



Principles and Guidelines for Pediatric Sedation and Analgesia

Bruce Stevenson, MD
Medical Director, RHQN
December 2008



Principles and Guidelines for Pediatric Sedation and Analgesia

This material may be reproduced without prior approval provided: (1) such reproductions include this footnote; and (2) there is no fee associated with distribution of reproductions. This material has been developed by the Rural Healthcare Quality Network (www.rhqn.org), Seattle Washington, and is for education and information purposes only. The RHQN Board, staff and contractors assume no liability resulting from actions, errors or omissions related to the use of the material herein.

December 2008

RHQN Quality Director:

After two years of research, RHQN collaboration and expert consultation we are pleased to distribute this Pediatric Sedation and Analgesia Guideline to our membership. This manual has been developed in the interests of enhancing the quality of care for pediatric patients who present to the ED with painful conditions and/or the need for us to perform painful procedures.

Management of pain in the ED pediatric population has long been recognized as an area in which we, as providers, have not optimally managed discomfort and anxiety. Please share this Guideline with the entire ED staff, anesthesia service, Director of Nursing , Medical Staff Leadership, Director of Pharmacy, Pharmacy and Therapeutics Committee, Risk Management, and your CEO.

Utilization of the Sedation and Analgesia forms (Pre-Procedure, Procedural Flow Sheet, QA/Process Improvement, Discharge Instructions) is suggested if your hospital does not currently use such documents. The QA/PI form in particular offers an excellent format to document the quality and safety of the care provided to your pediatric sedation patients.

Answers to the Self Learning Examination will be mailed to the Quality Director under a separate cover. The enclosed references should be read by providers prior to testing.

Thank you in advance for your interest in enhancing the ED management of pediatric pain.

Your patients, their parents and the community will appreciate your recognition of this critical aspect of pediatric care.

Best Wishes,

Bruce Stevenson, MD
RHQN Medical Director

Table of Contents

	Page
I. Introduction to Pediatric Sedation and Analgesia (PSA)	1
II. Credentialing Guidelines for PSA at Washington State RHQN Critical Access Hospitals	3
III. Emergency Department Clinical Indications for PSA	9
IV. Key Clinical and Procedural Points	10
V. Measurement of Pain	12
VI. Non-pharmacologic Interventions	13
VII. PSA: General Guidelines and Recommendations	14
VIII. Non-parenteral Medications Used for Sedation and Analgesia	16
IX. Physiologic Complications of PSA	19
X. Rescue Procedures and Rescue Medications	21
XI. Pre-procedural Patient Selection, Clinical Assessment, Fasting State and Informed Consent	22
XII. Critical Equipment and Supplies	24
XIII. Physiologic Monitoring During PSA	25
XIV. Discharge Process	27
XV. Quality Assurance/Process Improvement	28
XVI. Medications Used for PSA	29
XVII. PSA Self-Learning Examination	39
XVIII. Emergency Department Forms	45
A. PSA Pre-Procedure Assessment	47
B. Pediatric Sedation Flow Sheet	49
C. Quality Assurance/PI	51
D. ED Discharge Instructions	53

XIX. Appendix Error! Bookmark not defined.

A.	ASA Physical Status Classification	57
B.	ASA Depth of Sedation Definitions	59
C.	Mallampati Classification	61
D.	Pain scales	63
E.	ACEP Sedation Clinical Policies (Online: ACEP.org)	67
F.	Washington State Nursing Care Quality Assurance Commission: Scope of practice for Procedural Sedation	75

XX. References Error! Bookmark not defined.

A.	Pediatric Emergency Medicine Practice, May 2006	Publication
B.	Procedural Sedation in the Acute Care Setting, American Family Physician, 2005	79
C.	Ketamine: IV or IM?	85
D.	Versed syrup	87
E.	Oral ketamine, midazolam, and atropine	91
F.	J-TIP Injection vs. ELA-Max	93
G.	Transmucosal fentanyl	95
H.	Sucrose analgesia	97

XXI. Vendor Information Error! Bookmark not defined.

I. Introduction to Pediatric Sedation and Analgesia (PSA)

Adequate pain management for children in the ED has historically been largely misunderstood, underutilized, or unfortunately, simply ignored. Multiple research studies have documented that children fail to receive the same treatment as adults with similar painful conditions. Explanations for inadequate treatment include provider minimization of severity of pain, inexperience with medications and dosing, fear of adverse effects and concern for prolongation of treatment and delayed discharge.

Fortunately, there has been an increasing awareness of the magnitude and prevalence of this problem. The development of protocols for the administration of effective sedative and analgesic agents and standardized monitoring procedures have resulted in improved safety and efficacy. Enhanced provider acceptance and comfort with the management of many clinical scenarios associated with pediatric pain and anxiety have evolved. However, despite these clinical advances, some providers are still reluctant to utilize these widely accepted approaches.

The goals of pediatric sedation and analgesia are to:

- Maintain a carefully monitored procedural environment by providers skilled in PSA and cardiopulmonary resuscitation
- Promote patient safety and enhanced quality of care
- Minimize patient pain and anxiety
- Maximize amnesia to reduce negative psychological experiences
- Control physically combative behavior.

The terminology for procedural sedation has evolved over the past several years. "Conscious Sedation," an older term, is actually a misnomer for most pediatric patients undergoing the management of painful procedures in the Emergency Department. Procedural sedation is defined as a continuum of the level of

consciousness and responsiveness. A true patient state of awareness and purposeful response to stimulation does not allow for successful initiation and completion of most painful procedures. Thus, as a general rule, it is safest to assume that most children, particularly under the age of six or seven, may require medication and monitoring consistent with a brief duration of deep or dissociative sedation where the basic management of airway patency and support may be necessary.

