April 9, 2020 ▪ Volume 25 Issue 7

SPECIAL EDITION COVID-19

ISMP An ECRI Affiliate

Acute Care ISMP Medication Safety Alert!®

Educating the Healthcare Community About Safe Medication Practices

Planning for anticipated shortage of smart infusion pumps and dedicated administration sets

With the significant increase in the number of critically ill patients admitted to hospitals due to the coronavirus (COVID-19) pandemic, some organizations are already experiencing unprecedented shortages of smart infusion pumps and dedicated administration sets, while others are still anticipating such shortages. The following information is intended to support organizations that are considering various alternatives, including gravity flow of infusions, and careful allocation of smart infusion pumps for intravenous (IV) drug delivery for the patients most in need. Many of these alternatives might be unfamiliar to current staff, so the availability of just-in-time education and instruction manuals is key to avoid misuse.

Identify medications requiring smart pumps. The first step to smart infusion pump and administration set conservation is for hospitals to develop a list of medications that absolutely require delivery via smart infusion pumps, with an understanding that those not on the list may be administered using alternative means, if necessary, as described below. Medications to include on the list should be identified carefully by considering those on the *ISMP List of High-Alert Medications in Acute Care Settings* (www.ismp.org/node/103), and those on the organization's list of high-alert medications. The list will likely include at least IV infusions of vasopressors, antiarrhythmic agents, opioids, sedation and anesthetic agents, neuromuscular blocking agents, antithrombotics, and insulin. When developing the list of infusions that require administration via a smart infusion pump, also consider patient criteria, such as age, severity of illness, and comorbidities; infusion rate criteria, such as very low infusion rates; and vascular access criteria (e.g., central lines).

Take inventory of all available pumps. In addition to smart infusion pumps used in typical patient care units, some pumps may be located "off the beaten path," both on- and off-site, in settings such as interventional radiology, perioperative areas, ambulatory care/procedural areas, and surgery centers. Don't forget to take inventory of syringe pumps, including those unused in anesthesia supplies due to postponement of elective procedures. Syringe pumps might be used to administer small volume medications; however, clinical staff may require training if unfamiliar with syringe pumps, some of

continued on page 2 — Shortage of smart pumps >

Patient taking hydroxychloroquine right after discontinuing azithromycin develops QTc prolongation and cardiac arrest

Problem: A 70-year-old woman with a history of non-Hodgkin lymphoma, chronic obstructive pulmonary disease (COPD), adrenal insufficiency, and hypertension was hospitalized with a cough and shortness of breath. She was initially treated for community-acquired pneumonia with oral azithromycin, 500 mg on day 1, followed by 250 mg daily for 4 days, along with cef**TRIAX**one 1 g intravenous (IV) every 24 hours. She was tested for COVID-19 and confirmed to be positive. One day after azithromycin and cef**TRIAX**one were discontinued, the patient was started on oral hydroxychloroquine 400 mg twice daily on day 1, followed by 400 mg daily for 4 days.

continued on bottom of page 3— QTc prolongation >

HEALTHCARE WORKERS ARE OUR HEROES

Our hearts, thoughts, and prayers continue to go out to the courageous healthcare workers who are selflessly serving on the frontlines of the COVID-19 public health emergency, risking their own safety in the service of others. We are truly grateful for your unyielding compassion for patients and their families, and for the power and grace you display daily despite coping with unspeakable tragedies and unimaginable exhaustion in this battle against COVID-19. **From all of us at ISMP, we sincerely thank every one of you for all that you do.**

"You treat a disease, you win, you lose. You treat a person, I guarantee you, you'll win, no matter what the outcome."
Patch Adams

