INSTRUCTIONS FOR NEONATAL ICU (NICU) WARD (3C) DRUGS (DOSAGE, ADMINISTRATION, PRECAUTIONS AND MONITORING)

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1.Adrenaline Injection (1 mg/ml) Ampoule

Epinephrine 1:1000 = 1 mg/mL and is most commonly used IM

Epinephrine 1:10,000 = 0.1 mg/mL and is used IV

☒ Dosage:

✓ **Asystole/pulseless arrest, pulseless VT/VF (after failed defibrillation attempts), Bradycardia (symptomatic; unresponsive to atropine or pacing): :** Infants, Children:

IV, Intraosseous: 0.01 mg/kg (0.1 mL/kg of **0.1 mg/mL** solution) (maximum single dose: 1 mg) every 3 to 5 minutes until return of spontaneous circulation

Endotracheal: 0.1 mg/kg (0.1 mL/kg of **1 mg/mL** solution) (maximum single dose: 2.5 mg) every 3 to 5 minutes until IV/Intraosseous access established or return of spontaneous circulation.

Note: IV and Intraosseous are the preferred methods of administration.

✓ **Cardiac output maintenance/stabilization, postresuscitation :** Infants, Children: Continuous IV/Intraosseous infusion: 0.1 to 1 mcg/kg/minute; doses <0.3 mcg/kg/minute generally produce beta-adrenergic effects and higher doses (>0.3 mcg/kg/minute) generally produce alpha-adrenergic vasoconstriction; titrate dosage to desired effect.

✓ **Hypersensitivity reaction (eg, anaphylaxis):** Infants, Children:**Note:** SubQ administration results in slower absorption and is less reliable. IM administration in the anterolateral aspect of the middle third of the thigh is preferred in the setting of anaphylaxis

General dosing or health care settings: IM (preferred), SubQ: 0.01 mg/kg (0.01 mL/kg of **1 mg/mL** solution) not to exceed 0.3 to 0.5 mg every 5 to 15 minutes.

✓ **Hypotension/shock, fluid-resistant:** Infants, Children:

Continuous IV infusion: 0.1 to 1 mcg/kg/minute; rates >0.3 mcg/kg/minute associated with vasopressor activity; doses up to 5 mcg/kg/minute may rarely be necessary; for fluid-resistant shock, may be combined with inotropic support .

SubQ: 0.01 mg/kg (0.01 mL/kg of 1 mg/mL solution) (maximum single dose: 0.5 mg) every 20 minutes for 3 doses .

☒ Administration:

IV infusion: 1 mg in 250 mL (concentration: 4 mcg/mL) of D5W or NS.

IV: **central line** is preferred in continuous infusion. IV infusions require an infusion pump. If central line not available, as a temporary measure, may administer through a large vein. Avoid use of ankle veins, leg veins in elderly patients, or leg veins in those suffering from occlusive vascular diseases.

Vesicant; ensure proper needle or catheter placement prior to and during infusion; avoid extravasation. **Extravasation management**: stop infusion immediately and disconnect (leave cannula/needle in place); gently aspirate extravasated solution (do NOT flush the line); remove needle/cannula; elevate extremity. Initiate phentolamine (or alternative antidote). Apply dry warm compresses.

Phentolamine: Dilute 5 to 10 mg in 10 to 20 mL NS and administer into extravasation site as soon as possible after extravasation; may readminister if patient remains symptomatic.

- **SubQ** administration results in slower absorption and is less reliable.

- **Endotracheal**: Dilute in NS or sterile water. Absorption may be greater with sterile water. Stop compressions, spray drug quickly down tube. Follow immediately with several quick insufflations and continue chest compressions. May cause false-negative reading with exhaled CO_2 detectors; use second method to confirm tube placement if CO_2 is not detected.

☒ Precautions:

- Rapid IV administration may cause death from cerebrovascular hemorrhage or cardiac arrhythmias. However, rapid IV administration during pulseless arrest is necessary.

- IM administration in the anterolateral aspect of the middle third of the thigh is preferred in the setting of anaphylaxis. Do not administer repeated injections at the same site (tissue necrosis may occur). Monitor for signs/symptoms of injection-site infection.

- Correct blood volume depletion before administering adrenaline

- Adrenaline is sensitive to light and air. Protection from light is recommended. Oxidation turns drug pink, then a brown color. Solutions should not be used if they are discolored or contain a precipitate.

- Lacerations, bent needles, and embedded needles have been reported in young children who are uncooperative during injection for hypersensitivity reaction. To minimize risk, hold the child's leg firmly in place and limit movement prior to and during injection.

☒ **Monitoring Parameters:** HR, BP (invasive blood pressure monitoring and central venous pressure monitoring recommended while receiving continuous infusion); monitor site of infusion for blanching/extravasation.

2. Calcium Gluconate 10 % (10 ml)

☒ Dosage:

Pediatric: Note: One gram of calcium gluconate salt is equal to 93 mg of elemental calcium.**Dosages expressed in terms of the calcium gluconate salt are based on a solution concentration of 100 mg/mL (10%) containing 0.465 mEq (9.3 mg)/mL elemental calcium, except where noted.**

- ✓ **Hypocalcemia:** General dosing: Infants, Children: IV: 200 to 500 mg/kg/day as a continuous infusion or in 4 divided doses (maximum dose: 1,000 mg/dose [Infants, Children]; 2,000 to 3,000 mg/dose [Adolescents]) .

  Symptomatic (ie, seizures, tetany): Infants, Children: IV: 100 to 200 mg/kg/dose over 5 to 10 minutes; usual adult dose: 1,000 to 2,000 mg/dose; may repeat after 6 hours or follow with a continuous infusion of 200 to 800 mg/kg/day.