This manual, and included references, is intended to provide emergency medicine practitioners with information and guidelines which address the goals of safe and effective PSA. Specific recommendations will focus on:

- Provider credentialing
- Patient selection and pre-procedural clinical assessment
- Equipment and supplies to ensure patient safety
- Protocols for patient monitoring and discharge
- Medication selection , dosing and side effects
- Complications of PSA and rescue procedures
- QA/PI evaluation.

This manual was developed for the Washington State Rural Healthcare Quality Network (RHQN) to provide a basic didactic overview, suggested provider credentialing, and procedural guidelines for the administration of pediatric sedation and analgesia (PSA) in the Emergency Department. This reference guide is intended to enhance the safety and efficacy of PSA. The information provided is not intended to establish standard of care but rather to promote the use of medications which reduce anxiety, discomfort and the recollection of painful Emergency Department procedures. These suggested guidelines are subject to modification based on existing CAH practices, individual provider training and experience, and the nature of the clinical presentation.

II. Credentialing Guidelines for PSA at Washington State RHQN Critical Access Hospitals

A. Introduction

1. A clinical guideline is defined as a set of accepted and recommended medical practices which allow for the provider the latitude to choose alternative recognized medical/surgical approaches or methods.
2. It is recommended that each Washington CAH have a Pediatric Sedation and Analgesia Guideline, Protocol or Policy. Adult procedural sedation policy does not satisfy the requirement for a specific pediatric document.
3. This manual may be utilized by the CAH as the template for establishing their Pediatric Sedation and Analgesia (PSA) Guideline or may be used as a supplemental reference for their current pediatric sedation policy or for the development of an institution specific document.

B. Terminology

1. Licensed Independent Practitioners (LIPs) are defined as physicians, CRNAs and Allied Health Professionals (AHPs) licensed to practice in the State of Washington.
2. A Provider may be an LIP or a registered nurse licensed in the State of Washington.
3. Credentials are the professional qualifications of a Provider as determined by education, training, experience and ongoing performance evaluation.
4. Credentialing is the process of reviewing and documenting a provider's qualifications, to allow for the granting of privileges to perform professional duties at said hospital.

5. Privileging is the granting of permission by the CAH for credentialed LIPs to perform specific medical or surgical procedures.

C. Suggested minimum Licensed Individual Practitioner (LIP) privileging guidelines for the administration of Pediatric Procedural Sedation and Analgesia. This includes the continuum from moderate to deep sedation when clinically appropriate.

1. Licensed Independent Practitioners, as defined as above, possess:
 - a) PALS or APLS certification. (PALS preferred.)
 - b) Documented, complete review of the RHQN PSA Principles and Guidelines Manual.
 - c) Successful completion of the Washington State RHQN PSA self-learning examination. (Minimum score 80%.)
2. Privileging for LIPs will be verified by the Chief of Staff or Department Chief.
3. Individual CAHs to develop periodic re-privileging criteria for LIPs.
4. It is recommended that LIPs review and maintain their PALS certification and a current knowledge base regarding PSA.

D. Suggested Registered Nurses privileging criteria for assisting with PSA.

1. PALS or APLS certification. (PALS preferred.)
2. Documented complete review of this RHQN PSA Principles and Guidelines Manual.
3. Successful completion of the Washington State RHQN PSA self-learning examination. (Minimum score 80%.)
4. Privileges verified by CNO (Chief Nursing Officer).
5. Maintenance of PALS or APLS certification.

E. Quality Assurance /Performance Improvement Opportunities.

1. Each procedural sedation shall be recorded and maintained for subsequent review.
2. Individual provider's clinical performance and patient outcomes to be reviewed, at a minimum, annually.
3. Adverse drug reactions, actual or near miss medication errors, airway support, utilization of reversal agents, sentinel events, or other procedural complications will all be documented.
4. Documented internal committee review by the CAH for significant adverse events, particularly medication errors or procedural complications.

F. Pharmacy and Therapeutics Committee shall approve all medications to be utilized in the ED for PSA.

Washington State CAH Privileging Guidelines for Procedural Sedation and Analgesia (PSA)

1. Provider Name: _____

MD, DO

CRNA

AHP

Registered Nurse

2. PALS certified. Date: _____

APLS certified. Date: _____

Other PSA additional training or continuing education. Explain:

3. Completed review of the RHQN Principles and Guidelines for PSA and references.

Date: _____

Completion of RHQN PSA self-learning examination. (80% success rate.)

Date: _____

4. Provider Signature: _____

Date: _____

5. Approved by ED Director, Chief of Staff, Director of Nursing
(circle one)

Signature: _____

Date: _____

III. Emergency Department Clinical Indications for PSA

- A. Laceration management, particularly with the anxious/uncooperative child
- B. Wound management
 - 1. Burns
 - 2. Debridement of epidermal foreign bodies (“road rash”)
- C. Foreign body removal
 - 1. Skin, subcutaneous
 - 2. Complicated nasal or otic
 - 3. Rectal, vaginal
- D. Incision and drainage, abscess
- E. Joint dislocation reduction
- F. Fracture reduction
- G. Lumbar puncture
- H. Imaging studies – discuss with radiologist
- I. Cardioversion

IV. Key Clinical and Procedural Points

- A. "Do no harm." PREPAREDNESS for complications of PSA is key to patient safety.
- B. Airway rescue equipment and ACLS medications must be available at the bedside for immediate utilization.
- C. Pediatric procedural sedation is generally a THREE member team event. However, a CRNA may assume both medication administration and monitoring.
 - 1. Provider
 - 2. Medication nurse
 - 3. Vital sign monitor
- D. Appropriate patient selection. Limiting Critical Access Hospital PSA to ASA (American Society of Anesthesiologists) Class I and II patients. (Appendix-A)
- E. Moderate sedation, previously known as conscious sedation, may often progress to clinically desired deep sedation, which may require brief airway support and oxygenation.
- F. Pediatric physiologic response to analgesics and sedatives is VARIABLE and at times unpredictable.
- G. Special needs children may be taking medications which interact unfavorably with drugs utilized for PSA.
- H. A basic knowledge of the pharmacology of sedation and analgesic agents is a requirement for their safe and effective use.
- I. TITRATION – TITRATION – TITRATION. Repeated small doses of PSA medications to achieve the recommended total dose will minimize adverse side effects and prolonged recovery time.