COVID-19 *Collaboration*

Suspending independent double checks

A need to conserve personal protective equipment (PPE) has led to consideration of suspending or modifying independent double checks at the bedside prior to administration of high-alert medications to COVID-19 positive or presumptive positive patients. Abandoning independent double checks and making sweeping changes to the requirements to document the check in electronic health records (EHRs) compromises patient safety and can lead to unsafe practice habits in the future. Most organizations contributing to dialogue about this challenge are not abandoning all independent double checks but are establishing ways to conduct critical parts of independent double checks without entering a patient's room. Thus, the hard stop in EHRs requiring dual documentation of verification before proceeding now reflects only the components of the check that can be accomplished outside the patient's room. In a

continued on page 2 — *Collaboration* >

> Shortage of smart pumps — continued from page 1

which require the use of validated syringes and volumes, as well as specific processes for priming administration sets. Some facilities may still have older, general purpose pumps without a drug library, particularly in outpatient locations, that may be considered for use. If it is necessary to obtain additional pumps, it is best to buy or rent the same models currently used; however, pumps from other manufacturers might need to be considered, along with plans to limit the locations where the different pumps are used. Biomedical staff should be consulted if introducing pumps that are not already in mainstream use (e.g., for calibration prior to use), and instruction manuals should be available for all pumps in use on a shared online site for easy access by staff.

IV to oral (or IM) conversion. Organizations should switch patients from IV to oral therapies as soon as possible. This should be considered for all appropriate patients who can swallow and meet other facility-defined criteria (e.g., no fever), including patients in the emergency department (ED) and long-term care facilities associated with the health system. If oral administration is not possible, another option might be intramuscular (IM) injections instead of IV administration for certain medications.

Use IV push instead of infusions. Administering medications via IV push instead of as a secondary infusion should also be considered when appropriate. Hospital-specific IV push guidelines, along with the *ISMP Safe Practice Guidelines for Adult IV Push Medications* (www.ismp.org/node/97), should be consulted before considering this alternative. To support IV push administration, prefilled and/or ready-to-administer syringes of medications should be dispensed whenever possible; nurses should dilute the syringe contents only when necessary according to hospital policy or the product labeling. Also, it would be helpful for pharmacy staff to indicate how fast to administer the drug (e.g., "give over 3 minutes") on the pharmacy label (if space permits) and on the medication administration record (MAR). Those administering IV push medications should also be cautioned about inadvertent bolus injections when flushing the line, particularly with extension sets or when the port closest to the patient cannot be used for IV push administration. The timing of actual medication administration to the patient must be considered when administering IV push medications through extension sets.

Administration set change policy. Another item that should be reviewed is the hospital's current administration set change policy. The Infusion Nurses Society (INS) *Frequently Asked Questions Related to COVID-19 Health Care Challenges* notes that, primary and secondary administration sets used for continuous infusions (other than lipids, blood, or blood products) should be changed no more frequently than every 96 hours (www.ismp.org/ext/405). According to the Centers for Disease Control and Prevention (CDC), this may be extended, as long as the administration set is changed at least every 7 days (www.ismp.org/ext/406). However, tubing used to administer propofol infusions should be replaced every 6 or 12 hours, when the vial is changed, per the manufacturer's recommendation. Extension sets are "add-on devices," so precautions must be taken to limit the potential for contamination and misconnection.

Potential role for gravity infusions. Readers may recall a time when IV medications and solutions were administered by gravity infusion. With an anticipated infusion pump shortage, it is now time to again consider gravity administration of certain infusions. Examples may include IV hydration, some IV antibiotics, medications that are not high-alert, and others that might be appropriate for gravity infusion upon assessment during the ordering and dispensing process. To gauge the rate of flow in mL/hour for gravity infusions, it is necessary to know how many drops per mL the administration set delivers (e.g., 10, 15, 20, 60 drops per mL). The number of drops delivered is controlled by the roller clamp (gravity flow control clamp). In last week's newsletter (www.ismp.org/node/15321), a **Table** from B. Braun was included to help nurses count the number of drops of fluid needed for the required flow rate (mL/hour) using sets delivering varying drops per mL. This same **Table** is included on **page 5**.

continued on page 3 — Shortage of smart pumps >

COVID-19 *Collaboration* cont'd from pg 1

hospital where infusion pumps remain in the patient's room, the nurse who enters the room takes a picture of the pump screen using a mobile phone device left in the room, and sends the picture to a nurse outside the room via a secure messaging system. This allows most components of the independent double check to occur.

