v. 4, n. 12, 2024

International Journal of Health Science

MANAGEMENT AND PREVENTION OF ACUTE RADIATION DERMATITIS: A LITERATURE REVIEW

João Victor Oinhos de Oliveira
Faculdade Brasileira de Cachoeiro (MULTIVIX)
Cachoeiro de Itapemirim - ES
https://orcid.org/0009-0008-6072-3055

Valentina de Monteiro Bontempo
Faculdade Ciências Médicas Minas Gerais (FCMMG)
Belo Horizonte - MG
https://orcid.org/0009-0004-8992-3430

Luísa Tristão Sanches
Centro Universitário Ingá (UNINGÁ)
Maringá - PR
https://orcid.org/0009-0003-5283-2300

Giovanna Maiolli Signori
Universidade Luterana do Brasil (ULBRA)
Canoas - RS
https://orcid.org/0000-0002-5743-9570

Ana Júlia Pagnan
Centro Universitário Max Planck (UniMAX)
Indaiatuba - SP
https://orcid.org/0009-0005-0582-5671

Nadine Ribeiro Porto Fernandes
Faculdade Brasileira de Cachoeiro (MULTIVIX)
Cachoeiro de Itapemirim - ES
https://orcid.org/0009-0005-3584-4769

Letícia Barroso Luniere
Centro Universitário CEUNI (FAMETRO)
Manaus - AM
https://orcid.org/0009-0007-5273-3176

Rachel Neves Nicolau
Centro Universitário CEUNI (FAMETRO)
Manaus - AM
https://orcid.org/0009-0009-7256-5119

Larissy da Silva Maciel
Faculdade Brasileira de Cachoeiro (MULTIVIX)
Cachoeiro de Itapemirim - ES
https://orcid.org/0009-0007-6817-7354

Natalia Luiz da Silva Teixeira Bastos
Centro Universitário Zarns (ZARNS SALVADOR)
Salvador - BA
https://orcid.org/0000-0002-4784-3991

Julia Matsura Teles Costa
Universidade Federal de Ouro Preto (UFOP)
Ouro Preto - MG
https://orcid.org/0009-0001-4980-3723

Amanda Carolina Zicatti da Silveira
Pontifícia Universidade Católica de São Paulo
São Paulo - SP
https://orcid.org/0000-0001-8963-9553

Abstract: INTRODUCTION: Acute radiation dermatitis is one of the most common skin complications in patients undergoing radiotherapy, with an incidence that can vary from 50% to 95%, depending on the type of cancer and the treatment regimen. The prevalence of this condition is especially high in cancers that require radiation therapy in areas with a high density of hair follicles, such as breast cancer and head and neck cancer. **GOAL:** To address current strategies for management and prevention of acute radiation dermatitis in patients undergoing radiotherapy. **METHODOLOGY:** Bibliographic review carried out in October 2023. Literature searches were carried out in the PubMed databases. 333 articles were found and after applying inclusion and exclusion criteria, 23 articles were selected to form the collection. **DISCUSSION:** Although there is little data regarding the real effectiveness of topical use after each radiotherapy session, some topical products, such as homeopathic ointments traditionally used for skin irritations, appear as a promising treatment for burns and radiation-induced dermatitis, improving healing. by inhibiting the inflammatory process and the activity of matrix metalloproteinases. Furthermore, it is known that Biafine emulsion can prevent grade 3 radiodermatitis and Calendula officinalis has shown a reduction in dermatitis in patients with early breast cancer with postoperative radiotherapy. **FINAL CONSIDERATIONS:** Despite improvements in radiotherapy techniques, 90% of patients develop acute radiation dermatitis and up to 25% pruritus, occurring frequently, especially in the following days and weeks. Therefore, it is important that patients adopt some general skin care measures, such as avoiding sun exposure, washing the skin with warm water and neutral soap, keeping the irradiated area clean and dry, using water-based moisturizers

and loose-fitting clothing. Topical steroid applications for radiodermatitis.

Keywords: Acute radiation dermatitis, Radiotherapy, Treatment.

INTRODUCTION

Radiotherapy is a central pillar in the treatment of malignant tumors. However, in addition to its cytotoxic effect on tumor cells, radiation exerts a marked destructive effect on normal tissue cells in the irradiation field. Depending on variables such as age, physical conditions, skin types, location and duration of exposure, patients undergoing radiotherapy may develop different adverse skin manifestations (YANG X. J. et al., 2020).