- ✓ **Cardiac arrest or cardiotoxicity in the presence of hyperkalemia, hypocalcemia, or hypermagnesemia:** Infants, Children: IV, intraosseous: 60 to 100 mg/kg/dose (maximum: 3,000 mg/dose); may repeat in 10 minutes if necessary; if effective, consider IV infusion

- ✓ **Parenteral nutrition, maintenance requirement:** IV:

Infants and Children (≤50 kg): **Note:** Dose expressed as **elemental calcium:** 0.5 to 4 **mEq elemental calcium**/kg/day

☒ Preparation for Administration:

- IV: Observe the vial for the presence of particulates. If particulates are observed, place vial in a 60°C to 80°C water bath with occasional agitation until solution is clear; shake vigorously; cool to room temperature before use. Do not use vial if particulates do not dissolve. Prior to administration, dilute in D5W or NS and use immediately:

- Bolus: dilute to a concentration of 10 to 50 mg/mL. Continuous infusion: dilute to a concentration of 5.8 to 10 mg/mL.

☒ Administration: IV

- Administer bolus slowly (not to exceed 100 mg/minute in pediatric patients).

- For continuous infusions, adjust rate as needed based on serum calcium levels.

- Due to the potential presence of particulates, use a 0.22 micron inline filter for IV administration (1.2 micron filter if admixture contains lipids).

- Not for IM administration. In acute situations of symptomatic hypocalcemia, infusions over 5 to 10 minutes have been described in pediatric patients .

- **Vesicant**; ensure proper needle or catheter placement prior to and during IV infusion. Avoid extravasation. **Extravasation management:** If extravasation occurs, stop infusion immediately and disconnect (leave needle/cannula in place); gently aspirate extravasated solution (do **NOT** flush the line).

  Early/acute calcium extravasation: Initiate hyaluronidase antidote; remove needle/cannula; apply dry cold compresses; elevate extremity. **Hyaluronidase**: Intradermal or SubQ: Inject a total of 1 to 1.7 mL (15 units/mL) as five separate 0.2 to 0.3 mL injections (using a 25-gauge needle) into area of extravasation at the leading edge in a clockwise manner. May also inject hyaluronidase through the catheter that caused the infiltration.

  Delayed calcium extravasation: Closely monitor site; most calcifications spontaneously resolve. However, if a severe manifestation of calcinosis cutis occurs, may initiate sodium thiosulfate antidote. **Sodium thiosulfate:** IV: 12.5 g over 30 minutes; may increase gradually to 25 g 3 times per week; monitor for non-anion gap acidosis, hypocalcemia, severe nausea.

☒ Precautions :

- Use with caution in patients with severe hyperphosphatemia as elevated levels of phosphorus and calcium may result in soft tissue and pulmonary arterial calcium-phosphate precipitation.

- Hypomagnesemia is a common cause of hypocalcemia; therefore, correction of hypocalcemia may be difficult in patients with concomitant hypomagnesemia. Evaluate serum magnesium and correct hypomagnesemia (if necessary), particularly if initial treatment of hypocalcemia is refractory.

☒ Monitoring Parameters:

Serum calcium every 4 hours (during intermittent infusion) or every 1 to 4 hours (during continuous infusion); albumin, phosphate, and magnesium; vitals and ECG when appropriate. Monitor infusion site.

3. Diazepam(10 mg) Ampoule

☒ Dosage: Pediatric:

- ✓ **Muscle spasm associated with tetanus:** *IV, IM:* Infants >30 days and Children <5 years:1 to 2 mg/dose every 3 to 4 hours as needed.
- ○ **Status epilepticus:** *IV:* 0.1 to 0.3 mg/kg (maximum dose: 10 mg) given over ~2 minutes; may repeat dose after 5 to 10 minutes OR *IV*: 0.15 to 0.2 mg/kg (maximum dose: 10 mg); may repeat once OR *IV:* 0.15 mg/kg (maximum dose: 10 mg) given at a rate of ≤5 mg/minute; may repeat in 5 minutes.

☒ Administration:

- Administer undiluted by slow IV push; do not mix with other solutions or medications.
- Rapid injection may cause respiratory depression or hypotension. In infants and children, do not exceed 1 to 2 mg/minute IV push.
- Do not administer through small veins (eg, dorsum of hand/wrist). Avoid intra-arterial administration.
- Continuous infusion is not recommended because of precipitation in IV fluids and absorption of drug into infusion bags and tubing.
- Vesicant; ensure proper needle or catheter placement prior to and during infusion; avoid extravasation. **Extravasation management:** If extravasation occurs, stop IV administration immediately and disconnect (leave cannula/needle in place); gently aspirate extravasated solution (do **NOT** flush the line); remove needle/cannula; elevate extremity. Apply dry cold compresses.

☒ Precautions:

- It has been associated with anterograde amnesia.

- Patients must be cautioned about performing tasks that require mental alertness (eg, operating machinery, driving).

- Use with caution in patients with respiratory disease; a lower dose is recommended for chronic respiratory insufficiency.

- Concomitant use with opioids may result in profound sedation, respiratory depression, coma, and death; limit dosages and durations to the minimum required. Follow patients for signs and symptoms of respiratory depression and sedation.

- Chronic use of this agent may increase the perioperative benzodiazepine dose needed to achieve desired effect.

- Use caution when reducing dose or withdrawing therapy; decrease slowly and monitor for withdrawal symptoms.

☒ Monitoring Parameters:

HR, RR, BP, and mental status; liver enzymes and CBC with long-term therapy, depth of sedation in critically-ill patients.

4 . Dobutamine 250 mg injection

☒ Dosage:

✓ **Maintain cardiac output and for post-resuscitation stabilization:** Infants, Children: Continuous IV or Intraosseous infusion: Initial: 0.5 to 1 mcg/kg/minute, titrate gradually every few minutes until desired response achieved; usual range: 2 to 20 mcg/kg/minute.

☒ Administration:

- IV infusion: dilute in D5W or NS.
- Usual Infusion Concentrations for pediatric: 1,000 mcg/mL, 2,000 mcg/mL, or 4,000 mcg/mL.

- Always administer via infusion device; administer into large vein.

☒ Precautions:

- Ensure that ventricular rate is controlled in atrial fibrillation/flutter before initiating; may increase ventricular response rate.
- May cause dose-related increases in heart rate.
- Correct electrolyte disturbances, especially hypokalemia or hypomagnesemia, prior to use and throughout therapy to minimize the risk of arrhythmias.
- Correct hypovolemia first to optimize hemodynamics.

