

Cryotherapy in the Management of Chemotherapy-Induced Alopecia: Integrative Review

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Crioterapia no Manejo da Alopecia Induzida por Quimioterapia: Revisão Integrativa

Crioterapia en el Manejo de la Alopecia Inducida por Quimioterapia: Revisión Integradora

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ABSTRACT

Introduction: Chemotherapy is currently one of the most widely used cancer treatments; however, its systemic action leads to various side effects, including alopecia, which impacts the self-image and consequently the self-esteem of oncology patients. In an effort to prevent this adverse effect, scalp cryotherapy has emerged as a therapeutic option. **Objective:** To analyze the scientific knowledge produced on the use of cryotherapy to prevent chemotherapy-induced alopecia. **Method:** Integrative literature review conducted on the MEDLINE, PubMed, IBECs databases, and on the catalog of CAPES theses and dissertations, utilizing the descriptors “cold therapy”, “hair loss”, “scalp cooling”, “cryotherapy”, “alopecia” and “chemotherapy” from January 2015 to January 2023. **Results:** Eighteen studies were selected based on inclusion and exclusion criteria. Scalp cryotherapy is considered effective in preventing grade 2 alopecia and shows benefits related to the speed of hair growth post chemotherapy-induced alopecia (CIA). However, the technique did not yield good results for the black population analyzed. The most common adverse effects of the technique are headache, mandibular pain, and chills. **Conclusion:** The use of the technique has proven to be a good conduct to prevent CIA in individuals undergoing treatment for solid tumors due to its safety and effectiveness. However, further research is needed in black individuals due to the discrepancy in success rates, aiming to encompass all races and hair textures.

Key words: Drug Therapy; Alopecia; Cryotherapy/methods; Review.

RESUMO

Introdução: A quimioterapia é atualmente um dos tratamentos mais utilizados contra o câncer, porém, por possuir ação sistêmica, acarreta diversos efeitos colaterais, entre os quais, a alopecia, que impacta na autoimagem e consequentemente na autoestima do paciente oncológico. Visando prevenir esse efeito adverso, a crioterapia capilar passou a ser utilizada como uma opção terapêutica. **Objetivo:** Analisar o conhecimento científico produzido sobre o uso da crioterapia para prevenir alopecia decorrente de quimioterapia. **Método:** Revisão integrativa da literatura realizada nas bases de dados MEDLINE, PubMed, IBECs e no catálogo de teses e dissertações da CAPES, com os descritores *cold therapy*, *hair loss*, *scalp cooling*, *cryotherapy*, *alopecia* e *chemotherapy*, no período de janeiro de 2015 a janeiro de 2023. **Resultados:** Dezoito estudos foram selecionados com base nos critérios de inclusão e exclusão. A crioterapia capilar é considerada eficaz na prevenção da alopecia grau 2, além de mostrar benefícios relacionados à velocidade de crescimento capilar após alopecia induzida por quimioterapia (AIQ), porém a técnica não mostrou bons resultados na população negra analisada. Os efeitos adversos mais comuns da técnica são cefaleia, algia mandibular e calafrios. **Conclusão:** O uso da técnica mostra-se como boa conduta para prevenir a AIQ em indivíduos em tratamento para tumores sólidos em razão da sua segurança e eficácia, porém, ainda são necessárias mais pesquisas em indivíduos de raça negra, por causa da discrepância na taxa de sucesso, visando contemplar todas as raças e curvaturas capilares. **Palavras-chave:** Tratamento Farmacológico; Alopecia; Crioterapia/métodos; Revisão.

