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REVIEW

Is excision alone adequate for low-risk DCIS of the breast treated with breast conserving therapy

Reevaluating the role of adjuvant radiation therapy

Chirag Shah · Thomas B. Julian · J. Ben Wilkinson · Simona F. Shaitelman · Atif Khan · Steven Finkelstein · Frank A. Vicini

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Abstract
Background Ductal carcinoma in situ (DCIS) represents a quarter of newly diagnosed breast neoplasms, with the majority of cases detected on routine screening mammography in asymptomatic women. Currently, most women with newly diagnosed DCIS are eligible for breast conserving therapy (BCT); however, significant controversy exists regarding whether or not to add radiation treatment (RT) after surgical excision in low-risk patients.

Results While four older prospective randomized clinical trials have shown that the addition of RT after lumpectomy reduces the risk of ipsilateral breast tumor recurrence (IBTR) by approximately 50 %, recent studies have continued to attempt to identify a subset of patients with favorable risk DCIS who are at a sufficiently low-risk of IBTR that omitting RT might be reasonable. While a number of smaller studies have shown promising results, recent prospective data have consistently affirmed the increased risk of IBTR with the omission of RT, with no subset of patients consistently identified that can be safely observed without RT. While radiation after lumpectomy remains the "standard of care," even in these low-risk patients, future directions include improvements in genetic assays to better identify low-risk patients and new RT techniques and schedules that can potentially reduce the duration of therapy and toxicity while improving quality of life for patients.
Conclusion Based on the data available, we continue to recommend radiation therapy for low-risk patients with DCIS as no discernible subset has been identified that does not benefit from radiation therapy.

Keywords Ductal carcinoma in situ · Radiation therapy · Excision · Breast conserving therapy

C. Shah
Department of Radiation Oncology, Washington University School of Medicine, Saint Louis, MO, USA

T. B. Julian
Department of Surgical Oncology, Drexel University College/ Allegheny General Hospital, Pittsburgh, PA, USA

J. B. Wilkinson
Department of Radiation Oncology, Oakland University William Beaumont School of Medicine, Royal Oak, MI, USA

S. F. Shaitelman
University of Texas M.D. Anderson Cancer Center, Houston, TX, USA

A. Khan
Department of Radiation Oncology, The Cancer Institute of New Jersey, Robert Wood Johnson University Hospital, New Brunswick, NJ, USA

S. Finkelstein
21st Century Oncology, Scottsdale, AZ, USA

F. A. Vicini (✉)
Michigan Healthcare Professionals/21st Century Oncology, 28595 Orchard Lake Road, Farmington Hills, MI 48334, USA
e-mail: fvicini@rtsx.com

Introduction

Ductal carcinoma in situ (DCIS) represents 15–20 % of breast neoplasms diagnosed, with over 50,000 new cases diagnosed per year in the United States [1]. To date, no randomized Phase III trials comparing mastectomy and breast conserving therapy (BCT) have been performed in

patients with DCIS, with data supporting BCT extrapolated primarily from early stage invasive randomized trials and large retrospective series [2, 3]. Based on these studies, excellent outcomes are noted, with a 5–10 % local failure rate at 10 years and a 98 % 15-year cause-specific survival [3]. Unfortunately, because traditional techniques for adjuvant radiation therapy (RT) following breast conserving surgery (BCS) require a 5- to 6-week treatment duration, recent studies have found that up to 20–50 % of women with DCIS do not receive the radiation therapy (RT) component of their BCT placing them at a higher risk for ipsilateral failure; of note, some of these patients fail to receive RT due to surgeon preference, clinical practice guidelines, and socioeconomic factors [4–8].

The clinical benefit of RT in women with DCIS has been previously examined in several randomized trials from the United States and Europe. Each of these trials has consistently demonstrated an approximately 50 % reduction in local control/ipsilateral breast tumor recurrence (IBTR) with no cause-specific or overall survival benefit noted to date [9–12]. However, questions remain as to whether there exists a subset of low-risk DCIS patients for whom RT may not be necessary. This is secondary to adjuvant RT failing to demonstrate a survival benefit, requiring an extended duration of treatment, and having the potential to cause acute and late toxicities. Therefore, the purpose of this review is to examine the evidence supporting the use of RT in DCIS and in particular, recent data examining the potential omission of RT in low-risk cohorts as well as to research avenues on the horizon in DCIS.