Acute radiation dermatitis, defined as its onset within 90 days after exposure to radiation, is a common adverse effect of radiotherapy, developing in up to 95% of patients undergoing such treatment (BEHROOZIAN T. et al., 2023). Typical clinical manifestations include erythema, edema, pigmentation changes, hair loss, and wet or dry scaling. In more severe cases, infection and necrosis may occur (ZETNER D. et al., 2023).

The pathophysiology of radiation dermatitis is complex, being influenced by a myriad of factors such as the total dose of radiation administered, the fractionation regimen, the volume of tissue irradiated, concomitant systemic therapy and comorbidities present. Exposure to radiation results in extensive genetic damage, breaking the double strands of nuclear and mitochondrial DNA, and inhibiting the ability of cells to divide and replicate, culminating in radiation-induced dermatitis (ZASADZIŃSKI K. et al., 2022). Due to technological advances aimed at improving skin dose homogeneity and mitigating the severity of skin reactions, such as intensity-modulated radiotherapy and skin preservation techniques, acute radiation dermatitis persists as a prominent adverse reaction, potentially negatively affecting quality of life. of the patient, compromising aesthetics, and in severe cases, causing infection, sepsis and treatment interruptions (BEHROOZIAN T. et al., 2023).

Given the above, this study aimed to evaluate current management and prevention strategies for acute radiation dermatitis in patients undergoing radiotherapy. Using a narrative approach, we intend to investigate and evaluate the safety and effectiveness of strategies that include topical medications, skin care and other interventions in reducing the severity of acute radiation dermatitis and possible side effects resulting from skin exposure to radiation. The aim, therefore, is to provide valuable insights that can guide medical practice and offer a positive impact on the quality of life of patients facing this adverse condition that is so common in patients undergoing radiotherapy.

METHODOLOGY

This is a narrative bibliographic review developed according to the criteria of the PVO strategy, an acronym that represents: population or research problem, variables and outcome. Used to prepare the research through its guiding question: "How effective and safe are current strategies for managing and preventing acute radiation dermatitis in patients undergoing radiotherapy?". In this sense, according to the parameters mentioned above, the population of this research refers to patients undergoing radiotherapy who present or are at risk of developing acute radiation dermatitis to evaluate current therapeutic approaches and their effectiveness for the management and prevention of this condition. The search was carried out using the PubMed Central (PMC) database, using the following search strategy: (Acute Radiation Dermatitis) AND (Radiotherapy) AND ((Treatment) OR

(Prevention) OR (Management)).

From this search, 333 articles were found, subsequently submitted to the selection criteria. The inclusion criteria were: articles in English and Portuguese, published in the last five years and studies such as systematic reviews, meta-analysis, cohort studies, clinical trials, as well as other types of research available in full that addressed the themes proposed for this research. The exclusion criteria were: duplicate articles, available in abstract form, which did not directly address the proposal studied and which did not meet the other inclusion criteria. A total of 23 articles were selected to compose the present study.

DISCUSSION

Radiation Dermatitis (RD) is a common condition that occurs subsequent to Radiotherapy (RT), significantly impacting patients' quality of life, with up to 85% of treated patients experiencing moderate to severe skin reactions such as edema, erythema, depigmentation and necrosis (ROSENTHAL A. et al.,2019). Toxicity resulting from RT manifests itself within a period ranging from hours to weeks after exposure (ROSENTHAL A. et al., 2019). As described by Yang X. et al. (2020), the initial phase is characterized by erythema and scaling, progressing to the development of ulcers and telangiectasias and, eventually, evolving into chronic conditions such as atrophy and fibrosis. Progressive endometritis occurs due to gradual occlusion of the microvasculature and consequent hypoxia. Fibrosis, a harmful and irreversible chronic condition, appears weeks to years after exposure to radiation, adversely affecting patients' quality of life (YANG X. et al., 2020).

The biological effects of RT manifest hours to weeks after exposure, causing extensive genetic damage that results in the irreversible breakage of nuclear and mitochondrial DNA double strands, thus inhibiting the capacity for cell division and replication (ROSENTHAL A. et al., 2019).