RESUMEN

Introducción: La quimioterapia es actualmente uno de los tratamientos más utilizados contra el cáncer; sin embargo, debido a su acción sistémica, conlleva diversos efectos secundarios, entre los cuales figura la alopecia, que impacta en la autoimagen y, consecuentemente, en la autoestima del paciente oncológico. Con el objetivo de prevenir este efecto adverso, la crioterapia capilar pasó a ser usada como una opción terapéutica. **Objetivo:** Analizar el conocimiento científico producido sobre el uso de la crioterapia para prevenir la alopecia inducida por quimioterapia. **Método:** Revisión integradora de la literatura realizada en las bases de datos MEDLINE, PubMed, IBECs y en el catálogo de tesis y disertaciones de CAPES, utilizando los descriptores “cold therapy”, “hair loss”, “scalp cooling”, “cryotherapy”, “alopecia” y “chemotherapy”, en el período de enero de 2015 a enero de 2023. **Resultados:** Dieciocho estudios fueron seleccionados según los criterios de inclusión y exclusión. La crioterapia capilar se considera efectiva en la prevención de la alopecia de grado 2, además de mostrar beneficios relacionados con la velocidad de crecimiento capilar post alopecia inducida por quimioterapia (AIQ); sin embargo, la técnica no mostró buenos resultados en la población negra analizada. Los efectos adversos más comunes de la técnica son dolor de cabeza, algia mandibular y escalofríos. **Conclusión:** El uso de la técnica se muestra como una buena práctica para prevenir la AIQ en individuos en tratamiento para tumores sólidos debido a su seguridad y eficacia; no obstante, se necesitan más investigaciones en individuos de raza negra debido a la discrepancia en la tasa de éxito, con el objetivo de abarcar todas las razas y curvaturas capilares. **Palabras clave:** Quimioterapia; Alopecia; Crioterapia/métodos; Revisión.

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INTRODUCTION

Brazil has been through many sociodemographic, economic, and cultural changes through the years, which also generated a change in the population's epidemiological profile. It is undeniable that the Brazilian population's life expectancy has increased; however, along with it came a greater exposure to carcinogenic factors, whether related to work, food, or habits, like continuous solar exposure, ionizing radiation exposure, alcohol consumption, smoking, diet poor in natural and minimally processed food¹.

Likewise, the number of people with cancer has grown, but, as the detection and treatment methods are increasingly more effective, they allow for a rise in the survival rate of these patients. An array of therapeutic alternatives for treating cancer are available today, such as surgery, radiotherapy, chemotherapy, hormone therapy, immunotherapy, that are, in turn, combined to one or more types of treatments, depending on the cancer and on the patient's needs^{1,2}.

Among the antineoplastic therapies, chemotherapy is still one of the most used for healing as well as for palliative purposes. This is due to its systemic action that uses one or more chemical substances that are usually administered orally, intravenously, or subcutaneously. Once administered, chemotherapy will interfere in the cell division, destroying malign cells. The chemicals, however, make no selection, acting both on benign and malign cells. Thus, in addition to the medication's desired effects, the patient suffers adverse effects from this cell destruction¹⁻³.

The main chemotherapy's adverse effects include alopecia, nausea and vomiting, intestinal constipation, diarrhea, mucositis, fatigue, thrombocytopenia, neutropenia, anemia, in addition to cardiotoxicity and nephrotoxicity. Among those, alopecia is one of the most known complications feared by the patients, especially women, given the symbolic representation of femininity that society attributes to hair. Thus, alopecia affects people's self-esteem by changing the way they see themselves and are seen by others, which can generate psychic suffering and social isolation^{2,4}.

Aiming to counter this adverse effect that is so damaging to patients' self-esteem, hair cryotherapy, a recent technology proposed to prevent alopecia in patients undergoing oncological treatment, has emerged as a therapeutic option. It works by using thermal caps to cool the scalp, inducing vasoconstriction, which causes a decrease in blood flow and reduces the metabolic rate of hair follicles. Cryotherapy, however, is not yet widely used for managing chemotherapy-induced alopecia (CIA)⁴. Considering that cryotherapy generates concrete

benefits in preventing alopecia in patients undergoing chemotherapy, this study aims at analyzing the scientific knowledge produced on the use of cryotherapy to prevent chemotherapy-induced alopecia published from January 2015 to January 2023; and, specifically, characterizing the selected scientific productions.

This study is motivated by the expression of fear and grief associated to hair loss by patients that need chemotherapy to treat cancer, observed while working as an oncology resident nurse at a High-Complexity Oncology Unit (Unacon) and a High-Complexity Oncology Center (Cacon) in the state of Bahia.

The relevance of this study lies on the technique's complexity and the need to stimulate research about hair cryotherapy and training professionals to use this procedure. Its social relevance must also be highlighted, as cryotherapy emerges as a psychoemotional aid for people who experience alopecia, considered to be the most traumatic effect of chemotherapy by many patients, who sometimes reject treatment due to the anxiety related to this adverse effect, even though it means reducing their life expectancy⁵.

