Preemptive Management of Dermatologic Toxicities Associated With Epidermal Growth Factor Receptor Inhibitors

Jean Boucher, PhD, RN, ANP, Linnea Olson, RN, BSN, and Bilal Piperdi, MD

Epidermal growth factor receptor inhibitors (EGFRIs) are a treatment option for patients diagnosed with advanced-stage gastrointestinal, lung, and head and neck cancers. The most prevalent complications associated with EGFRIs are dermatologic toxicities, which may result in either disruption or discontinuation of treatment and adversely affect patients’ quality of life. Nurses play a vital role in educating patients about EGFRi-related dermatologic toxicities; therefore, nurses must continue to educate themselves on the various aspects of EGFRi treatment. An overview of the EGF signaling pathway is provided, and dermatologic toxicities associated with EGFRi treatment are described. A review of several studies evaluating reactive skin treatment regimens also are discussed. Nurses play a critical role in providing patient support. Informing patients about potential EGFRi-related symptoms and dermatologic toxicities will help prepare patients for their course of treatment. In addition, nurses should provide patients with a variety of coping strategies to help manage dermatologic toxicities that will assist in enhancing patients’ adherence to EGFRi treatment.

At a Glance

- Dermatologic toxicities are the most common side effects associated with epidermal growth factor receptor inhibitor (EGFRi) treatment.
- Nurses should be educated about the benefits of administering a preemptive skin treatment regimen to patients to potentially prevent or minimize dermatologic toxicities associated with EGFRi treatment.
- Oncology nurses can collaborate with physicians to perform a thorough assessment of EGFRi-related dermatologic toxicities and provide support and education to patients.

Oncology nurses treat an increasing number of patients diagnosed with cancer who receive epidermal growth factor receptor inhibitors (EGFRis). EGFRIs, either alone or in combination with chemotherapy, are the standard of care for the treatment of advanced-stage gastrointestinal (colorectal and pancreatic) (Jonker et al., 2007; Moore et al., 2007; Van Cutsem et al., 2007), lung (Shepherd et al., 2005), and head and neck cancers (Bonner et al., 2006). Treatment with EGFRIs may result in dermatologic toxicities that lead to interruption or discontinuation of patient treatment (Lacouture, Cotliar, & Mitchell, 2007; Molinari, De Quatrebarbes, Andre, & Aractingi, 2005); therefore, management of dermatologic toxicities in patients treated with EGFRIs is crucial to help promote patient adherence with therapy. The purpose of this article is to inform nurses about preemptive management strategies for dermatologic toxicities associated with EGFRi treatment. In addition, the important role nurses play in preemptive care working with healthcare providers will be addressed; including educating, monitoring, and providing supportive care that promotes better understanding of EGFRi-related dermatologic toxicities and coping strategies for patients. Results from several studies evaluating the use of preemptive treatments (e.g., topical steroids,
anti-acne agents, oral antibiotics) will be discussed, including the Skin Toxicity Evaluation Protocol With Panitumumab (STEPP) study (Lacouture, Mitchell, et al., 2010). STEPP was the first clinical trial designed to examine differences between preemptive and reactive skin treatment for EGFR-related dermatologic toxicities in patients with metastatic colorectal cancer (mCRC).

The Epidermal Growth Factor Signaling Pathway

EGFR (Erb-1; HER1 in humans) is a cell-surface receptor protein that binds extracellular ligands (e.g., EGF, transforming growth factor-α, amphiregulin) and activates EGFR. This activation stimulates intracellular tyrosine kinase activity that, in turn, activates downstream-signaling protein cascades that stimulate DNA synthesis and cellular proliferation (Oda, Matsuoka, Funahashi, & Kitano, 2005) (see Figure 1).

