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Review

Evidence-based summary of the prevention and management of radiation dermatitis in patients with breast cancer

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ABSTRACT

Objective: Up to now there is a lack of research to summarize the relevant evidence for radiation dermatitis (RD) management in patients with breast cancer. Therefore, this study aimed to summarize the best evidence for the prevention and management of RD in patients with breast cancer.

Methods: According to the "6S" evidence pyramid model, all major databases were searched from January 2018 to February 2024: UpToDate, BMJ Best Practice, National Guideline Clearinghouse, Guidelines International Network, MedSci, Yi Maitong Guidelines, National Comprehensive Cancer Network, Oncology Nursing Society, Radiology Assistant database, Society and College of Radiographers, Australian JBI Evidence-Based Health Care Center database, Cochrane Library, PubMed, CINAHL, Embase, Web of Science, China National Knowledge Infrastructure, Wangfang Data, Chinese Science and Technology Journal Database, Chinese Biology Medicine, etc.

Results: A total of 22 articles which met the inclusion criteria were included in the study, comprising six guidelines, nine systematic reviews, four evidence summaries, one clinical decision, one expert consensus, and one randomized controlled trial. We summarized 35 pieces of evidence across four aspects: influence factor, evaluation and monitoring, prevention and treatment, care and health education.

Conclusions: This study provides a comprehensive summary of the best evidence for the prevention and management of RD in patients with breast cancer. It is recommended that subsequent evidence transformation should be conducted based on specific clinical circumstances to standardize the process of clinical prevention and management of RD.

Systematic review registration: This study was registered at the Fudan University Center for Evidence-Based Nursing (Registration No. ES20244311).

Introduction

In 2022, global cancer statistics revealed that there were approximately 2.29 million new cases of breast cancer, with an incidence rate of 58.7/100000, the highest among all types of malignant tumors.[1,2] Radiotherapy is an important component of comprehensive treatment for breast cancer that can effectively reduce the risk of recurrence and metastasis and prolong survival.[3] However, radiation dermatitis (RD) is a common complication of radiotherapy, occurring in 74% to 100% of patients with cancer treated with radiotherapy.[4] In patients with breast cancer, the skin in the axilla and breast area is particularly susceptible due to its thinness, wrinkled, and tendency to sweat, resulting in an RD

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incidence rate exceeding 90%.[5] Moreover, patients who undergo breast remodelling and prosthesis implantation have a higher risk of moderate-to-severe RD due to the inability of the skin to dissipate heat.[6]

RD not only affects the daily dressing and activities of patients but can also lead to the interruption of radiotherapy, thereby prolonging the treatment time in severe cases.[7] Currently, many clinical practice guidelines and expert consensus studies address breast radiation dermatitis, but the proposed strategies remain controversial. For example, regarding the use of topical non-steroid cream, Fan et al.[8] concluded that triethanolamine cream can prevent RD. However, there was research which did not recommend the use of triethanolamine in patients with breast cancer experiencing RD, as evidence suggested no difference between triethanolamine and controls in preventing RD.[9] Similarly, Celia et al.[10] found no significant effect of prophylactic triethanolamine on the incidence of grade 1 or higher RD. Furthermore, specific and comprehensive nursing standards and uniform clinical practices for preventing and managing RD in patients with breast cancer are lacking.

With the rapid development of cancer radiotherapy, scientific and standardized research on the management of radiation dermatitis in patients with breast cancer is emerging.[11–13] Therefore, it is necessary to update and summarize the original evidence of different qualities. This study aimed to provide the best evidence for the clinical practice of preventing and managing radiation dermatitis in patients with breast cancer undergoing radiotherapy.

Methods

Question identification

The PIPOST analysis method was used to formulate evidence-based nursing questions concerning patients with breast cancer undergoing radiotherapy. In multi-disease studies, the sample must comprise $> 50\%$ of patients with breast cancer. Intervention (I): All measures used to evaluate, prevent, and manage breast cancer radiation dermatitis. Professional (P): Clinical medical personnel responsible for providing care to patients with breast cancer undergoing radiotherapy treatment. Outcome (O): The primary indicators included the incidence and severity of radiation dermatitis; secondary indicators included onset time, duration, maximum RTOG grade, skin pigmentation, edema, dryness, wet peeling, itching, pain, quality of life, and patient satisfaction. Setting (S): Hospital environment. Type of evidence (T): Clinical practice guidelines, best practices, evidence summaries, systematic reviews, and expert consensus.

