Daily skin care habits and the risk of skin eruptions and symptoms in cancer patients

H. J. Byun1,2,3, H. J. Lee4,5*, J. I. Yang6, K. H. Kim1,2,3, K. O. Park7, S. M. Park7,8, K. E. Lee5,9, J. Choi10, D.-Y. Noh5,11 & K. H. Cho1,2,3*

1Skin Cancer/Chemotherapy Skin Care Center, Seoul National University Cancer Hospital, Seoul; 2Department of Dermatology, Seoul National University College of Medicine, Seoul; 3Institute of Dermoatological Science, Medical Research Center, Seoul National University, Seoul; *Gastric Cancer Center, Seoul National University Cancer Hospital, Seoul; 4Department of Surgery and Cancer Research Institute, Seoul National University College of Medicine, Seoul; 5Department of Internal Medicine, Healthcare Research Institute, Seoul National University Hospital Gangnam Healthcare Center, Seoul; 6Center for Cancer Education and Information, Seoul National University Cancer Hospital and Department of Nursing, Seoul National University Hospital, Seoul; 7Department of Family Medicine, Seoul National University College of Medicine, Seoul; 8Thyroid Cancer Center, Seoul National University Cancer Hospital, Seoul; 9Department of Biomedical Engineering, Seoul National University College of Medicine, Seoul; 10Breast Cancer Center Seoul National University Cancer Hospital, Seoul, South Korea

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Background: Cancer patients are at high risk for skin problems because rapidly proliferating skin cells are susceptible to anticancer therapies. However, the effects of daily skin care habits on development of skin problems in cancer patients have rarely been studied.

Patients and methods: We conducted a survey of daily skin care habits and the presence of skin problems in 866 cancer patients.

Results: Hot water bath >1 h significantly increased the risk of definite eruptions (odds ratio (OR) 4.09) and the risk of itching or pain on the skin (OR 1.73). Diligent use of moisturizers did not decrease the risk of definite eruptions and symptoms, and daily bathing, scrubbing off the skin while bathing, and sun protection did not influence the risk of definite eruptions and symptoms. Subgroup analysis of 183 breast cancer patients showed results similar to the total results, including that hot water bath >1 h significantly increased the risk of definite eruptions (OR 3.41).

Conclusions: Being a cross-sectional study, our study could not prove causality. However, at the present stage of knowledge, avoidance of hot water baths of protracted duration should be first emphasized in patient education to prevent skin problems in cancer patients.

Key words: bath, cancer, eruptions, itching, moisturizer, skin care habits

Cancer patients are at high risk for skin problems because rapidly proliferating skin cells are susceptible to anticancer cytotoxic agents and radiation therapy. To overcome the nonspecific damage of normal cells by cytotoxic agents, targeted agents have been developed and are increasingly used; however, the most widely used targeted agents are epidermal growth factor receptor (EGFR) inhibitors, which notoriously induce aceniform rash in ~45%–100% [1]. Skin lesions can cause cosmetic problems leading to impairment in the quality of life and poor patient compliance, more dose delays, and even discontinuation of antineoplastic therapy [2, 3].
Previous studies on skin problems in cancer patients have exclusively focused on the adverse effects of chemotherapeutic agents and radiation therapy. Among them, skin toxic effects of EGFR inhibitors and radiation therapy have been the most studied; however, few controlled trials have been conducted to determine the best treatment [2–12]. Systemic minocycline has been reported to decrease the severity of cetuximab-induced acneiform rash [11], and pre-emptive skin treatment including doxycycline has been shown to be more effective for panitumumab-induced skin toxic effects than reactive treatment [12]. Daily skin care management in cancer patients has rarely been investigated. Although experts have recommended the use of moisturizers and sunscreens and avoidance of extreme temperatures during anticancer chemotherapies or radiation therapy [2, 3, 10], no reports have provided evidence for desirable skin care methods in the daily life of cancer patients. Actually, sunscreen use did not decrease the risk of EGFR inhibitor-induced rash in a placebo-controlled trial [13]. A recent review analyzed four reports regarding washing of the portal skin under radiation therapy and concluded that gentle washing with mild soap can be beneficial, which is limited to the management of the radiated skin only and not general skin care methods [10].

To evaluate the risk of skin eruptions and symptoms according to skin care habits in cancer patients, we conducted a survey in 866 cancer patients, using a digital survey system.

