

Heparin Education Teach Tool

By Nicki Eigenbrodt, PharmD, MBA, BCPS

1. Background:

- a. Heparin is an anticoagulant used for treating venous thromboembolism (DVT/PE), cardiac conditions (acute coronary syndromes/ACS, atrial fibrillation), and ischemic stroke
- b. Current Monitoring:
 - i. PTT is the lab Genesis currently uses to monitor all heparin drips
- c. Change in monitoring:
 - i. Genesis will be moving to using anti-Xa monitoring for most patients on heparin drips (with a few exceptions) as it is the gold standard for heparin monitoring
 - ii. All rate adjustments will now be made in units/kg/hr and pumps will run in units/kg/hr
- d. Why anti-Xa monitoring?
 - i. More direct measurement of therapeutic range
 - ii. Evidence shows this lab gets patients therapeutic more quickly
 - iii. Evidence shows this lab decreases the number of lab draws the patient should require
- e. Will we still use PTTs?
 - i. Patients taking oral factor Xa inhibitors (apixaban, rivaroxaban, edoxaban) cannot be monitored appropriately using the anti-Xa level due to the mechanism of action of these drugs
 1. These drugs are factor Xa inhibitors and falsely elevate the anti-Xa level
 - ii. Instead of using anti-Xa levels in patients who have taken oral factor Xa inhibitors in the last 72 hours, Genesis will continue using PTT monitoring for these patients
 - iii. It is important to select the correct PowerPlan based on the patient's medication history in order to provide the most reliable heparin monitoring and prevent harm
- f. There will now be six PowerPlans based on indication and oral factor Xa inhibitor (apixaban/rivaroxaban/edoxaban) exposure:
 - i. DVT/PE heparin without oral factor Xa inhibitor exposure in the last 72 hours (anti-Xa monitoring)
 - ii. DVT/PE heparin with oral factor Xa inhibitor exposure in the last 72 hours (PTT monitoring)
 - iii. Cardiac indication heparin without oral factor Xa inhibitor exposure in the last 72 hours (anti-Xa monitoring)
 - iv. Cardiac indication heparin with oral factor Xa inhibitor exposure in the last 72 hours (PTT monitoring)
 - v. Ischemic stroke heparin without oral factor Xa inhibitor exposure in the last 72 hours (anti-Xa monitoring)
 - vi. Ischemic stroke heparin with oral factor Xa inhibitor exposure in the last 72 hours (PTT monitoring)

- g. What if we do not know the patient's med history or if they recently had an oral factor Xa inhibitor (apixaban/rivaroxaban/edoxaban) in the last 72 hours?
 - i. First step is to check the external history and previous med recs and if looks like an oral factor Xa inhibitor is on the list, try to find out more information on when last dose was, but if this is not feasible or last dose was in the last 72 hours, choose the appropriate PTT protocol
 - ii. If no fills of apixaban, rivaroxaban, or edoxaban on external history, can likely choose the appropriate anti-Xa protocol unless you have reason to believe patient is on an oral factor Xa inhibitor
 - iii. If start with a PTT protocol and you find out the patient has not had an oral factor Xa inhibitor in the last 72 hours by the time the first PTT returns (so within the first 6 hours), can switch the patient to anti-Xa monitoring, but would not switch back to anti-Xa monitoring if after that first PTT check
- h. Will we switch to anti-Xa monitoring after patient has been off oral factor Xa inhibitor for 72 hours?
 - i. No, once the patient is stable on the PTT protocol, unless it is before the first lab comes back, they will continue on PTT protocol
- i. What if we find out in the first 72 hours since starting an anti-Xa heparin protocol that the patient had an oral factor Xa inhibitor in the last 72 hours?
 - i. We would switch the patient to the PTT protocol for appropriate monitoring
- j. What if we find out after 72 hours of being on the anti-Xa heparin protocol that the patient had an oral factor Xa inhibitor prior to starting the heparin drip?
 - i. At that point, we would continue the anti-Xa heparin protocol since it has been > 72 hours since they had the last oral factor Xa inhibitor dose and it should no longer be affecting the anti-Xa level

2. Procedures:

a. Pharmacists:

- i. Will now need to check recent home meds and recent anticoagulation administration in the hospital when a heparin protocol is being ordered to ensure the patient is on the correct protocol (anti-Xa vs PTT)
- ii. There is NO REASON to choose the PTT protocol **unless** the patient has had an oral factor Xa inhibitor (apixaban/Eliquis, rivaroxaban/Xarelto, edoxaban/Savaysa) in the past 72 hours
 - 1. i.e. if patient has not taken an oral factor Xa inhibitor in the last 72 hours and the DVT/PE protocol using PTT monitoring is ordered, you should call and tell the provider that the anti-Xa protocol should be ordered as it is a more direct measure of heparin anticoagulation
- iii. Continue to verify indication is correct, no drug-drug interactions exist, and check platelets/hemoglobin/hematocrit/INR
- iv. You must now verify an ED heparin drip before it is started
- v. Initial bolus doses and rates will remain the same, but adjustments will be different when patient is on anti-Xa protocol since we are using a different monitoring parameter (see tables in Appendix A).
- vi. Will also be leaving starting rate in units/kg/hr and pumps will run in units/kg/hr (do not need to change to mL/hr)
- vii. If starting rate (in units/kg/hr) after weight is factored in exceeds starting rates in units/hr in each protocol (1800 units/hr for DVT/PE, 1000 units/hr for

cardiac and stroke), will need to adjust units/kg/hr to appropriate rate using weight and max rate (e.g. 130 kg patient on DVT/PE protocol would equate to a starting rate of 2300 units/hr. This is over the max of 1800 units/hr so would need to change the starting rate in the order to 14 units/kg/hr by taking 1800 units/130 kg)

- viii. See page 10-17 for more in depth tutorials on starting rates
- ix. Appendix B contains a table for weight cutoffs and starting rate adjustments based on weight
- x. Do not hesitate to call nursing about patients' recent oral factor Xa inhibitor use or providers regarding questions about appropriate protocol

APPENDIX A: HEPARIN NOMOGRAM**[A.] DVT/PE**

Round doses to the nearest 100 units for boluses and whole number for infusion rates

- INITIAL IV BOLUS= **80 units/kg** (MAXIMUM= 10,000 units)
- BEGIN INFUSION AT **18 units/kg/hr IV** (MAXIMUM initial rate= 1800 units/hr IV)

No oral factor Xa inhibitor administered in last 72 hours:

Anti-Xa Level (IU/mL)	Give 1 Bolus Dose (Max 10,000 units)	Hold Infusion (minutes)	Dose Change (+ Increase) (- Decrease)	Repeat Anti-Xa
< 0.1	20 units/kg	0	+ 2 units/kg/hr	6 hours*
0.1 – 0.29	0	0	+ 1 units/kg/hr	6 hours
GOAL=0.3 – 0.7	0	0	NO CHANGE: Target Range	6 hours**
0.71 – 0.8	0	0	- 1 units/kg/hr	6 hours
0.81 – 0.99	0	0	- 2 units/kg/hr	6 hours
≥ 1	0	60 minutes	- 3 units/kg/hr	6 hours*

* Notify physician if 2 consecutive anti-Xa levels < 0.1 or ≥ 1.1

** If 2 consecutive anti-Xa levels are 0.3 – 0.7, obtain next anti-Xa level 24 hours later or the next AM (as appropriate)

Oral factor Xa inhibitor administered in last 72 hours:

PTT (seconds)	Give 1 Bolus Dose (Max 10,000 units)	Hold Infusion (minutes)	Dose Change (+ Increase) (- Decrease)	Repeat PTT
< 37	80 units/kg	0	+ 3 units/kg/hr	6 hours*
37-41	40 units/kg	0	+ 1 units/kg/hr	6 hours
GOAL = 42-64	0	0	NO CHANGE: Target Range	12 hours x 1 then daily**
65-69	0	0	- 1 units/kg/hr	6 hours
70-80	0	30	- 2 units/kg/hr	6 hours
> 80	0	60	- 3 units/kg/hr	6 hours*

* Notify physician if 2 consecutive PTTs < 37 or > 80

** If 2 consecutive PTTs are at 42-64, obtain next PTT 24 hours later or the next AM (as appropriate)

[B.] Cardiac Indication (e.g., ACS, atrial fibrillation, valvular heart disease)