Discussion

Initial randomized trials

From 1985 to 1999, four separate randomized trials enrolled a total of 4,596 patients with the purpose of evaluating the role of radiotherapy following BCS in women with DCIS. The National Surgical Adjuvant Breast and Bowel Project (NSABP) B-17 trial enrolled 818 patients with negative surgical margins (no tumor on ink) following BCS to whole breast irradiation (WBI) or observation following BCS. Radiation therapy was delivered to a dose of 50 Gy using traditional radiotherapy techniques with 9 % of patients receiving a dose beyond 50 Gy. With greater than 10-year follow-up, the addition of WBI reduced rates of IBTR by 50 %, from 32 % to 16 %, with similar benefit seen for invasive and non-invasive recurrences [9–13]. Multivariate analysis identified moderate/marked comedonecrosis and uncertain/positive margins to be associated with IBTR [9]. The above findings were confirmed by the European Organisation for Research and Treatment of Cancer (EORTC) 10853 trial which randomized 1,010 women with DCIS less than 5 cm and negative surgical margins to WBI (50 Gy) or observation. At 10 years, the addition of RT was associated with a 47 % reduction (26 % vs. 15 %) in IBTR, with all subgroups benefitting. Local recurrence was associated with age less than 40, grade 2/3 disease, uncertain margin status, failure to receive radiation therapy, and cribiform/solid growth pattern [10]. The Swedish DCIS trial enrolled 1,067 women with DCIS to a similar randomization to the NSABP/EORTC trials; target margins were 1 cm or greater but microscopic margin negativity was not required. At 10 years, RT reduced the rate of IBTR 40 % (22 % vs. 10 %) and no subgroup was identified that failed to benefit from RT [11]. Limitations of these three trials (NSABP, EORTC, Swedish) include higher rates of close/positive margins than seen in modern series, using a no tumor on ink definition for negative margins, larger tumors/higher-risk patients than are seen in current series, and a lack of hormonal therapy utilization [11].

The fourth randomized trial was the United Kingdom Coordinating Committee on Cancer Research (UKCCCR), which included a 2×2 randomization such that following BCS, patients could receive RT, RT plus tamoxifen, tamoxifen alone, or no adjuvant therapy. With over 12 years of follow up, RT was found to reduce invasive IBTR (HR= 0.32) and non-invasive IBTR (HR=0.38) with an overall reduction in IBTR of 12.3 % (19.4 % vs. 7.1 %). Limitations of this study included that approximately 50 % of patients underwent only one randomization, microinvasive disease was included, and margins were as defined as no tumor to the edge of specimen [12]. A meta-analysis of these four trials from the Early Breast Cancer Trialists Collaborative Group (EBCTG) found that radiotherapy reduced IBTR at 10 years (28 % vs. 13 %) and women greater than 50 years old derived the largest benefit from RT. Women with small, low-grade tumors, however, still derived a benefit in this analysis from RT in terms of IBTR (30 % vs. 12 %). Radiation therapy reduced the rates of IBTR independent of age, surgical technique, disease presentation, and tamoxifen usage but did not impact the rate of cancer-specific mortality or all-cause mortality; however, extrapolating from the EBCTG meta-analysis of invasive disease, prevention of invasive IBTRs reduces breast-cancer related mortality and with 50 % of all ipsilateral recurrences being invasive for DCIS patients, there is potentially a mortality benefit with larger numbers of patients examined [14, 15]. Based on these initial trials, no low-risk subset of patients for whom RT may not be necessary has been identified; however, this may be secondary to the limitations of these trials as noted above. Table 1 summarizes these initial randomized trials.

