Moderate Sedation
For Physicians/LIPs

CME program
# Table of Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>i. CME Background Information</td>
<td>3</td>
</tr>
<tr>
<td>I. Introduction to Moderate sedation</td>
<td>8</td>
</tr>
<tr>
<td>A. Policy: Why must we have one policy?</td>
<td></td>
</tr>
<tr>
<td>B. Qualified Personnel: Who can perform moderate sedation?</td>
<td></td>
</tr>
<tr>
<td>C. Levels of Supervision</td>
<td></td>
</tr>
<tr>
<td>D. Definition of Moderate Sedation</td>
<td></td>
</tr>
<tr>
<td>II. Medications and guidelines for use</td>
<td>11</td>
</tr>
<tr>
<td>A. Sedation Medications</td>
<td></td>
</tr>
<tr>
<td>B. Route of administration</td>
<td></td>
</tr>
<tr>
<td>C. Medication Review</td>
<td></td>
</tr>
<tr>
<td>III. Patient Selection and Preparation</td>
<td>22</td>
</tr>
<tr>
<td>A. Patient Assessment</td>
<td></td>
</tr>
<tr>
<td>1. History and Physical</td>
<td></td>
</tr>
<tr>
<td>2. ASA Classification</td>
<td></td>
</tr>
<tr>
<td>3. Informed Consent</td>
<td></td>
</tr>
<tr>
<td>4. Patient Education</td>
<td></td>
</tr>
<tr>
<td>5. Transportation Arrangements</td>
<td></td>
</tr>
<tr>
<td>B. Reassessment (immediately prior to moderate sedation)</td>
<td></td>
</tr>
<tr>
<td>1. Physician reassessment</td>
<td></td>
</tr>
<tr>
<td>2. NPO status</td>
<td></td>
</tr>
<tr>
<td>3. Time out</td>
<td></td>
</tr>
<tr>
<td>IV. Procedure Care Requirements</td>
<td>25</td>
</tr>
<tr>
<td>V. Procedural Monitoring and Documentation Requirements</td>
<td>25</td>
</tr>
<tr>
<td>VI. Complications</td>
<td>28</td>
</tr>
<tr>
<td>A. ABC</td>
<td></td>
</tr>
<tr>
<td>B. Cardiac Rhythm Identification</td>
<td></td>
</tr>
<tr>
<td>C. Defibrillator operation</td>
<td></td>
</tr>
<tr>
<td>D. Medications used for cardio-respiratory emergencies in moderate sedation</td>
<td></td>
</tr>
<tr>
<td>VII. Moderate Sedation: Adult Drug Overview Table</td>
<td>34</td>
</tr>
<tr>
<td>A. Local Anesthetic Toxicity: Protocol for Lipid Resuscitation</td>
<td>38</td>
</tr>
</tbody>
</table>
i. CME Background Information

Principal Faculty, Credentials, and Disclosure

<table>
<thead>
<tr>
<th>Michael Hensien, MD</th>
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</tr>
</thead>
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<tr>
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<td>• Michael Hensien, MD has completed a Disclosure of Relevant Financial Relationships form and has no relevant financial relationships to disclose. This educational activity has no commercial support.</td>
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<th>Chad A Kort, MD, FACS</th>
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<tr>
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<td>Diplomat of the American Board of Surgery</td>
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<td>Aurora Lakeland Medical Center</td>
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<td>Diplomat for the American Board of Anesthesiology, American Board of Pain Medicine and American Academy of Pain Medicine</td>
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<td>Aurora Lakeland Medical Center</td>
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<th>James Mesrobian, MD</th>
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<td>Diplomat of the American Board of Anesthesiology</td>
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<th>Dennis Brierton, PharmD</th>
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<td>• Dennis Brierton, PharmD, has completed a Disclosure of Relevant Financial Relationships form and has no relevant financial relationships to disclose. This educational activity has no commercial support.</td>
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**Target audience**

All Medical and Affiliate Staff requesting moderate sedation privileges within the Aurora System.

**Educational Content**

Moderate sedation is being used for patients undergoing a variety of diagnostic tests and procedures, not only in surgery but in other areas: Ambulatory clinics, radiology, emergency department, cardiac catheterization, outpatient, Intensive Care Unit (ICU), electrophysiology labs, and physician offices. Examples of procedures in which moderate sedation is used include, but are not limited to: bronchoscopy, gastroscopy, sigmoidoscopy, colonoscopy, angioplasty, reduction of dislocations, suturing of lacerations, incision and drainage of abscesses, synchronized cardioversion, transesophageal echocardiograms, breast biopsies, carpal tunnel release, bunions, orthopedic hardware removal and cystoscopy.

This CME activity is primarily directed at moderate sedation for ADULT patients, though much of the information is applicable to all populations.

**Purpose for the Enduring Material**

Criteria to request the special privilege of minimal or moderate sedation may be met by completing this Moderate Sedation CME Program.

This activity is intended to provide the education and information necessary for non-anesthesiologists to perform minimal or moderate sedation. The provider of minimal or moderate sedation should have the knowledge of the medications used, patient assessment and examinations, methods of caring for monitoring the patient throughout the procedure, identifying and treating potential complications. This program outlines how the participant can apply this knowledge to adequately and safely perform moderate sedation.

**Objectives**

This program will provide participants who complete it knowledge on the procedural aspects of providing sedation by non-anesthesiologist in conjunction with the Aurora Moderate Sedation policy. Participants who complete this CME program will be able to:
1. Define the qualifications of personnel who perform and/or participate in moderate sedation
2. Understand the medications used for sedation including: actions, dosage, contraindications and reversal agents
3. Evaluate a patient for moderate sedation including assessment for eligibility criteria
4. Monitor and document observations of the patient during and after the procedure
5. Provide the support for patient during the procedure to avoid any complications
6. Identify complications of sedation and apply interventions to avoid adverse outcomes
7. Comply with the AHC policy requirements

**Method of Learner Participation in the Learning Process**

Post-test and Evaluation

**Estimated Time needed to complete this Educational Activity (same as the number of credit hours designated)**

2 hours
Bibliographic Sources for Further Study


American Society of Anesthesiologists Website for Standards, Guidelines, Statements, and Other Documents [ASA website](http://www.asa.org/)
   a) Statement on granting privileges for deep sedation to non-anesthesiologist sedation practitioners (2010)
   b) Statement on the Safe Use of Propofol (2009)


The Joint Commission Standards PC.03.01.01, 03.01.03, 03.01.05, 03.01.07 and RC.02.01.03.

Micromedex 2012


www.SedationFacts.org

Original Release Date
October 12, 2009

Most Recent Review Date
April 2006

CME Approval Date
April 11, 2016

Termination Date
March 31, 2019

Verification of Participation
Completion of the evaluation form at the end of program.

Credit Certificate
The participant is required to receive a passing score of 85% and complete a program evaluation in order to receive credit.

For questions regarding the Enduring Material

- For content questions, contact Nikole Carter at 262-787-2763
- For technical questions, contact the help desk at 414-647-3520 in Milwaukee or 1-800-889-9677
- For credentialing questions, contact Aurora’s Medical Staff Office at 414-649-7496
- For CME questions, contact the Continuing Professional Development Office at 414-219-5490

Continuing Medical Education

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This CME Activity was planned and produced in accordance with the Wisconsin Medical Society’s Essential Areas, Elements, and Policies.
Accreditation

Aurora Health Care is accredited by the Wisconsin Medical Society to provide continuing medical education for physicians.

Aurora Health Care designates this enduring activity for a maximum of 2.0 AMA PRA Category 1 Credit(s)™. Physicians should claim only credit commensurate with the extent of their participation in the activity.
I. Introduction to Moderate Sedation

A. Policy: Why must we have one policy for moderate sedation?

Currently The Joint Commission (TJC) functional chapters require that a policy governing the activities surrounding the administration of sedation must be consistent in every area through the hospital. Two interdisciplinary protocols have been developed for moderate sedation: one policy for minimal/moderate sedation and one policy for deep sedation. The policies were developed with input from multidisciplinary groups of professionals, including physician specialties, nursing, inpatient and outpatient settings, and other departments throughout the system. The policies were written to meet CMS Guidelines, The Joint Commission standards, and to align with community standards.

