Ketamine Nursing – Self Learning Package

Developed by Waterloo Wellington Ketamine Education Committee
Reviewed by Dr. A. Moolman, Palliative Care Physician, MBChB, CCFP, LMCC,
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Ketamine Self-learning Package

Introduction

This self-learning package has been designed as a comprehensive reference and teaching guide for nursing staff involved in the monitoring of patients receiving ketamine in the community.

Learning Objectives

By completing this self learning module, the learner will be able to:

1. Describe the anatomy and physiology of pain
2. List the indications and contraindications for the use of Ketamine
3. Describe the mechanism of the pain response related to ketamine use
4. Describe Ketamine pharmacology
5. Identify potential side effects of Ketamine.
6. Identify the nursing assessment and documentation required for patients receiving Ketamine for pain control.
7. Identify and be familiar with the WW HPC Community Ketamine Protocol (see Appendix C)

Learning Activities/ Authorization

The care and monitoring of any patient receiving Ketamine is considered an advanced nursing competency and may only be performed by an RN/RPN who has received initial authorization by the unit educator or delegate.

In order to meet the objectives and obtain authorization, you will be required to successfully complete the following:

- Ketamine self learning package
- Demonstrate the appropriate assessment and documentation guidelines for the patient receiving Ketamine; this will be evaluated by your specific organization.
- Complete and pass (at least 80% correct) the written quizzes.
Section 1: Anatomy & Physiology

- The vertebral column is the bony outer structure protecting the spinal cord. It consists of 26 vertebrae. These vertebrae are divided into 7 cervical, 12 thoracic, 5 lumbar, 1 sacral and 1 coccygeal.
- The spinal cord is located within the vertebral column and it extends from the brain to the 1st or 2nd lumbar space.
- At each vertebral level there are nerve roots that come off the spinal cord bilaterally and which transmit both sensory and motor function.
- There are 31 pairs of spinal nerves, consisting of motor, sensory and sympathetic nerve fibres.

(McCaffrey & Passero, 1999, p.216)

- The spinal nerves exit between the vertebrae bilaterally and segmentally.
- Pain signals are carried through the dorsal horn of the spinal cord to the brain.
Mechanism of Pain

There are two major classifications of pain:

1. **Nociceptive** pain—further divided into somatic and visceral pain. Nociceptive pain is the body’s normal response to painful stimuli and is usually responsive to non-opioids and/or opioids.

   **Somatic nociceptive pain:**
   - Found in bones, muscles, connective tissue
   - This pain is described as well localized, often described as tender to touch, gnawing, aching and/or sharp

   **Visceral nociceptive pain:**
   - Found in organs and deep tissue/viscera
   - Originates from stretching or distension of viscera, peritoneum or pleural cavity
   - Diffuse pain, hard to localize, often refers to cutaneous areas
   - This pain may be described as sharp, aching, cramping, deep and/or dull

2. **Neuropathic** pain is an abnormal processing of sensory input either centrally or peripherally. The treatment of neuropathic pain usually requires the use of adjuvant medications.
   - This pain is often described as burning, shooting, intermittent electric shocks
   - This pain often radiates along a nerve pathway (e.g., sciatica)
There are 4 processes involved in the mechanism of pain:

1. **Transduction**: Conversion of one energy form to another. This process occurs in the periphery when a noxious stimulus causes tissue damage. Sensitizing substances are released by damaged cells and an action potential occurs.

2. **Transmission**: The action potential continues from the site of damage to the spinal cord and ascends to higher centers. Transmission may be considered in three phases: injury site to spinal cord, spinal cord to brain stem and thalamus, and thalamus to cortex.

3. **Perception of Pain**: Conscious experience of pain.

4. **Modulation**: Inhibition of nociceptive impulses. Neurons originating in the brain stem descend to the spinal cord and release substances such as endogenous opioids, serotonin, and norepinephrine that inhibit the transmission of nociceptive impulses.

(McCaffrey & Passero, 1999, p.21)
1 **Transduction:** Conversion of one energy form to another. This process occurs in the periphery when a noxious stimulus causes tissue damage. The damaged cells release substances that activate or sensitize nociceptors. This activation leads to the generation of an action potential.

A. **Sensitizing substances** released by damaged cells:
   - Prostaglandins (PG)
   - Bradykinin (BK)
   - Serotonin (5HT)
   - Substance P (SP)
   - Histamine (H)

   **Nonopioids:** At the site of injury NSAIDs inhibit PG production, causing a decrease in pain.

B. An **action potential** results from
   - Release of the above sensitizing substances (nociceptive pain)
     + a change in the charge along the neuronal membrane
   - Abnormal processing of stimuli by the nervous system (neuropathic pain)
     + a change in the charge along the neuronal membrane.

The change in charge occurs when Na⁺ moves into the cell and other ion transfers occur.

   **Adjuvants:** Local anesthetics and many anticonvulsants reduce pain by blocking Na⁺, thereby decreasing the action potential.

2 **Transmission:** The action potential continues from the site of damage to the spinal cord and ascends to higher centers. Transmission may be considered in three phases:

   - Injury site to spinal cord. Nociceptors terminate in the spinal cord.
   - Spinal cord to brainstem and thalamus. Release of SP and other neurotransmitters continues the impulse across the synaptic cleft between the nociceptors and the dorsal horn neurons. From the dorsal horn of the spinal cord, neurons such as the spinothalamic tract ascend to the thalamus. Other tracts carry the message to different centers in the brain.

