Student Worksheet:  Students should solve problems and answer questions before class.

**Directions:** Bring Davis’s Drug Guide and Dosage Calculations to class.

Complete the following: Self-study

<table>
<thead>
<tr>
<th>Drug</th>
<th>Classification</th>
<th>Dosage Infusion rate per hr for Continuous Infusion</th>
<th>Adverse Reactions Side Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. KCL</td>
<td></td>
<td></td>
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<tr>
<td>b. Heparin</td>
<td></td>
<td></td>
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<tr>
<td>c. Nitroglycerine IV</td>
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<tr>
<td>d. Dopamine IV</td>
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</tr>
</tbody>
</table>

- Complete true/false to review heparin and KCL infusion in appendix A of packet.

1. **CONTINUOUS IV MEDS**

   a. Do not piggyback other meds into line without checking compatibility chart.
   b. If medications are incompatible, use flush bottles between medications.
   c. Use infusion pumps for accuracy when indicated, e.g. Heparin, Nitroglycerin, and KCL.
   d. Heparin is ordered in units. Common concentration of Heparin solution is 25,000 units of Heparin in 250 or 500 cc D$_5$W
   e. Heparin infusions are adjusted using a nomogram based on PTT results.
   f. Document heparin infusion on heparin nomogram sheet with correlated lab values and action taken.

Refer to “Advanced IV Calculations” in Dosage Calculations, Pickar and review Continuous IV Heparin protocol practice, and medicated IV infusions.
### Sample Heparin Nomogram Sheet

#### Pre-printed Orders for Continuous Heparin Infusions

<table>
<thead>
<tr>
<th>Date:</th>
<th>Time: a.m./p.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Do not use Heparin Protocol if patient not on previous anticoagulant therapy has an INR &gt; 1.3 and /or PTT&gt; 35 seconds at baseline.</td>
<td></td>
</tr>
<tr>
<td>2. Obtain PT/PTT stat if not already drawn within the past 24 hours.</td>
<td></td>
</tr>
<tr>
<td>3. administer Heparin 5000 units IV Bolus stat</td>
<td></td>
</tr>
<tr>
<td>4. Start standard heparin infusion 25000 units /250 ml of D5W at:</td>
<td></td>
</tr>
<tr>
<td>1,200 units/hour patients &gt;100 kg</td>
<td></td>
</tr>
<tr>
<td>1,000 units/hour patients 80-100 kg</td>
<td></td>
</tr>
<tr>
<td>800 units/hour patients &lt;80 kg</td>
<td></td>
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<tr>
<td>5. Place order for repeat PTT under Heparin Protocol in computer system.</td>
<td></td>
</tr>
<tr>
<td>6. If patient on Coumadin, obtain PT daily and call results to MD</td>
<td></td>
</tr>
<tr>
<td>7. If patient is receiving both Coumadin and Heparin and INR &gt; 2.5 STOP IVHEPARIN and call MD</td>
<td></td>
</tr>
<tr>
<td>8. Titrate to keep PTT between 45-75 seconds using the following:</td>
<td></td>
</tr>
</tbody>
</table>

#### Heparin Adjustment Nomogram

<table>
<thead>
<tr>
<th>PTT</th>
<th>Bolus (Units)</th>
<th>Stop Infusion</th>
<th>Rate Change (ML/HR)</th>
<th>Repeat PTT</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 40</td>
<td>3000</td>
<td>0 min.</td>
<td>+1</td>
<td>5+ hours</td>
</tr>
<tr>
<td>40-44</td>
<td>0</td>
<td>0 min</td>
<td>+0.5</td>
<td>5+ hours</td>
</tr>
<tr>
<td>45-75</td>
<td>0</td>
<td>0 min</td>
<td>0 (no change)</td>
<td>Next am</td>
</tr>
<tr>
<td>76-85</td>
<td>0</td>
<td>0 min</td>
<td>-0.5</td>
<td>Next am</td>
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<td>86-100</td>
<td>0</td>
<td>30 min</td>
<td>-1</td>
<td>5+ hours</td>
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<tr>
<td>101-120</td>
<td>0</td>
<td>60 min</td>
<td>-1.5</td>
<td>5+ hours</td>
</tr>
<tr>
<td>&gt;120</td>
<td>0</td>
<td>60 min</td>
<td>-3</td>
<td>5+ hours</td>
</tr>
</tbody>
</table>

