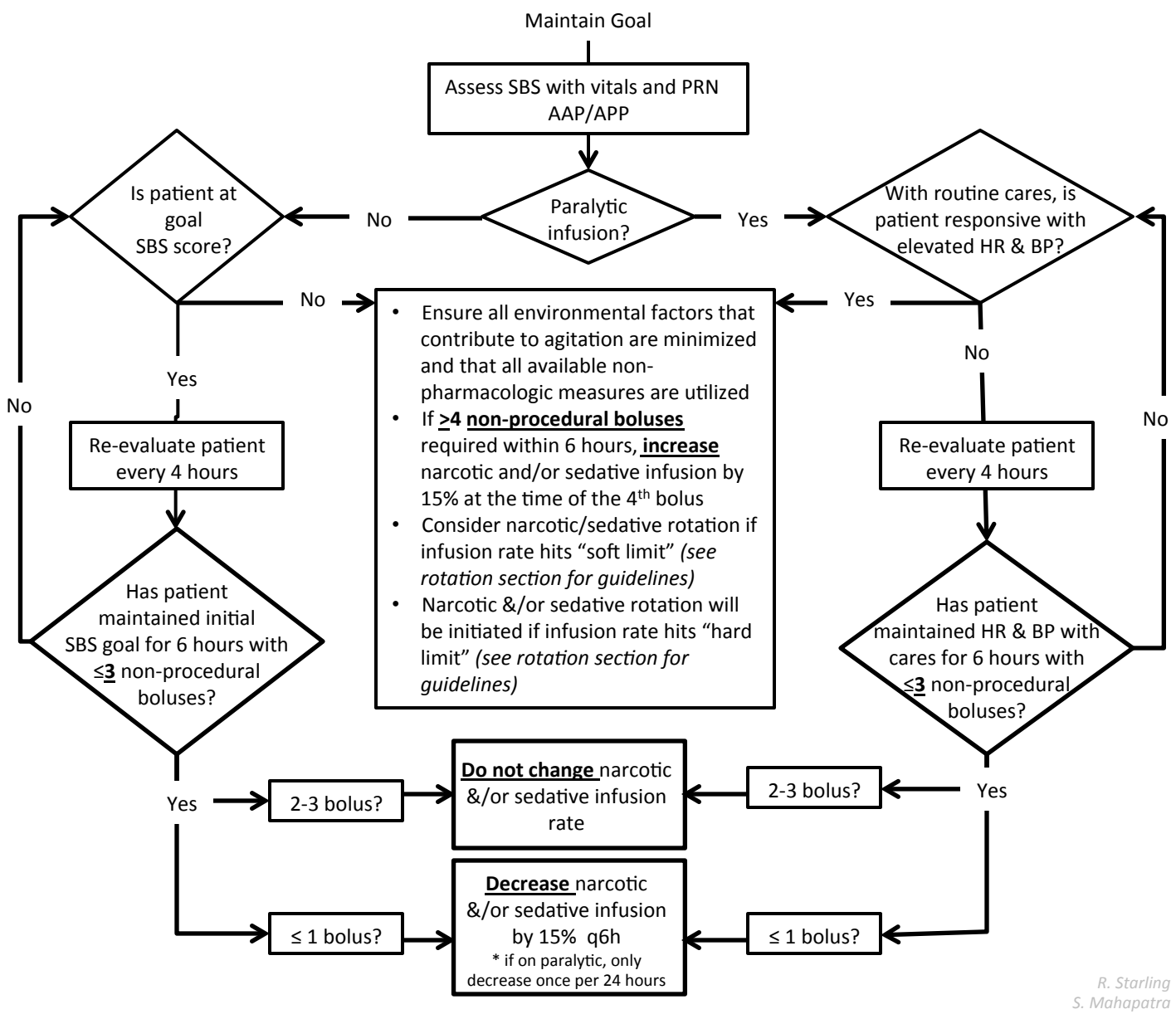
PICU SEDATION PROTOCOL

Initiation of protocol algorithm:

- Utilize non-pharmacologic measures described on the "Additional information" page
- Initiate bowel regimen when taking enteral nutrition
- Establish SBS goal
- Infusion: Initiate narcotics & sedatives at:
  - Dexmedetomidine 0.25 mcg/kg/hr
  - Narcotic:
    - Fentanyl infusion at 0.5-1 mcg/kg/hr
    - Alternative recommendation: Morphine 0.05-0.1 mg/kg/dose q2-4h PRN or NCA boluses for pain.
- PRNs: Order 1 hour bolus of Fentanyl. If utilizing infusion, that can be given every 30 minute if needed to achieve SBS goal
  - Preferentially use narcotic boluses instead of sedative boluses in hemodynamically unstable patients
  - Dexmedetomidine should not be bolused
- If >3 non-procedural boluses are required within first 2 hours after starting infusion, increase infusions by 50%
  - **See "Procedural bolus" section in "Additional information" for details of what constitutes a procedural bolus
- If patient has not achieved goal SBS score within 2 hours of 1st 50% increase, discuss with ICU provider
- Assess SBS score or AAP/APP a minimum of q4 hours and PRN (before and after each intervention) with vitals



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EXTUBATION & WITHDRAWAL

PICU SEDATION PROTOCOL

(excludes dexmedetomidine- see that section for details)

Patient on sedation infusions ≥ 5 days or infusion rate ≥ "soft limits"

5-6 days or ≥ soft limits → Consider adding morphine, lorazepam &/or pentobarbital PRNs at time of extubation

≥ 7 days

24 hours prior to extubation:

a) Start clonidine 2.5mcg/kg/dose PO/NG BID
   1. If clonidine contraindicated and infusion(s) ≥ soft limits or patient on sedation >3 weeks, consider starting enteral methadone &/or lorazepam based on current infusions

b) Use of clonidine patch is strongly discouraged; if used must overlap with oral by at least 48 hours

Day of extubation orders:

a. Measure WAT-1 baseline
b. Set WAT -1 target score: Measured baseline + 3 = goal max WAT-1
   1. Eg- heart failure with baseline sweating: Baseline WAT =1, Goal WAT = 1-4 (<5)
c. Measure WAT-1 q6h and prn
   1. If signs/symptoms of withdrawal, assess WAT-1. If greater than target, administer PRN morphine &/or Ativan and re-assess WAT-1 within 1 hour
d. Stop narcotic and midazolam infusions (see high dose infusion disclaimer)
e. Start Phenobarbital if on Pentobarbital (*see barbituate section for dosing)
f. Order PRN morphine & lorazepam
   1. If morphine allergy, consult pharmacy for equivalent hydromorphone dosing
g. 24 hours after last Methadone & lorazepam doses, wean clonidine by 25% daily x3 days

Morphine IV PRN dosing:

Fentanyl: $\frac{\text{Fentanyl dose (mcg/kg/hr) x weight x 0.5}}{10}$

Morphine: Morphine dose (mg/kg/hr) x weight x 0.5

Hydromorphone: HM dose (mg/kg/hr) x weight x 6.7 x 0.5

Order calculated dose q4h IV prn. Max dose 6mg/dose.

Lorazepam (Ativan) PRN dosing:

Midazolam dose: $\frac{\text{Midazolam dose (mcg/kg/min) x weight x 60 x 0.5}}{1000}$

Order calculated dose q6h IV prn. Max dose 6mg/dose.

High Dose Infusion Disclaimer:

If infusions between soft & hard limits (see narcotic & sedative rotation sections for doses) at time of extubation: consider stopping infusions just prior to extubation and re-starting infusion at 50% of dose 1 hour after extubation. Continue infusion(s) for 24 hours post-extubation. Add PRNs based on above calculations.

**DO NOT bolus infusions if patient is extubated

*** DO NOT increase infusions if patient is extubated unless discussed with PICU Attending.

≥4 PRN doses per 24h or enteral scheduled dose increased within the first 2 days

No → Continue WAT-1 scoring q6h for first 48 hours after extubation, then q12h until after last enteral benzodiazepine, narcotic or clonidine dose given

Yes →
a. Start enteral methadone &/or lorazepam based subsequent on flow chart
b. Continue WAT-1 scoring q6h and PRN until WAT <goal for 12 hours, then WAT-1 scoring q12h & PRN
c. Continue PRN morphine and lorazepam for pain/ agitation/withdrawal symptoms if needed
d. If PRN doses of either morphine or lorazepam required in 24 hour period, hold weaning of enterals by 1 day

≥4 PRN doses in last 24h?

