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ISMP

Nurse AdviseERR®

Educating the Healthcare Community About Safe Medication Practices

Ambulatory pump safety: Managing home infusion patients admitted to the ED and hospital

Before the 1980s, patients had to be hospitalized to receive various types of infusion therapies to treat diseases unresponsive to oral medications. Since then, the availability of lightweight ambulatory pumps has made infusion therapy possible in alternative settings outside the hospital, including in the home. A new market research study suggests that the use of ambulatory pumps is commonplace and will continue to grow at an annual rate of about 9% over the next 5 years.[1]

This growth is tied to an increasing geriatric population, expanding prevalence of chronic diseases such as cancer and diabetes, and positive patient outcomes in a less expensive home setting. Ongoing technology developments and newer applications of ambulatory pumps in the home are further driving an increase in their use. Today, ambulatory pumps are being used to deliver various medications (**Table 1**) to treat a wide array of diseases and conditions, from diabetes to chronic pain. This mode of delivery typically involves using a needle or catheter under the skin to administer medications, blood products, nutrition, or hydrating solutions via intravenous, subcutaneous, epidural/intrathecal, percutaneous, intrawound, intrahepatic, or other parenteral routes.

As with any medication delivery system, patient safety can be jeopardized if the devices are mishandled when filling, refilling, programming, attaching, and monitoring the pumps. The ambulatory pump marketplace is diverse, so the devices rarely have standard components. This poses a unique challenge for healthcare providers when patients using these devices are admitted to an emergency department (ED) or hospital. Often, healthcare providers are not familiar with all the ambulatory pumps in use, and most patients who use these devices are ill informed, leading to serious errors—the most dangerous of which is overinfusion. For example, just recently in our June 18, 2015, acute care newsletter, we described numerous overinfusions of fluorouracil caused by misprogramming a **CADD** ambulatory infusion pump and misusing a rate-specific elastomeric **EASYPUMP**. In our February 2015 nursing newsletter, we published an event in which both a patient and clinicians in the ED mistakenly believed an elastomeric **DOSIFUSER** pump had malfunctioned and delivered an overinfusion of fluorouracil when it had not. This led to the omission of a large portion of the prescribed chemotherapy after the infusion was disconnected prematurely.

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Table 1. Examples of medications/medication classes and solutions commonly administered at home via ambulatory pumps.

Analgesics
Antiemetics
Antimicrobial, antifungal, antiviral agents
Antineoplastic agents
Antispasmodic drugs, including baclofen
Biologic drugs
Blood factors
Corticosteroids
Diuretics
Epoprostenol or treprostinil
Hematopoietic agents
Heparin
Hormones, including insulin and growth hormones
Hydration
Immunologic medications
Inotropic medications
Monoclonal antibodies
Parenteral nutrition
Tocolytics

SAFETY wires

Alteplase and tenecteplase confusion.

A patient with slurred speech and facial droop arrived at an emergency department (ED) late in the evening. Upon arrival and assessment, a probable diagnosis of stroke was made, and alteplase, which has a stroke indication, was prescribed. In the ED, the drug was commonly referred to as "tPA." At an automated dispensing cabinet (ADC), a nurse typed "t" and tenecteplase appeared on the selection screen, which she selected and removed from the cabinet.

The hospital used tenecteplase for STEMI (segment elevation myocardial infarction) because it was less expensive than alteplase (**ACTIVASE**) for myocardial infarction (MI). But alteplase was also in the ADC for stroke and pulmonary embolism indications. Pharmacy was usually part of the stroke alert team, but the hospital pharmacy was not open 24 hours, so the pharmacist had already left for the day. Because the drugs were high-alert medications, a second nurse confirmed the dose calculations but not the actual product. Tenecteplase was given using the alteplase protocol, and the patient was transferred to another hospital.

The calculated alteplase dose for stroke in this patient was 65 mg. While tenecteplase is not approved for stroke, the tenecteplase STEMI dose would be 40 mg, so the 65 mg of tenecteplase that was inadvertently administered was about 60% higher than the approved STEMI dosing. A pharmacist noticed the error the next day when reviewing the orders, and notified the ED along with the hospital where the patient was transferred. The patient's family was also notified. Fortunately, the patient recovered; stroke symptoms were not apparent, and no adverse effects from the overdose were identified.

