

Conscious Sedation: A Primer for Outpatient Procedures

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Many painful or anxiety-provoking procedures can be successfully performed in the outpatient setting with the aid of pharmacologic agents. The provision of procedural sedation can be safe and successful as long as the available pharmacologic agents and the various techniques of administration are well understood. However, patient safety must remain the primary concern. Most agents used for sedation and analgesia are capable of causing inadequate spontaneous respirations and may also impair the patent airway. Occasionally, attempts at outpatient sedation must be abandoned and formal, general anesthesia must be performed in order to successfully complete a procedure. It is wiser to apologize for some discomfort during a procedure, or halt a procedure altogether, than to risk anoxic brain injury during an otherwise minor procedure. This review focuses on the provision of sedation and analgesia by non-anesthesiologists for procedures outside the operating room. Various sedative agents and reversal agents are presented. Considerations related to specific procedures and patient age are also discussed.

STANDARDS FOR ANESTHESIA CARE

The Joint Commission on Accreditation of Healthcare Organizations (JCAHO), in its *Comprehensive Accreditation Manual for Hospitals*,¹ states:

The standards for anesthesia care apply when patients, in any setting, receive, for any purpose, by any route . . . sedation (with or without analgesia) which, in the manner used, may be reasonably expected to result in the loss of protective reflexes . . .

JCAHO standards are intended to promote the safe provision of sedation and analgesia. These standards for anesthesia care apply not only to patients in the operating room, but also pertain to patients receiving procedural sedation in emergency departments, clinics, outpatient procedure areas, or any other areas of

the hospital. Familiarity with these standards for anesthesia care (**Table 1**) is important.

Basic Recommendations for Care

A preanesthetic assessment is used to identify patients who might experience complications after the administration of medications. Exclusion of patients at high risk for complications from conscious sedation is as important as careful technique. Patients with full stomachs or medical conditions such as advanced lung disease should not receive conscious sedation. Additionally, patients with conditions that might make airway management difficult (eg, facial injuries, limited jaw movement) should not receive combinations of medications or escalating dosages that may risk deep sedation. Patients with significant active medical conditions are at higher risk for complications during sedation procedures.

The anesthesia plan should be individualized to ensure patient comfort and the safe completion of the procedure. Informed consent is clearly mandated in the JCAHO policies as well. Patients and families must be made aware that the provision of sedation and analgesia has risks independent of, and sometimes exceeding, the risks of the actual procedure.

The equipment necessary to maintain a patient's airway should be assembled and ready to use when procedural sedation is being provided. Oxygen should always be available, as well as nasal cannulas, appropriately sized face masks, and bag-valve masks. Suction equipment should be accessible to collect secretions and vomit. The

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medications and equipment necessary for endotracheal intubation should also be immediately available.

Patient Monitoring

Adequate monitoring by experienced personnel who can interpret and react to changes helps to avoid catastrophes resulting from oversedation. According to JCAHO, the medical personnel who monitor patients under conscious sedation must be familiar with drug dosages, methods of administration, adverse reactions, and interventions for adverse reactions. They must also be able to recognize airway obstruction and assess a patient's respiratory rate, oxygen saturation, blood pressure, pulse, and level of consciousness. Because the physicians performing the procedure must concentrate primarily on the job at hand, they may not be able to monitor the patient's respiratory effort or respond to trends in pulse oximetry and heart rate. Therefore, personnel not immediately involved in the performance of the procedure should be present to continuously monitor and record the patient's condition (eg, level of consciousness, blood pressure) for the duration of the sedation.

Although the importance of monitoring patients who receive anesthesia is well accepted, the literature offers many examples of poor outcomes in under-monitored patients.² The amount of monitoring that is appropriate varies with each procedure and anesthesia plan; however, physicians should be prepared for possible complications (eg, hypotension, dysrhythmias, hypoxia). Thorough documentation of the patient's condition during the receipt of sedatives and analgesics is expected. Because the duration of the effects of anesthesia medications can persist after the completion of a procedure, monitoring should continue until patients meet criteria for discharge.

THE SEDATION SPECTRUM

Procedural sedation can range from simple analgesia, which decreases the perception of painful stimuli, to general anesthesia, which produces a loss of protective reflexes (ie, inability to independently maintain a patent airway or protect against aspiration) in addition to the loss of response to painful stimuli. The various levels of sedation are defined in **Table 2**. Between full consciousness and general anesthesia is a state of awareness called *conscious sedation* that allows a patient to tolerate the discomfort of a procedure while minimizing the risk of aspiration or cardiac or respiratory depression. This level of sedation, which maintains the patient's ability to spontaneously breathe and protect his or her own airway, is the target for most outpatient procedures.