**patients and methods**

**patients**

Cancer patients who visited Seoul National University Cancer Hospital were allowed to freely participate in the survey. The answers of 866 cancer patients were collected anonymously for a period of 7 months, from March to October 2011. Approval was obtained from the Ethical Review Committee of Seoul National University Hospital (E-1108-014-372). As we did not collect any personal information from the participants, written consent requirements were waived by the Committee.

**questionnaire**

The questionnaire consisted of three parts, including the questions about underlying cancers, current skin problems, and skin care habits, as follows:

1) **Underlying cancers**
   
   A) Which cancer do you have? Select among the following list.
   
   - Gastric cancer/Thyroid cancer/Colorectal cancer/Breast cancer/
     Liver cancer/Lung cancer/Prostate cancer/Uterine cervix cancer/
     Bladder cancer/Lymphoma/Renal cancer/Hematologic cancer/
     Oral cavity cancer/Head and neck cancer/Musculoskeletal cancer/
     Brain cancer/Spine cancer/Adolescent cancer/Pancreatic cancer/
     Biliary cancer/Skin cancer/Gynecologic cancer other than cervix cancer/Urological cancer other than bladder cancer
   
   B) How long have you been treated for that cancer? Select among the following list.
   
   - For less than 1 year/For 1–5 years/For more than 5 years

2) **Presence of skin problems**
   
   A) Do you have definite skin eruptions? Yes/No
   
   B) Do you feel itching or pain on the skin? Yes/No

3) **Skin care habits**
   
   A) Do you use moisturizers every day or every time after bathing (use moisturizers diligently)? Yes/No
   
   B) Do you bathe every day? Yes/No
   
   C) Do you have a hot water bath for more than 1 hour? Yes/No
   
   D) Do you scrub off your skin while bathing? Yes/No
   
   E) Do you use sun protection methods, such as sunscreens, a cap, or a parasol, when you are doing outdoor activities? Yes/No

Scrubbing off the skin while bathing is Korea’s unique bathing culture, widely accepted among Koreans. Although scrubbing off the skin can damage the skin barrier, many Koreans still scrub their skin because they think it cleans the skin. Therefore, we included the question about scrubbing habit to evaluate its effect on development of skin problems.

The participants who said ‘no’ to each question will be referred to as the control group for the positive respondents for that question.

**digital survey system**

Our hospital, Seoul National University Cancer Hospital, has digital information displays (DIDs) with touch screens, named ‘Smart Helper’ (Figure 1), for giving patients information about their reservations of clinics and examinations, medical information about cancers, and guidance of convenience facilities in the hospital. Participants were allowed to submit their answers to the questionnaire by themselves, using touch screens of the DIDs. The set of answers of each participant was saved in the database only when all of the questions were answered. We also gave information about current recommendations for daily skin care, including the use of moisturizers and sunscreens and avoidance of extreme temperatures [2, 3, 10]. We expected the informational aspect of our survey system to help recruit participants.

![Figure 1. Smart Helper. A patient is using a Smart Helper by touching the screen.](image-url)
statistical analysis

We carried out descriptive analysis and univariate analyses to evaluate the relationship of skin care habits and the presence of definite eruptions and itching/pain, using the Pearson $\chi^2$ test. Then, to estimate the relative risk of definite eruptions and itching/pain according to skin care habits, multivariate logistic regression analyses were carried out with the variables which showed clinically relevant results in univariate analyses to be independent factors for the development of skin problems. Results were expressed as odds ratios (ORs) with 95% confidence intervals (CIs).

All analyses were carried out using IBM SPSS Statistics 19 (SPSS, Inc., Chicago, IL). Two-sided $P < 0.05$ was considered statistically significant.

results

The answers of the participants are summarized in Table 1. The presence of definite skin eruptions and itching/pain on the skin was significantly related ($P < 0.001$). Seventy-two percent of the participants with definite eruptions also reported the presence of itching/pain, and 49.6% of the participants with itching/pain also had definite eruptions. However, 50.4% of the participants with itching/pain did not have definite eruptions, showing that itching/pain on the skin can develop without the prerequisite of definite eruptions.

