Safety and effectiveness of scalp cooling in cancer patients undergoing cytotoxic treatment

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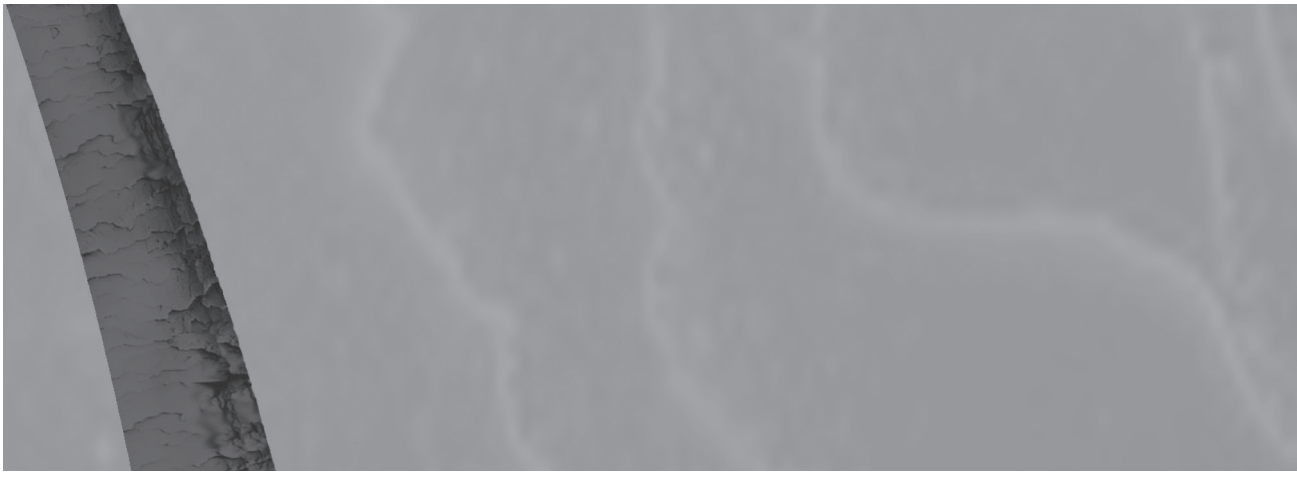
Chapter 7



Impact of scalp cooling on chemotherapy-induced alopecia, wig use and hair growth of patients with cancer

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Abstract

Introduction

Cytotoxic therapy for patients with cancer frequently induces reversible, but long-lasting alopecia which might be prevented by scalp cooling. This study evaluates the effectiveness of scalp cooling with respect to the severity of chemotherapy-induced alopecia (CIA) and the purchase and use of wigs and head covers.

Materials and Methods

In this observational study, scalp-cooled patients (n=160) were compared with non scalp-cooled patients (n=86) with several types of cancer. Patients were enrolled in 15, mostly general hospitals prior to taxane and/or anthracycline-based chemotherapy. Patients completed four questionnaires between the start and one year after the last chemotherapy.

Results

Severity of CIA, and purchasing and actually wearing wigs and head covers were significantly lower among scalp-cooled than non scalp-cooled patients. Overall, scalp cooling reduced the use of wigs and head covers by 40%. Among 84 scalp-cooled patients who purchased a wig (53%), only 52 patients actually wore it (62%), and they just wore it intensively (86% daily) for less than six months (80%). Especially young patients camouflaged CIA with a head cover instead of a wig.

Discussion

The relatively long duration of CIA, the wish of many patients to camouflage or rather prevent it and the 40% reduction for head covering by scalp cooling, makes it a worthwhile supportive intervention. However, (cost-) effectiveness can be improved. Many scalp-cooled patients purchased a wig unnecessarily.

Introduction

Alopecia is a common side-effect of systemic cancer treatment. Even before patients commence chemotherapy, they forsee a high psychological impact at the moment hair loss actually occurs[1], and it appears in fact to be distressing for many patients.[2-7] In a breast cancer focus group, organised by the authors, patients reported that their personal identity disappeared simultaneously with the sudden hair loss: *"You don't recognise the person in the mirror anymore, although you have known that person your whole life"*. At that moment patients feel labelled as a cancer patient and state that *"If you look ill, you feel more ill"*. CIA is an outward sign of cancer – it makes cancer visible. It reminds patients and their relatives continuously about cancer and it's treatment: *"On good days between chemotherapies, you don't think about the disease... until you look in the mirror*".