All moderate sedation must be performed under the guidelines and according to the procedures defined in the Policies on Moderate Sedation.

B. Qualified Personnel: Who can perform and assist with moderate sedation?

A. Physicians/Licensed Independent Practitioners (includes MD, DO, DDS, DPM, and APRN; referred to as Physician/LIP in this policy) are licensed caregivers that may participate in procedural sedation and analgesia based upon meeting the credentialing guidelines. Qualifications for non-anesthesiologists are based on the professional guidelines of the American Society of Anesthesiology (ASA) and their respective specialty organizations, including American college of Emergency Physicians (ACEP), American Dental Association (ADA), American Society for Gastrointestinal Endoscopy (ASGE), American Association of Nurse Anesthetists (AANA), the American Nurses Association (ANA), the Association of PeriOperative Registered Nurses (AORN), the Association of Women’s Health, Obstetric and Neonatal Nurses (AWHONN), the American Association of Critical Care Nurses (AACN), and the American Nurses Credentialing Center (ANCC).

Non-anesthesiologist Physicians/LIPs who perform Minimal/Moderate Sedation must have adequate education, training and demonstrated competency. Only those physicians/LIPS who meet the qualifications and criteria as defined by the Department of Anesthesia Services will be granted credentials and privileges to provide Minimal/Moderate Sedation by the hospital Medical Executive Committee or the AMG Management Committee.

Physician/LIP may delegate selected activities to Qualified Personnel within their scope of practice, but the Physician/LIP remains the primary responsible agent for all activities related to the sedation procedure.
2. Qualified Personnel: Additional personnel (Advanced Practice Nurse Practitioners, Registered Nurses, Licensed Practical Nurses, Unlicensed Assistive Personnel [Medical Assistants, Certified Nurse Assistants], Respiratory Therapists, Anesthesia Technicians) may participate in moderate sedation according to their scope of practice and privileges, under the designated level of supervision by the Physician/LIP, and if they meet the qualifications defined in the Moderate Sedation policy. These assisting personnel are referred to as Qualified Personnel in this CME Program.

Qualified Personnel may provide the following duties:
- Draw up and administer the medications for sedation if prescribed by and delegated from a Physician/LIP and under the appropriate level of supervision for that personnel
- At least one qualified personnel must be present during every moderate sedation procedure
- A qualified personnel who is designated to patient monitoring during the procedure must not leave the patient unattended

C. Levels of Supervision

Depending on the qualifications of the personnel assisting the Physician/LIP, there are two levels of supervision required.

**Direct Supervision** means immediately available to continually coordinate direct and inspect at first hand the practice of another. Direct supervision means the supervising personnel is at all times in the facility and able to respond rapidly to a request for assistance. Required for RNs and LPNs.

**Personal supervision** means a physician/LIP must be in attendance in the room during the performance of the procedure. Required for Unlicensed Assistive Personnel, Respiratory Therapists and Anesthesia Technicians.

D. Definition of moderate sedation: how is it different from other forms of patient medication for procedures?

The response to the administration of these medications is on a continuum from anxiolysis to general anesthesia. How much medication is given will determine where the patient will be on that continuum.

Achieving sedation in a patient may require a different dose for each patient. Manufacturers recommended dosage ranges should be followed. A patient’s physical condition and medication sensitivities, however, may cause the required dose within this range to vary. The goal is to achieve the right amount of sedation to depress the patient consciousness, yet allow them to maintain their protective reflexes. Administering too much medication will cause the patient to move from moderate sedation to deep sedation or general anesthesia. Remember patients can be anywhere on a continuum because of their varied response to the medication. You need to recognize and maintain them at the intended level of sedation and not allow them to progress beyond the intended level of sedation to a deeper state of sedation.
or general anesthesia. If protective reflexes are lost, you must be prepared to act. Airway assessment and management are integral parts of safe care in these patients.

Definitions:

**Procedural Sedation** refers to the technique of administering sedative or dissociative agents with or without analgesics to induce a state that allows the patient to tolerate unpleasant procedures with the intent of maintaining cardio-respiratory function. Recognizing the continuum of sedation, that is dependent on the administration of specific medications and the patient response, several levels of sedation are defined:

**Minimal sedation** is a drug-induced state during which patients respond normally to verbal commands. Although cognitive function and coordination may be impaired, ventilatory and cardiovascular functions are unaffected. Consistent with ASA guidelines and CMS, minimal sedation is not considered anesthesia.

**Moderate sedation/analgesia (formerly conscious sedation)** is a drug-induced depression of consciousness during which patients respond purposefully** to verbal commands, either alone or accompanied by light tactile stimulation. No interventions are required to maintain a patent airway and spontaneous ventilation is adequate. Cardiovascular function is usually maintained. Consistent with ASA guidelines and CMS, moderate sedation is not considered anesthesia.

**Deep sedation/analgesia** is a drug-induced depression of consciousness during which patients cannot be easily aroused but respond purposefully** following repeated or painful stimulation. The ability to independently maintain ventilatory function may be impaired. Patients may require assistance in maintaining a patent airway and spontaneous ventilation may be inadequate. Cardiovascular function is usually maintained. Use of propofol is considered deep sedation.

**Some agents used for moderate sedation** warrant special attention due to their potential for rapid, profound changes in the sedative and/or anesthetic depth or their lack of antagonist medications. Even if the intent is moderate sedation, patients receiving these drugs should receive care consistent with that required for deep sedation. These agents include but are not limited to ketamine and etomidate.

**General anesthesia** is a drug-induced state during which patients are not arousable, even by painful stimulation. The ability to independently maintain ventilatory function is often impaired. Patients often require assistance in maintaining a patent airway, and positive pressure ventilation may be required because of depressed spontaneous ventilation or drug-induced depression of neuromuscular function. Cardiovascular function may be impaired.

** Reflex withdrawal from a painful stimulus is NOT considered a purposeful response.**
II. Medications and Guidelines for Use

A. Sedation Medications: What medications are commonly used in moderate sedation?

Depending upon the acuity of the patient, and the extent, and length of the procedure, a number of pharmacologic effects may be desired. The intended level of sedation, along with individual patient factors, should guide selection of the most appropriate agent or agents to use. Confusion regarding the terminology associated with these intended effects are common. The three components of sedation are generally desired: sedation (tranquilization, anxiolysis, relaxation), analgesia (pain relief), and hypnosis (absence of memory or recall of the event).

Medications employed to obtain and maintain the various components of moderate sedation include benzodiazepines, opiate, butyrophenone derivatives, and other compounds. Routes of administration include oral and parenteral. Generally, the intravenous or oral route, not intramuscular route is used for moderate sedation. The following tables highlight the pharmacologic class and individual pharmacodynamic components of the agents routinely utilized for moderate sedation.

The primary medications used for minimal or moderate sedation include:

- Diazepam (Valium)
- Fentanyl (Sublimaze)
- Meperidine (Demerol)
- Morphine Sulfate
- Midazolam (Versed)
- Lorazepam (Ativan)

<table>
<thead>
<tr>
<th>Chemical Class</th>
<th>Benzodiazepines</th>
<th>Benzodiazepines</th>
<th>Opiates</th>
<th>Barbiturate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Functional Class</td>
<td>Sedative / Hypnotic</td>
<td>Antianxiety</td>
<td>Narcotic Analgesic</td>
<td>Sedative</td>
</tr>
<tr>
<td>Medication</td>
<td>Midazolam (Versed)</td>
<td>Diazepam (Valium)</td>
<td>Morphine Sulfate</td>
<td>Pentobarbital (Nembutal)</td>
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<td>Fentanyl (Sublimaze)</td>
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B. Route of Administration

Clearly, the oral (PO) route leaves much to be desired. While dosage is generally standardized, this is often at the expense of inadequate or over-sedation. Onset of effect is not considered rapid and duration of activity is often defined within a broad vs. the desired narrow range. Nothing is easier to administer however, and in the pediatric population, oral sedation is often the preferred method. Because absorption may be unpredictable, administration of repeat doses of oral medications to supplement sedation/analgesia is not recommended.

