Efficacy of Scalp Cooling in Preventing Chemotherapy-Induced Alopecia in Breast Cancer Patients Receiving Adjuvant Docetaxel and Cyclophosphamide Chemotherapy

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Abstract

Scalp cryotherapy may prevent chemotherapy associated alopecia (CIA). Degree of hair loss in 20 women electing to use scalp cooling during TC chemotherapy for breast cancer was assessed. After completion of chemotherapy only 2 (10%) reported the need to wear a wig or head covering. Scalp cooling appears to be effective in preventing CIA with a common chemotherapy regimen.

Background: Chemotherapy-induced alopecia (CIA) is a distressing adverse effect of many chemotherapy agents. The TC (docetaxel [Taxotere] and cyclophosphamide) chemotherapy regimen is typically associated with complete alopecia. Scalp cooling with cold caps has been reported to minimize or prevent CIA. We conducted a prospective study to assess efficacy of scalp cooling in preventing CIA among women receiving adjuvant TC chemotherapy for breast cancer. Methods: Women at the Weill Cornell Breast Center who independently elected to use scalp cooling with cold caps during adjuvant TC chemotherapy were asked to participate. Degree of hair loss was assessed by a single practitioner using Dean's alopecia scale (grade 1/excellent [< 25% hair loss], grade 2/good [25%-50% hair loss], grade 3/moderate [50%-75% hair loss], grade 4/poor [> 75% hair loss]), by digital photographs, and by patient self-report of hair thinning or the need to wear a wig/head covering, or both. Assessments were made before each chemotherapy treatment and at follow-up visits between 3 weeks and 3 months after completion of chemotherapy. Results: Of 20 evaluable patients, 10% reported a need to wear a wig/head covering at the follow-up visit. Dean's alopecia score was excellent for 65% of patients, good for 25% of patients, and moderate or poor for 10% of patients. The majority of patients reported hair thinning after every chemotherapy cycle. No patient discontinued therapy because of an intolerance to cold caps. Conclusion: Scalp cooling with cold caps appears to be effective in preventing CIA among the majority of women undergoing treatment with TC chemotherapy.

Introduction

Chemotherapy-induced alopecia (CIA) is a common and emotionally traumatic side effect of many cancer therapies. CIA has been associated with decreased body image, decreased self-esteem, and increased psychological distress.1,2 In fact, patients have been known to refuse potentially lifesaving chemotherapy because of concerns about hair loss.3-5 Hair loss often ranks as highly as nausea and fatigue as the most feared side effects of cancer treatment.1,2,6,7 Although a number of methods—including scalp tourniquets, pulsed electrostatic fields, and topical treatments such as minoxidil—have been proposed and tested for reducing CIA, scalp cooling or cryotherapy has proved the most effective and is the most widely used.8,9 It is thought that scalp cooling mediates its effect through two main mechanisms. The first is that the cold temperatures induce vasoconstriction, thereby limiting the concentrations of chemotherapy available for cellular uptake. The second is that the...
reduction of metabolic activity induced by the cold temperature lessens the effects of cytostatic agents on follicular cells.10,11

Scalp cooling has been successfully used in clinical practice, mostly in Europe and Canada. The largest published series of 1411 scalp-cooled patients from the Dutch Scalp Cooling Registry reports an efficacy rate of 50% among scalp-cooled patients receiving a variety of chemotherapy treatments and using either cold caps or machine cooling.12 Other smaller scale studies have established that efficacy is both dose dependent and dependent on the number of cycles and types of chemotherapeutic agents used.13-16

Despite the history of effective use in Europe and Canada, scalp cooling has been slow to gain popularity in the United States, perhaps because of concerns that limiting chemotherapeutic activity in the scalp may increase the risk for scalp metastasis. Studies to date, however, indicate that rates of scalp metastasis between scalp-cooled and non—scalp-cooled patients with solid tumor malignancies are virtually identical, and no long-term risks have been identified.17-19 Reassuringly, follow-up from the Dutch Scalp Cooling Registry found no cases of scalp metastases within 5 years of follow-up.12

Our prospective study aims to assess the efficacy of scalp cooling with the commercially available Penguin Cold Caps in preventing CIA among women with early-stage breast cancer receiving adjuvant docetaxel and cyclophosphamide chemotherapy.

Methods

Women at the Weill Cornell Breast Center who elected to use scalp cooling with Penguin Cold Caps during adjuvant chemotherapy with docetaxel and cyclophosphamide were asked to participate in the study. Participants all had early-stage breast cancer, and the treatment recommendation was to treat with 4 cycles of docetaxel 75 mg/m² and cyclophosphamide 600 mg/m² given every 3 weeks. Each participant signed an institutional review board—approved protocol-specific informed consent for participation.