EGFR is found in many cell types, and the overexpression or overactivation of EGFR has been associated with increased cellular proliferation and development of various types of cancer (Lynch et al., 2007). In clinical practice, therapeutics that target EGFR include monoclonal antibodies and low molecular weight tyrosine kinase inhibitors (TKIs). Monoclonal antibodies such as cetuximab and panitumumab competitively inhibit the binding of ligands to the EGFR extracellular domain. TKIs such as gefitinib and erlotinib inhibit EGFR cytoplasmic domain phosphorylation (Arteaga, 2001). Anti-EGFR therapeutics block the signaling cascades downstream of the receptor, which ultimately prevents cellular proliferation (Bulgaru, Mani, Goel, & Perez-Soler, 2003).

Note. The epidermal growth factor receptor (EGFR) pathway is a complex signaling cascade that is involved in the development and progression of cancer. EGF induces cellular proliferation by binding to the EGFR. EGFR has an extracellular domain, a single transmembrane domain, and a tyrosine kinase cytoplasmic domain. Binding of EGF to EGFR leads to receptor dimerization, autophosphorylation of the EGFR, and tyrosine phosphorylation of other proteins that, in turn, activate multiple pathways. For example, the KRAS pathway is a signaling cascade that is activated by the binding of EGF to EGFR. When the tyrosine residues (K, denoted in the cytoplasmic domain) of EGFR become phosphorylated, Ras is activated, which then activates the protein kinase activity of the Raf kinase. Raf kinase phosphorylates and activates MEK, and MEK, in turn, phosphorylates and activates mitogen-activated protein kinase (MAPK) (originally called extracellular signal-regulated kinases [ERKs]). As illustrated in this figure, EGFR is a junction point between several signaling cascades that, upon activation, ultimately lead to proliferative signaling.

Figure 1. Epidermal Growth Factor Receptor Cell Signaling Pathway Diagram

Note. Based on information from Avruch et al., 2001; Downward, 2003; Yarden & Sliwkowski, 2001.
Identification of these downstream signaling cascades has led to a better understanding of the side effects of these drugs and, more importantly, the identification of patients who are more likely to benefit from treatment (Livre et al., 2006). For example, about 40% of patients with mCRC have a mutation in a downstream gene called Kirsten rat sarcoma (KRAS) gene (Siddiqui & Piperdi, 2010). Mutations in KRAS are associated with resistance to the monoclonal antibodies cetuximab and panitumumab. The benefit from an EGFRi either alone or in combination with chemotherapy is limited to patients with a nonmutated or wild-type KRAS tumor status (Siddiqui & Piperdi, 2010).

Mechanisms of Dermatologic Toxicities

Dermatologic toxicities are the most common side effect associated with EGFRi treatment. The proper functioning of the EGFR signaling pathway contributes to normal development and maintenance of the skin (e.g., protection against ultraviolet [UV]-induced damage, wound healing) (Mitchell, Perez-Soler, Van Cutsem, & Lacouture, 2007). EGFR is highly expressed in the skin and plays a critical role in keratinocyte activation. Although the mechanisms underlying EGFRi-related dermatologic toxicities are not fully understood, animal models suggest that inhibition of EGFR blocks downstream signaling pathways and prevents keratinocytes from maturing properly as they migrate to the outer stratum corneum (Lacouture et al., 2007). This results in the thinning of the outermost layers of the epidermis and corneal layers, and the subsequent loss of the skin’s protective barrier function results in the increased sensitivity to UV radiation damage (Lacouture, 2006). The immune system also plays an important role in EGFRi-related dermatologic toxicities, although the exact mechanism is poorly understood (Lacouture, 2006).

Once damage to the skin occurs from EGFRi treatment, additional treatments to repair the damage are difficult. Patients may experience significant physical discomfort, with skin flaking, irritation, pruritus, and nail and hair changes having the largest impact on quality of life (Wagner & Lacouture, 2007). In addition, emotional distress from body image changes caused by EGFRi toxicities can lead to inadequate coping and refusal to continue treatments. Therefore, preemptive skin treatment is an important strategy for oncology nurses to understand, advocate, and adopt when treating patients who receive EGFRi treatment.