Table 1. Summary in total versus breast cancer participants

<table>
<thead>
<tr>
<th>Underlying cancers</th>
<th>Number of positive respondents (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cancer type</td>
<td>Total</td>
</tr>
<tr>
<td>Breast cancer</td>
<td>183 (21.1)</td>
</tr>
<tr>
<td>Gastric cancer</td>
<td>111 (12.8)</td>
</tr>
<tr>
<td>Colorectal cancer</td>
<td>82 (9.5)</td>
</tr>
<tr>
<td>Lung cancer</td>
<td>81 (9.4)</td>
</tr>
<tr>
<td>Hematologic cancer</td>
<td>58 (6.7)</td>
</tr>
<tr>
<td>Lymphoma</td>
<td>45 (5.2)</td>
</tr>
<tr>
<td>Thyroid cancer</td>
<td>37 (4.3)</td>
</tr>
<tr>
<td>Liver cancer</td>
<td>35 (4.0)</td>
</tr>
<tr>
<td>Pancreatic cancer</td>
<td>35 (4.0)</td>
</tr>
<tr>
<td>Gynecologic cancer other than cervix cancer</td>
<td>26 (3.0)</td>
</tr>
</tbody>
</table>

risk of definite skin eruptions according to skin care habits

Univariate analysis revealed significant correlations of hot water bath >1 h and diligent moisturizer use with the presence of definite eruptions (Figure 2A). Participants who took hot water baths >1 h showed a significantly higher incidence of definite eruptions compared with the control group ($P < 0.001$). Contrary to our expectations, diligent moisturizer users also showed a significantly higher incidence of definite eruptions than the control group ($P = 0.001$), which appears to have resulted from a significantly higher proportion of diligent moisturizer users in the participants with definite eruptions than in those without definite eruptions (Figure 3). Daily bathing, scrubbing of the skin while bathing, and the use of sun protection methods were not significantly related to the presence of definite eruptions (Figure 2A).

Then, to estimate the relative risk of definite eruptions according to skin care habits, we carried out multivariate logistic regression analysis with the variables that showed clinically relevant results in univariate analysis. Based on current dermatologic knowledge, it would be inappropriate to think that diligent moisturizer use can increase the risk of skin eruptions. Therefore, we did not include diligent moisturizer use in the model. We included the other four variables, hot water bath >1 h, daily bathing, scrubbing off the skin while bathing, and the use of sun protection methods, as independent factors for development of definite eruptions. Even after correction for the other factors, only hot water bath >1 h showed a significantly higher risk of definite eruptions. The ORs and 95% CIs are shown in Table 2.

risk of itching or pain on the skin according to skin care habits

Similar to the results of definite eruptions, univariate analysis revealed significant correlations of hot water bath >1 h and diligent moisturizer use with the presence of itching/pain (Figure 2B). The participants taking hot water baths >1 h showed a significantly higher incidence of itching/pain compared with the control group ($P = 0.001$). Diligent moisturizer users also showed a significantly higher incidence of itching/pain than the control group ($P = 0.047$), which is thought to have resulted from a significantly higher proportion of diligent moisturizer users in...
the participants with itching/pain than in those without itching/pain (Figure 3). Daily bathing, scrubbing of the skin while bathing, and the use of sun protection methods were not significantly related to the presence of itching/pain (Figure 2B).

To estimate the relative risk of itching/pain according to skin care habits, we carried out multivariate logistic regression analysis with the four variables which showed clinically relevant results in univariate analysis: hot water bath >1 h, daily bathing, scrubbing off the skin while bathing, and the use of sun protection methods. After correction for the other factors, only hot water bath >1 h showed a significantly higher risk of itching/pain. The ORs and 95% CIs are shown in Table 2.

The most frequent cancer in our participants was breast cancer. The number of breast cancer participants was quite high at 183, and therefore, we carried out subgroup analysis for breast cancer participants. The results were generally similar to those of the total participants and are summarized in Table 1. Compared with the total participants, breast cancer participants showed a lower proportion of definite eruptions and itching/pain. From univariate analysis, the participants
taking a hot water bath >1 h showed a significantly higher incidence of definite eruptions compared with the control group ($P = 0.004$); other skin care habits did not show a significant relationship with the presence of definite eruptions (Figure 4A). No skin care habits were significantly related to the presence of itching/pain, although the participants taking a hot water bath >1 h showed a higher incidence of itching/pain than the control group (Figure 4B). Unlike the results of the total participants, diligent moisturizer use was not significantly related to the presence of definite eruptions or itching/pain in breast cancer participants.