- J. Sedative and narcotic analgesic medications, when used in combination, increase the likelihood of respiratory and cardiovascular adverse events in a SYNERGISTIC fashion. Reduction of individual agent doses will minimize such physiologic complications.
- K. There is no SINGLE ideal medication which results in pediatric sedation, analgesia, amnesia and anxiolysis.
- L. Parenteral ketamine (which possesses sedative, analgesic and some amnestic properties) has a very high safety profile and rarely causes significant respiratory depression.
- M. Midazolam (Versed) and fentanyl (Sublimaze) are often preferred PSA agents because of their:
1. Brief duration of action
 2. Rapid response to reversal agents
- N. Midazolam exhibits a profound amnestic property which is exceedingly desirable in children.

V. Measurement of Pain

Patient perception of pain, often underestimated by providers, is unique to every individual and influenced by: prior experience, expectations, age, cognitive ability, emotional status, previous child abuse, special needs, gender, race and culture. Some providers, at times, minimize pediatric pain, anxiety, and suffering in order to alleviate their own frustration and clinical shortcomings.

There have been scores of peer reviewed journal studies addressing the measurement of pain in children. Multiple pain scales have been developed in an attempt to quantitate level of pain. However, skilled and experienced nurses and clinicians generally are excellent observers and judges of degree of pain experienced by infants, children, and adolescents. Thus, clinical judgment, recognizing the individual patient variables previously noted, is often the most accurate barometer of severity of pain and the need for anxiolysis, analgesia and/or sedation.

A quantitative pain assessment is considered a “fifth vital sign.” Numerous pain scales have been validated and are commonly used in ED practice settings. There is no evidence as to which scale is most accurate. The selection of any single pain scoring system is not as important as consistent observation and repeated assessment. Generally, observation of facial grimaces, vocal response and withdrawal behavior enable an accurate assessment of discomfort. The FLACC and FACES scales for infants and children are based on the observation of predictable pain behaviors, rather than on patients’ pain reports, and therefore are commonly utilized to quantitate level of pain. (Appendix-D)

VI. Non-pharmacologic Interventions

The hospital environment and medical personnel can be terribly frightening to many children, which has the potential to increase their PERCEPTION of pain. Also, and importantly, when the parent's anxiety/fears are minimized, the child will often also assume a higher comfort level.

A. Guidelines for successful communication and gaining trust:

1. Allow children time to feel comfortable with the environment.
2. Avoid sudden or rapid advances, extended eye contact or other gestures that may be perceived as threatening.
3. If the child is shy, initially directly speak to parents.
4. Assume a position that is at eye level with the child, generally sitting.
5. Speak in a quiet, unhurried and confident voice.
6. Use simple words and short sentences.
7. Offer the child choices only when they truly exist. Be honest!
8. Parents are generally helpful, but occasionally can be harmful in facilitating cooperation.

B. Pain reduction strategies:

1. Decrease environmental noise and light.
2. Distractions, such as television, children's reading materials, toys, hand-held video games.
3. Relaxation techniques, such as music.
4. Cutaneous stimulation, such as massage or warm or cool compresses.
5. Repositioning body or limb position may relieve discomfort or provide for a more relaxed posture.

VII. PSA: General Guidelines and Recommendations

NOTE: Nearly all medications utilized for sedation and analgesia, particularly benzodiazepines and opiates, can cause respiratory depression, hypotension and excessive sedation. These cardiopulmonary responses are generally transient and require only temporary support. However, occasionally antagonists such as naloxone and/or flumazenil will be necessary to reverse these side effects.

A. Identifying the “ideal agent.” The ideal agent would:

1. Exhibit a predictable time of onset of action.
2. Possess a predictable dose/response relationship.
3. Feature minimal respiratory and/or cardiovascular depressant effect.
4. Produce predictable anxiolysis and amnesia.
5. Be responsive to a pharmacologic antagonist.
6. Allow for rapid recovery with minimal nausea/emesis.

B. “Ideal agent” candidates:

1. No single agent meets all these ideal criteria.
2. The single agent ketamine reliably produces many of the desired PSA effects and is a safe and proven medication.
3. The selection of a benzodiazepine (midazolam) and opiate (fentanyl) are a common combination chosen for sedation, analgesia and amnesia. Do recall that this combination may result in increased respiratory depression and thus dosage reduction of both agents may be advisable.

C. Other PSA medications:

1. Diazepam and lorazepam are acceptable benzodiazepines but their long duration of action limits their utility.
2. Meperidine has fallen into disfavor primarily due to its potential for precipitating CNS excitation and rarely seizures.
3. Morphine sulfate is often chosen as an alternative to fentanyl, recognizing its longer duration of action, which may be beneficial where pain will continue after the procedure.

4. Propofol and etomidate are rapidly gaining popularity with ED practitioners, but are potent anesthetic drugs that can produce excessive sedation/anesthesia. They should be used by personnel trained and/or experienced in their use. Most CAHs have on call anesthesia providers who may be more experienced and comfortable with the use of these agents in the ED. However, their use is not limited to anesthesia providers.