Independent double checks should be used judiciously for only the most vulnerable high-alert medications—not for all high-alert medications (www.ismp.org/node/12490). ISMP recommends first evaluating your requirements for independent double checks to see if you can narrow their use to just a few of the most vulnerable high-alert medications. Fewer independent double checks strategically placed at the most vulnerable points of the medication use process will be more effective than an overabundance of independent double checks. For example, one hospital reported that independent double checks for subcutaneous insulin have been suspended for all except U-500 insulin, and the dual signoff in the EHR for subcutaneous insulin has been disabled. For any independent double checks suspended during the pandemic, ensure you are also using other higher leverage strategies (e.g., use of barriers, computer alerts with hard stops, standardization, barcode scanning) to prevent or detect errors.

Keep in mind that video conferencing technologies may allow independent double checks to be conducted virtually, particularly in the pharmacy. For example, a pharmacist verifying orders at home and a pharmacist working at the hospital may be able to provide independent double checks for each other. Video conferencing or the use of digital images in intravenous (IV) workflow systems may also be useful for pharmacy technicians during sterile production. If this technology reduces the number of people in the cleanroom, it will also reduce the need for PPE. Before initiating video conferencing, check with information technology staff to see if your organization requires a secure system for such activities.

Capturing COVID-19 adverse events

One health system shared that it has added a question to its online event reporting system, "Is this event related to COVID-19 (coro-

continued on page 3 — *Collaboration* >

> Shortage of smart pumps — continued from page 2

Tubing with integrated dial-calibrated IV flow rate regulators (e.g., **RATE FLOW** regulator, **DIAL-A-FLOW**) can be used to regulate the flow rate instead of the roller clamp. Add-on regulators are also available (www.ismp.org/ext/407). Although these devices make it easier to set the flow rate by dialing the mL/hour, they are only marginally more accurate, providing just an estimate of the flow rate based on compression of the tubing. Even when these flow regulators are used, staff still need to count the number of drops and adjust the flow rate as necessary.

A time tape should be affixed along the vertical edge of the infusion bag (**page 5**) to assist in visual checking of the total volume infused at a given time. Practitioners should be reminded that gravity flow rates may be influenced by a number of factors, including the bag height, type of IV access, position of the patient's arm, and length of the tubing.

Subcutaneous infusions. Subcutaneous gravity infusions may be an option for parenteral delivery of medications and solutions for some patients. This is mainly appropriate for hydration in locations such as the ED, urgent care, long-term care, and other non-acute care settings where patients do not require rapid fluid administration in large amounts. Subcutaneous infusions may be considered for certain drug infusions, such as potassium chloride replacement administered in hydration fluids. Up to 3,000 mL per day (1 mL per minute via two administration sites) has been given using this technique, also known as hypodermoclysis (Humphrey P. Hypodermoclysis: an alternative to i.v. infusion therapy. *Nursing 2011*. 2011;41[11]:16-7; www.ismp.org/ext/408).The upper arms, chest, abdomen, and thighs have been used as sites. Hyaluronidase can be used in conjunction with this method, given locally or via a Y-connector, to increase the rate of absorption from subcutaneous tissue. Subcutaneous infusions are contraindicated in patients at increased risk of pulmonary congestion or edema, and in patients with clotting disorders.

Other alternatives. Other alternative types of infusion devices should be considered during infusion pump shortages, such as volumetric burette tubing (e.g., **BURETROL**, **SOLUSET**), elastomeric devices, and other non-electronic rate controllers.

ISMP greatly appreciates the support of Shawn O'Connell, RN, MS, Director, Medical Affairs, from the B. Braun Corporation, for outlining and assisting in the development of this article.

> QTc prolongation— continued from page 1

In our March 26, 2020, Special Edition newsletter (www.ismp.org/node/14917), we warned about the risk of QTc prolongation and ventricular arrhythmias in patients who take hydroxychloroquine (or chloroquine) and azithromycin together. At that time, we noted that electrocardiogram (ECG) monitoring was imperative.