Retrieval strategy

According to the evidence "6S" pyramid model,[14,15] UpToDate, BMJ Best Practice, National Guideline Clearinghouse, Guidelines International Network, National Institute for Health and Clinical Excellence, Scottish Intercollegiate Guidelines Network, New Zealand Guidelines Group, MedSci, Yi Maitong Guidelines, Registered Nurses' Association of Ontario, National Comprehensive Cancer Network, Oncology Nursing Society, Physiotherapy Evidence Database, Radiology Assistant Database, Society and College of Radiographers, Australian JBI Evidence-Based Health Care Center database, Cochrane Library, PubMed, CINAHL, Embase, Web of Science, China National Knowledge Infrastructure (CNKI), Wangfang Data, Chinese Science and Technology Journal Database (VIP), and Chinese Biology Medicine (CBM) database were searched to collect the relevant articles. The search period covered January 2018 to February 2024. The search terms included The search terms included "Breast neoplasm", "breast cancer", "breast carcinoma", "breast tumor", "breast radiotherapy", "breast radiation dermatitis", "radiodermatitis", "radiation recall dermatitis", "radiation dermatitis", "radiation-induced dermatitis", "radiation-induced skin toxicity", "radiation-induced skin injury", "radiation-induced skin damage", "radiation-induced skin reaction", "radiation-related skin toxicity", "radiation-related skin injury", "radiation-related skin damage", "radiation-related skin reaction", "RD", and "RISR". The databases were searched using a combination of subject headings with free-text words. PubMed was used as an example of the English database, and the search strategy is shown in Fig. 1.

Literature inclusion and exclusion criteria

Inclusion criteria

(1) Patients with breast cancer undergoing radiotherapy, age $\geq$ 18 years. (2) This study involved the evaluation, prevention, and management of radiation dermatitis in patients with breast cancer. (3) The types of literature included are publicly published clinical decisions, guidelines, expert consensus, evidence summaries, systematic reviews, meta-analyses, and high-quality randomized controlled trials. (4) Language is limited to Chinese and English.

Exclusion criteria

(1) Literature with incomplete information, unobtainable full text, or direct translation. (2) Repeated publication. (3) Conference abstract, interpretation guide, and translation guide of the literature.

Literature quality evaluation

(1) Guidelines: We used the Clinical Guidelines for Research and Evaluation II (AGREE II) tool.[16] The tool consists of 23 items in six fields, each graded on a 7-point scale, with seven points for total agreement and one point for complete disagreement. The score for each field is equal to the sum of the item scores in that field, standardized as a percentage of the highest possible score for that field. The consistency between evaluators was tested using the interclass correlation coefficient (ICC).
(2) Expert consensus, systematic review, and randomized controlled trials: We used the evaluation criteria corresponding to JBI evidence-based health care centers.[17]
(3) Clinical decisions and evidence summaries: Sources from authoritative databases such as UpToDate and JBI, which were based on the latest published evidence that has undergone peer review. These sources represent the advanced evidence type in the "6S" pyramid model, and their evidence is assumed to be directly extracted from high-quality studies.[18]

Two researchers with evidence-based training conducted literature quality evaluations and crosschecks with each other. In case of disagreement, authoritative evidence-based experts in the relevant field were invited to evaluate and form a consistent conclusion.

Evidence extraction and integration

Two researchers independently extracted the evidence, translated, proofread, and then integrated it with the other researchers. The principle of integrating evidence are as follows:[19] (1) if the recommended content is the same, choose the most concise and logically clear recommendation; (2) if the recommendations are complementary, they should be merged according to their logical relationship and language; and (3) if the recommendation conflicts, priority should be given to evidence-based, high-quality, the recently published literature, and authoritative journal articles. After summarizing the evidence, it was graded using the JBI Evidence Pre-Grading and Evidence Recommendation Level System (2014).[20] According to the different research design types, the evidence levels were divided into levels 1–5, with level 1 being the highest and level 5 being the lowest. The original evidence level was retained for the evidence summary and guidelines.[21]

#1"Radiodermatitis"[Mesh]
#2"Radiodermatitides"[Title/Abstract] OR "Radiation-Induced Dermatiti*""[Title/Abstract] OR "Radiation Induced Dermatiti*"[Title/Abstract] OR "Radiation Recall Dermatiti*"[Title/Abstract] OR "Radiation Recall Reaction*"[Title/Abstract] OR "Radiation-induced skin toxicity"[Title/Abstract] OR "Radiation-induced skin injury"[Title/Abstract] OR "Radiation-induced skin damage"[Title/Abstract] OR "Radiation-induced skin reaction"[Title/Abstract] OR "Radiation-related skin toxicity"[Title/Abstract] OR "Radiation-related skin injury"[Title/Abstract] OR "Radiation-related skin damage"[Title/Abstract] OR "Radiation-related skin reaction"[Title/Abstract] OR "RD"[Title/Abstract] OR "RISR"[Title/Abstract]
#3 #1 OR #2
#4"Breast Neoplasms"[Mesh]
#5"Breast Neoplasm*"[Title/Abstract] OR "Breast Tumor*"[Title/Abstract] OR "Breast Cancer"[Title/Abstract] OR "Breast Malignant Neoplasm*"[Title/Abstract] OR "Breast Malignant Tumor*[Title/Abstract] OR "Mammary Cancer*[Title/Abstract] OR "Human Mammary Neoplasm*"[Title/Abstract] OR "Breast Carcinoma*"[Title/Abstract] OR "Human Mammary Carcinoma*"[Title/Abstract]))
#6 #4 OR #5
#7 #3 AND #6

Fig. 1. PubMed search strategy.

Results

Literature search results and general information

A total of 1436 articles were initially retrieved. After removing duplicates and reviewing the titles, abstracts, and full texts, 22 articles were ultimately included. These comprised one clinical decision, four evidence summaries, six guidelines, nine systematic reviews, one expert consensus, and one randomized controlled trial. A literature screening flowchart is shown in Fig. 2. The general characteristics of the included studies are presented in Table 1.