Clinical Presentation

The most common dermatologic toxicity resulting from EGFRi treatment is papulopustular eruption. Additional toxicities include nail changes, hair changes, ocular changes, pruritus, xerosis, and photosensitivity or erythema (Busam et al., 2001; Fox, 2007) (see Figure 2). In general, adverse events are graded using the National Cancer Institute Cancer Therapy Evaluation Program’s (2011) Common Terminology Criteria for Adverse Events (CTCAE), version 4.0; however, simplified criteria have been reported (Lynch et al., 2007). Stepwise criteria have been advocated by interdisciplinary groups (Eaby, Culkin, & Lacouture, 2008; Lacouture et al., 2007; Oishi, 2008), including a class-specific grading scale to help standardize EGFRi dermatoxicities developed by the Multinational Association of Supportive Care in Cancer Skin Toxicity Study Group (Lacouture, Maitland, et al., 2010). Classification using such criteria assists physicians and nurses in accurately grading dermatologic toxicities for assessment and management.

Epidermal Growth Factor Receptor Inhibitor–Related Papulopustular Eruption

EGFRi-related rashes, called papulopustular eruptions, are defined as a collection of pus in a hair follicle or sweat pore within or beneath the skin. Patients with papulopustular eruptions may present with pus, comedones, papulopustules, papulonodules, cysts, or nodules that resemble acne vulgaris localized to the face, arms, back, and chest region; these symptoms have been reported to affect many patients treated with EGFRi therapies (Agero et al., 2006; Busam et al., 2001; Perez-Soler et al., 2005; Segaert & Van Cutsem, 2005). This reaction may occur two to three days following the start of EGFRi treatment and worsen within one to three weeks (Mitchell et al., 2007). Severe papulopustular eruptions usually have a significant impact on activities of daily living.

Nail Changes

Nail and nailbed surfaces have similar EGFRi-related pathologic mechanisms of accelerated growth and, therefore, need to be monitored by nurses from the initiation of treatment. Paronychial nail changes are defined as a skin infection that occurs around the nail leading to inflammation and tenderness, possible ingrown nails, proliferation of granulation tissue, formation of pyogenic granuloma-type lesions, and fissuring of lateral nailfolds or distal finger nailbed (Busam et al., 2001). Nailbeds of the great toe are the most common digit affected. Paronychia and fissures occur in about 6%–12% of patients receiving EGFRIs (Lynch et al., 2007).
These nail changes develop four to eight weeks or as late as six months after the start of EGFRi treatment, and may persist for many months following discontinuation of the EGFRi treatment (Fox, 2007). Severe cases of observed grade 3 EGFRi nail changes also may require nail extraction (Galimont-Collen, Vos, Lavrijsen, Ouwerkerk, & Gelderblom, 2007).

Hair Changes

EGFRi therapies can result in hair changes such as alopecia or hirsutism. Alopecia is defined as the thinning or balding of the hair on the scalp or body, and this most often occurs after about 7–10 weeks of EGFRi treatment in 5%–6% of patients (Lynch et al., 2007). Hirsutism is defined as the excessive increase in hair growth (e.g., facial hypertrichosis and trichomegaly of the eyebrows), hair curling, and hair rigidity (Lacouture & Lai, 2006), and these symptoms most often occur within four to eight weeks of EGFRi treatment (Mitchell et al., 2007). Hypertrichosis and trichomegaly of eyelashes may cause eye irritation and enhance susceptibility to conjunctivitis (Lacouture, Maitland, et al., 2010).

Ocular Changes

Ocular changes associated with EGFRi treatment may include corneal dryness and abrasion (Lacouture, 2006), changes in the eyelids (e.g., squamous blepharitis, trichomegaly, meibomitis) and in the tear film (e.g., dysfunctional tear syndrome), as well as miscellaneous changes (e.g., iridocyclitis, corneal epithelial defect) (Basti, 2007). These ocular changes may occur within one to two weeks of treatment and result in a significant impact on patients’ quality of life.