D. Ultimate selection of PSA agents is dependent on:

1. The provider's experience and comfort with the medication(s) chosen.
2. The degree of pain associated with the presenting condition and the required procedure.
3. The degree of immobilization required.
4. The predicted duration of the procedure.
5. The recognition of previous adverse drug reactions.
6. A review of the patient's current medications and their potential for enhancing an adverse pharmacologic event.

VIII. Non-parenteral Medications Used for Sedation and Analgesia

A. Oral analgesic agents: Providers frequently overlook the clinical value of oral analgesics for painful traumatic presentations. These medications may be provided at triage or shortly after the provider evaluation.

1. Non-opiate oral analgesics

a. Ibuprofen

- i. Liquid more rapidly absorbed than tablets
- ii. 5-10mg/kg dosing
- iii. Peak serum concentration 30-60 minutes

b. Acetaminophen

- i. Liquid dosing
- ii. 10-15mg/kg
- iii. Peak serum concentration 30-60 minutes

c. Ketorolac - No significant advantage over ibuprofen

2. Opiate oral analgesics: Often underutilized initially for pain presentations and post procedure pain control

a. Tylenol elixir with codeine

- i. Dose: 2-6 years, 1 tsp
- ii. Dose: 7-12 years, 2 tsp

b. Lortab elixir (7.5mg hydrocodone/500mg acetaminophen per 15cc)

- i. Dose: 0.3cc/kg

c. Morphine sulfate - Oral solution or IV preparation used orally

- i. Dose: 0.2-0.5mg/kg

B. Topical/Injectable anesthetics

1. Topical

a. LET (Lidocaine, Epinephrine and Tetracaine)

- i. Gel or solution
- ii. Lacks potentially harmful cocaine
- iii. Useful for simple, small lacerations
- iv. 1-2cc applied in wound with small cotton pledget

- b. EMLA (Eutectic mixtures of local anesthetics)
 - i. 1:1 mixture of 2.5% lidocaine and 2.5% prilocaine
 - ii. Used over intact skin with occlusive dressing for IV starts
 - iii. 45-60 minutes application time
 - iv. Initiate in triage for patients likely requiring venipuncture
- c. Ela-max: 4% lidocaine cream.
 - i. Used over intact skin with occlusive dressing for IV starts
 - ii. 30 minute application time (less than EMLA)
- d. J-Tip injection system
 - i. See References and Vendor pages
 - ii. More effective than EMLA
 - iii. Consider ROUTINE USE for IV starts

2. Injectable anesthetics

- a. Suggestions for pain reduction
 - i. Buffer lidocaine with bicarbonate - 9:1 (anesthetic: bicarb)
 - ii. Slow injection
 - iii. Small needle (25 gauge or smaller)
 - iv. Inject through inside of wound
- b. Intradermal lidocaine reduces pain of IV placement
 - i. 0.2cc of 1% xylocaine with 30 gauge needle
- c. Maximum lidocaine dose, subcutaneous
 - i. Lidocaine 1% (10mg/cc)
 - a. 0.5cc/kg or 5mg/kg
 - ii. Lidocaine 1% with Epinephrine
 - a. 0.7cc/kg or 7mg/kg
- d. Maximum bupivacaine dose

- i. Bupivacaine 0.5%---0.5cc/kg or 2.5mg/kg
- ii. Bupivacaine 0.5% with epinephrine---0.7cc/kg or 3.5mg/kg
- iii. Bupivacaine 0.25%---1.0cc/kg or 2.5mg/kg
- iv. Bupivacaine 0.25% with epinephrine---1.3cc/kg or 3.5mg/kg

C. ORAL sedative medications: Frequently useful prior to painful procedures or imaging.

1. Midazolam. Dose: 0.5mg/kg p.o. single dose (max 20mg).
2. Ketamine. Dose: 6-10mg/kg p.o. 30 minutes prior to procedure, mixed with cola or other beverage.
3. Chloral hydrate. Dose: 25-100mg/kg (oral or rectal), up to one gram.
4. Fentanyl, transmucosal. See reference.

D. Nitrous oxide: A preset mixture of 50% nitrous oxide.

1. "Requires" cooperative child, generally over 3 years of age.
2. "Self" administered demand valve mask.
3. Non-invasive.
4. For procedural sedation, in recommended concentrations, this is a weak analgesic, sedative, and anxiolytic.

IX. Physiologic Complications of PSA

A. Adverse events generally involve either individually or in combination:

1. Inadequate practitioner skills
2. Inadequate pre-procedure evaluation
3. Multiple medications
4. Incorrect dosage calculation
5. Rapid injection
6. Inadequate monitoring
7. Premature discharge

Note: The most common “adverse” event is inadequate sedation. However, this may be the least dangerous adverse event.

B. Specific organ system complications:

1. Pulmonary

- a. Respiratory depression is the most common event and usually is dose dependent, secondary to rapid rate of infusion, or the synergistic effect of an opiate and benzodiazapine.
- b. Airway obstruction is generally related to improper head/neck positioning and/or excessive sedation.
- c. Laryngospasm is occasional with ketamine but usually transient. BVM positive pressure ventilation with oxygen may be required.
- d. Aspiration is rare, but suction must routinely be ready at the bedside.

2. Cardiovascular: Clinically relevant events

- a. Hypotension – usually responds to crystalloid challenge. Vasopressors if necessary.
- b. Arrhythmia – bradycardia most common, often self-limited.

3. Gastrointestinal

- a. Nausea/vomiting - generally shortly after the end of a procedure or at discharge.

4. Miscellaneous

- a. Emergence reactions (hallucinations)- secondary to ketamine.
- b. Paradoxical reactions - occasionally with oral midazolam, resulting in CNS stimulation.

X. Rescue Procedures and Rescue Medications

The critical axiom: BE PREPARED. Basic and advanced airway equipment and ACLS medications must be available at the bedside.