Round doses to the nearest 100 units for boluses and whole number for infusion rates

- INITIAL IV BOLUS= **60 units/kg** (MAXIMUM= 5000 units)
- BEGIN INFUSION AT **12 units/kg/hr IV** (MAXIMUM initial rate= 1000 units/hr IV)

No oral factor Xa inhibitor administered in last 72 hours:

Anti-Xa Level (IU/mL)	Give 1 Bolus Dose	Hold Infusion (minutes)	Dose Change (+ Increase) (- Decrease)	Repeat Anti-Xa
< 0.1	20 units/kg	0	+ 2 units/kg/hr	6 hours*
0.1 – 0.29	0	0	+ 1 units/kg/hr	6 hours
GOAL=0.3 – 0.7	0	0	NO CHANGE: Target Range	6 hours**
0.71 – 0.8	0	0	- 1 units/kg/hr	6 hours
0.81 – 0.99	0	0	- 2 units/kg/hr	6 hours
≥ 1	0	60 minutes	- 3 units/kg/hr	6 hours*

* Notify physician if 2 consecutive anti-Xa levels < 0.1 or ≥ 1.1

** If 2 consecutive anti-Xa levels are 0.3 – 0.7, obtain next anti-Xa level 24 hours later or the next AM (as appropriate)

Oral factor Xa inhibitor administered in last 72 hours:

PTT (seconds)	Give 1 Bolus Dose (Max 5000 units)	Hold Infusion (minutes)	Dose Change (+ Increase) (- Decrease)	Repeat PTT
< 37	60 units/kg	0	+ 3 units/kg/hr	6 hours*
37-41	30 units/kg	0	+ 1 units/kg/hr	6 hours
GOAL = 42-58	0	0	NO CHANGE: Target Range	12 hours x 1 then daily**
59-69	0	0	- 1 units/kg/hr	6 hours
> 69	0	60	- 2 units/kg/hr	6 hours

* Notify physician if 2 consecutive PTTs < 37 or > 69

** If 2 consecutive PTTs are at 42-58, obtain next PTT 24 hours later or the next AM (as appropriate)

[C.] Ischemic Stroke

Round doses to the nearest whole number for infusion rates

- **NO BOLUSES**
- BEGIN INFUSION AT **12 units/kg/hr IV** (MAXIMUM initial rate= 1000 units/hr IV)

No oral factor Xa inhibitor administered in last 72 hours:

Anti-Xa Level (IU/mL)	Hold Infusion (minutes)	Dose Change (+ Increase) (- Decrease)	Repeat Anti-Xa
< 0.1	0	+ 2 units/kg/hr	6 hours*
0.1 – 0.29	0	+ 1 units/kg/hr	6 hours
GOAL=0.3 – 0.5	0	NO CHANGE: Target Range	6 hours**
0.51 – 0.6	0	- 1 units/kg/hr	6 hours
0.61 – 0.8	30	- 2 units/kg/hr	6 hours
≥ 0.81	60 minutes	- 3 units/kg/hr	6 hours*

* Notify physician if 2 consecutive anti-Xa levels < 0.1 or ≥ 0.81

** If 2 consecutive anti-Xa levels are 0.3 – 0.5, obtain next anti-Xa level 24 hours later or the next AM (as appropriate)

Oral factor Xa inhibitor administered in last 72 hours:

PTT (seconds)	Hold Infusion (minutes)	Dose Change (+ Increase) (- Decrease)	Repeat PTT
< 37	0	+ 3 units/kg/hr	6 hours*
37-41	0	+ 1 units/kg/hr	6 hours
GOAL = 42-58	0	NO CHANGE: Target Range	12 hours x 1 then daily**
59-69	0	- 1 units/kg/hr	6 hours
> 69	60	- 2 units/kg/hr	6 hours

* Notify physician if 2 consecutive PTTs < 37 or > 69

** If 2 consecutive PTTs are at 42-58, obtain next PTT 24 hours later or the next AM (as appropriate)

General Questions:

1. SR is a 72 yoF admitted with afib. She takes Xarelto at home and her last dose was last night. The hospitalist would like to start her on heparin for her afib. She is 72 kg.
 - a. Which protocol should the doctor choose?
 - a. DVT/PE protocol with recent oral factor Xa inhibitor use
 - b. Cardiac protocol with recent oral factor Xa inhibitor use
 - c. Cardiac protocol without recent oral factor Xa inhibitor use
 - d. Ischemic stroke protocol with recent oral factor Xa inhibitor use
 - b. Which lab will we need to use to monitor this patient's heparin?
 - a. Anti-Xa levels
 - b. aPTT
 - c. INR
 - c. What starting rate of heparin would this patient need in units/kg/hr?
 - a. 12 units/kg/hr
 - b. 18 units/kg/hr
 - c. 10 units/kg/hr
 - d. The patient's first PTT comes back at 72 and her anti-Xa is 0.8. How would you adjust?
 - a. Hold infusion for 60 minutes and decrease rate by 2 units/kg/hr to 10 units/kg/hr
 - b. Hold infusion for 30 minutes and decrease rate by 2 units/kg/hr to 10 units/kg/hr
 - c. Hold infusion for 60 minutes and decrease rate by 3 units/kg/hr to 7 units/kg/hr
 - d. Do not hold infusion, but decrease rate by 2 units/kg/hr to 8 units/kg/hr
2. PB is a 54 yoM admitted with COVID-19. His D dimer is elevated to 10.91. A CT is done to rule out PE. The CT comes back positive for PE so the hospitalist would like to start the patient on a heparin drip. The patient has not been to a doctor in 20 years and does not take any home medications. He is 108 kg.
 - a. Which protocol should the doctor order?
 - a. DVT/PE protocol without recent oral factor Xa inhibitor use
 - b. DVT/PE protocol with recent oral factor Xa inhibitor use
 - c. Cardiac protocol without recent oral factor Xa inhibitor use
 - d. Ischemic stroke protocol without recent oral factor Xa inhibitor use
 - b. What heparin bolus would you give this patient?
 - a. 5,000 units
 - b. 6,500 units
 - c. 8,600 units
 - d. 10,000 units
 - c. Which lab will we need to use to monitor this patient's heparin?
 - a. Anti-Xa levels
 - b. aPTT
 - c. INR
 - d. What starting rate of heparin would this patient need in units/kg/hr (assuming max starting rate is 1800 units/hr)?
 - a. 19 units/kg/hr

- b. 18 units/kg/hr
 - c. 13 units/kg/hr
 - d. 17 units/kg/hr
- e. The patient's first PTT comes back at 40 and his anti-Xa is 0.6. How would you adjust?
- a. Leave infusion at the same rate and check a PTT in 6 hours
 - b. Leave infusion at the same rate and check an anti-Xa in 6 hours
 - c. Give 40 unit/kg bolus and increase rate to 18 units/kg/hr

Answers:

1a: b (She recently took Xarelto, making her qualify for the cardiac protocol with recent oral factor Xa inhibitor use)

1b: b (Patient is on the PTT protocol due to recently taking an oral factor Xa inhibitor-Xarelto-so we would need to monitor with PTTs in order to appropriately titrate)

1c: a (12 units/kg/hr is the starting rate for the cardiac protocol. Her weight does not cause her starting rate to exceed the max starting rate of 1000 units/hr)

1d: a (You would need to use the PTT since she is on the PTT protocol due to recent oral factor Xa inhibitor use. You would follow the table for cardiac indication with recent oral factor Xa inhibitor use and see that her PTT qualifies the drip to be held for 60 minutes and the rate then decreased by 2 units/kg/hr from 12 units/kg/hr to 10 units/kg/hr)

2a: a (DVT/PE protocol without recent oral factor Xa inhibitor use as the patient has a new PE and does not take any home medications)

2b: c (use the starting bolus dose for DVT/PE protocol of 80 units/kg. This is 8640 units and round to the nearest hundred. Max bolus is 10,000 units for this protocol, but he does not hit that number)







2c: a (Patient can be monitored with the gold standard, anti-Xa levels, since he does not take an oral factor Xa inhibitor like apixaban or rivaroxaban at home that would sway anti-Xa levels)

2d: d (Since the patient is 108 kg, his starting rate would calculate to 1944 units/hr which is over the starting max of 1800 units/hr. Therefore we would adjust the starting rate by taking the max rate of 1800 units and dividing it by his weight 108 kg and would get 16.67 which rounds up to 17 units/kg/hr to prevent him from getting over the max rate)

