

Provincial Clinical Knowledge Topic
Low Dose Ketamine Infusion for Analgesia – Adult,
Acute Care
Version 1.0

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Revision History

Version	Date of Revision	Description of Revision	Revised By
1.0	January 2018	Topic complete	Dr. Jeremy Hamming

Important Information Before you Begin

The recommendations contained in this knowledge topic have been provincially adjudicated and are based on best practice and available evidence. Clinicians applying these recommendations should, in consultation with the patient, use independent medical judgment in the context of individual clinical circumstances to direct care. This knowledge topic will be reviewed periodically and updated as best practice evidence and clinical practice change.

The information in this topic strives to adhere to Institute for Safe Medication Practices (ISMP) safety standards and align with Quality and Safety initiatives and accreditation requirements such as the Required Organizational Practices. Some examples of these initiatives or groups are: Health Quality Council Alberta (HQCA), Choosing Wisely campaign, Safer Healthcare Now campaign etc.

This topic was developed to provide guidance and support for all clinicians involved in the ordering and management of low dose ketamine infusion for analgesia across the province. The acute care '**Pain Consultant**' includes all physicians practicing within Acute Pain Service roles, and will include on-call anesthesiologists responsible for providing pain management options for patients, or other designated clinicians. The term **APS/Pain Consultant** used in this topic encompasses all these roles.

This topic is based on the following guideline:

[Guidelines on the management of postoperative pain](#)

Rationale

Evidence demonstrates the use of low-dose ketamine infusion for analgesia to be useful as a part of multimodal analgesia regime to manage post-operative pain, malignant (cancer) pain, neuropathic pain and severe pain in opioid tolerant/opioid addicted patients.

Low-dose ketamine infusion for analgesia is an effective adjunct to opioid analgesia for patients with intractable pain and a helpful adjunct to patients who are extremely opioid tolerant.

The low-dose ketamine infusion for analgesia clinical knowledge topic has been developed to enhance efficacy, patient safety while minimizing practice variation throughout the province.

The low-dose ketamine infusion for analgesia clinical knowledge topic is based on current evidence and clinical practice.

Goals of Management

Low-dose ketamine infusion for analgesia offers an additional analgesic modality for patients with severe, difficult to manage pain.

Goals:

- May improve patients' subjective perception of their pain.
- May facilitate opioid dose reduction and opioid related side effects.
- May enhance pain management allowing for better mobilization, improved physiotherapy participation and shorter length of stay

Decision Making

Indications for Low-Dose Ketamine Infusion for Analgesia

Low-dose ketamine infusion for analgesia is shown to be beneficial in providing analgesia when given in conjunction with traditional analgesics for patients with:

- Chronic or intractable pain
- Severe post-operative pain
- Malignant (cancer) pain
- Neuropathic pain
- Significant opioid tolerance

Relative Contraindications for Low-Dose Ketamine Infusion for Analgesia

- Hypersensitivity to ketamine
- Increased intracranial pressure
 - Evolving research suggests this may not be a relative contraindication
- Seizure disorder (e.g., epilepsy)
- Increased intraocular pressure
- Porphyria
- Significant cardiovascular disease, severe hypertension, myocardial ischemia and stroke
- Pulmonary hypertension
- Psychiatric conditions including: post-traumatic stress disorder, psychosis and mania

Pharmacokinetics of Low-Dose Ketamine Infusion for Analgesia (without a bolus or loading dose)

Plasma levels and therapeutic effect build over first several hours of the infusion

It is recommended to monitor the patient up to 8 to 12 hours post cessation of infusion because of prolonged half-life of active metabolite

Ketamine is metabolized in the liver and should be administered with caution to people with altered hepatic function.

Ketamine's metabolite is norketamine, which is pharmacologically active but approximately one-third as potent as ketamine.

Norketamine is excreted via the kidneys and the biliary system.

Advantages and Disadvantages

The **advantages** of low-dose ketamine infusion for analgesia are:

Low Dose Ketamine Infusion for Analgesia, Adults – Acute Care Version 1.0

- Opioid-sparing.
- May be an effective adjunct to opioid analgesia for patients with intractable pain.
- May be a helpful adjunct to patients who are extremely opioid tolerant.

The **disadvantages** of low-dose ketamine infusion for analgesia are as follows:

- Although the risk of CNS depression is low with ketamine alone, ketamine will most often be administered concurrently with opioids; therefore, there is still a risk of **opioid induced CNS depression**.
- Psychotomimetic effects may become intolerable to patients.

Therapeutic Effects

The analgesia effect is via a non-opioid mechanism. Ketamine binds to N-Methyl-D-aspartate (NMDA) receptors in the spinal cord, principally within the nociceptive neurons of the dorsal horn. Chronic and severe pain leads to an up regulation in the NMDA receptors, sensitizing the patient further to painful stimuli. Ketamine binding to the NMDA receptor, decreasing activity of the nociceptive neurons and reduces spinal cord sensitization.

Potential Side Effects of Low-Dose Ketamine Infusion for Analgesia Administration

Central Nervous System

- Psychotomimetic effects
- Impaired physical and mental abilities
- Increased Cerebrospinal fluid (CSF) volume
- Increased intracranial pressure (debatable)
- Nystagmus
- Sedation/CNS depression
- Increased muscle tone/tremors/neuromuscular tonic-clonic movements
- Diplopia
- Pupil dilation

Cardiovascular

- Hypertension and tachycardia are common
- Arrhythmia, hypotension and bradycardia are possible

Respiratory

Rapid administration may cause:

- Respiratory depression or apnea
- Increase in bronchial secretions
- Bronchodilation

Ear, Nose, Throat

- Hypersalivation
- Increased secretions

Gastrointestinal

- Nausea
- Vomiting

Local

- Pain
- Erythema

- Irritation (tissue irritant) at site of injection

Note: Most of the above mentioned major complications are dose related, and usually the consequence of rapid administration of large doses, i.e. when ketamine is used as a general anesthetic in the operating room. The incidence and severity of reactions are therefore less when used as a low dose infusion without a bolus.