Severe chemotherapy-induced alopecia (CIA) occurs mostly within three weeks of the first chemotherapy cycle.[8,9] While cytostatics mainly influence anagen hair follicles[10], i.e. in the growth phase, the growth of hairs is diminished until some weeks to months after the last chemotherapy cycle.[8,9] Alopecia-inducing chemotherapy schedules continue for at least nine weeks, but more often up to 21 weeks[11], so patients often have to deal with a bald head or short hair for up to about nine months. It may take some additional time before patients have their usual appearance again, because when hair grows back, the structure is often temporarily different from the hair they used to have.[8]

Many patients camouflage CIA by wearing a wig or head cover. Wearing a wig is a compensation for the changed appearance and makes the patient look normal again. However, some patients prefer not to hide hair loss and share their baldness.[3]

CIA is however not inevitable. Scalp cooling is a supportive care treatment that overall prevents severe CIA in about half of the patients, who otherwise would have lost their hair.[12] Its effectiveness has been shown in 6 out of 7 randomised studies with several types of chemotherapy, published between 1977 and 2003.[13] An overview of the results after 40 years of scalp cooling has been provided in recent reviews.[13,14] These reviews however show a broad diversity in CIA evaluation methods.

This study evaluates the effectiveness of scalp cooling by comparing severity of CIA and the purchase and use of wigs and head covers between scalp-cooled and non scalp-cooled patients. Furthermore, the duration of CIA is taken into consideration.

Methods

Patients and setting

In this observational prospective study scalp-cooled patients were compared with non scalp-cooled patients. Patients were treated in 13 hospitals which used scalp cooling and two which did not. Patients in the participant scalp cooling hospitals who did not want scalp cooling, could participate in the non scalp-cooled group. Patients were eligible if they received a chemotherapy schedule with the potential of inducing severe CIA and for which scalp cooling was commonly applied. They had to be at least 18 years old and had to understand the Dutch language. Exclusion criteria for scalp cooling were baldness before the

start of chemotherapy, haematological malignancies with generalised metastases, clinical signs of scalp skin metastases, cold sensitivity, cold agglutinin disease, cryoglobulinaemia, cryofibrinogenaemia and cold post-traumatic dystrophy.

Scalp cooling was performed using the Paxman system (type PSC1 or PSC2) with a standardised cooling time from 30 min before starting the chemotherapy infusion to 90 min after stopping the infusion.

Approval for this study was obtained from the Medical Ethics Committees and all participating patients signed forms of informed consent.

Measures

Patients received four sets of questionnaires with return envelopes and completed them at home before the start of chemotherapy (M1) and three weeks (M2), six (M3) and twelve months (M4) after completing chemotherapy. If the questionnaires were not returned in time, patients received a reminder. Patients were eligible for analysis if they completed at least the first and second questionnaire. Clinical patient characteristics were collected from patient files.

Patients evaluated in M2 the severity of CIA as defined by the World Health Organisation (WHO) scale for alopecia: grade 0 for none, grade 1 for mild, grade 2 for pronounced and grade 3 for total alopecia.[15] Furthermore, patients filled in a Visual Analogue Scale (VAS) ranging from 0 (for no alopecia) to 100 (for total baldness).

Patients reported whether they had purchased (M1, M2, M3) and used (M2, M3, M4) a wig or head cover and during what time period (M3 and M4). They also stated whether they had used it inside or outside of the home. In addition, they reported when their hair started to grow again (M3) and whether they were satisfied with their hairstyle 3 weeks and 6 months after the last chemotherapy cycle (M2, M3).

Statistics

The Chi-square test was used to compare the proportion of scalp-cooled and non scalp-cooled patients with respect to demographics and clinical characteristics, purchase and use of wigs or head covers, WHO scores, and growth of hair. VAS for CIA was compared between scalp-cooled and non scalp-cooled groups with the standard t test for unequal variances. Associations between the outcome measures were tested by the Spearman's rank correlation test, using the SAS computer package (version 9.1, SAS Institute Inc., Cary, North Carolina, USA, 1999).

Results

Patients and setting

In this observational study 160 scalp-cooled and 86 non scalp-cooled patients were available for analysis (Figure 1). Only six men were included, all underwent scalp cooling (Table 1). The majority of patients had a Dutch ethnicity (96%), had breast cancer (93%), were treated in the adjuvant setting (87%) and had oncological surgery (93%). Scalp-cooled patients received

FEC chemotherapy (5-Fluorouracil, Epirubicin, Cyclophosphamide) more often than those who did not undergo scalp cooling. Scalp-cooled patients received a mean of six (range 1-27) chemotherapy cycles and five (range 1-27) scalp cooling cycles. Non scalp-cooled patients received a mean of six (range 3-16) chemotherapy cycles, and 56% of them were treated in the two hospitals that did not offer scalp cooling.