Literature quality-evaluation results

Guidelines quality evaluation

This study included six guidelines,[4,8,25–28] and the quality evaluation results are shown in Table 2. The standardized percentages in all fields of the guidelines met the inclusion criteria, and the ICC values of both researchers were > 0.750, supporting their inclusion.

Expert consensus quality evaluation

This study included one expert consensus.[29] Except for item 6, which states "where there is any inconsistency between the proposed viewpoint and previous literature," all other items should be rated "yes" indicating high overall quality and eligibility for inclusion.

Systematic reviews quality evaluation

This study included nine systematic reviews, Table 3. The overall quality was deemed high and following a discussion between the two researchers, who approved the review inclusion in the study.

Randomized controlled trial quality evaluation

This study included one randomized controlled trial, Table 4. Except for item 5, which states "Were those delivering the treatment blind to treatment assignment?" all other items should be rated "yes" indicating high overall quality and eligibility for inclusion.

Evidence summary and description

The evidence for the prevention and management of RD in patients with breast cancer undergoing radiotherapy primarily consists of four key aspects: influence factor, evaluation and monitoring, prevention and treatment, and care and health education, Table 5.

Among the seven pieces of evidence regarding the factors influencing RD in patients with breast cancer, three are strongly recommended as first-level evidence. The dose and protocol of radiotherapy, as well as combination therapy, are the key factors that have been identified to influence the occurrence of RD in patients with breast cancer.

There are six pieces of evidence supporting the evaluation and monitoring of RD in patients with breast cancer, with one piece being strongly recommended. Medical personnel are advised to use standardized evaluation tools to evaluate and monitor the occurrence of RD during radiotherapy and until 2–4 weeks post-treatment. In the initial stages of radiotherapy, skin conditions should be evaluated weekly. When erythema is observed, the frequency of assessment should be increased to twice a week, and daily evaluation is warranted for wet desquamation or bleeding. The common terminology criteria for adverse events (CTCAE) of the National Cancer Institute and Radiation Therapy Oncology Group (RTOG) toxicity scoring system are commonly used evaluation tools. The evaluation should include the location, extent, skin color, discomfort, presence of erythema, or dry desquamation, damp desquamation, and late manifestations of dermatitis. For patients with impaired skin integrity, the evaluation should cover the site, size, base of the wound, type, amount, and odor of exudate, discomfort, and infection symptoms.

In terms of prevention and treatment, there are thirteen pieces of evidence, of which eight are primary evidence. Non-medical interventions recommended for the prevention and treatment of RD radiation dermatitis in breast cancer in this study include intensity-modulated radiotherapy (IMRT), volume modulated arc therapy (VMAT), hypo fractionated radiotherapy, partial breast irradiation (which can be used as an alternative method for whole breast irradiation after breast-conserving surgery in certain patients with low-risk breast cancer), prone breast radiotherapy, photobiomodulation or low-level laser therapy, physical exercise, and multidisciplinary team treatment. Drugs recommended for the prevention and treatment of acute and chronic radiation dermatitis in breast cancer include topical corticosteroids, deodorants or antiperspirants, silicone film-forming gel dressings, barrier films, hexanone theobromine, and vitamin E; however, aloe vera, triethanolamine, sucralfate, and hyaluronic acid are not recommended.

In terms of care and health education, nine pieces of evidence exist, of which three is strongly recommended. Throughout the entire

