Objectives

- Describe Epoprostenol and Treprostinil medications and properties
- Discuss the risks/benefits of allowing patients to use their home pumps as inpatients
- Discuss specific safety measures that should be considered when using continuous infusion prostacyclin therapies
- Discuss IV room specific safety measures that can minimize errors during preparation of intravenous prostacyclin products
By a show of hands…

- How many people in this room take care pulmonary hypertension patients?

- Are those patients on continuous prostacyclin therapy?

- Does your institution have policies and procedures in place to help you manage this patient population and their medications?
Pulmonary Arterial Hypertension (PAH)

Restricted flow through the pulmonary arterial circulation
↓
Increases PVR
↓
Increases RV pressure
↓
Right Heart Failure

Treatment of PAH

- Prostacyclins
  - Epoprostenol (IV)
    - Flolan®
    - Veletri®
  - Treprostinil (IV/SQ/Inhaled)
    - Remodulin®
  - Iloprost (Inhaled)
    - Ventavis®

- Endothelin receptor antagonists
- Phosphodiesterase inhibitors
- Soluble guanylate cyclase stimulator
Prostacyclin Errors in Hospitalized Patients

Prostacyclins

- **Mechanism of Action**
  
  - Endogenous prostacyclin is a vasodilator with antiproliferative effects.
  
  - PAH patients have decreased production of prostacyclin synthase therefore decreased production of prostaglandin I$_2$.

Intravenous Epoprostenol (Flolan®)

- High-risk medication

- Dosing
  - ng/kg/min
  - Continuous IV infusion
  - Half-life
    - 3 to 5 min

- Stability

- Compliance / Cost
Challenge Question

- How many nanograms are in a milligram?
  A. 100
  B. 1,000
  C. 10,000
  D. 1,000,000
Prostacyclins

- Side Effects
  - Headache
  - Hypotension
  - Flushing
  - Jaw pain
  - Nausea
  - Diarrhea
  - Injection site pain
    - (SQ administration only)
Intravenous Epoprostenol (Flolan®)

- Therapy Titration
  - Initiate therapy at 1-2 ng/kg/min
  - Increase doses by 1-2 ng/kg/min
  - “Flow Rate Worksheet” and/or EPIC order entry
Flow Rate Worksheet

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Practice Problem

Patient is a 39 yo female with PAH who is admitted through the ED at 5 pm on a Saturday night for an expected extended stay to treat her uncontrolled pulmonary hypertension. She is currently being treated with IV epoprostenol therapy. Upon questioning, the patient explains to the pharmacist that they change their bag every night at 10 pm right before bedtime. It is currently 6 pm. The patient puts 4 vials of medicine in her IV, and it runs at 3.4 ml/hr. She is not sure what her dosing weight is but says she weighs about 175 lbs. She has never heard of a “nanogram,” but she says her dose is 42.5. She tells you she is a patient of Dr. Sood’s and that Accredo supplies her medication.

You call Accredo and they verify that the patient makes an IV bag of 6 mg/100 mL. You are told by the Accredo nurse that the dosing weight is 80 kg and the rate of infusion is 3.4 ml/hr, which equals 42.5 ng/kg/min.

Does the dosing information you are presented with all match up?

(Calculate to make sure that 3.4 ml/hr = 42.5 ng/kg/min for this patient)
1. Calculate current bag concentration in ng/mL

\[
\frac{6 \text{ mg}}{100 \text{ mL}} \times \frac{1,000,000 \text{ ng}}{1 \text{ mg}} = 60,000 \text{ ng/mL}
\]

2. Convert from known mL/hr to ng/hr

\[
\frac{3.4 \text{ mL}}{1 \text{ hr}} \times \frac{60,000 \text{ ng}}{1 \text{ mL}} = 204,000 \text{ ng/hr}
\]

3. Use ng/hr to calculate ng/kg/hr

\[
204,000 \text{ ng/hr} = \frac{2500 \text{ ng/kg/hr}}{80 \text{ kg}}
\]

4. Convert ng/kg/hr to ng/kg/min

\[
\frac{2550 \text{ ng/kg/hr}}{60 \text{ min/hr}} = 42.5 \text{ ng/kg/min}
\]
Continuous Infusion Treprostinil (Remodulin®)