Toxicity

Ketamine effects at high dose typically include:

- Respiratory depression
- Altered mental status
- Tachycardia
- Cardiac arrhythmias
- Hypertension
- Hallucinations
- Anxiety
- CNS depression
- Anesthesia.

Reversal of Effects

There is currently no medication that can reverse the effects of ketamine.

Naloxone has no effect on ketamine. However, naloxone should be given for opioid-induced CNS depression for a patient receiving both opioids and ketamine.

Psychotomimetic effects of ketamine can be attenuated with benzodiazepines.

Precautions

Use with caution in patients with:

- Coronary artery disease
- Hypertension
- Tachycardia
- Altered liver function
- Increased intracranial pressure
- Chronic alcohol use.

Concurrent Multimodal Analgesia

Patients who are receiving low-dose ketamine infusion for analgesia will likely be receiving other analgesic agents

Patients on opioids and ketamine should be closely monitored for respiratory or CNS depression. It is important for all caregivers to be aware of the indications, effects and adverse effects of all medications administered to the patient. Careful monitoring is required to ensure that the patient receives relief from pain while avoiding complications.

All opioids given in conjunction with a low-dose ketamine infusion for analgesia must be assessed, ordered, and adjusted only by [APS/Pain Consultant](#).

Sedation Score

Table 1: Assessing Sedation Score	
Score	Description
S	Normal sleep, easy to arouse
0	Alert
1	Slightly drowsy
2	Frequently drowsy, easy to arouse
3	Somnolent, difficult to arouse

Low Dose Ketamine Infusion for Analgesia Adult Orders

Order Set Restrictions: Restricted to Acute Pain Services (APS) and/or Pain Consultant. The acute care '**Pain Consultant**' includes all physicians practicing within Acute Pain Service roles, and will include on-call anesthesiologists responsible for providing pain management options for patients, or other designated clinicians.

Warnings and Cautions:

Relative contraindications include: hypersensitivity to ketamine, increased intracranial pressure, seizure disorder, increased intraocular pressure, porphyria, significant cardiovascular disease, severe hypertension, myocardial ischemia, stroke, pulmonary hypertension, psychiatric conditions.

Patient Care

- Clinical Communication: Prior to starting low-dose ketamine infusion; review all previous analgesic, antiemetic, antipruritic and sedation orders with ordering service.
- Clinical Communication: Low-dose ketamine infusion for analgesia, analgesics, sedatives, antipruritics and antiemetics must be ordered by the Acute Pain Service/Pain Consultant.
- Clinical Communication: Use designated pain assessment documentation to monitor and document status related to analgesic administration.
- Notify Acute Pain Service/Pain Consultant for all problems and orders related to pain, sedation, nausea and vomiting, and pruritus.
- Notify Acute Pain Service/Pain Consultant if patient continues to experience agitation/psychotomimetic effects despite administration of benzodiazepine and reduction of ketamine infusion.
- Notify: Stop Low-Dose Ketamine infusion and notify Acute Pain Service/Pain Consultant if heart rate greater than 110 beats per minute, respiratory rate less than or equal to 8 per minute or oxygen saturation less than or equal to 92% despite oxygen administration

Monitoring

Consider patient characteristics, infusion duration and dose when selecting post discontinuation monitoring duration.

- Vital Signs Protocol for duration of infusion and 12 hour post discontinuation of Low-Dose Ketamine Infusion for Analgesia – Monitor as follows:
Every 15 minutes for one hour, every 2 hours for 4 hours, then every 4 hours for duration of infusion and **12** hours post discontinuation of infusion. Repeat monitoring sequence with any rate increase of the low-dose ketamine infusion for analgesia.
- Vital Signs Protocol for duration of infusion and 8 hours post discontinuation of Low-Dose Ketamine Infusion for Analgesia – Monitor as follows:
Every 15 minutes for one hour, every 2 hours for 4 hours, then every 4 hours for duration of infusion and **8** hours post discontinuation of infusion. Repeat monitoring sequence with any rate increase of the low-dose ketamine infusion for analgesia.
- Weigh patient prior to starting infusion
- Monitor Cardiorespiratory: Continuous oxygen saturation and pulse monitoring.
Document every four hours and PRN

Intravenous Therapy

- Maintain Intravenous Access for duration of therapy and for 8 to 12 hours post discontinuation of Low-Dose Ketamine Infusion for Analgesia.

Medications

Recommended Dose is 0.05 to 0.2 mg/kg/hour. Select patient populations may require a dose range of 0.05 to 0.3 mg/kg/hour. It is reasonable to use actual body weight up to a weight to 100 kg. Maximum recommended infusion 30 mg/hour.

- ketamine Infusion _____ mg/kg/hour, IV, Continuous. Titration instructions to be provided by APS/Pain Consultant. Additional Information: _____

Treatment of Side Effects of Low Dose Ketamine Infusion

Patient Care

- In and Out catheter every 6 hours PRN for urinary retention.

Respiratory Care

- Oxygen therapy: Titrate saturation as needed to maintain SpO₂ greater than or equal to 92%.
- Assess patient as needed for excessive secretions. Ensure respiratory suction is available at bedside.