☒ Monitoring Parameters

BP, ECG, HR, CVP, RAP, MAP

5. Dopamine (40 mg/ ml) ampoule(5 ml)

☒ Dosage:

- ✓ **Hemodynamic support:** IV infusion: 2 to 20 mcg/kg/minute; titrate to desired response (maximum: 50 mcg/kg/minute); infusion may be gradually increased by 5 to 10 mcg/kg/minute increments until optimal response is obtained .

☒ Administration:

- IV administer as a continuous infusion with the use of an infusion pump.
- Administer into large vein to prevent the possibility of extravasation (central line administration); monitor continuously for free flow; use infusion device to control rate of flow; administration into an umbilical arterial catheter is not recommended.
- When discontinuing the infusion, gradually decrease the dose of dopamine (sudden discontinuation may cause hypotension).

- **Vesicant**; ensure proper needle or catheter placement prior to and during infusion; avoid extravasation.

Extravasation management: If extravasation occurs, stop infusion immediately and disconnect (leave cannula/needle in place); gently aspirate extravasated solution (do **NOT** flush the line); remove needle/cannula; elevate extremity. Initiate phentolamine antidote. Apply dry warm compresses.

Phentolamine: Dilute 5 to 10 mg in 10 to 20 mL NS and administer into extravasation site as soon as possible after extravasation; may readminister if patient remains symptomatic.

☒ Precautions:

- May cause increases in heart rate, increasing the risk of tachycardia and other tachyarrhythmias including ventricular arrhythmias.
- Correct electrolyte disturbances, especially hypokalemia or hypomagnesemia, prior to use and throughout therapy to minimize the risk of arrhythmias.

- Protect from light.

☒ Monitoring Parameters:

BP, ECG, HR, CVP, RAP, MAP

6 . Flumazenil 0.5 mg amp

☒ Dosage:

- ✓ **Reversal of benzodiazepine when used in conscious sedation:** Children ≥1 year and Adolescents: IV: Initial dose: 0.01 mg/kg (maximum dose: 0.2 mg) given **over 15 seconds**. Repeat doses (maximum: 4 doses): If the desired level of consciousness is not obtained, 0.01 mg/kg (maximum dose: 0.2 mg) repeated at 1-minute intervals. **Maximum** total cumulative dose: 1 mg or 0.05 mg/kg (whichever is lower). **Mean total dose**: 0.65 mg (range: 0.08 to 1 mg)

☒ Administration: Administer in freely-running IV into large vein.

- Store at 20°C to 25°C .Once drawn up in the syringe or mixed with D5W, LR, or NS, use within 24 hours. Discard any unused solution after 24 hours.

☒ Precautions:

- Does not consistently reverse amnesia; patient may not recall verbal instructions after procedure.

-Patients must be cautioned about performing tasks which require mental alertness (eg, operating machinery or driving) for 24 hours after discharge.

- Flumazenil is not a substitute for evaluation of oxygenation. Establishing an airway and assisting ventilation, as necessary, is always the initial step in overdose management.

- Benzodiazepine reversal may result in seizures; seizures may occur more frequently in patients on benzodiazepines for long-term sedation or following tricyclic antidepressant overdose. Dose should be individualized and practitioners should be prepared to manage seizures.

☒ Monitoring Parameters

Monitor for return of sedation, respiratory depression, benzodiazepine withdrawal, and other residual effects of benzodiazepines for at least 2 hours and until the patient is stable and re-sedation is unlikely.

7 . Furosemide (20 mg/ 2ml) ampoule(2 ml)

☒ Dosage:

- ✓ **Edema:** Infants, Children: IM, IV: Initial: 1 mg/kg/dose; if response not adequate, may increase dose in increments of 1 mg/kg/dose and administer not sooner than 2 hours after previous dose, until a satisfactory response is achieved; may administer maintenance dose at intervals of every 6 to 12 hours; maximum dose: 6 mg/kg/dose.

☒ Preparation for Administration:

IV infusion solution may be mixed in NS or D5W solution. May also be diluted for infusion to 1 to 2 mg/mL (maximum: 10 mg/mL).

☒ Administration:

- In children, a maximum rate of 0.5 mg/kg/minute has been recommended.

- May administer IM.

- Protect from light. Exposure to light may cause discoloration; do not use furosemide solutions if they have a yellow color.

- Refrigeration may result in precipitation or crystallization; however, resolubilization at room temperature or warming may be performed without affecting the drug's stability.

- Infusion solution in D5W, NS, or LR is stable for 24 hours at room temperature.

☒ Precautions:

- Close medical supervision and dose evaluation are required. Watch for and correct electrolyte disturbances; adjust dose to avoid dehydration. When electrolyte depletion is present, therapy should not be initiated unless serum electrolytes, especially potassium, are normalized.

- Asymptomatic hyperuricemia has been reported with use.

- Monitor fluid status and renal function in an attempt to prevent oliguria, azotemia, and reversible increases in BUN and creatinine; close medical supervision of aggressive diuresis required.

- Rapid IV administration, severe renal impairment, excessive doses, hypoproteinemia, and concurrent use of other ototoxins are associated with ototoxicity.

- Photosensitization may occur.

- Avoid in patients with Sulfonamide (“sulfa”) allergy.

- If given the morning of surgery, furosemide may render the patient volume depleted and blood pressure may be labile during general anesthesia.

- Pediatric: May lead to nephrocalcinosis or nephrolithiasis in premature infants and in infants and children <4 years of age with chronic use. May prevent closure of patent ductus arteriosus in premature infants.

☒ Monitoring Parameters:

Monitor I & O and weight daily; BP, orthostasis; serum electrolytes, renal function; monitor hearing with high doses or rapid IV administration.

8. Heparin sodium (5000 IU/ ml) vial

☒ Dosage:

✓ **Thrombosis, treatment:** *Systemic heparinization:* Infants: IV: Initial loading dose: 75 units/kg over 10 minutes; then initial continuous maintenance infusion at: 28 units/kg/hour; adjust dose to maintain an anti-Xa activity of 0.35 to 0.7 units/mL or an aPTT range that correlates to this anti-Xa range or a protamine titration range of 0.2 to 0.4 units/mL .