**NOTE:** ANTICIPATED REDRAW TIME IS 5-12 HOURS

#### Ongoing Monitoring and Heparin Dose Adjustments

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Initials</th>
<th>PTT</th>
<th>Bolus (units)</th>
<th>Infusion (units/hr)</th>
<th>Doctor Notified</th>
<th>Date</th>
<th>Time</th>
<th>Initials</th>
<th>PTT</th>
<th>Bolus (units)</th>
<th>Infusion (unit/hr)</th>
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</table>

#### RN Initials & Signature:

<table>
<thead>
<tr>
<th>Initials</th>
<th>RN Signature</th>
<th>Initials</th>
<th>RN Signature</th>
</tr>
</thead>
<tbody>
<tr>
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HEPARIN PROTOCOL PRACTICE

Use the following physician orders to answer questions.

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**HEPARIN ADJUSTMENT NOMOGRAM**

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<th>BOLUS (UNITS)</th>
<th>STOP INFUSION</th>
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NOTE: ANTICIPATED REDRAW TIME IS 5-12 HOURS

11. You are caring for a client who has the above orders placed on their chart to initiate the heparin protocol. The morning results of the client’s baseline PTT is 25 seconds. The INR 1.0. What would you do next?

_____________________________________________________________________________________

12. You are preparing to administer the bolus and have available heparin 10000 units/ml. How many milliliters would you prepare to administer? ________________

13. The client weighs 218 pounds. How many units per hour would you initiate? ______________

14. What would you program the infusion pump at? _____________________

15. The IV infusion is initiated at 8 am. A PTT result of 28 seconds is released at 12pm. What action would you take?

_____________________________________________________________________________________

_____________________________________________________________________________________

_____________________________________________________________________________________
16. The client has a PTT result of 44 seconds released at 4 pm. What would you prepare to perform? (check all that apply)
   a. Stop infusion for one hour
   b. Bolus 3000 units of heparin
   c. Increase infusion by 50 units/Hr
   d. Repeat the PTT at least five hours later
   e. Repeat the PTT in the morning.

17. The client has a PTT result of 39 seconds released at 12am. What would you prepare to perform? (check all that apply)
   f. Stop infusion for one hour
   g. Bolus 3000 units of heparin
   h. Increase infusion by 50 units/hr
   i. Increase the infusion by 100 units/hr
   j. Repeat the PTT at least five hours later
   k. Repeat the PTT in the morning.

18. The client has a PTT result of 87 seconds released at 6am. What would you prepare to perform? (check all that apply)
   l. Stop infusion for 30 minutes
   m. Stop infusion for 60 minutes
   n. Bolus 3000 units of heparin
   o. Decrease infusion by 50 units/hr
   p. Decrease the infusion by 100 units/hr
   q. Repeat the PTT at least five hours later
   r. Repeat the PTT in the morning.

19. The client has a PTT result of 77 seconds released at 2 pm. What would you prepare to perform? (check all that apply)
   s. Stop infusion for 30 minutes
   t. Stop infusion for 60 minutes
   u. Bolus 3000 units of heparin
   v. Decrease infusion by 50 units/hr
   w. Decrease the infusion by 100 units/hr
   x. Repeat the PTT at least five hours later
   y. Repeat the PTT in the morning.

20. The client has a PTT result of 67 seconds released at 8 pm. What would you prepare to perform? (check all that apply)
   z. Stop infusion for 30 minutes
   aa. Stop infusion for 60 minutes
   bb. Bolus 3000 units of heparin
   cc. Increase infusion by 50 units/hr
   dd. Increase the infusion by 100 units/hr
   ee. Repeat the PTT at least five hours later
   ff. Repeat the PTT in the morning.
Review your text and drug guide about potassium chloride and heparin infusions.