Pruritis, Xerosis, and Photosensitivity or Erythema

Pruritis is defined as an unpleasant sensation that leads to itching of the skin and occurs in response to the release of histamine. As pruritis worsens, exposed skin regions (e.g., nail surfaces) become more susceptible to infection in the form of cellulitis and folliculitis. This reaction may occur one to two months following the start of EGFRi treatment. Papulopustular reactions that occur following the start of EGFRi treatment in 85% or more of patients have been associated with incidence of pruritus for some patients (Galimont-Collen et al., 2007).

Xerosis, which includes pruritus, is defined as dry, flaking skin that develops in about 35% of patients treated with EGFRIs (Galimont-Collen et al., 2007; Hu, Sadeghi, Printer-Brown, Yas-har, & Chiu, 2007); this dermatologic toxicity may or may not be associated with pruritus. Patients with xerosis may develop mucosal irritation, inflammation, erythema, and tearing of the eyelids and swelling and cracking of the lips. Dry skin and pustule formation may occur on the face, scalp, and upper thorax regions one to two months following the start of EGFRi treatment (Galimont-Collen et al., 2007).

Patients treated with EGFRIs may develop photosensitivity characterized by erythema from UV-induced damage. Erythema may be painless or painful and associated with desquamation. In severe cases, photosensitivity and erythema may be disabling or life-threatening. Photosensitivity is not always reported in clinical trials and the exact incidence among patients taking EGFRi is unknown (Lacouture, Maitland, et al., 2010).

Reactive Treatment of Dermatologic Toxicities

The majority of the literature on managing EGFRi-related dermatologic toxicities includes descriptive and case studies (Shu, Kindler, Medenica, & Lacouture, 2006) describing reactive skin treatment regimens for managing patient toxicities associated with EGFRi treatment. Results from these reactive skin treatment studies have influenced treatment choices of physicians and nurses (e.g., the use of topical treatments and oral antibiotics) for treating EGFRi-related dermatologic toxicities.

Topical Treatment

The most commonly used reactive treatment for EGFRi-related dermatologic toxicities is an emollient, such as moisturizing lotions and topical steroids (e.g., 1% hydrocortisone ointment). Recommendations based on European studies suggest treating papulopustular eruptions with topical metronidazole and use of oral minocycline 100 mg one to two times daily (Segaert & Van Cutsem, 2005). Although use of topical anti-acne agents such as erythromycin, clindamycin, and benzoyl peroxide have been previously reported (Segaert et al., 2005), the benefits of using anti-acne agents to treat EGFRi-related

<table>
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<tr>
<th>STUDY</th>
<th>EGFR</th>
<th>CLASS</th>
<th>TREATMENT</th>
<th>DOSING</th>
<th>PATIENTS</th>
<th>ENROLLED</th>
<th>EVALUABLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lacouture, Mitchell, et al., 2010</td>
<td>Panitumumab</td>
<td>Monoclonal antibody</td>
<td>Doxycycline, hydrocortisone cream, sunscreen, and moisturizer</td>
<td>100 mg twice a day, 1% cream topically daily for six weeks</td>
<td>95</td>
<td>95</td>
<td></td>
</tr>
<tr>
<td>Jatoi et al., 2008</td>
<td>Cetuximab</td>
<td>Gefitinib</td>
<td>Monoclonal antibody Tyrosine kinase inhibitor</td>
<td>Tetracycline</td>
<td>500 mg orally every other week for 28 days</td>
<td>61</td>
<td>27</td>
</tr>
<tr>
<td>Scope et al., 2007</td>
<td>Cetuximab</td>
<td>Monoclonal antibody</td>
<td>Minocycline and tazarotene</td>
<td>100 mg per day orally, 0.02%</td>
<td>48</td>
<td>35</td>
<td></td>
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EGFRi—epidermal growth factor receptor inhibitor.
Patients should