Intramuscular (IM) administration has a more rapid onset and is generally more predictable than oral but also is less acceptable to the patient. As with oral dosing, there is an inability to remove medication if untoward effects or over-sedation becomes apparent. Likewise, minute-to-minute control is not attainable with IM administration.

Intravenous (IV) sedation demonstrates all attributes described for administration of moderate sedation especially ease of use. Aside from a patent IV access site, considerable training and a good knowledge base of the agents used are required by the administering physician/LIP. The art of titration cannot be overemphasized. By injecting the appropriate agent(s) at an adequate dose over an acceptable time span, with constant observation, each patient will arrive at that degree of sedation that ensures comfort and necessary cooperation to enable successful completion of the planned procedure.

C. Medication Review:

This review of the common medications used in moderate sedation is not intended to be a complete listing of medication information. Primary source of information should be that obtained from a reputable drug information source including the Physician's Desk Reference or other references.

Of note, combination of agents may produce synergistic cardiorespiratory depression. Dose reduction of 50-75% or prolongation of dosing interval is appropriate when used in combination with other agents or use in the elderly, debilitated, or patients with compromised end-organ function.

Medications used in Moderate Sedation

1. Midazolam (Versed)

Classification:

A benzodiazepine (BZD) sedative/hypnotic.

Action:

Midazolam acts at the limbic thalamic and hypothalamic levels of the Central Nervous System (CNS) producing sedative, anxiolytic, hypnotic, amnestic,
muscle relaxant and anticonvulsant effects. Benzodiazepines as a class are capable of producing all levels of CNS depression from mild sedation to hypnosis in a progressive dose-related fashion.

Midazolam is differentiated from other BZD’s by a short half-life (2-5 hours), a shorter duration and onset of action, low frequency of pain at the injection site, and increased water solubility (less drug-drug incompatibilities).

**Dosage:**

Midazolam is formulated in a 1 mg, 2mg or 5 mg per ml injection. The typical concentration for IV administration is 1 mg/ml.

Adult dose: initial IV dose: 0.25 - 1 mg q 1-5 minutes slowly over at least a 2-minute period or per physician order. Total dose is based upon individual need and titrated to desired response. Total doses greater than 5 mg are generally not needed. Maximum dose 0.1 mg / kg.

Pediatrics - Oral Dosage: 0.25-0.5 mg/kg PO up to a maximum of 20 mg
Onset: 10-20min. Must be given only to patients under direct visual observation by a qualified health care provider.

**Reversal:**

Flumazenil (Romazicon)

**Adverse Effects:**

- Observe patient for the following untoward effects:
  - Loss of consciousness
  - Laryngospasm
  - Bronchospasm
  - Dyspnea
  - Airway obstruction
  - Cardiac Arrhythmias (i.e.: Premature Ventricular Contraction (PVC), bradycardia, tachycardia)
  - Anaphylactic reactions as evidenced by acute shortness of breath, acute hypotension, and tachycardia

- Respiratory depression - hypoventilation or apnea (10-77%) especially elderly, debilitated or chronically ill.
- Erythema/pain at administration site (5%) - infuse into central line or running peripheral IV if possible
- Prolonged sedation (1-2%)
- Paradoxical excitation, irritability, hostility, emergence delirium (<1%)

**Precautions:**
Although profound hypotension and apnea have been reported, the cardiovascular and respiratory depressant effects of midazolam are generally mild. Fluctuations in respiratory rate, volume, pulse and blood pressure are more clinically important in patients who are critically ill, have COPD, are receiving concurrent opiates, or have received high doses of midazolam (>10 mg).

**Incompatibilities:**

Midazolam is fortunately compatible with many other drugs and solutions. Dimenhydrinate, barbiturates, prochlorperazine, and ranitidine form precipitates when admixed in the same syringe. When combined with foscarnet, a gas is formed. Consult the Pharmacist on all issues of compatibility, as new information is continually being made available.

**Special Considerations:**

- Routinely assess the degree of sedation provided by midazolam
- Monitor for early signs of significant hypotension and cardiovascular or respiratory depression.
- Concomitant sedative plus opiate administration may result in more pronounced decreased in blood pressure or cardiac output. If possible, titrate analgesic to acceptable dose before initiation and titration of sedative.
- Agitation, involuntary movements, hyperactivity and/or combativeness may be signs of inadequate or paradoxically excessive dosage.

2. **Diazepam (Valium)**

**Classification:**

A benzodiazepine (BZD) sedative/hypnotic

**Action:**

Diazepam acts at the limbic, thalamic and hypothalamic levels of the CNS producing sedative, anxiolytic hypnotic amnestic, muscle relaxant and anticonvulsant effects. Benzodiazepines as a class are capable of producing all levels of CNS depression from mild sedation to hypnosis in a progressive dose-related fashion.

**Dosage:**

Adult dose: 1-2.5 mg q 3-10 minutes IV; total doses up to 10 mg are usually adequate in combination with opioids.

Pediatric dose IV: 0.05-0.1mg/kg IV over 3-5min titrated slowly to effect (max total cumulative dose 0.25mg/kg). Note: Midazolam preferred due to rapid onset and short duration.
Pediatric dose oral: 0.25 mg/kg (maximum 10mg) 45-60 min prior to procedure.

Doses smaller than those recommended above have resulted in significant hypoventilation or apnea. This has occurred more commonly in patients over the age of 60 and/or with chronic disease states such as COPD or Congestive Heart Failure (CHF). Likewise, individuals premedicated with an opiate or other sedative often respond to lower doses.

**Reversal agent:** Flumazenil (Romazicon).

**Adverse Effects:**
- Respiratory depression - hypoventilation or apnea, especially elderly, debilitated or chronically ill.
- Erythema/pain at administration site - infuse into central line or running peripheral IV.
- Prolonged sedation.
- Paradoxical excitation, irritability, hostility (<1%)

**Precautions:**
Although profound hypotension and apnea have been reported, the cardiovascular and respiratory depressant effects of diazepam are generally mild. Fluctuations in respiratory rate, volume, pulse and blood pressure are more clinically important in patients who are critically ill, have COPD, are receiving concurrent opiates, or have received high doses of diazepam (>20 mg).

**Incompatibilities:**
Diazepam is unfortunately incompatible with most other drugs and solutions. Do not dilute injectable solution prior to administration. Consult the Pharmacist on all issues of compatibility, as new information is continually being made available.

**Special Considerations:**
- Routinely assess the degree of sedation provided by diazepam.
- Monitor for early signs of significant hypotension and cardiovascular or respiratory depression.
- Concomitant sedative plus opiate administration may result in more pronounced decreased in blood pressure or cardiac output. If possible, titrate opiate to acceptable dose before initiation and titration of diazepam.
- Agitation, involuntary movements, hyperactivity and/or combativeness may be signs of inadequate or paradoxically excessive dosage.
3. Fentanyl (Sublimaze)

Classification:

A synthetic opiate analgesic available as an injection, transdermal patch, and transmucosal lozenge. Only the injection formulation will be used in the setting of moderate sedation.

Action:

Fentanyl shares the actions of the opiate agonists (morphine, meperidine, hydromorphone). In general, fentanyl has a shorter duration of action, does not cause histamine release, and has mild emetic properties. Respiratory depression is the dose limiting effect of this and other opiate analgesics.

Dosage:

Fentanyl is approximately 100 times more potent than morphine and 1000 times more potent the meperidine. In other words, 100-mcg fentanyl is comparable to 10 mg morphine or 100 mg meperidine.