Medications

Antipruritics – PRN

- nalbuphine 2.5 mg IV every 3 hours PRN for pruritus.

Recommended dose range: 0.02 to 0.04 mg

- naloxone _____ mg IV every 2 hours PRN for pruritus.

Recommended dose range: 12.5 to 50 mg.

- diphenhydrAMINE _____ mg IV every 4 hours PRN for pruritus or nausea.

- naltrexone 5 mg PO/NG/OG every 12 hours PRN for pruritus.

Antiemetics – PRN

- metoclopramide 10 mg IV every 4 hours PRN for nausea.
- ondansetron 4 mg IV every 8 hours PRN for nausea.

Psychotomimetic Effects – PRN

Recommended dose range: 1 to 2 mg.

- midazolam _____ mg IV every 2 hours PRN for agitation/psychotomimetic effects.

Recommended dose range: 0.5 to 1 mg.

- LORazepam SL _____ mg PO/SL every 4 hours PRN for agitation/psychotomimetic effects.

Naloxone Protocol

Patient Care

- Notify – Attending Service when Respiratory rate less than 8 per minute and Sedation Level 3.
- Vital Signs – When respirations less than 8 per minute and Sedation Level 3 as per local Naloxone Protocol monitor pulse, respirations, oxygen saturation, pain score, sedation

level, blood pressure every 5 minutes for 30 minutes and then every 15 minutes for one hour and then when required.

Medication

- ☑ naloxone 0.1 mg Direct IV every 3 minutes PRN for respiratory rate less than 8 per minute and sedation level 3. Maximum 4 doses. Give first dose STAT.
- ☑ If no IV access, naloxone 0.2 mg subcutaneously/intramuscularly (IM) every 10 minutes PRN for respiratory rate less than 8 per minute and sedation level 3. Maximum 4 doses. Give first dose STAT.

Clinical Decision Support

Alert to occur at time of Order Set selection for all non-APS and non-anesthesia clinicians:

Orders pertaining to low-dose ketamine infusion for analgesia are only to be initiated, modified and discontinued by an appropriate consultant service, typically Acute Pain Service (APS)/Anesthesia/Pain Consultant with the exception of other services such as Children's Health, Critical Care and Palliative Care Areas which may have their own unique ketamine infusion protocols for their respective patient cohorts, that are not meant to be included in coverage by this protocol).

Relevant Links

Link to Lidocaine Continuous Infusion Clinical Knowledge Topic:

<http://insite.albertahealthservices.ca/assets/klink/et-klink-ckv-lidocaine-continuous-infusion-therapy-adult-acute-care.pdf>

Link to Alberta Health Services Ketamine Parenteral Monograph:

http://webappsint.albertahealthservices.ca/pharmacy/pm/pm_preview.asp?id=8903

Disposition Planning

1. Considerations for admission
 - Consultation with the appropriate specialist supporting patient care in the facility must be completed prior to initiating low-dose ketamine infusion for analgesia
2. Considerations for Discharge/Transfer
 - Low-dose ketamine infusion for analgesia is to occur within acute care settings only and must be discontinued prior to patient discharge from the acute care facility.
 - It is recommended to discontinue infusion 8 – 12 hours prior to discharge. If discharge occurs prior to this, patient should be assessed by APS/Pain Consultant to confirm readiness for discharge.

Analytics

Outcome Analytic 1

Name of Measure	Patient Outcome and Low Dose Ketamine Infusion for Analgesia
Definition	To measure meaningful patient outcomes which may be improved throughout the use of low dose ketamine infusion for analgesia. These include: <ol style="list-style-type: none"> 1. Facilitating opioid dose reduction and opioid related side effects 2. Enhance pain management 3. Decrease length of stay 4. Improve physiotherapy participation
Rationale	Measurement of the improvement in patient outcomes demonstrate the effectiveness of low dose ketamine continuous infusion for analgesia.
Cited References	Chou R, Gordon DB, de Leon-Casasola OA, et al. Guidelines on the management of postoperative pain. Management of postoperative pain: A clinical practice guideline from the American Pain Society, the American Society of Regional Anesthesia and Pain Medicine, and the American Society of Anesthesiologists' Committee on Regional Anesthesia, Executive Committee, and Administrative Council. <i>JPain</i> . 2016; 17(2): 131-157. dx.doi.org/10.1016/j.jpain.2015.12.008

Outcome Analytic 2

Name of Measure	Order Set Usage for Low Dose Ketamine Infusion Therapy for Analgesia – Adult Order Set.
Definition	For all surgical patients, number of times Low Dose Ketamine Infusion Therapy Order Set is used. Overall, by region, by sites and by unit.
Rationale	Intended to measure if the order set cited in the knowledge topic is being used and what percentage of the time for the indicated condition. May indicate areas with adoption issues or gaps in topic.
Notes for Interpretation	Health record to have coding for Low Dose Ketamine Infusion Therapy for Analgesia – Adult Order Set, site capacity, roll out of provincial CIS.

Outcome Analytic 3

Name of Measure	Compliance to clinical standards in Low Dose Ketamine Infusion Therapy for Analgesia – Adult Order Set
Definition	To determine compliance to clinical standards within the order set
Rationale	What percentage of the time are the orders within the Low Dose Ketamine Infusion Therapy for Analgesia – Adult Order Set followed for patients in which the Low Dose Ketamine Infusion Therapy for Analgesia – Adult Order Set is ordered?
Notes for Interpretation	Health record to have coding for Low Dose Ketamine Infusion Therapy for Analgesia – Adult Order Set.