Table 1. Joint Commission on Accreditation of Healthcare Organizations' Standards for Anesthesia Care

Standards

- A preanesthesia assessment must be performed for each patient before anesthesia induction.
- Each patient's anesthesia care is planned.
- Anesthesia options and risks are discussed with the patient and family prior to administration.
- Each patient's physiologic status is monitored during anesthesia administration.
- The patient's postprocedure status is assessed on admission to and before discharge from the postanesthesia recovery area.

Minimum protocol requirements

- Sufficient qualified personnel present to perform the procedure and to monitor the patient
- Appropriate equipment for care and resuscitation
- Appropriate monitoring of vital signs (ie, heart and respiratory rates, oxygenation using pulse oximetry equipment)
- Documentation of care
- Monitoring of outcomes

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Patient Response

The precise prediction of a patient's response to varying doses of medications is difficult; however, prediction of a patient's response to combinations of different classes of medications is even more of a challenge.³ Additive and synergistic effects can be minimized by using lower doses or fewer agents in the sedation plan. Some patients are still wide awake after what might be considered "heroic" doses of narcotic, whereas other patients become obtunded after smaller doses. The medications used for conscious sedation usually have maximal effect within a few minutes of administration; however, patients may traverse levels of sedation well after the final dose. Patients must be monitored for changes in the level of sedation both during and after a procedure. Stimulation factors influence the effect of sedation on patients as well. For example, an elderly patient with a hip dislocation may moan in pain until receiving high doses of narcotic, only to slip into unconsciousness and hypoventilate after joint reduction and removal of the painful stimulus.

Table 2. Levels of Procedural Sedation

Level	Patient Response
Analgesia	Decreased perception of painful stimuli
Anxiolysis	Decreased anxiety
Sedation	Decreased awareness of environment
Conscious sedation	Decreased level of awareness that allows toleration of an unpleasant procedure while maintaining the ability to spontaneously breathe and protect the airway
Deep sedation	Unconscious state during which patients do not respond to voice or light touch; minimal spontaneous movement; may be accompanied by partial or complete loss of protective reflexes*
General anesthesia	Loss of response to painful stimuli and loss of protective reflexes*

*Inability to maintain a patent airway independently or protect against aspiration.

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MEDICATIONS

Many agents are available to provide analgesia, sedation, or both. Agents commonly used for outpatient procedural sedation are listed in **Table 3** and reviewed here. Familiarity with the routes of administration, indications, dosages, and possible side effects of each agent is essential. In addition, it is important to know the appropriate approach to problems that may develop during the administration of an agent (eg, oversedation, hypotension).

Benzodiazepines

Benzodiazepines act at the γ -aminobutyric acid (GABA) receptor complex. In addition to their sedative activity, benzodiazepines possess anxiolytic, amnesic, anticonvulsant, and muscle relaxing effects.

Midazolam. Midazolam⁴⁻⁶ is a short-acting benzodiazepine with a short recovery period. An intravenous (IV) dose of 0.02 to 0.1 mg/kg typically produces sedation in 2 to 3 minutes with the clinical effects lasting 10 to 30 minutes. In patients in whom a more pronounced sedative effect and a longer recovery period may be anticipated (eg, the elderly), lower initial doses

are recommended. Doses may be repeated to achieve the desired effect. Midazolam is reversible. Additional dosage information and routes of administration for midazolam are listed in Table 3.

Side effects of midazolam may include dose-related respiratory depression (which is more pronounced in elderly patients and patients with chronic obstructive pulmonary disease, or in the presence of alcohol, barbiturates, opioids, or other central nervous system [CNS] depressants) and hypotension (usually insignificant but more common and severe in hypovolemic patients and elderly patients). Headache, nausea, vomiting, and coughing are rarely encountered. Cardiovascular effects are minimal at sedative doses.

Diazepam and lorazepam. Diazepam and lorazepam are also used for conscious sedation. However, because diazepam and lorazepam have longer half-lives compared with midazolam, these agents may be more difficult to titrate and may provide a longer than desired duration of action.