- Apply skin moisturizer daily, in the morning, to the face, hands, feet, neck, back, and chest.
- Apply sunscreen to exposed skin areas before going outdoors. Sunscreen should be para-amino benzoic acid free, have an sun protection factor of 15 or higher, and be an ultraviolet A or B protectant.
- Apply a steroid, such as 1% hydrocortisone, at bedtime to the face, hands, feet, neck, back, and chest.
- Take doxycycline 100 mg twice a day during the six-week skin treatment period. Each dose should be taken with 8 ounces of water. Avoid taking doxycycline with dairy products, vitamins, and iron and calcium supplements. Also, avoid sunlight or wear protective clothing.
- Review video instructions on measures involving the skin treatment regimen.

Note. The reactive skin treatment regimen, per investigator discretion, was administered anytime during the six-week skin treatment period.

Figure 3. Preemptive Treatment Used in the Skin Toxicity Evaluation Protocol With Panitumumab Study

*Note.* Based on information from Lacouture, Mitchell, et al., 2010.

dermatologic toxicities may be limited, as these agents have the potential to cause skin irritation and excessive drying. Specifically, retinoids are not recommended as they may cause irritation and/or worsening of EGFRI-related dermatologic toxicities (Lacouture, Mitchell, et al., 2010) (see Table 1).

**Oral Antibiotics**

Oral antibiotics have been commonly administered in medical practice for EGFRI-related papulopustular eruptions, particularly for patients at risk for superimposed infection. Several clinical studies (Jatoi et al., 2008; Lacouture, Mitchell, et al., 2010; Scope et al., 2007) suggested that reactive use of oral tetracycline-based antibiotics reduced the severity of papulopustular eruptions in patients with EGFRI-related dermatologic toxicities. Scope et al. (2007) evaluated either oral minocycline with topical tazarotene (a retinoid that is part of the vitamin A family) or oral placebo with topical tazarotene both to reduce or prevent cetuximab-related papulopustular eruption in patients with mCRC (Scope et al., 2007; Shu et al., 2006). Forty-eight patients were randomly assigned to receive minocycline or oral placebo, along with daily tazarotene cream at the start of treatment. Results from the study indicated that, during the first month of treatment, total facial lesion counts were less in patients who received minocycline, including less pruritus than the placebo arm (20% versus 50%, respectively; p = 0.05). Administration of tazarotene cream had no clinical benefit, and skin irritation was reported in one third of patients. Results from this study have encouraged physicians and nurses to administer oral minocycline when treating patients with papulopustular eruptions associated with EGFRI treatment and to avoid use of retinoids.

In Jatoi et al. (2007), researchers from the North Central Cancer Treatment Group examined the role of oral tetracycline in reducing the incidence of EGFRI-related papulopustular eruption. The study included 61 patients who received various anti-EGFRI therapies and did not experience a papulopustular eruption. Patients were randomly assigned to receive either oral tetracycline (n = 31; 500 mg orally twice per day for 28 days) or placebo (n = 30). Tetracycline did not decrease the incidence of papulopustular eruptions compared with placebo (70% and 76% of patients in the tetracycline and the placebo arm, respectively, developed papulopustular eruption); however, the severity of papulopustular eruptions was reduced in patients receiving tetracycline. After four weeks of treatment, grade 2 papulopustular eruption occurred in 17% of patients treated with tetracycline compared to 55% in the placebo arm. Patients treated with tetracycline reported better quality of life scores (SKINDEX-16), including a decrease in skin burning and skin irritation (Jatoi et al., 2007).

Shu et al.’s (2006) case study report of paronychial treatment with oral minocycline was evaluated in the treatment of these nail changes elicited by EGFRI use. Incidence of EGFRI-related paronychia ranged from 6%–50%, with a median occurrence of two months after the start of EGFRI treatment (Busam et al., 2001; Lee et al., 2004). Infection of the nailbed region was unresponsive to antibiotics for staphylococcal infection, but instead responsive to oral minocycline, which provides coverage for gram-positive and gram-negative organisms (Shu et al., 2006).