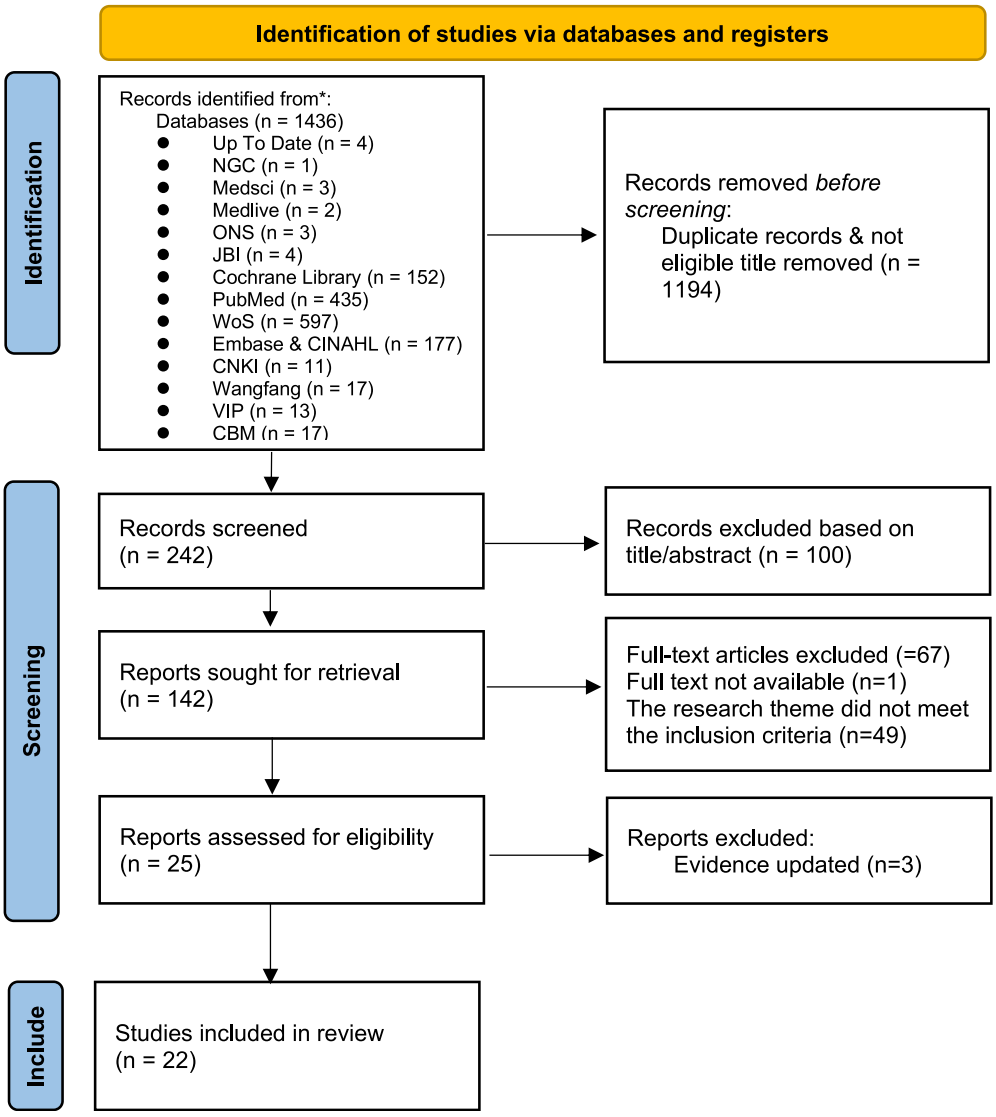

Fig. 2. Screening flow chart for literature.

radiotherapy period and until 2–4 post-radiotherapy, patients should maintain good skin care to keep the treated area clean and dry. In addition, health education should be provided to protect the skin from irritation and friction.

Discussion

Radiation dermatitis occurs frequently, and severe cases can have serious consequences. Existing evidence on its prevention and management remains controversial. This study evaluated and summarized the best evidence for the prevention and management of RD in patients with breast cancer, including risk assessment, continuous monitoring, prevention and treatment, daily care, and health education.

Articles 1–7 provide evidence highlighting the risk factors associated with RD in patients with breast cancer. Several factors, including the total dose, irradiation angle, exposed breast surface area, and duration of radiation therapy can influence the effectiveness of skin treatment. Various patient factors, such as age, nutritional status, long-term sun exposure, smoking, and alcohol consumption, can also influence the occurrence of dermatitis. In addition, the color, integrity, and hydration level of the skin; wrinkles; areas of skin contact on the same side; and the big size of the breast are related to heightened skin reactions. In clinical practice, medical personnel should prioritize patients using of Bolus, breast reconstructions, and prosthesis implantations, as they are at higher risk of severe radiation dermatitis. Disease factors such as atopic dermatitis, lymphedema, psoriasis, scleroderma, and genetic conditions can also exacerbate skin damage. Moreover, several studies.[39,40] have found that bacterial decolonization may be a safe and effective intervention to prevent severe radiation dermatitis; however, large-scale confirmatory studies are needed before it can be routinely recommended for patients undergoing radiotherapy. Medical personnel should regularly screen and assess the risk of RD in high-risk groups and promptly identify and prioritize patients with breast cancer who may develop RD. This proactive approach can effectively prevent RD and reduce the incidence of moderate and severe cases. However, this issue has often been overlooked in previous research.

Sections 8–13 detail the evaluation tool, content, and frequency required for assessing RD, a persistent disease necessitating consistent evaluation and monitoring of patient's skin condition using standardized tools during radiotherapy.[8,33] The severity of acute radiation dermatitis is typically assessed using the criteria from the RTOG[41] and the CTCAE.[42] Late radiation dermatitis toxicity is commonly evaluated using the LENT-SOMA.[8,33] Additionally, the multidimensional assessment encompasses quality of life, symptom management, and other factors beyond the single-dimensional approach. The STAT[43] is often used to evaluate

Table 1
Evidence source and content.