On admission to the hospital, this patient's ECG showed a QTcB interval (a heart rate-corrected QT interval using Bazett's formula) of 460 milliseconds (ms). A prolonged QTc increases the risk of developing ventricular arrhythmias, including torsades de pointes and fatal ventricular fibrillation. A borderline QTc for women is between 451-470 ms, and an abnormally long QTc is above 470 ms. The day oral hydroxychloroquine was started, the patient's ECG showed a QTcB of 490 ms.Three days later, the patient's QTcB was 515 ms. On the fifth and last day of taking hydroxychloroquine, the patient experienced ventricular fibrillation and coded. After two cycles of cardiopulmonary resuscitation, a return of spontaneous circulation was achieved. An ECG performed afterwards showed a QTcB of 605 ms, and all QTc-prolonging medications (www.ismp.org/ext/428) were discontinued. Initially, the patient was not responding neurologically. However, after undergoing targeted temperature management (therapeutic hypothermia) post-arrest, the patient now appears to be responding and is expected to recover with good neurological function.

continued on page 4 — QTc prolongation >

COVID-19 Collaboration cont'd from pg 2

navirus)?" to help centralize these events, allow rapid analysis of quickly emerging risks, and reduce leadership's reaction time with knowing about and addressing these issues. A weekly summary is being provided to the leadership command center. Several Patient Safety Organizations (PSOs) have also noted that their reporting systems include a mechanism to indicate if an incident is related to COVID-19. Although the number of reported COVID-19 events to PSOs is low, most are associated with communication breakdowns, largely in emergency departments and during transitions of care, or pressure injuries from positioning COVID-19 patients in the prone position.

Flagging adverse events associated with COVID-19 also makes it easier to pass on relevant information, in confidence, to ISMP and the US Food and Drug Administration (FDA). **Please remember to report COVID-19-related challenges, ideas, and preventable adverse events to ISMP** via email (ismpinfo@ismp.org), phone (215-947-7797), or online at: www.ismp.org/MERP, so we can share these risks and strategies in our newsletters as well as with FDA.

Code team and carts

When a patient has a cardio-respiratory arrest, the typical scenario is to bring the entire code team and code cart to the patient's bedside. However, to minimize practitioner exposure to COVID-19, conserve PPE, and reduce the risk of code cart surface contamination, code carts and some code team members, including pharmacists, are now remaining outside the room when a presumptive or confirmed COVID-19 patient suffers a cardio-respiratory arrest. One hospital reported that pharmacists pass medications from the code cart into the patient's room as needed. Several other hospitals created a "grab bag" or "starter kit" to bring into the room with enough medications (e.g., **EPINEPH**rine, calcium chloride, sodium bicarbonate, 10% dextrose and water, prefilled saline flush solutions) and equipment to begin resuscitation. Some practitioners reported that a mobile work phone, typically left in COVID-19 isolation rooms for communication, is used during codes to communicate with code team members (e.g., pharmacists) who remain outside the patient's room. "Grab bags" and "starter kits" used for suspected or con-

continued on page 4 — Collaboration >

The ISMP ActionAgenda for the **first quarter of 2020** is postponed and will be *published* with the **April 23, 2020**, newsletter.

> QTc prolongation — continued from page 3

The hospital determined that the patient suffered ventricular fibrillation and cardiac arrest due to QTc prolongation from the combination of hydroxychloroquine and azithromycin. Even though the patient did not receive azithromycin and hydroxychloroquine concomitantly, given the long half-life of azithromycin (68 to 72 hours in adults), it was suspected that azithromycin was still at or near a therapeutic concentration when the patient started receiving hydroxychloroquine.

Safe Practice Recommendations: This adverse event reinforces our recent newsletter reminder for ECG monitoring of all patients who receive these medications in combination (or close together). The hospital where this event occurred now requires monitoring of all patients taking these medications via continuous telemetry and a daily 12-lead ECG at baseline and while therapy continues. The hospital also noted that the event clearly showed the need to act on increasingly prolonged QTc intervals. In fact, hospitals should consider whether azithromycin and hydroxychloroquine should be administered, either separately or concurrently, to patients with a baseline QTc elevated above 450 ms (men) or 470 ms (women), as both drugs (also chloroquine) may prolong the QT interval.

Keep in mind that azithromycin has a half-life up to 72 hours, hydroxychloroquine up to 40 days, and chloroquine up to 5 days. So, discontinuing one drug and starting another too soon may result in a similar adverse event. Also, remember that elderly patients with other serious underlying conditions, who are already vulnerable to complications from COVID-19, may be at higher risk for cardiac and hepatic side effects from these agents.

