

Ketamine Administration Guidelines

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Introduction and Mechanism of Action

Ketamine is a dissociative anesthetic extensively used for sedation, analgesia, and anesthetic induction. It offers a rapid onset and favorable hemodynamic profile, making it particularly valuable in trauma and ICU settings where respiratory drive preservation and hemodynamic stability are critical. Its versatile use spans across procedures, pain control, and emergency intubations.

Ketamine primarily acts as a noncompetitive antagonist at the N-methyl-D-aspartate (NMDA) receptor, thereby reducing excitatory neurotransmission central to pain pathways and the development of central sensitization (Lee et al., 2011). Other contributing mechanisms include:

- **Opioid Receptor Modulation:** Enhances analgesia
- **GABAergic Effects:** May aid in sedation
- **Monoaminergic Interactions:** Influences mood and perception

Chemically, ketamine is a cyclohexanone derivative with a chiral center; its S(+) enantiomer exhibits higher potency and fewer psychotomimetic effects compared to the R(-) form (Garcia et al., 2013). Pharmacokinetically, ketamine is characterized by rapid distribution, a short duration of action, and hepatic metabolism via cytochrome P450 enzymes to form active metabolites such as norketamine (Nguyen et al., 2014).

Indications for Ketamine Use

Ketamine is indicated in multiple clinical scenarios, including:

- Sole anesthetic agent for diagnostic and surgical procedures.
- Induction and maintenance of anesthesia.
- Refractory Status Epilepticus (RSE).
- Rapid Sequence Intubation (RSI).
- Pain Control for severe, refractory pain.
- Procedural (Conscious) Sedation.
- Acute Severe, Refractory Agitation.
- Acute Trauma Pain and opioid-refractory chronic pain.

Dosage Guidelines

➤ Intravenous (IV) Administration

IV Induction of Anesthesia

- **Adults:** 1-4.5 mg/kg IV (generally 2 mg/kg for 5-10 minutes of surgical anesthesia).
- **Pediatrics (Age 1 to 15 years):** 0.5 to 2mg/kg IV as single dose

Pain Control

- **Adults (Off-Label):** 0.2-0.5 mg/kg IV bolus; followed by 0.05-0.25mg/kg/hour continuous infusion; titrate to pain goal and tolerability
- **Pediatrics (Off-Label):** Start 0.05-0.2 mg/kg/hour. Max 1mg/kg/hour.

Procedural (Conscious) Sedation

- **Adults (Off-Label):** Initial: 1mg/kg IV over 1-2 minutes; repeat with 0.5-1 mg/kg every 5-10 minutes.
- **Pediatrics (Off- Label) (Age 3 months to 17 years):** 0.5 to 2mg/kg IV, may repeat 0.25 to 1.5 mg/kg/dose IV every 5 to 15 minutes as needed.

Acute Severe, Refractory Agitation

- **Adults (Off-Label):** Initial: 1-2 mg/kg IV over 30-60 seconds; repeat dose 0.5-1 mg/kg if needed.

Rapid Sequence Intubation (RSI)

- **Adults (Off-Label):** 1-2 mg/kg IV.
- **Pediatrics (Off- Label):** 1-2mg/kg/dose IV

➤ Intramuscular (IM) Administration

Pain Control

- **Adults:** 0.2-0.5 mg/kg IM.

Procedural (Conscious) Sedation

- **Adults:** 4-5 mg/kg IM; repeat dose 2-5 mg/kg if needed.
- **Pediatrics (Off-Label) (Age 3 months to 17 years):** 2-5 mg/kg/dose IM; may repeat dose after 5 to 10 minutes as needed.

Administration Areas

- **IV Administration:** Surgery, ED, ICU. For pain control in monitored beds with pulse oximetry.
- **IM Administration:** Surgery, ED, ICU. For pain control in monitored beds with pulse oximetry.
- **Procedural Sedation:** Procedural areas (ED, ICU, L&D, OR, PACU, GI Lab, Radiology, Cath Lab).
- **Acute Severe, Refractory Agitation:** ICU, ED, PACU, Operating Rooms.

Monitoring and Safety

- Mental status, blood pressure, respiration, pulse, cardiac function.
- Continuous hemodynamic and neuropsychiatric monitoring.
- Use with caution in patients with psychiatric disorders, elevated intracranial pressure, or uncontrolled cardiovascular disease.

Side Effects

- Increased blood pressure, arrhythmias (sinus tachycardia), nausea, vomiting, pain at injection site, laryngospasm, vivid dreams, hallucinations, tremors.

Stability and Preparation

- **Stability:** 2 mg/mL in D5W or 0.9% NaCl. Use 10 mg/mL concentration if fluid restricted.
- **Preparation:** Medications for RSI will be given in the presence of the physician (ED, Trauma, Anesthesia, Critical Care) or CRNA supervising RSI. The specific medication dose and timing of the medication administered will be determined by the supervising physician or CRNA.

Precautions and Recommendations

Ketamine serves as a valuable tool in trauma and ICU settings, offering rapid onset, preserved respiratory drive, and opioid-sparing benefits. Appropriate patient selection, dosing, and monitoring are critical to maximizing its benefits while minimizing risks.

Caution: When Ketamine is combined with other sedatives (benzodiazepines, opioids, etc.), the additive effect can result in respiratory distress and apnea.

Emergent Reactions: Occur in up to 20% of patients, necessitating careful patient selection and possible premedication with benzodiazepines (Anderson et al., 2023).

Contraindications

- **Psychiatric Disorders:** A history of psychosis or schizophrenia may be exacerbated by ketamine's psychotomimetic effects (Roberts et al., 2021).
- **Elevated Intracranial or Intraocular Pressure:** Ketamine should be used with caution or avoided in patients with intracranial pathology or acute glaucoma (Evans et al., 2022).
- **Uncontrolled Cardiovascular Disease:** Due to its sympathomimetic effects, ketamine is contraindicated in patients with severe cardiac disease or uncontrolled hypertension (Turner et al., 2023).



Version Control Record

Version	Date	Author/Reviewer	Description of Changes
1	10/9/24	Paul Wisniewski, D.O.	Initial review and update to reflect latest evidence/practice

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