The different phases of the cell cycle present varying levels of sensitivity to radiation (FUZISSAKI A. M. et al., 2021). The ability to affect cells in the G2 and mitosis phases - the most radiosensitive - leads to apoptosis, impairing cell proliferation and migration and resulting in general cell depletion. Ionizing radiation can alter collagen structures and suppress cell proliferation in irradiated wounds (FUZISSAKI A. M. et al., 2021) (ROSENTHAL A. et al., 2019). Reduced angiogenesis and increased levels of transforming growth factor β (TGF-β) lead to changes in blood vessels, increasing endothelial fibrosis, causing occlusion of the vascular lumen and subsequent tissue hypoxia. Furthermore, reduced expression of the apoptosis inhibitor gene and overexpression of apoptosis-inducing genes, such as p35, attributed to radiation, result in excessive apoptosis in the tissue (YANG X. et al., 2020). The sum of these processes causes skin damage with tissue destruction, reduction of functional stem cells, initiation of epidermal and dermal inflammatory responses and necrosis (ROSENTHAL A. et al., 2019).

As pointed out by Olivia D. et al. (2018), individual genetic variations, along with other factors such as breast size, body mass index, smoking status, and RT modality, may influence acute skin reactions and related symptoms. Among the genes involved, XRCC2 plays a role in DNA repair caused by radiation. Genetic damage, together with the generation of reactive oxygen species and other structural changes in tissues, triggers epidermal and dermal inflammatory responses, in addition to cellular necrosis, culminating in DR, which significantly affects patients' quality of life (ROSENTHAL A. et al.,2019).

Fuzissaki A. M. et al. (2021), highlights that a greater amount of breast adipose

tissue in breast RT is associated with the development of skin toxicities. Adipose tissue exposed to radiation becomes a source of autotaxin secretion, which is responsible for the production of lysophosphatidic acid. This cycle triggers a persistent inflammatory process that promotes the activation of nuclear factor Kappa B, the expression of the enzyme cyclooxygenase-2 (COX-2) and the signaling of the secretion of inflammatory cytokines, chemokines and growth factors, including transforming growth factor. alpha. A factor of statistical relevance is the high skin phototype, such as V or VI, associated with high eumelanin. The synthesis of this melanin variant is stimulated by the action of alpha melanocyte-stimulating hormone. A correlation was observed between the high frequency of single nucleotide polymorphisms in the melanocortin 1 receptor gene and severe acute skin toxicity (FUZISSAKI A. M. et al., 2021). According to Olivia D. et al. (2018), the XRCC2 gene, involved in DNA repair, is associated with burns; and the immune response gene interferon gamma has been associated with pruritus.

In the study conducted by Bhangoo R. S. et al. (2022), it was observed that DR was more prevalent in patients treated for breast cancer, followed by gastrointestinal and lung cancer. The analysis also revealed that the majority of affected patients were Caucasians with Fitzpatrick 1–2 skin phototypes, indicating increased sensitivity to the sun. In another research, Borm J. K. et al (2018) explored the incidence of erythema in breast cancer patients undergoing conservation therapy before RT, noting that grade 1 or 2 erythema was evident in the majority of cases, while erythema was not was observed in 28.9% of cases. Finally, Fuzissaki A. M. et al. (2021) highlighted that premenopausal patients with positive lymph nodes were treated with adjuvant chemotherapy, while postmenopausal women received tamoxifen. The presence of diabetes has been reported as an unfavorable prognostic factor for toxicity, especially late subcutaneous fibrosis, in univariate and multivariate analyzes of hypofractionated RT.

Currently, there is no consensus on the control or prevention of radiodermatitis (RD). In general, recommendations include skin cleansing, hydration, photoprotection and general practices, such as wearing loose, cotton clothing to avoid irritation (GOBBO M. et al, 2023). Approximately 85% of patients undergoing radiotherapy will experience noticeable skin reactions, ranging from mild erythema and dry scaling to confluent moisture and ulceration, resulting in decreased quality of life (THANTHONG S. et al, 2020). Furthermore, these conditions can limit the therapeutic dose administered and/or lead to temporary or even permanent interruption of radiotherapy (RACADOT S. et al, 2023).

