Advances in Radiation Oncology (2017) 2, 288-290

advances
in radiation oncology

www.advancesradonc.org

Teaching Case

A method to improve dose uniformity during total skin electron beam therapy in patients with pendulous breasts

Brian J. King MD [a], Christopher L. Deufel PhD [b], Sarah E. Locher PhD [b], Luke B. McLemore MS [b], Barbara S. Brekke-Hackman RTT [b], James A. Martenson MD [b,*]

[a] *Department of Dermatology, Mayo Clinic, Rochester, Minnesota*
[b] *Department of Radiation Oncology, Mayo Clinic, Rochester, Minnesota*

Received 1 March 2017; received in revised form 23 April 2017; accepted 30 May 2017

Introduction

Cutaneous lymphomas are particularly radiosensitive and amenable to palliative radiation therapy. Total skin electron beam therapy (TSEB) is effective for palliation of Sézary syndrome and cutaneous T-cell lymphoma with large body surface area involvement.[1] Focal radiation therapy is often used for treatment of localized disease.[2] Treatment of cutaneous T-cell lymphoma can often pose technical challenges that require creative, patient-specific solutions.[3,4]

The electron beam used in TSEB is superficially penetrating. Although technique-dependent variation exists in the depth of penetration, delivery of an effective dose is generally limited to a depth of less than 1 cm. The inframammary fold of a pendulous breast is generally deeper than 1 cm and therefore will not receive an adequate radiation dose when treated by this technique. The use of a thin brassiere, as suggested in American Association of Physicists Report 23,[5] may overcome this problem in some patients. We report the use of a sling made from nylon stockings to suspend large, pendulous breasts. This allows direct exposure of the inframammary fold to the electron beams used in TSEB and delivery of adequate dose to this area.

Methods and materials

The Mayo Clinic Institutional Review Board approved our study of cutaneous lymphoma. In addition, the 2 patients described in this report provided written permission to report the details of their cases, including clinical photographs.

Nylon breast supports

Each patient had pendulous breasts (Fig 1) that would have resulted in negligible therapeutic dose to the inframammary folds from superficially penetrating total skin electron beam therapy. A member of our team and fellow coauthor (B. Brekke-Hackman) devised a sling by sewing 2 nylon stockings together (Fig 2A). Each sling was constructed from 1 pair of pantyhose by cutting away the pantyhose legs and whip-stitching them together along the long edge. The stitched seam extended over the central 20 cm of the leg length. The sling was positioned under the patients' breasts with the widest seamed area of the sling centered under the breast, and the ends of the legs knotted behind the patient's neck. Tension was adjusted on each

Conflicts of interest: None.

Written consents are available upon request.

* Corresponding author. Department of Radiation Oncology, Mayo Clinic, 200 First St SW, Rochester, MN 55905.

E-mail address: jmartenson@mayo.edu (J.A. Martenson)

http://dx.doi.org/10.1016/j.adro.2017.05.009

leg segment individually to open the inframammary fold. Figure 2B shows the same patient pictured in Fig 1 with the sling in place. When the sling was optimally adjusted (a process that was performed before delivering radiation to each treatment field), the entire inframammary fold was exposed to the electron beam.

TSEB treatment delivery

TSEB dose was delivered using the Stanford-style 6 dual field technique, which has been described previously.[5,6] In our adaptation of TSEB, the patient rotates through all 6 poses at each treatment, at 60° increments: anterior, posterior, right anterior oblique, right posterior oblique, left anterior oblique, and left posterior oblique. The patient is positioned behind a thin polycarbonate scattering panel (2 m × 0.9 m × 6 mm), which is 212 cm from the isocenter (source to scattering panel distance, 312 cm). At each of the 6 positions, dual electron fields with central rays ± 20° from horizontal are delivered with a Varian TrueBeam linear accelerator (Varian Medical Systems, Palo Alto, CA) using a 6-MeV energy and High Dose Total Skin Electron treatment mode.

In vivo dosimetry

In vivo dosimetry was performed to verify that adequate dose was delivered to the inframammary fold using methods previously described.[3,4] Briefly, a 2 × 2 cm^2 piece of Gafchromic EBT3 film (Ashland ISP Advanced Materials, Bridgewater, NJ), each wrapped in a single layer of plastic wrap, was taped onto each patient's skin in the inframammary fold after the patient was fitted with the sling. The plastic wrap served to keep the films clean for scanning and analysis, and was discarded after treatment and before analysis. Film analysis was performed using FILMQA Pro Software (Ashland ISP Advanced Materials), using the methodology described in prior work.[3,4] The average dose was taken from a 1 cm × 1 cm region of interest that was centered on each film. Only 1 set of measurements was obtained from each patient.