**Preemptive Versus Reactive Skin Treatment**

STEPP was the first clinical study conducted to evaluate and demonstrate the differences between preemptive and reactive skin treatment protocols. A total of 95 patients were randomized to either the preemptive arm or the reactive arm during the skin treatment period. The study evaluated the incidence of grade 2 or higher skin toxicities in the two arms. Table 2 summarizes the results.

**Table 2. STEPP Study: Incidence of Grade 2 or Higher Skin Toxicities in Preemptive Versus Reactive Skin Treatment Arms During the Skin Treatment Period**

<table>
<thead>
<tr>
<th>CATEGORY</th>
<th>PREEMPTIVE SKIN TREATMENT (N = 48)</th>
<th>REACTIVE SKIN TREATMENT (N = 47)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patients with grade 2 or higher skin toxicity*</td>
<td>n = 14, % = 29</td>
<td>n = 29, % = 62</td>
</tr>
<tr>
<td>Grade 2</td>
<td>n = 11, % = 23</td>
<td>n = 19, % = 40</td>
</tr>
<tr>
<td>Grade 3</td>
<td>n = 3, % = 6</td>
<td>n = 10, % = 21</td>
</tr>
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*Adverse events were graded using the National Cancer Institute Cancer Therapy Evaluation Program’s Common Terminology Criteria for Adverse Events (CTCAE), version 3.0, except for panitumumab-related skin toxicities, which were graded using a modified CTCAE, version 3.0.

**Note.** No grade 4 skin toxicities were reported during the skin treatment period.
skin treatment for treating EGFR-related dermatologic toxicities in patients with mCRC (Lacouture, Mitchell, et al., 2010). Specifically, this study evaluated patients receiving chemotherapy with panitumumab (a fully human anti-EGFR monoclonal antibody used as monotherapy for chemorefractory mCRC in patients with wild type KRAS tumors). Patients were randomized to receive either a preemptive or a reactive skin treatment regimen (see Figure 3).

Patients randomized to the preemptive skin treatment regimen were administered treatment beginning one day before the administration of the first panitumumab dose and continuing through the following six weeks. This regimen included the use of a sunscreen, a topical steroid (1% hydrocortisone cream), an antibiotic (doxycycline), and a skin moisturizer. A video was provided that described suggested measures to decrease skin irritation and provided instructions on how to apply the skin moisturizer, sunscreen, and topical steroids.

During weeks 1–6, patients randomized to the reactive skin treatment regimen were permitted to receive any treatments the investigator deemed necessary for managing emergent dermatologic toxicities. A similar video was provided to this group that only described suggested measures to reduce skin irritation (instructions for the application of the skin moisturizer, sunscreen, and topical steroid were not included).

The primary endpoint of the study was the difference in incidence rates between the preemptive and reactive treatment arms for specific grade 2 or higher dermatologic toxicities of interest. Of the protocol-defined dermatologic toxicities, a greater than 50% decrease was noted in specific grade 2 or higher dermatologic toxicities in the preemptive group compared with the reactive group (see Table 2). Median time to first occurrence of specific grade 2 or higher dermatologic toxicities of interest was not reached in the preemptive treatment group and was 2.1 weeks in the reactive treatment group (Lacouture, Mitchell, et al., 2010). Quality of life was assessed using the Dermatology Life Quality Index (DLQI), which is a questionnaire used to assess quality of life in patients with dermatologic disorders (Finlay & Khan, 1994). Results from the DLQI indicated that quality of life was less impaired in the preemptive treatment group compared with the reactive treatment group.

Results generated from this study may assist nurses in using a standardized preemptive skin treatment regimen that potentially minimizes EGFR-related dermatologic toxicities to patients. In addition, nurses are encouraged to use this preemptive skin treatment regimen because of the possible improvements in treatment adherence and quality of life for patients.

