fr is safe, and these data are supported by results from the DBCG PBI trial using the same treatment strategy, there is support for the statement that IMRT is the best for PBI.

However, we are also awaiting results from the ongoing NSABP B-39/RT0G 0413 trial, which has accrued >4000 patients, who were randomized to APBI versus WBI. The majority of patients in the APBI arm have been treated with 3D-CRT. Many of the APBI trials were designed and initiated a decade ago, where the local recurrence risk was higher than we see today. Therefore some of these trials are underpowered to support the statement they are investigating. For WBI, it is more expected that results from several trials investigating external APBI will be published in the near future, and hopefully results from the trials will be included in meta-analyses to achieve enough statistical power to identify subgroups of patients where APBI is safe and other subgroups where WBI is to be preferred.

**SP-0307**

**Dosimetric pros and cons of available PBI techniques**

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Partial breast irradiation (PBI) can be performed with various techniques including both brachytherapy (BT) and external beam radiotherapy (EBRT). These methods differ from each other regarding technical skill and dosimetric characteristics. Recent developments in imaging, dose calculation algorithms and beam delivery techniques have made all methods clinically feasible, but in most institutions the applied method mostly depends on the physician’s preference and the technical availability.

Among all techniques the longest experience exists with multicatheter interstitial BT which can provide highly conformal dose distribution, large dose gradient at target edge, but it is quite complex and requires certain manual skillfulness. The possible geometric miss can result in significant under dosage of the target.

Technically, the intracavitary applicators are easier to be used and with balloon applicators the same volume at the same time; it can occur, but proper tissue conformance is not always guaranteed. In dosimetric point of view drawbacks of the Mammosite applicator are the spherical dose distribution, the symmetric margin and the potential high dose to skin, lungs and ribs. In some anatomical situation the balloon can be asymmetric resulting in asymmetric target coverage. The multichannel applicators are more flexible regarding shaping the dose distribution and reducing dose to critical structures without compromising the target volume coverage. With these applicators asymmetric margins can be used to a small degree.

At *intraoperative electronic BT* using spherical applicators the dose distribution is also spherical and a large dose inhomogeneity develops due to the sharp dose fall-off of the low energy X-ray beam. The margin is always symmetric, but the geometric accuracy is always ensured.

At *intraoperative irradiation with electron beams* there is no 3D-defined target volume, modulation possibilities to shape the dose distribution are very limited and conformal radiotherapy cannot be performed.

Linear accelerators based EBRT techniques expose relatively large volumes of non-target breast to high dose mainly due to the extended target volume created from CTV. In three-dimensional conformal radiotherapy (3D-CRT) dose to contralateral breast, lung or heart can be reduced with