A. Respiratory depression and/or airway obstruction are the most common complications of PSA and are generally easily managed.

1. Hypoxia (and respiratory depression) are nearly always successfully managed by supplemental oxygen and BVM ventilatory support.
2. Airway obstruction is nearly always managed with repositioning with the head-tilt, chin-lift maneuver.
3. Aspiration is uncommon. Suction at bedside.

B. Hypotension is usually associated with the use of multiple drugs.

1. Crystalloid bolus infusion is first line therapy. (10-20cc/kg.)
2. Pressors (Dopamine) are rarely required.

C. Rescue medication recommendations:

1. Naloxone: Dose: 0.01mg/kg IV every 15-30 seconds until respirations adequate.
2. Flumazenil: Dose: 0.01mg/kg IV over 15 seconds every 1 minute until respirations adequate. (Max total dose, 0.05mg/kg or 1mg, whichever is lower.)

XI. Pre-procedural Patient Selection, Clinical Assessment, Fasting State and Informed Consent

Candidate selection for PSA is a structured process which evaluates the acute nature of the presentation, the patient's age and developmental status, baseline health status, specific chronic medical co-morbidities, current medications, emotional and cognitive baselines, and past sedation experience.

A. American Society of Anesthesiologists (ASA) health status classification. See Appendix-A. Generally only Class I and II ASA patients are selected for CAH ED management.

B. Mallampati classification.

1. Ability to manage the patient's airway is determined by provider skill and training. However, oropharyngeal anatomy is an important selection factor.
2. Visual inspection of the patient's oropharynx should be accomplished prior to the initiation of procedural sedation.
3. Mallampati Class I and II patients are the safest candidates. See Appendix-C.

C. Clinical assessment

1. History to include significant past medical and surgical, particularly cardiopulmonary issues. Also included: current medications, medication allergy, recent illness (particularly respiratory) and previous problems with sedation/anesthesia.
2. Provider physical exam - to include age, weight, vital signs, mental status, oropharyngeal and cardiopulmonary exam.

D. Fasting status.

1. Many peer reviewed publications support the observation that aspiration, even without regard for fasting status, is rare with

2. These ASA fasting guidelines are:
 - a. 2 hours after clear liquids
 - b. 4 hours after breast milk (generally these patients are younger than CAH PSA candidates)
 - c. 6 hours after meals, milk, infant formula

E. Informed consent.

1. Parental consent should, at a minimum, be obtained verbally and documented.
2. Signed consent is recommended, ideally with a specific ED consent form.

XII. Critical Equipment and Supplies

Procedural sedation should not be initiated until the “stage is set.” To proceed in a safe and efficient manner, all of the following rescue equipment and supplies shall be at/or near the patient’s bedside.

- A. BVM with appropriate mask and oral airway for the patient’s size. Both mask and oral airway measured prior to the procedure.
- B. Wall suction ready to activate with suction tube attached.
- C. Appropriately sized laryngoscope blade and ET tube readily available.
- D. Vials of rescue medications (Narcan and Flumazenil) immediately available, ideally with dose pre-calculated for patient.
- E. Pediatric ACLS medications readily available.
- F. If patient sedated with IM ketamine, rapid IV or IO (intraosseous) equipment readily available.

XIII. Physiologic Monitoring During PSA

A registered nurse will be responsible for monitoring the patient during and after procedural sedation. This individual will be competent in the following areas:

- Pediatric BLS (PALS if also administering drugs)
- Pediatric airway management
- Cardio-respiratory assessment
- Recognition of potential PSA airway complications
- Cardiac arrhythmia recognition

A. Required Equipment

1. O₂ delivery system, generally nasal prongs
2. Continuous pulse oximetry monitor
3. Cardiac monitor, continuous
4. Sphygmomanometry appropriate to age
5. Capnometry ideal, but optional. Not required standard of care at this time

B. Physiologic parameters monitored

1. Pulse rate
2. Respiratory rate
3. Pulse oximetry
4. Blood pressure for children and adolescents
5. Sedation Level:

Modified Ramsey

1. *Patient anxious, agitated, or restless.*
2. *Patient cooperative, oriented, and tranquil.*
3. *Patient responds to vocal commands.*
4. *Patient Asleep. Responds to gentle shaking or loud auditory stimulus.*

5. *Patient Asleep.* Does not respond to gentle shaking or loud auditory stimulus but does respond to pain.
6. *Patient unarousable.* Does not respond to pain or noxious stimuli.

C. Nursing documentation of physiological parameters for moderate/deep sedation.

1. During procedure: every 5 minutes.
2. After procedure: every 5 minutes until stable and awakening. Then every 15 minutes until discharge criteria are met.

XIV. Discharge Process

The use of short acting PSA agents enable earlier safe discharge. Children should not be discharged until they have returned to their baseline mental, verbal and ambulatory status. Suggested discharge instructions should generally include the following:

- A. Children should not be left in a car seat unobserved during transport home.
- B. Solid foods should not be given immediately following discharge. First, check tolerance for clear liquids.
- C. A child's balance may be affected over the next 24 hours. Activities requiring coordination during this time frame should be supervised.
- D. Children should not swim or bathe unattended for 8 hours.
- E. If there appears to be any difficulty with breathing or inability to awaken the child, 911 should be contacted immediately.
- F. Call Emergency Department 24 hours a day if there are any questions regarding the child's post-procedure recovery.

XV. Quality Assurance/Process Improvement

- A. All procedural sedation documentation shall be reviewed by ED Director on a periodic basis, ideally quarterly. The focus shall be on individual provider performance with respect to patient outcomes and adverse events.
- B. Adverse drug reactions, near miss or actual medication errors, need for rescue medications and/or unexpected cardiopulmonary support shall be identified and reviewed by ED provider group, including nurses.
- C. Sentinel events shall be promptly reported to the DOH as required by law.

