DERMATOLOGY ASSOCIATION of RADIATION THERAPY™

v1.0

DART CLINICAL GUIDELINES FOR NONMELANOMA SKIN CANCER

Appropriate Use Criteria for the Treatment of Early-Stage Cutaneous Squamous Cell Carcinoma (SCC) Using Image-Guided Superficial Radiation Therapy *(Version 1.2024)*

I. BACKGROUND AND STANDARDS

Use of Multidisciplinary Team

Radiotherapy has recently experienced a renaissance in the treatment of nonmelanoma skin cancer (NMSC). The gold standard treatment that has emerged is called Image-Guided Superficial Radiation Therapy (IGSRT). IGSRT combines high-resolution dermal ultrasound (HRDUS) imaging with superficial radiation therapy. To optimize patient outcomes, IGSRT should be delivered in the dermatology setting by a board-certified dermatologist with a multidisciplinary team (MDT) in accordance with the Dermatology Association of Radiation Therapy (DART) Appropriate Use Guidelines. The MDT must include a board-certified radiation therapist (RTT) for treatment delivery of IGSRT under the supervision of the prescribing dermatologist. The MDT must also include access to a board-certified radiation oncologist, a medical physicist, and organized weekly national Grand Rounds. Grand Rounds assist dermatologists with complex scenarios such as dose decay calculations, inverse square calculations, and review of beam parameters and field placement to determine whether the anatomic location of the current NMSC overlaps with previously radiated fields, as well as the latest clinical data and research regarding the optimal indications and contraindications in the treatment of NMSC of all modalities. Dermatologists and their RTTs must be trained in how to utilize IGSRT and how to present challenging cases to Grand Rounds so that they can access the support of the MDT at any time. Once this training is accomplished, the dermatologist has met all qualifications necessary to safely and effectively perform IGSRT with ongoing support from the MDT.

The 2024 National Comprehensive Cancer Network (NCCN) guidelines suggest that "the determination of the appropriateness of radiation therapy (RT) should be determined by a radiation oncologist".[1] DART notes that this NCCN suggestion does not apply to dermatologists supported by a MDT, as long as that MDT includes general access to a radiation oncologist. The treatment of NMSC has long been a substantial component of clinical practice for dermatologists who are well versed in the numerous available therapeutic options including, but not limited to, superficial radiation therapy (SRT).[2] Dermatologists are widely regarded as the skin cancer experts who have safely and effectively used office-based SRT to treat NMSC for over a century.[2] Supporting these skin cancer experts with a MDT provides more than enough expertise to "determine the appropriateness of RT".[1]

II. SCC CRITERIA

SCC tumors must be Tis, T1 or T2 lesions according to the American Joint Committee on Cancer (AJCC) guidelines 8th ed.[3] (NB While AJCC 8th Ed. staging pertained to cutaneous SCC of the head and neck, these same criteria for staging are applied throughout the entire body.)[3]

SCC Tumors Can Be Low Risk or High Risk According to 2024 NCCN Guidelines[1]

RISK OF RECURRENCE FOR SCC TUMORS[1]			
	Low-Risk Factors	**High-Risk Factors***	**Very High-Risk Factors†**
Location/size	Trunk or extremities with ≤2.0 cm diameter	Trunk or extremities with >2.0 cm or ≤4.0 cm diameter Tumors of any size located on the head, neck, hands, feet, pretibial, anogenital area	Tumors with >4.0 cm diameter Any location
Depth	<2.0 mm, no invasion beyond subcutaneous	2.0 mm to 6.0 mm	>6.0 mm or invasion beyond subcutaneous
Borders	Well defined	Poorly defined	Poor
Tumor occurrence	Primary	Recurrent	
Immunosuppression	No	Yes	
Prior radiation therapy or chronic inflammatory response	No	Yes	
Growth rate	Not rapid	Rapid	
Neurologic symptoms	No	Yes	
Differentiation	Well or moderate		
Histology: acantholytic, adenosquamous, or carcinosarcomatous features	No	Yes	Desmoplastic SCC
Perineural involvement (PNI)	No	Yes, with histologically-confirmed involvement of nerve twigs <0.10 mm in diameter and on head and neck only	Tumor cells within the nerve sheath of a nerve deeper than the dermis or measuring ≥0.10 mm
Lymphatic or vascular involvement	No	No	Yes

*Any high-risk factor places the patient in the high-risk category.[1]
†Very high-risk tumors are not appropriate for IGSRT. Treatment should follow the recommended clinical guidelines, which may include linear accelerator and/or surgery and/or systemic therapy and/or immunotherapy.