During follow-up, the nurse said she had

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> **Ambulatory pump**—continued from page 1

Insulin pumps provide another example of a unique challenge to clinicians when patients with these devices present for treatment. Insulin pumps have been used for more than 35 years. There are nearly a dozen different devices available in the US today. In 2007, about 374,000 patients with type 1 diabetes were using insulin pumps.[2] Today, more than half a million patients with type 1 and type 2 diabetes are using insulin pumps.[3,4] Yet, few healthcare clinicians have a comprehensive understanding of these devices. When patients with insulin pumps are evaluated in the ED or admitted to the hospital, they typically have more knowledge and expertise with using the pump for insulin delivery than the medical professionals who are handling their care.[1]

So, what happens in your hospital when a patient using an ambulatory pump to deliver a medication or solution is admitted to the ED or hospital? What if the patient is unresponsive and cannot help identify the medical device found at his or her waist? Simply discontinuing the therapy may **NOT** be the most clinically appropriate or safest solution. Turning off the ambulatory pump without understanding its purpose and contents could lead to serious, even fatal, events.[5] For example, in a 2014 consensus statement, the American Association of Clinical Endocrinologists and the American College of Endocrinology encourage hospitalized patients and their admitting physicians to not discontinue an insulin pump, but rather to consult the specialist responsible for the patient's insulin pump management if the patient cannot manage his or her own pump.[4] Another example includes the serious consequences of interrupting a continuous infusion of an IV prostacyclin (epoprostenol or treprostinil) used to treat pulmonary hypertension.

But continuing the infusion without knowing how to manage the pump may not be a clinically appropriate or safe alternative either, especially if the patient is not well enough to assist with managing the device. Even allowing a very capable patient to manage his or her own ambulatory medication pump can be risky.[5] For example, it may be impossible to determine if the device is working properly or where to find replacement parts or batteries if clinicians don't know how to operate that particular pump. Clinicians may not know how to turn off the pump in an emergency or refill the device when it is empty.[6] Serious errors are possible due to these factors. With insulin pumps, for example, errors have been reported in which a patient self-administered a dose of insulin via an ambulatory pump without telling the nurse, and the nurse administered the same dose via an injection leading to an overdose. Also, if the patient's condition changes or they must undergo surgery, the ambulatory pump may need to be managed by clinicians or turned off temporarily.[5]

ISMP is interested in learning how hospitals are handling patients who arrive for treatment with an external ambulatory pump, with a goal of publishing guidelines associated with this situation. We have prepared a short survey to learn about your practices, concerns, and patient outcomes. We encourage all US hospitals to participate in this important survey. See **page 4** for the survey, which can be accessed at: www.ismp.org/sc?id=612. We would appreciate your online responses by **October 30, 2015**.

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> **SAFETY** wires continued from page 1

the "t" in tPA on her mind while obtaining the medication from the ADC. Nomenclature on the ADC screen listed generic then brand names, and the "t" in tPA led the nurse to select the tenecteplase (**TNKase**). Since this error, pharmacy built an alert for tenecteplase in the ADC so, when selected, a notice will appear stating: "STEMI ONLY."

ISMP recommends not using any drug name abbreviations throughout the drug use process—including tPA. Patients exposed to a thrombolytic overdose are at risk of bleeding complications. A recurring danger has been confusion between Activase (alteplase), commonly referred to as tPA, and TNKase (tenecteplase), sometimes called TNK or even TNK-t-PA. Upon learning of the error, staff at the transfer hospital stated that this had happened once before with a patient from another hospital. The abbreviations tPA or TNK may lead to confusion and overdoses, as noted in our list of abbreviations to avoid (www.ismp.org/sc?id=378).