☒ Administration:

- Continuous IV infusion: Infuse via infusion pump. Do **not** administer IM due to pain, irritation, and hematoma formation.

- Heparin lock: Inject via injection cap using positive pressure flushing technique. Heparin lock flush solution is intended only to maintain patency of IV devices and is **not** to be used for anticoagulant therapy.

- Central venous catheters: Must be flushed with heparin solution when newly inserted, daily (at the time of tubing change), after blood withdrawal or transfusion, and after an intermittent infusion through an injectable cap. A volume of at least 10 mL of blood should be removed and discarded from a heparinized line before blood samples are sent for coagulation testing.

☒ Precautions :

- Use with caution in patients with an increased risk of bleeding.
- Monitor for hyperkalemia.
- Heparin-induced thrombocytopenia (HIT) may occur. Monitor platelets closely; discontinue therapy and consider alternatives if platelets are <100,000/mm^3 and/or thrombosis develops. HIT may be delayed and can occur up to several weeks after discontinuation of heparin.

☒ Monitoring Parameters:

- **Hemoglobin, hematocrit, signs of bleeding; fecal occult blood test**; **aPTT**(prior to heparin therapy, 6 hours after initiation, and 6 hours after any dosage change, and should be used to adjust the heparin infusion until the aPTT exhibits a therapeutic level. When two consecutive aPTT values are therapeutic, subsequent measurements may be made every 24 hours, and if necessary, dose adjustment carried out.
- **Platelet** counts should be routinely monitored (eg, every 2 to 3 days on days 4 to 14 of heparin therapy) when the risk of HIT is >1% (eg, receiving therapeutic dose heparin, postoperative antithrombotic prophylaxis), if the patient has received heparin or low molecular weight heparin (eg, enoxaparin) within the past 100 days, if pre-exposure history is uncertain, or if anaphylactoid reaction to heparin occurs. When the risk of HIT is <1% (eg, medical/obstetrical patients receiving heparin flushes), routine platelet count monitoring is not recommended.

- Institution-specific and indication-specific nomograms should be consulted for dose adjustment.

9 . Hydralazine 20mg amp

☒ Dosage:

- ✓ **Hypertensive emergency/urgency:** IM, IV: Initial: 0.1 to 0.2 mg/kg/**dose** every 4 to 6 hours; increase as required to suggested usual range: 0.2 to 0.6 mg/kg/**dose** every 4 to 6 hours as needed; maximum dose: 20 mg/dose .

Dosing in renal impairment: Pediatric: IV: 0.1 to 0.2 mg/kg/**dose** every 6 hours; maximum dose: 20 mg/dose

GFR >50 mL/minute/1.73 m^2: No adjustment necessary

GFR 10 to 50 mL/minute/1.73 m^2: Administer every 8 hours

GFR <10 mL/minute/1.73 m^2: Administer every 12 to 24 hours

Intermittent hemodialysis: Administer every 12 to 24 hours

Peritoneal dialysis (PD): Administer every 12 to 24 hours

Continuous renal replacement therapy (CRRT): Administer every 8 hours

☒ Administration: undiluted as IM injection. **Also** undiluted as slow IV push. Maximum rate in children: 5 mg/minute.

☒ Precautions:

- May cause a drug-induced lupus-like syndrome including: glomerulonephritis, especially in patients receiving higher doses.

  - Postural hypotension may occur.

- Use is contraindicated in patients with coronary artery disease (CAD)
- Use with caution in patients with mitral valvular disease; may increase pulmonary artery pressure in these patients. Use is contraindicated in patients with mitral valve rheumatic heart disease.
- Use with caution in patients with advanced renal impairment; dosage adjustment recommended

☒ Monitoring Parameters:

- BP , HR,CBC

10 . Hydrocortisone 100 mg vial

☒ Dosage:

Pediatric

- ✓ **Anti-inflammatory or immunosuppressive:** *Infants and Children:* IM, IV: Initial: 0.56 to 8 mg/kg/day or 20 to 240 mg/m^2/day in 3 or 4 divided doses. Alternate dosing: 1 to 5 mg/kg/day **or** 30 to 150 mg/m^2/day divided every 12 to 24 hours. *Adolescents:* IM, IV, SubQ : 15 to 240 mg every 12 hours .
- ✓ **Septic shock:** Infants, Children, and Adolescents: IV (hydrocortisone sodium succinate): 50 to 100 mg/m^2/day ; in some cases, doses may be titrated up to 50 mg/**kg**/day for shock reversal; however, efficacy data variable with the higher doses .

☒ Preparation for Administration:

- IV bolus or IM administration: Reconstitute 100 mg vials with bacteriostatic water or bacteriostatic sodium chloride (not >2 mL).

- IV infusion administration: Add reconstituted solutions to an appropriate volume of D5W, NS, or D5NS (100 to 1,000 mL for a 100 mg solution) .In cases where administration of a small volume of fluid is desirable, 100 to 3,000 mg of hydrocortisone may be added to 50 mL of D5W or NS.

- Reconstituted solutions are stable for 3 days at 20°C to 25°C (68°F to 77°F); protect from light. Solutions prepared for IV infusion are stable for at least 4 hours.

☒ Administration:

IM: Avoid injection into deltoid muscle (high incidence of subcutaneous atrophy). Dermal and/or subdermal skin depression may occur at injection site.

IV: Dermal and/or subdermal skin depression may occur at injection site.

IV bolus: Administer undiluted over at least 30 seconds; for large doses (≥500 mg), administer over 10 minutes.

IV intermittent infusion: Further dilute in a compatible fluid and administer over 20 to 30 minutes.

☒ Precautions :

- Prolonged use of corticosteroids may increase the incidence of secondary infection, mask acute infection (including fungal infections), prolong or exacerbate viral infections.
- May cause hypercortisolism or suppression of hypothalamic-pituitary-adrenal (HPA) axis, particularly in younger children or in patients receiving high doses for prolonged periods.
- Acute myopathy has been reported with high dose corticosteroids, usually in patients with neuromuscular transmission disorders; may involve ocular and/or respiratory muscles; monitor creatine kinase; recovery may be delayed.
- Corticosteroid use may cause psychiatric disturbance.