   **Opioids:** Morphone-like drugs bind to mu opioid receptors and block the release of SP, preventing the impulse from crossing the synapse.

   - Thalamus to cortex. Thalamus acts as a relay station sending the impulse to central structures for processing.

3 **Perception of pain:** Conscious experience of pain is decreased by actions of the nonopioids, adjuvants, and opioids.

4 **Modulation:** Inhibition of nociceptive impulses. Neurons originating in the brain stem descend to the spinal cord and release substances such as endogenous opioids, serotonin (5HT), and norepinephrine (NE) that inhibit the transmission of nociceptive impulses.

   **Adjuvants:** Tricyclic antidepressants enhance normal modulation by interfering with the reuptake of 5HT and NE.
**TRANSDUCTION**

A. Cell damage releases sensitizing substances: PG, BK, 5HT, SP, H

**NONOPIOIDS: NSAIDs decrease PG**

B. Action potential

**ADJUVANTS:**
Local anesthetics and many anticonvulsants block NA+

- Na⁺ Na⁺ Na⁺
- Na⁺ Na⁺ Na⁺
- Na⁺ Na⁺ Na⁺

**ACTION POTENTIAL**

**PERCEPTION OF PAIN**

**TRANSMISSION**

Spinothalamic tract neuron

Transmission inhibited

This phase of transmission occurs in the dorsal horn of the spinal cord.

**OPIOIDS:** Morphine-like drugs bind to mu opioid receptors and block the release of Substance P

**MODULATION**

Neurons from the brain stem release 5HT, NE, endogenous opioids

**ADJUVANTS:** Norepinephrine enhances normal modulation by interfering with the release of 5HT & NE

- Substance P
- Opioid receptors


* * *

**FIGURE 4.2 B.** Illustrates analgesic action sites.

Developed by McCaffrey M, Pasero C, Falce LA.
Ketamine may be effective in management of specific neuropathic syndromes including:

- Neuropathic Pain
- Phantom Pain
- Complex Pain Syndromes
- Tenesmus- defined as especially long-continued, ineffectual and painful straining at stool or urination
- Any pain syndrome with the triad of:
  - **Allodynia** – Pain caused by a stimulus that does not normally provoke pain (such as severe pain from light touch)
  - **Hyperalgesia** - An increased response to a stimulus that is normally painful
  - **Prolongation of Pain Response**
- Ischemic Pain (including peripheral vascular disease)

✓ The sensory receptors that are responsible for detecting pain are called nociceptors. These nociceptors carry impulses from the periphery to the dorsal horn of the spinal cord. From there the message is carried by neurotransmitters, including glutamate and substance P.

✓ There are two specific types of nociceptors that play an important role in the pain mechanism. These are the **Delta A and C fibres**.

  - The Delta A fibres are responsible for the transmission of acute, well-localized pain and are less sensitive to opioids.
  - The C fibres transmit poorly-localized, dull, aching pain and are more sensitive to opioids.

✓ Prolonged firing of the C fibre nociceptors causes the release of certain neurotransmitters, including glutamate. Glutamate normally binds to the M-methyl-D-aspartate (NMDA) receptors in the dorsal horn.

✓ **Ketamine is an NMDA antagonist**

✓ Opioids play an important role in pain control by binding to opioid receptor sites and blocking the release of the neurotransmitters. One of the major types of opioid receptor sites are the mu-receptors.

✓ **Ketamine, in low doses, increases the action of the mu-receptors, making them more receptive to opioids.**
Section 1- Anatomy and Physiology Quiz

Please answer the following questions.

1. Name the two major classifications of pain.
   I. _________________________
   II. _________________________

2. Neuropathic pain is usually responsive to opioids only.
   □ True
   □ False

3. Name the third step in the transmission of pain:
   a. Nociception
   b. Modulation
   c. Perception
   d. Reception

4. The Delta A fibres are responsible for transmitting acute, well-localized pain.
   □ True
   □ False

5. Ketamine acts to increase the receptiveness of opioids at which receptor site:
   a. NMDA
   b. Mu
   c. Delta
   d. Alpha
Section 2: Pharmacology of Ketamine

Ketamine is a rapid-acting dissociative general anesthetic agent, with analgesic properties in sub-anesthetic doses. Its principle site of action is in the dorsal horn of the spinal cord where it blocks the N-methyl D-aspartate (NMDA) receptor complex.

Ketamine is a controlled substance

When is Ketamine appropriate?

Ketamine is used in palliative care most often for neuropathic pain that is not responsive to, or elicits a poor response to first line drugs such as opioids, NSAIDS, tricyclic antidepressants or anticonvulsants.

Ketamine has also been found to be effective for those who have developed significant opioid-tolerance. It is believed that the central nervous system can become desensitized and less responsive to opioids for pain, if the pain has been poorly controlled over a period of time. This opioid tolerance refers to client situations where increasing doses of opioids does not result in better pain management. Clients experiencing increasing side-effects and signs of toxicity, in-spite of not achieving pain control may be candidates for Ketamine.