2e: b (You would use his anti-Xa level of 0.6 to adjust since he is on the PE/DVT protocol with no recent oral factor Xa inhibitor use. The level is at goal so no adjustment is needed)

In Depth Review for Pharmacists With PharmNet Screenshots

1. Heparin Anti-Xa level is the gold standard for monitoring heparin
2. There will be the following PowerPlan options for selection in PowerChart:

-  Adult Unfractionated Heparin (Anti-Xa) - Cardiac Indication (ACS, MI, AFib, Valvular H...
-  Adult Unfractionated Heparin (Anti-Xa) - DVT and/ or PE Protocol
-  Adult Unfractionated Heparin (Anti-Xa) - Ischemic Stroke Protocol
-  Adult Unfractionated Heparin (PTT) - DVT and/ or PE Protocol
-  Adult Unfractionated Heparin (PTT) - Ischemic Stroke Protocol
-  Adult Unfractionated Heparin (PTT)- Cardiac Indication (ACS,MI, AFib,Vavular Heart D...

3. The reasoning behind 6 different protocols (3 PTT, 3 Anti-Xa)
 - a. Anti-Xa levels are affected by patients taking oral factor Xa inhibitors (apixaban/rivaroxaban/edoxaban) since they are factor-xa inhibitors
 - b. We cannot use anti-Xa monitoring for patients who have received an oral factor Xa inhibitor in the last 72 hours as it will not be accurate and could cause harm
 - i. Anti-Xa level may be elevated due to oral factor Xa inhibitor, causing us to use decreased rates of heparin even though they are no longer getting full anticoagulant effects from oral factor Xa inhibitor
 - c. For patients who have received an oral factor Xa inhibitor in the last 72 hours, you would choose the PTT protocol with the appropriate indication
 - d. For patients who have not received an oral factor Xa inhibitor in the last 72 hours (EVERYONE NOT ON APIXABAN, RIVAROXABAN, or EDOXABAN), you would choose the anti-Xa protocol with the appropriate indication
 - e. Pharmacy will be responsible for verifying the correct protocol was chosen, both based on indication and monitoring (anti-Xa vs PTT)
 - f. You will need to double check eMAR, fill records, and med rec to ensure patient is not on an oral factor Xa inhibitor
 - g. If you have any questions, ALWAYS reach out to the physician or nurse so he or she can ask the patient or their family about home medications and when they were last taken
4. All units for heparin rates will now stay in units/kg/hr
 - a. Can leave free text rate in units/kg/hr. Do not need to change to mL/hr in rate field like we currently do as everything will now be in units/kg/hr increments
 - i. Pumps
 - ii. Starting rate
 - iii. Rate adjustments
 - b. **HOWEVER YOU MUST PAY ATTENTION TO PATIENTS' WEIGHTS*******
 - i. There is currently no way to max the starting rate through Cerner when it is in units/kg/hr (i.e. 200 kg patient would get starting rate 3600 units/hr with dvt/pe protocol if not adjusted for weight and current max is 1800 units/hr)
 - ii. **PHARMACY IS RESPONSIBLE FOR ADJUSTING THE STARTING RATE IN UNITS/KG/HR TO REFLECT A MAX STARTING RATE OF:**
 1. 1800 units/hr for DVT/PE protocol
 2. 1000 units/hr for cardiac and stroke protocols
 3. SEE TABLE IN APPENDIX B FOR THESE ADJUSTMENTS

- a. Weight cutoffs and adjustments are available in the table so that no calculations are necessary

iii. Examples:

1. Patient A

- a. DVT/PE Protocol starting rate is 18 units/kg/hr
- b. Your patient weighs 80 kg
- c. $18 \text{ units/kg/hr} \times 80 \text{ kg} = 1440 \text{ units/hr}$
- d. 1440 units/hr is below max of 1800 units/hr so would leave free text rate as 18 units/kg/hr
- e. See screenshot below-this is how the order will come through and you will not have to change the free text rate

Vol	Drug	Dose	Normalized Rate	Concentration	Frequency	Ordered As
250	Heparin - 0.45%NaCl (25...	25,000 Units / ...			Every Bag	heparin 2...
Heparin 25,000 units/NaCl 0.45% 250 mL (RTU)						

