Standard Operating Procedure	Flushing Medications	CHPS SOP

INTRODUCTION:

Nurses at the Center for Human Phenomic Science (CHPS) regularly administer infusions of investigational products (IP) and non-investigational products. Infusions can be administered intravenously or subcutaneously, although the vast majority are intravenous (IV). Medications administered by infusion will collectively be referred to as "drugs" for the remainder of the SOP. A flush is typically administered to ensure the full volume of the drug is infused. The timepoints associated with administration of drug are recorded on the Medication Administration Record (MAR) in the Electronic Medical Record (EMR).

PURPOSE:

To outline the procedure for flushing investigational and non-investigational products given by CHPS staff or on a CHPS unit and documentation on the MAR of these products. Research protocols vary in their flushing instructions, are silent on the topic, or may be unclear in their language. Standardization of these practices increases accuracy of timepoints which are critical in the research setting. A standard flushing practice is also recommended by the Infusion Nursing Society (Nickel et al., 2024).

SCOPE: CHPS RNs and Clinical Study Teams (CSTs)

DEFINITIONS:

1. **Flush** refers to administering a compatible diluent through the length of the IV tubing to ensure the full volume of a drug is received by the patient. For the purposes of this document, flush does not refer to the practice of instilling solution in the pigtail of an IV catheter to ensure that blood does not backflow into the line (this is sometimes referred to as "locking" the IV). CHPS RNs do lock IV catheters following drug administration as part of their standard practice, but this is not the topic under discussion.

2. **Primed with Drug** refers to running the medication in the bag through the attached IV tubing so that both the bag and the IV tubing are filled with the investigational or non-investigational product prior to attaching the IV tubing to the patient.

3. The above contrasts with **Primed with Diluent** which is when the bag has the IP or non-investigational product in it, but the IV tubing does not. Instead, the IV tubing is filled with a diluent that is compatible with the IP or non-investigational product. Common examples of diluent include normal saline solution (NSS) or dextrose 5% water (D5W). Note: Hazardous drugs prepared in bags are primed with diluent.

4. **Hyper-priming** refers to the practice of programming an infusion pump faster than the ordered rate to push diluent through the tubing and arrive at the true start of the drug. In our department, hyper-priming is done by programming the pump for 999ml/hour and a Volume To Be Infused (VTBI) of an amount less

than the tubing volume, namely 15mL if there is no filter on the tubing, and 18mL if there is a filter on the tubing. 15mL and 18mL are used as conservative estimates for when to calculate the IP or non-investigational product has reached the patient.

PROCEDURE:

1. IV Infusions
    a. IV Medication Prepared in **Bags**
        i. Tubing **Primed with Drug**:
            1. Procedure
                a. Dual medication check will be performed per institutional policy.
                b. CHPS RNs will program the infusion pump for the rate ordered and a Volume To Be Infused (VTBI) of 30mL less than the total volume stated on the bag of drug (ex. if the total volume of drug is 100mL, the VTBI will be programmed at 70mL). This process is called "undercutting". The rate is calculated based off the total volume listed on the bag label. **The rate is not based on the undercut volume.**
                c. When the infusion pump alarms that the programmed volume has been infused, the drug bag should be empty, and the drip chamber should be 1/3 to ½ full. If this is not the case, re-program the pump until the drug bag is empty and the drip chamber is 1/3 to ½ full.
                d. Remove the drug bag from the tubing and connect a bag of a compatible diluent solution. Re-program the pump for an additional 30mL to be infused at the same rate as the drug. This is considered the flush.
                e. When the infusion pump alarms that the programmed volume of the flush has been infused, this signifies that the entire drug has been infused and marks the End of Infusion (EOI).
            2. Documentation in the EMR
                a. For tubing primed with drug, the Start of Infusion (SOI) is the time when the "Start" button on the infusion pump is pressed.
                b. At the time that the compatible diluent solution bag is connected to the tubing, the diluent order will be marked as "Given" on the MAR.
                c. At the time that the 30mL flush is completed, it is considered the End of Infusion. The RN will document "Infusion Complete" on the MAR.

d. Screenshot is included below for clarity. The screenshot demonstrates that the flush will be marked as "Given" prior to the "Infusion Complete" timestamp. In the example below, the compatible diluent solution bag is connected to the tubing at 1250. The 30 mL line flush is complete at 1300.