METHOD

Integrative literature review, with analyses of published studies, knowledge synthesis and reflections about future interventions.

The data collection was guided by a research question, defined by the PICO strategy (Chart 1): "What is the scientific knowledge produced about hair cryotherapy in managing chemotherapy-induced alopecia?"

The next steps were followed: 1. Theme identification and selection of the research question (problem definition; elaboration of guiding question; search strategy definition; database and descriptors definition); 2. Determination of inclusion and exclusion criteria and search for studies based on the determined criteria; 3. Identification of pre-selected and selected studies (skimming of abstracts, keywords, and publication titles); 4. Organization of pre-selected studies; identification of selected studies; 5.

Chart 1. PICO strategy acronym definition

PICO Strategy	Selection
P - Population	Patients undergoing chemotherapy-induced alopecia
I - Intervention	Hair cryotherapy
C - Control	Knowledge produced
O - Outcome	Search the scientific knowledge about the use of cryotherapy in these patients

Categorization of selected studies; elaboration and use of synthesis matrix; 6. Critical analysis of selected studies and interpretation (discussion) of the found results. 7. Presentation of the review/synthesis of knowledge produced by the scientific literature researched.

The studies were searched in the following databases: Medical Literature Analysis and Retrieval System Online (MEDLINE) and *Índice Bibliográfico Español en Ciencias de la Salud* (IBECs), through the *Biblioteca Virtual em Saúde* (BVS); PubMed Central through the National Library Of Medicine (NLM) of the National Center for Biotechnology Information (NCBI); as well as the *Catálogo de Teses e Dissertações da Coordenação de Aperfeiçoamento de Pessoal de Nível* (CAPES) through the Medical Subject Headings (MeSH) and *Ciências da Saúde* (DeCS) descriptors: cold therapy, hair loss, scalp cooling, cryotherapy, alopecia and chemotherapy, equivalent to the Portuguese and Spanish descriptors: “crioterapia”/“crioterapia”, “alopecia”/“alopecia”, “couro cabeludo”/“cuero cabelludo”, “temperatura baixa”/“frío” and “quimioterapia”/“quimioterapia”, in association to Boolean operators AND and OR, with the following search strategies and descriptors cross-reference (Chart 2).

Chart 2. Search strategy

Crossings	Search strategy
Crossing 1	<i>cold therapy AND hair loss</i>
Crossing 2	<i>scalp cooling OR cryotherapy AND alopecia AND chemotherapy</i>

To select the documents in the current review, some eligibility criteria (inclusion and exclusion) were used. The inclusion criteria were original articles published and indexed to the referred databases over the last eight years, from January 2015 to January 2023, that were available in full and free of charge, published in Portuguese, English or Spanish and associated with the objective of the study. Duplicate articles were excluded. The previously established time frame for searching eligible articles was defined considering the year the Food and Drug Administration (FDA)⁶, the regulatory agency connected to the USA health department, authorized the use of cryotherapy (2015).

After analysis and selection of the scientific articles, reading of abstracts and full text, a chart was elaborated with the collected data and information from each article, detailing the obtained results.

To organize the data to be analyzed, a form was created to record the content extracted from the selected articles, comprising the title of the scientific production, year of

publication, journal, objective of the study, type of study and main results. The information obtained from the selected articles were analyzed. Later, the data were compared to the related literature to fulfill the last step on the study methodology, that is, the integrative review presentation.

As this was an integrative literature review, there was no need to submit the study to a Research Ethics Committee; nonetheless, ethical and legal criteria related to authorship of the works included in the review were respected.

RESULTS

From the selected results, two empirical categories were elaborated to analyze the articles included in this integrative review: characterization of scientific productions and scientific knowledge on the use of cryotherapy to prevent chemotherapy-induced alopecia.

CHARACTERIZATION OF SCIENTIFIC PRODUCTIONS

The descriptors' crossing resulted in a total of 720 articles, 18 of which met the inclusion criteria (Chart 3).

