1. POLICY STATEMENT
This document details the management of patients receiving a ketamine infusion for the management of pain enabling the patient to receive optimum pain relief safely and effectively.

2. BACKGROUND
Ketamine is an anaesthetic agent known to have analgesic properties in sub-anaesthetic doses. Ketamine analgesia is mediated by its effect on the N-methyl-D-aspartate (NMDA) receptor where it blocks excitatory nerve activity involved in pain transmission. Ketamine is administered in combination with other analgesics, may improve pain and reduce opioid requirements. Best effects are obtained when given as a continuous infusion either intravenously or subcutaneously. Ketamine is a Schedule 8 drug under the Poisons and Therapeutic Goods Act.
Ketamine can produce severe dysphoric and hallucinogenic sensations/reactions. For this reason the use of a benzodiazepine or low dose haloperidol in patients receiving ketamine could be considered.

3. RESPONSIBILITIES
Registered Nurses
Medical Staff

4. PROCEDURE

4.1 Patient selection
When commencing ketamine therapy the patient has either;
- a) proven to be resistant to opioids for acceptable analgesia or
- b) has had major surgery with the expectation that the opioid requirements alone could cause significant side effects and complicate patient recovery.
- c) Pre-emptive use may minimise patient opiate use in enhanced recovery protocols.

Patients who are on opioids, preoperatively or who have had multiple surgeries for ongoing pathology may find their pain improved while requiring less opioid if ketamine is added to their regimen. Loading doses in the Operating Theatres while under anaesthesia may be helpful and preferable over frequent boluses in recovery. Each patient will need to be assessed for thrombosis risk.

4.2 Prescribing
- Patient should be informed of potential side effects of ketamine
- Ketamine infusions must be prescribed on State Ketamine Infusion (Adult) charts
- If the order is changed it must be rewritten and completed as described above
- Recommended dose varies depending on specific patient population.
- Ketamine is compatible with fentanyl, morphine sulphate and hydromorphone.
- Ensure dose is prescribed in milligrams.
Contraindications and Precautions
Known contraindications to ketamine are hypersensitivity to ketamine and any conditions where a significant elevation of blood pressure is hazardous. These include:
- Intracranial hypertension, Cerebral aneurysms, Raised intraocular pressure
- May exacerbate pulmonary hypertension
- Psychiatric disorders: psychomimetic effects are more pronounced in the presence of schizophrenia and delirium.
- Ketamine should be used with caution in the presence of ischaemic heart disease because of the risk of increased heart rate and blood pressure.

4.2.1 Acute Pain
Continuous intravenous or subcutaneous infusions at doses of 0.1-0.2 mg/kg/hr are commonly used in combination with an opioid for the management of post-operative and post-injury pain.

Commence ketamine infusion at (2-4 mg/hr), (2mg/hr for elderly), and then titrate up according to the anaesthetist/pain consultant, once the effects of the anaesthetics subside.

The recommended infusion rate is usually 2–8 mg/hr and should only be prescribed by an anaesthetist or Acute Pain Service Medical Officer.

4.2.2 Chronic Pain
Patients with intractable chronic pain may be admitted for administration of ketamine infusion with escalation of dose as prescribed. This may be given by subcutaneous or infrequently by intravenous infusion.

The dose of ketamine may be increased and titrated by the pain medical officer as prescribed, according to analgesic response and/or side effects.

Suggested Doses for Chronic Non-Malignant Pain Patients
Commence infusion at 4mg/hr
- Increase infusion as prescribed by the Anaesthetist/Pain Service.

4.2.3 Suggested Doses for Cancer Pain Patients
Refer to ketamine in Cancer Pain procedure.
4.3 Preparation

- Ketamine is a S8 drug and is required to be administered via a lockable infusion device.
  - Remove PCA handset if fitted.
- Wash hands and use aseptic technique during filing procedure.
- Use ketamine 200mg in 2 mL ampoule.
- Dilute to 2mg per ml for *subcutaneous* infusion
- 100mg in 100mls of normal saline for *intravenous* use, (Bag and Gemstar pump) which equals 1mg per ml
- Regular opiate may continue- see observation protocol.

A usual starting dose would be dependant on the patients weight.

2 mg per hour in the <60kg patient.  approximately 50mg/day
4mg per hour in the >60kg patient  approximately 100mg/day

The dose may be increased in increments up to a total of 0.1mg/kg/hr if required.

- Ensure the infusion given via giving set with back check valve to prevent migration into additional lines.

4.4 Administration

Infusion via pump/delivery device can only be commenced and managed by Registered Nurses who are competent in using the specific pump/delivery device.

The ketamine infusion must be clearly labelled for easy identification.

