

## ***Ketamine and the Emergency Department: It's Going to Get Weird***

Over the last 20 years, ketamine has gone from rarely used to one of the most helpful medications in the emergency department. My initial experience with the drug was using it on intravenous drug users with abscesses in Vancouver, British Columbia. Ketamine overcame their opiate tolerance, but many suffered horrendous hallucinations on emergence. Working in Abu Dhabi, I gave ketamine predominantly to children, who had only pleasant experiences on emergence. In my current practice in a Level 2 trauma center, I use ketamine on a regular basis to help give my patients a better clinical experience. I hope I can share my experience to help inform your practice.

### **Indications and Dosage:**

**Procedural sedation** (for abscess drainage, reduction of fractures, laceration repair)<sup>1</sup>

0.5-1.0 mg/kg intravenous (IV)

**Pediatric sedation** (laceration repair, reduction of fractures, removal of foreign bodies)<sup>1</sup>

4 mg/kg intramuscular (IM), 1 mg/kg IV, 1-10 mg/kg intranasally (IN).

Despite similar absorption, ketamine is dosed much higher when given IM to children.

**Subdissociative dose for pain management**<sup>2</sup>

0.15-0.3 mg/kg over 10 minutes followed by the same amount per hour IV.

Particularly useful for neuropathic pain, for acute-on-chronic pain and for patients already taking opiates (See Opiate Induced Hyperalgesia below)

**Prehospital analgesia**<sup>3</sup>

0.75 mg/kg IN, with another 0.5 mg/kg IN at 20 minutes if required

Ambulances in British Columbia are now equipped with intranasal ketamine as a result of the PAIN-K trial.

**Delayed Sequence Intubation**<sup>4</sup>

1 mg/kg initial dose, with additional 0.5 mg/kg doses until dissociated IV. This is a protocol (<https://emcrit.org/dsi/>) where patients with respiratory failure are given a dissociative dose of ketamine to settle them and allow additional oxygen to be administered for 3 minutes, after which intubation is carried out.

**Sedation of the out of control agitated patient – the “ketamine blow dart”<sup>5</sup>**

4-6 mg/kg IM

The Black Rock City Medical Plan 2016 recommends ketamine 4-6 mg IM or 2 mg IV for management of the overstimulated. Subsequent research spurred use in our department and this is now a regular protocol. The initial dosage suggested was 5 mg/kg IM, although adverse effects such as prolonged sedation and airway issues can occur. A more recent paper<sup>6</sup> suggests that a lower dose of 2 mg/kg can still be effective, with fewer side effects.

## **Asthma<sup>7</sup>**

Definitely a second line therapy, but useful in the severe asthmatic, especially if intubation is required. The dose of ketamine varies wildly in the literature, but is generally by IV infusion.

## **Seizures<sup>8</sup>**

Ketamine is a second line agent for the management of status epilepticus, helping to block excitatory neurotransmitters.

## **Cannabis Hyperemesis Syndrome<sup>9</sup>**

A recent study noted the effectiveness of ketamine and chlorpromazine intravenously over 15 min for the treatment of unexplained vomiting, predominantly associated with chronic cannabis use.

## **Depression and Suicidality<sup>10</sup>**

We are not currently using ketamine as a treatment for suicidality or depression in the emergency department. This seems unfortunate as the only other rapidly acting treatment for depression is electroconvulsive therapy. At times, emergency department treatment is limited to locking the patient in an isolated room, with no natural light and terrible food. This is rarely associated with an improvement in their mood.

There are several issues around ketamine treatment of the suicidal patient in the emergency department.

1. Ketamine can cause dysphoric reactions that may potentially worsen an already bad situation.
2. Ketamine assisted psychotherapy (KAP) is typically preceded by briefing sessions. This is less feasible in the emergency department.
3. Few psychiatric patients have intravenous access. Hospital protocols may dictate that they have to be moved to a monitored area for ketamine treatment. Intranasal ketamine is likely a more viable option.
4. The dosage of ketamine for treatment of depression is 0.5-1 mg/kg IV<sup>11</sup>. It is unclear to what degree the benefits are linked with dissociation. Delivering the same dose over a long period may be more palatable for psychiatric patients.

## **Contraindications**

Ketamine was historically underutilized due to overblown concerns regarding adverse effects and contraindications. Past concerns with increased intra-ocular pressure<sup>12</sup> and increased intracranial pressure<sup>13</sup> have not been borne out by ongoing evidence. Unfortunately dogma dies hard and these concerns are still found in recent guidelines.

The major real risk is cardiovascular. Ketamine remains a strong choice for the treatment of the hypotensive trauma patient as it tends to produce a sympathomimetic response. The typical response to intravenous ketamine is increased blood pressure and heart rate. This is unfortunate not favorable

for cardiac perfusion and may place patient's risk particularly those with previous cardiac conditions. It should be avoided in those with uncontrolled tachycardia or hypertension.

Ketamine is also avoided in those with age < 3 months, pregnancy and in thyroid conditions<sup>14</sup>

## **Complications**

### **Laryngospasm<sup>15</sup>**

Laryngospasm is relatively rare, occurring in around 0.3% of procedural sedations. It is more common when doing procedures in the oropharynx. Patients can typically be bagged despite the laryngospasm, although a two person bagging technique should be used to generate adequate pressure.

Laryngospasm can also be broken by the Larson maneuver, which is essentially a jaw thrust with additional firm pressure directed towards the opposite fingers.

### **Apnea**

Rapid IV push ketamine can rarely lead to apnea. A slow push, mini-bag or infusion is preferred.

### **Emergence Reactions**

Many ketamine procedural sedations are done with no preparation or minimal preparation; "It's going to get weird". As physicians have tuned into the importance of set and setting, we have taken to dimming the lights and decreasing extraneous noise in rooms after procedural sedation.

Treatment of emergence reactions can be done in two different ways. First, midazolam can be given to decrease anxiety. Secondly, additional ketamine can be given to dissociate the patient and get control of the situation.

### **Vomiting**

Typically in the recovery stage. Relatively common.

## **Other Issues:**

### **Co-administered Medications**

Propofol is the most common drug co-administered alongside ketamine. Propofol has amnestic and anxiolytic properties, which complement the analgesia from ketamine. Some emergency physicians mix ketamine and propofol in a 1:1 ratio referred to as "ketofol". Midazolam and ondansetron are less commonly used.

### **Is there a maximum dosage of ketamine?**

Once patients have reached a dissociated stage, additional ketamine serves only to prolong the duration of effect. The maximum daily dose of IV ketamine is 3600 mg and concerns about bladder toxicity begin to appear with larger dosages. This case report of a patient receiving a 500 mg intravenous push of ketamine is a harrowing tale.<sup>16</sup>

### **Opiate hyperalgesia**

“Burst” ketamine protocols have been used to decrease opiate tolerance with a short term, high dose ketamine treatment.<sup>17</sup> The use of ketamine to help diminish opiate use revolves around the concept of opiate induced hyperalgesia (OIH). OIH is a phenomenon where prolonged use of opiate analgesics increases a person's sensitivity to painful stimuli. Many chronic opiate patients exhibit this phenomenon with decreasing function and increased pain over time. OIH is thought to be related to NMDA receptors and to be treated by NMDA antagonists such as methadone, dextromethorphan and ketamine.<sup>18</sup>

In the emergency department this makes ketamine particularly useful in the treatment of acute on chronic pain or for an acute injury in someone who takes regular opiates.

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