Among the selected articles, it was possible to observe a predominance of the English language (94.44%),

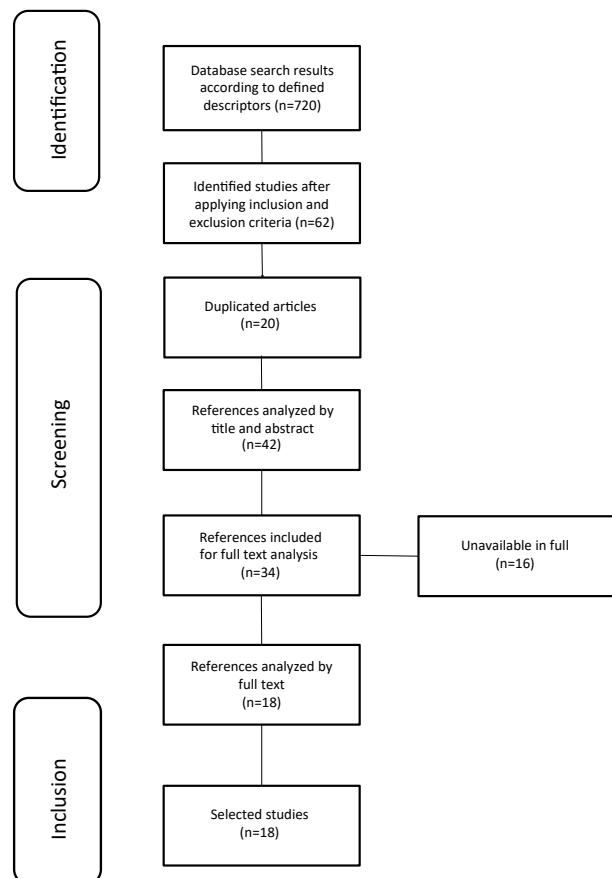


Figure 1. Flowchart of articles searched in the databases

Source: Adapted from PRISMA 2020⁷.



Chart 3. Description of the selected articles detailing author/year, study location, publication, objective, type of study and main results

Author/Year/ Country	Journal	Objective	Type of study	Main outcome
Bajpai et al., 2020. India ⁸	The Breast	Evaluate the effect of hair cryotherapy on CIA and hair growth in patients using anthracycline and taxane	Randomized clinical trial	Women with breast cancer under anthracycline and taxane treatment who received hair cryotherapy were more prone to losing 50% less hair after chemotherapy, showing extreme hair growth after CIA and better results reported by the patients, with acceptable tolerance
Munzone et al., 2018. Italy ⁹	British Journal of Cancer	Evaluate the viability and efficacy of the hair cryotherapy system DigniCap for preventing CIA in breast cancer patients undergoing adjuvant chemotherapy treatment with anthracyclines	Prospective study	The DigniCap System was capable of significantly preventing CIA in over 40% of patients with primary breast cancer who received adjuvant chemotherapy with anthracyclines
Mitric et al., 2021. Canada ¹⁰	Gynecologic Oncology Reports	Determining the efficacy of hair cryotherapy in preventing CIA in gynecological oncological patients	Pilot prospective study	Hair cryotherapy may preserve the hair of gynecological oncological patients who receive weekly carboplatin and paclitaxel in combined chemotherapy
Dilawari et al., 2021. USA ¹¹	The Oncologist	Verify the efficacy of hair cryotherapy in black patients undergoing chemotherapy for breast cancer	Phase II viability study	Hair cryotherapy may not be effective in preventing alopecia in black women. Differences in hair thickness, volume and design limitations of the cooling cap may contribute to its ineffectiveness in this population
Kate et al., 2020. India ¹²	Cancer Treatment and Research Communications	Identify and assess the safety, efficacy, and tolerability of the cold cap in patients with different types of cancer undergoing chemotherapy with a risk of alopecia	Prospective observational study	Hair cryotherapy was observed to be more effective in reducing CIA in patients that underwent taxane and anthracycline-based chemotherapy
Kinoshita et al., 2019. Japan ¹³	Frontiers in Oncology	Assess the efficacy of hair cryotherapy devices in preventing CIA in Japanese breast cancer patients and investigate if there is a better hair volume recovery after the end of chemotherapy	Controlled clinical trial	The use of a scalp cooling device avoided alopecia with acceptable safety in Japanese patients. Moreover, even in patients whose alopecia was not prevented, cooling the scalp resulted in a faster hair volume recovery after CIA