Over the past decade, increasing data has been published regarding the role of radiotherapy in patients with DCIS following BCS. One of the initial concerns regarding the

Table 1 Review of prospective randomized trials evaluating adjuvant radiotherapy following breast conserving surgery in patients with DCIS

	NSABP B-17		EORTC 10853		Swedish DCIS		UKCCCR	
	No RT	RT	No RT	RT	No RT	RT	No RT	RT
Number of Patients	818		1,010		1,067		1,701	
Mammographically detected	81.1 %	80.5 %	70 %	73 %	78.5 %	78.9 %	Not reported	
Mean size (mm)	13	12	20	20	≈15	≈15	Not reported	
Positive margins	0 %	0 %	0 %	0 %	11 %		Not reported	
Median follow-up (months)	207		128		102		151	
Local recurrence/ IBTR	35 % (n=141)	19.8 % (n=81)	26 % (n=132)	15 % (n=75)	21.6 % (n=141)	10.3 % (n=64)	19.4 % (n=105)	7.1 % (n=40)
Invasive	19.6 % (n=79)	10.7 % (n=44)	13 %	8 %	12.3 % (n=64)	7.2 % (n=38)	9.1 % (n=50)	3.3 % (n=19)
Non-invasive	15.4 % (n=62)	9.0 % (n=37)	14 %	7 %	14.8 % (n=77)	4.9 % (n=26)	9.7 % (n=51)	3.8 % (n=21)
Contralateral failure	7.9 % (n=32)	9.3 % (n=38)	4 %	8 %	5.9 % (n=31)	6.5 % (n=34)	4.1 % (n=21)	3.3 % (n=18)

NSABP National Surgical Adjuvant Breast and Bowel Project, *EORTC* European Organisation for Research and Treatment of Cancer, *DCIS* ductal carcinoma in situ, *UKCCCR* United Kingdom Coordinating Committee on Cancer Research, *RT* radiation therapy, *IBTR* ipsilateral breast tumor recurrence

four randomized trials hinged on their definition of negative surgical margins (no tumor at margin/on ink). Data from the NSABP B-24 trial evaluated a subset of patients receiving BCS and RT and found a difference in the rate of IBTR for surgical margin negative patients (13 %) compared with those with positive margins (23 %) [16]. This was confirmed by a retrospective series of 294 patients from Memorial Sloan Kettering which found surgical margin status to be associated with rates of IBTR. In patients receiving RT, the relative reduction in IBTR with RT decreased as the surgical margin increased (<1 mm: 83 %, 1–9 mm: 70 %, ≥10 mm 24 %), with no statistically significant benefit to RT noted in those with margins 10 mm or greater. Furthermore, high-volume disease near the margin was associated with a greater benefit to RT [17]. A retrospective, pooled analysis of 994 patients also found a significant reduction in IBTR based on margin status, with a rate of 19 % for positive margins, 9 % for close margins (<2 mm), and 4 % for negative margins [18]. However, the EBCTG meta-analysis analyzed the impact of surgical margin status and found RT to reduce the rate of IBTR for both surgical margin negative (26 % vs. 12 %) and positive patients (44 % vs. 24 %) [15]. Based on this data, questions have arisen as to the true ideal margin in patients with DCIS and whether there exists a subset of patients with favorable characteristics who may be treated with excision alone when that excision incorporates large surgical margins [19].

Another limitation of the initial three (NSABP, EORTC, Swedish) of the randomized trials is the lack of a tamoxifen only arm. Data from the NSABP B-24 trial, which randomized 1,799 patients receiving BCS and RT to the addition of tamoxifen (20 mg daily for 5 years) or no further treatment, demonstrated that endocrine therapy reduced the rate of IBTR as well as contralateral breast tumors [13, 20]. This was confirmed by the UKCCCR trial, which found that tamoxifen reduced all new breast events (HR 0.71), non-invasive IBTRs, and contralateral tumors although an impact on invasive IBTRs was not identified [12]. Based on these findings, several investigators have hypothesized that the benefit of RT may be limited in low-risk cases treated with BCS and adjuvant tamoxifen.