Clinical Recommendations Summary

Clinical Question #1: In postoperative patients, does low dose, continuous ketamine infusion for analgesia improve patient outcomes (e.g. length of stay, reduced nausea and vomiting, improved recovery [functional capacity and physiotherapy participation])?

Clinical Recommendation #1: Low dose, continuous ketamine infusion in some postoperative patients may reduce opioid side effects (as a measure of reduced opioid consumption). The optimal dose, timing, duration of low dose ketamine infusion are unknown.

Quality of Evidence:

Length of Stay – insufficient evidence

Reduced nausea and vomiting (indirectly as result of reduced opioid consumption): Low, GRADE C

Recovery – Very low, GRADE D

Strength of Recommendation:

Length of Stay – insufficient evidence

Opioid side effects (indirectly as result of reduced opioid consumption): Weak, GRADE 2

Recovery – insufficient evidence

References

The resources provided by Acute Pain Service, Calgary Zone have been invaluable to the development of the information within this Clinical Knowledge Topic including the information provided within the topic appendices.

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Acute Pain Service – Calgary Zone. Low-Dose Ketamine Continuous Intravenous Infusion – Adult Practice Support Document Protocol PS-37-01. 2015. Alberta Health Services.

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Keywords

Ketamine

Low-dose ketamine continuous intravenous infusion

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Appendix A – Resource for Management of Low Dose Ketamine Infusion for Analgesia

The Low Dose Ketamine Infusion for Analgesia Clinical Knowledge Topic is the Alberta Health Services (AHS) endorsed standard of care and the information within this topic is intended for use by all healthcare professionals involved with the education and management of low dose ketamine infusion for analgesia. Low dose ketamine infusion for analgesia may be performed by a healthcare professional who:

- Is authorized by legislation to perform this activity; and
- Has completed additional relevant education/training; and
- Is competent to perform this procedure; and
- Is supported by the AHS unit or site to perform this competency.

The information provided within these appendixes is meant to support the education and resources necessary to manage adult patients requiring low dose ketamine continuous therapy and is intended to enhance the knowledge and skills of nurses and other healthcare professionals to facilitate safe and effective care of adult patients.

Prerequisites

For healthcare professionals administering low dose ketamine infusion for analgesia, competency is to be achieved by review of the information within this Clinical Knowledge Topic along with attainment of score of at least 85% on the low dose ketamine infusion for analgesia exam: <http://insite.albertahealthservices.ca/assets/anec/tms-anec-ketamine-test.pdf>.

Additionally, successful completion of the Intravenous (IV) Medication Administration Learning Module as applicable for Unit/Site/Zone and relevant Clinical Care Knowledge Topics must occur prior to completion of the low dose ketamine infusion for analgesia exam.

Note: Competency in infusion therapy, medication administration, and basic pain theory and pain management is required before competency can be reached to manage low dose ketamine infusion for analgesia.

Note: Attendance at the AHS Basic Pain Workshop is strongly recommended, **if offered within your zone**. Discuss with your Clinical Nurse Educator, practice leader and/or manager to determine course dates and locations.

Note: Discuss learning needs required to gain competency to manage low dose ketamine infusion for analgesia with your education, practice leader and/or manager.

Learning Resources

Alberta Health Services Ketamine Parenteral Monograph
http://webappsint.albertahealthservices.ca/pharmacy/pm/pm_preview.asp?id=8903

In addition to reviewing this Clinical Knowledge Topic, review of relevant applicable resources including policies, procedures and protocols.

Instructions to Gaining Competency

To gain competency in management of patients receiving low dose ketamine infusion for analgesia:

1. Review the information provided within this Clinical Knowledge Topic
2. Complete the online Low Dose Ketamine Infusion for Analgesia Exam located in <http://insite.albertahealthservices.ca/assets/anec/tms-anec-ketamine-test.pdf>. Provide a copy of the completion certificate to your Clinical Nurse Educator/information session facilitator.
Note: A minimum pass mark of 85% for the Low Dose Ketamine Infusion for Analgesia Exam is mandatory. If a mark less than 85% is achieved, further study may be necessary before gaining competency in this skill. Consult with your Clinical Nurse Educator.
3. Attend a low dose ketamine infusion for analgesia information session/basic pain workshop **if this is offered within your zone**
Note: You **must** provide a copy of the Low Dose Ketamine Infusion for Analgesia Exam located in to the facilitator of the workshop at time of attendance.
4. Review infusion pump skills with healthcare professionals experienced in low dose ketamine infusion for analgesia.
5. Demonstrate the ability to apply knowledge and skills related to caring for patients receiving low dose ketamine infusion for analgesia by successful completing the Competency Checklist for Low Dose Ketamine Infusion for Analgesia – Adults located in [Appendix C](#) competently when evaluated by a Clinical Nurse Educator or designate.

Following completion of these learning activities, healthcare professionals will be evaluated in the clinical area on their ability to perform the procedures of setting up, programming and caring for patients using low dose ketamine infusion for analgesia. Healthcare professionals requiring an update may independently refer to this Clinical Knowledge Topic, repeat portions of, or complete all the Instructions to Gaining Competency requirements in collaboration with the Clinical Nurse Educator and/or designate. Please direct any questions or concerns to the Clinical Nurse Educators and/or designates within your clinical area.

Exceptions

Patient Populations where compliance with the prerequisites and instructions to Gaining Competency are **not** applicable (this may vary by zonal requirements) include:

- Cardiovascular Intensive Care Units,
- Coronary Intensive Care Units,
- Emergency Departments,
- Intensive Care Units,
- Operating Rooms,
- Palliative Intensive Care Units and
- Post Anesthetic Care Units.