-Use with caution in patients with HF and/or hypertension; use has been associated with fluid retention, electrolyte disturbances, and hypertension.
- May alter glucose production/regulation leading to hyperglycemia.
- Use with caution in patients with GI diseases (diverticulitis, fresh intestinal anastomoses, active or latent peptic ulcer, ulcerative colitis, abscess or other pyogenic infection) due to perforation risk.
- High-dose corticosteroids should not be used for the management of head injury.
- Use with caution in patients with cataracts and/or glaucoma; increased intraocular pressure, open-angle glaucoma, and cataracts have occurred with prolonged use.
- May affect growth velocity; growth should be routinely monitored in pediatric patients.
- Withdraw therapy with gradual tapering of dose.

☒ Monitoring Parameters:

Serum glucose, electrolytes; BP, weight, presence of infection; monitor IOP with therapy >6 weeks; bone mineral density; assess HPA axis suppression (eg, ACTH stimulation test, morning plasma cortisol test, urinary free cortisol test); growth in pediatric patients.

11. Magnesium Sulfate 10% (10ml) ampoule

☒ Dosage:

Note: 1 g of magnesium sulfate = 98.6 mg elemental magnesium = 8.12 mEq elemental magnesium = magnesium 4.06 mmol

- ✓ **Hypomagnesemia, treatment: Note:** Treatment depends on severity and clinical status: IV, I.O.: 25 to 50 mg/kg/dose over 10 to 20 minutes (over several minutes for torsade de pointes); maximum single dose: 2000 mg .
- ✓ **Hypomagnesemia, prevention (parenteral nutrition supplementation) :**IV:
  ≤50 kg: 0.3 to 0.5 mEq elemental magnesium/kg/day
  >50 kg: 10 to 30 mEq elemental magnesium daily
- ✓ **Asthma (acute severe exacerbations) :** IV: Children and Adolescents: 25 to 75 mg/kg (maximum: 2000 mg) as a single dose over 20 to 60 minutes; recommended as adjunctive therapy for severe life-threatening exacerbations and for exacerbations that remain severe after 1 hour of intensive conventional therapy.

☒ Preparation for Administration:

IV: Dilute to ≤20% in a compatible solution (eg, D5W, NS) for IV infusion.

☒ Administration:

- Must be diluted to a ≤20% solution for IV infusion and may be administered IV push, IVPB, or as a continuous IV infusion, or intraosseous (IO).

- When giving IV push, must dilute first and should generally not be given any faster than 150 mg/minute.

- Maximal rate of infusion (routine administration for hypomagnesemia prevention/treatment): Up to 50% of an IV dose may be eliminated in the urine, therefore, slower administration may improve retention (maximum rate: 1 g/hour in asymptomatic hypomagnesemia). For doses <6 g, infuse over 8 to 12 hours and for larger doses infuse over 24 hours if patient is asymptomatic. If patient is severely symptomatic (or has conditions such as preeclampsia or eclampsia) more aggressive therapy (≤4 g over 4 to 5 minutes) may be required; patients should be closely monitored .

- **IM**: Must be diluted prior to administration for children (Children: ≤20% diluted solution)

☒ Precautions:

- Use with extreme caution in patients with myasthenia gravis or other neuromuscular disease.

- Use with caution in patients with renal impairment; accumulation of magnesium may lead to magnesium intoxication.

- Concurrent hypokalemia or hypocalcemia can accompany a magnesium deficit. Hypomagnesemia is frequently associated with hypokalemia and requires correction in order to normalize potassium.

- Magnesium toxicity can lead to fatal cardiovascular arrest and/or respiratory paralysis.

☒ Monitoring Parameters:

ECG, vital signs, deep tendon reflexes; magnesium concentrations if frequent or prolonged dosing required particularly in patients with renal dysfunction, calcium, and potassium concentrations; renal function.

12. Midazolam(15 mg/3ml) Ampoule

☒ Dosage:

Note: The dose of midazolam needs to be individualized based on the patient's age, underlying diseases, and concurrent medications. Decrease dose (by ~30%) if opioids or other CNS depressants are administered concomitantly. Children <6 years may require higher doses and closer monitoring than older children; in children with obesity, calculate dose based on ideal body weight.

- ✓ **Sedation/Anxiolysis/Amnesia (preoperative/procedural):** Infants ≥6 months, Children, and Adolescents ≤16 years:
  - ***IM:*** 0.1 to 0.15 mg/kg 30 to 60 minutes before surgery or procedure; range: 0.05 to 0.15 mg/kg; doses up to 0.5 mg/kg have been used in more anxious patients; maximum total dose: 10 mg
  - ***IV:*** Infants <6 months: Limited information is available in nonintubated infants; dosing recommendations not clear; infants <6 months are at higher risk for airway obstruction and hypoventilation; titrate dose in small increments to desired effect
  - Infants 6 months to Children 5 years: Initial: 0.05 to 0.1 mg/kg; total dose of 0.6 mg/kg may be required; maximum total dose: 6 mg
  - Children 6 to 12 years: Initial: 0.025 to 0.05 mg/kg; total doses of 0.4 mg/kg may be required; maximum total dose: 10 mg
  - Children 12 to 16 years: Refer to adult dosing; maximum total dose: 10 mg