Recent series

Multiple retrospective series have evaluated outcomes following excision alone in patients with DCIS. An early series from the Joint Center for Radiation Therapy evaluated 59 patients treated with excision alone and found a 5-year IBTR rate of 10 % despite all patients having negative surgical margins [21]. Silverstein et al. evaluated 469 patients treated with BCS with or without RT and found that in patients with margins of 10 mm or greater (n=93), the 8-year rate of recurrence was 3 % without radiotherapy, with no benefit for RT noted; however, a recent update demonstrated a 13.9 % rate of IBTR at 12 years for this cohort of patients compared with 2.5 % for the RT cohort [22, 23]. Limitations of this series include its retrospective nature and potential for bias, as treatment was selected by treating physicians. Also, patient specimens underwent

serial sectioning which is not utilized routinely. Another series from Nottingham evaluated 256 patients treated with surgery alone with 10 mm surgical margins required; the crude rate of IBTR was 10 % (n=28) with a median follow up of 86 months [24]. A more recent population-based study from the Netherlands evaluated 798 patients and found a decreased recurrence-free survival (75 % vs. 91 %) with the omission of RT [25]. Finally, a retrospective analysis from the French Cancer Centers evaluated 705 patients treated with BCS and at median follow up of 7 years found an IBTR rate of 12.6 % with radiotherapy and 32.4 % without [26]. Limitations of these studies also include their retrospective nature but more importantly, a lack of a clearly defined low-risk group.

Due to findings noted above, three prospective trials accrued low-risk DCIS patients from 1995 to 2006 in an attempt to determine if RT could be omitted and are summarized in Table 2. The Eastern Cooperative Oncology Group (ECOG) E-5194 trial was a prospective non-randomized trial that enrolled 670 patients to observation following BCS; eligibility requirements were low/intermediate-grade DCIS that was 2.5 cm or smaller or high-grade DCIS that was 1 cm or smaller with all cases requiring 3 mm or wider surgical margins following sequential sectioning. Tamoxifen use was not allowed until a protocol amendment in 2000, and only 30 % of patients received adjuvant endocrine therapy. At 5/10 years, the rate of IBTR was 6.1 %/15.4 % and 15.3 %/15.1 % for the low/intermediate and high-grade cohorts, respectively, suggesting that with long-term follow up that low-grade patients have similar rates of IBTR with a longer time to recurrence; limitations of the long-term data includes a limited number of patients having follow up to 10 years and the underutilization of tamoxifen in the study cohort [27, 28].

A second prospective trial evaluating excision alone comes from the Dana-Farber Cancer Institute where patients with low/intermediate-grade DCIS measuring 2.5 cm or less with surgical margins greater than 1 cm were observed following BCS without adjuvant tamoxifen. The Phase II trial was closed prematurely following enrollment of 158 patients due to a 5-year IBTR rate of 12 %, which is higher than the rates seen in previous series [29]. However, the trial included patients with nuclear grade that was "predominantly" grade 1 and 2, thus allowing some grade 3 components and therefore, having a higher rate of local recurrence than might be observed in other trials due to the inclusion of higher grade lesions.

The Radiation Therapy Oncology Group (RTOG) 9804 trial was designed as a randomized Phase III study, in which women with mammographically detected low/intermediate grade DCIS measuring less than 2.5 cm and 3 mm or greater margins would be randomized to observation or RT with or without tamoxifen following BCS. Radiation therapy on this trial could be delivered with standard fractionation (50–50.4 Gy/25–28 fractions) or hypofractionation (42.5 Gy/16 fractions), with no boost delivered. The trial was designed to accrue 1,790 patients; however, due to slow accrual, this trial was closed in 2006 with only 636 patients enrolled. A

