Clinical aspects of scalp cooling in chemotherapy induced alopecia

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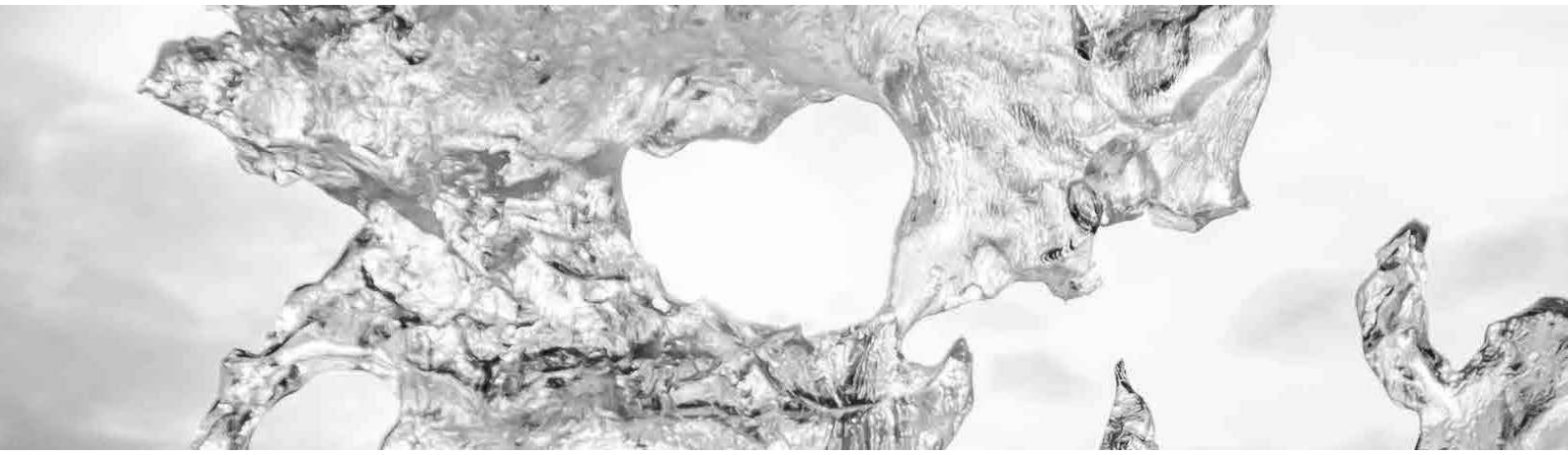
Summary



SUMMARY

Approximately 30,000 patients start chemotherapy each year (Nederlandse Kankerregistratie). Although many side effects of chemotherapy can be controlled, hair loss is still a major problem.(1,2) Every year 15,000 patients are at risk for hair loss as a result of chemotherapy treatment (Nederlandse Kankerregistratie). To prevent chemotherapy induced alopecia, scalp cooling can be used.(3)

Unfortunately, scalp cooling is not effective in every patient. A review in The Oncologist **(Chapter 2)** showed that type and dose of chemotherapy are the most important factors which can influence the outcome of scalp cooling. The influence of patient-related factors (age, gender and hair type) is less convincing or evidence is lacking.(4-7) Decreased liver function and menopausal status may also effect the outcome of scalp cooling, but so far, there is no convincing evidence.(4-7)

Gregory et al. carried out a study in 1982 to search for a threshold temperature, below which hair preservation was likely.(8) Although this study was performed with outdated cooling techniques and a small sample size, it showed that an epicutaneous scalp temperature below 19° C was needed for hair preservation. Nowadays, both cooling technology and chemotherapy regimens have changed. Therefore, a new study was performed to investigate the scalp skin temperature in relation to scalp cooling outcomes. Patients with hair preservation had significantly lower scalp skin temperatures compared to patients who lost their hair. A precise cutoff point could not be detected, but the best results seemed to be obtained when the scalp temperature decreases below 18° C **(Chapter 3)**.