Select the statements that are true about potassium chloride (KCL):

a. KCL is an essential vitamin found in bananas.
b. KCL is the chief ion of intracellular fluid.
c. Potassium deficiency can lead to irregular heart rhythms.
d. Potassium chloride can never be administered IV push.
e. Potassium chloride can never be administered as an IVPB.
f. Rapid administration of KCL can lead to cardiac arrest.
g. IV KCL must be administered on an infusion pump.
h. Concentrations of 0.1 meq to 0.4 mEq/ml are intended for administration on an IV administration set.
i. The maximum infusion rate for KCL on a med-surg floor is 40 mEq/hour.
j. Clients receiving KCL infusions greater than 10 meq but less than or equal to 20 mEq/hr should be on a cardiac monitor in a specialty unit.
k. KCL is the antidote to coumadin overdoses.

Select the statements that are true regarding heparin infusions:

a. A heparin infusion is indicated for clients experiencing thrombotic conditions such as MI, CVA, DVT and PE.
b. The therapeutic effect of heparin is as an anticoagulant to minimize clot formation.
c. Clients receiving heparin must have their PT/INR monitored frequently.
d. Heparin can be administered SQ, IM, or IV.
e. When administering heparin to a client it is important to initiate the infusion with a loading dose.
f. The loading dose for heparin is a weight-adjusted dose based on the diagnosis.
g. Heparin is ordered in units/kg/minute.
h. When caring for a client, the nurse initiates bleeding precautions.
i. Heparin must be administered on an infusion pump.
j. The nurse must calculate cc/hr to administer heparin.
k. The therapeutic range of heparin is determined by the disorder but is generally 1.5 -2 times the range.
l. When administering the loading dose of heparin, the nurse selects the concentration of 10,000 units/ml using a tuberculin syringe.
m. The nurse rounds off the heparin infusion calculation to the nearest 0.1 (tenth).
n. The following actions should be included:
   - wear masks in close contact
   - no flowers
   - no razors
   - soft bristled toothbrushes
   - activity as tolerated
   - avoid excessive venipuncture
   - monitor H & H
   - monitor for thrombocytopenia
   - Monitor for heparin resistance.
   - Monitor ptt time.
Complete the following calculations:

1. The doctor orders heparin to infuse at 750 units per hour. The pre-mixed intravenous solution available is 250cc D5W with 25000 units heparin added. Calculate the infusion rate for delivery with an infusion pump.

2. The doctor orders heparin to infuse at 1200 units per hour. The pre-mixed intravenous solution available is 250cc D5W with 25000 units heparin added. Calculate the infusion rate for delivery with an infusion pump.

3. The doctor orders heparin to infuse at 800 units per hour. The pre-mixed intravenous solution available is 250cc D5W with 25000 units heparin added. Calculate the infusion rate for delivery with an infusion pump.

4. The doctor orders heparin to infuse at 750 units per hour. The pre-mixed intravenous solution available is 500cc D5W with 25000 units heparin added. Calculate the infusion rate for delivery with an infusion pump.

5. The doctor orders heparin to infuse at 1000 units per hour. The pre-mixed intravenous solution available is 500cc D5W with 25000 units heparin added. Calculate the infusion rate for delivery with an infusion pump.

6. The doctor orders heparin to infuse at 1250 units per hour. The pre-mixed intravenous solution available is 500cc D5W with 25000 units heparin added. Calculate the infusion rate for delivery with an infusion pump.

7. The doctor orders heparin to infuse at 950 units per hour. The pre-mixed intravenous solution available is 500cc D5W with 25000 units heparin added. Calculate the infusion rate for delivery with an infusion pump.

8. Administer Dopamine 2.5 mcg/kg/minute
   Client’s weight 70 kgs
   Available infusion Dopamine 400 mg/500 cc D5W

9. Administer Dopamine 5 mcg/kg/minute
   Client’s weight 100 kgs
   Available infusion Dopamine 400 mg/500 cc D5W

10. Administer Dopamine 5 mcg/kg/minute
    Client’s weight 70 kgs
    Available infusion Dopamine 400 mg/250 cc D5W
11. Administer Nitroglycerine 5 mcg/minute
   Available infusion Nitroglycerine 50 mg/250 ml D5W

12. Administer Nitroglycerine 10 mcg/minute
    Available infusion Nitroglycerine 50 mg/250 ml D5W

Calculating Weight-Adjusted Heparin Boluses

Calculate the weight-adjusted bolus dose of 64 units/kg and round to the nearest 100 units.