Opioids

Opioids are typically thought of as analgesics that also possess sedative properties. Opioids act predominantly at the μ and κ receptors in the brain and spinal cord. Respiratory depression resulting from a blunted response to hypercapnia and hypoxia is the most common side effect of conscious sedation with opioids. In addition, hypotension may result from a decreased catecholamine release as well as a histamine release.

Morphine. A powerful analgesic with sedative properties, morphine⁷ is the most active narcotic alkaloid of opium. An IV dose of 0.1 to 0.2 mg/kg becomes clinically effective within 5 minutes of administration and lasts between 3 to 4 hours.

As with all narcotics, morphine decreases the medullary response to hypercapnia and hypoxia. Morphine also causes significant histamine release, which may lead to local irritation and occasional hypotension. Additional adverse reactions associated with morphine include hypotension secondary to decreased circulating catecholamines or histamine release; respiratory depression, which is dose dependent and becomes more pronounced in the presence of other CNS depressants; pruritus; rash; and nausea and vomiting. While morphine has traditionally been the drug of choice for painful procedures, fentanyl has been increasingly used as a replacement for morphine.

Fentanyl. Fentanyl^{8,9} is the most potent of the commonly used opioids and is the preferred agent for outpatient sedation because of its quick onset, short duration

Table 3. Agents Commonly Used for Outpatient Procedural Sedation

Medication	Side Effects	Route	Total Dose*	Onset	Duration
Barbiturates					
Methohexital	Respiratory depression, hypotension	IV	0.75–1 mg/kg	45 sec	5–10 min
		PR	20–30 mg/kg	8–10 min	45–60 min
Pentobarbital	Respiratory depression, hypotension	IV	2.5 mg/kg	45 sec	15 min
		IM	2.5 mg/kg	10–15 min	NA
		PO/PR	2–6 mg/kg	15–60 min	1–4 hr
Benzodiazepines					
Midazolam	Respiratory depression	IV	0.02–0.1 mg/kg	2–3 min	30 min
		IM	0.05–0.15 mg/kg	2–5 min	30–40 min
		PO	0.5–0.75 mg/kg	15–20 min	45–60 min
		PR	0.7–1 mg/kg	10–15 min	45 min
		Nasal	0.2–0.4 mg/kg	10–15 min	45 min
Opioids					
Fentanyl	Respiratory depression	IV	2 µg/kg	1–2 min	20–30 min
Morphine	Respiratory depression, hypotension, nausea and vomiting	IV	0.1–0.2 mg/kg	1–5 min	3–4 hr
		IM/SQ	0.1–0.2 mg/kg	30 min	4–5 hr
Other sedative agents					
Chloral hydrate	Prolonged sedation	PO/PR	50–75 mg/kg	30–60 min	1–8 hr
Ketamine	Postemergence delirium	IV	0.5–1 mg/kg	1 min	15 min
		IM	4 mg/kg	5 min	15–30 min
		PO	5–10 mg/kg	30–40 min	2–4 hr
		PR	5–10 mg/kg	5–10 min	15–30 min
		Nasal	3–6 mg/kg	5–10 min	15–30 min
Propofol	Respiratory depression, hypotension	IV	0.05–0.1 mg/kg/min	30 sec	8–10 min
		IV bolus	1 mg/kg	30 sec	
Reversal agents					
Flumazenil	Withdrawal symptoms (agitation)	IV	0.2 mg 0.01 mg/kg (pediatrics)	1–3 min	30–45 min
Naloxone	Withdrawal symptoms (agitation)	IV/IM/SQ	0.1–2 mg	1–2 min (IV)	15–45 min

IM = intramuscular; IV = intravenous; NA = not available; PO = oral; PR = rectal; SQ = subcutaneous.

*Doses should be administered in fractional boluses (eg, one quarter to one half) and titrated to effect.

of action, and favorable side effect profile. Fentanyl offers a stable cardiovascular profile and is reversible. The typical dose of fentanyl is 2 to 3 µg/kg given intravenously and titrated to effect. Duration of action is 20 to 30 minutes.

Fentanyl, which causes the least amount of histamine release when compared with the other opioids, is less likely to cause hypotension or irritation after injection. Side effects associated with fentanyl include respiratory depression (related to dose and route of administration,

more pronounced in the presence of other CNS depressants) and "board chest," a phenomenon of chest wall rigidity associated with high doses of rapidly administered fentanyl that limits the patient's ability to ventilate. Board chest phenomenon, which has not been reported during conscious sedation, can be treated with benzodiazepines or paralytic agents.