Cooling time was another important factor that could influence scalp cooling outcomes. Scalp cooling is applied before, during and after chemotherapy administration. The pre-cooling time was easy to determine. A temperature measurement of the scalp skin during scalp cooling showed a temperature plateau after 30 minutes of cooling.(9) Determining the best post-infusion cooling time is more complicated. Theoretically, the half-life time of cytostatics should be considered. However, there are large differences between the half-lives of cytostatics, and the pharmacokinetics show considerable interindividual variation. Therefore, the results of different post-cooling times have been investigated. **(Chapters 4 and 5)** In a study investigating a shorter post-infusion cooling time, patients treated with docetaxel were randomized between 20 and 45 minutes after-cooling. The results for both patient groups were similar. **(Chapter 4)** In contrast, in the FEC chemotherapy regimen, a prolonged post-infusion cooling time was investigated. In this study, breast cancer patients were randomized between 90 and 150 minutes post-infusion cooling time. Prolonging the post-infusion cooling time did not significantly reduce hair loss. **(Chapter 5)**

To compare the results of scalp cooling research, it is important to standardize hair loss measurements **(Chapter 6)**. Scalp cooling studies report the use of various measurement scales. Beside the use of these subjective scales, there also exists a method to objectify hair loss with a Hair Check. Therefore, the correlation between subjective measurement scales and an objective measurement with the Hair Check to measure CIA was investigated in clinical practice. The Hair Check proved to be suitable to quantify the amount of hair loss. However, the best method to assess hair loss in clinical practice should be the patient's opinion.

The molecular damage caused by chemotherapy in hair follicles was also investigated (Figure 1) **(Chapter 7)**. It is thought that the mechanism of action is based on vasoconstriction and changed cell metabolism, but the exact mechanism is not known.

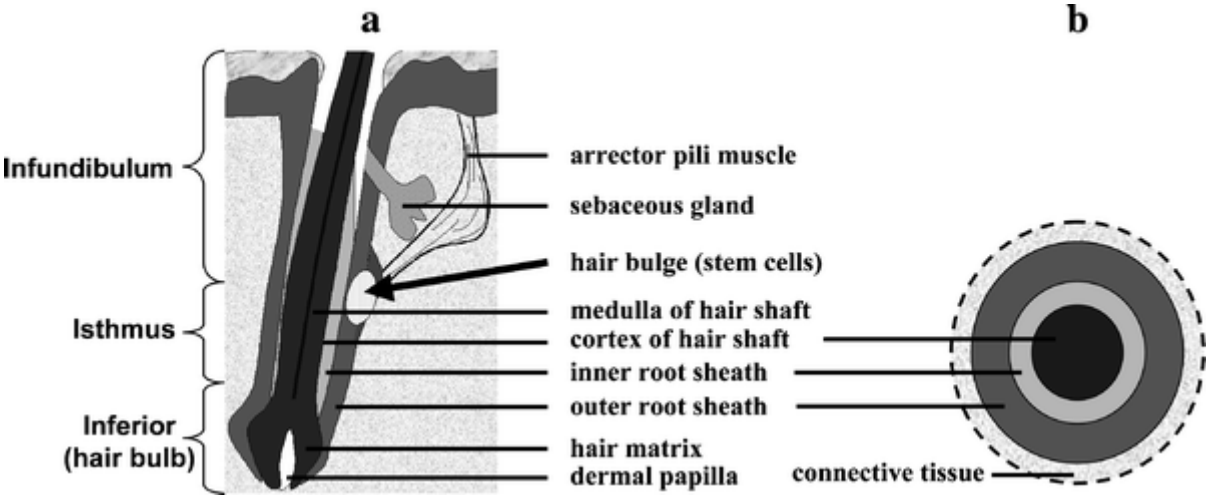


Figure 1. Hair follicle, (a) cross section length, (b) cross section. From: Protection against chemotherapy-induced alopecia. Wang J, Lu Z, Au JL. 2006 Pharm Res.Nov;23(11):2505-14.

Unfortunately, hair follicle research turned out to be a very delicate process. Better and standardized techniques are needed to study the damaging effects of cytostatic agents and to test new potential interventions for hair loss prevention.

Conclusion and future

The Netherlands have made considerable progress in improving scalp cooling and worldwide there is also more attention. Scalp cooling research has provided important implications for clinical practice and there are many opportunities for improvement. Future research should primarily focus on explaining the working mechanism at a molecular level and on individualizing scalp cooling: Would it be possible to easily measure the scalp skin temperature of the scalp during scalp cooling? Would it be possible to identify patients who will benefit from scalp cooling? And additional research to reduce the post-infusion scalp cooling time: Would it be possible to reduce the post-

infusion scalp cooling time for all types of chemotherapy to 20 minutes? Or could scalp cooling perhaps even be stopped immediately after chemotherapy administration? It is important to improve scalp cooling outcomes and to minimize the burden for the patient. Registration of data remains important because the treatment with chemotherapy is constantly changing.

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