to be continued

Chart 3. continuation

Author/Year/ Country	Journal	Objective	Type of study	Main outcome
Lugtenberg et al., 2022. Netherlands ¹⁴	Supportive Care in Cancer	Compare the efficacy of post-infusion cooling time reduced from 45 and 90 minutes to 20 minutes in hair cryotherapy	Randomized clinical trial	A 20-minutes post-infusion cooling is as effective as a 45- and 90-minutes cooling to prevent weekly paclitaxel-induced alopecia
Carbognin et al., 2022. Italy ¹⁵	Current Oncology	Assess the efficacy and safety of the DigniCap device in preventing CIA	Prospective study	Confirmed usefulness of hair cryotherapy in preventing CIA in patients submitted to sequential chemotherapy based on anthracyclines and taxanes
Brunner et al., 2022. Austria ¹⁶	The Breast	Assess the efficacy of the ice cap in different chemotherapy routines as to hair recovery after the treatment	Prospective interventional study	Hair cryotherapy has shown to be effective in preventing CIA in breast cancer patients, mainly for taxane monotherapies, however, no significant results were observed in hair recovery
Ohsumi et al., 2021. Japan ¹⁷	Supportive Care in Cancer	Assess hair growth recovery after CIA in patients who underwent hair cryotherapy	Observational study	The use of an ice cap during chemotherapy infusion in Japanese breast cancer patients increased the hair recovery rate and had preventive effects against persistent alopecia
Bitto et al., 2020. Germany ¹⁸	Breast Care	Assess patient satisfaction, well-being, and selection criteria for hair cryotherapy	Field study	Hair cryotherapy is usually a promising approach that improves patient well-being, but there are still limitations to its utility, depending on the used chemotherapy routine
Gianotti et al., 2019. Italy ¹⁹	Asia-Pacific Journal of Oncology Nursing	Assess the effectiveness of the ice cap in the daily clinical practice in three Italian oncological units	Multicentric interventional study	The ice cap provides a reliable possibility for patients with breast cancer to prevent CIA during taxane and/or anthracycline-based chemotherapy
Saad et al., 2018. India ²⁰	Indian Journal of Cancer	Assess the effectiveness and tolerability of hair cryotherapy in breast cancer patients	Controlled prospective study	Hair cryotherapy is potentially effective in reducing CIA caused by docetaxel. It wasn't well tolerated, however
Fehr et al., 2016. Switzerland ²¹	Current oncology	Assess the efficacy and tolerability of an ice cap system controlled by regulated feedback by directly taking the patient's individual scalp temperature	Prospective cohort study	The ability of hair cryotherapy to prevent CIA varies with the chemotherapy routine and age of the patient

to be continued



Chart 3. continuation

Author/Year/ Country	Journal	Objective	Type of study	Main outcome
Rugo et al., 2017. USA ²²	Journal of the American Medical Association	Assess if the use of an ice cap system is associated to a decrease in hair loss among women undergoing chemotherapy and its effect in the quality of life	Prospective cohort study	A hair loss decrease was observed in 4 weeks after the last chemotherapy dose in patients who used cryotherapy. More studies are needed to evaluate the outcomes after anthracycline infusion, prevention in the long-term and adverse effects
Belum et al., 2016. USA ²³	Breast Cancer Research and Treatment	Report the occurrence of scalp thermal lesion after the use of ice caps to prevent CIA	Case report	Thermal lesions caused by the use of ice caps are probably infrequent and preventable adverse effects that may result from inadequate device application
Keim et al., 2022. Germany ²⁴	Oncology research and treatment	Assess the efficacy and viability of cooling the scalp in a real-world hematological and oncological outpatient center	Prospective study	Cryotherapy increases patient acceptance and administration of chemotherapy and decreases the suffering in patients and their attending physicians
Monteiro, 2021. Brazil ²⁵	CAPEs	Assess the outcome of the use of hair cryotherapy in reducing CIA in different chemotherapy schemes	Descriptive study	Hair cryotherapy was effective in reducing CIA, however, not for every patient and different levels of alopecia

Caption: CIA = chemotherapy-induced alopecia

though articles in English, Spanish and Portuguese were consulted. The countries that published the articles were: India (3), Italy (3), USA (3), Germany (2), Japan (2), Austria (1), Canada (1), Netherlands (1), Switzerland (1) and Brazil (1).

The predominant publication years were 2021 and 2022, with four articles each, totaling eight of the 18 studied articles, which shows an increase in the scientific production regarding the theme over the years.