There is currently no standard skin care for radiodermatitis available. Products such as hyaluronic acid cream, aloe vera gel, topical vitamin C, chamomile, almond cream, and trolamine have shown inconsistent effectiveness, as have daily hygiene, topical corticosteroids and antibiotics, and silver sulfadiazine. On the other hand, photobiomodulation therapy has demonstrated significant efficacy in preventing DR in breast cancer patients (HYE P. et al, 2019).

As indicated by Racadot S. et al. (2023), in recent decades, treatments have become more effective with milder adverse effects, based on histological type and molecular characteristics. However, despite improvements in radiotherapy techniques, 90% of patients develop acute radiation dermatitis. Dermatitis associated with ionizing radiation is common, especially in the subsequent days and weeks, manifesting as dry or exudative radiodermatitis, or acute

radionecrosis. These conditions can not only negatively affect the patient's quality of life, but also limit the therapeutic dose administered and/or lead to temporary or even permanent interruption of radiotherapy. Prophylactic treatment is preferred to delay the onset and reduce the severity of skin reactions, which can contribute to increasing patients' adherence to cancer treatment, in addition to improving quality of life. Patients undergoing radiotherapy must be instructed to keep their skin moist to reduce the chance of developing acute radiodermatitis (THANTHONG S. et al., 2020).

Given the current prevalence of the problem, several studies and methods have been developed with the aim of finding new prevention and skin management strategies in the face of radiotherapy (RT). In line with Robijns J. et al. (2022), skin barrier protectors appear to reduce the risk of confluent wet peeling, improve patient comfort, and decrease pain and itching. These protectors can be applied to different regions of the skin under different types of radiotherapy. Additionally, Zasadziński K. et al. (2022) highlight that the possible side effects of applying the barrier film, such as itching or rash, are mild and, for the most part, self-limited. Dressings have the advantage of creating a moist, stable environment that facilitates faster re-epithelialization of radiation-damaged skin, with some having antimicrobial and anti-inflammatory characteristics that help prevent or heal radiation damage.

Photobiomodulation involves the application of low-power light sources in the visible and infrared spectrum, aiming to promote healing and reduce pain, in addition to counteracting inflammation and offering antimicrobial properties. Its use has been growing in cancer patients due to its applicability in different areas of the body and to treat different side effects, in addition to being able to improve nutritional status, quality of life and survival. Photobiomodulation is also capable of reducing the need for radiotherapy interruptions, directly contributing to the prognosis (GOBBO M. et al, 2023). According to Gobbe M. et al. (2023), photobiomodulation has biostimulant properties that favor faster tissue regeneration and healing, in addition to presenting analgesic properties, reducing inflammation and fibrosis, without causing notable side effects. Photobiomodulation also reduces the need for radiotherapy interruptions, directly contributing to the prognosis (GOBOO M. et al., 2023).

It was found that the incidence of severe radiodermatitis (grade 3) and pain was significantly lower in patients who underwent photobiomodulation at the end of radiotherapy. However, it was observed that patients undergoing radiotherapy showed an increase in physical and mental stress, and that photobiomodulation could exacerbate these symptoms, causing a decrease in treatment adherence (GOBBO M. et al, 2023).

The preventive application of photobiomodulation is effective in reducing the incidence of wet desquamation in patients with breast cancer, and can stabilize the degree of pigmentation and improve the function of the skin barrier during radiotherapy. In general, research suggests that photobiomodulation has biostimulant properties that allow for faster tissue regeneration and healing (GOBBO M. et al, 2023).

According to Thanthong S. et al. (2020), prophylactic treatment is preferable to delay the onset and reduce the severity of skin reactions, which can contribute to increasing patients' adherence to cancer treatment, in addition to improving quality of life. A crucial point is to instruct patients to keep their skin moist in order to reduce the chance of developing acute radiodermatitis. Finally,

it was found that there were no adverse events related to photobiomodulation, and that the incidence of grade 3 DR was only 9 %, demonstrating the preventive effect of reducing the severity of radiodermatitis, being a safe and clinically viable practice (HYE P. et al, 2019).

