INSTRUCTIONS FOR DRUGS IN SURGARY WARD (6 A)

(DOSAGE, ADMINISTRATION, PRECAUTIONS AND MONITORING)

PREPEARED BY CLINICAL PHARMACIST: ESHRAQ ALABWEENY

THE SUPERVISOR OF DRUG INFORMATION CENTER / JUST

1. Chlorpheniramine maleate 10mg/1ml

☒ Dosage:

- ✓ **Allergic symptoms, allergic rhinitis, urticaria, pruritus** :IM, IV, or SubQ
  :Usual range: 5 to 20 mg once or twice daily (maximum: 40 mg/24 hours)

☒ Administration :

IV Inject slowly over at least 1 minute.

☒ Preparation for Administration:

May be diluted with NS to a final concentration of 1 mg/mL to facilitate accurate measurement.

☒ 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).

-Use with caution in patients with cardiovascular disease (including hypertension and ischemic heart disease).

- Use with caution in patients with increased intraocular pressure.

- Use with caution in patients with prostatic hyperplasia and/or GU obstruction.

- Use with caution in patients with asthma or other chronic breathing disorders.

-Use with caution in patients with thyroid dysfunction.

- Effects may be potentiated when used with other sedative drugs or ethanol.

- Antihistamines may cause excitation in young children. Not for OTC use in children <2 years of age.

2. Diazepam(10 mg) Ampoule

☒ Dosage:

- ✓ **Acute ethanol withdrawal:** *IV, IM:* 10 mg initially; may administer 5 to 10 mg 3 to 4 hours later, if needed.
- ✓ **Anxiety (symptoms/disorders):** *IM, IV:* 2 to 10 mg; may repeat in 3 to 4 hours, if needed. **Preoperative: Anxiety:** *IM:* 10 mg prior to surgery
- ✓ **Sedation in the ICU patient:** *IV:* Loading dose: 5 to 10 mg; Maintenance dose: 0.03 to 0.1 mg/kg every 30 minutes to 6 hours.

☒ Administration:

- Administer undiluted by slow IV push; do not mix with other solutions or medications.
- Rapid injection may cause respiratory depression or hypotension, in adults, maximum infusion rate is 5 mg/minute.
- 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.

3 . Flumazenil 0.5 mg amp

☒ Dosage:

- ✓ **Benzodiazepine reversal when used in conscious sedation or general anesthesia:** IV: Initial dose: 0.2 mg **over 15 seconds**. Repeat doses (maximum: 4 doses): If the desired level of consciousness is not obtained, 0.2 mg may be repeated at 1-minute intervals. Maximum total cumulative dose: 1 mg (usual total dose: 0.6 to 1 mg). In the event of resedation: Repeat doses may be given at 20-minute intervals as needed at 0.2 mg per minute to a maximum of 1 mg total dose and 3 mg in 1 hour.
- ✓ **Management of benzodiazepine overdose:** IV: Initial dose: 0.2 mg **over 30** seconds; if the desired level of consciousness is not obtained 30 seconds after the dose, 0.3 mg can be given over 30 seconds. Repeat doses: 0.5 mg over 30 seconds repeated at 1-minute intervals. Maximum total cumulative dose: 3 mg (usual total dose: 1 to 3 mg).

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

☒ 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 resedation is unlikely.

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

☒ Dosage:

- ✓ **Acute pulmonary edema:** IV: Initial: 40 mg/dose. If response not adequate within 1 hour, may increase to 80 mg/dose. **Note:** Minimal additional response is gained by single doses over 160 to 200 mg; maximum: 200 mg/dose
- ✓ **Edema:**IM, IV: Initial: 20 to 40 mg/dose; if response is not adequate, may repeat the same dose or increase dose in increments of 20 mg/dose and administer 1 to 2 hours after previous dose (maximum: 200 mg/dose). **Note:** A higher initial dose may be considered for those receiving chronic oral diuretic therapy. Individually determined dose should then be given once or twice daily although some patients may initially require dosing as frequent as every 6 hours.