No → Discontinue infusions & utilize PRNs

Yes → Convert current infusion(s) dose to methadone &/or lorazepam & discontinue infusions after 2nd enteral dose

≥ 4 narcotic PRNs

Methadone scheduled dose (PO/NG): (minimum dose 0.1mg)

Methadone dose calculation:

Fentanyl: $\frac{\text{Fentanyl dose (mcg/kg/hr) x weight (kg) x 120 x 0.75}}{1000}$

Morphine: Morphine dose (mg/kg/hr) x weight (kg) x 0.75

Hydromorphone: Hydromorphone dose (mg/kg/hr) x weight (kg) x 6.7 x 0.75

Day 1&2: Methadone as calculated above PO/NG q12h x 4 doses
Day 3-8: Decrease dose by 15% q48h given q12h
Day 9: Same dose qhs x1
Day 10-off: Decrease dose by 15% daily given qhs

≥ 4 benzodiazepine PRNs

Lorazepam (Ativan) scheduled dose (PO/NG): (minimum dose 0.1mg)

Lorazepam dose calculation: $\frac{\text{Midazolam dose (mcg/kg/min) x weight x 60 x 0.75}}{1000}$

Day 1-3: Lorazepam (as calculated above) q6h. Max of 6mg q6h.
Day 4: Continue same dose as day 1-3, decrease frequency to q8h
Day 5-off: Decrease dose by 20% daily, give q8h x 3 doses

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NARCOTIC ROTATION
PICU SEDATION PROTOCOL

- Decision to change narcotic infusion to be made on daytime rounds by PICU team
  - Goal to notify pharmacy by 11am of need for change
- Narcotic infusion rate:
  - Initial infusion rates:
    - Fentanyl: 0.5-1 mcg/kg/hr (initial narcotic infusion of choice)
    - Morphine at 0.02 mg/kg/hr *
    - Hydromorphone (Dilaudid) at 0.005 mg/kg/hr
  - Soft limits:
    - Fentanyl (FE): 4 mcg/kg/hr
    - Morphine (MS): 0.3 mg/kg/hr
    - Hydromorphone (HM): 0.05 mg/kg/hr
  - Hard limits:
    - Fentanyl: 6 mcg/kg/hr
    - Morphine: 0.5 mg/kg/hr
    - Hydromorphone: 0.08 mg/kg/hr
- Steps to calculate infusion rate conversion:
  1. Calculate equianalgesic dose using following conversion ratios:
     - FE: MS = 1:100 (1 mcg Fentanyl = 100 mcg of morphine)
     - HM: MS = 1: 6.7 (1 mg hydromorphone = 6.7 mg morphine)
     - FE: HM = 1:15 (1 mcg Fentanyl = 15 mcg hydromorphone)
  2. Calculate 50% dose reduction
  3. Rescue dose (bolus)
     1. Fentanyl: dose equal to 1 hour of infusion given IV q1h prn
     2. Morphine/hydromorphone: dose equal to ½ hour of infusion given IV q1h prn
  4. Nurses to perform SBS and WAT scores (intubated) & titrate infusion per sedation protocol

*Consider naloxone (Narcan) infusion for following morphine infusion side effects: Itching, nausea, constipation, urinary retention
-Dosing:
- Start infusion at 0.25 mcg/kg/hr
- Titrate by 20% q30min to goal of amelioration of side effects
- Dosing range 0.25-1 mcg/kg/hr

- Conversion calculation examples:
  - Fentanyl ➔ Morphine:
    - Fentanyl 5 mcg/kg/hr X 100 = 500 mcg/kg/hr = 0.5 mg/kg/hr
    - 50% dose reduction: 0.5 mg/kg/hr X 0.5 = 0.25 mg/kg/hr of morphine
  - Morphine ➔ Hydromorphone:
    - Morphine infusion 0.3 mg/kg/hr X 1/6.7= 0.045 mcg/kg/hr
    - 50% dose reduction: 0.045 mg/kg/hr X 0.5 = 0.022 mg/kg/hr hydromorphone
  - Hydromorphone ➔ Fentanyl:
    - Hydromorphone infusion 0.03 mg/kg/hr = 30 mcg/kg/hr X 1/15= 2 mcg/kg/hr
    - 50% dose reduction: 2 mcg/kg/hr x 0.5 = 1 mcg/kg/hr fentanyl