- ✓ **Sedation in mechanically-ventilated patients:** Infants, Children, and Adolescents: IV: Loading dose: 0.05 to 0.2 mg/kg, followed by initial continuous infusion: 0.06 to 0.12 mg/kg/**hour** (1 to 2 **mcg**/kg/minute); range in clinical trials: 0.024 to 0.564 mg/kg/**hour** (0.4 to 9.4 **mcg**/kg/minute) .
- ✓ **Seizures, acute treatment:** Children and Adolescents: IM: 0.2 mg/kg (maximum dose: 6 mg); may repeat every 10 to 15 minutes .
- ✓ **Status epilepticus:** Infants, Children, and Adolescents: Limited data available:
  - *IM:* **Note:** Midazolam IM is the preferred treatment in patients *without* IV access. Weight-based dosing: 0.2 mg/kg once; maximum dose: 10 mg/dose .
  - Fixed dosing : <13 kg: Not evaluated ,13 to 40 kg: 5 mg once, >40 kg: 10 mg once
- ✓ **Status epilepticus, refractory:** Infants, Children, and Adolescents:
  IV: **Note:** Mechanical ventilation and cardiovascular monitoring required :
  - Loading dose: 0.2 mg/kg followed by a continuous infusion.
  - Continuous infusion: 0.05 to 2 mg/kg/**hour** (0.83 to 33.3 **mcg**/kg/minute) titrated to cessation of electrographic seizures or burst suppression. If patient experiences breakthrough status epilepticus while on the continuous infusion, administer a bolus of 0.1 to 0.2 mg/kg and increase infusion rate by 0.05 to 0.1 mg/kg/**hour** (0.83 to 1.66 **mcg**/kg/minute) every 3 to 4 hours. **Note:** A period of at least 24 to 48 hours of electrographic control is recommended prior to withdrawing the continuous infusion; withdraw gradually to prevent recurrent status epilepticus.

☒ Preparation for Administration:

For continuous IV infusion, may dilute with NS or D5W to a final concentration of 0.5 mg/mL or 1 mg/mL.

☒ Administration:

IM: Administer undiluted deep IM into large muscle.
IV: Do **not** administer intra-arterially. For procedural sedation/anxiolysis/amnesia, administer by slow IV injection over at least 2 minutes using a concentration of 1 mg/mL or a dilution of the 1 or 5 mg/mL concentrations. For induction of anesthesia, administer IV bolus over 5 to 15 seconds. For other clinical situations (eg, sedation in the mechanically-ventilated patient), a continuous infusion may also be administered.

☒ Precautions:

- Midazolam has been associated with anterograde amnesia.

- Concomitant use of benzodiazepines and opioids may result in profound sedation, respiratory depression, coma, and death. Limit dosages and durations to the minimum required. Follow patients for signs and symptoms of respiratory depression and sedation.
- Immediate availability of resuscitative drugs and age- and size-appropriate equipment for bag/valve/mask ventilation and intubation, and personnel trained in their use and skilled in airway management should be assured. For deeply sedated patients, a dedicated individual, other than the practitioner performing the procedure, should monitor the patient throughout the procedure.
- Patients must be cautioned about performing tasks that require mental alertness. A minimum of 1 day should elapse after midazolam administration before attempting these tasks.
- Hypotension may occur more frequently in patients who have received opioid analgesics.
- Contraindicated in patients with acute narrow angle glaucoma; may use in patients with open-angle glaucoma only if receiving appropriate therapy.
- Use with caution in patients with renal impairment; half-life of midazolam and metabolites may be prolonged.
- Use with caution in patients with respiratory disease (eg, COPD); these patients may be sensitive to the respiratory depressant effects of midazolam.
- Withdrawal symptoms (convulsions, hallucinations, tremor, abdominal and muscle cramps, vomiting and sweating) may occur following abrupt discontinuation or large decreases in dose. Use caution when reducing dose or withdrawing therapy; decrease slowly and monitor for withdrawal symptoms.
- In pediatric and neonatal patients <3 years of age, the repeated or lengthy exposure to sedatives or anesthetics during surgery/procedures may have detrimental effects on child or fetal brain development and may contribute to various cognitive and behavioral problems.

☒ Monitoring Parameters

Level of sedation, respiratory rate, HR, BP, oxygen saturation (ie, pulse oximetry), depth of sedation in critically-ill patients.

13. Naloxone (0.4 mg/ml) amp

☒ Dosage:

✓ **Opioid overdose:**

IV: Note: May be administered IM, SubQ, or endotracheal (off-label route), but onset of action may be delayed, especially if patient has poor perfusion; endotracheal preferred if IV route not available; doses may need to be repeated. The use of naloxone is not recommended as part of initial resuscitative efforts in the delivery room for neonates with respiratory depression; support ventilation to improve oxygenation and heart rate.

Infants and Children <5 years or ≤20 kg: 0.1 mg/kg/dose (maximum dose: 2 mg); repeat every 2 to 3 minutes if needed

Children ≥5 years or >20 kg and Adolescents: 2 mg; if no response, repeat every 2 to 3 minutes

Endotracheal (off-label route): Infants, Children, and Adolescents: Optimal endotracheal dose unknown; current expert recommendations are 2 to 3 times the IV dose.

Continuous IV infusion: Infants, Children and Adolescents: 24 to 40 mcg/kg/hour has been reported. Doses as low as 2.5 mcg/kg/hour have been reported in adults and a dose of 160 mcg/kg/hour was reported in one neonate. If continuous infusion is required, calculate dosage/hour based on effective intermittent dose used and duration of adequate response seen or use two-thirds of the initial effective naloxone bolus on an hourly basis; titrate dose. **Note:** The infusion should be discontinued by reducing the infusion in decrements of 25%; closely monitor the patient (eg, pulse oximetry and respiratory rate) after each adjustment and after discontinuation of the infusion for recurrence of opioid-induced respiratory depression .

IM, SubQ: Infants, Children and Adolescents: Initial: 0.01 mg/kg/dose; if no response, a subsequent dose of 0.1 mg/kg may be given; **Note:** If using IM or SubQ route, dose should be given in divided doses.

✓ **Reversal of respiratory depression with therapeutic opioid dosing:**

Weight-directed dosing: Infants, Children, and Adolescents: IV: 0.001 to 0.005 mg/kg/dose; titrate to effect. **Note:** AAP recommends a wider dosage range of 0.001 to 0.015 mg/kg/dose .

Fixed dosing: Infants, Children, and Adolescents: IV: Initial: 0.005 to 0.01 mg; repeat every 2 to 3 minutes as needed based on response

☒ **Preparation for administration:** IV push: Dilute naloxone 0.4 mg (1 mL ampule) with 9 mL of NS for a total volume of 10 mL to achieve a concentration of **0.04 mg/mL.**

- IV infusion: Dilute naloxone 2 mg in 500 mL of NS or D5W to make a final concentration of 4 **mcg**/mL.