Unexpected painful breath. When teaching patients about the proper use of an inhaler, be sure to emphasize the importance of recapping the device after use. We were reminded of this when reading the April 9, 2015 *BMJ Case Reports*. A woman accidentally inhaled a small earring while using her asthma inhaler which was uncapped and stored in her purse (www.ismp.org/sc?id=575). As she inhaled the medicine, she felt a painful scratch in her throat and started coughing blood. She was taken to the emergency department, where the earring was removed from her lung. If the inhaler's cap had been in place, the loose earring in her purse would not have gotten into the inhaler.

In April 2015, another event was reported in England (www.ismp.org/sc?id=576). A woman used her inhaler and suddenly felt something shoot to the back of her throat. She began gasping for air and spitting up blood. She ran outside, and a neighbor came to her rescue and called emergency medical services. The woman eventually coughed out a fake nail that had been part of a set she had worn weeks ago. In this case, the inhaler's cover had been in place before use, so the nail had probably lodged in the inhaler

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Zoster vaccine—Not for the immunosuppressed

A 90-year-old man went to a community pharmacy to refill a prescription for 60 mg of predni**SONE** daily for an unspecified condition. While there, the man was told about **ZOSTAVAX** (zoster vaccine, live), and he expressed an interest in receiving the vaccine. He was asked to complete a vaccine screening questionnaire, and billing for the vaccine was processed. Unfortunately, the pharmacist did not review the completed vaccine screening questionnaire, and when Zostavax was entered into the computer system, she didn't notice a patient-specific alert to avoid administration of Zostavax because the patient was taking an immunosuppressant. Another pharmacist was notified that the man was waiting for the vaccine. This pharmacist reviewed the vaccine screening questionnaire but stopped part way through when she noticed the man had indicated that he did not know if he had received a "shingles" vaccine in the past. The pharmacist verified that the man had not received the vaccine by checking the state immunization information system. She then forgot to review the remainder of the questionnaire, missing that the patient had indicated that he was taking predni**SONE** or an immunosuppressant.

The pharmacist prepared the vaccine while teaching a pharmacy intern about proper mixing. Once the pharmacist was ready to administer it, the man mentioned that he had been taking predni**SONE** 40 to 60 mg daily for more than 3 months, but the pharmacist did not recall that Zostavax was contraindicated in patients with long-term steroid use. The vaccine was administered, and when completing the documentation, the pharmacist remembered to review the remainder of the vaccine screening questionnaire and realized the contraindication with long-term steroid use. The man was notified of the error, and his physician elected to prescribe val**ACY**clovir to lessen the risk of an adverse reaction.

The risk of herpes zoster and its accompanying morbidity and mortality is much greater among people who are immunosuppressed. Review of vaccination status for herpes zoster and screening for diseases that might make patients immunocompromised should be a key component of the medical assessment for patients 60 years and older, especially if they might be anticipating initiation of immunosuppressive treatments. The Advisory Committee on Immunization Practices (ACIP) states that the MMR (measles, mumps, rubella) vaccine, varicella vaccines (including in combination with MMR), and the zoster vaccine are contraindicated in people receiving high-dose steroids. High-dose steroids are defined as 2 mg/kg or more, or a total of 20 mg/day or more of predni**SONE** or the equivalent for people who weigh more than 10 kg, when administered for 2 weeks or more. MMR, varicella, and zoster vaccines should not be given for at least 1 month after the discontinuation of steroids. The vaccine is also not recommended for patients with chronic lymphocytic leukemia (CLL) because it may cause a shingles infection due to a compromised immune system (www.ismp.org/sc?id=559).

One might also question giving the zoster vaccine to a 90-year-old person, but there is no upper age limit for administration of the zoster vaccine. The incidence of herpes zoster increases with age; about half of people living until the age of 85 years will develop shingles. ACIP recommends the vaccine for people 60 years and older, even though the vaccine's efficacy decreases as the recipient's age increases (www.ismp.org/sc?id=560). In general, with increasing age at vaccination, the vaccine is more effective in reducing the severity of zoster and post-herpetic neuralgia than it is in reducing its occurrence. For more information, see the ACIP General Recommendations on Immunization (www.ismp.org/sc?id=561) and other vaccine specific recommendations (www.ismp.org/sc?id=562). The ACIP General Recommendations on Immunization will be updated soon.

