Although great strides have been made in preventing chemotherapy-induced nausea and vomiting (CINV), some patients continue to experience this distressing side effect of treatment. Evidence-based guidelines used in clinical practice to help prevent CINV include a serotonin antagonist, a neurokinin-receptor antagonist (e.g., aprepitant, fosaprepitant), and dexamethasone for highly emetogenic chemotherapy regimens and moderately emetogenic chemotherapy with a high risk of delayed CINV. A serotonin antagonist and dexamethasone are administered prior to other moderately emetogenic regimens. Dopamine antagonists, lorazepam, metoclopramide, haloperidol, droperidol, and other agents are used to control breakthrough symptoms. Options for refractory CINV include olanzapine, dronabinol, nabilone, and gabapentin (Herrstedt, 2008; Kris et al., 2006; National Comprehensive Cancer Network, 2009; Tipton et al., 2007).

A major limitation of the recommended antiemetics is how they are administered. Parenteral administration requires an available IV device and a nurse or other healthcare professional (or a specially trained patient or family caregiver in some instances) to administer the antiemetic. Oral antiemetics require a functioning gastrointestinal system, patient and family adherence to an antiemetic administration schedule, and the patient’s ability to swallow and retain the antiemetic.

Transdermal Medication Delivery

Transdermal medication delivery systems are designed to administer medication through the skin to obtain a systemic effect. Transdermal delivery ensures a constant rate of administration and a prolonged action. Compared to parenteral administration, transdermal delivery has no risk for infection and specialized nursing care is not required. Transdermal medication delivery also bypasses the gastrointestinal system and may be particularly well suited for patients who are unable to take or tolerate oral medications. Although the main function of the skin is to act as a protective barrier, it is permeable to many substances, including many medications. Medications that have a low-molecular weight and are highly lipid soluble are easily absorbed through the skin;
these medications may be given transdermally via creams, gels, and patches (Prausnitz & Langer, 2008).

Transdermal medication delivery via a patch worn on the skin was introduced in 1981 when patches containing scopolamine for motion sickness became available. Patches containing nitroglycerin were introduced soon afterward, but transdermal medication patches were not used widely until 1996, when the U.S. Food and Drug Administration (FDA) approved the nicotine patch. Several medications are now available as transdermal patches, such as clonidine, estradiol, fentanyl, lidocaine, nicotine, and testosterone (Schulmeister, 2005). Granisetron transdermal system (Sancuso®, ProStrakan, Inc.) is a transdermal patch that contains the antiemetic granisetron (see Figure 1) (ProStrakan, Inc., 2008b). The patch received FDA approval in 2008 and is the first transdermal medication indicated for CINV (FDA, 2008). Other transdermal medication delivery approaches are in development, such as transdermal ultrasound to deliver insulin noninvasively (Park, Dodds, & Smith, 2008), bioadhesive films that deliver fentanyl to the buccal mucosa (Díaz del Consuelo, Falson, Guy, & Jacques, 2007), and a nasal delivery formulation of ondansetron (Cho, Gwak, & Chun, 2008).

Transdermal medication patches provide systemic therapy by passive diffusion. When placed on intact skin, a patch containing a highly soluble medication creates a concentration gradient between the saturated solution of medication in the patch to the much lower concentration of water in the skin. The medication passively diffuses from the patch to the stratum corneum (the outermost layer of the skin) into the capillaries of the epidermis and provides relatively long periods of continuous medication delivery to distant sites of action (Hampton, 2005).

Transdermal patches offer an alternate route of medication administration that avoids first pass metabolism. The expression “first pass metabolism” refers to the metabolism that an ingested compound (e.g., oral medication) undergoes in its passage through the stomach, intestines, and liver before reaching systemic circulation. Transdermal medications are designed to bypass the gastrointestinal system and directly enter the circulatory system (Schulmeister, 2005).

A transdermal medication patch is comprised of three elements: a protective outer seal, a medication compartment, and a release liner that is peeled away prior to application. Depending on the type of patch, the elements can exist as separate layers or one layer. The reservoir-type patch (sometimes called a “ravioli” design) is a multilayer disk that contains a medication reservoir sandwiched between an impermeable backing membrane, which has an adhesive gel to secure the patch to the skin, and a rate-controlling microporous membrane. Matrix-type patches are smaller and thinner than reservoir patches. The medication film that controls release of the medication and the adhesive backing are integrated into one layer (Wokovich, Prodduturi, Douh, Hussain, & Buhse, 2006).

Medications are delivered via patch at a rate controlled by the type of material used for the microporous membrane. Therefore, the rate of medication absorption into the systemic circulation is determined by the medication delivery system (the patch) and not by the skin. Studies of dermal penetration of transdermal medications show little variation in the absorption and biodistribution of these medications. In other words, people of different ages (including older adults) with varying skin textures, thickness, and pigment generally all absorb transdermal medications in the same way at about the same rate (Brown, Martin, Jones, & Akomeah, 2006; Kaestli, Wasilewski-Rasca, Bonnabry, & Vogt-Ferrier, 2008). In addition, very little variation exists in dermal penetration, with respect to body site; transdermal medications are absorbed equally well when applied to the arms, thighs, back, or abdomen. However, a consideration regarding placement location is that transdermal patches do not adhere well in areas of hair growth, so an upper-outer arm application site often is recommended by transdermal patch manufacturers (Brown et al.; Kaestli et al.).