Table 2 Modern prospective series evaluating excision alone

Type of Series	ECOG E-5194		Dana Farber	RTOG 9804	
	Non-randomized two arm		Non-randomized single arm	Randomized	
	Low Risk	High Risk		No RT	RT
Number of patients	565	105	158	636	
Mammographically detected	100 %	100 %	94 %	100 %	
Median size (mm)	6	5	9	–	
Median age	60	59	51	59	
Margins (mm)	>3	>3	>10	>3	
Low/intermediate grade	100 %	0 %	100 %	100 %	
High grade	0 %	100 %	0 %	0 %	
Tamoxifen	31.3 %	28.6 %	0 %	62 %	
Central pathology review	97 %		100 %	0 %	
Median follow-up (mo)	74	79	40	78	
Local Recurrence/IBTR (5/7 year)	6.1 %/10.5 % (n=49)	15.3 %/18.0 % (n=17)	12 % (n=13)	3.2 % (n=15)	0.4 % (n=2)
Invasive	3.2 %/5.6 % (n=26)	5.4 %/6.4 % (n=6)	3.7 % (n=4)		
Non-invasive	2.9 %/4.9 % (n=23)	9.9 %/11.6 % (n=11)	8.3 % (n=9)		
Contralateral failure (5/7 year)	3.7 %/4.8 % (n=23)	3.9 %/7.4 % (n=6)	(n=8)	1.9 %	3.0 %

ECOG Eastern Cooperative Oncology Group, *RTOG* Radiation Therapy Oncology Group, *RT* radiation therapy, *IBTR* ipsilateral breast tumor recurrence

recent analysis of patients who were enrolled found the 5-year rate of IBTR to be 3.2 % in the observation arm compared with 0.4 % in the RT arm, representing an 86 % relative reduction in IBTR; however, longer follow up is needed to assess whether RT provides a meaningful difference in rates of IBTR. Further, no true recurrences (in the quadrant of the primary) were noted in the RT arm while 2/3 of recurrences in the observation arm were deemed to be true recurrences. Importantly, rates of toxicity were low, with a 4 % any grade 3 or greater toxicity for both arms [30].

Beyond prospective and retrospective series evaluating low-risk DCIS, there exists the potential to extrapolate from modern series evaluating patients with low-risk invasive cancers exists as well. The Cancer and Leukemia Group B 9343 trial was a randomized trial enrolling low-risk women with early stage invasive disease (70 years or older, tumor 2 cm or less, estrogen receptor positive, clinically node negative) to tamoxifen alone following BCS or RT and tamoxifen. A recent 10-year update of this trial found the rates of IBTR and loco-regional recurrence to be higher without RT (8 % vs. 2 % and 9 % vs. 2 %) with no impact on survival [31]. However, a trial from Canada that randomized women age 50 years or older with node-negative T1/2 tumors and negative surgical margins to tamoxifen with or without RT found that not only were rates of IBTR increased (7.7 % vs. 0.6 %) without RT but disease-free survival was reduced (84 % vs. 91 %). When evaluating a lower-risk subgroup from this trial (tumor 2 cm or less, estrogen receptor positive), the benefit of RT on IBTR held (5.9 % vs. 0.4 %) [32]. Finally, an Austrian randomized trial of 869 women with node-negative, hormone-receptor positive breast cancer less than 3 cm randomized patients to hormonal therapy (tamoxifen/Arimidex) with or without RT. At 5 years, RT reduced the rate of IBTR (5.2 % vs. 0.4 %) and overall relapses (6.1 % vs. 2.1 %) with no impact on survival [33].

Guidelines/prognostic classification

Multiple sets of guidelines and prognostic indices have been developed in order to guide clinicians as to what subset of patients with DCIS should receive radiotherapy following BCS. The National Comprehensive Cancer Network (NCCN) currently states the lumpectomy with adjuvant whole breast radiotherapy is a category 1 recommendation while lumpectomy alone is a category 2B recommendation regardless of clinical or pathologic factors. These guidelines note a lack of survival benefit regarding the use of radiotherapy for low-risk in situ disease but they do not specifically outline a subset of patients for which RT can be omitted [5]. The Van Nuys prognostic index (VNPI) represents an alternative guideline to help clinicians select patients requiring adjuvant radiotherapy and extent of surgery. The index utilizes tumor size (≤1.5, 1.5–4.0, >4 cm), margin status (≥1 cm, 1–9 mm, <1 mm), grade (Grade 1–2, Grade 1–2 with necrosis, Grade 3) and age (>60, 40–60, <40 years) and assigns each category a scale from one to three. Based on initial publications, patients with scores of 4–6 could be treated with excision alone, as no benefit to RT was seen, while patients with scores of 7–9 benefitted from adjuvant RT, and those with scores of 10–12 required mastectomy due to high rates of IBTR with BCS and RT [34, 35]. Unfortunately, independent attempts to validate this index have not found it to be prognostic; McAusland et al. [36] retrospectively analyzed 222 patients and found no correlation between VNPI and risk of IBTR. This was confirmed by an Italian series of 259 patients that found no correlation between rates of IBTR and the VNPI [37]. An additional limitation of the VNPI, beyond the lack of external validation, is their use of serial sectioning which is not utilized routinely in the majority of clinics due to cost and time limitations.