Author	Publication/Update date	Literature source	Literature type	Topic
Wolf et al.[6]	2023	Up To Date	Clinical decision-making	Risk factors, prevention and treatment of radiation dermatitis
Magtoto et al.[9]	2023	JBI	Evidence summary	Prevention of radiation dermatitis
Zachary[22]	2023	JBI	Evidence summary	Management of radiation dermatitis
Eric[23]	2023	JBI	Evidence summary	Aloe vera for preventing and manageing radiation dermatitis
Nour[24]	2022	JBI	Evidence summary	Skin washing for radiation dermatitis
Tara et al.[25]	2023	Yimai Tong	Clinical practice guideline	Prevention and management of acute radiation dermatitis
Fan et al.[8]	2023	Yimai Tong	Clinical practice guideline	Prevention and treatment of radiation dermatitis
Agbejule et al.[26]	2021	ISNCC	Clinical practice guideline	Prevention and management of radiation dermatitis
Tracy Gosselin et al.[27]	2020	PubMed	Clinical practice guideline	Prevention and management of radiation dermatitis
ScoR Radiotherapy Working Group[28]	2020	ScoR	Clinical practice guideline	Radiation dermatitis guidelines for radiotherapy health care professionals
Cancer Care Manitoba[4]	2018	CCMB	Clinical practice guideline	Assessment and management of radiation-induced skin toxicity in breast cancer
Wilson et al.[29]	2022	PubMed	Expert consensus	Clinical management of chronic radiation dermatitis and radiation fibrosis
Que et al.[30]	2024	PubMed	Systematic review	Evaluation of the effect of traditional Chinese medicine on radiation dermatitis of breast cancer
Fatima et al.[11]	2023	PubMed	Systematic review	Local nonsteroidal drugs for the prevention of radiation dermatitis
Dejonckheere et al.[31]	2023	PubMed	Systematic review	Barrier membrane prevents acute radiation dermatitis of breast cancer
Baharara et al.[32]	2023	PubMed	Systematic review	Efficacy of medicinal plant preparation in relieving radiation dermatitis of breast cancer
Behroozian et al.[33]	2021	PubMed	Systematic review	Evaluation tool for radiation dermatitis of breast cancer
Heydarirad et al.[34]	2021	PubMed	Systematic review	Traditional Chinese Medicine Treatment for Radiation Dermatitis
Aguiar et al.[35]	2021	PubMed	Systematic review	The effectiveness of photobiological regulation in the treatment of radiation dermatitis
Wang et al.[36]	2020	CNKI	Systematic review	The effect of skin cleansing on radiation dermatitis in cancer patients
Yee et al.[37]	2018	PubMed	Systematic review	Radiation-induced skin toxicity in breast cancer patients
Vesprini et al.[38]	2022	PubMed	Randomized controlled trial	Effect of breast radiotherapy position on acute toxic effects of the skin among women with large breast size

ISNCC, International Society of Cancer Nurses; ScoR, Radiologist Association Guidelines; CCMB, Manitoba Cancer Care Association.

Table 2
Guidelines quality evaluation results ($N = 6$).

Inclusion guidelines	Normalized percentage of scores (%)						≥ 60% of fields	≥ 30% of fields	Recommendation level	ICC
	Scope and Purpose	Involved personnel	Preciseness of guideline development	Clarity of presentation	Applicability	Independence of writing				
Tara et al.[25]	83.35	69.15	56.25	80.55	45.85	87.50	4	6	B	0.807
Fan et al.[8]	69.44	55.56	45.80	52.75	35.41	41.67	1	6	B	0.825
Agbejule et al.[26]	83.34	69.45	75	83.33	54.17	54.17	4	6	B	0.870
Tracy et al.[27]	86.11	75	67.71	77.78	64.59	83.33	6	6	A	0.781
ScoR Radiotherapy Working Group[28]	88.89	80.56	80.21	75	68.75	66.67	6	6	A	0.871
Cancer Care Manitoba[4]	80.56	75	73.96	77.78	70.83	83.33	6	6	A	0.769

ICC, value is the intra group correlation coefficient; ICC, interclass correlation coefficient.

patients from multiple perspectives, allowing a more detailed understanding of their current symptoms and needs. Moreover, the choice of evaluation content varied according to the patient's skin condition, with particular attention to wounds, exudate, and infection when the patient's skin integrity is compromised.[4] Sandler et al.[44] found that patients with breast cancer experiencing RD have unique skin symptoms. This highlights the importance of using specific tools to assess the severity of RD in patients with breast cancer. Professional advice and patient symptom characteristics should be combined to select evaluation tools for more accurate assessment.

Articles 14–18 summarize non-medical preventive and therapeutic measures for RD in breast cancer. Research has shown that radiation therapy can influence the occurrence and severity of radiation dermatitis.[6,8,37] After considering the patient's condition and treatment factors, intensity-modulated radiation therapy and large segmentation schemes were chosen. For specific low-risk populations, partial breast irradiation can be used instead of whole breast irradiation following breast-conserving surgery. Compared with the supine position, treatment in the prone position allows for more homogeneous dose distribution owing to the smaller separation when compared with the supine position, which decreases deposition of higher doses in the inframammary fold and axilla.[45] Therefore, for patients with large breasts, prone position radiotherapy can be chosen to reduce moist skin desquamation. In addition to radiotherapy, modern physical technologies, such as photobiological regulation and lasers, have shown good therapeutic efficacy in the treatment of RD. One systematic evaluation showed that photobiological modulation therapy can significantly reduce the risk of grade 3 radiation dermatitis in patients, playing a preventive and therapeutic role by regulating inflammatory mechanisms and promoting healing.[35] There is a strong consensus on the use of laser therapy for treating chronic radiation dermatitis resulting from

Table 3
Quality evaluation results of the included systematic reviews ($N = 9$).