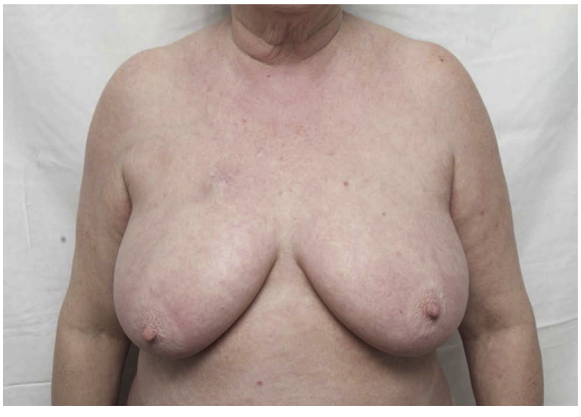

Figure 1 Pendulous breasts in one of the patients with cutaneous lymphoma.

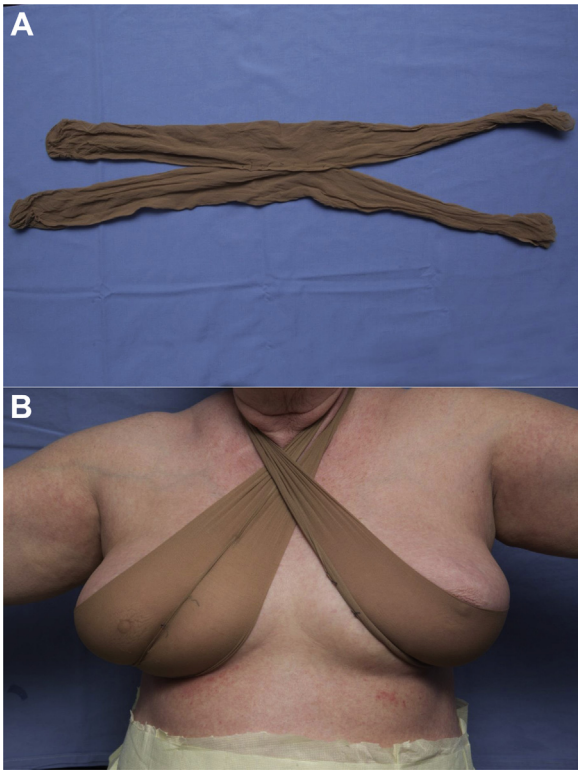

Figure 2 Breast sling. (A) Two nylon stockings were sewn together to create the breast sling. (B) When worn by the patient, the inframammary fold was exposed to the electron beam.

Results

The average dose to the inframammary folds was 78% to 98% of the prescription dose, as reported in Table 1. Differences in the measured dose between the right and left breast (11%-20%, Table 1) serve as a

Table 1 Dosimetry measurements

Patient	Location	Average % dose of TSEB prescription over 2 cm × 2 cm region in the inframammary fold
Patient 1	Right breast fold	84
Patient 1	Left breast fold	95
Patient 2	Right breast fold	98
Patient 2	Left breast fold	78

surrogate to estimate variation in dose that can be expected because of daily setup variations. Neither patient reported any discomfort during treatment as a result of wearing the sling. Film dosimetry also confirmed that the thin nylon material attenuated the radiation dose by less than 5%, including the tied nylon knot. Both patients reported excellent palliation of pruritus following treatment.

Conclusion

We have used a simple, inexpensive breast sling that can be used during TSEB to avoid undertreatment of the inframammary fold in patients with pendulous breasts. Care should be taken to ensure that the sling is optimally adjusted before each treatment to provide complete exposure of the inframammary fold to the electron beam with each treatment.

References

1. Elsayad K, Kriz J, Moustakis C, et al. Total skin electron beam for primary cutaneous T-cell lymphoma. *Int J Radiat Oncol Biol Phys*. 2015;93:1077-1086.
2. Cicaily B, Miyamoto C, Kantor G, et al. Radiation therapy for unilesional mycosis fungoides. *Int J Radiat Oncol Biol Phys*. 1998;42:361-364.
3. Evans JD, Haley LL, Locher SE, et al. Clinical application of lying-on-the-floor total skin electron irradiation for frail patients with cutaneous lymphoma: An emphasis on the importance of in vivo dosimetry. *Adv Radiat Oncol*. 2016;1:101-105.
4. Ahmed SK, Grams MP, Locher SE, et al. Adaptation of the Stanford technique for treatment of bulky cutaneous T-cell lymphoma of the head. *Pract Radiat Oncol*. 2016;6:183-186.
5. American Association of Physics in Medicine Report 23. *Total skin electron therapy: Technique and dosimetry*. New York, NY: American Institute of Physics; 1998.
6. Antolak JA, Cundiff JH, Ha CS. Utilization of thermoluminescent dosimetry in total skin electron beam radiotherapy of mycosis fungoides. *Int J Radiat Oncol Biol Phys*. 1998;40:101-108.