  - Continuous IV infusion: Initial: IV bolus dose 40 to 100 mg over 1 to 2 minutes, followed by continuous IV infusion rate of 10 to 40 mg/hour; repeat loading dose before increasing infusion rate.

  Note: In clinical trials evaluating dosing strategies in acute decompensated heart failure, median and maximum doses were ≤ 20 mg/hour. With lower baseline CrCl (eg, CrCl <25 mL/minute), the upper end of the initial infusion dosage range should be considered. If urine output is <1 mL/kg/hour, double as necessary to a maximum of 80 to 160 mg/hour. The risk associated with higher infusion rates (80 to 160 mg/hour) must be weighed against alternative strategies.

Note: in acute renal failure, doses up to **1 to 3 g** daily may be necessary to initiate desired response; avoid use in oliguric states.

☒ 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:

- Undiluted direct IV injections may be administered at a rate of 20 to 40 mg per minute; maximum rate of administration for short-term intermittent infusion is 4 mg/minute; exceeding this rate increases the risk of ototoxicity.

- 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.

- For some patients, despite higher doses of loop diuretic treatment, an adequate diuretic response cannot be attained. Diuretic resistance can usually be overcome by iv administration, the use of two diuretics together (eg, furosemide and chlorothiazide), or the use of a diuretic with a positive inotropic agent. When such combinations are used, serum electrolytes need to be monitored even more closely.

☒ Monitoring Parameters:

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

5. Heparin sodium (5000 IU/ ml) vial

☒ Dosage:

- ✓ **Acute coronary syndromes:** IV infusion (weight-based dosing per institutional nomogram recommended):

  STEMI, NSTE-ACS: Adjunct to fibrinolysis, Initial bolus of 60 units/kg (maximum: 4,000 units), then 12 units/kg/hour (maximum: 1,000 units/hour) as continuous infusion. Adjust to target aPTT of 1.5 to 2 times control (approximately 50 to 70 seconds). Continue for a minimum of 48 hours, and preferably for the duration of hospitalization (up to 8 days) or until revascularization (if performed)

- ✓ **Anticoagulation (Intermittent administration):** IV: Initial: 10,000 units, then 50 to 70 units/kg (5,000 to 10,000 units) every 4 to 6 hours.

- ✓ **Maintenance of catheter patency (continuous infusion):** Using heparin 2 unit/mL large volume IV solutions, may administer at an infusion rate of 3 mL/hour (equivalent to 6 units/hour); however, rate of infusion dependent upon age, weight, clinical condition of patient, and procedure being employed. Do not use as a "catheter lock flush".

- ✓ **Maintenance of line patency (line flushing):** When using daily flushes of heparin to maintain patency of single and double lumen central catheters, 10 units/mL is commonly used for younger infants (eg, <10 kg) while 100 units/mL is used for older infants, children, and adults.

- ✓ **Thromboprophylaxis (low-dose heparin):** SubQ: 5,000 units every 8 to 12 hours. Duration of therapy and specific dosing for certain populations*:*

  - *Acute illness in hospitalized cancer patients:* SubQ: 5,000 units every 8 hours; recommended duration of therapy is length of hospital stay or until fully ambulatory.

  - *Major surgery in cancer patients:* SubQ: 5,000 units 2 to 4 hours preoperative and 5,000 units every 8 hours thereafter; continue therapy for at least 7 to 10 days. Prolonged treatment up to 4 weeks should be considered in patients undergoing major abdominal or pelvic surgery for cancer with high-risk features (eg, limited mobility, obesity, VTE history, comorbid conditions) .

  - *Orthopedic surgery:* Minimum duration of therapy of 10 to 14 days for patients undergoing total hip arthroplasty, total knee arthroplasty, or hip fracture surgery .