SEDATIVE ROTATION
PICU SEDATION PROTOCOL

- Decision to change sedative infusion to be made on daytime rounds by PICU team
  - Goal to notify pharmacy by 11am of need for change
- Sedative infusion rate:
  - Starting dose:
    - Midazolam 0.5-1 mcg/kg/min
    - Pentobarbital 0.5 mg/kg/hr
  - Soft limits:
    - Midazolam: 4 mcg/kg/min
    - Pentobarbital 2 mg/kg/hr
  - Hard limits:
    - Midazolam: 6 mcg/kg/min
    - Pentobarbital 4 mg/kg/hr
- Infusion rotation protocol:
  1. Transition dosing:
     1. Midazolam to Pentobarbital:
        1. Start pentobarbital infusion at 0.5 mg/kg/hr
        2. Midazolam infusion to be decreased by 25% every 6 hours until off
        3. If increased agitation/withdrawal, increased pentobarbital per protocol
           1. Leave midazolam infusion rate the same and re-evaluate in 6 hours
           2. If patient at SBS goal in 6 hours, restart scheduled midazolam wean
     2. Pentobarbital to Midazolam:
        1. Start midazolam infusion at 1 mcg/kg/min
        2. Pentobarbital infusion to be decreased by 25% every 6 hours until off
        3. If increased agitation/withdrawal, increased midazolam per protocol
           1. Leave pentobarbital infusion rate the same and re-evaluate in 6 hours
           2. If patient at SBS goal in 6 hours, restart scheduled pentobarbital wean
  2. Rescue dose (bolus)
     1. Midazolam: dose equal to 1 hour of infusion given IV q1h prn
     2. Pentobarbital: dose equal to ½ hour of infusion given IV q1h prn
  3. Nurses to perform SBS and WAT scores (intubated) & titrate infusions per sedation protocol

DEXMEDETOMIDINE (Precedex)
PICU SEDATION PROTOCOL

- Decision to change sedative infusion to be made on daytime rounds by PICU team
- Sedative infusion rate:
  - Starting dose: 0.25 mcg/kg/hr
  - Soft limit: 1 mcg/kg/hr or 7 days
  - Hard limit: 1.5 mcg/kg/hr or 14 days
- If benzodiazepine or barbituate infusion added for sedation and goal SBS achieved, dexmedetomidine infusions should be weaned to a goal of off
  - 5-7 days: wean by 0.1 mcg/kg/hr q8h
  - 7-14 days: wean by 0.1 mcg/kg/hr q12h
  - >14 days: wean by 0.1 mcg/kg/hr q24h
- Extubation & Withdrawal:
  - Infusion duration:
    - <5 days: no enteral clonidine, can d/c infusion
    - 5-7 days: Wean infusion by 0.1 mcg/kg/hr q8h until infusion at 0.25-0.3 mcg/kg/hr then convert to enteral clonidine
    - 7-14 days: Wean infusion by 0.1 mcg/kg/hr q12h until infusion at 0.25-0.3 mcg/kg/hr then convert to enteral clonidine
    - >14 days: Wean infusion by 0.1 mcg/kg/hr q24h until infusion 0.25-0.3 mcg/kg/hr then convert to enteral clonidine
  - Enteral clonidine conversion:
    - Once infusion at 0.25-0.3 mcg/kg/hr covert to enteral clonidine dose of 2.5 mcg/kg/dose PO/NG q8h.
    - Decrease infusion by 0.1 mcg/kg/hr with each clonidine dose until infusion is off