We carried out multivariate logistic regression analyses for the development of definite eruptions and itching/pain with the same variables used in the analyses of the total participants. After correction for the other factors, hot water bath >1 h still showed a significantly higher risk of definite eruptions. The ORs and 95% CIs are shown in Table 2.

**Discussion**

In the current study, we evaluated the risk of definite eruptions and itching or pain on the skin according to skin care habits in general cancer patients. From our results, hot water bath >1 h significantly increased the risk of definite eruptions about four times and itching/pain nearly twice. Previously, no studies have focused on the effects of hot water baths on the risk of skin toxic effects in cancer patients. In the medical field, hot water baths have been used for reducing pain and muscle spasms in rheumatic diseases as a part of spa therapies; however, the scientific rationale and the action mechanism are still unclear and a subject of debate [14–16]. The main effects of hot water baths on the skin appear to be thermal, water-contact, and hydrostatic effects. Thermal stimuli have been known to induce the expression of inflammatory cytokines and matrix metalloproteinases and to increase reactive oxygen species, the number of mast cells, and the expression of tryptase by mast cells in the skin [17]. In addition, increased blood flow following increased temperature in the skin may bring more inflammatory mediators to the skin. Long time exposure of the skin to hot water may wash out natural moisturizing factors and stratum corneum intercellular lipids, which can cause dry skin and disruption of the skin barrier. Considering the fact that daily bathing itself did not increase the risk of definite eruptions or symptoms in our results, high temperature and protracted exposure to water appear to be significant factors that increase the risk of skin problems. Hydrostatic pressure during a water bath has been reported to result in increased diuresis and natriuresis [18–20], which can cause dehydration of the body and also the skin. All these changes can contribute to the development of skin eruptions and symptoms in cancer patients taking excessively long hot water baths. However, being a cross-sectional study, our study could not prove causality. We cannot exclude the possibility that patients having skin problems were more likely to take hot water baths of protracted duration, which calls for further prospective studies. However, as previously mentioned, hot water baths can cause the scientific changes which may harm a patient’s skin health. Therefore, at the present stage of knowledge, cancer patients should be educated not to take hot water baths of protracted duration, which should be first emphasized in patient education than the traditionally emphasized ones, including the use of moisturizers and sunscreens.

Moisturizers are products which are expected to increase skin hydration and to strengthen the skin barrier. The use
of moisturizers has been universally emphasized in populations with a high risk of skin problems such as patients with chronic skin diseases, including atopic dermatitis and senile dry skin [21], and also in cancer patients receiving EGFR inhibitors or radiation therapy [2, 3, 10]. Contrary to our expectations, diligent use of moisturizers did not decrease the risk of definite eruptions or itching/pain in our study, and even higher proportions of definite eruptions and itching/pain were observed in the diligent moisturizer users compared with the control group. It appears to have been a wrong model which set diligent moisturizer use as an independent factor and the presence of skin problems as a dependent factor. Instead, the presence of skin problems appears to have filled a role as an independent factor, leading participants to use moisturizers diligently. This was demonstrated as a significantly higher proportion of the diligent moisturizer users in the participants with skin problems than in those without skin problems.

We carried out subgroup analysis for 183 participants with breast cancer, the most frequent cancer in our participants. Compared with the total participants, breast cancer participants showed lower proportions of definite eruptions and itching/pain. However, we cannot say that breast cancer patients show a lower incidence of skin problems compared with the general cancer population, because we did not survey all patients in the hospital but only the patients who voluntarily participated in our digital survey. Instead, female patients with breast cancer might have had more interest in skin care information provided by our survey system, even without skin problems. Higher proportions of diligent moisturizer users and sun protection users in breast cancer participants than in the total participants also appear to be related to the female predominance in breast cancer patients. Similar to the total participants, hot water bath > 1 h significantly increased the risk of definite eruptions in breast cancer participants. However, the increased risk of itching/pain by hot water bath > 1 h lost its significance in breast cancer participants, which possibly resulted from low statistical power due to the low number of participants.

We demonstrated the usefulness of a digital survey system in the current study. We could collect a high number of answers easily without additional efforts to give and gather the questionnaire papers and to manually insert the data into a data file. This kind of digital systems also can be made to share patient information with electronic medical record systems, enabling more in-depth analysis, and we are planning to do those sorts of studies in the future.