If the infusion is delivered via disposable elastomeric device, (Chronic or Palliative Care)e.g. Dosifuser®, the manufacturer directions must be followed. Refer to individual hospital business rule for further detail on the preparation, concentration and rate of the infusion.

4.5 Observations

All patient must be observed for psychomimetic reactions – e.g. unpleasant dreams, vivid imagery and hallucinations, alterations in perception described as “floating in space” or as a “feeling of unreality”. For detailed information on potential adverse effects refer to TGA approved product information.

**Acute pain**

- If patient is receiving ketamine in addition to Patient Controlled Analgesia or Opioid Infusion then observations should be completed on the relevant PCA prescription and observation chart.
- If ketamine is administered alone or in addition to oral/subcutaneous opioid analgesia then Ketamine observations should be completed every 2 hours on the Ketamine infusion chart including Pain Score. Other observations must be completed on the adult general observation chart.

Maintain normal PCA observations- otherwise every 4 hours T P R BP, sedation, pain scores.

Patients should be informed of the possibility of hallucinations or unpleasant reactions.

…/4
Chronic non-malignant pain
- ON commencement of the infusion the patient should be monitored hourly for 4 hours particularly noting psychotropic reactions followed by Routine observations every 4 hours which include T P R BP, sedation, and pain scores. (unless directed otherwise).
- Observations should be recorded on the specific ketamine infusion Adult Chart.

4.6 Management of Adverse Effects

Dysphoria- vivid / bad dreams / disassociation / hallucinations
- Reduce infusion by half
- Check drug and prescription and ensure pump programme and infusion rate is correct
- Contact the pain team or anaesthetic registrar/anaesthetist.
- Have diazepam 2 to 5mg available.

Increased Sedation
- If drowsy but rousable administer oxygen via nasal prongs at 2 litres per minute, check infusion rate, check respiratory rate more frequently and if concerned contact PACE Team or Anaesthetic registrar.
- If difficult to rouse, cease the infusion, administer oxygen via Hudson mask at 6 litres per minute and contact the Acute Pain Team or Anaesthetic Registrar/Anaesthetist.
- If opioids are administered in conjunction with the ketamine infusion a review of opioid prescription is required.

Respiratory depression / apnoea (usually caused by rapid infusion)
- Check the infusion rate.
- If respiratory rate is 8 to 10 breaths per minutes, continue to observe closely and administer oxygen via nasal prongs at 2 litres per minute.
- If respiratory rate is less than 8 breaths per minute, cease the infusion, administer oxygen via Hudson mask at 6 litres per minute and initiate PACE Tier 1 call and contact Anaesthetic Registrar/Anaesthetist.
- If apnoea is present, cease the infusion, initiate PACE Tier 2 call, provide basic life support and contact Anaesthetic registrar/Anaesthetist.
- If opioids are administered in conjunction with the ketamine infusion a review of opioid prescription is required.

Hypertension (i.e. Systolic greater than 40mmHg above patients usual OR Diastolic greater than 95mmHg).
- If BP greater than180/95 and/or pulse greater than 110 reduce ketamine infusion rate by 25% per hr and contact the Acute Pain Team or Anaesthetic Registrar or Medical Officer.
- If raised BP or Pulse remains elevated despite rate reduction inform anaesthetic registrar.
5. DOCUMENTATION
Ketamine Infusion Chart SMR130028
Standard Adult General Observation Chart SMR 110010

6. AUDIT
Patients receiving a Ketamine infusion will be regularly reviewed at least daily by Pain Management clinicians.

7. REFERENCES
• Australian Injectable Drugs Handbook 4th Edition
• NSW Health Policy PD2007_077, Medication Handling in New South Wales Public Hospitals.
• Australian and New Zealand College of Anaesthetists and Faculty of Pain Medicine. Acute Pain Management: Scientific Evidence. Approved by the NHMRC 2005 P 53-54.
• Goodchild, C. The Role of Ketamine in Pain Management, Sensorium, A Neuroscience journal for Australasian Clinicians, 5:2004;5-8
• Poisons List 2010, Department Of Health, New South Wales TG 147/85
• Yamauchi, M. et al Continuous Low-Dose Ketamine Improves the Analgesic Effects of Fentanyl Patient-Controlled Analgesia After Cervical Spine Surgery Anesth Analg 2008;107:1041–4

REVISION & APPROVAL HISTORY
Reviewed and changes endorsed by Director of Anaesthetics and Clinical Nurse Consultant Pain Management September 2013
Approved Quality & Patient Safety Committee 18/8/11
Endorsed Therapeutic & Drug Utilisation Committee 14/6/11
Changed title from : Ketamine Analgesia – Acute Post Operative Pain Procedure and Guidelines’ Approved Quality Council 15/3/04