All four measurements were complete in 76% of the patients (Figure 1). Reasons for incompleteness (n=59) were: 75% unknown, 17% died, 3% missing patient identification (impossible to send a reminder) and 5% actively discontinued participation. Compliance with scalp cooling was high, only four patients (3%) stopped it because of intolerance, others stopped only because of CIA. No scalp skin metastases were reported from the inclusion of patients in 2007 and 2008 until January 2012.

Severity of CIA

Hair loss was significantly less pronounced in scalp-cooled than in non scalp-cooled patients ($p<0.0001$) (Table 2). Mean VAS scores and proportion head cover use increased when categories of WHO scores increased. Correlation coefficients were 0.86 for VAS versus WHO, 0.63 for WHO versus head cover use and 0.65 for VAS versus head cover use. Scalp-cooled patients with pronounced CIA on the WHO scale reported that they had lost half of their hair (VAS 52) and overall 45% of them did use a head cover.

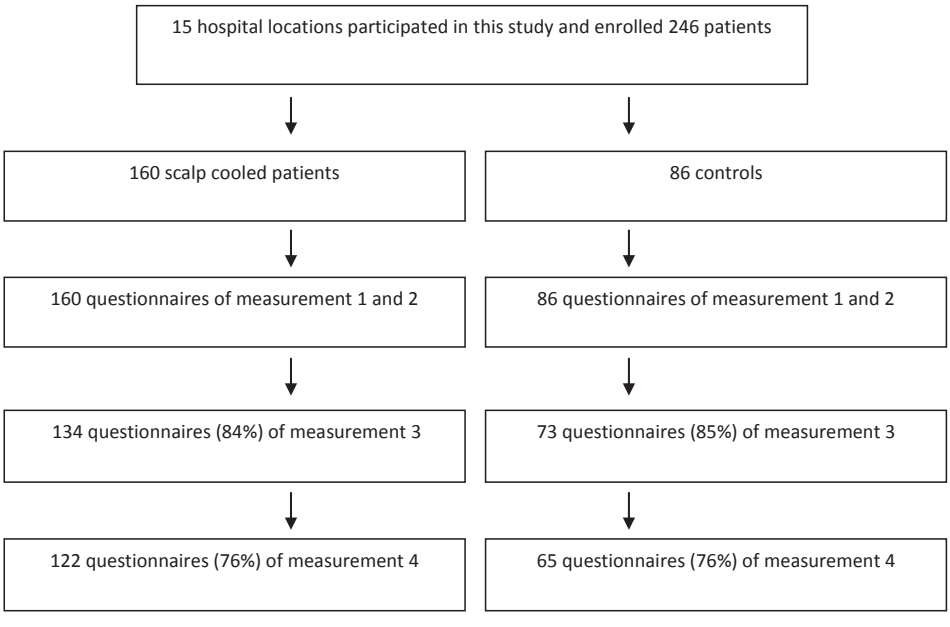

Figure 1. Flow-chart of the data collection process.

Table 1. Socio-demographic and clinical characteristics of patients treated with or without scalp cooling (n=246).

	Scalp-cooled n=160 (%)	**Non scalp-cooled** n=86 (%)	**p-value** scalp-cooled vs non scalp-cooled
Age (years)			0.6
≤49	70 (44)	43 (50)	
50-59	63 (39)	29 (34)	
≥ 60	27 (17)	14 (16)	
Gender			0.07
Male	6 (4)	0	
Female	152 (96)	86 (100)	
Missing	2		
Ethnicity			0.4
West-European	154 (97)	82 (95)	
Else	4 (3)	4 (5)	
Missing	2		
Site of Cancer			0.001
Breast	152 (95)	77 (90)	
Ovary	0	8 (9)	
Gastro-intestinal	3 (2)	0	
Lung	3 (2)	1 (1)	
Prostate	2 (1)	0	
Chemotherapy[a]			0.0006
FEC	101 (66)	39 (45)	
Paclitaxel combination	4 (3)	7 (8)	
Docetaxel mono/ combination	8 (5)	1 (1)	
ACTH	11 (7)	11 (13)	
FAC	12 (8)	4 (5)	
FECD	6 (4)	7 (8)	
DAC	5 (3)	14 (16)	
Other	6 (4)	3 (4)	
Missing	7		
Chemotherapy setting			0.3
Adjuvant	131 (86)	78 (91)	
Palliative	22 (14)	8 (9)	
Missing	7		
Surgery			0.9
Yes	147 (96)	83 (96)	
Comorbidity			0.3
Yes	31 (19)	22 (26)	
No	129 (81)	64 (74)	