More recently, a nomogram was developed at Memorial Sloan Kettering Cancer Center based on 1,868 consecutive patients treated between 1991 and 2006. The nomogram incorporates age at diagnosis, family history, initial presentation, radiation therapy, endocrine therapy, nuclear grade, necrosis, margins, number of excisions, year of treatment into a composite score between 0 and 500 with the dominant factors being radiation therapy (yes — 0 points, no — 100 points) and endocrine therapy (yes — 0 points, no — 80 points). Based on this nomogram, at 10 years, the risk of IBTR ranges from 5 % with a score of 150 to over 60 % with a score of 450 [38]. However, this nomogram was evaluated by Yi et al. [39] and, it was found that the nomogram failed to demonstrate an acceptable calibration based on a series of 734 patients.

Future directions

One potential direction for better selecting low-risk DCIS patients is utilizing novel assays based on tumor genetics that can identify tumor genetic profiles that portend improved prognosis. Available assays, including those developed by Genomic Health (Oncotype DX®, Redwood City, California) and Agendia, Inc. (MammoPrint®, Irvine, California), are 21- and 70-gene tests, respectively, that provide prognostic information for hormone-receptor positive, node-negative invasive cancers. Results from these tests provide a recurrence score to stratify patients into risk groups with data demonstrating the relative benefit from chemotherapy for each risk category [40–43]. Initially these assays were not designed to be utilized in patients with DCIS; however, recent analysis of the ECOG E-5194 trial from Solin et al. has demonstrated the feasibility of using new assays specific for patients with in situ disease. The new assay, the

Oncotype DX® assay (DCIS Score™), uses a 21-gene assay with 16 cancer genes (identified based on correlation with distant recurrence free survival from a cohort of 447 patients) and five reference genes. When 327 cases from the ECOG trial were evaluated using DCIS Score™, it was found that a continuous scoring system that was associated with rates of IBTR. When stratifying patients into low (score <39), intermediate (39–54), and high (>55), the rates of IBTR were 12.0 %, 24.5 %, and 27.3 % at 10 years [28, 44]. As further studies confirm the validity of these assays in patients with DCIS, prospective studies will need to be performed in order to determine if RT can safely be omitted based on recurrence profiles generated from these assays.

An alternative approach being investigated through the NSABP B-43 trial is the usage of trastuzumab in patients with DCIS that is Her2 positive. Patients treated with lumpectomy undergo central Her2 testing and will be stratified by menopausal status, hormonal therapy, and grade. Patients randomized to trastuzumab will receive two doses 3 weeks apart [45].

An alternative direction rather than omitting RT is to use new techniques and schedules to address concerns regarding radiation including the duration of treatment and potential for increased toxicity compared with BCS alone. Hypofractionation schedules can be utilized to deliver treatment in approximately 3 weeks, reducing treatment duration by roughly 50 %. One the largest randomized trials was conducted by Whelan et al. [46], which demonstrated equivalent outcomes and toxicity compared to traditional WBI; however, this series excluded DCIS patients. A recent series from Princess Margaret Hospital of 266 patients evaluated hypofractionated RT in patients with DCIS and reported a 7 % rate of recurrence at 4 years with no difference compared to standard WBI [47]. The 2011 ASTRO evidence-based guidelines on hypofractionation found that there was insufficient data supporting or refuting the usage of hypofractionation in patients with DCIS [48]. Accelerated partial breast irradiation (APBI) represents another alternative and is a technique that shortens treatment duration to 1 week or less and has been shown to have promising toxicity profiles and cosmesis compared with traditional WBI [49]. Initial trials examining APBI had limited numbers of patients with DCIS; however, recent series have demonstrated comparable clinical outcomes to traditional series using WBI for patients with DCIS less than 3 cm. A recent pooled analysis of the American Society of Breast Surgeons (ASBrS) MammoSite® Registry Trial and William Beaumont Hospital series included 300 patients; in this analysis, the 5-year rate of IBTR was 2.6 % [50]. Also, a comparison of the ASBrS Trial and the ECOG E-5194 trial was performed by Goyal et al. [51]: in the low-risk cohort (low/intermediate grade, 2.5 cm or smaller), the rate of IBTR was 0 % for APBI compared with 6.1 % with excision alone, while in the high-risk cohort (high grade, 1 cm or smaller), the rate of IBTR was 5.3 % with APBI compared with 15.3 % with excision alone, suggesting that even low rates of IBTR after observation alone for low-risk patients may be able to be improved upon.