According to Robijns J. et al. (2022), radiodermatitis can worsen due to friction, shear, allergens, chemicals, body fluids and friction with the skin and tissues. The use of a skin barrier protector can prevent the desquamation of superficial keratinocytes in the stratum corneum, thus keeping the skin barrier function intact and preventing worsening of radiodermatitis. This way, a skin barrier protector composed of a tetra acrylic polymer with 2-octyl-cyanoacrylate was developed. When applied to the skin, it forms a waterproof, robust and long-lasting film, which physically acts against moisture, irritants and abrasion, creating an environment conducive to dermatitis wound healing (ROBIJNS J. et al., 2022). In the study, the barrier protector was applied twice a week to the irradiated area, and it was observed that the use of the product was beneficial in reducing pain, itching and moist scaling, in addition to being classified as safe for use in cancer patients. undergoing radiotherapy (ROBIJNS J. et al., 2022).

The main mechanism of skin injury from radiation involves the production of free radicals and the reduction of the skin's antioxidant capacity. With this in mind, Chitapanarux I. et al. (2019) described that olive oil has moisturizing and anti-inflammatory properties, in addition to antioxidant compounds, such as phenolics, tocopherol, squalene and triterpenic acids, making it a very positive product in the management of dermatitis caused by radiation. However, to maintain all the beneficial properties of olive oil, it is necessary to promote a refining process with calcium hydroxide, a compound that has the ability to maintain the advantageous properties of olive oil and remove unwanted free fatty acids (CHITAPANARUX I. et al, 2019). The olive oil emulsion was applied twice a day, from the first day of radiotherapy until two weeks after its completion. The only side effect presented by one of the patients involved in the research was the presence of a temporary tingling sensation after applying the product (CHITAPANARUX I. et al., 2019). However, the final result of the emulsion was satisfactory. Its use significantly reduced the intensity of the acute skin reaction induced by radiation, postponed skin toxicity and increased the quality of life of patients, being characterized as an effective and safe prophylactic treatment (CHITAPANARUX I. et al., 2019).

Topical corticosteroids are also effective in reducing symptoms associated with DR (post-radiotherapy dermatitis), such as pain, burning or itching, although they must preferably be used only on intact skin, as they can delay wound healing or promote infection in scenarios of advanced wet peeling (DEJONCKHEERE C.S. et al., 2023). Mometasone Furoate (MMF) is a potent corticosteroid, with a low risk of skin atrophy, has a prolonged effect lasting 24 hours and has a strong inhibitory effect on IL-6 activity, both at the transcriptional and protein levels, during radiotherapy. (LIAO Y. et al., 2019). In the study by Liao Y. et al. (2019), a randomized trial was carried out in which patients applied a thin layer of MMF, once a day, from the date of the first radiotherapy until 2 weeks after the end of it. It was observed in the study that the characteristic of radiation injury changes according to the seasons. In winter, dry and patchy skin peeling occurred after MMF application, while wet peeling increased significantly in summer. It was inferred that the difference in results occurred due to

the large variation in ambient temperature (LIAO Y. et al., 2019). Furthermore, it was also concluded that the local application of MMF significantly reduced itching and pain in irradiated skin, regardless of the dose of radiotherapy, proving that the use of this substance post-radiotherapy can prevent acute radiation dermatitis (LIAO Y. et al., 2019).

Ointments for the treatment of DR were also evaluated, such as Centella asiatica, a medicine used to heal wounds and skin diseases; Thunbergia laurifolia, which accelerates the rate of healing in burns and has antinociceptive and anti-inflammatory effects; and Cucumis sativus, which has soothing properties against skin irritation and swelling. However, the results showed that no cream was effective in preventing or delaying radiodermatitis, only that cucumber cream could be useful in recovering the skin after exposure to radiation, reducing the severity of grade 1 dermatitis after 1 month of use (THANTHONG S. et al, 2020). There is still a lack of data on the real effectiveness of using a topical after each radiotherapy session. However, Cicaderma ointment, a homeopathic ointment traditionally used for skin irritations, appears as a promising treatment for burns and radiation-induced dermatitis, improving healing by inhibiting the inflammatory process and the activity of matrix metalloproteinases. Furthermore, it is known that Biafine emulsion can prevent grade 3 radiodermatitis, and that Calendula officinalis has shown reduced DR in patients with early breast cancer undergoing postoperative radiotherapy (RACADOT S. et al, 2023).