BARBITURATE ENTERAL CONVERSION & WITHDRAWAL
PICU SEDATION PROTOCOL

- Phenobarbital to be initiated on day of extubation.
- Dosing:
  - Scheduled:
    - IV Pentobarbital to (IV/PO/NG) phenobarbital
      - Pentobarbital infusion rate: 1-2 mg/kg/hr
        - Load patient with phenobarbital 4mg/kg/dose q6h x2 doses
        - Discontinue pentobarbital infusion when 1st loading dose given
        - Start phenobarbital 1.3 mg/kg/dose given q12h
      - Pentobarbital infusion rate: 2-3 mg/kg/hr
        - Load patient with phenobarbital 7.5mg/kg/dose q6h x 2 doses
        - Discontinue pentobarbital infusion when 1st loading dose given
        - Start phenobarbital 2.5 mg/kg/dose given q12h
      - Pentobarbital infusion rate: 3-4 mg/kg/hr
        - Load patient with phenobarbital 10mg/kg/dose q6h x 2 doses
        - Discontinue pentobarbital infusion when 1st loading dose given
        - Start phenobarbital 3.3 mg/kg/dose given q12h
    - Weaning Phenobarbital:
      - When patient receiving 0-1 PRNs in 24 hour period start wean of phenobarbital
        - Wean by 20% every 3 day until off
  - PRN dosing:
    - IV Pentobarbital infusion rate: 1-2 mg/kg/hr
      - Pentobarbital 0.25 mg/kg/dose IV q6h PRN
    - IV Pentobarbital infusion rate: 2-3 mg/kg/hr
      - Pentobarbital 0.5 mg/kg/dose IVq6h PRN
    - IV Pentobarbital infusion rate: 3-4 mg/kg/hr
      - Pentobarbital 1 mg/kg/dose IV q6h PRN

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PICU SEDATION PROTOCOL
Additional Information Section

Patient Exceptions to the Protocol
PICU SEDATION PROTOCOL

- Decision to be made by PICU Attending
- Patient criteria that may indicate exclusion from protocol:
  - Status epilepticus
  - Status asthmaticus
  - Post-cardiac arrest (1st 24 hours)
  - Hemodynamic instability
    - Once hemodynamic stability achieved, patient should be placed back on sedation protocol
  - Intracranial hypertension
  - Trauma patient
  - Patient requiring only prn sedation
  - Documented allergy (not side effect)
  - Precedex use for arrhythmia control
  - Ketamine infusion
    - Other narcotic/sedation infusions can still be on protocol
  - ECMO, CRRT/HD
- Patient characteristics that do NOT warrant exclusion from protocol:
  - Physician preference
  - Paralytic infusion
  - HFOV
  - Difficult to sedate patients
  - Non-naïve patients
  - Post-op cardiac patients
  - Delirium
- Must be documented in EPIC as an order for "Sedation Protocol Exemption"
  - Requires documentation as to "why" patient exempted
    - Order will be required to renew every 24 hours to maintain patient exemption
  - Cannot be given as verbal order

PROCEDURAL BOLUSES
PICU SEDATION PROTOCOL

- Procedural boluses include:
  - Routine/scheduled cares
  - Sedation for line &/or drain placement or removal
  - Any bedside procedure
  - PIV placement
  - Dressing changes
  - Baths
  - Suctioning
  - Bladder irrigation
  - Imaging (chest xray, CT, MRI, echo, US)
- Boluses given for the above indications must be charted as being given for "procedure"

NON-PHARMACOLOGIC MEASURES
PICU SEDATION PROTOCOL

- Implement home comfort measures (toys, music, pictures, etc) with help of family
- Maintain home sleep/wake patterns as able
- Ensure families are aware of realistic pain & sedation goals and enlist their help in providing maximum comfort
- Modify environment (light & noise)
- Thermoregulation: • Room temperature • Application of warm packs/ blankets as needed
- Positioning: swaddling (<6 mo old), position on side or tummy
- Therapeutic touch consult
- Oral pacifiers
- Evaluate for confounding factors:
  - Teething? • Hunger? • Full bladder? • Constipation? • Creases in blankets (under)?
- Sucrose (<6mo old)
- Distraction: • Child life consult • Favorite music or movies

Adjunct Pharmacologic Measures:

- Acetaminophen or Ibuprofen for pain if no contraindications
- Diphenhydramine prn for itching, discomfort, nausea or vomiting
- Consider melatonin for sleep