Another alternative radiation therapy modality is intraoperative radiation therapy (IORT); this technique allows for the delivery of radiation therapy at the time of surgery. Limited data with long-term follow up is available at this time and few DCIS patients have been treated to date. A randomized trial of 2,232 patients with invasive cancers found the 4-year rate of IBTR to be 1.2 % with IORT; however, only a small portion of the patients had 4-year follow up and all patients had invasive disease; a more recent update of this trial suggested higher rates of IBTR with IORT [52]. These findings are supported by data from Milan which initially demonstrated promising results with subsequent follow up data demonstrating higher rates of IBTR than anticipated [53]. We will need to await additional data on patients with DCIS treated with this technique in order to better assess its efficacy.

Tumor bed boost

Another issue with regards to radiation therapy in patients with DCIS is the role for tumor bed boost following WBI. No randomized trials have been performed to examine this issue; however, extrapolating from the randomized trials performed with patients having invasive disease, one would expect a reduction in local recurrence with a potential increase in toxicities [54, 55]. When looking at DCIS series, evaluation of NSABP B-24 found no difference in rates of IBTR between those receiving boost (44 % of patients) and those not; however, those receiving boost were more likely to have positive surgical margins (46 % vs. 37 %) and comedonecrosis (42 % vs. 35 %), which may have negated a potential local recurrence benefit [56]. A recent retrospective analysis of 220 patients from McGill University found that in spite of higher rates of positive margins and increased VNPI scores, that boost was associated with a reduction in local recurrences which was confirmed by a Rare Cancer Network Study of 373 women that found a 14 % increase in local control with the addition of a boost [57, 58]. At this time, however, there is insufficient evidence to make a definitive conclusion regarding the role of tumor bed boosts in patients receiving WBI for DCIS.

Conclusions

Based on several randomized trials, the addition of adjuvant radiation therapy currently represents the standard of care following breast-conserving surgery in women with DCIS.

Over the past two decades, attempts have been made to identify a cohort of low-risk patients who may be sufficiently treated with excision alone, potentially sparing them the lengthy treatment and possible toxicity associated with radiotherapy. More recent prospective trials omitting radiation therapy have found higher rates of local failures than seen with modern series of patients treated with excision and radiotherapy. RTOG 9804, though underpowered, confirmed that radiotherapy significantly reduced local failures, although the absolute benefit was small. However, based on the current data, no subset of patients has been identified that have low-risk features such that radiotherapy provides no benefit to local control. Moving forward, low-risk patients may be better identified by tumor genetic assays rather than clinical and pathologic factors; however these data have yet to be prospectively tested. Furthermore, innovations in radiation techniques and delivery included limited-field and accelerated radiotherapy may allow for a reduction in treatment duration and toxicity.

At this time, our practice recommendations are to offer radiation therapy to the majority of patients with low-risk DCIS due to the inability to discern which patients may not require radiation therapy. In cases of older patients with multiple co-morbidities and limited long-term life expectancy we may not recommend radiation therapy but will have a full discussion with the patient regarding the potential benefits and the potential side effects and limitations of radiation therapy. In patients with low-risk disease, we also offer alternative techniques including APBI based on the excellent clinical outcomes noted to date as well as the reduced treatment duration, improved quality of life, and potential for reduced toxicity.

Conflict of interest None

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