There is evidence to support the use of Ketamine in the following pain types/syndromes:
- Neuropathic pain
- Phantom pain
- Complex pain syndrome
- Tenesmus – defined as especially long-continued, ineffectual and painful straining, at stool or urination
- Any pain syndrome with the triad of:
  » Alldynia - pain caused by a stimulus that does not normally provoke pain (such as severe pain from light touch)
  » Hyperalgesia - an increased response to a stimulus that is normally painful
  » Prolongation of pain response
- Ischemic pain (including peripheral vascular disease)

Indications for Use

1. Opioid Intolerance
2. Opioid Toxicity
3. Pain poorly responsive to opioids
4. Pain crisis

It is important to note, that all other conventional analgesic combinations should be used prior to considering Ketamine.
Ketamine has also been used for phantom limb and ischemic pain and for intractable incident pain for procedures such as dressing changes

**Ketamine should be avoided for clients with:**
- Increased intracranial pressure
- Severe systemic hypertension
- Raised intra-ocular pressure
- Recent history of seizures
- Recent history of psychosis

**Use Ketamine with caution for those with:**
- Intracranial space occupying lesion
- Cardiac arrhythmias
- On long-acting opioids

**Routes of Administration**

Ketamine is an anesthetic agent. For pain management, Ketamine can be delivered, **using much lower doses**, by the parenteral, oral, intranasal, transdermal, rectal, and subcutaneous routes.

**Patients discharged to the community should be receiving their Ketamine intravenously,** due to the site irritation when given subcutaneously. However, in certain circumstances where clinical judgment dictates, it may be more appropriate to deliver this medication subcutaneously. Ketamine should be administered by a pump delivery system, with **no other medications added**, as per the WW Ketamine Protocol.

Subcutaneous: clients complain of site burning related to medication – assess and re-site frequently as needed. Keep in mind that the subcutaneous route can be used temporarily when a venous access loss has occurred.

Orally or buccally: Ketamine has a ‘bad’ bitter taste which can be masked by mixing in fruit juice or carbonated cola just prior to administering.

**In Waterloo and Wellington Ketamine is administered parentally only (as of 2010).**

Rotation and titration, as well as ongoing orders of Ketamine will be managed by the Palliative Care Physician in all care settings.

**Action**

When administered for pain management, Ketamine is used as a co-analgesic with an opioid. As low dose Ketamine is titrated to effect, remember that the mu receptors actions are increased. Thus, the opioid dose should be carefully assessed and decreased as appropriate.

**A breakthrough opioid dose is required during Ketamine use.**

**NB:** Sedation Scales must be done to assess patients carefully during titration periods.

**Therapeutic Dose Range:**

**Usual starting dose** – 1 mg/ hr (24 mg/day), titrating up to but not exceeding ceiling dose of 700mg/ 24 hours

Ketamine is titrated very slowly, e.g.: 1mg/ day
Onset of action – 15-30 minutes by subcutaneous or oral routes

Duration of action – 15 minutes to 2 hours when administered by the IV or subcutaneous route, and possibly longer if given PO

Stability – Ketamine is physically stable (and thus safe to have a “Y” connector for central lines) when mixed with the following drugs: Morphine, Dexamethasone, low-dose Haloperidol and Metoclopramide
   (In WW, Ketamine is always delivered as a single medication in its own delivery pump)

Drug Interactions
Drugs that may have the potential to affect Ketamine metabolism are Azole Antifungals, Macrolide Antibacterials, HIV Protease Inhibitors, and Cyclosporin

Metabolism
Ketamine is predominantly metabolized in the liver into nor-Ketamine and then further metabolized via the liver before being excreted by the kidneys. Impaired renal function does not prolong the action of Ketamine.

PUMP Tubing & Marking of Tubing
The Ketamine pump and tubing should be well defined in labeling for safety and minimizing the risk of drug errors

Ketamine Side-Effects
Common side effects include:
Hallucinations, dysphoria, agitation, vivid dreams, drowsiness, delirium, dizziness, nausea, ‘feeling strange’, excessive sedation and signs of opioid toxicity

Other side effects include:
Hypertension, tachycardia, diplopia, nystagmus and pain or erythema at the injection site

In order to manage these side effects, Haldol or Midazolam should be administered (under the direction of a physician).
Clients must be observed for opioid toxicity.
Symptoms of cystitis, hematuria and supra-pubic pain have been linked to Ketamine.
Section 2- Pharmacology Quiz

Please answer the following questions:

1. Ketamine is an anaesthetic agent and is sometimes used in the community to provide aggressive sedation for clients requiring palliative sedation
   a. True
   b. False

2. Ketamine has been found to be effective as an adjuvant to opioids, in the case of opioid toxicity or poor pain control using opioids, by being able to reduce the amount of opioid being given because:
   a. It is believed that the central nervous system can become desensitized and less responsive to opioids for pain, if the pain has been poorly controlled over a period of time and Ketamine has the ability to enhance this receptiveness
   b. It is given intravenously, thus allowing more drug to be used for analgesia
   c. It is a much stronger analgesic agent than other opioids
   d. All of the above.