[a] F=5-fluorouracil E=epirubicin C=cyclophosphamide A=adriamycin T=paclitaxel H=herceptin D=docetaxel

Purchase and use of wigs and head covers

Purchase and use of wigs and head covers differed significantly between scalp-cooled and non scalp-cooled patients (Table 3). Overall, scalp cooling reduced the use of a wig or head cover by 40% (p<0.0001). Among 84 scalp-cooled patients who purchased a wig, only 52 (62%) patients used it, whereas of 66 non scalp-cooled patients who purchased a wig 59 (89%) used it.

Additional analysis for patients aged ≤49 years (n=113) and >60 years (n=133) showed that 29% of the young age group bought only a head cover and no wig, versus 13% of those over 50 years (p=0.0016). There was no difference in the use of wigs or head covers between age groups, once they purchased one.

Wigs were used inside and outside of the home by 75% of the patients who reported wearing one; 86% of them wore it daily or almost daily. Head covers were used only inside the house by 26% of the patients who reported wearing one, others used it also outside of the home. About 80% of the 159 patients wore their wig or head cover less than six months after the last chemotherapy cycle, of whom 15 (12%) had hardly used it anymore in that time period.

Growth of hair

In 24% of the scalp-cooled and 7% of the non scalp-cooled patients hair kept growing during chemotherapy (Table 3). The remaining patients most often reported that their hair started to grow again between three and six weeks after the last chemotherapy. Most patients were satisfied with their hairstyle three weeks and six months after chemotherapy.

Table 2. WHO, VAS score of alopecia and head covers used in scalp-cooled and non scalp-cooled patients (n=246).

CIA		**Scalp-cooled** (n=160)			**Non scalp-cooled** (n=86)	
WHO[a]	**WHO**	**VAS**	**Head cover use**	**WHO**	**VAS**	**Head cover use**
	n (%)	Mean (sd)	n (%)[b]	n (%)	Mean (sd)	n (%)[b]
No	7 (4)	4 (9)	0	0	-	0
Mild	25 (16)	25 (26)	3 (12)	2 (2)	8 (6)	1 (50)
Pronounced	80 (50)	52 (20)	36 (45)	6 (7)	74 (21)	4 (67)
Total	48 (30)	95 (8)	42 (88)	78 (91)	97 (5)	73 (94)
Overall		58 (33)[a]	81 (51)		94 (16)[a]	78 (91)

WHO: World Health Organisation scale for alopecia
VAS: Visual Analogue Scale, ranging from 0 (no alopecia) to 100 (total baldness)
Spearman's rho: 0.86 (WHO vs VAS), 0.63 (WHO vs head cover use), 0.65 (VAS vs head cover use)
[a] Both, WHO and VAS: group comparison scalp cooling versus no scalp cooling: p<0.0001
[b] Including wigs

Table 3. Purchase and use of wig and head cover (from before starting chemotherapy to 6 months after chemotherapy) and growth of hair during and after chemotherapy (n=246).

	Scalp-cooled (n=160)	Non scalp-cooled (n=86)	p-value
	n (%)	**n (%)**	
Purchase/use			
Purchased wig	84 (53)	66 (77)	0.0002
Used wig	52 (33)	59 (69)	<0.0001
Purchased head cover[a]	117 (73)	83 (97)	<0.0001
Used head cover[a]	81 (51)	78 (91)	<0.0001
Growth			0.03
During chemotherapy	31 (24)	5 (7)	
Within 3 weeks after chemotherapy	19 (19)	10 (16)	
3-6 weeks after chemotherapy	45 (46)	27 (43)	
6-8 weeks after chemotherapy	18 (18)	18 (28)	
8 weeks after chemotherapy	17 (17)	8 (13)	
Missing	30	18	
Satisfied with current hair style?[b]			
3 weeks after chemotherapy	111 (85)	57 (78)	0.23
6 months after chemotherapy	111 (94)	50 (86)	0.08