- ✓ **Venous thromboembolism (DVT/PE), treatment :***Initial anticoagulation:*

  IV: Inpatient setting: 80 units/kg (or alternatively 5,000 units) IV bolus followed by an initial continuous infusion of 18 units/kg/hour (or alternatively 1,000 units/hour).

☒ Administration:

- Continuous IV infusion: Infuse via infusion pump.

- 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.

- Do **not** administer IM due to pain, irritation, and hematoma formation.

☒ 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.

6.Hydrocortisone 100 mg vial

☒ Dosage:

- ✓ **Anti-inflammatory or immunosuppressive:** IM, IV: Initial: 100 to 500 mg/dose at intervals of 2, 4, or 6 hours.
- ✓ **Multiple sclerosis, acute exacerbations:** IM, IV: 800 mg/day for 1 week, followed by 320 mg every other day for 1 month
- ✓ **Adrenal insufficiency:**
  Acute adrenal insufficiency (adrenal crisis) : 100 mg IV bolus, immediately followed by 200 mg over 24 hours as a continuous IV infusion or in divided doses (IM or IV) every 6 hours, then 100 mg over 24 hours the following day. Alternatively, may administer 100 mg IV bolus, then 50 to 75 mg IV every 6 hours for 24 hours, followed by a slow taper over the next 72 hours (administering doses every 4 to 6 hours during taper).
- ✓ **Stress dosing in patients known to be adrenally-suppressed (ie, prevention of adrenal crisis in glucocorticoid-treated patients) :**

Gastroenteritis with vomiting and/or diarrhea: IM, SubQ: 100 mg dose given early in course of illness; repeat after 6 to 12 hours .

Severe infection (eg, pneumonia/with altered cognition): IM, SubQ: 100 mg dose given early in course of illness; repeat after 6 to 12 hours until recovery.

Surgery:Minor stress (ie, inguinal herniorrhaphy): IV :25 mg/day for 1 day *Moderate stress (ie, joint replacement, cholecystectomy):* IV: 50 to 75 mg/day (25 mg every 8 to 12 hours) for 1 to 2 days .*Major stress (pancreatoduodenectomy, esophagogastrectomy, cardiac surgery):* IV: 100 to 150 mg/day (50 mg every 8 to 12 hours) for 2 to 3 days

- ✓ **Septic shock:** IV:50 mg bolus every 6 hours, either as monotherapy or in combination with fludrocortisone **or** 200 mg/day as a continuous infusion . Guidelines suggest a therapy duration of ≥3 days; most studies treated for up to 7 days; not all studies tapered therapy. May consider a slow taper over several days when vasopressors are no longer required to avoid possible hemodynamic deterioration which may occur with abrupt .
- ✓ **Thyroid storm:** IV: 300 mg loading dose, followed by 100 mg every 8 hours .

☒ 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.

☒ 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.

7. Isosorbid Dinitrate 5 mg tab

☒ **Dosage**:

✓ Acute angina attack: sublingual: 5 mg , in the case of no response within 5 minutes, an additional tab must be administered. In the case of no response within the next 5 minutes, an additional tab must be administered with going to the emergency.

☒ **Administration:**

Place one tablet under the tongue and allow it to dissolve. Do not chew or swallow the tablet.

☒ **Precautions** :

- Take the dose while you are sit-down to prevent orthostatic hypotension.

8. Lidocaine 2% plain (50 mg) Vial

☒ Dosage:

- ✓ **Antiarrhythmic for VF or pulseless VT (after defibrillation attempts, CPR, and vasopressor administration), alternative to amiodarone and for hemodynamically stable monomorphic VT:** IV, intraosseous (IO): Initial: 1 to 1.5 mg/kg bolus. If refractory VF or pulseless VT, repeat 0.5 to 0.75 mg/kg bolus every 5 to 10 minutes (maximum cumulative dose: 3 mg/kg). Follow with continuous infusion (1 to 4 mg/minute) after return of perfusion . Reappearance of arrhythmia during constant infusion: 0.5 mg/kg bolus and reassessment of infusion .