Learning Objectives

Competency for Low Dose Ketamine Infusion for Analgesia – Adults includes the ability to:

1. State the dosage of analgesic low dose ketamine infusion for analgesia
2. Explain the pharmacokinetics, side effects and potential complications of low dose ketamine administration
3. Describe concurrent multimodal analgesia and potential interactions with opioid administration
4. Explain the indications and contraindications for the use of low dose ketamine infusion for analgesia

5. Describe advantages and disadvantages of managing pain with low dose ketamine infusion for analgesia.
6. Demonstrate the safe performance of:
 - Setting up of the large volume infusion smart pump.
 - Programming the infusion smart pump following patient care orders
 - Completing independent double check practices and infusion pump settings in accordance with the [Independent Double-Check Practice Support Document Guideline PS-60-01](#)
 - Titrating the range dose orders to effect if this information is provided in order
 - Identifying potential adverse effects.
7. Describe the nursing assessment, monitoring and management of a patient receiving low dose ketamine infusion for analgesia.
8. Describe patient and family education regarding low dose ketamine infusion for analgesia.
9. Document assessment and interventions regarding low dose ketamine infusion for analgesia accurately.
10. Describe interventions to manage complications of low dose ketamine infusion for analgesia.
11. Describe actions for resolving potential and actual safety concerns related to the analgesic use of low dose ketamine infusion for analgesia.

Key Terms

Dissociative Anesthesia: prevention of the higher brain centers from perceiving auditory, visual or painful stimuli. The patient appears awake, but uncommunicative and unresponsive to pain.

Ketamine: a N-methyl-D-aspartate (NMDA) glutamate receptor antagonist but also binds to opioid mu and sigma receptors at high doses. It is known as a dissociative anesthetic via its action on the cerebral cortex and limbic system and causes the release of endogenous catecholamines (epinephrine, norepinephrine). In addition, it reduces polysynaptic spinal reflexes.

Low Dose Ketamine Infusion for Analgesia: ketamine continually infused intravenously at a dose between 0.05 mg/kg/hour – 0.3 mg/kg/hour for the purpose of enhancing analgesia.

NMDA Receptor: a receptor in the spinal cord that assists in the transmission of pain impulses to the brain.

Opioid-induced Hyperalgesia: hypersensitivity to pain stimuli that occurs after prolonged administration of opioids, individuals can even develop a painful response to previously non-noxious stimuli. Pain can increase with increased doses of opioids; hyperalgesic pain can seem unrelated to the original cause of pain. Treatment: reduction or discontinuation of opioid administration.

Opioid-sparing Medication: non-opioid medication that potentiates the analgesic effect of opioids, allowing for equal analgesic effect with less opioid required when administered concurrently.

Psychotomimetic Effects: ketamine, as well as other opioids, may cause patients to experience hallucination, bad dreams or dysphoria. Severity is dose related, incidence is

greatest in adult females and patients with a history of psychosis or personality disorders. May be moderated by decreasing environmental stimulation and the administration of a benzodiazepine.

Ketamine Properties

Ketamine is traditionally used anesthesia as an adjuvant to general anesthetics but is not considered a general anesthetic itself. Ketamine is also used for procedural sedation, predominantly in children's health areas. Its properties include anesthesia, analgesia, dissociation and amnesia.

Therapeutic Effects

Analgesia – Ketamine binds to receptors in the spinal cord, preventing the binding of amino acids that assist in the transmission of pain impulses, therefore blocking the pain sensation from ascending to the brain.

Opioid-sparing effects – Ketamine allows for dose reduction on concurrent opioids.

Appendix B – Set Up, Administration, Maintenance and Monitoring Ordering and Administration Highlights

- Orders pertaining to low dose ketamine infusion for analgesia – adult are only to be initiated, modified and discontinued by [APS/Pain Consultant](#) (with the exception of Children’s Health, Critical Care and Palliative Care areas).
- Dosage is dependent on the patient’s body weight. An accurate documented weight within 24 hours of initiating a low dose ketamine infusion for analgesia – adult must be used upon initiating the infusion. If no weight is documented, the nurse must manually weigh the patient prior to programming the pump and initiating the infusion.
- Dosing may be ordered in a range to be titrated by nursing to effect; provided [APS/Pain Consultant](#) has provided titration information in the order set, otherwise notify [APS/Pain Consultant](#) should the dose require adjustment.
- Low dose ketamine infusion for analgesia – adult is administered via the drug library of a large volume smart infusion pump.
- Low dose ketamine infusion bags are mixed on demand by the nurse who will administer the infusion. Ketamine should be protected from heat and light. For information regarding reconstitution, dilution, stability and compatibility, refer to the Ketamine Parenteral Monograph. Link to Alberta Health Services Ketamine Parenteral Monograph http://intraweb01.albertahealthservices.ca/pharmacy/pm/pm_preview.asp?id=8903
- An independent double check and documentation of a co-signature are required when:
 - Initiating an infusion
 - Changing or titrating the rate (if this option is provided within the order and completed by nursing)
- Low dose ketamine infusion for analgesia must be accompanied by a maintenance infusion, or “runner line,” of normal saline or D5W. The runner line infusion must infuse into one lumen of vascular access at a minimum rate of to keep the vein open. No other medication is to be “piggybacked” into the low dose ketamine infusion tubing or the runner line as low dose ketamine is incompatible with most intravenous infusion medications. The administration set is to be without ports.
- Low Dose Ketamine Infusion for Analgesia may be set up with Patient Controlled Analgesia ([Appendix D](#)) or Lidocaine Infusion for Analgesia ([Appendix E](#)).