3. Ketamine is an excellent choice of drug to use with a person suffering pain from brain mets and increasing intracranial pressure.
   a. True
   b. False

4. The onset and duration of action of Ketamine is approximately 15 minutes, when given subcutaneously.
   a. True
   b. False

5. Common side effects of Ketamine include all of the symptoms below except:
   a. hallucinations
   b. agitation,
   c. vivid dreams,
   d. delirium,
   e. constipation
   f. excessive sedation

6. Medications shown to be very effective in managing the aforementioned side effects of Ketamine are:
   a. Ativan
   b. Haldol
   c. Midazolam
   d. All of the above
Section 3: Monitoring a Patient Receiving Ketamine

Monitoring

**Recommended for in hospital:**
- First 12 - 24 hours most important
- Pain Score
- Sedation Score (*refer to Analgesia Flow Sheet – to be created*)
- Blood pressure, pulse and respiratory rate at time of initiation
  - Then in 60 minutes and → then q4h for 24 hours → then q8h
  - If dose rate is increased revert to 60 minutes → then q4h for 24 hours

**Recommended Monitoring in Community:**
- BID nursing visits × 48 hours with VS monitored every visit
- Assess pain every visit – perform a thorough pain assessment
- VS - Blood Pressure, Pulse and Respirations every visit – initially BID
- Assess level of sedation every visit
- Monitor for side effects listed above and report to physician providing palliative care
- Report all changes to physician providing palliative care

**What you should monitor for:**

1) Pain
2) Vital signs
3) Respiratory function & Sedation Level
4) Side effects/complications

1) Pain Scale
Pain severity needs to be performed frequently and consistently. Use either:
- ESAS
- Faces Scale
- Other validated tool appropriate to patient need

*A full pain assessment using a validated pain assessment tool should be implemented and used whenever there is a change in the severity or type of pain or behavior.*
The assessment should then be reported to the physician to update the care plan and orders.

2) Vital Signs (VS)
- BP and pulse, and respirations should be recorded on the agency flow sheet each visit

3) Respiratory/Sedation Assessment
- Record the respiratory rate and sedation scale each visit, and report a sedation score of 3 or more.
- Analgesia should provide pain relief only, not sedation (not to be confused with drowsiness)
- Notify the palliative care physician for a respiratory rate <8 or sedation scale of >3
- Sedation scales should be taught to families in the home
Sedation scale
S=sleep, arouses easily
1=awake, alert
2=occasionally drowsy
3=frequently drowsy, drifts off to sleep during conversation
4=somnolent, minimal or no response to stimulus

Why such careful monitoring??

- Ketamine may increase opioid effectiveness as well as reverse opioid tolerance, resulting in sedation and possibly respiratory depression, so careful monitoring is required
- A breakthrough opioid dose is required during Ketamine use
- Consider haloperidol 1 mg po BID for prevention and/or management of emergence phenomena (vivid dreams, hallucinations, delirium, agitation, excess sedation)
- Opioid doses often need to be adjusted (lowered). The risk of sedation and opioid toxicity is much higher with a patient receiving Ketamine

Documentation

Below is a sample flow sheet that demonstrates the required elements for a nursing assessment in a non-acute care setting. The fields include:

- Date and time of the assessment
- Vital signs
- Level of consciousness
- Signs of confusion or delirium
- Any medications being used to control the signs and symptoms of confusion
- Pain assessment
- Ketamine dose and pump bag or cassette changes
<table>
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<tr>
<th>Date &amp; Time</th>
<th>Vital Signs</th>
<th>LOC - Alert &amp; Orientated, Confused, Drowsiness, Arousable, etc.</th>
<th>Confusion, Delirium, Aggression, Dreams, Hallucinations</th>
<th>Meds to manage psychosis –eg) Haldol, Versed, etc.</th>
<th>Pain Assessment q, visit - review analgesic use Report to MD PRN</th>
<th>Ketamine Dose Pump bag or cassette changes</th>
<th>See PN RTC</th>
<th>Initials &amp; Designation</th>
</tr>
</thead>
</table>

6/4/2010
Section 3- Nursing Monitoring and Documentation Quiz

Please answer the following questions.

1. When a patient is receiving Ketamine in the community, the pump delivering the Ketamine should:
   a. Should be set for boluses q1h
   b. Be clearly labeled, as well as the tubing as the Ketamine pump/ tubing.
   c. Have a cassette mixed with compatible drugs to reduce administration sites required.
   d. All of the above.

2. When assessing pain of a patient receiving Ketamine, there needs to be daily documentation of:
   a. The severity of the pain
   b. The quality of the pain
   c. Side effects
   d. Bolus doses taken of opioids in past 24 hours
   e. All of the above

3. Your patient’s sedation score yesterday was 2. This means your patient was:
   a. occasionally drowsy
   b. Somnolent, minimal or no response to stimulus
   c. frequently drowsy, drifts off to sleep during conversation
   d. awake, alert

4. Today, when you visit your patient, he tells you he has been having wild dreams. His sedation score is 3. You do a full pain assessment, and document on your agency flow sheet. Given this assessment, you should also:
   a. Open the Symptom Response Kit, and administer Haldol for mild delirium.
   b. Nothing: continue to monitor as you suspect he might be starting to show side effects.
   c. Call the physician to receive orders.
   d. None of the above.
   e. All of the above.