XVI. Medications Used for PSA

- A. Morphine**
- B. Fentanyl**
- C. Midazolam**
- D. Ketamine**

Morphine Sulfate

- **Class** - Opiate Narcotic
- **Contraindication:** Known hypersensitivity
- **Advantages**
 - Can be given subcutaneously with less discomfort than IM.
(10mg/cc concentration) although absorption is less predictable.
 - Longer duration of action for procedures such as burn debridement, and post-fracture reduction pain.
 - Produces less CNS excitement than meperidine.
 - Reversible with naloxone.
- **Disadvantages**
 - Occasionally causes pruritis, bronchospasm or hypotension secondary to histamine release.
 - Long duration of action may exceed short procedures.
 - Respiratory depression may persist beyond analgesic effect.
 - Nausea or emesis may occur, as with all opiates.
 - No amnesic properties.

Morphine Sulfate Guidelines

CONTRAINDICATION: Known hypersensitivity

- The initial dose of morphine sulfate may be reduced when given with a benzodiazepine such as midazolam.
- Subcutaneous administration should be considered, in order to reduce the discomfort of IM injection (This assumes an IV line has not been established).
- Morphine may be given orally p.o. (0.2-0.5mg/kg) for minor procedures. Onset of action is less predictable than parenteral administration.

Is Naloxone at the bedside?

MORPHINE DOSING:

Intravenous	Intramuscular, subcutaneous
1. Peak effect 15 minutes	1. Peak effect 30 minutes
2. 0.05-.1mg/kg slowly over 1-2 minutes	2. 0.1mg/kg
3. May repeat at 10 minutes, at 50% of initial dose	3. May repeat at 15 minutes, at 50% of initial dose

Fentanyl

- **Class** - Opiate narcotic
- **Contraindication:** Known hypersensitivity
- **Advantages**
 - Rapid onset action (<1 minute)
 - Short duration of action (30 minutes)
 - Reversible with naloxone
- **Disadvantages**
 - Short duration of action if longer procedure anticipated
 - As with all opiates: CNS depression, respiratory depression, possible hypotension
 - Occasional transient chest wall spasms/rigidity with rapid IV administration

Fentanyl Guidelines

CONTRAINDICATION: Known hypersensitivity

- Fentanyl, 100 micrograms (0.1mg) is approximately equal to:
 - Morphine 10mg
 - Demoral 100mg
- In combination with midazolam, use midazolam first followed by fentanyl 1-2 minutes later.
- Dosage may be reduced by 25% when given with sedatives such as midazolam.
- Naxolone rapidly reverses CNS and respiratory depression but also the analgesic effect.

Is Naloxone at the bedside?

Fentanyl Dosing

Intravenous (SLOW)	Intramuscular
<ul style="list-style-type: none">• 0.5-1 micrograms/kg over 1-2 minutes.• May repeat after 2-3 minutes at 50% of initial dose.	<ul style="list-style-type: none">• 1-2 micrograms/kg dose every 30 minutes.

Midazolam (Versed)

- **Class** – Benzodiazepine sedative/amnesic
- **Contraindication:** Hypersensitivity to benzodiazepines
- **Advantages**
 - Rapid onset action (<1-2 minutes)
 - Short duration of action (30 minutes)
 - Anxiolytic and amnesic effects
 - Reversal agent available: flumazenil (Romazicon)
 - Can be administered nasally, rectally, orally, IM and IV due to water solubility
- **Disadvantages**
 - No analgesic properties
 - Nasal administration causes mucosal burning
 - Occasional paradoxical hyperactivity reaction
 - Short duration of action
 - Dose/response curve highly variable in children

Parenteral Midazolam Guidelines

CONTRAINDICATION: Known hypersensitivity

NOTE: Children under age 5 may require higher doses.

Is Flumazenil at the bedside?

Midazolam Dosing

Intravenous (preferred route)	Intramuscular
<ul style="list-style-type: none">• Children up to age 5: initial dose 0.05-0.1mg/kg max 6mg• Children age 5-12: initial dose 0.025-0.05mg/kg max 10mg• Children 12-16: (adult dose) 2-5mg max 10mg• Duration of action 20-60 minutes	<ul style="list-style-type: none">• 0.1-0.2mg/kg 30-60 minutes prior to procedure

Ketamine

- **Class** – Dissociative agent. Chemically disconnects cerebral cortex from mid-brain producing a condition where the patient appears awake, but is in a trance-like state.
- **Contraindications**
 - Do not use in children less than 3 months of age
 - Clinical psychosis
 - Known hypersensitivity
- **Relative Contraindications**
 - Less than 12 months of age
 - Seizure disorder
 - Upper respiratory infection – increased likelihood of laryngospasm
 - Increased intracranial pressure
- **Advantages**
 - Has sedative, analgesic and amnestic properties
 - Long history of safety and efficacy
 - Airway protective reflexes generally maintained, even with increasing doses
 - Can be safely given intravenously, intramuscularly and orally
- **Disadvantages**
 - Recovery agitation, delirium, hallucinations, the “emergence phenomenon.” This is uncommon in children less than 15 years of age. Parents should be warned of this potential side effect.
 - Hypersalivation. Premedication with atropine or glycopyrolate MAY minimize this side effect.
 - No antidote available
 - Duration of action longer than midazolam/fentanyl. However, this may be advantageous for longer duration procedures .

Ketamine Guidelines

CONTRAINDICATIONS: Increased intracranial pressure; known hypersensitivity.

RELATIVE CONTRAINDICATION: U.R.I. may increase likelihood of laryngospasm.