Considering the participants in the selected studies, most were women with breast cancer undergoing healing (adjuvant and neoadjuvant) treatment. All the 18 articles (100%) showed at least one chemotherapeutic protocol with an antineoplastic substance from the anthracyclines and taxanes class.

It was not possible to observe a pattern in the evaluation of the treatment's efficacy, because, among the selected studies for this review, the evaluation methodology varied among photographic records, patient self-assessment, use of the Dean scale and Common Terminology Criteria for Adverse Events (CTCAE).

DISCUSSION

The studies' participants were mainly women with breast cancer. In fact, there are much more scientific evidence about the use of cryotherapy to prevent CIA in women with breast cancer, however, studies such as Keim *et al.*²⁴ and Mitric *et al.*¹⁰ show the use of hair cryotherapy in patients with other types of cancer, such as gynecological, lung cancer, sarcoma, and lymphoma. Nonetheless, the use of cryotherapy is usually not recommended for patients with hematological tumors such as lymphomas, due to the risk of scalp metastasis. Thus, hair cryotherapy is recommended for solid tumors²⁵.

SCIENTIFIC KNOWLEDGE ABOUT THE USE OF CRYOTHERAPY TO PREVENT CHEMOTHERAPY-INDUCED ALOPECIA

From Chart 3, it was possible to identify evidence that hair cryotherapy is effective in preventing grade 2 alopecia, in addition to showing benefits regarding a faster hair loss recovery. Still, there is a discrepancy in results for the black population. The adverse effects related to the technique

are generally mild and it is not possible to correlate the use of cryotherapy with the presence of scalp metastasis.

Regarding the effectiveness of hair cryotherapy in preventing CIA, most studies found good results, succeeding in preventing grade 2 alopecia, which, according to CTCAE (Chart 4), refers to the loss of over 50% of hair volume in most study participants.

The Bajpai⁸ study noticed a significant difference in the prevention of alopecia according to the order of medications. Among women who initiated treatment with taxane, 77% presented satisfactory hair preservation. As to those who initiated with anthracycline, only 33% obtained a satisfactory result.

The Dilawari *et al.*¹¹ study, that aimed at assessing the technique's results in the black population, noticed a decrease in the quality of outcomes, when compared to the studies that had white people as their subjects, with success rates between 50% and 80%. From the 30 black participants evaluated in the study, only one obtained a satisfactory result. This is believed to be due to the different hair thickness and volume of black people in comparison to white people, which may impair adequate adaptation to the ice cap, affecting temperature distribution on the scalp. Thus, more studies with the black population are needed to better assess the technology's performance as well as to improve the quality of results in this population.

Regarding hair growth post-CIA, it was possible to observe that even among the participants who showed greater hair loss at the end of treatment, the use of hair cryotherapy was beneficial, and it was possible to observe a faster recovery from alopecia in comparison to patients who did not use the technique^{13,8}.

Most side effects identified in the 18 analyzed studies were mild, with the most frequent side effects from hair cryotherapy being: pain in the jaw region associated with excessive compression of the cap on the area, headache, chills, and dizziness.

However, though less frequent, there is a risk of hypothermic lesion, very common in direct and prolonged exposures to ice. According to Belum *et al.*²³, this event

may be related to the patient's physical features, such as, for example, a pre-existing alopecia, or the inadequate application of the technique, when no proper protection barrier is put between the skin and the ice, thus creating a lesion that may cause not only physical but psychic pain to the patient, since, in addition to generating persistent alopecia, it can also produce scars, affecting the individual's self-image even more.

Health professionals are still concerned about prescribing hair cryotherapy due to the possibilities of patients not receiving adequate chemotherapy and consequently developing metastasis in the scalp in case there are tumoral cells in this area's tissue. However, this adverse effect was reported by a single patient in all the 18 integrated studies analyzed.

Monteiro²⁵ shows a brief analysis of the risk of scalp metastasis due to hair cryotherapy, based on retrospective and systemic analyses, in which it was possible to observe an event incidence percentage ranging from 0.4% to 1.1% among users, while the incidence among patients who did not go through cryotherapy usually ranges from 0.3% to 3%.