5. Your patient has been on Haldol 1 mg po bid for 4 weeks now, and is not experiencing any psychomimetic side effects. At this time, you should:
   a. Continue the Haldol as ordered. as part of the Ketamine/ opioid protocol
   b. Recommend decreasing the dose to the patient and physician
   c. Hold Haldol for a few days to assess if this medication is still needed, or if the patient has developed tolerance to the side effects
   d. Recommend increasing the dose of Haldol, due to expected tolerance to this low dose.
Answer Key for Self-Assessment Quizzes

Section 1: Anatomy & Physiology

Question 1 – Nociceptive & Neuropathic Pain
Question 2 – False
Question 3 – c
Question 4 – True
Question 5 - b

Section 2: Pharmacology

Question 1 – False
Question 2 – a
Question 3 – False
Question 4 – True
Question 5 – e
Question 6 - d

Section 3: Nursing Monitoring and Documentation

Question 1 – b
Question 2 – e
Question 3 – a
Question 4 – c
Question 5 - a
References


Macpherson, N. (2006). Rationale and guidelines for the use of ketamine in palliative medicine &/or opioid poorly responsive pain (OPRF)


Vancouver Coastal Health (VGH/UBCH/GFS). (2007). Palliative Care Unit – Ketamine Infusion Orders

Appendix A

CLINICAL POLICY
GRAND RIVER HOSPITAL

Freeport Health Centre
Kitchener Waterloo Health Centre

Developed By: Name: Dr. André Moolman and Heather Gross Title: Palliative Care / Pain and Symptom Management Physician and Palliative Care Coordinator
Date Originated: May 2009
Date of Review or Revision:
Approval by
Approval Date: July 2009
Approval verification signatures: Name: Susan Robertson Title: VP Clinical Services & chief Nursing Officer
Date July 2009

KETAMINE IN PALLIATIVE CARE

Ketamine is a rapid-acting dissociative anesthetic agent, with analgesic properties in sub-anesthetic doses. It is handled as a controlled substance. Its principal site of action is in the dorsal horn of the spinal cord where it blocks the N-methyl D-aspartate (NMDA) receptor complex.

POLICY:
The management of ketamine involves the administration of this medication using via gemstar pump for continuous subcutaneous (SC) or intravenous (IV) infusion.

Ketamine can be administered at both K-W Health Centre on the Inpatient Oncology Unit and Freeport Health Centre on the Palliative Care Unit, where the staff have been specifically trained for the administration of ketamine. The Palliative / Pain and Symptom Management physician (PSM physician) will write the orders for the infusion and will oversee the management of its titration, along with the other medications used in conjunction with ketamine. The PSM physician will be on the unit for the first hour of administration and will be available (on-call) for the duration of the infusion.

The pharmacist will prepare the loading dose and the continuous infusion of ketamine using Normal Saline or 5% Dextrose in Water solutions with 1 mg./ml. concentration.
PROCESS/PROCEDURE:

- Patient monitoring and assessment are indicated for all patients receiving ketamine.
- Consent is received from patient and orders written by PSM physician
- Infusion is initiated by RN using administration route and dose schedule as written in order.
- The RN/RPN will be present attending the patient for the initial hour of its infusion and will continuing to monitor and assess the patient as per guidelines.
- Intolerance at the infusion site when given subcutaneously. If site intolerance develops, the site should be changed for both the narcotic and ketamine. Ketamine can be given by Y-connection into a single injection site, with morphine or hydromorphone or midazolam. Ketamine has also been given in a combination with fentanyl and midazolam.
- Intermittent bolus doses of Ketamine for breakthrough pain are not recommended. Breakthrough pain should be managed with opioid bolus doses.
- An infusion pump, such as a gemstar pump, must be used to administer the infusion of Ketamine.

EDUCATIONAL REQUIREMENT:

Each RN will have verified their competency in administering medications by PCA gemstar infusion pumps by completing check-list through education practice.

Each RN will verify his/her competency to administer Ketamine by attending Ketamine inservice provided by GRH Inpatient Oncology PSM physician, education practice lead or palliative care coordinator.

Each RN will review written protocol for GRH Ketamine Policy before beginning infusion.
**Appendix A:**

<table>
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<th>Indications</th>
<th>Contraindications</th>
<th>Considerations</th>
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<tr>
<td>Ketamine</td>
<td><em>Indications are same regardless of code status.</em></td>
<td><strong>ABSOLUTE:</strong></td>
<td><strong>Responsibilities:</strong></td>
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<td></td>
<td>- Patients who have had poor response to first line drugs for pain management such as opioids, NSAIDS, tricycles, antidepressants or anticonvulsants</td>
<td>- Patients under 18</td>
<td>- Pain symptom physician</td>
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<td>- Patients with opioid tolerance where increasing doses of opioids have not improved pain management</td>
<td>- Patients with uncontrolled seizures</td>
<td>- Provide patient (family) drug protocols and alternatives</td>
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<td>- Patients in pain crisis with consistent ESAS pain scores rated as 8 out of 10 or higher</td>
<td>- Patients with sign of uncontrolled intracranial hypertension (radiological evidence of ICP) Not contraindicated in uncomplicated intracranial processes</td>
<td>- Obtain informed consent</td>
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<tr>
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<td>- Allergy to Ketamine</td>
<td>- Order ketamine infusion</td>
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<td><strong>Relative Contraindications</strong></td>
<td>- Orders for opioid reduction</td>
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<td>- Uncontrolled hypertension (systolic greater than 160mmHg)</td>
<td>- Orders for prophylactic benzodiazepine to be administered either prior to or concurrently to ketamine</td>
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<td>- Severe cardiac failure</td>
<td>- Be present on unit first hour of administration and on call throughout infusion</td>
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<td>- History of CVA/severe neurological</td>
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</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><strong>Nurses:</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Complete independent double check according to hospital policy #</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Monitor vital signs, mental status, pain score, sedation levels, monitor increased intracranial pressure, document, titrate dosage according to template (Appendix A)</td>
</tr>
</tbody>
</table>
## Side Effects of Ketamine Infusion