Natural alternatives were also explored, highlighting chamomile. The gel from this plant can delay or reduce itching and burning sensations, as well as minimize the development of hyperpigmentation in post-radiation dermatitis. Due to its anti-inflammatory effects similar to those of benzydamine, which result in the reduction of edema and inhibition of dermatitis induced by harmful agents, chamomile is seen as a potential topical anti-inflammatory agent (FERREIRA E. B. et al., 2020). Olive oil is also relevant in reducing the intensity of the acute skin reaction induced by radiation (CHITAPANARUX I. et al., 2019). Before using the gel, patients were instructed to avoid sun exposure, and to perform self-care after radiotherapy, including oral hydration (approximately 2 liters of water per day) and general skin care (washing with moisturizing soap and drying the area with a soft towel) (FERREIRA E. B. et al., 2020). Chamomile gel was used three times a day in the irradiated area, throughout the radiotherapy period. At the end of the study, it was seen that the cost of chamomile gel is about a third of the cost of urea cream. Furthermore, it was observed that the gel can delay or reduce itching and burning sensations, in addition to reducing the development of hyperpigmentation, having a more positive action than urea cream (FERREIRA E. B. et al., 2020).

Finally, Doxepin is a tricyclic antidepressant that has promising antihistamine, anti-inflammatory and analgesic properties, having the lowest number of side effects among active treatment creams (SHARIATI L. et al., 2020). In the study by Shariati L. et al. (2020), it was proposed to use a 5% Doxepin cream on the irradiated areas, three times a day, for seven days, starting from the last week of radiotherapy. After the period of use, it was verified that the incidence of grade 3 dermatitis was not detected in the treated group. Furthermore, a great improvement in radiodermatitis was noted. It was therefore found that Doxepin cream is an affordable, easy-to-use product with the ability to prevent pain and irritation, making it a

potential treatment for dermatitis in patients undergoing radiotherapy (SHARIATI L. et al., 2020).

FINAL CONSIDERATIONS

The results of this literature review point to the importance of keeping the skin moist in cancer patients as a preventive measure against Radiodermatitis, a common and challenging complication in radiotherapy treatment. This review details the effectiveness of various interventions to treat and prevent Radiodermatitis, including barrier protectants, wound dressings, photobiomodulation, cicaderma, doxepin and chamomile gel. Each of these methods demonstrates potential in treating different side effects of radiotherapy, contributing to improving the quality of life and survival of cancer patients. Furthermore, it was observed in studies that the use of olive oil emulsions and topical corticosteroids shows an improvement in the side effects of radiotherapy. However, it is important to note that these treatments can generate their own side effects, requiring a careful balance in their application. Despite significant advances, the review highlights the need for more large-scale clinical studies. This is essential to strengthen the evidence base and guide future practices, especially considering the frequency of clinical manifestations of Radiodermatitis and its impact on a large proportion of cancer patients around the world. Fully understanding the best approaches to preventing and treating Radiodermatitis will not only improve skin care, but also the overall cancer treatment experience, minimizing side effects and improving outcomes for patients.

AUTHORIZATIONS/ ACKNOWLEDGMENT

When submitting the work, the authors become responsible for the entire content of the work.

QUOTES

According to ABNT standards.

REFERENCES

BEHROOZIAN, T. et al. MASCC clinical practice guidelines for the prevention and management of acute radiation dermatitis: part 1) systematic review. **EClinicalMedicine**, v. 58, e101886, 2023.

BHANGOO, R. S. et al. Radiation recall dermatitis: A review of the literature. **Seminars in oncology**, v.49, n.2, p. 152-159, 2022.

BORM, J. K. et al. Acute radiodermatitis in modern adjuvant 3D conformal radiotherapy for breast cancer - the impact of dose distribution and patient related factors. **Radiation Oncology**, v. 13, p.1-7, 2018

CHITAPANARUX, Imjai et al. Emulsion of olive oil and calcium hydroxide for the prevention of radiation dermatitis in hypofractionation post-mastectomy radiotherapy: a randomized controlled trial. **Breast care**, v. 14, n. 6, p. 394-400, 2019.

DEJONCKHEERE, C.S. et al. Barrier films for the prevention of acute radiation dermatitis in breast cancer: A systematic review and meta-analysis of randomised controlled trials. **Breast**, v. 71, p. 31-41, 5 jul. 2023.