It is noteworthy that the cause of the only case of scalp metastasis found in this integrative review, reported by Kate *et al.*¹², is unknown, since the patient in question had completed just one cycle of hair cryotherapy and abandoned the treatment due to low cold tolerability. For the efficacy of the treatment, the technique should be applied in every chemotherapy session with a potential to cause alopecia.

Due to the very similar percentages regarding scalp metastasis incidence in patients who have and have not gone through cryotherapy, such findings may suggest that the risk of experiencing an adverse event is very small when compared to the benefits the patient may obtain with the technology.

Regarding the discontinuation of cryotherapy, based on all the studies that integrate this literature review, dropouts were observed, as expected in clinical and experimental trials. However, a fact that draws attention

Chart 4. Common Terminology Criteria for Adverse Events (CTCAE)

Adverse event	Grade				
	1	2	3	4	5
Alopecia	Hair loss of <50% of normal for that individual that is not obvious from a distance but only on close inspection; a different hair style may be required to cover the hair loss, but it does not require a wig or hair piece to camouflage	Hair loss of ≥50% normal for that individual that is readily apparent to others; a wig or hair piece is necessary if the patient desires to completely camouflage the hair loss; associated with psychosocial impact	-	-	-

Source: USA²⁶, translated by the authors.



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is the reason behind dropouts, which mostly occur due to adverse events related to treatment, the increase in the patient's stay in the chemotherapy room and, mainly, the perception of hair loss the patient has. This happens even though patients are properly informed that hair cryotherapy does not prevent hair loss from happening but acts in reducing it and fostering a faster post-alopecia growth. When experiencing partial loss of hair strands, patients often get disappointed and opt for suspending the use of cryotherapy²⁵.

Another important factor is the high cost of the technology. Today, in Brazil, each session costs R\$ 200.00. Thus, a patient in a weekly taxol treatment would spend approximately R\$ 800 a month just for the use of hair cryotherapy, in addition to the costs of a longer stay in the chemotherapy room, such as feeding, for instance. Here, only additional expenses are being considered, without adding them to those already arising from the cancer treatment itself, such as housing and transportation, which are often necessary and high due to the distance between the patient's place of residence and treatment²⁵.

Cryotherapy application increases the patient's stay in the chemotherapy room, which affects not only the patient, but the room's logistic since the cooling is applied before, during and after the infusion.

To solve this issue and reduce the patient's stay in the chemotherapy room as well as to keep the rooms less crowded, studies have attempted to decrease post-infusion cooling time in taxane treatments from 95 to 20 minutes. In general, no significant difference was identified in the quality of the outcome resulting from the reduction in time and, in addition to the benefits already mentioned, this reduction in the time of exposure to scalp cooling can help reduce the chances of the patient developing a hypothermic injury or end up giving up the use of the technique^{14,23}.

From this, the high cost of the technology added to the increased time spent by the patient in the chemotherapy room and, consequently, a smaller number of patients treated per day can be considered relevant difficulties for the implementation of this technique in public health services in Brazil²⁷.

CONCLUSION

Based on the 18 studies that integrate this review, hair cryotherapy is considered effective in preventing grade 2 alopecia in addition to showing benefits related to the speed of hair growth after chemotherapy-induced alopecia (CIA). The technique, however, did not show good results in the analyzed black population. The most common adverse effects of hair cryotherapy are headache, mandibular pain, and chills.

Thus, from the analyzed data, this study can confirm that hair cryotherapy does add concrete benefits to preventing CIA, and the technique's application, being safe and effective, should be adopted to prevent alopecia in individuals with solid tumors undergoing treatment. However, more research is still needed in black individuals, aiming to contemplate all races and hair curvature.

Despite the reduced number of free available studies, which limits the research, it was possible to know the scientific production about the studied theme. New studies are required to contribute with care delivered to patients in oncological treatment. This study can favor the understanding of this technology and foster scientific production related to the theme, so that its use can be even more optimized, bringing better quality of life to patients with cancer, as it is not enough to survive, but to live with quality.

By promoting information about hair cryotherapy, it is expected that more people can access the benefits of this technology, regardless of their socioeconomic context, so that the results of scientific endeavors may reach more patients.

CONTRIBUTIONS

Both authors have contributed to the study design, acquisition, analysis and interpretation of the data, wording, and critical review. They approved the final version for publication.

DECLARATION OF CONFLICT OF INTERESTS

There is no conflict of interest to declare.

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None.

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