  Note: Reduce maintenance infusion in patients with CHF, shock, or hepatic disease; initiate infusion at 10 mcg/kg/minute (maximum dose: 1.5 mg/minute or 20 mcg/kg/minute).

- ✓ **Anesthesia, local injectable:** Varies with procedure, degree of anesthesia needed, vascularity of tissue, duration of anesthesia required, and physical condition of patient.

  - *Cutaneous infiltration*: Maximum: 4.5 mg/kg/dose not to exceed 300 mg; do not repeat within 2 hours.

  - *Intraosseous line or infusion pain:* Lidocaine 2% preservative-free solution: Intraosseous: Initial dose: 40 mg over 1 to 2 minutes; usual adult dose range and maximum: 20 to 50 mg/dose; after allowing lidocaine to dwell for up to 1 minute, follow with NS flush; immediately following the NS flush, some centers administer a second lower (50% dose reduction) lidocaine dose over 30 to 60 seconds (usual adult maximum repeat dose: 20 mg/dose); if discomfort reoccurs, may repeat doses at a maximum frequency of every 45 minutes during intraosseous access; maximum total dose not established .

☒ Preparation for Administration:

Local infiltration: Buffered lidocaine for injectable local anesthetic may be prepared: Add 2 mL of sodium bicarbonate 8.4% to 18 mL of lidocaine 1%.

☒ Administration:

IV Bolus: may administer at 25 to 50 mg/minute. In the setting of cardiac arrest (eg, ventricular fibrillation or pulseless ventricular tachycardia), may be infused rapidly into a peripheral vein .

IV Continuous infusion: After initial bolus dosing, may administer as a continuous infusion; refer to indication-specific infusion rates in dosing for detailed recommendations. In the setting of cardiac arrest, infusion may be initiated once patient has return of spontaneous circulation resulting from lidocaine administration; however, there is no evidence to support subsequent continuous infusion to prevent recurrence. Local thrombophlebitis may occur in patients receiving prolonged IV infusions.

☒ Precautions:

- Use with extreme caution in patients with severe hepatic dysfunction; may have increased risk of lidocaine toxicity.

- Constant ECG monitoring is necessary during IV administration.

- Use cautiously in hepatic impairment, HF, marked hypoxia, severe respiratory depression, hypovolemia, history of malignant hyperthermia, or shock. Increased ventricular rate may be seen when administered to a patient with atrial fibrillation.

- Use is contraindicated in patients with Wolff-Parkinson-White syndrome and severe degrees of SA, AV, or intraventricular heart block (except in patients with a functioning artificial pacemaker).

- Correct electrolyte disturbances, especially hypokalemia or hypomagnesemia, prior to use and throughout therapy.

- Correct any underlying causes of ventricular arrhythmias. Monitor closely for signs and symptoms of CNS toxicity.

☒ Monitoring Parameters:

Liver function tests, ECG; in patients requiring drug >24 hrs, blood level monitoring recommended.

9. Midazolam(15 mg/3ml) Ampoule

☒ Dosage:

✓ **Anesthesia:** IV: ***Induction****:* Adults <55 years of age:
- Unpremedicated patients: Initial: 0.3 to 0.35 mg/kg over 20 to 30 seconds; after 2 minutes, may repeat if necessary at ~25% of initial dose every 2 minutes, up to a total dose of 0.6 mg/kg in resistant cases.
- Premedicated patients: Usual dosage range: 0.05 to 0.2 mg/kg. Use of 0.2 mg/kg administered over 5 to 10 seconds has been shown to safely produce anesthesia within 30 seconds and is recommended for ASA physical status P1 and P2 patients. When used with other anesthetic drugs (ie, coinduction), the dose is <0.1 mg/kg .
- ASA physical status >P3 or debilitation: Reduce dose by at least 20% .