FERREIRA, Elaine B. et al. Chamomile gel versus urea cream to prevent acute radiation dermatitis in head and neck cancer patients: results from a preliminary clinical trial. **Integrative Cancer Therapies**, v. 19, p. 1534735420962174, 2020.

FUZISSAKI, Marceila A. et al. A protective effect of morning radiotherapy on acute skin toxicity in patients with breast cancer: A prospective cohort study. **Medicine**, v. 100, n. 42, 2021.

GOBBO, Margherita et al. Photobiomodulation therapy for the prevention of acute radiation dermatitis: a systematic review and meta-analysis. **Supportive Care in Cancer**, v. 31, n. 4, p. 227, 2023.

KARBASFOROOSHAN, H. et al. Topical silymarin administration for prevention of acute radiodermatitis in breast cancer patients: A randomized, double-blind, placebo-controlled clinical trial. **Phytotherapy research**, v. 33, n. 2, p. 379-386, 2019.

LIAO, Yao et al. Randomized, self-controlled, prospective assessment of the efficacy of mometasone furoate local application in reducing acute radiation dermatitis in patients with head and neck squamous cell carcinomas. **Medicine**, v. 98, n. 52, 2019.

NABI-MEYBODI, Mohsen et al. Effects of topical timolol for the prevention of radiation-induced dermatitis in breast cancer: a pilot triple-blind, placebo-controlled trial. **BMC cancer**, v. 22, n. 1, p. 1079, 2022.

OLIVA, Delmy et al. Individual genetic variation might predict acute skin reactions in women undergoing adjuvant breast cancer radiotherapy. **Anticancer Research**, v. 38, n. 12, p. 6763-6770, 2018.

PARK, Ji-Hye et al. Feasibility of photobiomodulation therapy for the prevention of radiodermatitis: a single-institution pilot study. **Lasers in Medical Science**, v. 35, p. 1119-1127, 2020.

RACADOT, Séverine et al. Cicaderma® in radiation--related dermatitis of breast cancer: Results from the multicentric randomised phase III CICA-RT. **Clinical and Translational Radiation Oncology**, v.1, n.41, e100647, 2023.

ROBIJNS, Jolien et al. Photobiomodulation therapy for the prevention of acute radiation dermatitis in head and neck cancer patients (DERMISHEAD trial). **Radiotherapy and Oncology,** v. 158, p. 268-275, 2021.

ROBIJNS, Jolien et al. The Effectiveness of a Novel Skin Barrier Protectant in the Management of Acute Radiation Dermatitis: A Case Series. **Advances in Skin & Wound Care,** v. 35, n. 7, p. 1-6, 2022.

ROSENTHAL, Amanda et al. Management of acute radiation dermatitis: a review of the literature and proposal for treatment algorithm. **Journal of the American Academy of Dermatology**, v. 81, n. 2, p. 558-567, 2019.

SHARIATI, Laleh et al. Protective effects of doxepin cream on radiation dermatitis in breast cancer: A single arm double-blind randomized clinical trial. **British Journal of Clinical Pharmacology,** v. 86, n. 9, p. 1875-1881, 2020.

THANTHONG, S et al. Prophylaxis of radiation-induced dermatitis in patients with breast cancer using herbal creams: a prospective randomized controlled trial. **Integrative Cancer Therapies,** v. 19, p. 2-9, 2020.

YANG, Xiaojing et al. Radiation-induced skin injury: pathogenesis, treatment, and management. **Aging (Albany NY)**, v. 12, n. 22, p. 23379, 2020.

ZASADZIŃSKI, Konrad; SPAŁEK, Mateusz Jacek; RUTKOWSKI, Piotr. Modern Dressings in Prevention and Therapy of Acute and Chronic Radiation Dermatitis—A Literature Review. **Pharmaceutics**, v. 14, n. 6, p. 1204, 2022.

ZETNER, Dennis et al. Effect of melatonin cream on acute radiation dermatitis in patients with primary breast cancer: A double-blind, randomized, placebo-controlled trial. **Journal of Pineal Research**, v. 75, n. 1, p. e12873, 2023.

ZYGOGIANNI, Anna et al. Two hypofractionated schedules for early stage breast cancer: Comparative retrospective analysis for acute and late radiation induced dermatitis. **J. BUON,** v. 25, p. 1315-1322, 2020.