ii. Tubing **Primed with Diluent**:

1. Procedure

a. Dual medication check will be performed per institutional policy.

b. **As part of the dual medication check, two CHPS RNs will independently verify that the line is primed with diluent** (as opposed to drug) by reading the drug label on the bag. Once this fact has been confirmed by both RNs, move to step #c.

i. **If the line is primed with drug, do NOT hyper-prime the line.** Contact pharmacy if this is out of line with what is expected. Otherwise, see section above on "Tubing Primed with Drug".

c. CHPS RNs will hyper-prime by programming the infusion pump for 999ml/hour and a VTBI of 15mL if there is no filter on the tubing, or 18mL if there is a filter. Both RNs will wait in room until hyper-priming is completed.

d. When the infusion pump alarms that the programmed volume has been administered, clear the Volume Infused (VI) and reprogram the pump for a VTBI that is equal to the total volume stated on the drug bag minus 30mL (total volume of drug – 30mL). This process is called "undercutting". The rate is calculated based off the total volume listed on the bag label. **Rate is not based on the undercut volume.** This is considered the Start of Infusion. CHPS RNs will mark this time on the MAR as "Infusion Start".

e. This time, when the infusion pump alarms that the programmed volume has been infused, the drug bag should be empty, and the drip chamber should be 1/3 to ½ full. If this is not the case, re-program the pump until the drug bag is empty and the drip chamber is 1/3 to ½ full.

f. Insert 30mL of a compatible diluent into the tubing administration set while maintaining the closed system. This may be done by injecting three pre-filled 10mL flush syringes into a side port with closed system transfer device (CSTD) adaptors. Re-program the pump for an additional 30mL to be infused at the same rate as the drug. This is considered the flush.

g. When the infusion pump alarms that the programmed volume has been infused, this signifies that the entire drug has been infused and marks the End of Infusion (EOI).

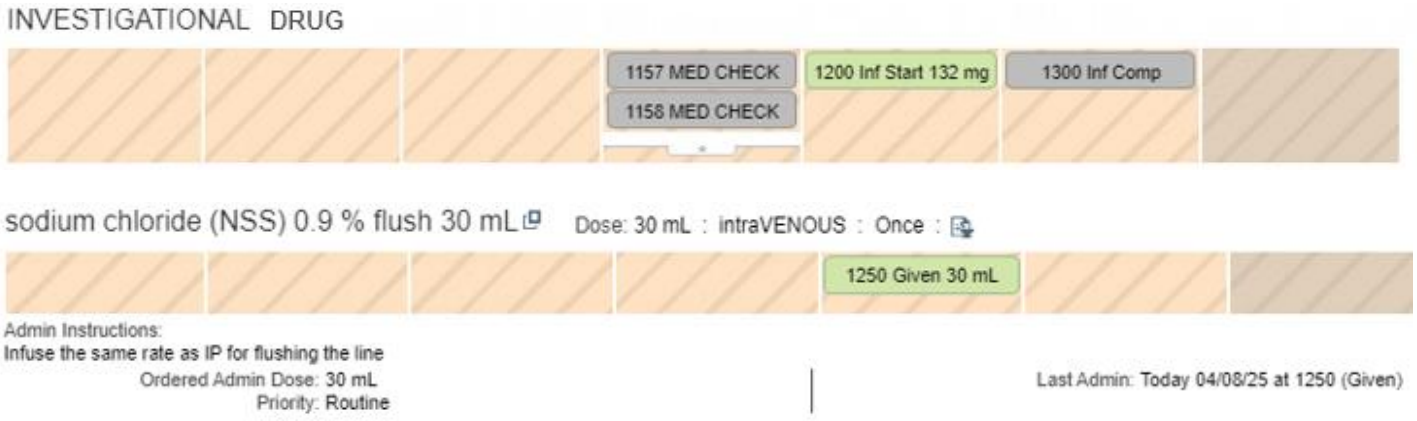
2. Documentation in the EMR

a. For tubing primed with diluent, the Start of Infusion (SOI) occurs after the hyper-priming is complete and after the pump has been re-programmed for the ordered rate. The SOI is when the "Start" button is pressed with the rate ordered in the MAR.

b. At the time that the compatible diluent solution bag is connected to the tubing and pump restarted, the diluent order will be marked as "Given" on the MAR.