Total volume mL: 250
Ingredient volume mL: 250

* Route: IV
Weight: (None)
BSA(m2):
Rate: 0 (None)
Duration: (None)
Fretext rate: 18 Units/kg/hr
Next dose date: 01/19/2023 Time: CST 12:48
Infuse over: 0 (None)
Stop date: 02/18/2023 Time: CST 10:07
* Physician: Test MD, Cemer P
* Replace every: 24 hour(s)
* Stop type: Soft Stop

Order comments: DVT and/or PE Indication: Max initial infusion rate = 1,800 units per hour. Follow titration rate tables. Concentration : 100 Units per ml Caution: High Risk - High Alert Med.

Product notes:

2. Patient B

- a. DVT/PE protocol starting rate is 18 units/kg/hr
- b. Your patient weighs 125 kg
- c. $18 \text{ units/kg/hr} \times 125 \text{ kg} = 2250 \text{ units/hr}$
- d. 2250 units/hr is over the max of 1800 units/hr so must change free text rate
- e. Calculation: $\text{Max of } 1800 \text{ units/hr} \div \text{weight} = \text{starting rate}$
- f. $1800 \text{ units/hr} \div 125 \text{ kg} = 14.4 \text{ units/kg/hr}$
- g. See also tables in Appendix B for help with this adjustment
- h. You would change the free text rate to 14 units/kg/hr
- i. You can double check your math by taking the patient's weight $\times 14 \text{ units/kg/hr}$ and that should equal close to 1800 units/hr
 - i. $14 \text{ units/kg/hr} \times 125 \text{ kg} = 1750 \text{ units/hr}$

j. First screenshot below shows how order will come through

The screenshot shows the 'Verify Continuous Order' window. The drug is Heparin - 0.45%NaCl (25,000 Units / 250 mL). The dose is 25,000 Units / 250 mL. The normalized rate is 18 Units/kg/hr. The concentration is 100 Units per ml. The frequency is Every Bag. The ordered as is heparin 2... The route is IV. The rate is 18 Units/kg/hr. The duration is 30 day(s). The start date is 01/19/2023 at 10:08 CST. The stop date is 02/18/2023 at 10:07 CST. The physician is Test MD, Cemer P. The replace every is 24 hour(s). The stop type is Soft Stop. The order comments are: DVT and/or PE Indication: Max initial infusion rate = 1,800 units per hour. Follow titration rate tables. Concentration : 100 Units per ml. Caution: High Risk - High Alert Med.

k. Screenshot below for changing free text rate appropriately

The screenshot shows the 'Verify Continuous Order' window with the free text rate changed to 14 Units/kg/hr. The drug is Heparin - 0.45%NaCl (25,000 Units / 250 mL). The dose is 25,000 Units / 250 mL. The normalized rate is 14 Units/kg/hr. The concentration is 100 Units per ml. The frequency is Every Bag. The ordered as is heparin 2... The route is IV. The rate is 14 Units/kg/hr. The duration is (None). The next dose date is 01/19/2023 at 12:49 CST. The stop date is 02/18/2023 at 10:07 CST. The physician is Test MD, Cemer P. The replace every is 24 hour(s). The stop type is Soft Stop. The order comments are: Wt: 125 kg. 1800 units per hour/125 kg=14 units/kg/hr. DVT and/or PE Indication: Max initial infusion rate = 1,800 units per hour. Follow titration rate tables. Concentration : 100 Units per ml. Caution: High Risk - High Alert Med.

3. Patient C

- DVT/PE protocol starting rate is 18 units/kg/hr
- Your patient weighs 110 kg
- $18 \text{ units/kg/hr} \times 110 \text{ kg} = 1980 \text{ units/hr}$ which is above max rate of 1800 units/hr so must change free text rate
- $1800 \text{ units/hr} \div 110 \text{ kg} = 16.36 \text{ units/kg/hr}$
- See also tables in Appendix B for help with this adjustment
- Change free text rate to 16 units/kg/hr to reflect max

- g. The screenshot directly below is how your order will come through, but you will need to change the rate as is shown in the 2nd screenshot