☒ Administration:

- IV push: Administer over 30 seconds as undiluted preparation **or** administer as diluted preparation slow IV push by diluting 0.4 mg (1 mL) ampoule with 9 mL of normal saline for a total volume of 10 mL to achieve a concentration of 0.04 mg/mL.

- May administer IM or SubQ if unable to obtain IV access.

Endotracheal: There is only anecdotal support for this route of administration. May require a slightly higher dose than used in other routes. Dilute to 1 to 2 mL with normal saline; flush with 5 mL of saline and then administer 5 ventilations.

☒ Precaution:

- Administration of naloxone causes the release of catecholamines, which may precipitate acute withdrawal or unmask pain in those who regularly take opioids. Symptoms of acute withdrawal in opioid-dependent patients may include pain, tachycardia, hypertension, fever, sweating, abdominal cramps, diarrhea, nausea, vomiting, agitation, and irritability**.**

- Continuously observe patients until there is no further risk of recurrent respiratory or CNS depression.

- Use with caution in patients with history of seizures; avoid use in the treatment of meperidine-induced seizures.

- Excessive dosages should be avoided after use of opioids in surgery.

☒ Monitoring Parameters

Respiratory rate, HR, BP, temperature, level of consciousness, ABGs or pulse oximetry.

14.Phenobarbitone Sodium 200mg/ml

☒ Dosage:

- ✓ **Sedation:** Infants and Children: IM: 2 to 3 mg/kg/day in divided doses every 8 to 12 hours
- ✓ **Status epilepticus:** Infants, Children, and Adolescents: IV: Initial:20 mg/kg (maximum dose: 1,000 mg) over 10 minutes; if necessary, may repeat dose after 15 minutes (maximum total dose: 40 mg/kg) .
- ✓ **Seizures:** Maintenance dose: IV: **Note:** Maintenance dose usually starts 12 hours after loading dose. Initial: IV: Infants and Children ≤5 years of age: 3 to 5 mg/kg/day in 1 to 2 divided doses. Children >5 years of age: 2 to 3 mg/kg/day in 1 to 2 divided doses. Adolescents: 1 to 3 mg/kg/day in 1 to 2 divided doses.

☒ Administration:

- IM: Inject deep into muscle. Do not exceed 5 mL per injection site due to potential for tissue irritation.

-IV: rapid IV administration >30 mg/minute in children should be avoided. In the setting of status epilepticus, administration at a rate of 50 to 100 mg/minute.

- Avoid extravasation.

- Intra-arterial injection is contraindicated. Avoid subcutaneous administration.

☒ Precautions:

- May cause CNS depression, which may impair physical or mental abilities; patients must be cautioned about performing tasks which require mental alertness (eg, operating machinery or driving).

- May cause respiratory depression particularly when administered intravenously; use with caution patients with respiratory disease, including status asthmaticus.

- Use with caution in patients with depression or suicidal tendencies, diabetes.

- Use with caution in patients with acute or chronic pain; paradoxical excitement could be induced or important symptoms could be masked.

- It should not be discontinued abruptly because of the possibility of increasing seizure frequency.

- Phenobarbital has been associated with cognitive deficits in children receiving therapy for complicated febrile seizures.

☒ Monitoring Parameters:

RR, HR, BP, IV site (stop injection if patient complains of pain in the limb).

15. Phytomenadione (2 mg/0.2 ml) ampoule

☒ Dosage :

✓ **Vitamin K deficiency bleeding (formerly known as hemorrhagic disease) of the newborn:**

Prophylaxis: IM: **Note:** Administer within 1 hour of birth

AAP recommendations :Preterm neonate: Optimal dose not established Birth weight <1,000 g: 0.3 to 0.5 mg/kg. Birth weight ≥1,000 g: 0.5 to 1 mg. Term neonate: 0.5 to 1 mg

Alternate dosing: GA <32 weeks: 0.2 mg; may repeat dose for prolonged prothrombin time or clinical signs of bleeding.

Treatment: SubQ, IM: 1 to 2 mg/day .

✓ **Reversal of vitamin K antagonists (eg, warfarin):** Limited data available: Infants, Children, and Adolescents:

Weight-based dosing (preferred): *Chest* recommendations: IV: 0.03 mg/kg/dose is recommended for excessively prolonged INR (usually INR >8; no evidence of bleeding) due to vitamin K-antagonist (eg, warfarin): if significant bleeding, consider use of fresh frozen plasma, prothrombin complex concentrates, or recombinant factor VIIa .

Alternate dosing: Fixed dosing: **Note:** Smaller pediatric patients should receive doses on the low end of dosing range; excessive dosages may cause warfarin-resistance .

No bleeding, rapid reversal needed, patient will require further oral anticoagulant therapy: SubQ, IV: 0.5 to 2 mg

No bleeding, rapid reversal needed, patient will not require further oral anticoagulant therapy: SubQ, IV: 2 to 5 mg

Significant bleeding, not life-threatening: SubQ, IV: 0.5 to 2 mg

Significant bleeding, life-threatening: SubQ, IV: 5 mg

✓ **Parenteral nutrition, maintenance requirement:** Limited data available: IV: **Note:** Patients receiving warfarin may not require TPN supplementation of phytonadione. Infants: 10 **mcg**/kg/day. Children and Adolescents: 200 **mcg**/day

☒ Preparation for Administration:

To reduce the incidence of anaphylactoid reaction upon IV administration, dilute dose in a minimum of 50 mL of preservative-free NS, D5W, or D5NS and administer using an infusion pump over at least 20 minutes

☒ Administration:

IV Infuse slowly; rate of infusion should not exceed 1 mg/minute.

☒ Precautions

- Fatal hypersensitivity reactions, including anaphylaxis, have occurred; onset may occur during or immediately after intravenous (IV) administration.Proper dosing, dilution, and administration will minimize risk .
- Cutaneous reactions have occurred, including delayed-type hypersensitivity reactions, eczematous reactions, scleroderma-like patches, and urticaria; onset may occur within 1 day to a year. If skin reactions occur, discontinue therapy and treat appropriately.
- Use with caution in neonates, especially premature infants; severe hemolytic anemia, jaundice, and hyperbilirubinemia have been reported with larger than recommended doses (10 to 20 mg).