Penguin Cold Caps are a commercially available scalp cooling system, made from a cryogenic insulation material-filled polyurethane. Caps were cooled to —32°C. Caps were worn 50 minutes before chemotherapy, during the chemotherapy infusion, and for 4 hours after the completion of the infusion. Caps were replaced every 30 minutes to ensure adequate cooling. Patients were advised to follow the following hair care instructions from 2 weeks before chemotherapy until 4 months after completion of chemotherapy: limit hair washing to no more than 2 times per week using a mild shampoo and tepid water; avoid coloring hair; avoid blow dryers, hot rollers, or curling irons; and avoid hair products containing alcohol or peroxide.

The degree of alopecia was assessed by the same health care practitioner using Dean’s alopecia scale for hair loss: grade 1/excellent (< 25% hair loss), grade 2/good (25%-50% hair loss), grade 3/moderate (50%-75% hair loss), and grade 4/poor (> 75% hair loss). Assessment of hair loss was made at baseline, before each chemotherapy treatment, and at follow-up (3 weeks to 3 months after the fourth chemotherapy treatment). Photographic documentation was also obtained at each assessment. At each visit, patients were asked to report whether they had experienced hair thinning or whether they felt the need to wear a wig or head covering.

Results

Twenty-two patients enrolled in the study. One patient withdrew consent before beginning chemotherapy and 1 patient discontinued chemotherapy after the first cycle because of toxicity not related to alopecia. Twenty patients completed treatment and had evaluable data.

Baseline patient characteristics are summarized in Table 1. Median patient age was 51 years. The majority of patients were white. No patient had evidence of baseline alopecia.

Table 2 summarizes the degree of alopecia as assessed by the same practitioner at each visit using Dean’s alopecia scale, as well as patient self-assessment of hair thinning and the need to wear a wig or head covering. At the follow-up visit, 13 (65%) patients had experienced < 25% hair loss (Dean’s grade 1), 5 (25%) patients had experienced 25% to 50% hair loss (Dean’s grade 2), 1 (5%) patient had experienced 50% to 75% hair loss (Dean’s grade 3), and 1 (5%) patient had experienced > 75% hair loss (Dean’s grade 4).

At the follow-up visit, 18 (90%) patients did not feel the need to wear a wig or head covering. Only 2 (10%) patients reported the need to wear a wig or hair covering at the follow-up visit. These 2 patients correspond to those assessed as having grade 3 and grade 4 hair loss by Dean’s scale, respectively. Of note, of the 5 patients assessed as having grade 2 hair loss by Dean’s scale, none reported the need to wear a wig or head covering. Despite not requiring a wig or head covering, the majority of patients reported hair thinning at each visit.

Scalp cooling was generally well tolerated. No patient discontinued cold cap therapy because of side effects from the cold caps.

Discussion

Patients are increasingly interested in scalp cooling to decrease the risk of CIA. Data, predominantly from Europe and Canada, suggest...
that scalp cryotherapy is variably effective, depending on the specific chemotherapeutic regimen.

Our study demonstrates that the Penguin Cold Caps are highly effective in preventing CIA among women with early-stage breast cancer receiving adjuvant chemotherapy with docetaxel and cyclophosphamide. Without cold cap therapy, docetaxel and cyclophosphamide chemotherapy is well known to cause complete scalp alopecia. Typically, patients lose a majority of their scalp hair approximately 17 to 21 days after the first treatment. In our study, cold cap therapy was well tolerated, with no patient discontinuing therapy because of side effects. Sixty-five percent of patients at follow-up had lost < 25% of their hair, and only 10% felt the need to wear a wig or hair covering.

Of concern is whether there may be long-term toxicities associated with scalp cooling, particularly whether lack of sufficient scalp penetration of the chemotherapeutic agents may fail to protect the scalp from metastases. We believe that although theoretically possible, the increased risk of scalp metastases associated with cryotherapy is remote. Scalp metastases from breast cancer are extremely rare, and given that most patients report hair thinning, it is likely that chemotherapy still penetrates the scalp to some extent. We are reassured by the fact that published data to date demonstrate tumors treated with scalp cooling. Nevertheless, larger-scale studies with longer-term follow-up are needed.

**Clinical Practice Points**
- Chemotherapy induced alopecia (CIA) is one of the most distressing side effects of many chemotherapy regimens.
- Scalp cryotherapy has been reported to decrease CIA. Among 20 women breast cancer using scalp cryotherapy with Penguin Cold Caps during TC chemotherapy, 90% maintained excellent or good hair preservation and only 10% reported the need to wear a wig or head covering.
- Scale cooling with Penguin Cold Caps appears to be effective in preventing CIA.
- Larger scale studies with longer term follow up are needed.

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**References**

**Disclosure**
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