Maintenance*:* 0.05 mg/kg as needed , or continuous infusion 0.015 to 0.06 mg/kg/**hour** (0.25 to 1 **mcg**/kg/minute) .

✓ **Sedation/anxiolysis/amnesia (preoperative/procedural):**
- *Healthy adults <60 years of age:* **IM**: 0.07 to 0.08 mg/kg 30 to 60 minutes prior to surgery/procedure; usual dose: 5 mg.

IV: Initial: 0.5 to 2 mg over at least 2 minutes; slowly titrate to effect by repeating doses every 2 to 3 minutes if needed; usual total dose: 2.5 to 5 mg .. A total dose >5 mg is generally not needed.

- *Adults ≥60 years of age, debilitated, or chronically ill:* **IM**: 2 to 3 mg (or 0.02 to 0.05 mg/kg) 30 to 60 minutes prior to surgery/procedure; some may only require 1 mg if anticipated intensity and duration of sedation is less critical.

IV: Initial: same dose of as healthy adults.

✓ **Sedation in mechanically-ventilated patients:** IV: Initial: 0.01 to 0.05 mg/kg (~0.5 to 4 mg); may repeat at 10- to 15-minute intervals until adequate sedation achieved; maintenance infusion: 0.02 to 0.1 mg/kg/**hour** (0.3 to 1.7 **mcg**/kg/minute). Titrate to reach desired level of sedation. Titration to maintain a light rather than a deep level of sedation is recommended unless clinically contraindicated . May consider a trial of daily awakening; if agitated after discontinuation of drip, then restart at 50% of the previous dose.

✓ **Palliative sedation:** *IV, SubQ:* Continuous infusion: Initial: 0.5 to 1 mg/hour; may increase as needed. Usual dosage range: 1 to 20 mg/hour; may also intermittently administer 1 to 5 mg during infusion as needed. Some have recommended an initial bolus dose of 5 to 10 mg (size of dose depending on patient weight, age, and degree of debility).

☒ 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 intraarterially. 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 (eg, operating machinery, driving). 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.

☒ Monitoring Parameters

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

10 . Naloxone (0.4 mg/ml) amp

☒ Dosage:

- ✓ **Opioid overdose:** IV, IM, SubQ: Initial: 0.4 to 2 mg; may need to repeat doses every 2 to 3 minutes. A lower initial dose (0.1 to 0.2 mg) should be considered for patients with opioid dependence to avoid acute withdrawal or if there are concerns regarding concurrent stimulant overdose. After reversal, may need to readminister dose(s) at a later interval (ie, 20 to 60 minutes) depending on type/duration of opioid. If no response is observed after 10 mg total, consider other causes of respiratory depression. *Continuous infusion:* IV: **Note:** For use with exposures to long-acting opioids (eg, methadone), sustained release product, and symptomatic body packers after initial naloxone response. Calculate dosage/hour based on effective intermittent dose used and duration of adequate response seen **or** use two-thirds ($^2/_3$) of the initial effective naloxone bolus on an hourly basis (typically 0.25 to 6.25 mg/hour); one-half ($^1/_2$) of the initial bolus dose should be readministered 15 minutes after initiation of the continuous infusion to prevent a drop in naloxone levels; adjust infusion rate as needed to assure adequate ventilation and prevent withdrawal symptoms.

- ✓ **Reversal of respiratory depression with therapeutic opioid doses:** IV: Initial: 0.02 to 0.2 mg; titrate to avoid profound withdrawal, seizures, arrhythmias, or severe pain. *Continuous infusion:* IV: **Note:** same regimen as in opioid overdose but the rate is (typically 0.2 to 0.6 mg/hour).