Join ISMP in celebrating
- **American Pharmacists Month** (October)
- **National Hospital & Health-System Pharmacy Week** (October 18-24)
- **National Pharmacy Technician Day** (October 20)!

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while using it when wearing the nails.

Encourage patients to always inspect the inhaler thoroughly before use to ensure that there are no unwanted objects within the inhaler. Patients need to understand the importance of replacing the cap after each use. Some of the newer inhalers have an attached cap. If a foreign object enters the inhaler, it places the person at risk of breathing in the object and causing choking or severe respiratory difficulties.

Special Announcement

ISMP webinar

Join us on **November 18** for our webinar, ***Oops, Sorry, Wrong Patient: Taking Steps to Improve the Identification and Prevention of Wrong Patient Errors in Electronic Systems***. Our speaker will describe the challenges of wrong patient errors in electronic systems and the use of an automated "retract and reorder" measure to discover wrong patient errors. Learn about the possible causes of these events as well as the value of applying Just Culture principles with these types of events.

For details and to register, please visit: www.ismp.org/sc?id=349.

To subscribe: www.ismp.org/sc?id=384

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ISMP Survey on the Use of External Ambulatory Pumps in Hospitals

ISMP is interested in learning how hospitals are managing patients who present for treatment with a medication, blood product, nutrition, or hydrating solution infusing via an external ambulatory pump. An external ambulatory pump is a portable infusion device typically connected to a needle or catheter under the skin, which is used to administer products continuously over an extended period at home via various parenteral routes of administration. This survey is designed to collect information about three categories of ambulatory infusion pumps: insulin pumps, elastomeric pumps, and IV pumps (nonelastomeric) that deliver drugs such as epoprostenol, analgesics, or chemotherapy. **Pumps that are fully implanted under the skin (e.g., SyncroMed II) are excluded from this survey.** Please complete the survey by **October 30** and submit your responses to ISMP at: www.ismp.org/sc?id=612.

1 Please answer the following questions for each of the three categories of ambulatory pumps in the table, using the answer key below.

Key: Y=Yes S/P=Sometimes or Partly N=No DK=Don't Know NA=Not Applicable

Questions		Insulin Pumps					Elastomeric Pumps					IV Pumps (nonelastomeric)				
		Y	S/P	N	DK	NA	Y	S/P	N	DK	NA	Y	S/P	N	DK	NA
a)	Does your hospital have a policy, procedure, or guidelines regarding the management of patients who present for care with a medication or solution being delivered via an ambulatory pump?															
b)	Is it your policy to halt use of ambulatory pump infusions during the patient's hospitalization after switching to a hospital pump or device, or an alternative treatment (e.g., insulin injections)?															
c)	Do you have a standard process to determine if the patient is an appropriate candidate to manage his or her infusion (per physician's orders) during hospitalization?															
d)	Would suicidal ideation exclude a patient from access to and self-administration of a medication via an ambulatory pump?															
e)	If the patient requires assistance managing the pump, do you require a knowledgeable support person (e.g., family member) or staff member to remain available in the hospital at all times?															
f)	Do you have a process in place to ensure that a wireless ambulatory pump will work in areas of the hospital where the patient may visit before allowing its continued use?															
g)	Before continued use, must the ambulatory pump be inspected by the biomedical engineering department to verify it is functioning properly?															
h)	Do you require the healthcare provider responsible for the patient's ambulatory pump infusion to be contacted upon the patient's arrival for input as needed?															
i)	Do you specify the content required for complete orders for medications or solutions to be delivered via an ambulatory pump (e.g., basal rate, bolus doses, infusion rate, related monitoring)?															
j)	If the patient is a candidate for self-management of the pump, do you require a prescriber with specialized knowledge about the pump, medication being infused, and patient to provide orders for its continuation in consultation with the admitting physician?															
k)	If the patient will be managing the infusion via an ambulatory pump, must he or she sign a patient agreement or consent form specifying the risks and delineating the responsibilities?															
l)	If patients are self-managing their infusions via ambulatory pumps, do you provide them with a flow sheet to document all doses, monitoring results, site changes, rate changes, and other related clinical data?															
m)	If patients are self-managing their infusions via ambulatory pumps, is the device and medications or solutions infusing via the pump on the patient's medication administration record (MAR)?															