☒ Monitoring Parameters

PT, INR; hypersensitivity reactions.

16. Potassium Chloride 15% (10 ml) ampoule

☒ **Dosage: Note:** Maintenance potassium IV doses should be incorporated into the patient's maintenance IV fluids; intermittent IV potassium administration should be reserved for severe depletion situations; continuous ECG monitoring should be used for intermittent IV doses >0.5 mEq/kg/**hour.**

☒ **Hypokalemia, treatment; severe**: Infants, Children, and Adolescents: Intermittent IV infusion: 0.5 to 1 mEq/kg/dose; maximum dose: 40 mEq/dose; infuse at a rate ≤0.5 mEq/kg/**hour** ; serum concentrations should be evaluated 1 to 2 hours after completion of infusion; may repeat as needed based on lab values; severe depletion or ongoing losses may require >200% of normal daily maintenance .

☒ **Preparation for Administration:** It must be diluted prior to parenteral administration. The concentration of infusion may be dependent on patient condition and specific institution policy. Some clinicians recommend that and 20-40 mEq/100 mL for central infusions.

☒ **Administration:** Potassium chloride **must be diluted** prior to parenteral administration. For IV infusion; **do not administer IV push.** Usual range: 0.2 to 0.5 mEq/kg/hour up to 10 mEq to 20 mEq/hour have been used. Critical care settings/situations: Higher rates may be used; maximum rate: 1 mEq/kg/hour up to 40 mEq/hour; continuous cardiac monitoring recommended for rates >0.5 mEq/kg/hour.

- **Vesicant/irritant** (at concentrations >0.1 mEq/mL); ensure proper needle or catheter placement prior to and during IV infusion. Avoid extravasation. **Extravasation management:** If extravasation occurs, stop infusion immediately and disconnect (leave needle/cannula in place); gently aspirate extravasated solution (do **NOT** flush the line); initiate hyaluronidase antidote; remove needle/cannula; apply dry cold compresses; elevate extremity. *Hyaluronidase:* Intradermal or SubQ: Inject a total of 1 to 1.7 mL (15 units/mL) as five separate 0.2 to 0.3 mL injections (using a 25-gauge needle) into area of extravasation at the leading edge in a clockwise manner .

☒ **Precautions**:

- Use with caution in patients with cardiovascular disease (eg, heart failure, cardiac arrhythmias, atrioventricular [AV] block); patients may be more susceptible to life-threatening cardiac effects associated with hyper/hypokalemia.
- Evaluate renal function, cardiac and fluid status, and any factors contributing to altered potassium concentrations (eg, acidosis, alkalosis) prior to therapy.
- Pain and phlebitis may occur during parenteral infusion requiring a decrease in infusion rate or potassium concentration.

☒ **Monitoring Parameters:** Electrolytes (including serum potassium, calcium, chloride, magnesium, phosphate, sodium), acid/base balance; renal function; cardiac monitor (if intermittent infusion or potassium infusion rates 0.5 mEq/kg/hour in children; to assess adequate replacement, repeat serum potassium level 2 to 4 hours after dose; IV infusion site.

17 . Sodium Bicarbonate 8.4% (50 ml) vial

☒ **Dosage:** **Note:** 1 mEq $NaHCO_3$ is equivalent to 84 mg; each g of $NaHCO_3$ provides ~12 mEq each of sodium and bicarbonate ions**.**

✓ **Cardiac arrest:** IV, I.O.: Infants and Children: 1 mEq/kg/dose; repeat doses should be guided by arterial blood gases; children <2 years of age should receive 4.2% (0.5 mEq/mL) solution. **Note:** If I.O. route is used for administration and is subsequently used to obtain blood samples for acid-base analysis, results will be inaccurate.

✓ **Metabolic acidosis:** IV: Infants and Children: Dosage should be based on the following formula if blood gases and pH measurements are available:

HCO_3^-(mEq) = 0.5 x weight (kg) x [24 - serum HCO_3^-(mEq/L)] **or** HCO_3^-(mEq) = 0.5 x weight (kg) x [desired increase in serum HCO_3^-(mEq/L)]

Administer $^1/_2$ dose initially, then remaining $^1/_2$ dose over the next 24 hours; monitor pH, serum HCO_3^-, and clinical status. **Note:** These equations provide an estimated replacement dose. The underlying cause and degree of acidosis may result in the need for larger or smaller replacement doses. In most cases, the initial goal of therapy is to target a pH of ~7.2 and a plasma bicarbonate level of ~10 mEq/L to prevent over alkalinization. **Note:** If acid-base status is not available: Dose for older Children: 2-5 mEq/kg IV infusion over 4-8 hours; subsequent doses should be based on patient's acid-base status.

☒ **Administration**:

- For IV administration to **infants**, use the 0.5 mEq/mL solution or dilute the 1 mEq/mL solution 1:1 with **sterile water**; for direct IV infusion in emergencies, administer slowly (maximum rate in infants: 10 mEq/minute); for infusion, dilute to a maximum concentration of 0.5 mEq/mL in dextrose solution and infuse over 2 hours (maximum rate of administration: 1 mEq/kg/hour).

- **Vesicant** (at concentrations ≥8.4%); ensure proper needle or catheter placement prior to and during IV infusion. Avoid extravasation.
Extravasation management: If extravasation occurs, stop infusion immediately and disconnect (leave needle/cannula in place); gently aspirate extravasated solution (do **NOT** flush the line); initiate hyaluronidase antidote; remove needle/cannula; apply dry cold compresses, elevate extremity. ***Hyaluronidase****:* Intradermal or SubQ: Inject a total of 1 to 1.7 mL (15 units/mL) as five separate 0.2 to 0.3 mL injections (using a 25-gauge needle) into area of extravasation at the leading edge in a clockwise manner .

☒ **Precautions:** Rapid administration in **neonates, infants, and children <2 years** of age has led to hypernatremia, decreased CSF pressure, and intracranial hemorrhage.

☒ **Monitoring Parameters:** Monitor infusion site, monitor for signs of fluid retention, and monitor cardiac status, arterial blood gases, and electrolytes.