[a] wig included

[b] n<246 because measured in M3 and M4

Discussion

Scalp cooling significantly reduced the severity of CIA and the purchase and use of wigs and head covers after anthracycline- or taxane-based chemotherapy. However, a head cover was still used by 51% of the scalp-cooled patients, so improvement in effectiveness is desirable. Meanwhile, cost-effectiveness can be improved because 38% of the scalp-cooled patients were thought to have purchased a wig needlessly (unpublished results). In another study this unnecessary purchase totalled 80% of the patients.[16] Nowadays, many Dutch scalp-cooled patients consult their hairdressers and agree that the wig will not be purchased when scalp cooling is effective. Ideally, a wig is chosen and reserved before starting chemotherapy, but only styled and delivered once hair loss occurs. Such an arrangement should not be restricted to scalp-cooled patients, as the incidence of CIA without scalp cooling is sometimes overestimated and also 7 (11%) non scalp-cooled patients did not use their wig.

Patients, who used their wig or head cover, used it intensively for several months. It has been shown previously that breast cancer patients (n=175) were generally satisfied with their wig, but about two-thirds of them felt it was expensive[17], which is again a reason for postponing the purchase. Especially younger patients regularly (29%) preferred a head cover above a

wig. Therefore, in our opinion, head covering in general should be reimbursed by health insurance companies instead of only wigs.

The high frequency of wigs and head covers purchased to camouflage potential hair loss illustrates the importance of CIA for patients undergoing systemic therapy. The psychological impact of CIA, for males and females, has been described in several studies.[1,5,7,8,18,19] While a high proportion of patients were satisfied with their hairstyle shortly following the last chemotherapy, hair quality for successfully scalp-cooled patients seems to be good. The satisfaction among non scalp-cooled or unsuccessfully scalp-cooled patients might be explained by adaptation to the situation[3] or hair growth may visualise the healing process.[20] Nevertheless, the majority of patients with CIA reported wearing head coverings until several months after the last chemotherapy. In other studies it was reported that six months following chemotherapy, whether or not combined with scalp cooling, the majority of patients were satisfied with the rate of growth and length, thickness and texture of the hair, but less with the colour.[17,21] Patients valued scalp cooling to be worthwhile, as shown by the small proportion of patients who stopped scalp cooling for reasons other than CIA.

Up to now, there is no optimal outcome measure for severity of CIA. This study showed correlation but also inconsistencies between three subjective measures (WHO, VAS, head cover use, table 2). Other scales like the Common Toxicity Criteria[22] or Dean's scale[23] are comparable to WHO scores and therefore not inferior in distinguishing CIA. The Dutch Scalp Cooling Group now uses the Hair Check device in studies[24,25], which is an objective measure, but time consuming and therefore not clinically feasible for daily use at oncology wards. Moreover, Hair Check outcomes also show inconsistence with the patients' opinion of whether head covering is desirable. While some patients loose almost all of their hair but do not wear head covering and vice versa, in our opinion head cover use still best reflects the patients' satisfaction with scalp cooling.

This study has some limitations. The most important one is the difference in the proportion of patients with FEC and DAC chemotherapy between the scalp-cooled and non scalp-cooled groups. For the other types of chemotherapies the number of patients was small, but hardly differed. While the expert opinion is that all regimens almost always cause total baldness without scalp cooling, it is unlikely to fully explain the differences in amount of hair loss and head cover use between both groups. Nevertheless, while it is a non randomised design, outcomes have to be interpreted with care. Another limitation is the lack of information about chemotherapy dosages, which is associated with the scalp cooling result. However, it is improbable that it differs between both groups; firstly, proportions of adjuvant and palliative treated patients were equal and besides, our registration of results shows adherence to the Dutch treatment guidelines.[12]

In conclusion, the reasonably long duration of CIA, the wish of many patients to camouflage or rather prevent it and the reduced need for head covering in 40% of the patients, makes scalp cooling a worthwhile supportive intervention. However, scalp cooling (cost-) effectiveness can be improved. Improvement can be obtained by studying scalp-cooling times[26] and temperatures, by adapting indications (e.g. type of chemotherapy and patient motivation),

but also by adapting patient information about CIA and scalp cooling. For example, patients should be advised not to buy a wig as a precaution, but to wait until it becomes necessary. The use of scalp cooling will probably increase, because of increasing cancer incidence, more frequent use of chemotherapy in solid tumours and improved acquaintance with scalp cooling in hospitals but also among patients.

In order to compare scalp cooling outcomes in the future, a questionnaire should be developed and validated to evaluate the extent of CIA and its impact on patient's lives.

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