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> SURVEY—continued from page 4

Questions		Insulin Pumps					Elastomeric Pumps					IV Pumps				
		Y	S/P	N	DK	NA	Y	S/P	N	DK	NA	Y	S/P	N	DK	NA
n)	If patients are self-managing their infusions via ambulatory pumps, do you require a nurse to document medication/product administration at least daily on the MAR or other comparable record?															
o)	Must the medication or solution being administered via the pump or used to refill the pump be dispensed from, or verified by, the hospital pharmacy?															
p)	If an ambulatory pump requires a refill of the product while the patient is hospitalized, do you have guidelines to follow regarding who can prepare the solution, fill the device, and program it, and how to carry out these processes?															
q)	Are any required refills of ambulatory pumps carried out by clinicians who have specific competencies related to the device and its refill?															
r)	Do all ambulatory pump refills of medications or solutions require an independent double check by another clinician before restarting the pump?															
s)	If the ambulatory pump or medication is investigational, do you specify from where the medication will come if a refill is necessary?															
t)	Do you have an in-house expert who is knowledgeable about most ambulatory pumps, who can be called for consultation when necessary?															
u)	Are clinicians who might encounter ambulatory pumps educated about the pumps seen most often in their respective healthcare settings?															
v)	Does the organization maintain a set of resources about ambulatory pumps being used in the community that clinicians can easily access?															
w)	Do you require anesthesia to evaluate patients prior to surgical procedures requiring general anesthesia to determine the appropriateness of continuing the therapy infusing via an ambulatory pump during the procedure?															
x)	Do you specify how to communicate to other healthcare professionals that the patient is receiving medications or solutions via an ambulatory pump?															
y)	Do you specify how ambulatory pumps will be managed to avoid exposure to ionizing radiation or magnetic fields during a radiology procedure?															
z)	Do you have a process in place to ensure that clinical staff know how to turn the pump off in case of an emergency?															
aa)	Do you ensure that patients discharged with home infusion therapy understand how to use/monitor the ambulatory pump and medication or solution?															
bb)	Do you provide patients with written information about how to stay safe when discharged with home infusion therapy via an ambulatory pump?[5]															
cc)	Do you specify how to disconnect an ambulatory pump, where to store it, and when to reconnect it if it must be temporarily discontinued or the patient is not a candidate for continued use of the ambulatory pump during hospitalization?															
dd)	Do you specify how to manage patients who have had an ambulatory pump infusing medications or solutions discontinued while hospitalized?															

2 How many times during the past 2 years have you encountered a patient using an ambulatory pump upon admission to the ED or hospital?
☐ Never ☐ 1-5 ☐ 6-10 ☐ More than 10

3 How many times during the past 2 years have you encountered a patient using an ambulatory pump upon admission to the ED or hospital that you had not been trained to manage (e.g., unsure how to fill, program, check remaining content, verify and/or change the site)?
☐ Never ☐ 1-5 ☐ 6-10 ☐ More than 10

4 Are you aware of any errors that have occurred in your facility during the last 2 years involving an ambulatory pump?
☐ No ☐ Yes ☐ If yes, please list the name of the medication or type of solution, and briefly describe the error and the patient's outcome.

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5 Please select the category that best describes your hospital's bed size.
☐ Less than 100 beds ☐ 100-250 beds ☐ 251-400 beds ☐ Greater than 400 beds ☐ Other: Not a hospital

6 Please select the category that best describes your profession.
☐ Physician ☐ Other Prescriber ☐ Pharmacist ☐ Nurse ☐ Diabetes Educator ☐ Infusion Therapy Nurse ☐ Other

7 Please select the category that best describes your position.
☐ Staff ☐ Supervisor ☐ Manager ☐ Director ☐ Administrator ☐ Other