**Granisetron Transdermal System**

The granisetron transdermal system is a serotonin subtype 3 (5-HT3) receptor antagonist indicated for the prevention of nausea and vomiting in patients receiving moderately or highly emetogenic chemotherapy for up to five consecutive days. The thin, translucent, matrix-type transdermal patch is rectangular in shape and has rounded corners, which help the patch adhere to skin. Each patch contains 34.3 mg of granisetron, delivering 3.1 mg of granisetron per 24 hours for up to seven days (for a total of 21.7 mg) (ProStrakan, Inc., 2008b). The patch contains more granisetron than it delivers. When residual content of the patch was measured, about 66% of granisetron was found to have been delivered; therefore, each patch contains enough granisetron (34.3 mg) to provide the desired amount (3.1 mg per 24 hours of wear time) (ProStrakan, Inc., 2008a).

A single patch is applied to dry, intact skin on the upper-outer arm 24–48 hours before chemotherapy administration. Gloves do not need to be worn when applying the patch. The patch is removed at least 24 hours after the completion of chemotherapy and can be worn up to seven days (ProStrakan, Inc., 2008b).

In two double-blind safety studies, 404 patients wore a granisetron patch for up to seven days, and 406 patients (the control

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**Figure 1. Sancuso® (Granisetron Transdermal System) Packaging**

*Note. Image courtesy of ProStrakan, Inc. Used with permission.*
The primary endpoint of the study was the proportion of the 641 patients who did not experience CINV or retching, had no more than mild nausea, and did not require rescue antiemetic treatment. Sixty percent of patients who wore the granisetron patch and 64.8% of patients who took oral granisetron met the primary endpoint of the study. Therefore, the granisetron-containing patch had similar efficacy to that of oral granisetron in preventing CINV, but costs vary because of bulk, group, and contract pricing (ProStrakan, Inc., 2008a, 2008b). The safety and effectiveness of the granisetron transdermal system in pediatric patients younger than age 18 have not been established.

### Safety Considerations

Transdermal medication patches such as the granisetron transdermal system should be stored at room temperature in their original packaging. The medication reservoirs of transdermal patches can burst from excessive heat or pressure, so they need to be stored and used properly. Medication patches should not be removed from their protective wrappers until immediately prior to use; damaged or leaking patches should not be applied. Used patches need to be discarded with household waste in a manner that avoids accidental contact by people and pets (e.g., fold patch in half to stick to itself, wrap used patches in old newspaper or a paper towel before discarding), as residual medication may be present on the discarded patch (Schulmeister, 2005).

From 2002–2006, the only published data found pertaining to transdermal system safety were 336 inadvertent exposures to medications in transdermal patches reported to the Texas Poison Center (Parekh, Miller, Borys, Patel, & Levsky, 2008). About 33% of the exposures involved children younger than age 12, and one death from opioid toxicity after handling a fentanyl patch was reported. Although clinical toxicity rarely occurred, inadvertent exposure to medications in transdermal patches may be harmful, particularly for children (Parekh et al.).

Transdermal patches are waterproof and designed to adhere to skin; however, the FDA has received numerous reports of “adhesion lacking” for transdermal medication delivery systems (Wokovich et al., 2006). Excessive sweat or immersion in water may cause transdermal patches to peel off partially or completely. Patches also may loosen when exposed to hot, steamy environments (e.g., hot tubs, saunas). Bath oils, soaps with a high cream content, and skin moisturizers should be avoided in areas where a transdermal patch will

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**Figure 2. Study Design Evaluating the Granisetron Transdermal Patch Versus Oral Granisetron**

*Note. Illustration courtesy of ProStrakan, Inc. Used with permission.*
be or has been applied. In addition, transdermal patches should only be applied to clean, dry, intact skin.

The granisetron transdermal patch may be affected by natural or artificial sunlight. Patients should be instructed to cover the patch with clothing and avoid direct sunlight, sunlamps, and tanning beds while wearing the patch and for ten days following its removal because of the potential for skin reactions (ProStrakan, Inc., 2008b).

Various units of measure are used to describe doses of medication contained in transdermal patches. The granisetron transdermal system is imprinted with the words “granisetron 3.1 mg/24 hours.” Other transdermal medication patches are imprinted with milligrams per hour (mg/hour), milligrams per day (mg/day), micrograms per hour (mcg/hour), or simply as milligrams. The dose contained in a patch that is changed weekly may be expressed as mg/day/week. Therefore, nurses must check the dose and delivery rate of transdermal patches carefully before applying them and instruct patients who self-apply patches to do the same. Also, with the increasing usage of transdermal patches, a patient may be applying or wearing more than one medication patch (Schulmeister, 2005). Wearing a transdermal medication patch may sometimes be too convenient, with patients forgetting to remove a patch at the prescribed interval. Patients also may overlook mentioning transdermal medication patches when they are asked what medications they are taking, and may not know the dose of medication being delivered transdermally.

Conclusions

Oral medications are absorbed variably and are not appropriate for patients who cannot swallow, and parenteral medications (administered by injection or infusion) are not easily self-administered and may cause discomfort and increase patients’ risk for infection. Therefore, transdermal medication delivery via a patch provides convenient, controlled, continuous medication delivery while avoiding problems associated with oral or parenteral medication administration.

Oncology nurses need to be well informed about new developments in managing symptoms that their patients may experience, such as CINV. The granisetron transdermal system is an antiemetic patch that offers a new option in preventing CINV. Nurses should be aware of how transdermal medication patches work and know how to properly apply them. Although medication patches are relatively simple to administer, safety considerations with respect to their storage, handling, application, and disposal should be recognized.

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References