II. SCC CRITERIA *(Cont'd)*

Advanced/Neglected SCCs that are high risk solely based on size of 2.0 mm to 6.0 mm are only appropriate for IGSRT after surgical debulking or shrinkage via the PD-1 inhibitor cemiplimab until the tumor depth is confirmed via HRDUS imaging to be 2.0 mm or less in thickness.[1,4] Grand rounds consultation/presentation could be sought prior to starting treatment with IGSRT.

III. CONTRAINDICATIONS

ABSOLUTE CONTRAINDICATIONS[1,4]

Gorlin's Syndrome
(Basal Cell Nevoid Syndrome)

Xeroderma Pigmentosum

Ataxia Telangiectasia

Previous ionizing radiation at proposed treatment site

RELATIVE CONTRAINDICATIONS[1,4]

Ehlers-Danlos Syndrome

Scleroderma

Mixed Connective Tissue Disease

Systemic Lupus Erythematosus

IV. DIAGNOSIS, STAGING, AND USE OF IGSRT

SCC Tumors – Role of HRDUS Imaging in Diagnosis and Staging

Pathology reports are often prone to sampling error, i.e., "tumor is transected at the base, so a deeper component cannot be ruled out in these sections". These "partial" pathology reports should be considered preliminary diagnoses. HRDUS imaging is performed on the anatomic site to measure depth and evaluate tumor shape and morphology after the biopsy. The HRDUS images are evaluated in the context of the preliminary histologic diagnosis to see if the findings match (confirmatory) or differ (revelatory).

IV. DIAGNOSIS, STAGING AND USE OF IGSRT *(Cont'd)*

HRDUS imaging of cutaneous SCC prior to definitive therapy has the potential to advance the current standard of care with regards to the diagnosis and staging of SCC. HRDUS imaging for depth measurement is crucial to SCC risk stratification and staging, as HRDUS imaging can accurately visualize SCC tumor depths >2.0 mm to determine if it invades the reticular dermis.

SCC tumors should ideally be fully visualized and measured using the HRDUS imaging to:

1. Risk stratify and confirm clinically appropriate candidates for IGSRT treatment.
2. Facilitate more accurate staging in clinically appropriate patients with low-risk and high-risk SCC tumors prior to treatment initiation.

MEASURING SCC DEPTH AND STRATIFYING RISK TO DETERMINE APPROPRIATE USE[1]		
Low Risk	**High Risk**	**Very High Risk**
Appropriate For IGSRT	**Appropriate For IGSRT**	**NOT Appropriate For IGSRT**
SCC tumors <2.0 mm in depth without the presence of high-risk factors are appropriate for IGSRT	SCC tumors 2.0 mm to 6.0 mm in depth without the presence of other high-risk factors are appropriate for IGSRT if the: • HRDUS imaging shows that the SCC tumor does not invade the reticular dermis *and* • Tumor is surgically debulked via shave removal or electrodessication and curettage (ED&C), or medically debulked via the PD-1 inhibitor cemiplimab, to achieve a depth of <2.0 mm prior to initiating IGSRT treatment	SCC tumors >6.0 mm in depth, and SCC tumors in which the HRDUS imaging shows penetration through the superficial reticular dermis, are not appropriate for IGSRT: • Although PNI is rare, it should be suspected in any SCC when the HRDUS imaging confirms that the tumor penetrates through the reticular dermis • Other risk factors for PNI include SCC tumors that are >2.0 cm in diameter, >2.0 mm in depth, those with aggressive histology and/or those with pain or neurologic symptoms

Confirmatory HRDUS Imaging

A pathology report diagnoses a SCC in situ, transected at the base. HRDUS imaging shows a ridged epidermal layer above a thin "ribbon-shaped" tumor without an invasive border. This image has confirmed that the diagnostic subtype is indeed SCC in situ.

Revelatory HRDUS Imaging

EXAMPLE 1

Pathology report #1 diagnoses a SCC in situ, transected at the base. Post-biopsy HRDUS imaging shows a residual round tumor without an infiltrative/invasive border that is 1.8 mm deep. This image has revealed that the diagnostic subtype is definitely not an SCC in situ because it lacks a "thin ribbon" morphology. The rounded, non-infiltrative tumor shape on the HRDUS imaging is most consistent with a diagnosis of superficially-invasive SCC.

The depth of 1.8 mm means the SCC is classified as low risk without the presence of high-risk or very high-risk factors. The patient is an IGSRT candidate.