<table>
<thead>
<tr>
<th>Side Effect</th>
<th>Cause</th>
<th>Medical Management</th>
<th>Nursing Implications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vivid dreams, depersonalization, hallucinations, delirium, agitation</td>
<td>Psychomimetic emergence phenomena</td>
<td>Notify PSM physician who will advise re-adjustment of ketamine infusion, opioids, and accompanying prophylactic benzodiazepines/kalol. Continue to monitor using increased vigilance and standard assessments as deemed clinically necessary.</td>
<td>Evidence of psychomimetic emergence phenomena will require decrease or cessation of ketamine depending on severity.</td>
</tr>
<tr>
<td>Painful indurations at SC injection site</td>
<td>Localized intolerance of the drug ketamine at the SC site</td>
<td>Change site of infusion as needed. Switch to IV if SC is not tolerated very well by patient. Equianesthetic dose of IV:SC ketamine is 1:1</td>
<td>Close observation of site used decreases risk of tissue damage. Educating patient prepares him/her for initial discomfort felt at injection site.</td>
</tr>
<tr>
<td>Excessive sedation Decreased BP, decreased respiration Diplopia, mydriasis, eye pain</td>
<td>Depression of the respiratory centre by opioid toxicity - by less opioids required by patient during ketamine infusion. Notify PSM. Narcan as required. Continue to monitor.</td>
<td>Notify PSM physician who will advise re-adjustment or cessation of ketamine depending on severity of side effects, and reduction of opioids. If sedation score greater than 2 and respiratory less than 8 minute, notify PSM physician and give narcan as required – Narcan 0.04 mg in small increments until sedation score decreased and respirations increasing (see pharmacy order sheet).</td>
<td>Close monitoring of sedation scale and respiratory status will help to identify if patient is at risk for respiratory depression. Have narcan available for administration for when needed.</td>
</tr>
<tr>
<td>Hypersalivation</td>
<td></td>
<td>Order glycopyrrolate 0.2 mg SC every 4-6 hours PRN Or scopelamine 0.4 – 0.6 mg SC every 4 hours PRN</td>
<td>Administration of medication will increase comfort of patient.</td>
</tr>
</tbody>
</table>
# Routine Orders for Palliative Care Ketamine Infusion

<table>
<thead>
<tr>
<th>Date:</th>
<th>Time:</th>
</tr>
</thead>
</table>

- **Patient Weight:** ____________  
  **Allergies:** □ None  □ Specify: ____________

## Palliative Care Physician:

1. **B/P, respiratory rate, heart rate, SaO2, temperature, sedation score, pain rating (ESAS scale) mental status and observe for signs of intracranial pressure q 4hr AND**
2. **every 15 min for first hour after initiation infusion and thereafter q 4 hours for first 24hrs, after each dose titration, AND if route changes from continuous SC infusion to I.V. or dose increased by more than 1 mg/kg or 100 mg/day.**

- CBC  □ Creatinine  □ Electrolytes  □ Billirubin, AST, ALT, ALP

- **Ketamine Bolus Dose** (concentration 1 mg/ml)
  Ketamine _____ mg over _____ minutes Route SC____ IV____

- **Ketamine Continuous Infusion:** Start infusion at _______ mg/hr □ IV or □ SC

3. **If Systolic B/P drops greater than 30%, respiratory rate less than 8 per/min, or profound sedation occurs stop ketamine and notify PSM physician immediately**

### Prophylaxis of Psychomimetic side effects:

- □ Lorazepam 0.5 – 1.0 mg BID PO, SC, SL
- □ Midazolam infusion _______ mg / per hour SC
- □ Haldol 1-2 mg BID orally or SC

### Naloxone (Narcan) Administration

If respiratory rate is < or equal to 8/min:

- □ STOP ketamine infusion
- □ Initiate oxygen and support respirations as needed.
- □ Naloxone (Narcan) 0.04mg IV push (preferred) or sc q1minute until respirations >6/minutes *(Dilute 1 cc Naloxone 0.4mg/ml with 9 cc NS for final concentration of 0.04mg/ml).*
- □ Notify PSM/Palliative Care Physician immediately

---

**Physician’s Signature:** __________________
**Transcriber’s Signature:** __________________
**Date:** __________________
Reverse – Routine Orders

Ketamine can be effective as an adjuvant in treating patients in palliative care. It is most often considered for patients with neuropathic pain with limited response to first line drugs such as opioids, NSAIDS, tricyclic antidepressants or anticonvulsants. If there has not been a significant analgesic effect before reaching an infusion rate of MAXIMUM 700 mg/day, then it is unlikely to occur.

The following pain types/syndromes are mostly likely to respond:

- Neuropathic, inflammatory, ischemic pain (including peripheral vascular disease), phantom limb pain, tenesmus
- Pain syndrome with the triad of: allodynia, hyperalgesia, prolongation of pain response.