Adult dose: 12.5-50 mcg q 5-10 minutes

Elderly or debilitated patient: use reduced dose

Pediatric dose: 0.5 – 2 mcg / kg. Consult for an anesthesia provider is recommended for dose above 100 mcg (or 2ml).

Give slowly IV over 1 - 2 minutes. Onset of action is almost immediate with duration of analgesia lasting 30-60 minutes.

Reversal:

Naloxone (Narcan)

Adverse Effects:

Respiratory and circulatory depression are major adverse effects, the former occurring at therapeutic doses. Dose related signs of intoxication include: miosis, drowsiness, decreased rate and depth of respiration, bradycardia and hypotension. Sedation, dizziness, nausea, vomiting, and sweating occur frequently.

Precautions:

If combinations of agents are selected for induction of moderate sedation the opiate is recommended for initial administration followed by the sedative of choice. Administer to patients with asthma or COPD history cautiously.
Incompatibilities:

Fentanyl is fortunately compatible with many other drugs and solutions with the exceptions of diazepam and barbiturates. Consult the Pharmacist on all issues of compatibility, as new information is continually being made available.

Nursing Considerations:

- Do not administer IV unless a narcotic antagonist and facilities for assisted or controlled respiration are immediately available.
- Signs of respiratory or cardiovascular depression should be monitored.

4. Morphine Sulfate

Classification:

An opiate analgesic available as an injection, oral tablets, and oral solution. Only the injection will be used in the setting of moderate sedation.

Action:

Morphine shares the actions of the opiate agonists (fentanyl, meperidine, hydromorphone). Respiratory depression is the dose limiting effect of this and other opiate analgesics.

Dosage:

Adult dose: 1-4 mg q2-15 minutes (or 2.5 mg slowly over five minutes; dose may be repeated in 15 minutes). Maximum dose should not exceed 10 mg/hour.

Pediatric IV dose: 0.05 mg / kg to 0.1 mg / kg.

Reversal:

Naloxone (Narcan)

Adverse Effects:

Respiratory and circulatory depression is major adverse effects, the former occurring at therapeutic doses. Dose related signs of intoxication include: miosis, drowsiness, decreased rate and depth of respiration, bradycardia, and hypotension. Sedation, dizziness, nausea, vomiting, and sweating occur frequently.

Precautions:

If combinations of agents are selected for induction of moderate sedation the opiate is recommended for initial administration followed by the sedative of choice. Administer to patients with asthma or COPD history cautiously.
Incompatibilities:

Morphine is fortunately compatible with many other drugs and solutions with the exceptions of diazepam and barbiturates. Consult the Pharmacist on all issues of compatibility, as new information is continually being made available.

Nursing Considerations:

Do not administer IV unless a narcotic antagonist and facilities for assisted or controlled respiration are immediately available.

Signs of respiratory or cardiovascular depression should be monitored.

5. Meperidine (Demerol)

Classification:

An opiate analgesic available as an injection, oral tablets, and oral syrup. Only the injection will be used in the setting of moderate sedation.

Action:

Meperidine shares the actions of the opiate agonists (fentanyl, hydromorphone, morphine). Respiratory depression is the dose limiting effect of this and other opiate analgesics.

Dosage:

Meperidine should be used with caution and its use is to be avoided in patients 65 or older and in patients with pre-existing CNS or renal dysfunction

Adult dose: 12.5-25 mg q 2-15 minutes (or 25 - 50 mg IV given slowly over 1 – 2 minutes). Maximum dose of 100 mg / hour.

Pediatric dose: 0.25 – 2 mg / kg, up to a maximum of 50 mg. Increased usual dose range to account for titration.

Reversal:

Naloxone (Narcan)

Adverse Effects:

Respiratory and circulatory depression are major adverse effects, the former occurring at therapeutic doses. Dose related signs of intoxication include: miosis, drowsiness, decreased rate, and depth of respiration, bradycardia, and hypotension. Sedation, dizziness, nausea, vomiting, and sweating occur frequently. Meperidine, unlike other opiates, demonstrates a high degree of anticholinergic effects. Delirium (particularly in the elderly), dry mouth, urinary retention, etc. appear with greater frequency following meperidine
administration than with other opiates. Active metabolite (normeperidine) may precipitate anxiety, tremors and seizures.

**Precautions:**

If combinations of agents are selected for induction of moderate sedation the opiate is recommended for initial administration followed by the sedative of choice. Administer to patients with asthma or COPD history cautiously.

Use in patients over the age of 65 years, is not advised secondary to profound anticholinergic effect (delirium). In elderly patients, use of an alternative opiate (morphine, hydromorphone, fentanyl) is recommended.

Patients receiving monoamine oxidase inhibitors (MAOI) for treatment of depression (tranylcypromine - Parnate®, Isocarboxazid - Marplan® or linezolid – Zyvox®) should NOT receive meperidine. A severe, perhaps life-threatening reaction may occur.

**Incompatibilities:**

Meperidine is fortunately compatible with many other drugs and solutions with the exceptions of bicarbonate, heparin, diazepam and barbiturates. Consult the Pharmacist on all issues of compatibility, as new information is continually being made available.

**Nursing Considerations:**

Do not administer IV unless a narcotic antagonist and facilities for assisted or controlled respiration are immediately available.

Signs of respiratory or cardiovascular depression should be monitored.

6. **Ketamine (Ketalar)**

**Classification:**

Ketamine is a rapid-acting intravenous general anesthetic that produces dose-related unconsciousness and analgesia. It is FDA approved as a sole anesthetic agent for diagnostic and surgical procedures that do not require skeletal muscle relaxation and for the induction of anesthesia prior to the administration of other general anesthetic agents. Patients receiving ketamine should receive care consistent with that required for deep sedation.

**Mechanism of Action:**

Ketamine produces a cataleptic-like state in which the patient is dissociated from the surrounding environment by direct action on the cortex and limbic system.

- The onset of ketamine sedation is 1-3 minutes.
- Duration of effect following IV administration: 5-15 minutes.
**Contraindications:**

Ketamine is contraindicated in patients in whom a significant elevation in blood pressure would constitute a serious hazard including patients with elevated intracranial pressure, hypertension, aneurysms, thyrotoxicosis, congestive heart failure, angina, psychotic disorders and pregnancy.

**Dosage:**

**Adults & Children - Intermittent Bolus Dose:** Ketamine 0.5-2 mg/kg IV

May be followed by 0.25-0.5 mg/kg IV every 10 minutes as needed.

Administer slowly over at least 1 minute (maximum rate 0.5mg/kg/min). Use smaller doses (0.5-1 mg/kg) for sedation for minor procedures. Source: Pediatric Dose Handbook.

**Reversal:**

None – there are no pharmacologic antagonist for the reversal of ketamine.

**Adverse Effects:**

- Ketamine has a Black Box Warning for risk of emergence reactions. Dysphoric reactions, (vivid dreams, hallucinations, delirium) may occur in roughly 12% of patients up to 24 hours post-operatively. Incidence of emergence reactions is least in young patients (<15yo) and in the elderly (>65yo). Pretreatment with a benzodiazepine (i.e. midazolam, diazepam) may reduce risk of emergence reactions.
- Hypertension and tachycardia due to catecholamine release; however, hypotension and bradycardia have been described.
- Excessive salivation may occur and may be managed with atropine and / or glycopyrolate.

**Precautions:**

- Because of dissociative properties, usual signs of depth of sedation may not apply (e.g. the patient’s eyes may be open while in a state of deep sedation/general anesthesia).
- Associated with less cardiopulmonary depression than other sedative-hypnotics, airway obstruction, laryngospasm, and pulmonary aspiration may still occur with ketamine.

**Incompatibilities:**

Ketamine is incompatible with diazepam and barbiturates. Consult the pharmacist on additional compatibility issues, as new information is continually being made available.
Reversal Agents

1. Flumazenil (Romazicon)

**Action** capable of reversing the effects of midazolam and diazepam.

**Dosage** Intravenous doses of 0.2 mg are administered over 15-30 seconds. The 0.2 mg dose may be repeated every minute to a maximum four additional doses (or 1 mg).