Patient Education

Before initiating a low dose ketamine infusion for analgesia – adult patients should be informed that:

- They may experience dream-like sensations
- They should inform the nursing staff should the dream-like sensations worsen or become intolerable
- There are medications they may request that may help alleviate these potential unpleasant adverse events (if ordered)
- Visitors should be kept to a minimum to decrease stimulation and moderate unpleasant or disturbing psychotomimetic effects
- Televisions, computers, or other devices that produce sound and light should be turned off to decrease stimulation
- Lights should be lowered to decrease stimulation
- They should inform nursing staff if pain does not improve or worsens

Infusion Management Considerations

1. Each patient shall be assessed for pain using a consistent and valid pain assessment tool
2. It is recommended that a pain management plan and/or goal(s) be identified prior to starting low dose ketamine infusion for analgesia.
3. [APS/Pain Consultant](#) is responsible for providing orders for all analgesics, including opioids, in addition to the low dose ketamine infusion for analgesia.
4. Initial programming and all dose adjustments require an independent double-check by another competent healthcare professional in accordance with the [Independent Double-Check Practice Support Document Guideline PS-60-01](#).
5. Prior to commencing a low dose ketamine infusion for analgesia, the healthcare professional shall discuss the expected effect(s) of the treatment, as well as signs of potential local anesthetic toxicity with the patient and/or healthcare personnel involved in the patient's care.
6. Patients receiving low dose ketamine infusion for analgesia in addition to opioid medications may require more frequent monitoring than typically required.

Infusion Preparation and Initiation

Before initiating low dose ketamine infusion for analgesia – adult, patients should be informed that:

- [APS/Pain Consultant](#) has ordered low dose ketamine infusion for analgesia including the following orders:
 1. Infusion dose in mg/kg/hour or Infusion range dose in mg/kg/hour
 2. Route
 3. Mode of delivery (continuous infusion)
 4. Monitoring parameters
 5. Other medications such as benzodiazepines and/or opioids
- Baseline vital signs are recorded (respiratory rate, blood pressure, pulse and oxygen saturation), along with pain rating and sedation level
- A dedicated vascular access site exists or is initiated.
- An accurate weight has been obtained and documented within the appropriate documentation in the last 24 hours, if not, obtain and record an accurate weight.

Patient assessment is to include:

1. Understanding of the education provided regarding the low dose ketamine infusion for analgesia
2. Ability to ask for analgesia
3. Pain intensity using a valid assessment tool
4. Sedation level
5. Baseline vital signs including:
 - a. Blood pressure
 - b. Pulse
 - c. Respiratory rate, and
 - d. Oxygen saturation
6. Any other relevant assessment(s) and/or actual/potential problems.

Equipment Required

The following equipment is required for low dose ketamine infusion for analgesia (Exceptions: When patient controlled analgesia (PCA) is ordered concurrently – see [Appendix D](#) Set Up of

Low Dose Ketamine Infusion for Analgesia plus Patient Controlled Analgesia or when lidocaine infusion therapy for analgesia is ordered concurrently – see [Appendix E](#) Set Up of Low Dose Ketamine Infusion for Analgesia plus Lidocaine Continuous Infusion for Analgesia)

- Two (2) Smart intravenous infusion pumps
 - One dedicated to the low dose ketamine infusion line and
 - One dedicated to the maintenance infusion line
- Intravenous infusion pump dedicated to runner line
- 2 sets of port-less infusion tubing
- Dual lumen saline lock primed with saline
- Normal saline flush
- Ketamine bag mixed for intravenous administered
- Intravenous infusion maintenance bag of D5W, normal saline or ringer's lactate
- Patent intravenous site or available central vascular catheter lumen dedicated for ketamine infusion.

Mixing the Medication Infusion Bag

- Prepare and label the ketamine infusion bag and administration set according to the Line Labelling and Tracing Policy <http://insite.albertahealthservices.ca/8470.asp> and the [Independent Double-Check Practice Support Document Guideline PS-60-01](#).
- Aseptic technique is required during contact with the ketamine infusion solution, tubing, vascular access device dressing, and/or access site.

Procedure

1. Review patient health record for low dose ketamine infusion for analgesia order as well as patient allergies (e.g. latex, tape, or antiseptic agents).
2. Gather supplies and perform hand hygiene.
3. Explain therapy to patient.
4. Receive consent to proceed and provide adequate support to patient during initiation.
5. Verify patient identity using two patient identifiers.
6. Obtain patient weight if not previously recorded.
7. Perform hand hygiene and prepare administration and infusion supplies prior to initiating therapy.
8. Prime one port-less infusion administration set with the low dose ketamine infusion for analgesia solution; prime the other port-less infusion administration set with a maintenance (D5W, normal saline or ringer's lactate) to run to keep vein open (TKVO) unless order for alternate maintenance line infusion rate provided.
 - Program the ketamine infusion into the smart intravenous infusion pump that will be dedicated to ketamine.
 - Program the second intravenous infusion pump for the runner line. Ensure that the rate of the runner line is sufficient to maintain patency of the vascular access device used (minimum rate of to keep vein open).
 - Connect each of the two sets of tubing (the ketamine tubing and runner line tubing) to each of the two lumens on the normal saline primed saline lock.
Note: If central vascular access is used, a dual lumen saline lock extension is used to infuse both lidocaine and the runner solution into the same lumen.
9. Label each set of tubing with its respective contents in accordance with the Invasive Infusion Line Policy.
10. Prime a double lumen saline lock with normal saline.