Available concentrations ketamine

- 100mg/cc for IM use
- 10mg/cc for IV use

Premedicate with atropine or glycopyrolate

- Atropine: 0.01mg/kg IV or IM (may mix with ketamine)
- Glycopyrolate: (Robinal) 0.005mg/kg IV or IM
- Intravenous ketamine should be administered over 1-2 minutes to reduce likelihood of laryngospasm which can generally be managed with BVM ventilation.
- Analgesia and amnesia may persist for up to 12 hours.

Ketamine Dosing

Intravenous	Intramuscular
<ul style="list-style-type: none">• 0.5 – 2mg/kg over 1-2 minutes• Rapid onset (30-60 seconds)• May repeat at $\frac{1}{3}$ to $\frac{1}{2}$ initial dose every 10 minutes for maintenance• Duration action 10-20 minutes.	<ul style="list-style-type: none">• 1-4mg/kg• Onset action 3-10 minutes• Duration action 15-45 minutes• Total recovery may take 1-2 hours.

XVII. PSA Self-Learning Examination

1. Adverse events with procedural sedation are most commonly associated with:
 - a. Use of the IV route
 - b. Use of midazolam
 - c. Use of ketamine
 - d. Use of more than 2 drugs in combination
 - e. Non-fasting state

2. Titration of intravenous medications means repeated, incremental doses rather than a bolus of the total calculated dose.
 - a. True
 - b. False

3. Supplemental oxygen can mask hypoventilation, that is CO₂ retention.
 - a. True
 - b. False

4. Hypotension associated with PSA rarely requires pressor therapy.
 - a. True
 - b. False

5. With current rapid CT technology, imaging of the head for trauma in infants and young children generally requires sedation.
 - a. True
 - b. False

6. Excessive salivation may occur with ketamine. This side effect may be minimized with the use of:
 - a. Atropine
 - b. Phenergan
 - c. Glycopyrolate
 - d. a & c
 - e. All of the above

7. When a combination of an opiate (fentanyl, morphine sulfate) and a benzodiazepine are utilized for PSA:
 - a. Hypoventilation is more likely
 - b. Reversal agents should be at the bedside
 - c. A third sedative or analgesic should generally be avoided
 - d. All of the above

8. End tidal carbon dioxide (ETCO₂) measurement is valuable for the assessment of sub-clinical respiratory depression.
- True
 - False
9. Oral sedative medication options would include:
- Midazolam
 - Chloral hydrate
 - Ketamine
 - All of the above
10. The use of topical epidermal anesthetics reduces the pain of IV insertion.
- True
 - False
11. If a patient experiences severe recovery agitation after ketamine (the emergence reaction), the use of IV midazolam is recommended.
- True
 - False
12. Histamine release with morphine can cause all of the following except:
- Hypotension
 - Pruritis
 - Nausea
 - Bronchodilatation
13. Midazolam produces all of the following except:
- Sedation
 - Anxiolysis
 - Analgesia
 - Amnesia
14. A contraindication to the use of flumazenil is:
- Non-fasting state
 - Hypotension
 - Bradycardia
 - Known seizure disorder
 - Fever

15. Buffering of lidocaine with bicarbonate in a 9:1 mixture reduces the pain of a local anesthetic injection.
- True
 - False
16. The pain associated with injectable anesthetics can be reduced by slow injection and with needles 25 gauge or smaller.
- True
 - False
17. Local anesthetics combined with epinephrine produce a longer duration of action and increase the total safe dosage.
- True
 - False
18. Naloxone will reverse the following effects of opiates: Respiratory depression; CNS depression; analgesic effect.
- True
 - False
19. Naloxone can be given undiluted by IV push for opiate overdose.
- True
 - False
20. ELA-Max (5% lidocaine cream) and EMLA (Eutetic mixture of local anesthetics) and the J-Tip device are useful methods to reduce the pain of IV insertion.
- True
 - False
21. Lidocaine and bupivacaine are both safe and reliable injectable anesthetic agents.
- True
 - False
22. Lidocaine toxicity can result in:
- Confusion
 - Seizures
 - Arrhythmia
 - b & c
 - All of the above

23. Placing topical LET (lidocaine, epinephrine, tetracaine) into a wound prior to injecting local anesthetics may reduce the pain of injection.
- True
 - False
24. Ketamine chemically disconnects higher order neurons between the thalamus and the cerebral cortex resulting in a trance-like dissociative state.
- True
 - False
25. Ketamine, with increasing doses, generally does not cause patients to lose protective airway reflexes, enhancing its safety margin.
- True
 - False
26. Diazepam (Valium) is highly recommended as a pediatric sedation medication.
- True
 - False
27. The use of opiate oral medications are generally underutilized for pediatric traumatic pain.
- True
 - False
28. Initial oral analgesics should generally be avoided if parenteral procedural sedation is anticipated.
- True
 - False
29. Fentanyl is 100 times more potent than morphine.
- True
 - False
30. Fentanyl is:
- Longer acting than morphine
 - A non-opioid analgesic
 - Best reserved for adults
 - Does not induce histamine release

31. Ketamine is an excellent drug for PSA because:
- a. It has a strong safety profile
 - b. It can be administered both IM and IV
 - c. Has a significant analgesic effect
 - d. a & b
 - e. All of the above
32. Fentanyl and midazolam have a similar duration of action (30–60 minutes).
- a. True
 - b. False
33. Emergence reactions associated with the use of ketamine:
- a. Usually occur in children less than 10 years of age
 - b. Can be reversed with flumazenil
 - c. Can be prevented with atropine
 - d. Often require intubation
 - e. None of the above
34. A reasonable method for enhancing the safety of intramuscular ketamine is to initially administer IM ketamine and then start a safety IV after the dissociative state has begun.
- a. True
 - b. False
35. A patient who is deeply sedated:
- a. May have loss of protective airway reflexes
 - b. May not be easily aroused by physical stimulation or verbal commands
 - c. a & b
36. Diazepam is painless on IV injection.
- a. True
 - b. False
37. Informed consent should be obtained and documented before procedural sedation is administered.
- a. True
 - b. False