**Adverse Effects** Risk of seizures / withdrawal in patients dependent on benzodiazepines

**Precautions** Half-life of flumazenil (40 minutes) may be shorter than the agent reversed. Respiratory depression and sedation may recur

**Incompatibilities** Flumazenil is compatible with D5W, NS and lactated ringers. Consult the pharmacist on additional compatibility issues as new information is continually being made available.

**Nursing considerations:** The patient should be observed for improved response and recurrent sedation. Patients who receive flumazenil are to be monitored for an additional 2 hours post last dose of reversal agent.

2. Naloxone

**Action** injection can quickly reverse the respiratory depression or over-sedation secondary to the opiate analgesics including: fentanyl, morphine, meperidine. Typically mild respiratory depression or over-sedation can be quickly reversed.

**Dosage** 0.1- 0.4 mg of naloxone given IV over 15-30 seconds. This dose may be repeated every 2 - 3 minutes until the desired response is achieved, or a maximum of 2 mg is administered.

**Adverse Effects** Rapid reversal may induce hypertension, tachycardia, nausea, vomiting and sweating. Respiratory depression and sedation may recur due to short half-life of 60 min.

**Precautions** Risk of withdrawal in opioid dependent patients

**Incompatibilities** Naloxone is compatible with D5W and normal saline. Consult the pharmacist on additional compatibility issues as new information is continually being made available.

**Nursing considerations:** Monitor for resedation after use.
III. Patient Selection and Preparation

A. Patient Assessment: How will I know the patient is suitable for moderate sedation administration?

Each patient receiving moderate sedation must have a physician/LIP assessment completed within 30 days prior to the procedure AND updated on the day of the procedure. (In an emergency situation, these requirements may be waived.) Elements of the assessment must include:

1. History and Physical including:
   a. Significant medical/surgical history
   b. Significant family history
   c. Smoking history
   d. Alcohol/drug abuse
   e. Possible pregnancy (LMP)
   f. Airway risk history *
   g. Physical exam of heart and circulatory system
   h. Physical exam of lungs
   i. Physical exam of airway **
   j. Level of consciousness/mental status
   k. Review of current medications
   l. Allergies/previous adverse drug reactions
   m. Pertinent lab or test results

* Risk factors and physical findings associated with a difficult airway management include:

- History of previous complications, sleep apnea, stridor, snoring, neck arthritis
  - Hoarse voice or previous tracheostomy could indicate possible stenosis at some level
- Significant obesity (especially involving the neck and facial structures)
- Head and Neck: Short neck, limited neck extension
  - Neck examination: check for masses, mobility, deviation of the trachea.
- Mouth: small opening (<3 cm in an adult), edentulousness, presence of a beard, loose or capped teeth, high arched palate, tonsillar hypertrophy, non-visible uvula, temporomandibular joint problems.
  - Mouth examination: an opening of at least two large finger breadths between the upper and lower incisors in the adult is desirable.

** Physical examination of the airway may include the Mallampati classification. In anesthesiology, the Mallampati score, also Mallampati classification, is used to predict the ease of intubation. It is determined by looking at the anatomy of the oral cavity; specifically, it is based on the visibility of the base of uvula, faucial pillars (the arches in front of and behind the tonsils) and soft palate. Scoring may be done with or without phonation. Higher Mallampati Score (Class 4) is associated with more difficult intubation as well as a higher incidence of sleep apnea.
Scoring is as follows:

Class 1: Full visibility of tonsils, uvula and soft palate  Figure A
Class 2: Visibility of hard and soft palate, upper portion of tonsils and uvula Figure B
Class 3: Soft and hard palate and base of the uvula are visible Figure C
Class 4: Only Hard Palate visible Figure D

2. The American Society of Anesthesiology (ASA) Physical Status Classification system (ASA Classification) will be employed in determining the suitability of the patient for moderate sedation administration. The physician/LIP performing the moderate sedation will be responsible for the assigning and documentation of the patient’s ASA class.

Review of ASA Physical Status Classification System:

Class I: A normal healthy patient
Class II: A normal patient with mild systemic disease
Class III: A patient with a severe systemic disease that limits activity but is not incapacitating
Class IV: A patient with an incapacitating systemic disease that is a constant threat to life
Class V: A moribund patient not expected to survive 24 hours with or without the procedure

Most patients in Class I-III will generally tolerate minimal and moderate sedation without any problems. However, use of moderate sedation for patients in Class IV and V is of higher risk.

3. Informed Consent The Physician/LIP performing the procedure must inform the patient/guardian about the risks, benefits and alternatives to sedation as a component of the planned procedure. The Physician/LIP prior to the procedure must document this discussion in the medical record with date and time. This requirement does not apply to emergencies.
4. Patient education: Age-appropriate patient education should be provided to all competent patients and/or their family member, answering any questions prior to the administration of sedation. Psychological preparation of the patient is always important. Thorough preparation can contribute to sedation that is more effective and may even reduce the need for higher doses during the procedure.

5. Transportation Arrangements

An arrangement for transportation home with an individual who accepts responsibility is to be determined before the patient is sedated. Without these satisfactory arrangements, the physician ordering the sedation or performing the procedure must be notified in advance of this situation. The Physician/LIP will then determine if the administration of sedation will proceed as planned and document medical necessity to proceed as planned.

**Pediatric patients:** When moderate sedation is used for a pediatric patient, a qualified physician/LIP or an anesthesia provider must be present at bedside to sedate the patient.

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**B. Reassessment: What must be done immediately before the administration of moderate sedation?**

1. Physician/LIP Reassessment: must be performed immediately prior to the moderate sedation to assure that the patient remains a candidate for the planned sedation. Evaluation will include a review of the patient’s Pre-Sedation Assessment (H &P) to confirm there have been no changes. (In an emergency situation, this requirement may be waived.)

2. Nothing By Mouth (NPO) status must also be considered when performing moderate sedation as patients will be at greater risk of aspiration if they become over-sedated. Patients at risk for aspiration include: morbidly obese patients, patients with history of reflux esophagitis, hiatal hernia, pregnant patients in their last trimester of pregnancy, full stomach patients. (In an emergency situation, this requirement may be waived.)

NPO status (time and nature of last oral intake)
   a. Minimum fasting period: 2 hours (clear liquids)
   b. Minimum fasting period: 6 hours (light meal)
   c. Minimum fasting period: 8 hours (heavy meal)
   d. Exceptions to fasting include sips of water for swallowing medications, required oral preparations and per physician discretion

3. **Time Out:** Time out and site marking must be performed and documented according to the Universal Protocol for Prevention and Wrong Site Wrong Surgery (system policy).
IV. Procedure Care Requirements:

What resources must I have available to me during the administration of moderate sedation?

Prior to initiating the moderate sedation the following must be complete:

A. Establish intravenous (IV) access (for moderate sedation using intravenous medication administration). The IV access should be maintained when using IV medications throughout the administration of moderate sedation until the patient has returned to baseline assessment after the procedure is complete.

1. IV catheter must be used; butterfly needles are not acceptable.
2. In cases where non-IV medication is used or when the IV line has become dislodged or blocked, a case-by-case determination should be made.
3. IV access is not required for Minimal Sedation.

B. Equipment at the bedside shall include:

1. Pharmacologic reversal agents
2. Supplemental oxygen: must be available but its use is NOT required for minimal or moderate sedation
3. Appropriately sized airway equipment
4. Resuscitation bag and mask
5. Pulse oximetry
6. Blood pressure monitoring equipment
7. Suction setup
8. EKG monitoring when required
9. For PEDIATRIC SEDATION: Immobilization devices

C. Emergency equipment must be immediately accessible at every location where sedation is administered and includes the following:

1. EKG monitor/defibrillator
2. ACLS (Advanced Cardiac Life Support) emergency drugs
3. Intubation equipment
4. For PEDIATRIC sedation, must also have: Pediatric Life Support (PALS) and Advanced Life Support (ACLS) emergency drugs with Broselow tape.