c. At the time that the 30mL flush is completed, it is considered the End of Infusion. The RN will document "Infusion Complete" on the MAR.

d. Screenshot is included below for clarity. The screenshot demonstrates that the flush will be marked as "Given" prior to the "Infusion Complete" timestamp. In the example below, the compatible diluent solution bag is connected to the tubing at 1250. The 30 mL line flush is complete at 1300.



b. IV Medication Prepared in **Syringes**

i. IV medications prepared in syringes are evaluated on a case-by-case basis.

ii. Variations in how the drug is prepared and subsequently administered take the following into consideration:

1. Hazardous versus non-hazardous drugs

2. Line primed with drug versus diluent

3. Exact volume prepared versus overfilled to remove the need for a flush

a. *If* the syringe is overfilled to prime the line with drug, no flush is administered as this would lead to over-dosing. **The CST must clearly state in the MAR order and on the CHPS Nursing Worksheet that the syringe is overfilled and therefore no flush is permitted to be administered.**

4. Closed-system transfer devices

2. Subcutaneous (SQ) Infusions

a. SQ infusions are evaluated on a case-by-case basis. Generally, SQ infusions are not flushed.

3. Exceptions

a. Exceptions to this SOP must be approved by CHPS Leadership. Please email the CHPS Nurse Manager and/or Clinical Practice Lead to discuss the circumstances related to the request. Decisions are made on a case-by-case basis.

RATIONALE BY TOPIC:

1. IV Infusions

a. IV Medications Prepared in Bags

i. Flush amount

1. A standard 30mL flush is administered for a few reasons:

a. A flush ensures the full volume of drug has been administered.

b. A 30mL flush is the most common volume that research protocols request.

c. Typical IV infusion tubing with or without a filter ranges from 25-27mL. A 30mL flush covers the volume in all types of tubing utilized.

ii. Defining the End of Infusion (EOI)

1. The EOI is defined as the end of the flush because the patient continues to receive drug during the flushing time. If the flush was not included in the drug administration time, this would lead to misleading timepoints (ex. an EOI pharmacokinetic (PK) blood sample could be collected while the patient is actively receiving drug.)

2. Additionally, drugs are commonly prepared by injecting medication into pre-packaged bags of diluent. These bags of diluent can have **overfill** of up to 10%. Therefore, there is variation is how much volume must be infused into the patient to achieve full dose administration. Defining the EOI as the end of the flush ensures that the EOI marks when drug has been fully delivered, whether or not the bag is overfilled.

iii. Hyper-priming

1. Hyper-priming is required to attain accurate start times for an infusion primed with diluent. It is also required for accurate timing of rate changes during a titration.

    a. Timepoints Calculated from SOI:

        i. Without hyper-priming, an infusion could run for a significant amount of time before the drug reaches the patient, since the patient would be receiving diluent for the first 15-30mL. Research studies often require pre-dose tasks to be performed within a certain amount of time prior to the SOI. Hyper-priming allows for accurate calculation of when to perform these pre-dose tasks in relation to the true SOI, i.e. when the drug begins to infuse into the patient.

        ii. Additionally, some intra-dose or post-dose research tasks are timed from the SOI. Without hyper-priming, the SOI would mark the start of the diluent as opposed to the start of the drug, thereby leading to misleading intra-dose and post- dose timepoints and data collection.

    b. Titrations

        i. Titrations are often time-based such as “increase infusion from 100mL/hour to 200mL/hour *after 30 minutes* if no signs or symptoms of Infusion-Related Reaction are present.” However, without hyper-priming, part of that 30 minutes would be time spent infusing diluent. Therefore, there would be a risk of increasing rates of infusion prematurely which could pose a safety risk. Hyper-priming allows for accurate timing of rate changes during a titration

since it allows the RN to know the true SOI, i.e. when the drug begins to infuse into the patient.

b. IV Medication Prepared in Syringes

i. These are evaluated on a case-by-case basis.

2. SQ Infusions

a. These are evaluated on a case-by-case basis.

REFERENCES:

Nickel, B., Gorski, L., Kleidon, T., Kyes, A., DeVries, M., Keogh, S., Meyer, B., Sarver, M.J., Crickman, R., Ong, J., Clare, S., & Hagle, M.E. (2024). Infusion Therapy Standards of Practice. *Journal of Infusion Nursing, 47* (1S), 126.

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