Include literature	①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩	⑪
Que et al.[30]	Yes	Yes	Unclear	Yes	Unclear	Unclear	Yes	Yes	Yes	Yes	Yes
Fatima et al.[11]	Yes	Yes	Yes	Yes	Yes	Yes	Unclear	Unclear	Yes	Yes	Yes
Dejonckheere et al.[31]	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Baharara et al.[32]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	N/A	Yes	Yes	Yes
Behroozian et al.[33]	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Heydarirad et al.[34]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Aguiar et al.[35]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Unclear	Yes	Yes	Yes
Wang et al.[36]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Unclear	Yes	Yes	Yes
Yee et al.[37]	Yes	Yes	Yes	Yes	Unclear	Unclear	Yes	Unclear	Unclear	Yes	Yes

①Is the evidence-based question raised clear and explicit? ②Is the inclusion criteria for literature appropriate for this evidence-based question? ③Is the retrieval strategy appropriate? ④Is the search database or resources sufficient? ⑤Is the literature quality evaluation standard used appropriate? ⑥Are there 2 or more evaluators independently completing quality evaluations? ⑦Are certain measures taken to reduce errors when extracting data? ⑧Is the method of merging research appropriate? ⑨Has the possibility of publication bias been evaluated? ⑩Are the policy or practice recommendations based on the results of a systematic evaluation? ⑪Is the proposed further research direction appropriate?.

Table 4
Quality evaluation results of the included randomized controlled trial (RCT) ($n = 1$).

Include literature	①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩	⑪	⑫	⑬
Vesprini et al.[38]	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

①Was true randomization used for assignment of participants to treatment groups? ②Was allocation to treatment groups concealed? ③Were treatment groups similar at the baseline? ④Were participants blind to treatment assignment? ⑤Were those delivering the treatment blind to treatment assignment? ⑥Were treatment groups treated identically other than the intervention of interest? ⑦Were outcome assessors blind to treatment assignment? ⑧Were outcomes measured in the same way for treatment groups? ⑨Were outcomes measured in a reliable way? ⑩Was follow up complete and if not, were differences between groups in terms of their follow up adequately described and analyzed? ⑪Were participants analyzed in the groups to which they were randomized? ⑫Was appropriate statistical analysis used? ⑬Was the trial design appropriate and any deviations from the standard RCT design (individual randomization, parallel groups) accounted for in the conduct and analysis of the trial?

radiation-induced capillary dilation and excessive pigmentation.[29] In addition, exercise can improve the range of motion and minimize contractures, which help prevent chronic radiation-induced fibrosis.[8,29]

Evidence 18 recommends the use of multidisciplinary comprehensive treatment for breast radiation dermatitis, with the multidisciplinary team comprising trauma surgeons, radiation therapists, dermatologists, and specialist wound nurses. Grade 4 RD may manifest as full-thickness skin necrosis and ulceration, for which treatment with general skincare or medications alone is inadequate. Multidisciplinary treatment plays an important role in managing RD, particularly Grade 4 RD. Severe radiation dermatitis can be treated with surgical debridement, full-layer skin transplantation, muscle flap procedure, and pedicled skin flap technique to enhance wound healing and skin beauty.[6] At the same time, nurses play an important role as liaisons between doctors and patients,[46,47] they should develop training programs for specialized nurses in the prevention and management of RD, incorporate nurse-led standardized evaluation of RD into daily rounds, established a collaborative management model involving medical personnel, nursing professionals, and patients. This approach can improve the prevention and management of RD in patients with breast cancer and foster scientific management of RD.[48]

Articles 19–26 discuss the prophylactic and therapeutic measures for managing RD in patients with breast cancer. Evidence suggests that corticosteroids, when used as topical drugs, can effectively prevent radiation dermatitis in breast cancer; however, these drugs can cause skin thinning, and excessive use should be avoided.[22] The traditional view is that using antiperspirants, especially those containing metal components, may increase the risk of RD. However, several studies have shown that antiperspirants do not increase the risk of early radiation dermatitis.[49,50] Therefore, antiperspirants can be used during radiotherapy to reduce sweating, which reduces the incidence of RD. Barrier films and dressings protect the skin and mucosal tissue. They can be used in patients with breast cancer who have damaged skin integrity and can be selected according to the patient's specific situation. Studies have found that Hydrofilms have stronger adhesion and are suitable for patients with larger breasts, wrinkled skin, and easy sweating;[31] Mepitel films are easier to remove and more suitable for patients with sensitive and fragile skin.[51] Silicone film-forming gel dressings are designed to promote a moist wound-healing environment, which leads to rapid wound healing and faster skin recovery.[52] easy detachment particularly when bathing or perspiring, and the need for frequent replacement at least twice a week. Although barrier films and silicone film-forming gel dressings play a positive role in the prevention of RD, they are easy detachment particularly when bathing or perspiring, requiring more frequent replacement of the film, and the cost of them may hinder its widespread adoption. The long-term use of pentoxifylline and vitamin E has proven effective in the treatment of chronic radiation dermatitis.[6,8] However, the evidence does not support the use of aloe vera, triethanolamine, sucralfate, or hyaluronic acid for the prevention and treatment of RD.[6,23] Another evidence suggests that *Staphylococcus aureus* colonization may play a role in the development of severe radiation dermatitis. A small randomized trial enrolled 77 patients with breast or head and neck cancer undergoing radiotherapy who received either *S. aureus* decolonization therapy (intranasal 2% mupirocin ointment twice daily, Chlorhexidine gluconate 4% body wash once a day for 5 consecutive days, once every 2 weeks) or standard treatment.[53] None of the 39 patients who received bacterial decolonization developed grade 2 or higher RD. Therefore, bacterial decolonization may be a safe and simple intervention to prevent severe radiation dermatitis. In the future, effective methods for prevention and treatment of RD in patients with breast cancer should be investigated.