V. Moderate Monitoring and Documentation Requirements

How can you assure the patient receives the necessary level of assessment and monitoring required for safe administration of moderate sedation?

The Physician/LIP along with the Qualified Personnel managing the care of the patient receiving moderate sedation will assure that the patient is not left alone during moderate sedation and must have continuous monitoring and patient assessment to insure patient safety.
A. Moderate Monitoring Requirements - the following should be monitored:

1. Vital signs
   a. Respiratory rate
   b. Blood pressure
   c. Heart rate
   d. Cardiac rhythm monitoring is required for the following:
      • Patients who are ASA Class III, IV, or V
      • Patients who have a history of cardiac disease

2. Consider monitoring exhaled carbon dioxide (through capnography) for patients whose ventilation cannot be directly observed during MODERATE sedation

3. Skin color
   a. Pallor
   b. Cyanosis

4. Oxygenation status
   a. Pulse Oximetry
   b. Amount of oxygen delivered, if applicable
   c. Route of oxygen delivered, if applicable

5. For all patients with an intravenous catheter, monitor and maintain IV access.

6. Comfort level
   a. Level of pain (use institution approved pain scale)
   b. Patient response to analgesic, if analgesic administered
   c. Nausea/vomiting
   d. Patient response to antiemetic, if administered

7. Level of consciousness
   a. Monitor level of sedation using Ramsay Sedation Scale
   b. Compare the current level of consciousness with the established sedation goal

RAMSAY SEDATION SCALE

<table>
<thead>
<tr>
<th>Score</th>
<th>Level of Sedation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Patient is anxious and agitated or restless, or both</td>
</tr>
<tr>
<td>2</td>
<td>Patient is co-operative, oriented, and tranquil</td>
</tr>
<tr>
<td>3</td>
<td>Patient responds to commands only</td>
</tr>
<tr>
<td>4</td>
<td>Patient exhibits brisk response to light tactile stimuli or loud auditory stimulus</td>
</tr>
<tr>
<td>5</td>
<td>Patient exhibits sluggish response to light tactile stimuli or loud auditory stimulus</td>
</tr>
<tr>
<td>6</td>
<td>Patient exhibits no response</td>
</tr>
</tbody>
</table>
B. Documentation

Moderate Sedation forms have been developed for documentation use by Physician/LIPs and qualified personnel during the procedure. These should be used to assure compliance with the required elements of the Moderate Sedation policy. Documentation of the moderate monitoring must be conducted according to the frequency below.

1. The following must be documented, including date and time, at a minimum of every five minutes during the moderate sedation:
   - Heart rate
   - Oxygen saturation
   - Respiratory rate
   - Blood pressure

2. The following must be documented, including date and time, at a minimum of every 15 minutes during moderate sedation:
   - Level of sedation utilizing the Ramsay Sedation Scale
   - Level of pain

C. Post-moderate Monitoring and Documentation

When the moderate sedation is completed, the same parameters monitored during the procedure listed above AND the Modified Aldrete Score must be monitored by a Qualified Personnel during the recovery period and prior to discharge from the facility.

**Modified Aldrete Score**

<table>
<thead>
<tr>
<th>Score</th>
<th>Activity</th>
<th>Respiration</th>
<th>Circulation</th>
<th>Consciousness</th>
<th>O₂ Saturation</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Able to move 4 extremities</td>
<td>Deeply breathes, coughs freely</td>
<td>Systolic BP +/-20-50% pre-procedure level</td>
<td>Fully awake</td>
<td>Able to maintain SaO₂ &gt; 92% on room air</td>
</tr>
<tr>
<td>1</td>
<td>Able to move 2 extremities</td>
<td>Limited respiratory effort</td>
<td>Systolic BP +/-20-50% pre-procedure level</td>
<td>Arousable</td>
<td>Needs O₂ inhalation to maintain SaO₂ &gt;90%</td>
</tr>
<tr>
<td>0</td>
<td>Able to move 0 extremities</td>
<td>Apneic</td>
<td>Systolic BP +/- 50% pre-procedure level</td>
<td>Unresponsive</td>
<td>SaO₂&lt;90% even with O₂ supplement</td>
</tr>
</tbody>
</table>

The following must be documented, including date and time, every 15 minutes throughout the recovery period until the patient returns to pre-procedure status:
• Heart rate
• Blood pressure
• Oxygen saturation
• Modified Aldrete score
• Level of pain

Note: Patient may be eligible for discharge with a score of less than 10 if return to baseline score.

When a patient who has not recovered is transported from one department to another, a qualified staff member must accompany the patient to continue monitoring for potential delayed complications.

Assessments should be documented PRN (whenever necessary) if a change in the patient condition occurs, and until the patient has returned to pre-procedure baseline or vitals are within acceptable norm.

D. Discharge Process and Criteria

All of the following criteria must be met prior to discontinuation of post-procedure monitoring. After meeting the criteria, the patient may be transferred to an inpatient floor or discharged from the facility with a responsible person.

1. Patient is easily awakened by normal or softly spoken verbal commands.

2. Patient is awake and alert to baseline level of consciousness, at his/her pre-procedure level.


4. There is no significant risk of losing protective reflexes.

5. Patient is able to maintain pre-procedure mobility with minimal assistance as appropriate for procedure.

6. Patient has minimal nausea and/or dizziness.

7. Patients receiving a reversal agent must stay a minimum of two hours and be monitored after the last administration of the reversal agent to ensure that patients do not become reedated after reversal effects have abated.

VI. Complications

Under ideal circumstances, the patient undergoing a procedure under “moderate sedation” is able to experience a pain free procedure with minimal risk. However, deeper levels of sedation are sometimes required to accomplish the goal of painlessness, and higher doses of more potent medications must be utilized. This puts the patient at higher risk of medication side effects, hemodynamic instability, loss of protective reflexes including airway control, hypoxia, and cardiac arrhythmias.
The Physician/LIP in charge of the procedure must have a working knowledge of the common reasons for patient instability in this setting, and the tools necessary to regain control of the situation.

While this section will deal with arrhythmia interpretation and use of common medications, it is vital to always first assess the “ABC’s” before other interventions. Very commonly, the reason for an arrhythmia or drop in blood pressure often regains stability without requiring medication. The goal of this section will be to obtain a working knowledge of some basic arrhythmias, and some medications that may be useful in the first few minutes of a patient decompensating.

A. ABC: First and foremost is to systematically evaluate the patient in distress. In Emergency Medicine, the initial evaluation of an unstable patient follows the “ABC’s.”

**Airway**

Protective reflexes may become absent. Maintain the airway by chin lift or jaw thrust technique and/or insert a nasal or oropharyngeal airway, if appropriate, to assure the tongue does not occlude the airway. Suction as necessary to maintain a patent airway. If apnea or airway obstruction is not properly treated, they may result in cardiac arrest.

If Airway obstruction occurs, the following sedation airway management algorithm should be followed

1. Head tilt
2. Chin lift
3. Jaw thrust and consider pharmacologic reversal
4. Call for additional assistance
5. Insert oral airway
6. Attempt Positive pressure Ventilation (Ambu bag)
7. Call Respiratory Prepare for intubation

(Adapted from Moderate sedation/analgesia, 2nd edition, Kost, 2004)

**Head Tilt:** Moves the head from the neutral position to the lateral (side) position. This maneuver may result in tongue displacement from the posterior pharyngeal wall to the side of the oropharynx.

**Chin Lift:** combined with hyperextension of the head and neck and forward displacement of the mandible will elevate the soft tissue anteriorly and open the airway.

**Jaw Thrust:** If tactile stimulation, head tilt, and chin lift do not produce relief of airway obstruction, attempt the jaw thrust. The jaw thrust maneuver places significant anterior forward displacement on the jaw in an attempt to relieve obstruction and restore air flow. Great care must be taken not to exert excessive pressure for a prolonged period of time when performing a jaw thrust to prevent damage to the facial nerve.
Breathing

The most serious effect of many of the moderate sedation agents is respiratory depression, which can progress to apnea, even in arousable, responsive patients. Apnea must be immediately treated by assisting ventilation with a bag valve mask with reservoir and 100% supplemental oxygen.