### Dosing
- ng/kg/min
- Continuous IV infusion
- SQ administration
- Half-life (t1/2)
  - ~ 4 hours
  - Elimination 12 – 20 hrs

### Stability
- IV – 48 hours at RT
- SQ pump – 72 hours at RT
- SQ site – variable
Continuous Infusion Treprostinil (Remodulin®)

- Treprostinil CONCENTRATED IV administration via Chrono-5 pump
Continuous Infusion Treprostinil (Remodulin®)

- Compliance/Cost

- Therapy Titration
  - Initiate therapy at 1-2 ng/kg/min
  - Increase doses by 1-2 ng/kg/min
    - “Flow Rate Worksheet”
Pumps

- When a patient is admitted to the hospital should they stay on their home pump or be transitioned to a hospital pump?

- Things to consider
  - Is the patient on a Chrono-5 pump?
  - Nursing education regarding pumps
  - Physical and mental capacity of the patient
  - Distributor resources
  - Hospital resources
Safety Considerations

- Verifying prescription with medication supplier
- Dosing weight
- Discontinuation of therapy / dose changes
- RN double-check
- Restrictions
- Back up IV access, IV bag, pump
- Priming or “packing” the line
- Aspiration of lines
Verifying the Prescription

- Accredo
- Caremark
- Curascript

- Confirm
  - Dosing weight
  - Dose
  - Concentration of medication
  - Home pump rate
    - CADD-1 – mL/day
    - CADD-MS3 – mL/hr
Dosing Weight

- Dosing weight is the weight the patient was on the day that the prostacyclin therapy was initiated regardless how long ago that occurred.

- ALWAYS use dosing weight, NOT actual weight to calculate dosing parameters.
Discontinuation of Therapy and Dosing Changes

- Continuous Infusion Prostacyclin therapy is LIFELONG.

- Dose changes either purposely or accidental WILL lead to side effects in the patient.
  - Nursing education
  - To treat or not to treat?
RN double check / Restrictions

- Double check helps to prevent errors
  - It takes a village!

- Physician restrictions
- Location restrictions
  - Staff education
Back up IV access, IV bag, pump

- Epoprostenol – half life ~ 4 minutes
- Treprostinil – half life ~ 4 hours

- Especially with EPO – best to be proactive and prepared for any worst case scenario
Priming or “packing” of lines

- When TO prime
  - Concentration changes
  - New line (PIV or CVC)

- When NOT TO prime
  - Routine IV bag changes (same conc.)
  - Routine transition from home supply to hospital supply (same conc.)
Aspiration of IV lines

- When TO aspirate
  - If the prostacyclin line is not going to be used for prostacyclin administration anymore for any reason
  - If prostacyclin cannot be aspirated out of the line – the line MUST be labeled “do not use” and must be removed from the patient
Challenge Question

- A patient tells you that when they prepare their home epoprostenol pump they use 2 of the 1.5 mg vials and qs to 100 ml total volume. What is the concentration of their medication?

A. 30,000 ng/ml
B. 15,000 ng/ml
C. 3,000 ng/ml
D. 1,500 ng/ml
Challenge Question / Case

- RQ is a 48yo female who presents to the ED complaining of SOB and decreased exercise tolerance. She has been on IV treprostinil therapy for 2 years for PAH. Upon presentation to the ED, her weight is 105kg.

- You want to get the dosing parameters for her IV treprostinil and you call Accredo. They tell you:
  
  Dose: 45ng/kg/min  
  Dosing weight: 92kg  
  Concentration: 180,000ng/mL  
  Rate: 67mL/day
Challenge Question / Case

- What weight do you use to calculate her dosing while in the hospital?

92KG
Preparation of Intravenous Prostacyclin

- Minimizing errors in the IV room
  - Store medication in isolated location
    - Separate out strengths of treprostinil
  - Prepare Veletri vs. Flolan vs. Remodulin at different specified times during the day
  - Stickers / Colored baggies
  - Pharmacist log sheet
  - Nothing else in the hood during preparation
    - RPh check prior to injection into empty bag (in hood)
Intravenous Prostacyclin Use in Hospitalized Patients – Safety First!

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THE OHIO STATE UNIVERSITY
WEXNER MEDICAL CENTER