



SCAI QIT Tip—October 2017

Moderate Sedation Practices for Adult Patients in the Cardiac Catheterization Laboratory (CCL)

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Invasive and interventional cardiologists routinely order moderate sedation for patients undergoing procedures in the CCL. The American Society of Anesthesiologists (ASA) defines moderate sedation (also referred to as “conscious sedation”) as a drug-induced depression of consciousness during which patients respond purposefully to verbal commands, either alone or accompanied by tactile stimulation. No interventions are required to maintain the patient’s airway, and spontaneous ventilation is adequate. Cardiovascular function is usually maintained.

Therefore, moderate sedation is a level of sedation/analgesia that allows the patient to report pain and reduces recovery time. In the CCL, all physicians and nursing staff are expected to have an in-depth knowledge regarding the safe and effective use of moderate sedation, including being credentialed by the hospital for providing moderate sedation. This SCAI QIT Tip is a concise summary of moderate sedation in line with CCL best practices and is written with the intention of quality improvement.¹ Advanced sedation techniques are beyond the scope of this article.

Best Practices Tips for Sedation in the CCL

1. **Pre-procedure assessment:** It is critical that a thorough pre-procedure evaluation occur to assess the patient’s suitability to tolerate sedation (Table 1). This assessment, along with the patient’s ASA class, should be documented and included in the pre-procedure time-out. In addition, anatomic variables, which impact the airway, should be reviewed to allow for proactive planning should intubation be required. The Mallampati Scale (Table 2) is an objective assessment of the oral cavity and predicts the level of difficulty required to intubate the patient.

Table 1: Pre-Procedure Evaluation.²

System	Rationale
Pre-existing cardiac or pulmonary disease	Sedative agents can cause cardiovascular or respiratory depression.
Pre-existing renal or hepatic disease	Abnormalities may impair how fast the drug is metabolized and excreted from the system, resulting in a longer drug action and an increased drug effect.
Time and type of last oral intake	Reflex suppression could result in aspiration. Clear liquids may be permitted up to two hours prior to the procedure. Otherwise, the patient should fast for six hours prior to the procedure. Medications should be held or taken as directed by the physician.
History of drug and alcohol abuse	The dose and action of sedative agents may be affected in patients that abuse drugs and alcohol. In addition, procedural agitation may be higher.
History of smoking	Patients who smoke are at increased risk of bronchospasm, airway problems, or coughing.
Previous experience with sedative agents	Any previous adverse reactions to sedation should be noted.

Table 2: The Mallampati Scale.³

	Anatomic Findings	Difficulty of Intubation
Class I	Soft palate, uvula, fauces, tonsillar pillars are visualized	No difficulty
Class II	Soft palate, uvula, fauces seen; tonsillar pillars not visualized	No difficulty
Class III	Only soft palate and base of uvula visualized	Moderate difficulty
Class IV	Uvula not visualized, only hard palate seen	Severe difficulty

2. **Selection of pharmacological agents:** Ideally, pharmacologic agents utilized during cardiac catheterization should possess anxiolytic, amnestic, and analgesic properties. A combination of opioids, such as fentanyl 25–50 mcg, and benzodiazepines, such as midazolam 0.5–2 mg, are most frequently utilized, but dosage should be carefully considered based on age, body size, and comorbidities. The most common agents and their properties used are listed in Table 3.

Table 3: Common Pharmacological Agents Used for Moderate Sedation during Cardiac Catheterization Procedure

Agent	Dose		Pharmacokinetics		Metabolism	Preferred Route of Administration	Reversal Agent	Adverse Effects
	Initial	Maximum	Onset/ Duration	½ life				
Benzodiazepines								
Diazepam	IV: 2.5 mg over 3–5 minutes (reduce to 1.5 mg if age >60)	Maximal of 0.2 mg/kg if no opioids (Max of 0.1 mg/kg if >60 years of age)	0.5–2 hours	15–21 hours	Hepatic	IV	Flumazenil 0.2 mg IV, repeat as needed (max dose 1 mg)	Amnesia, respiratory depression, hypotension, headache, drowsiness, nausea/vomiting, injection-site reactions
Midazolam	IV: 0.02–0.04 mg/kg	Until desired response or 0.1 mg–0.2 mg/kg	2–5 minutes/ less than 2 hours	2–6 hours (prolonged in renal failure, elder, cirrhosis, and HF)	Hepatic	IV	Flumazenil 0.2 mg IV, repeat as needed (max dose 1 mg)	Amnesia, respiratory depression, hypotension, headache, drowsiness, nausea/vomiting, injection-site reactions
Lorazepam	IV: 0.044 mg/kg	4 mg IV	2–3 minutes/ ip to 8 hours	~12–14 hours	Hepatic	IV	Flumazenil 0.2 mg IV, repeat as needed (max dose 1 mg)	Amnesia, respiratory depression, hypotension, headache, drowsiness, nausea/vomiting, injection-site reactions, propylene glycol toxicity (in renal failure)
Non-Benzodiazepines								
Diphenhydramine (adjunctive to other agents)	IV: 25–50 mg given 3 minutes prior to sedation	Not defined for this indication	30–90 minutes/ 4–7 hours	7–18 hours (prolonged in elderly)	Hepatic	IV	None	Hypotension, palpitations, confusion, drowsiness, dry mouth, blurred vision
Ketamine	IV: 1–2 mg/kg, repeat 0.25–0.5 mg/kg every 5–10 minutes after		30 seconds/5–10 minutes	10–15 minutes/ 2 hours	Hepatic	IV	None	Tachycardia, hypertension, laryngospasm, emergence reactions, nausea/vomiting, hypersalivation