For set up of low dose ketamine infusion plus PCA, review [Appendix D](#) Set Up of Low Dose Ketamine Infusion for Analgesia plus Patient Controlled Analgesia. For set up ketamine infusion plus lidocaine infusion therapy for Analgesia, review [Appendix E](#) Set Up of Low Dose ketamine Infusion for Analgesia plus Lidocaine Continuous Infusion Therapy for Analgesia.

11. Select the large volume infusion pump that will be dedicated to the low dose ketamine infusion for analgesia, load the infusion administration set, and program the pump according to the information required in the smart pump's drug library.
12. Load and program the second large volume infusion pump for the maintenance solution
 - The maintenance solution shall infuse at a minimum TKVO rate to maintain patency of the vascular access device.
13. Connect each of the two (2) infusion administration sets (the low dose ketamine tubing and the maintenance line tubing) to the primed double lumen saline lock and attach to the dedicated intravascular access.
14. Seek a qualified healthcare professional to complete the mandatory independent double-check to verify medication, pump settings, and infusion solution with the orders prior to initiating the infusion.
15. Complete a baseline assessment including:
 - a. Pain score using a valid scoring tool
 - b. Sedation level
 - c. Respiratory rate
 - d. Blood pressure
 - e. Pulse and
 - f. Oxygen saturation
16. Start the low dose ketamine and maintenance infusions
17. Follow orders to complete initial monitoring after infusion initiation including pain score, sedation level, respiratory rate, pulse, blood pressure and oxygen saturation level
Note: After increasing the infusion rate of low dose ketamine and /or after stopping and restarting the infusion; the monitoring requirements return to the initial monitoring rates as described in the order.

Titrating the Infusion to Effect (if this option is provided by the Pain Consultant)

[APS/Pain Consultant](#) will order the starting infusion dose. Ensure that the patient has agreed upon a pain score goal, and increase the rate of infusion slowly within the ordered range until the established pain goal is reached. Decrease the rate of infusion if psychotomimetic side effects become intolerable and benzodiazepines are not effective. [Monitor](#) more frequently after rate titration. Continue to monitor for side effects and adverse effects for the duration of the infusion.

Management of Side Effects and Complications

For modulation of psychotomimetic effects, give a benzodiazepine as ordered, and decrease tactile, auditory and visual stimulation in patient's room. An authorized prescriber order is required for administration of benzodiazepines for psychotomimetic disturbances.

If symptoms of opioid withdrawal occur, notify [APS/Pain Consultant](#).

If Central Nervous System depression occurs (i.e. sedation score of 2) assess the patient's level of consciousness, respiratory rate, oxygen saturation, and opioid use; notify the attending service then the [APS/Pain Consultant](#), address **opioid-induced CNS depression** by following the naloxone protocol and call the [APS/Pain Consultant](#).

Monitoring

Respiratory rate, blood pressure, pulse, oxygen saturation, pain and sedation scores, and monitoring for adverse effects are to be recorded as outlined in the order set provided by [APS/Pain Consultant](#).

These monitoring guidelines must be repeated after increasing the infusion rate of ketamine, or after stopping and restarting the infusion

Increased monitoring frequency is determined by the patient condition and nursing discretion.

Monitoring for High Risk Patients

Monitoring for high risk patients is to be completed as outlined in the order set provided by [APS/Pain Consultant](#). Additional monitoring (continuous oxygen saturation monitoring) may be required for patients that have or have had any of the following conditions:

- Airway instability
- History of sleep apnea or abnormal sleep study results
- Significant co-existent respiratory, cardiac or neurological disease
- Significant co-existent respiratory, cardiac or neurological disease
- Significant renal or hepatic impairment
- Use oxygen therapy pre-operatively
- Respiratory irregularity in the OR
- Administration of other sedatives (i.e. Phenobarbital, benzodiazapines) pre- or post-operatively
- Deemed high risk for any other reason by the anesthesiologist or [APS/Pain Consultant](#)

Documentation

All information shall be documented in the patient's health record at the time of initiation, when the patient is received into care/at the start of every shift while ketamine is infusing, any time the infusion rate is changed or infusion stopped, when a new bag is hung and at the time of discontinuation.

Initial documentation shall include the following:

- Date and time of therapy initiation,
- Pain goal,
- Indication of the patient's level of understanding of the treatment, including awareness of need to notify the healthcare professional of any early signs of [potential side effects](#).
- Baseline assessment and vital signs, and
- Low dose ketamine dosage and infusion pump settings.

Ongoing documentation shall include all of the following:

- Assessments,
- Changes to low dose ketamine infusion dosage,
- Patient teaching,
- Patient's response to therapy,
- Any unexpected/adverse findings, including interventions taken, and
- Communication with members of the healthcare team, including the Pain Consultant.

All independent double-checks shall be co-signed and documented in the health record.

When to call APS/Pain Consultant

[APS/Pain Consultant](#) should be called if the patient experiences any of the following:

- Uncontrolled pain
- Systolic Blood Pressure (SBP) less than 85 or greater than 160
- Pulse less than 60 beats per minute or greater than 110 beats per minute
- Respiratory Rate (RR) of 8 or less
- Sedation score of 2 or more
- SpO₂ less than or equal to 92% despite oxygen administration
- Intolerable psychotomimetic effects despite benzodiazepine administration
- Severe delirium or confusion
- Uncontrolled nausea and vomiting despite providing anti-emetics
- Symptoms of opioid withdrawal