Ketamine

Ketamine^{10,11} is a phencyclidine derivative that results in a dissociation between the cortical and limbic systems of the brain called *dissociative anesthesia*. Ketamine prevents the higher cortical centers from perceiving visual, auditory, and painful stimuli. Ketamine, which produces sedation, amnesia, and analgesia, is unique among conscious sedation medications. An IV dose of 1 mg/kg induces sedation in 2 minutes, and effects last 15 to 30 minutes. Patients demonstrate nystagmus and display a blank stare that is characteristic of dissociative anesthesia. Ketamine maintains cardiovascular stability as well as muscle tone and airway reflexes. Respiratory rate, tidal volume, end tidal carbon dioxide, and minute ventilation are minimally affected by ketamine.

Disadvantages of ketamine may include increased intracranial and intraocular pressures, hypertension, and tachycardia. Ketamine also stimulates airway secretions. However, atropine or glycopyrrolate is often used to reduce secretions, especially in children. Purposeless movements also occur. The movements rarely prevent the completion of a procedure; however, they may limit the usefulness of ketamine for procedures requiring a still patient. Patients with respiratory infections and infants younger than age 3 months who undergo ketamine administration are at increased risk of laryngospasm, although the occurrence is extremely rare. Postemergence delirium (ie, vivid nightmares) is present in up to 10% of children and 30% of adult patients after ketamine administration.^{11,12} This phenomenon is much more prevalent in patients with a psychiatric history and, thus, ketamine should be avoided in this patient population. Postemergence delirium can be markedly reduced with the combined use of ketamine and a benzodiazepine (eg, midazolam). Midazolam is typically given prior to the administration of ketamine to reduce or eliminate the dysphoria sometimes associated with ketamine and to counter postemergence delirium.

Barbiturates

Barbiturates result in a general CNS depression by acting at the GABA receptor and are primarily used

when deep sedation is desired (eg, immobilizing patients for diagnostic interventions such as computed tomography [CT] or magnetic resonance imaging [MRI]). In general, barbiturates can cause hypotension and dose-related respiratory depression. At lower doses, these medications can also cause paradoxical excitation. Barbiturates have no analgesic properties and are not reversible.

Methohexital. Methohexital^{12,13} is an ultra-short-acting barbiturate with rapid onset. Although IV dosing is ideal, methohexital's high lipid solubility allows intramuscular (IM), oral, or rectal administration. An IV dose of 0.75 to 1 mg/kg typically produces a sleeplike state without spontaneous movements within 1 minute; patients usually wake up within 10 minutes. Alternatively, 20 to 30 mg/kg of a 10% solution given rectally can produce deep sedation in 8 to 10 minutes, and lasts 45 to 60 minutes. Airway reflexes are maintained at sedative doses. Methohexital is not reversible.

Because methohexital is not an analgesic, administration may potentiate pain perception. Additional side effects may include heightened airway reflexes (eg, hiccups, coughing). Respiratory depression and laryngospasm are rarely encountered. Myocardial depression and venodilation that result from barbiturate administration can cause a transient drop in blood pressure with an increase in heart rate. This effect may be most notable in patients who are hypovolemic.

Pentobarbital. Pentobarbital¹⁴ is a short-acting barbiturate that is often used for nonpainful diagnostic studies. A dose of 2.5 mg/kg should produce deep sedation within 5 minutes, and effects should last between 30 to 60 minutes. A repeat dose of 1.25 mg/kg may be necessary, but repeated dosing may lead to prolonged sedation. Pentobarbital is also titratable but not reversible.

Hypoxia occurs in 3% to 7% of patients and is usually resolved with administration of supplemental oxygen or a change in the patient's head position.¹⁴ Hypotension is also a potential side effect of pentobarbital.

Nitrous Oxide

Nitrous oxide (NO)^{15,16} is a colorless, sweet-smelling gas that has been used reliably and safely in the outpatient setting for decades. In a 50/50 mixture with oxygen, NO has sedative, analgesic, and anxiolytic properties with a favorable side effect profile. NO can also be administered in combination with opioids or benzodiazepines. NO diffuses rapidly, which provides a sedation that is rapid in onset and short in duration. This diffusion also causes accumulation and increased gas pressure in closed, air-filled body cavities. Therefore,

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NO should not be used in patients with such disorders as pneumothorax or bowel obstruction. NO can be self-administered by the patient. When NO is self-administered, patients limit their own level of sedation.