EXAMPLE 2

Pathology report #2 diagnoses a SCC in situ, transected at the base. Post-biopsy HRDUS imaging shows a round-shaped residual tumor that is 3.0 mm deep. The depth image has revealed that the diagnostic subtype is definitely not a superficial SCC.

The depth of 3.0 mm means the SCC is classified as high risk. Without the presence of other high-risk factors, or any very high-risk factor, the patient is an IGSRT candidate, as long as the 3.0 mm depth of the tumor is surgically or medically debulked to a depth of ≤2.0 mm prior to treatment initiation.

Two Methods for Debulking SCCs With Depth Measurements >2.0 mm

SCC tumors deeper than 2.0 mm post-biopsy that are not located in cosmetically- or functionally-sensitive anatomic areas can be surgically debulked via shave removal or ED&C until the pre-treatment depth of 2.0 mm or less is confirmed by HRDUS imaging.

SCC tumors deeper than 2.0 mm post-biopsy that are located in cosmetically- or functionally-sensitive anatomic areas can be medically debulked via several months of pre-treatment with the PD-1 inhibitor cemiplimab. It is strongly recommended that the patient comply with HRDUS monitoring every 3- to 4-weeks during cemiplimab therapy to measure tumor shrinkage. Once the SCC tumor depth is reduced to 2.0 mm or less, the patient may discontinue PD-1 therapy and begin IGSRT treatment.

IV. DIAGNOSIS, STAGING AND USE OF IGSRT *(Cont'd)*

SCC Subtypes and Appropriate Margins

Dermoscopy: Can be used if available to improve the accuracy of identifying the clinical diameter/peripheral edges of the SCC tumor prior to radiation delivery

SCC in situ: 5.0 mm margin around clinically apparent tumor

SCC With Superficial Invasion: 5.0 mm margin around clinically apparent tumor

Well Differentiated SCC: 5.0 mm to 7.0 mm margin around clinically apparent tumor

Acantholytic (Adenoid) SCC: Strong consideration of 7.0 mm to 10.0 mm margins that can be reduced to not less than 5.0 mm at adjacent critical structure around clinically apparent tumor (i.e., eye, canthus)

Moderately Differentiated SCC: For SCC tumors without other high-risk factors (nerve involvement, poor differentiation, etc.), strong consideration of 7.0 mm to 10.0 mm margins that can be reduced to not less than 5.0 mm at adjacent critical structure around clinically apparent tumor (i.e., eye, canthus)

Baso-Squamous Carcinoma: For SCC tumors without other high-risk factors (nerve involvement, poor differentiation, etc.), strong consideration of using 7.0 mm to 10.0 mm margins that can be reduced to not less than 5mm at adjacent critical structure around clinically apparent tumor (i.e., eye, canthus)

Adenosquamous SCC (showing mucin production): NOT appropriate for IGSRT

Poorly Differentiated SCC: NOT appropriate for IGSRT

Metaplastic (Carcinosarcomatous) SCC: NOT appropriate for IGSRT

SCC With Carcinosarcomatous Differentiation: NOT appropriate for IGSRT

V. RATIONALE AND IGSRT PROTOCOL GUIDELINES

The IGSRT protocol is based on HRDUS imaging of tumor depth, which changes regularly. Depth intervals are measured in millimeters from lowest to highest. Each depth interval corresponds to similarly increasing intervals of energy (kV) and time, dose, fractionation (TDF). Prior to delivering radiation, the depth is measured and the corresponding interval is selected, clearly defining the appropriate energy (kV) and TDF to use. For NMSC tumors that have increased in depth, adaptive increases in kV and TDF serve to optimize efficacy. For NMSC tumors that have decreased in depth, adaptive decreases in kV and TDF serve to minimize toxicity. The adaptive nature of the IGSRT protocol has proven in multiple retrospective studies to consistently deliver 99% cure rates for NMSC with minimal toxicity.[4-9]

Rationale for HRDUS Imaging and Adaptive Changes Prior to Each Fraction

92% of NMSC tumors undergoing IGSRT exhibit measurable changes in the depth of invasion compared to that of the previous image.[10] Because these measurements are collected immediately prior to treatment, they allow for the opportunity to implement adaptive changes in treatment parameters, such as kV, TDF, and dose/boost. These adaptive changes are necessary in approximately 40% of cases, directly benefitting patients by maximizing efficacy and minimizing toxicity.[10]

