Results of scalp cooling during chemotherapy with anthracyclines depend on scalp skin temperature


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Introduction
Alopecia is a much feared side effect of chemotherapy and may have an impact on treatment decisions. Scalp cooling still remains the only current intervention to prevent chemotherapy induced alopecia (CIA).

The success of scalp cooling in preventing or reducing CIA is highly variable between patients undergoing similar chemotherapy regimens. Scalp skin temperature may be an important factor, but data on the optimum temperature of scalp cooling to prevent CIA are lacking. There are suggestions in the literature that a subcutaneous scalp skin temperature below 22 degree Celsius (°C) (corresponding to an epicutaneous scalp skin temperature below 19°C) is required for hair preservation, but there is considerable variation in cooling methods and temperature measurement in studies on scalp skin temperature during scalp cooling.

Aim of this study
This study investigated the relation between scalp skin temperature and the efficacy of scalp cooling.

Methods
- Patients with primary breast cancer
- Treated with up to six cycles of adjuvant anthracycline chemotherapy FEC (5-fluorouracil 500 mg/m2, epirubicin 90-100 mg/m2, cyclophosphamide 500 mg/m2) or AC (adriamycin 60 mg/m2, cyclophosphamide 600 mg/m2)
- Scalp cooling using the Paxman® PSC-1 system
- Measuring scalp skin temperature at both temporal sides of the head
- Using thermocouples attached to the skin
- Using a non pre-cooled Paxman cap
- Informed consent
- Satisfactory hair retention = no head covering needed

Results
We conducted an explorative single-centre study between August 2010 and January 2014. A total of 62 female patients with breast cancer were included in this study. Maximal cooling was reached after 45 minutes and was continued for 90 minutes after chemotherapy infusion. The scalp skin temperature following 45 minutes cooling varied between patients from 10°C to 31°C, resulting in a mean scalp skin temperature of 19°C (Standard error of the mean (SEM) 0.4). The most pronounced hair loss was recorded after cycle 1: 40% of patients lost their hair after the first treatment. Thirteen out of 62 patients (21%) showed satisfactory hair retention during anthracycline chemotherapy. Patients with good hair retention had a mean scalp skin temperature of 17.7°C (SEM:0.7) while patients with hair loss resulting in the use of a wig or other head covering had a mean scalp skin temperature of 19.9°C (SEM:0.5) (p=0.01) (Figure 1).

Conclusions
- The efficacy of scalp cooling during chemotherapy seems to be temperature dependent.
- To obtain optimal results of scalp cooling to prevent chemotherapy induced alopecia, a scalp skin temperature of at least 18°C should be reached.

Figure 1: Mean scalp skin temperatures in degrees Celsius during all scalp cooling cycles in patients with and without head covering