Respiratory depression is rarely encountered in patients treated with NO. When NO is administered in combination with opioids or benzodiazepines, oversedation can occur and respiratory depression can become more prominent. To protect health care personnel from possible toxicity from long-term, low-level exposure, NO should be used with a scavenger system to limit the amount of gas released into the air.

Chloral Hydrate

Chloral hydrate^{17,18} is a sedative-hypnotic without analgesic properties, which produces a state of disinhibition with an agitated response to noxious stimuli. The usefulness of chloral hydrate is limited to non-emergent, nonpainful interventions in young children (eg, diagnostic imaging). A dose of 50 to 75 mg/kg given orally or rectally usually produces sedation in 45 minutes. Sedation typically lasts 40 to 60 minutes, although effects can linger for several hours.

Chloral hydrate produces minimal respiratory depression. In the liver, chloral hydrate is metabolized to its active agent trichloroethanol; therefore, the agent is contraindicated in patients with hepatic failure. Side effects of chloral hydrate include nausea and vomiting and paradoxical hyperactivity.

Meperidine, Chlorpromazine, and Promethazine

Also known as the "lytic cocktail," the mixture of meperidine, chlorpromazine, and promethazine (MCP) given as a single IM injection has been widely used to produce sedation in the emergency department setting.^{18,19} Despite its popularity, this combination is poorly titratable and can produce prolonged sedation (up to 19 hours). Side effects include hypotension, respiratory depression, dystonic reactions, and seizures. In the outpatient setting, MCP is being replaced by safer, more predictable alternatives.

Propofol

Propofol^{20,21} is an ultra-short-acting sedative-hypnotic that has been increasingly used outside the operating room. Propofol has an immediate onset of action with short duration. Consequently, propofol requires continuous infusion or intermittent bolus administration to maintain effect. Deep sedation can be achieved by bolus administration of 1 to 2 mg/kg followed by an infusion of 50 to 100 µg/kg/minute. Patients typically come to consciousness within 8 minutes of cessation of the drug.

Propofol is safely administered in patients with kidney failure and liver failure and may be particularly useful in patients who have developed a tolerance to benzodiazepines or narcotics. Propofol, which has both antiemetic and amnestic properties, produces minimal respiratory depression at sedative doses.

Side effects of propofol include hypotension (especially with higher doses and in hypovolemic patients), respiratory depression (dose related, more common in conjunction with opioids), and pain at the injection site.

Reversal Agents

Determining the best route and dose of medication for a patient undergoing sedation is not an exact science. Because pharmacokinetic and pharmacodynamic properties vary, the occasional occurrence of oversedation is inevitable. Two classes of agents commonly used for analgesia and sedation—opioids and benzodiazepines—have reversal agents. Naloxone and flumazenil enhance the safety of conscious sedation and should be immediately available and ready to be administered whenever opioids or benzodiazepines are being used.

Naloxone. Naloxone²² is a pure opioid antagonist with a brief onset of action and a clinical duration of approximately 30 minutes. Naloxone can be administered intravenously, intramuscularly, subcutaneously, and endotracheally. A dose of 0.4 mg (0.05 mg/kg in children) should reverse respiratory and CNS depression. The typical IV dose of naloxone ranges between 0.1 mg and 2 mg. If symptoms are not reversed after the administration of 10 mg of naloxone, opioids should be excluded as the etiology of the respiratory and CNS depression.

The main complication of naloxone use is the induction of opiate withdrawal in dependent patients. Resedation can occur because the duration of action of naloxone may be shorter than that of the offending agent; in turn, patients should be observed well beyond naloxone's duration of action. Observation for at least 1 hour after naloxone administration is required, although longer periods of observation and repeated doses of naloxone may be necessary if a longer-acting opiate is used and resedation occurs.

Flumazenil. Flumazenil^{23,24} is a benzodiazepine antagonist that reversibly binds the CNS benzodiazepine receptors. An IV dose of 0.2 to 5 mg in adults (0.02 mg/kg in children) causes a clinically evident reversal of benzodiazepine effects within 2 minutes; the reversal lasts approximately 45 minutes. Incremental doses of 0.2 mg can be given 1 minute apart and titrated to the desired level of reversal. Similar to naloxone, patients may become resedated if the

flumazenil wears off. Observation for up to 2 hours after flumazenil administration is warranted.