Circulation

Hypotension should be treated by placing the patient in the modified Trendelenburg position. An intravenous fluid challenge, and/or vasopressors may be used at the direction of the physician. The appropriate reversal agent(s) should be drawn up and readied for administration. If ECG rhythm disturbances occur, the physician is responsible for ordering appropriate treatment can be obtained. Be sure to obtain a strip and attach it to the documentation forms.

B. Cardiac Rhythm Identification

The following will be a review of common arrhythmias and a methodology for identification. Once again, it must be stressed that the first step in assessing a patient with an abnormal monitor tracing is to assure adequate airway, breathing, and circulation. If the patient has a good blood pressure, then the rhythm is “stable” and definite treatment need not be initiated emergently. Identifying a rhythm off a monitor tracing is often difficult. Make sure the leads are making good contact with the patient, and print out a rhythm strip to analyze.

Rate:  Bradycardic < 60

Tachycardic > 100

Is it a sinus rhythm? If there are P waves associated with every QRS complex and the PR interval is consistent then the rhythm is sinus.

If the rate is bradycardic, is there a heart block? Are there more P waves than QRS complexes present? In a complete heart block (3rd degree block) the P waves do not conduct, and there is no relationship between the P waves and the QRS complexes. In a 2nd degree block some of the P waves conduct, but there will be some P waves without a QRS (“dropped beat”).

If the rate is tachycardic and not sinus, then the first question is whether the QRS complexes are narrow or wide. This can often be quite difficult to ascertain depending on the rate. “Classic” Ventricular Tachycardia (Vtach) has a sine-wave appearance, with wide complex, regular QRS complexes.
Some important rhythms to identify:

This is Ventricular Tachycardia.

This is Ventricular Tachycardia. Note the absence of P waves, and the wide, regular QRS complexes.

This is Sinus Tachycardia. This patient has a bundle branch block making the QRS complex wide, however, there are P waves correlating with each QRS.
This is Supraventricular Tachycardia (SVT). Note the absence of P waves. The QRS complexes are narrow and regular. It is often quite difficult to distinguish between SVT and Vtach.

This is Rapid Atrial Fibrillation. Classic “Irregularly, irregular” pattern. Narrow complexes, no P waves seen.

This is Ventricular Fibrillation. Disorganized complexes, Irregular.

This is Asystole. Remember to check in 2 leads to assure this is truly asystole.
Sinus Bradycardia.

Third Degree (complete) heart block. More P waves than QRS complexes, no relationship between P and QRS.

C. Defibrillator Operation:

There are different types of defibrillators available throughout Aurora. Basic operation is quite similar. Every unit has the capability to be used as a monitor, as well as a defibrillator. Attach monitor leads, and set the machine to display the rhythm strip. If in doubt as to the rhythm, the unit can change the lead it is displaying. You also have the option of reading the rhythm through the paddles “quick look.” This is especially helpful for Vtach / Vfib where early defibrillation is essential. You can always continue to monitor the rhythm on a dedicated cardiac monitor, and use the defibrillator to deliver a shock.

Initial defibrillation is only for the unstable patient. Otherwise, calling a code or arranging immediate transfer to the emergency department is preferred.

To defibrillate, first turn the unit on. The patient can be shocked via sticky pads, or hand held paddles. Set the desired energy level. Make sure the paddles or pads are firmly attached. Ideally, one pad is placed to the right of the sternum just below the clavicle, and the other to the left of the nipple in the mid-axillary line. Make sure the area is clear and press the defib button.

The patient can also be paced externally using the defibrillator unit. Pacemaker pads should be placed anteriorly and posteriorly. Start with a moderate rate of 60-80. Slowly increase the current until there is capture.

Cardiopulmonary resuscitation should be initiated if the patient becomes pulseless and/or non-breathing.
VII. Medications used for cardio-respiratory emergencies in moderate sedation in adults.

Adenosine:

Indication: Drug of choice for SVT. May use in a stable patient where it is unclear if there is a wide or narrow-complex tachycardia
Precautions: may cause flushing, chest pain, transient bradycardia or brief asystole
Dosage: initial dose of 6mg rapid Intravenous Push (IVP), if not effective then may repeat with 12 mg X 1 dose

Amiodarone:

Indication: Vtach / VFIB.
Precautions: may cause hypotension.
Dosage: If cardiac arrest: 300 mg IVP. If stable Vtach then 150 mg in 100mL d5W slow IV infusion over 10 minutes

Atropine:

Indication: Symptomatic bradycardia.
Precautions: may increase myocardial oxygen demand
Dosage: Bradycardia: 0.5 mg IVP. Repeat every 3-5min. Maximum 3mg.
Source: ACLS 2010.

Calcium Chloride:

Indication: Hyperkalemia, hypocalcemia, over dosage of calcium channel blocker
Dosage: For severe hyperkalemia with hemodynamic instability: 0.5-1 gram slow IV Push over 2-5min or as slow IV infusion over 30 min

Diltiazem:

Indication: Control rate in rapid AFIB / Aflutter
Precautions: may cause hypotension, avoid in patients with Wolf-Parkinson-White
Dosage: Initial bolus 15 – 20 mg slow IV Push; may start infusion at 5-15 mg/hr

Dopamine:

Indication: Hypotension not responding to IV fluids, symptomatic bradycardia
Precautions: may cause arrhythmias
Dosage: 5 - 20 mcg/kg/minute – titrate to control BP; ROSC: 2-10mcg/kg/min

Epinephrine:

Indication: Allergic reaction / anaphylaxis, asystole, PEA, pulseless Vtach / Vfib, symptomatic bradycardia
Precautions: May cause myocardial ischemia
Dosage: Allergic Reaction: 0.3 mg SQ/IM. Cardiac arrest with above rhythms: 1 mg IVP repeated every 3-5minutes. Bradycardia: 2-10mcg/min. ROSC: 0.1-0.5mcg/kg/min (7-35mcg/min).
Flumazenil:

Indication: Reverse benzodiazepine overdose
Precautions: Half-life of benzodiazepine may be longer than flumazenil, may cause seizures
Dosage: 0.2mg IVP over 15 seconds. May repeat Q1 minute x 4 doses. Usual total dose is 0.6mg-1mg.

Furosemide:

Indication: Acute pulmonary edema
Precautions: may cause hypotension, hypokalemia
Dosage: 40 – 80 mg IVP

Glucose:

Indication: Hypoglycemia, altered mental status
Precautions: may cause hyperglycemia
Dosage: Dextrose 25 grams (50 ml of D50W)

Lidocaine:

Indication: Vtach / Vfib
Precautions: monitor for mental status changes with continuous infusions
Dosage: 1 – 1.5 mg/kg IVP. Max total dose 3mg/kg.

Naloxone (Narcan):

Indication: Opiate reversal
Precautions: May precipitate withdrawal in opioid-tolerant patients
Dosage: 0.04-0.4mg IV push over 30 seconds. May repeat prn until ventilation adequate.

Nitroglycerin:

Indication: Angina, acute pulmonary edema, hypertensive emergency
Precautions: may cause hypotension, bradycardia, tachycardia
Dosage: 0.4 mg SL, IV infusion 10 mcg/min titrate q 5 minutes

Sodium Bicarbonate:

Indication: Hyperkalemia, metabolic acidosis
Precautions: do not use for Hypercarbic (respiratory) acidosis
Dosage: 1 mEq/kg IVP
Combination of agents produce synergistic cardiorespiratory depression. Dose reduction of 50%-75% or prolongation of dosing interval is appropriate when used in combination with other agents or used in the elderly, debilitated, or patients with compromised end-organ function. Adult doses listed. Refer to pediatric reference as needed.