1. ORDER: 64 units/kg and round to the nearest 100 units.
   WEIGHT: 110 lbs
   AVAILABLE: Heparin 10000 units/1 ml
   ADMINISTER: __________________________

2. ORDER: 64 units/kg and round to the nearest 100 units.
   WEIGHT: 165 lbs
   AVAILABLE: Heparin 10000 units/1 ml
   ADMINISTER: __________________________

3. ORDER: 64 units/kg and round to the nearest 100 units.
   WEIGHT: 150 lbs
   AVAILABLE: Heparin 10000 units/1 ml
   ADMINISTER: __________________________

4. ORDER: 64 units/kg and round to the nearest 100 units.
   WEIGHT: 200 lbs
   AVAILABLE: Heparin 10000 units/1 ml
   ADMINISTER: __________________________
2. **VOLUME CONTROL DEVICES**: Infusion Controllers and Pumps

**PURPOSE**: to maintain the prescribed fluid infusion rate.

**Infusion Controllers**: Operate solely by gravitational force to deliver a constant rate of flow. They do not have the ability to add pressure to the line to overcome resistance to fluid flow.

Rate is set in drops per minute or mL/hr.

**Infusion Pumps**: deliver fluid by exerting positive pressure on the tubing or on the fluid. When the fluid flow is unrestricted, the pump pressure is comparable to that of gravity flow. However, if restrictions develop (increased venous resistance), the pump can maintain the fluid flow by increasing the pressure applied to the fluid. This pressure is a disadvantage when infiltration occurs. The machine can continue to pump fluid into the tissue, causing an extensive infiltration if the patient is not assessed frequently.

Rate is set in milliliters per hours.

**KEY POINTS**:

1. Select the appropriate tubing for the controller/pump.

2. **Set the Rate**: Set in mL/hour

3. **Set the Volume To Be Infused** (VTBI): To avoid the transfer of air from the fluid container to the patient, the selected volume to be infused should not exceed the volume of fluid in the container.

4. **Pressure Setting**: Infusion pumps require you to set the pressure at which fluid is to be delivered. Check the manufacturer’s instructions for recommended pressure settings, considering type and rate of fluid to be delivered and age and condition of patient.

5. **Multiple Alarm Systems**: Notify you if infusion is blocked, air is in system, or if the desired infusion volume has been reached. Check manufacturer’s directions for specific information.

6. **Battery**: To allow client mobility, most models are equipped with a rechargeable battery that operates the device from 1 to 4 hours.

7. **Monitor the Infusion**: Monitor the infusion flow at least hourly, and compare the volume of fluid infused with the time tape on the IV container. Controllers and pumps are not infallible.
Electronic infusion pump exercises

Review the procedure in your text about use of electronic infusion pumps. Examine the mock up of a Baxter infusion pump below.

Based on the display of an infusion pump above, answer the following:

a. Explain the following abbreviations:
   - PRI RATE _________________________________
   - PRI VTBI _________________________________
   - SEC RATE _________________________________
   - SEC VTBI _________________________________

b. Can you describe the steps to initiate an IV infusion through the pump?

Select the statements that are true regarding the use of an electronic infusion pump. (circle all that apply)

a. Electronic infusion pumps use positive pressure to overcome resistance.
b. Electronic infusion pumps will alarm if there is an occlusion.
c. When assessing for occlusion, the nurse checks the site and tubing for kinking.
d. If the pump alarms for “air in Line”, the nurse opens the IV pump door and allows the IV to run freely to permit the air to pass the pump controls.
e. Electronic pumps are programmed in gtt/minute.
f. Gravity control devices will not alarm for occlusion or air but will regulate flow according to gravity.
g. Either Electronic infusion pumps or IV administration sets can be used for medication intravenous infusions such as heparin or potassium.