Clinical Perspectives | Breast

RADIATION TREATMENT TO THE BREAST IN THE PRONE POSITION

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Introduction

Breast cancer is the most commonly diagnosed cancer, accounting for 200,000 new cases each year. For patients diagnosed with small tumors, breast-conserving lumpectomy followed by radiation to the whole breast has replaced mastectomy as the standard of care. Radiotherapy to the conserved breast decreases the rate of disease recurrence in half and reduces the breast cancer death rate by about one-sixth, according to the findings of a 2011 meta-analysis of 17 randomized trials.

While radiotherapy plays an important role in improving breast cancer survival, the soft tissue of the breast creates unique challenges for the delivery of external beam radiation. In the traditional supine position for breast cancer treatment, setup is not sufficiently reproducible to take full advantage of the accuracy of available treatment planning and delivery technology. Compared to supine, the prone position improves setup reproducibility, negates respiratory motion, and pulls the breast away from the chest wall. As a result, the prone position can be used for post-surgical radiation therapy to reduce irradiation of cardiac and lung tissue. Research has shown that the prone position can reduce the volume of heart and lung in the treatment field, regardless of breast size.

The prone position also has distinct advantages over the traditional supine position when the breast is large and pendulous. Daily patient setup is easier to reproduce, and deep skin folds are eliminated.

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5. Formenti S, et al. Results of NYU 05-181: A Prospective Trial to Determine Optimal Position (Prone versus Supine) for Breast Radiotherapy. IJROBP 2009; 75(3): S203-S204
A 58-year old woman was diagnosed with Grade 2 infiltrating ductal carcinoma of the left breast. A lumpectomy was performed, and, five weeks following surgery, the patient began whole-breast external beam radiation treatment. She was treated in the prone position, primarily due to her large breast size. The patient reported her bra size as 38 DDDD, and the breast volume measured 2,919 cubic centimeters. The size and pendulous shape of her breast made it difficult if not impossible to reproduce setup in the supine position for each treatment fraction. In addition, the deep skin folds increased the risk of skin toxicity. This patient was deemed an ideal candidate for prone treatment. She was treated using the Varian Pivotal™ treatment solution for prone breast care.

CT simulation
At Arizona Breast Cancer Specialists, all new early-stage breast cancer patients to be treated with external beam radiation are screened for prone versus supine treatment. Screening consists of CT simulation and a patient comfort survey. Treatment plans in both supine and prone positions are compared for optimal dose distribution and normal tissue sparing.

In this case, this patient was sufficiently mobile and flexible to assume and remain in the prone position with her arms extended above her head for 15 minutes. Importantly, the prone position pulled the target volume away from the chest wall and allowed exclusion of more normal tissue from the treatment fields. The prone position also reduced the risk of skin effects due to skin folding.

Use of a small-bore CT simulator presented a limitation in this case because of the breast size. When the breast is especially large and pendulous, it can puddle on the couch or flatten in a small-bore CT scanner. We use adjustable CT risers for CT simulation in the prone position. However, in the small bore of the CT scanner, they allow a maximum 14 cm for free clearance of the breast, while this patient’s breast measured 20 cm. On the treatment machine, the same puddling of the breast does not occur, and the result is a more pointed breast shape.

We overcame this discrepancy between the simulation and treatment environment by adapting a sling for the breast from an Aquaplast mask. The sling prevented the breast from puddling or flattening during prone CT simulation. It was used for both simulation and treatment delivery to provide a consistent and repeatable breast shape.

Treatment plan
Treatment was planned on the Varian Eclipse™ treatment planning system. The patient was prescribed a standard protocol for whole breast radiotherapy: 46.8 Gy in 26 fractions plus a boost to the lumpectomy cavity of an additional 16 Gy in 8 fractions. The plan consisted of four opposing tangent fields. A combination of 6X and 16X energies maximized dose to the target volume while minimizing dose to the skin. 16X was used for the field-in-field technique which has been shown to improve dose distribution and reduce skin toxicity.

Treatment delivery
The treatment was delivered by the Clinac® iX system, equipped with a kVue™ Access 360™ couch top insert. To deliver the boost to the cavity bed, we used AcuBoost™ brachytherapy.

Setup: Reproducibility of patient setup is a challenge that prone positioning can help resolve. Prone position reduces concern over variability in the fall of the breast and skin folds. It also reduces or eliminates respiratory motion as a factor in planning and delivery. However, the prone position requires different thinking about setup because the physical landmarks are inverted. As in traditional supine treatment, we used leveling marks on skin for alignment. A three point set up was used on the patient in the same plane as the isocenter, but posteriorly for stability. The radiation therapist (RT) palpated the sternum from underneath to make sure that it was not rubbing against or sitting on top of the prone breast device inserted into the treatment table. The RT also checked that the opposing breast was pulled away, preventing it from glancing into the treatment field.

Proper setup was verified by port film on the first day of treatment and once a week thereafter. To avoid exposing the patient to unnecessary radiation, the RT first used the field light in the treatment room to check for the expected flash and adjusted the patient position as necessary. When the patient is supine for treatment, the flash is easily seen medially and laterally. For the prone position, however, the flash is limited to one side. Then the RT took the port film to verify the setup.

Due to potential for day to day variation, orthogonal kV localization images were taken with the Varian On-Board Imager® kV imaging system whenever there was uncertainty about the setup. Any resultant shifts tended to be in the superior/inferior direction.

**Dose verification:** For treatment verification, we used MOSFET dosimeters to verify that the dose actually delivered to the skin matched the plan. One dosimeter was placed at isocenter. Another was placed on the medial edge of the breast near the breast device interface to check for attenuation or bolus effects created by the couch insert.

**Results**
The patient completed radiation treatment in the prone position, experiencing some discomfort from lying on the contralateral breast.

Skin reaction was minimal, consisting of some dry desquamation in the inferior portion of the breast. However, the skin effects were significantly less severe than we would have anticipated with whole breast radiation in the supine position, due to the resulting deep skinfolds.

Daily treatment sessions took a few minutes longer due to the new patient setup procedures. As the therapists become familiar with them, we expect prone treatment and supine treatment to take the same amount of time.

**Conclusions**
All new early-stage breast cancer patients to be treated with external beam radiation are now screened for prone versus supine treatment. To date, we have treated four patients using the Varian Pivotal™ treatment solution for prone breast care. Our experience with treating breast cancer patients in the prone position shows that patient setup is more reproducible than in the supine position. While large breasted patients may be the most obvious candidates for prone treatment, our experience has shown that prone position offers advantages to many patients regardless of breast size. Respiratory motion is minimized in the prone position. As the breast pulls away from the chest wall, deeply seated cavities can be treated while excluding more normal tissue from irradiation.

Prone positioning is not suitable for everyone, however. Factors such as obesity, mobility, and number of weeks post surgery need to be considered when selecting patients for prone treatment.

Radiation treatments are not appropriate for all types of cancers and serious side effects can occur, including skin irritation, mild to moderate breast swelling, fatigue, breast or chest wall tenderness, swelling to the ipsilateral arm, reduced blood count and fibrosis.