Flumazenil administration occasionally results in seizure activity. Seizures are most prevalent in patients who have an underlying seizure disorder or in patients with benzodiazepine dependence; flumazenil administration should be avoided in these groups.

PROCEDURE-SPECIFIC CONSIDERATIONS

As previously mentioned, sedation plans must be individualized. Outpatient procedures that require sedation can be brief or prolonged, intensely painful or painless. Patients may be openly anxious or stoic. Some patients may be too anxious or agitated to permit the completion of a simple procedure that does not typically require sedation. Definition of the goals of sedation and refinement of the medication plan are essential steps in the care of each patient.

Prior to administering medications, physicians must consider whether a sedative agent is necessary. Some procedures (eg, lumbar puncture, wound repair) can be performed in cooperative adult patients with only the aid of local anesthesia. In an anxious child, however, stitching a wound without the additional administration of a sedative agent may be impossible. Physical restraint (eg, a papoose board), although never a substitute for adequate analgesia, may be an appropriate adjunct and avoids the risk of sedative administration for a minimally painful or nonpainful procedure in a young patient. Pain relief is not an issue for most imaging studies, but sometimes deep sedation is required to prevent motion from interfering with the imaging. If sedation is deemed necessary, the best agent, route of administration, required duration, and target level of sedation must all be carefully considered.

Painless Procedures

Diagnostic studies (eg, CT, MRI) are sometimes complicated by the movement of patients, especially pediatric patients. Ideally, patients should not display unwanted movements, but airway reflexes and spontaneous breathing must be maintained. Analgesia is not required.

Barbiturates. Methohexital or pentobarbital can be used to achieve the state of unconsciousness necessary for such procedures. The quick onset and short duration of these agents are appropriate for most imaging studies. At sedative doses, airway reflexes are usually maintained and respiratory depression is minimal. Deeper sedation is possible with methohexital and pentobarbital; monitoring (ie, electrocardiography, blood pressure, pulse oxymetry) and constant respira-

tory observation are mandatory when these agents are used. In addition, a physician skilled in airway management and airway equipment must constantly be available.

Chloral hydrate. Chloral hydrate has a long history of safe use for diagnostic studies in young patients. The agent has traditionally been used in the outpatient setting, and the initial dose can be administered at home by the patient's parents. The agent cannot be used for emergent procedures because of its delayed onset of activity. Chloral hydrate may also require repeat dosing, which prolongs the onset of effects as well as the recovery period. Minimal respiratory depression and the convenience of not requiring an IV line are advantages to chloral hydrate. Although experiences with chloral hydrate have generally been favorable, deaths have occasionally been reported.^{2,25} Chloral hydrate does result in deep sedation, and monitoring by medical personnel is appropriate.

Minimally Painful Procedures

Procedures such as simple laceration repair or lumbar puncture can typically be accomplished with local anesthesia alone. However, in anxious or frightened patients, sedation may be necessary or preferred. IV midazolam may be used in addition to local anesthesia to make the procedure more tolerable.

For the very anxious child, a cocktail of ketamine, atropine, and midazolam with local anesthesia can be administered. This combination provides effective sedation with quick recovery and few side effects. Ketamine provides the sedation, creating a very cooperative child. The atropine decreases the secretions induced by ketamine. The midazolam reduces the likelihood of emergence delirium and provides improved amnesia and anxiolysis. Children can be pretreated with 0.01 mg/kg of IV atropine, followed by 0.1 mg/kg of IV midazolam. Ketamine is then administered at an IV dose of 0.5 to 1 mg/kg. Constant monitoring is required.

Painful Procedures

To initiate conscious sedation in an adult patient undergoing a painful procedure where the efficacy of local anesthesia may be limited (eg, hemorrhoid thrombectomy, large abscess incision and drainage, joint reduction), these authors suggest a combination of fentanyl and midazolam given intravenously. These agents are short acting and titratable; they also have reversal agents. The rapid onset of fentanyl and midazolam allows for observation of sedative effect before the administration of additional doses. As previously

discussed, ketamine, midazolam, and atropine are the preferred sedative agents in children; significant experience with this combination has been reported.^{10,26}

Painful but very brief procedures (eg, joint or fracture reduction, cardioversion) can be accomplished by administering short-acting barbiturates or propofol. If hypotension is a concern, midazolam with or without fentanyl may be preferred. For brief procedures, continuous monitoring until the sedatives wear off is essential.