Worth visiting...

IBM Micromedex and DynaMed COVID-19 Resource Catalog (www.ismp.org/ext/389)

IBM Micromedex and DynaMed are providing FREE public access to their referential database for medication information as well as their peer reviewed clinical content, including systematic literature reviews in 28 specialties for comprehensive disease topics, health conditions, and abnormal findings. Users will be able to access drug monographs, drug consults, disease monographs, and patient education materials.

National Institutes of Health (NIH) (www.ismp.org/ext/423)

Get the latest information about research underway to study and address the COVID-19 viral threat, including more than 300 clinical trials studying symptoms, testing, possible vaccines, and possible treatments (e.g., remdesivir, chloroquine, hydroxychloroquine).

The Society of Infectious Diseases Pharmacists (SIDP) (www.ismp.org/ext/398)

SIDP has developed a series of YouTube videos on medications considered for treating patients with COVID-19, including remdesivir; chloroquine and hydroxychloroquine; lopinavir and ritonavir; ribavirin; tocilizumab; and angiotensin-converting enzyme inhibitors (ACEIs), angiotensin II receptor blockers (ARBs), and nonsteroidal anti-inflammatory drugs (NSAIDs).

National Association of Boards of Pharmacy (NABP)—NABP Passport (www.ismp.org/ext/425)

NABP Passport is a temporary authorization that facilitates pharmacists and pharmacy technicians practicing in another state. The program, developed in response to COVID-19, allows states to efficiently grant temporary or emergency licensure. License verifications for NABP Passport are conducted at no cost to the applicant or the boards of pharmacy. NABP monitors emergency declarations and updates the status of each COVID-19 authorization accordingly. To date, 18 states recognize NABP Passport.

COVID-19 *Collaboration* cont'd from pg 3

firmed COVID-19 patients are then cleaned according to facility-established guidelines.

Remember that masks and other PPE often make communication more difficult. During all codes, always use repeat back to confirm all drug and dose choices.

Announcements

Healthcare worker memorial

As frontline healthcare workers care for patients with COVID-19, they commit themselves to difficult, draining work, and put themselves at risk of infection. Tragically, hundreds of healthcare workers throughout the world have died. *Medscape*, an online global destination for medical news and expert perspectives, has started a list of our fallen colleagues (www.ismp.org/ext/403) to make sure they are not forgotten. The publication is asking for help in, sadly, updating the list as needed. Please submit the names of healthcare workers who have died after contracting COVID-19 by visiting: www.ismp.org/ext/404.

FREE access to IHI Open School courses

The Institute for Healthcare Improvement (IHI) is providing FREE access through May 31 to numerous Open School courses associated with improvement capability, patient safety, leadership and teamwork, person- and family-centered care, and the design of educational experiences (educator's toolkit). These modules also offer a total of 9.75 continuing education credits. For details, visit: www.ismp.org/ext/409.

To subscribe: www.ismp.org/node/10

ISMP Medication *Safety Alert!* Acute Care (ISSN 1550-6312)

Report medication and vaccine errors to ISMP: Call 1-800-FAIL-SAF(E), or visit: www.ismp.org/MERP or www.ismp.org/VERP. ISMP guarantees the confidentiality of information received and respects the reporters' wishes regarding the level of detail included in publications.

B BRAUN
SHARING EXPERTISE

GRAVITY FLOW RATE DRIP CHART

Flow Rate (mL/hr)	**10** drops =1 mL (drops/min)	**15** drops =1 mL (drops/min)	**20** drops =1 mL (drops/min)	**60** drops =1 mL (drops/min)
10	2	2	3	10
25	4	6	8	25
50	8	12	17	50
75	12	19	25	75
100	17	25	33	100
125	21	31	42	125
150	25	37	50	150
200	33	50	67	200
250	42	62	83	250
500	83	125	167	500
1,000	167	250	333	1,000

- Confirm tubing set drip rate on set package, i.e., 10, 15, 20, or 60 drops/mL
- Recommended that all gravity infusion bags be time taped for additional flow confirmation
- Alterations of bag height distance to patient will affect flow rate