<table>
<thead>
<tr>
<th>Agent</th>
<th>Dose (IV unless indicated)</th>
<th>Frequency</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Opioids</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fentanyl (Sublimaze®)</td>
<td>12.5-50mcg</td>
<td>Q5-10min</td>
<td>Rapid onset. Potential for apnea.</td>
</tr>
<tr>
<td>Meperidine (Demerol®)</td>
<td>12.5-25mg</td>
<td>Q2-15min</td>
<td>Histamine release. Active metabolite is neurotoxic. Avoid in renal failure &amp; elderly.</td>
</tr>
<tr>
<td>Morphine</td>
<td>1-4mg</td>
<td>Q2-15min</td>
<td>Histamine release.</td>
</tr>
<tr>
<td><strong>Benzodiazepines</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Midazolam (Versed®)</td>
<td>0.25-1mg</td>
<td>Q1-5min</td>
<td>Rapid onset IV.</td>
</tr>
<tr>
<td><strong>Other</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Choral Hydrate</td>
<td>250-1000mg PO</td>
<td>--</td>
<td>30min prior to procedure</td>
</tr>
<tr>
<td>Droperidol (Inapsine®)</td>
<td>0.625-1.25mg</td>
<td>Q5-10min</td>
<td>Black Box Warning: Idiosyncratic QT prolongation / arrhythmia / death. Contraindicated in Parkinson's.</td>
</tr>
<tr>
<td><strong>Reversal Agents</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Naloxone (Narcan®)</td>
<td>40-400mcg</td>
<td>Q1-10min</td>
<td>Must be available but not for routine use. Withdrawal in opioid dependent patients. Rapid reversal may induce hypertension, tachycardia, vomiting, sweating. Respiratory depression &amp; resedation may recur. t ____ 60min.</td>
</tr>
<tr>
<td>Flumazenil (Romazicon®)</td>
<td>0.2mg</td>
<td>Q1min up to 1mg</td>
<td>Must be available but not for routine use. Seizures / withdrawal in benzodiazepine dependent patients. Respiratory depression &amp; resedation may recur. t ____ 40-80min.</td>
</tr>
<tr>
<td>Atropine</td>
<td>0.5-1mg</td>
<td>--</td>
<td>Onset: rapid. t ____ 2-3 hrs. Doses &lt;5mcg/kg may result in paradoxical decrease in HR. Administration can also result in ↑ HR to unsafe levels in elderly / cardiac dx.</td>
</tr>
<tr>
<td>Glycopyrolate (Robinul®)</td>
<td>0.1mg</td>
<td>Q2-3min</td>
<td>Onset: 3-5min. t ____ 2-30min. Administration can result in ↑HR to unsafe levels in elderly / cardiac dx.</td>
</tr>
<tr>
<td><strong>Local Anesthetics</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lidocaine</td>
<td>Max Dose: 4.5mg/kg (or 300mg) infiltrated locally</td>
<td>Duration = 30-60min</td>
<td>Avoid inadvertent IV administration. In the event of severe, acute toxicity - refer to Lipid Rescue Protocol. Dose varies on location, extent, &amp; duration of procedure.</td>
</tr>
<tr>
<td>Lidocaine w/ Epi</td>
<td>Max Dose: 7mg/kg (or 500mg) infiltrated locally</td>
<td>Duration = 120min</td>
<td>Avoid inadvertent IV administration. In the event of severe, acute toxicity, refer to Lipid Rescue Protocol. Dose varies on location, extent, &amp; duration of procedure. Do not inject digits, penis, or nose due to risk of vasoconstriction &amp; necrosis.</td>
</tr>
<tr>
<td>Bupivicaine (Marcaine®)</td>
<td>Max Dose: 2.5mg/kg (or 175mg) infiltrated locally</td>
<td>Duration = 120-240min</td>
<td>See Lidocaine</td>
</tr>
<tr>
<td>Bupivicaine w/ Epi</td>
<td>Max Dose: 3mg/kg (or 225mg) infiltrated locally</td>
<td>Duration = 180-420min</td>
<td>See Lidocaine w/ Epi</td>
</tr>
<tr>
<td><strong>Anti-emetics</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Metoclopramide (Reglan®)</td>
<td>10mg</td>
<td>Q6h</td>
<td>Contraindicated in Parkinsons Disease</td>
</tr>
<tr>
<td>Ondansetron (Zofran®)</td>
<td>2-mg</td>
<td>BID prn</td>
<td>Failure to respond may require additional drug class to be utilized.</td>
</tr>
<tr>
<td>Prochlorperazine (Compazine®)</td>
<td>5-10mg PO/IV, 25mg PR</td>
<td>Q6-12h</td>
<td>Contraindicated in Parkinsons Disease.</td>
</tr>
<tr>
<td>Promethazine (Phenergan®)</td>
<td>12.5-25mg PO</td>
<td>Q4-6h</td>
<td>Contraindicated in Parkisons Disease and children under 2 years old.</td>
</tr>
<tr>
<td>Trimethobenzamide (Tigan®)</td>
<td>200mg IM</td>
<td>Q6-8h</td>
<td>Available also as 300mg capsule</td>
</tr>
</tbody>
</table>

Local Anesthetics-Adults: Maximum Dose & Volume for Infiltration
Local Anesthesia Toxicity: Lipid Resuscitation

Cardiac arrest due to inadvertent intravenous administration of local anesthetics is notoriously difficult to treat and oftentimes refractory to conventional resuscitation measures. The mechanism of anesthetic toxicity may be due to inability to move fatty acids across mitochondrial membranes, thereby interfering with cardiac ATP synthesis. **Lipid administration is thought to override this process by serving as a lipid reservoir for anesthetics.** Toxicity may be immediately evident or may occur several minutes after local anesthetic injection.

- Signs and symptoms of local anesthetic toxicity include: Neurologic: lightheadedness, agitation, confusion ⇒ sudden loss of consciousness, with or without tonic-clonic seizure
- Cardiovascular: tachycardia, hypertension, cardiovascular collapse (sinus bradycardia, conduction blocks, ventricular arrhythmias, and asystole may all occur)

**Immediate management:**
- If not done already, stop injection of local anesthetic, initiate CPR/ PALS/ACLS per standard algorithms (prolonged resuscitation may be necessary). Control seizures if present with benzodiazepines, barbiturates in refractory cases; avoid use of phenytoin ⇒ may worsen or precipitate local anesthetic-induced arrhythmias.
- Consider treatment with INTRAVENOUS LIPID (in addition to standard advanced life support measures)

**LIPID RESUSCITATION PROTOCOL**
- Lipid 20% 1.5 mg/kg IV bolus over 1 minute. **Draw up dose in syringes and administer IV push.** Continue CPR.
- Start intravenous infusion of lipid 20% IV 0.25 mg/kg/min. **Attach IV tubing to lipid bag and hang.**
- Repeat IV bolus up to two more times q 3-5 minutes if adequate circulation has not been restored.
- Increase infusion to 0.5 mg/kg/min if adequate circulation not restored/BP declines after second bolus.
- Continue lipid infusion until hemodynamic stability restored. A total cumulative dose of 8 mg/kg has been recommended.

**Important notes:** Dosing of lipid has varied in clinical practice and no standard dosing has been established. Advanced life support should be continued throughout treatment with lipid emulsion. Recovery from local anesthetic toxicity may take more than an hour. **Propofol should not be used as a therapeutic lipid source.**

**Allergic Reactions to Local Anesthetics**

True hypersensitivity reactions to local anesthetics are rare, allergic reactions are more commonly reported with the ester-type agents & structurally related compounds (paraben preservatives). Reactions may be related to the local anesthetic itself or preservatives in the solutions. Allergic reactions to esters may be avoided by giving the amide type of local anesthetic (without preservative).

### References

**Prepared by Margaret Cook, PharmD, BCPS; Reviewed by Mike Mazl, MD – February 2003; Revised January 2009; Reviewed by Dennis Brierton, March 2013**