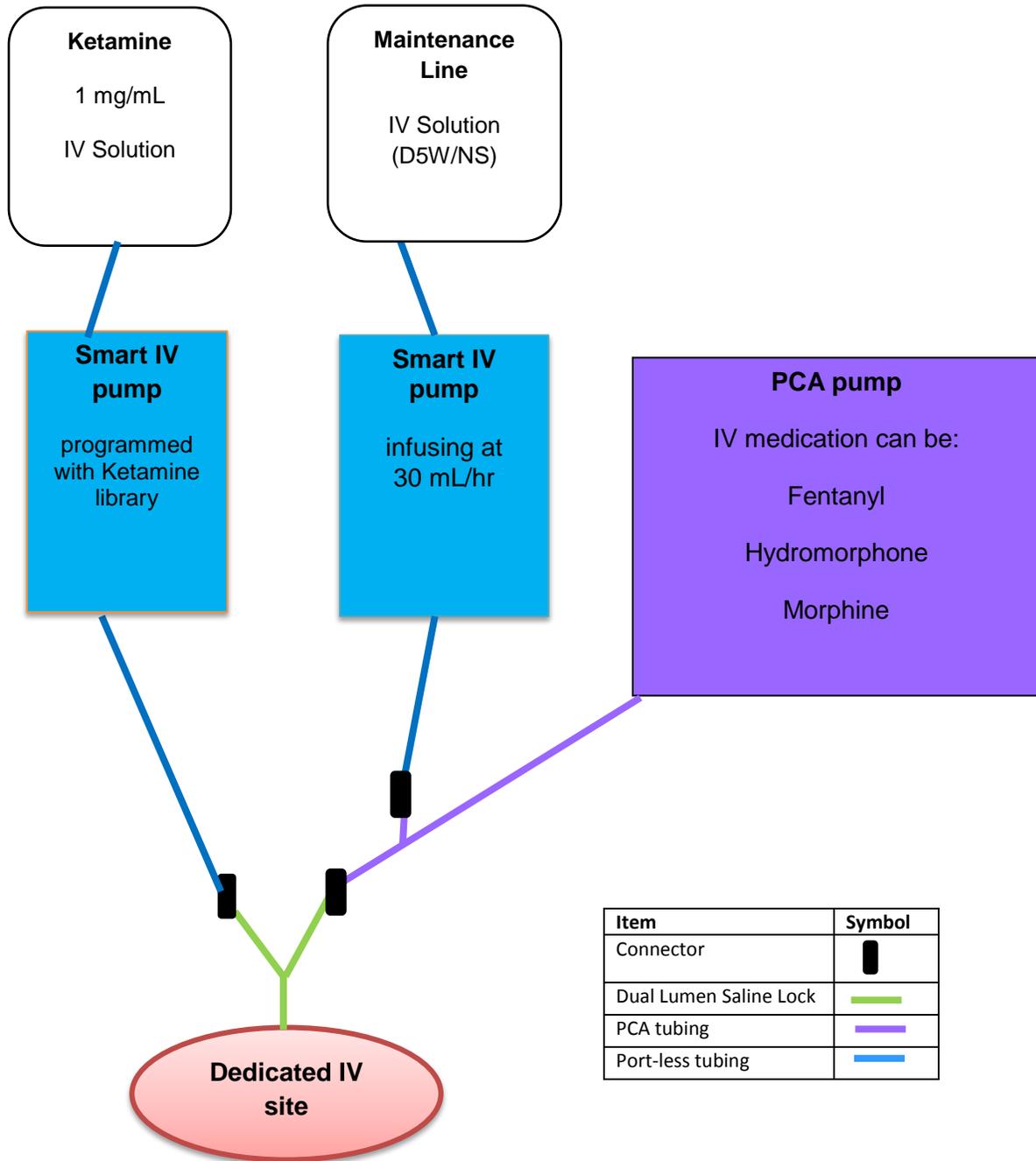
Discontinuing Therapy

1. Confirm the presence of an order to discontinue the therapy.
2. Turn off infusion, disconnect patient from infusion, remove pump from patient's bedside
 - a. Ensure the presence of a maintenance infusion line remains for emergency medication delivery purpose for a minimum of 12 hours after discontinuing the infusion.
3. Discard any remaining ketamine and record waste on the Narcotic Record as per policy
4. Assess pain scores frequently
5. Continue to monitor vital signs for 12 hours after discontinuing therapy
6. If at any time the patient experiences symptoms of [potential side effects](#) after the discontinuation of the low dose ketamine infusion, contact [APS/Pain Consultant](#) immediately.

Appendix C – Competency: Low Dose Ketamine Infusion for Analgesia – Adult Checklist

Name: _____ Date: _____ Unit _____ Site _____	Achieved
1. Review patient health record for low dose ketamine infusion for analgesia order and patient allergies.	
2. Gather supplies and perform hand hygiene.	
3. Approach patient, identify yourself, verify patient identity using two patient identifiers, explain procedure to patient and answer questions.	
4. Receive consent to proceed and provide adequate support to patient.	
5. Obtain patient weight if not previously recorded.	
6. Perform hand hygiene and prepare administration and infusion supplies prior to initiating therapy.	
7. Seek qualified healthcare professional to complete mandatory independent double-check verifying medication, pump settings, and infusion solution with the orders prior to initiating infusion.	
8. Complete a baseline assessment.	
9. Start the ketamine and maintenance infusions.	
10. Follow orders to complete initial monitoring after infusion initiation.	
Competency Achieved: <input type="checkbox"/> Yes <input type="checkbox"/> To complete insertion procedure _____ time(s). Observer Name and Signature:	

Appendix D – Set Up of Low Dose Ketamine Infusion for Analgesia plus Patient Controlled Analgesia



Appendix E – Set Up of Low Dose Ketamine Infusion for Analgesia plus Lidocaine Continuous Infusion Therapy for Analgesia