Short-Acting Opioids

Fentanyl	IV: 25–100 mcg every 3 minutes	Doses greater than 200 mcg rarely needed unless on chronic opioids)	Immediate/ 0.5–1 hour but increases with more doses	2–4 hours (increase with repeated dosing)	Hepatic/ Intestinal	IV	Naloxone (0.2–2 mg IV repeated 2–3 minutes)	Respiratory depression, apnea, hypotension, nausea/vomiting, pruritus, constipation, cardiac dysrhythmia
Hydro-morphone (Dilaudid)	IV: 0.5–1.5 mg IV over 1–2 minutes	2 mg/hour	1–2 minutes/ 3–4 hours	2–3 hours	Hepatic	IV	Naloxone (0.2–2 mg IV repeated 2–3 minutes)	Respiratory depression, apnea, hypotension, nausea/vomiting, pruritus, constipation
Morphine	IV: 1–4 every 5 minutes	Doses greater than 6 mg rarely needed (unless on chronic opioids)	5–10 minutes/4 hours	2–4 hours	Hepatic	IV	Naloxone (0.2–2 mg IV repeated 2–3 minutes)	Respiratory depression, apnea, hypotension, nausea/vomiting, pruritus, constipation, anaphylaxis, blurry vision, urinary retention

mg = milligram; micrograms = mcg; kg = kilogram; IV = intravenous; HF = heart failure

3. Patient monitoring during sedation:

- a. Nursing staff should not administer sedation unless the physician is physically in the room. Ideally, it is reserved until after the time-out; so that the risks of sedation can be reviewed before it is actually delivered. The physician should be notified or asked for permission before the staff gives additional sedation. For patients who are elderly, somnolent, have Chronic Obstructive Pulmonary Disease (COPD), or borderline blood pressure (BP), it is prudent to begin with “half-dose” and titrate to achieve a balance between safety and comfort. Ancillary techniques such as liberal use of local anesthesia and ultrasound for vascular access, music and frequent reassurance can often decrease requirements for sedation and analgesics. It is important to remember that the dose can always be increased as needed, and it is therefore important to begin with lower doses.
- b. Irrespective of the agent selected, it is critical that the patient is closely monitored. A nurse providing moderate sedation during the procedure must have no other responsibilities that would compromise continuous patient assessment. The ASA focuses on the four key areas of monitoring for moderate sedation: (1) level of consciousness, (2) pulmonary ventilation, (3) oxygenation, and (4) hemodynamics. Monitoring requires direct observation via operator and staff with utilization of appropriate medical equipment. One of the biggest concerns with sedation is respiratory depression. The ASA recommends use of end-tidal CO₂ monitoring via capnography. Vitals signs should be monitored every 15 minutes for the first two hours post-procedure by personnel trained in recovery from moderate sedation.⁴
- c. Finally, it is critical for the CCL staff to have the knowledge and equipment to manage any sedation emergency. The staff should have knowledge of reversal agents such as flumazenil and naloxone. Basic Life Support (BLS) and Advanced Cardiovascular Life Support (ACLS) certification should be up-to-date for all staff.

4. Sedation in patients with comorbidities or altered sedation threshold:

- a. The selection and dosing of an agent should take into consideration the patient's renal and hepatic function, age, past medical and social history, and body weight. For example, patients who are older may accumulate midazolam and thus require lower doses. Patients with a history of alcohol abuse may require higher doses of benzodiazepines. Also, patients with a history of opioid use or using prescription opioids (especially a fentanyl patch) will require a higher dose of opioids and frequently require adjunctive medications (e.g., diphenhydramine).
- b. Some patients have a high threshold for sedatives and analgesics, or are at a high risk for airway compromise (e.g., morbid obesity, severe sleep apnea, hostile airway), and cannot be adequately and/or safely sedated to allow the procedure. In such cases, monitored anesthesia care (MAC) administered by an anesthesiologist (or similarly trained provider) is required to ensure patient comfort and safety during the procedure. Policies should be in place that are consistent with hospital credentialing and state guidelines.
- c. Ketamine is gaining favor slowly due to its ability to produce sedation, analgesia, and amnesia.⁵ Providers who wish to use ketamine should become familiar with the medication's properties and adverse effects. Ketamine is becoming more appealing for patients who are hypotensive or have a difficult airway or compromised respiratory function.
- d. Dexmedetomidine (prece dex) (an alpha 2 agonist) and other new agents have not been extensively studied in the CCL and currently cannot be recommended. However, trials are underway exploring its use.

5. Quality considerations:

All patients should have an assessment for their suitability to receive moderate sedation according to the four classes from the ASA guidelines. In addition, narcotic management should follow local dispensing practices, including documentation of amount used and wasted. Ideally, the use of an automated dispensing cabinet should occur to optimally operationalize this process.

Summary

The safe and effective delivery of moderate sedation is an essential knowledge and skill set for physicians and nursing staff working in the CCL. It is therefore crucial that the CCL staff member periodically review his or her institution's educational material and guidelines for moderate sedation. In addition to BLS and ACLS skills, CCL staff (especially new or part-time staff) should prepare for sedation-related complications using mock drills and critical knowledge assessments. The reader is referred to the ASA practice guidelines for sedation and analgesia by nonanesthesiologists for a comprehensive review on this subject.²

References:

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