38. Which of the following opiate narcotics may cause undesirable CNS excitation?
- a. Fentanyl
 - b. Morphine sulfate
 - c. Meperidine
 - d. Hydromorphone
39. It is generally recommended that only ASA Class I and Class II pediatric patients receive elective sedation in CAH Emergency Departments.
- a. True
 - b. False
40. Which of the following effects can be produced by ketamine:
- a. Dissociative state
 - b. Excess salivation
 - c. Laryngospasm
 - d. Bronchodilation
 - e. a & b
 - f. All of the above

XVIII. Emergency Department Forms

A. PSA Pre-Procedure Assessment	47
B. Pediatric Sedation Flow Sheet	49
C. Quality Assurance/PI	51
D. ED Discharge Instructions	53

PSA PRE-PROCEDURE ASSESSMENT

❖ To be completed by LIP (Physician, CRNA, AHP)

American Society of Anesthesiologists Classification

- Class I. Healthy patient
- Class II. Mild systemic disease, no functional limitations

Patient History

- Allergies: _____
- Current Meds: _____

- No cardiopulmonary problems
- No history sedation problems
- No recent respiratory illness

- Time last p.o. intake: _____
- Informed consent form completed
- Target level for sedation: Moderate, to include possibly brief, deep sedation.
- Planned medications: _____

Physical Examination

- Vital signs reviewed
- Normal oropharyngeal airway inspection
- Normal cardiopulmonary exam

PRE-PROCEDURE CHECKLIST:

SAFETY PAUSE

- | | |
|--|---|
| <input type="checkbox"/> Sedation team members all present | <input type="checkbox"/> Suction setup at bedside |
| <input type="checkbox"/> Allergies verified | <input type="checkbox"/> Appropriately sized BVM <u>and</u> oral airway, at bedside |
| <input type="checkbox"/> Oxygen _____ liters/nasal | <input type="checkbox"/> Reversal agents immediately available |
| <input type="checkbox"/> Pulse oximeter applied | <input type="checkbox"/> Broeslow tape, pediatric crash cart immediately available for intubation, ACLS |
| <input type="checkbox"/> B.P. cuff <input type="checkbox"/> N.A. | |
| <input type="checkbox"/> Cardiac monitor | |

Date: _____ Patient Age: _____ Weight: _____ kg

Procedure: _____

LIP (print): _____ Signed: _____

---Patient ID---

Pediatric Sedation Flow Sheet

Allergies: _____ Weight: _____ (kg) NPO Since: _____	Baseline: BP _____ Pulse _____ O ₂ Sat _____ Calculated naloxone dose = _____ .01mg/kg. Repeat q 30 seconds Calculated flumazenil dose = _____ .01mg/kg. Repeat q 30 seconds
--	---

Monitoring

- During procedure, every 5 minutes
- After procedure, when stable, every 15 minutes

Time	Medication and Dose	BP	HR	Resp Rate	O ₂ SAT	Sedation Level See below	Events

Post-Procedural Checklist

- Vital signs at pre-procedural baseline. Time: _____
- Patient awake, alert, ambulatory. Time: _____

Modified Ramsey Sedation Scale

- 1.) Patient anxious, agitated or restless
- 2.) Patient cooperative, oriented, and tranquil
- 3.) Patient responds to vocal commands
- 4.) Patient asleep. Responds to gentle shaking or loud auditory stimulus
- 5.) Patient asleep. Does not respond to gentle shaking or loud auditory stimulus but responds to pain
- 6.) Patient unarousable. Does not respond to pain or noxious stimuli

---Patient ID---

Monitoring Nurse: _____ RN

Monitoring Nurse: _____ RN

Pediatric Sedation and Analgesia
Quality Assurance – Performance Improvement

❖ To be completed by RN, following the procedure

Practitioner: _____

Date: _____

Type of Procedure: _____

Medications used: _____

Route of Administration:

- | | |
|-------------------------------------|--------------------------------------|
| <input type="checkbox"/> P.O. _____ | <input type="checkbox"/> SQ _____ |
| <input type="checkbox"/> IM _____ | <input type="checkbox"/> I.V. _____ |
| | <input type="checkbox"/> Other _____ |

- Start time of sedation: _____
- End time of procedure: _____
- Duration of time from end of procedure to full recovery: _____ minutes

Informed Consent signed, in chart

- No Yes

Sedation Flow Sheet completed

- No Yes

Adverse drug reaction

- No Yes Type: _____

Rescue medication used

- No Yes Medication: _____ Dose: _____

Ventilatory support required

- No Yes Type: _____ Duration: _____

Blood pressure support required

- No Yes Type: _____

Other unexpected events? Describe: _____

---Patient ID---

Monitoring Nurse: _____ RN

Pediatric Conscious Sedation Discharge Instructions

- 1.) Child should be observed while being driven home, particularly if in a car seat.
- 2.) If child goes to sleep following discharge, wake him or her every two hours, at least twice.
- 3.) Vomiting may occasionally occur following ED discharge.
- 4.) Do not give solid foods immediately after discharge. Start with liquids first.
- 5.) Children should not bathe unattended for eight hours.
- 6.) Effects of sedation (balance, for example) may rarely persist for up to 24-hours.
- 7.) No swimming, cycling, skating, or similar sports for 24-hours.
Supervise other activities
- 8.) If there appears to be any difficulty with breathing or inability to awaken the child, 911 should be contacted.
- 9.) Call the Emergency Department 24-hours a day if there are any questions regarding your child's post-procedure recovery.

---Patient ID---

Parent or Guardian: _____
Signature

Monitoring Nurse: _____RN