  - *Opioid-dependent patients being treated for cancer pain:* IV: **Note:** May dilute 0.4 mg/mL (1 mL) ampule into 9 mL of normal saline for a total volume of 10 mL to achieve a 0.04 mg/mL (40 **mcg**/mL) concentration. 0.02 mg (20 **mcg**) IV push; administer every 2 minutes until improvement in symptoms **or** 0.04 to 0.08 mg (40 to 80 **mcg**) slow IV push; administer every 30 to 60 seconds until improvement in symptoms; if no response is observed after total naloxone dose 1 mg, consider other causes of respiratory depression. If respiratory depression is due to long-acting opioids, may consider administering naloxone as a continuous infusion starting at 66% of the total bolus dose (or 0.2 mg per hour) to reverse the opioid toxicity .

  - *Postoperative reversal:* IV: 0.1 to 0.2 mg every 2 to 3 minutes until desired response (adequate ventilation and alertness without significant pain). **Note:** Repeat doses may be needed within 1 to 2 hour intervals depending on type, dose, and timing of the last dose of opioid administered.

- ✓ **Opioid-induced pruritus:** IV infusion: 0.25 **mcg/kg/hour** . Doses up to ~3 **mcg/kg/hour** have been employed. However, doses >2 **mcg/kg/hour** are more likely to lead to reversal of analgesia and are not recommended.

☒ **Preparation for administration:** IV push: Dilute naloxone 0.4 mg (1 mL ampul) 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.

☒ 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.

11. Regular Insulin (100IU/ ml)(10 ml vial)

☒ Dosage:

✓ **Diabetes mellitus, type 1:** SubQ:. **The total daily doses (TDD) presented below are expressed as the total units/kg/day of all insulin formulations combined.**

General insulin dosing: ***Initial TDD:*** ~0.4 to 0.5 units/kg/day ; conservative initial doses of 0.2 to 0.4 units/kg/day may be considered to avoid the potential for hypoglycemia; higher initial doses may be required in patients who are obese, sedentary, or presenting with ketoacidosis .

Usual TDD maintenance range: 0.4 to 1 units/kg/day in divided dose

Division of TDD (multiple daily injections): Basal insulin: Generally, 40% to 50% of the TDD is given as basal insulin (intermediate [NPH]- or long-acting [eg, glargine, degludec, detemir]) in 1 to 2 daily injections . Prandial insulin: The remaining portion (ie, 50% to 60%) of the TDD is then divided and administered before or at mealtimes.

Dose adjustment: Dosage must be titrated to achieve glucose control and avoid hypoglycemia. Adjust dose to maintain premeal and bedtime glucose in target range.

✓ **Diabetes mellitus, type 2:** SubQ: *Initial:* 4 to 6 units **or** 0.1 unit/kg **or** 10% of the **basal** insulin dose administered before the largest meal of the day and usually given in addition to a regimen that includes basal insulin (ie, a long-acting insulin such as glargine, degludec, or detemir; or an intermediate-acting insulin such as NPH) and metformin +/- other noninsulin agents. Consider reducing the basal insulin dose if HbA_{1c} is <8% when initiating prandial insulin.

*Dosage adjustment:*To reach self-monitoring glucose target: Adjust prandial insulin dose by 10% to 15% **or** 1 to 2 units; may adjust at weekly **or** twice weekly intervals .For hypoglycemia: If no clear reason for hypoglycemia, decrease prandial insulin dose by 2 to 4 units **or** by 10% to 20% .
HbA_{1c}still not controlled despite titrations to reach glycemic targets: One option is to advance to 'basal-bolus' (ie, prandial insulin coverage before ≥2 meals per day) in addition to **basal** insulin and usually given in addition to metformin +/- other noninsulin agents .

✓ **Patients with diabetes receiving enteral feedings:** SubQ: **Note**: TDD of insulin is divided into a basal component (intermediate- or long-acting insulin) and nutritional and correctional components (regular insulin or rapid-acting insulins).