The screenshot shows the 'Verify Continuous Order' window. The drug is Heparin - 0.45%NaCl (25,000 Units / 250 mL). The dose is 25,000 Units / 250 mL. The normalized rate is 18 Units/kg/hr. The concentration is 100 Units per ml. The frequency is Every Bag. The ordered as is heparin 25,000 units/NaCl 0.45% 250 mL (RTU). The route is IV. The weight is (None). The BSA(m2) is (None). The physician is Test MD, Cemer P. The rate is 0 (None). The freetext rate is 18 Units/kg/hr. The duration is 30 day(s). The start date is 01/19/2023 at 10:08 CST. The stop date is 02/18/2023 at 10:07 CST. The replace every is 24 hour(s). The stop type is Soft Stop. The order comments include: DVT and/or PE Indication: Max initial infusion rate = 1,800 units per hour. Follow titration rate tables. Concentration : 100 Units per ml. Caution: High Risk - High Alert Medt.

- h. The screenshot below has had the free text rate modified to the appropriate free text rate

The screenshot shows the 'Verify Continuous Order' window with the same drug and dose as the previous screenshot. The normalized rate is now 16 Units/kg/hr. The freetext rate is 16 Units/kg/hr. The order comments include: Wt: 110 kg. 1800 units per hour/110 kg=16 units/kg/hr. DVT and/or PE Indication: Max initial infusion rate = 1,800 units per hour. Follow titration rate tables. Concentration : 100 Units per ml. Caution: High Risk - High Alert Medt.

4. Patient D

- Cardiac protocol starting rate is 12 units/kg/hr with a max rate 1000 units/hr
- Your patient weighs 90 kg
- $12 \text{ units/kg/hr} \times 90 \text{ kg} = 1080 \text{ units/hr}$

- d. 1080 units/hr is over the max of 1000 units/hr
- e. Instead, take $1000 \text{ units/hr} \div 90 \text{ kg} = 11 \text{ units/kg/hr}$
- f. See also tables in Appendix B for help with this adjustment
- g. You would then enter 11 units/kg/hr in the free text field
- h. Screenshot below is how the order will come through

The screenshot shows the 'Verify Continuous Order' window. The drug is Heparin - 0.45%NaCl (25,000 Units / ...). The dose is 25,000 Units / ... and the concentration is 250 mL (RTU). The frequency is 'Every Bag' and the ordered as is 'heparin 2...'. The route is IV, the rate is 12 Units/kg/hr, and the duration is 30 days. The start date is 01/19/2023 at 13:10 and the stop date is 02/18/2023 at 13:09. The physician is Test MD, Cemer P. The order comments include 'Cardiac Indication: Max initial infusion rate = 1,000 units per hour. Follow Protocol dosing.' and the product notes include 'Concentration : 100 Units per ml' and 'Caution: High Risk - High Alert Med.'

- i. Screenshot below is how you will change the free text rate to prevent going over the max

The screenshot shows the 'Verify Continuous Order' window with the rate changed to 11 Units/kg/hr. The drug is Heparin - 0.45%NaCl (25,000 Units / ...). The dose is 25,000 Units / ... and the concentration is 250 mL (RTU). The frequency is 'Every Bag' and the ordered as is 'heparin 2...'. The route is IV, the rate is 11 Units/kg/hr, and the duration is 30 days. The start date is 01/19/2023 at 13:10 and the stop date is 02/18/2023 at 13:09. The physician is Test MD, Cemer P. The order comments include 'Weight 90 kg', '1000 units/hr / 90 kg = 11 units/kg/hr', and 'Cardiac Indication: Max initial infusion rate = 1,000 units per hour. Follow Protocol dosing.' and the product notes include 'Concentration : 100 Units per ml' and 'Caution: High Risk - High Alert Med.'