Usual concentration would be 1 mg/ml mixed in Normal Saline or 5% Dextrose in Water solution

<table>
<thead>
<tr>
<th>KETAMINE</th>
<th>Routine Initiation Schedule</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loading dose</td>
<td>Use of loading dose depends on acuity of the pain syndrome. Explain to patient that there may be painful duration at site of loading dose, if it is by SC route. SC – preferred route*</td>
</tr>
<tr>
<td>Subcutaneously/ Intravenously</td>
<td>Start @ 1-4 mg/hr (range 25-100 mg per 24 hrs) Usual: 50mg/24hr (2mg/hr)</td>
</tr>
<tr>
<td>Infusion Rate</td>
<td>Titratin rate: Increase by 1mg/hr q24hr until @ 4mg/hr thereafter increase by 1-2mg/hr q 24hr up to a maximum daily dose of 700mg/day</td>
</tr>
<tr>
<td>Subcutaneously/ Intravenously</td>
<td></td>
</tr>
</tbody>
</table>

Sedation scale
5 – Sleep, easily aroused
1 – Awake and alert
2 – Occasionally drowsy, easily aroused
3 – Frequently drowsy, arousable, drifts off to sleep during conversation
4 – Somnolent, minimal or no response to stimuli

Prophylaxis of Psychomimetic Side Effects: Start either a benzodiazepine or haloperidol prior to or concurrently with Ketamine:
- Lorazepam 0.5 mg - 1 mg twice daily (BID) either orally or SC or sublingually
- Midazolam 5-20 mg subcutaneously over 24 hours
- Haloperidol, 1-2 mg BID, orally or subcutaneously

Management of opioids during ketamine infusion
*Subject to clinical judgement and patient response
Total opioid dose for 24 hours equal regular opioid dose given in 24 hours plus total breakthrough (BT) doses for 24 hours.
- Based upon patient response to ketamine opioids may be gradually reduced
- Stable opioid dose less than 3 BT per 24 hours, reduce by 25-50%
- Between 3-6 BT per 24 hrs, reduce by 20%
- Greater than 6 BT per 24 hrs, reduce by 10%
- Continue with prior BT opioid PRN

6/4/2010
Reference List


Gilron et al. Neuropathic pain: a practical guide for the clinician. CMAJ 175(3).


Appendix B

COMPETENCY ASSESSMENT CHECKLIST

Ketamine Administration

Competency Statement:
The registered nurse will demonstrate the ability to set up and program the PCA pump, as well as ongoing monitoring and assessment for therapeutic effect and potential complications.

Instructional Strategies include:

- Self Learning Package
- Instructional class
- Review of the GRH policy and procedures
- Written test

Date: ____________  RN Name: ________________________________  Unit: ____________
Manager/Educator or Delegate: _________________________________

Ketamine Competency Checklist

<table>
<thead>
<tr>
<th>Performance Criteria – Knowledge</th>
<th>Initial self-assessment of competency (Level 1-6)</th>
<th>Preceptor or educator initials verifying competence</th>
<th>Maintenance of Competency (using self-assessment tool Level 1-6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Discus the purpose and indications for using Ketamine.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3) Describe the anatomy, physiology and mechanism for Ketamine action</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4) Discuss the nursing assessment and documentation for a patient receiving Ketamine.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6) Describe the potential complication seen in patients given Ketamine and the nursing actions for these complications.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7) Discuss the patient teaching for a patient receiving Ketamine.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8) Describe the nursing actions for patients with sedation score of 3 and 4.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9) Written Ketamine test score.</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

Initial Authorization Overall Performance:

- Satisfactory
- Unsatisfactory
- Reschedule

6/4/2010
<table>
<thead>
<tr>
<th>Performance Criteria – Skill</th>
<th>Initial self-assessment of competency (Level 1-6)</th>
<th>Preceptor or educator initials verifying competence</th>
<th>Maintenance of Competency (using self-assessment tool Level 1-6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Demonstrate the assessment of a patient receiving Ketamine</td>
<td>__________________</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2) Demonstrates the programming and set-up of the Ketamine infusion pump, including maintaining appropriate safety precautions.</td>
<td>__________________</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3) Documents accurately the patient assessment and response to therapy using the Ketamine flow sheet.</td>
<td>__________________</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4) Monitors patient parameters regularly in order to assess effectiveness and complications.</td>
<td>__________________</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Self-Assessment Tool for Advanced Nursing Competency (ANC)**

According to the College of Nurses Standards, you are responsible to assess your competence for all the generic competencies and the unit specific competencies that pertain to your area of practice. Use the scoring tool below as the guide. Competent independent practice, which is a score of 4 or greater, indicates that you have the knowledge, skill and judgment for the ANC and can practice according to this regional policy. Competency checklists have been included in your package to assist you in determining the level of knowledge and skill required to perform the skill, you will need to individually reflect on your judgment ability. In addition, you are asked to identify whether you require a theoretical review on the identified competency.

1. Limited or no experience
2. Have theoretical knowledge only
3. Have practiced successfully in the clinical setting with supervision
4. Competent independent practice
5. Competent independent practice with advanced trouble shooting
6. Competent independent practice with advanced trouble shooting and can teach the skill to others
Appendix C

**Waterloo-Wellington Palliative Care Community Protocol for Ketamine Administration**

Developed by Waterloo Wellington Ketamine Education Committee

Working group members:
Carol Kopp, Clinical Educator, Bayshore Home Health
Cathy Joy, Palliative Nurse Consultant, HPC Consultation Services, Waterloo Region
Charlotte Koso, Manager, Clinical Practice and Special Projects, CarePartners
Christine Bigelow, Palliative Nurse Consultant, HPC Consultation Services, Wellington County
Deb Dalton, Clinical Resource Nurse, Hospice Palliative Care Community Team, Waterloo Region
Grace Egberts, Clinical Educator, Lissard House Hospice
Heather Gross, Supportive Care Coordinator, Grand River Regional Cancer Centre
Heather Vomberg, RN, CarePartners
Stephanie Doran, RN Supervisor, Paramed