Nutritional/Correctional: SubQ: 1 unit of regular insulin per 10 to 15 g of carbohydrate plus correctional regular insulin (as needed for hyperglycemia) administered every 6 hours or prior to each bolus feeding.

✓ **Patients with diabetes receiving parenteral feedings (ADA 2018)**:

IV (added to TPN solution): 1 unit of regular insulin per 10 g of carbohydrate added to TPN IV solution; adjust dose daily. One option is to increase the amount of regular insulin added to the TPN by two-thirds of the amount of

the correctional insulin used on the previous day . *SubQ*: Administer correctional regular insulin every 6 hours as needed for hyperglycemia.

- ✓ **Diabetic ketoacidosis:** IV:*Bolus:* 0.1 units/kg (optional), *Infusion:* If a bolus was administered, follow with 0.1 units/kg/hour. If no bolus was administered, initiate with 0.14 units/kg/hour (lower doses may not achieve adequate insulin concentrations to suppress hepatic ketone body production).

Adjustment: If serum glucose does not fall by at least 10% in the first hour, give an IV bolus of 0.14 units/kg and continue previous regimen. In addition, if serum glucose does not fall by 50 to 75 mg/dL in the first hour, the insulin infusion dose should be increased hourly until a steady glucose decline is achieved Once serum glucose reaches **200** mg/dL, decrease infusion dose to 0.02 to 0.05 units/kg/hour or switch to SubQ rapid-acting insulin (eg, aspart, lispro) at 0.1 units/kg every 2 hours; administer dextrose-containing IV fluids to maintain serum glucose between 150 to 200 mg/dL until the resolution of ketoacidosis.

Transition from IV to SubQ insulin: After resolution of diabetic ketoacidosis, supplement IV insulin with SubQ insulin as needed until the patient is able to eat and transition fully to a SubQ insulin regimen. An overlap of ~1 to 2 hours between discontinuation of IV insulin and administration of SubQ insulin is recommended to ensure adequate plasma insulin levels; for basal insulin analogues (eg, degludec, detemir, glargine), may consider an overlap of 3 to 4 hours due to their delayed onset of action .

- ✓ **Hyperkalemia, moderate to severe:** IV: 10 units regular insulin mixed with 25 g dextrose (50 mL $D_{50}W$) given over 15 to 30 minutes or alternatively, 10 units regular insulin as IV bolus followed by 50 mL $D_{50}W$ administered over 5 minutes; a weight-based insulin dose of 0.1 units/kg (maximum: 10 units) may also be considered to reduce the risk of hypoglycemia. Effects on potassium are temporary; repeat dosing as needed.
- ✓ **Hyperosmolar hyperglycemic state: IV** *Bolus:* 0.1 units/kg bolus (optional)

Infusion: If a bolus was administered, follow with 0.1 units/kg/hour. If no bolus was administered, initiate with 0.14 units/kg/hour.

Adjustment: If serum glucose does not fall by at least 10% in the first hour, give an IV bolus of 0.14 units/kg and continue previous regimen. In addition, if serum glucose does not fall by 50 to 75 mg/dL in the first hour, the insulin infusion dose should be increased hourly until a steady glucose decline is achieved. Once serum glucose reaches **300** mg/dL, decrease dose to 0.02 to 0.05 units/kg/hour; administer dextrose-containing IV fluids to maintain serum glucose between **200 to 300** mg/dL until the patient is mentally alert.

Transition from IV to SubQ insulin: same as **Diabetic ketoacidosis**.

- ☒ **Preparation for Administration: For IV infusion:**100 IU may be diluted in 100 ml NS to concentrations of 1 unit/mL.

☒ Administration:

✓ IV:

- Do not use if solution is viscous or cloudy; use only if clear and colorless.