AGE-RELATED CONSIDERATIONS

Pediatric Patients

Fear and anxiety are often more pronounced in pediatric patients. A child may not be able to tolerate a procedure without pharmacologic intervention, even if topical anesthetics are used in lieu of an injection. Although the patient's apprehension is sometimes out of proportion to the complexity of the procedure, pediatric patients deserve the same considerations of pain management and sedation as adults.

Once the decision to administer sedation has been made and the risks and benefits have been discussed with the patient's family, the route of administration must be determined. Although the IV route is the easiest to titrate and offers an avenue for the administration of fluids and reversal agents if required, obtaining IV access in a pediatric patient can be as stressful as the procedure itself. The pain of IV insertion can be avoided with the prior application of a eutectic mixture of local anesthetics, and for many medications, alternative routes (eg, oral, IM, rectal, nasal) provide viable solutions. At these authors' institution, midazolam is often administered by the nasal route for short, minimally painful procedures. Familiarity with the differences in dosing and duration of onset and effect is essential before attempting administration via alternative routes. Regardless of the route of administration, the same safety issues apply. IV access equipment must be readily available and physicians must be confident that access is easily obtainable if necessary. All patients must be fully monitored.

Many sedative drugs, although not specifically indicated for pediatric patients, are widely and safely used in young patients. For example, propofol is not approved by the Food and Drug Administration for administration in children younger than 12 years. Similarly, midazolam is not approved in patients younger than 18 years, and fentanyl is not approved in patients younger than 2 years; however, these drugs have been routinely, safely, and effectively used in both patient populations at the institution of these authors.

Infant patients. Special consideration must be given when administering sedation to infants younger than age 3 months. These patients have an increased incidence of complications, especially respiratory depression,² which may be secondary to factors such as decreased respiratory reserve, an incompetent blood-brain barrier, and altered pharmacokinetics. Most non-painful procedures in infants can be preformed without sedation. Many of these patients simply fall asleep with a pacifier and a dry diaper. If sedation is required, the titrated administration of reversible agents is preferred. Administration of any sedative agent in infants requires continuous cardiorespiratory monitoring by a skilled physician and the immediate availability of intubation equipment. Specific experience with the management of sedation and its complications in this age-group is recommended.

Geriatric Patients

The prevalence of comorbid illnesses and the use of daily medications both increase with age. Because elderly patients are more likely to be taking multiple medications, the risk for drug interactions with sedative agents is greater.²⁷ For example, hypotension may be exaggerated or sedation increased if synergy with the patient's regular medication occurs. In turn, a complete medication history should be obtained for all patients before administering any sedative agents.

Conscious sedation agents can safely and effectively be used in the elderly patient population. These authors recommend initiating common medication regimens (eg, fentanyl, midazolam) at lower doses; the medications can be titrated to the desired effect with smaller aliquots. This technique provides adequate sedation and minimizes the chance of oversedation, which can be less predictable in the elderly patient population.

Health factors can sometimes alter the effects of sedatives in elderly patients. Renal and liver dysfunction can alter many drug clearances, which necessitates dosage modification (midazolam dosage should be reduced, typically by one half; propofol dosing need not be changed). Respiratory depression may be more pronounced in patients with respiratory disease. Blood pressure in elderly patients may be more sensitive to sedative agents because of decreased blood vessel compliance and increased sensitivity to decreases in circulating catecholamines.

Additionally, the demented patient may require deep sedation to allow the completion of diagnostic imaging studies. IV access, appropriate personnel, and monitoring are required. Sedative agents not specifically

discussed in this review (eg, haloperidol, droperidol) may be particularly useful in demented patients, with or without administration of a benzodiazepine. These agents induce a sleep-state without respiratory depression or loss of reflexes.

SUMMARY

Safe and adequate administration of sedative and analgesic medications can make painful and anxiety-provoking situations tolerable. Specifically, conscious sedation is a tool available to physicians in the outpatient setting that can improve patient tolerance and acceptability of unpleasant procedures. In all patients who require sedation, the importance of a preanesthetic assessment and proper monitoring cannot be over-emphasized. Knowledge of medications and the ability to address oversedation and side effects is essential for safe and effective outpatient procedural sedation. HP

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