*Formal review of this protocol to be undertaken in 2 years (2012)*
*Pilot initiative to include 5 case studies for review/evaluation purposes prior to adoption of final draft*
Ketamine Protocol

Overriding Expectation and Understanding
- Ketamine will be initiated, titrated and stabilized in hospital prior to client being discharged into the community with a Ketamine infusion
- The preferred route of administration is via central intravenous (IV) access, however, subcutaneous (subcut) port delivery may be considered on a case by case basis
- The concurrent opioid dose will also be established in hospital
- The client must have 24/7 access to Palliative Care Services, including coverage by a Pain & Symptom management MD, when clients are receiving Ketamine
- Community agencies require a minimum of 48 hours notice prior to sending client home on Ketamine

Educational Requirement
Each nurse will have verified their competency in managing the pump chosen for the administration of Ketamine (ie: Gemstar, CADD, etc.)
Each nurse will ensure his/her competency to administer Ketamine by having previously attended an educational session on the administration of Ketamine, demonstrating the knowledge, skill and judgment to do so. Each nurse will review the written P&P prior to caring for a client receiving Ketamine and successfully complete the nursing self-learning package.

Purpose
Ketamine is used in low doses (sub-dissociative anaesthetic dose) as a co-analgesic for pain in palliative care. Ketamine is a potent non-competitive N-methyl D-asparate (NMDA) receptor antagonist. Hyperactivity of the NMDA receptors may be involved in the induction and maintenance of certain pain states such as neuropathic pain and hyperalgiesia.

There is evidence to support the use of Ketamine in the following pain types/syndromes:
- Neuropathic pain
- Phantom pain
- Complex pain syndrome
- Tenesmus – defined as especially long-continued, ineffectual and painful straining, at stool or urination
- Any pain syndrome with the triad of:
  › Allodynia
  › Hyperalgesia
  › Prolongation of pain response
- Ischemic pain (including peripheral vascular disease)

Indications for Use
1. Opioid Intolerance
2. Opioid Toxicity
3. Pain poorly responsive to opioids
4. Pain crisis
Contraindications

Absolute:
Patients under 18
Allergy to Ketamine
Uncontrolled seizures
Symptomatic raised intracranial pressure (ICP) – for example clinical signs of uncontrolled headaches with nausea & vomiting
Not-contraindicated in uncomplicated intracranial metastases

Relative:
Uncontrolled hypertension – systolic > 160mmhg
Severe Cardiac Failure
Previous Cerebral Vascular Accident (CVA) / Severe Neurological Impairment

Special Considerations for Administration of Ketamine
- Ketamine will always be initiated in hospital
- At this time Ketamine will only be administered IV or subcut via pump
- Pumps must be clearly labeled; preferably using a different type of pump than the one used for the opioid. (e.g. Gemstar and CADD)
- Ketamine is always given concurrently with an opioid. A breakthrough dose for the opioid must also be available.

Routes of Administration:
IV: preferred route for Waterloo Wellington at this time
Sub cut: Ketamine is very irritating at the s/c site, therefore requiring frequent site changes
Orally: When taken orally, Ketamine has a very bitter taste, which can be masked by mixing in fruit juice or carbonated cola.

Drug Precautions
Ketamine may decrease or even reverse opioid tolerance due to blocking of NMDA receptors. This improved response to opioids may lead to increased opioid side effects such as sedation and respiratory depression, if the opioid dose is not adjusted appropriately. Since Ketamine enhances the effectiveness of the prescribed opioid, titration of the opioid as well as Ketamine must be managed very carefully.

Potential Side Effects:
Psychomimetic: Emergence Phenomena
- characterized by vivid dreams
- de-personalization
- hallucinations
- delirium
- agitation
- excessive sedation
**Sympathomimetic: Actions**
- increased blood pressure
- tachycardia
- increased cardiac output
- Hyper-salivation
- Increase in intracranial pressure
- Vision changes: Diplopia, Nystagmus, eye pain
- Nausea
- Skeletal muscle hyperactivity
- Rash & itching

**Prophylaxis Management of Psychomimetic Side Effects**
- This protocol may have been initiated in hospital and should continue in the community
- Patients may have started either a Benzodiazepine or Haloperidol **before or with** Ketamine
- recommended medications include:
  - Lorazepam 0.5-1mg BID p.o. or s/c or S/L
  - Midazolam 5-20mg s/c over 24 hours **or**
  - Haloperidol 1-2mg BID p.o. or s/c dependant on individual
- These medications may be used concurrently in the management of psychomimetic side effects.
- **Note:** Benzodiazepines increase the bio-availability of Ketamine, thus may potentiate respiratory depression

**NOTE:**
It is important to monitor closely for side effects and report changes in condition to the Palliative MD

**Ketamine Infusion Monitoring in Community**
- BID nursing visits X 48 hours & following each Ketamine or opioid dose adjustment
- Monitor VS - Blood Pressure, Pulse and Respiration q. visit
- Assess pain q. visit – perform a thorough pain assessment
- Assess level of sedation q. visit
- Monitor for side effects listed above and report all changes to Palliative physician providing care
References


Macpherson, N. (2006). Rationale and guidelines for the use of ketamine in palliative medicine &/or opioid poorly responsive pain (OPRF)


Northern Regional Palliative Care Physicians (2008). Guidelines for using ketamine.


Vancouver Coastal Health (VGH/UBCH/GFS). (2007). Palliative Care Unit – Ketamine Infusion Orders