- IV infusions: To minimize insulin adsorption to plastic IV tubing: Insulin loss will occur by adsorption to plastic (ie, PVC, polyethylene, polyolefin, polypropylene) IV containers and tubing .Therefore, flush the IV tubing with a priming infusion of 20 mL from the insulin infusion, whenever a new IV tubing set is added to the insulin infusion container .
- If insulin is required prior to the availability of the insulin drip, regular insulin should be administered by IV push injection.
- Because of insulin adsorption to plastic IV tubing or infusion bags, the actual amount of insulin being administered via IV infusion could be substantially less than the apparent amount. Therefore, adjustment of the IV infusion rate should be based on effect and not solely on the apparent insulin dose. The apparent dose may be used as a starting point for determining the subsequent SubQ dosing regimen ; however, the transition to SubQ administration requires continuous medical supervision, frequent monitoring of blood glucose, and careful adjustment of therapy.

✓ Subcutaneous:

- Do not use if solution is viscous or cloudy; use only if clear and colorless.
- Regular insulin cold injections should be avoided.
- Should be administered approximately 30 minutes before a meal.
- SubQ administration is usually made into the thighs, arms, buttocks, or abdomen; rotate injection sites within the same region to avoid lipodystrophy.
- When mixing 100 IU regular insulin with NPH insulin, 100 IU regular insulin should be drawn into syringe first.

☒ Precautions:

- Close monitoring of blood glucose and serum potassium.

- Exclusive use of **a sliding scale** insulin regimen in the inpatient hospital setting is strongly discouraged. In the critical care setting, continuous IV insulin infusion has been shown to best achieve glycemic targets.

- In noncritically ill patients with either poor oral intake or taking nothing by mouth, **basal** insulin or **basal** plus bolus is preferred.
- In noncritically ill patients with adequate nutritional intake, a combination of **basal** insulin, nutritional, and correction components is preferred.
- A blood glucose value <70 mg/dL should prompt a treatment regimen review and change, if necessary, to prevent further hypoglycemia.
- Diabetes self-management education (DSME) is essential to maximize the effectiveness of therapy.

☒ Monitoring Parameters

Serum potassium and glucose.

12. Salbutamol solution (0.5%) (5 mg/ml)

☒ Dosage:

- ✓ **Bronchospasm:** *Nebulization solution:* 2.5 mg 3 to 4 times daily as needed; Quick relief: 1.25 to 5 mg every 4 to 8 hours as needed
- ✓ **Exacerbation of asthma (acute, severe):** *Nebulization solution:* 2.5 to 5 mg every 20 minutes for 3 doses, then 2.5 to 10 mg every 1 to 4 hours as needed, **or** 10 to 15 mg/hour by continuous nebulization.
- ✓ **Hyperkalemia :** Inhalation: *Nebulization solution:* 10 to 20 mg over 10 minutes in combination with other recommended therapies .

☒ Preparation for Administration:

Dilute 0.25 mL (1.25 mg dose) or 0.5 mL (2.5 mg) of solution to a total of 3 mL with normal saline; also compatible with cromolyn or ipratropium nebulizer solutions.

☒ Administration:

Concentrated solution should be diluted prior to use; adjust nebulizer flow to deliver dosage over 5 to 15 minutes; avoid contact of the dropper tip (multidose bottle) with any surface, including the nebulizer reservoir and associated ventilator equipment. Blow-by administration is not recommended; use a mask device if patient unable to hold mouthpiece in mouth for administration.

☒ Precautions:

- Use with caution in patients with cardiovascular disease (arrhythmia, coronary insufficiency, hypertension, heart failure). It may produce ECG changes (flattening of the T wave, prolongation of the QTc interval, ST segment depression) and/or cause elevation in blood pressure, heart rate and result in CNS stimulation/excitation.

Use with caution in patients with hypokalemia.

- May elevate intraocular pressure.

- May increase serum glucose.

☐ Monitoring Parameters:

BP, HR; CNS stimulation; serum glucose, serum potassium, serum creatinine; asthma symptoms; arterial or capillary blood gases (if patients condition warrants).