5. Patient E

- a. Cardiac protocol starting rate is 12 units/kg/hr with a max starting rate of 1000 units/hr
- b. Your patient weighs 60 kg
- c. $60 \text{ kg} \times 12 \text{ units/kg/hr} = 720 \text{ units/hr}$ which is less than max of 1000 units/hr

- d. Leave free text rate field as 12 units/kg/hr-no change needed
- e. Screenshot below shows how the order will come through and the free text rate does not need to be changed

The screenshot shows the 'Verify Continuous Order' window. At the top, there is a 'Drug:' field. Below it is a table with columns: Vol, Drug, Dose, Normalized Rate, Concentration, Frequency, and Ordered As. The table contains one row for Heparin. To the right of the table are buttons for Update, Remove, and Modify, along with volume fields for Total and Ingredient. Below the table are several input fields: Route (IV), Weight (None), BSA(m2), Rate (12 Units/kg/hr), Freetext rate (12 Units/kg/hr), Infuse over (None), Duration (30 day(s)), Start date (01/19/2023), Time (13:10), Stop date (02/18/2023), Time (13:09), Physician (Test MD, Cemer P), Replace every (24 hour(s)), and Stop type (Soft Stop). At the bottom, there are two text areas: Order comments (Cardiac Indication: Max initial infusion rate = 1,000 units per hour. Follow Protocol dosing.) and Product notes (Concentration : 100 Units per ml, Caution: High Risk - High Alert Med.).

- 5. Heparin orders will now have an added box to click on in PharmNet that is called related results as shown below on a heparin bolus. This box will open up to relevant results including anti-Xa level, PTT, hgb, hct, plt.

Δ	Vol	Drug	Dose	Ordered As
Δ		Heparin (1,000-1)	5,000 Units / 5 mL [60 Units/kg]	heparin cardiac bolus
		Heparin 1,000 Units/ml Inj 10 ml		

A red arrow points to a small icon in the first column of the second row of the table.

- a. This patient does not have an anti-Xa level or PTT resulted but this is what the pop up box should look like

The screenshot displays a 'Verify Med Order' interface. At the top, the drug is identified as Heparin (1,000-1) with a dose of 5,000 Units / 5 mL [60 Units/kg] and ordered as 'heparin cardiac bolus'. The route is 'IV Push' and the frequency is 'OT (One Time Only)'. The dosage form is 'Injection' and the dispense category is 'Inj'. The price is \$31.33 and the cost is \$4.32. The physician is 'Test MD, Cemer P'. The stop type is 'Physician Stop'. The order comments state: 'Initial IV Bolus. Dose rounded to the nearest 100 5,000 units (Cardiac Indication). Do not administer heparin has been administered within the past 6 hours. Target Dose: heparin cardiac bolus 60 Units/kg (60 Units/kg) 3/6/2023 12:03:10'. The 'Related Results' pop-up window shows the following data:

Test	Value	Date/Time
Hgb	15.0 gm/dL	1/24/2005 14:39 CST
Hct	45.0 %	1/24/2005 14:39 CST
Platelet	150 thous/uL	1/24/2005 14:39 CST

- 6. Below are the weight-based starting rate tables to make things a bit simpler
 - a. You can simply use these to determine your heparin drip's starting rate as opposed to doing the math (however it is always good to double check with calculations)

APPENDIX B: Starting Weight-Based Rates

DVT/PE Heparin **Starting Rates** (max rate 1800 units/hr)

Weight (kg)	Rate in units/kg/hr
< 103 kg	18 units/kg/hr
103-109	17 units/kg/hr
110-116	16 units/kg/hr
117-124	15 units/kg/hr
125-133	14 units/kg/hr
134-144	13 units/kg/hr
145-156	12 units/kg/hr
157-171	11 units/kg/hr
172-189	10 units/kg/hr
190-211	9 units/kg/hr
212-240	8 units/kg/hr
241-276	7 units/kg/hr

Cardiac Indication Heparin **Starting Rates** (max rate 1000 units/hr)

Weight (kg)	Rate in units/kg/hr
<87 kg	12 units/kg/hr
87-95	11 units/kg/hr
96-105	10 units/kg/hr
106-117	9 units/kg/hr
118-133	8 units/kg/hr
134-153	7 units/kg/hr
154-181	6 units/kg/hr
182-222	5 units/kg/hr
223-285	4 units/kg/hr

Ischemic Stroke Indication Heparin **Starting Rates** (max rate 1000 units/hr)

Weight (kg)	Rate in units/kg/hr
<87 kg	12 units/kg/hr
87-95	11 units/kg/hr
96-105	10 units/kg/hr
106-117	9 units/kg/hr
118-133	8 units/kg/hr
134-153	7 units/kg/hr
154-181	6 units/kg/hr
182-222	5 units/kg/hr
223-285	4 units/kg/hr