Evidence 27–28 describes daily skincare for RD. Skincare should commence on the first day of radiotherapy and continue for 2–4 weeks after the end of radiotherapy.[4] During this period, it is important to cleanse the skin with water, soy water, or water alone. Evidence also supports the daily use of non-aromatic lanolin-free hydrophilic moisturizers. If the skin is damaged, treatment should be discontinued. In addition, it is crucial to prioritize protecting the skin in the treatment area from irritation and friction.[6,22,24,36]

Evidence 29 to 35 summarizes the relevant aspect of health education on RD. Medical personnel should provide corresponding health education

Table 5
Summary of evidence for prevention and management of radiation dermatitis in breast cancer patients.

Evidence topic		Evidence description	Level	Recommendation level
Influence factor	External factors	1. Radiotherapy dose and plan: radiatherapy technology, dose, segmentation plan, irradiation volume and surface area, and use of Bolus and fixed devices[4,6,8,28]	1	A
		2. Radiotherapy combined with traditional chemotherapy or epidermal growth factor receptor inhibitor targeted cancer therapy[4,6,8,28]	1	A
	Internal factors	3. Age, nutritional status, long-term sun exposure, someking and drinking[4,6,8,28]	3	B
		4. Skin color, the size of the breast, breast reconstruction and prosthesis implantation, axillary and inframammary skin wrinkles[8]	2	A
		5. Existing state of the skin (such as atopic dermatitis, lymphedema, psoriasis or scleroderma)[4]	4	B
		6. Genetic diseases associated with impaired DNA repair capacity, such as ataxic telangiectasia, Bloom syndrome, Fanconi's anemia, Gorlin syndrome, or xeroderma pigmentosum[4,6,8,28]	3	B
		7. Colonization by *Staphylococcus aureus*[6]	2	B
Evaluation and monitoring	Evaluation tool	8. The National Cancer Institute Common Terminology Criteria for Adverse Events (CTCAE) and Radiation Oncology Group (RTOG) toxicity scoring system are commonly used for evaluation[8,33]	4	A
		9. The Skin Toxicity Assessment Tool (STAT) can evaluate the subjective and objective symptoms of radiation dermatitis[8,33]	4	B
		10. The Late Effects Normal Tissue Task Force subjective, objective, management, and analytic (LENT-SOMA) assessment tool is used to evaluate the late effects of radiation dermatitis in the normal tissue working group[8,33]	4	B
	Evaluation content	11. Before radiotherapy, the risk of radiation dermatitis was evaluated according to internal and external factors[28]	5	B
		12. During radiotherapy to 2–4 weeks after the end of radiotherapy, the irradiation area (neck, breast, under breast and axilla) and the surrounding skin conditions should be continuously evaluated and monitored. Patients after radical mastectomy should also observe the skin condition at the surgical incision[4]	4	B
	Frequency of evaluation	13. Patients were evaluated at least weekly at the beginning of radiotherapy. When erythema occurs, the frequency of evaluation can be increased appropriately, twice a week. Wet peeling or bleeding, shall be assessed and recorded daily[28]	5	B
Prevention and treatment	Non-medicine intervention	14. Selection of radiotherapy mode: intensity modulated radiotherapy (IMRT) and volume rotation intensity modulated radiotherapy (VMAT), large fraction radiotherapy, partial breast irradiation (which can be used as an alternative method for whole breast irradiation after breast conserving surgery in certain low-risk breast cancer patients)[6,8,37]	1	A
		15. Prone breast radiotherapy can reduce moist desquation in patients with large breasts[38]	1	A
		16. Photobiomodulation or low-level laser therapy may reduce inflammation and pain[25,29,35]	2	B
		17. Active and passive exercise can minimize contracture and fibrosis[8,29]	4	B
		18. Multidisciplinary team treatment, including trauma surgeons, radiation therapists, dermatologists, and wound specialist nurses[6,8]	5	B
	Medicine intervention	19. Prophylactic use of topical corticosteroids is recommended to reduce pruritus and discomfort. Low - to intermediate-acting topical corticosteroids are recommended to be applied to the skin of the irradiated area once or twice daily starting on the first day of radiotherapy and continuing throughout the treatment cycle[6,9,22]	1	A
		20. Breast cancer patients in need can use deodorant/antiperspirant during radiotherapy to reduce sweating[8,27]	1	A
		21. Aloe vera, triethanolamine, sucralfate, or hyaluronic acid are not recommended[6,9,23]	1	A
		22. Bacterial decolonization can be used to prevent severe radiation dermatitis[6]	2	B
		23. Silicone film-forming gel dressings can be applied prophylactically twice daily from the first day of radiation therapy to 4 weeks after the completion of treatment to prevent and delay the development of acute radiation dermatitis[8,26]	1	A
		24. Barrier films (such as Hydrofilm, Mepitel film)can prevent radiation dermatitis among patients receiving whole-breast or chest wall irradiation[8,25]	1	A
		25. Do not use antibiotics prophylactically. If bacterial infection occurs, seek local and/or systemic antibiotic treatment[6,8]	4	A
		26. Hexanone theobromine and vitamin E combination of more than 3 years can help prevent and treat chronic radioactive dermatitis[6,8]	1	B
Care and health education	Skin care	27. Use warm water and mild soap water to clean the skin, no more than two times a day. When the skin is sensitive or wet, use only warm water to wash and dry after cleaning[6,22,36]	1	A
		28. Use 2–3 times a day of non aromatic, lanolin free hydrophilic moisturizers, including weekends without radiation therapy. If the skin is damaged, stop using[6,22]	1	A
	Health education	29. Wear loose, cotton clothes[4]	4	B
		30. Do not use skin care products containing alcohol and perfumes at the irradiation area[4,6]	4	B
		31. Do not use talcum powder, baby talcum powder, or corn starch on skin wrinkles[4,6]	4	B
		32. Avoid direct sunlight and recommend using SPF 30 or higher grade sunscreen[4,29]	4	B
		33. Avoid wearing jewelry, sticking adhesive tape or band aids at the irradiation area, and coming into contact with items that are too cold or too hot to prevent skin damage[4]	4	B
		34. Swimming was prohibited during radiotherapy[4]	4	B
		35. For patients without risk factors, it is not recommended that patients use local humectants, gel, lotion or dressings before radiotherapy to avoid compensatory tablet effect[6,8]	2	A