### Supportive Nursing Measures

At the start of EGFR treatment, nurses should inform their patients of potential EGFR-related symptoms of dermatologic toxicities as part of supportive measures (see Table 3). In addition, nurses should educate patients about preemptive skin care treatments and possible lifestyle changes that may enhance their comfort. For example, nurses may want to obtain information regarding a patient’s occupation and previous skin conditions and sensitivities, as this type of information may help nurses design treatment strategies for individual patients that can help prevent or minimize EGFR-related dermatologic toxicities.

Patients should be made aware of nonpharmacologic skin treatments that may enhance patient comfort, such as nonirritating skin cleansers, moisturizers, and sun block. Lifestyle changes also may promote patient comfort, including optimal hydration and nutrition, cushioning of tender areas, wearing more comfortable clothing, using warm soaks for eye irritation, and avoiding irritants such as fragrances and perfumes. In addition, nurses should encourage open communication with their patients to ensure that patients promptly report any dermatologic toxicities during the course of EGFR treatment.

Patients may not be evaluated as frequently when receiving oral EGFR treatment at home compared with patients receiving infusion treatment by nurses weekly, every few weeks, or monthly in the clinical setting. Nurses are encouraged to make follow-up evaluations based on local practice guidelines.
phone calls to their patients, as this will promote patient communication regarding their treatment experience. In addition, follow-up phone conversations will allow nurses to periodically assess and monitor their patients’ health status; these phone calls also are an opportunity for nurses to educate and lend supportive care during the course of the treatment period to their patients.

Several guidelines are available to assist nurses with providing supportive patient care throughout the EGFR treatment period. Nurses must monitor skin integrity to minimize potentially serious complications, such as secondary infections. In general, most recommended skin assessment tools are clinician-based. Such tools include the CTCAE, which uses a grading system that ranges from 1 (marginal) to 4 (severe) to describe dermatologic toxicity severity (Witherspoon, Wagner, & Rademaker, 2008). Algorithms, such as the SERIES (Skin and Eye Reactions to Inhibitors of EGFR and kinases) evaluation developed for use with these cutaneous toxicities, also can be used by nurses to assess, treat, and manage EGFR-related toxicities (Lacouture, Basti, Patel, & Benson, 2006; Purdom & Ohinata, 2007).

This assessment tool provides guidance on how to treat patients with mild, moderate, or severe EGFR-related dermatologic toxicities. Guidelines also are available for nurses to help determine whether EGFR-treated patients show improvement in dermatologic toxicities. These guidelines also can be used for designing alternative treatments if the EGFR-related dermatologic toxicities worsen. Additional algorithms exist that address the management of EGFR-related papulopustular eruptions, xerosis, pruritus, and nail toxicities in relation to severity (Lacouture et al., 2007).

**Conclusion**

Dermatologic toxicities are a common side effect resulting from EGFR treatment. These toxicities may include papulopustular eruptions, nail and nailbed changes, hair changes, ocular changes, pruritus, xerosis, and photosensitivity or erythema (Busam et al., 2001; Fox, 2007). A preemptive skin treatment regimen has been reported to prevent or minimize dermatologic toxicities associated with EGFR treatment (Lynch et al., 2007). The STEPP study was the first clinical study to evaluate the differences between preemptive and reactive skin treatments for EGFR-related dermatologic toxicities in patients with mCRC. Results from the study demonstrated that the incidence of specific grade 2 or greater dermatologic toxicities was reduced by more than 50% in the preemptive treatment group compared with the reactive treatment group.

In conclusion, the crucial role nurses play in providing support and appropriate treatment options may help minimize dermatologic toxicities in patients receiving EGFR treatment. Understanding the dermatologic toxicities associated with EGFR treatment and using the tools available for managing these toxicities may assist in enhancing patient quality of life and EGFR treatment adherence.

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**Author Contact:** Jean Boucher, PhD, RN, ANP, can be reached at Jean.Boucher@umassmed.edu, with copy to editor at CJONEditor@ons.org.

**References**


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