Our study has several limitations. Being a cross-sectional study, our study could not prove causality and could not exclude the bias that past or present skin problems might have influenced current skin care habits. The presence of definite skin eruptions was self-reported and not confirmed by physicians. We did not gather information about age, gender, and what treatment each participant was on; therefore, we could not adjust for age, gender, and treatment-related factors. Selection bias can be present because the patients who are not familiar with electronic devices would not have participated in our survey and patients suffering from skin problems would have been more likely to participate in the survey. Our survey was done over 7 months, from spring to fall, not including winter season. Therefore, we cannot say it is safe to stop using moisturizers also in winter, as moisturizers can relieve skin dryness in the winter season. Further studies throughout all seasons are needed to confirm our results. We used the term ‘diligent use of moisturizers’ based only on the frequency of moisturizer use, without a quantitative assessment of moisturizer used per day. Sunscreen use may not have caused a difference because people do not sunbathe as much when they have cancer or even as part culturally. Koreans do not sunbathe as much as Caucasians do. However, we think a large number of participants can overcome some of these biases.

In conclusion, avoidance of hot water baths of protracted duration should be first emphasized in patient education to prevent skin eruptions and symptoms in cancer patients. Our work has significance as the first step to evidence-based skin care in cancer patients, and we encourage further work in this field not only for skin health, but also for the emotional quality of life for cancer patients.

**disclosure**

The authors declare no conflicts of interest.

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Cancer effect on periprocedural thromboembolism and bleeding in anticoagulated patients

A. J. Tafur¹, W. E. Wysokinski¹⁎, R. D. McBane¹, E. Wolny², E. Sutkowska³, S. C. Litin⁴, P. R. Daniels⁴, J. P. Slusser⁵, D. O. Hodge⁵ & J. A. Heit¹

¹Division of Cardiovascular Diseases, Department of Internal Medicine, Mayo Clinic, Rochester; ²Department of Radiotherapy, Memorial Regional Hospital, Zielona Góra; ³Division of Rehabilitation, Department of Orthopedic Surgery, University Medical School of Wroclaw, Wroclaw, Poland; ⁴General Internal Medicine, Department of Internal Medicine; ⁵Division of Biomedical Statistics and Informatics, Department of Health Sciences Research, Mayo Clinic, Rochester, USA

Background: Patients with active cancer are often on chronic anticoagulation and frequently require interruption of this treatment for invasive procedures. The impact of cancer on periprocedural thromboembolism (TE) and major bleeding is not known.

Patients and methods: Two thousand one hundred and eighty-two consecutive patients referred for periprocedural anticoagulation (2484 procedures) using a standardized protocol were followed forward in time to estimate the 3-month incidence of TE, major bleeding and survival stratified by anticoagulation indication. For each indication, we tested active cancer and bridging heparin therapy as potential predictors of TE and major bleeding.

Results: Compared with patients without cancer, active cancer patients (n = 493) had more venous thromboembolism (VTE) complications (1.2 % versus 0.2 %; P = 0.001), major bleeding (3.4 % versus 1.7 %; P = 0.02) and reduced survival (96 % versus 99 %; P < 0.001). Among active cancer patients, only those chronically anticoagulated for VTE had higher rates of periprocedural VTE (2 % versus 0.16 %; P = 0.002) and major bleeding (3.7 % versus 0.6 %; P < 0.001). Bridging with heparin increased the rate of major bleeding in cancer patients (5 % versus 1 %; P = 0.03) without impacting the VTE rate (0.7 % versus 1.4 %; P = 0.50).

Conclusions: Cancer patients anticoagulated for VTE experience higher rates of periprocedural VTE and major bleeding. Periprocedural anticoagulation for these patients requires particular attention to reduce these complications.

Key words: bleeding, malignancy, periprocedural management of anticoagulation, thromboembolism

introduction

More than 2.5 million Americans are chronically anticoagulated for indications including venous thromboembolism (VTE), mechanical heart valve(s) (MHV) or atrial fibrillation (AF) [1]. Each year, ~10 % of these patients require temporary interruption of anticoagulation for an invasive procedure. Defining the most appropriate management strategy for these patients requires an assessment of the periprocedural risk of thromboembolism (TE) and major hemorrhage. Cancer is associated with an increased risk of thrombosis and patients with cancer often require chronic anticoagulation [2–4]. Because these patients also frequently undergo invasive diagnostic or therapeutic procedures,