and support to patients from both behavioural and cognitive perspectives.[4,8,29] In terms of behaviour, patients should be advised to wear loose-fitting and cotton clothes; gently clean the treated skin area; refrain from using towels for drying; avoid irritants such as skincare products, perfume, or desiccants to maintain cleanliness and dryness of the treated skin area, and enhance their self-care ability by providing health education to patients. In terms of cognition, nurses should guide patients to protect their skin from irritation and trauma, as well as inform them of pre-radiotherapy precautions to correct any misconceptions and improve self-care awareness.

Implications for nursing practice and research

In practice, medical professionals should conduct a comprehensive assessment of patient conditions, improve awareness regarding the risk of RD, optimize management strategies, and implement evidence-based approaches to the prevention, treatment, and nursing care of RD in clinical practice. These measures are essential to relieve patients suffering and improve their quality of life. Nursing managers are advised to actively optimize the workflow of clinical RD management and organize and conduct relevant training to promote the smooth transformation of evidence and improve the quality of nursing services.

Limitations

The evidence summarized in this study serves as a reference for the prevention and management of RD in patients with breast cancer. However, it is important to acknowledge that the occurrence and progression of RD can be influenced by various factors, such as race, physical constitution, and underlying medical conditions. This study did not provide personalized management recommendations for RD that are specifically designed for patients in different circumstances, primarily due to the limited quality and quantity of relevant primary or secondary studies. Moreover, part of the evidence stems from expert opinions, and evidence derived from randomized controlled trials is scarce; notably, 20 out of 35 pieces of evidence were classified as "Level B - weak recommendation." Hence, readers should carefully and critically choose the most reliable evidence. In addition, it is imperative to recognize that the best evidence summary is susceptible to ongoing modifications, necessitating researchers to update it continuously. Furthermore, only articles published in Chinese and English were selected, which may have resulted in the exclusion of relevant articles in other languages.

Conclusions

Using an evidence-based approach, this study summarizes the best evidence for the prevention and management of RD in patients with breast cancer. A total of 35 pieces of evidence demonstrated strong clinical relevance. This study aimed to provide evidence-based recommendations for clinical caregivers to reduce the incidence of RD and improve the quality of life of patients with breast cancer undergoing radiotherapy. Future clinical researchers should continually seek updated evidence and implement evidence-based practice to maximize patient benefits.

Ethics statement

Not required.

CRediT authorship contribution statement

Xiaocen Chen: Research conception and design, Methodology, Make key revisions to important academic content. Xueyu Li: Data collection, analysis and interpretation, Writing - Original draft preparation. Zhao Wang: Data collection, analysis and interpretation, Writing - Original draft preparation. Ruishuang Zheng: Writing - Revised draft preparation. Fang Zhang: Data collection, Formal analysis. Jing Zhao: Review and finalize - Original and Revised draft preparation. Huiying Liu: Data collection, Formal analysis. Hongyuan Luo: Data collection, Formal analysis. All authors had full access to all the data in the study, and the corresponding author had final responsibility for the decision to submit for publication. The corresponding author attests that all listed authors meet authorship criteria and that no others meeting the criteria have been omitted.

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Data availability statement

The data that support the findings of this study are available from the corresponding author, Jing Zhao, upon reasonable request.

Declaration of competing interest

All authors declare no conflicts of interest. Dr. Ruishuang Zheng, the 4th author, serves on the editorial board of the *Asia-Pacific Journal of Oncology Nursing*. The article underwent standard review procedures of the journal, with peer review conducted independently of Dr. Zheng and their research groups.

Declaration of generative AI and AI-assisted technologies in the writing process

No AI tools/services were used during the preparation of this work.

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