HRDUS Imaging, Adaptive Changes and Efficacy

Any measured increase in NMSC depth is clinically significant during treatment with IGSRT as it may change the tumor coverage based on the percentage depth dose (PDD) initially selected for that lesion. A lower energy PDD means significantly less radiation is delivered to the deepest tumor cells compared to a higher energy PDD. This results in comparatively diminished therapeutic efficacy if the tumor becomes deeper (at times due to tissue edema) during the treatment. Thus, by performing HRDUS depth measurements prior to every fraction, dermatologists and RTTs know exactly when to make adaptive increases in kV, TDF, and dose/boost. This ensures that every NMSC tumor is adequately and uniformly radiated to achieve a 99% cure rate.[4-9]

HRDUS Imaging, Adaptive Changes and Toxicity

Any measured decrease in NMSC depth is clinically significant during treatment with IGSRT as it is an opportunity to decrease unnecessary radiation and minimize toxicity. The guiding principle of radiation safety is ALARA, which stands for "as low as reasonably achievable". ALARA means avoiding exposure to radiation that does not have a direct benefit to the patient, even if the dose is small. Thus, by performing HRDUS depth measurements prior to every fraction, dermatologists and RTTs know exactly when to make adaptive decreases in kV, TDF, and dose/boost. This ensures that the safety of every NMSC patient is optimized by reducing radiation toxicity whenever possible.[11]

Procedures and Protocol

Tumor depth measurements should be recorded prior to every fraction to optimize efficacy.

RTOG scores should be recorded after every 5 fractions to monitor radiation toxicity.

Rationale for imaging and adaptive changes 3- to 6-weeks after IGSRT is completed:
Patients and dermatologists need visual confirmation of SCC eradication once therapy has been completed. If no residual SCC is identified, IGSRT has successfully cured the SCC.

Suggested Follow Up Protocol

If the possibility of residual SCC is visualized, the recommended course of action is to wait an additional 3- to 4-weeks (total of 6- to 10-weeks after completion of treatment) for a second follow-up evaluation and perform follow-up HRDUS imaging. If no residual SCC is identified, IGSRT has successfully cured the SCC.

If after waiting the additional 3- to 4-weeks for the second follow-up evaluation, the HRDUS imaging is still suspicious for residual tumor, the case should be presented to MDT/Grand Rounds so that the radiation oncology/dermatology experts can review the case and make specific recommendations regarding boost doses if possible or recommended.

After boost dosing is completed, follow up using HRDUS imaging is necessary to visually confirm that IGSRT has successfully cured the resistant portion of the SCC tumor. If a small localized "stubborn" residual portion of the SCC tumor persists 6 weeks or longer after boost dosing, it may be injected with 5-FU or bleomycin while the area is healing. It is advisable to wait 2- to 3-months before starting intralesional injections unless the tumor is obviously progressing. Such injections often assist in the resolution of radioresistant SCC, which is often preferable to surgery. If the SCC does not resolve with injections, it can be salvaged with Mohs micrographic surgery after 4- to 6-months of healing, unless the tumor is obviously progressing. These decisions are based on the clinical judgement of the dermatologist.

HOW TO USE THESE GUIDELINES AND DISCLAIMER

These guidelines were developed by the Dermatology Association of Radiation Therapy (DART) and its panel of experts from its education committee to provide clinicians, patients, and policy makers with an orientation as to how to inform patients and assess and treat certain medical conditions. These guidelines were developed by an expert panel that critically appraised, summarized, and interpreted recent and relevant clinical evidence to provide recommendations that can be applied to patient care. Healthcare providers should exercise their own clinical judgment and discretion when utilizing these guidelines in the care of patients. Individual patient circumstances may vary and adherence to these guidelines does not guarantee specific outcomes. The ultimate judgment regarding a specific therapy must be made by the physician and the patient in light of all the circumstances presented by the individual patient and the biological variability of their disease. The content in these guidelines should not be used as a substitute for professional medical advice, diagnosis or treatment. Users of these guidelines are encouraged to review updates and revisions regularly, as medical knowledge is constantly evolving.

DART guidelines are reviewed and updated periodically to ensure alignment with the latest advances in evidence-based care, treatment technologies, and clinical research. Clinicians and healthcare providers seeking to consult on DART guidelines may contact info@DermAssociationRT.org.

APPROVAL	DATE
DART Education Committee	**June 12, 2024**
Subcommittee on SRT/IGSRT *Reviewed and approved by:* Jeff Stricker, DO, FAOCD, FAAD Liqiao Ma, MD, FAAD Clay Cockerell, MD, FAAD Blake Robbins, DO, FAOCD, FAAD Ashwin Patel, MD, DABR Daniel Ladd, DO, FAOCD, FAAD Lio Yu, MD, DABR	**June 12, 2024**
Board Approval/Membership Approval	**Approved**

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