

UNIVERSITY OF VIRGINIA CHILDREN'S HOSPITAL
PEDIATRIC SEDATION FOR DIAGNOSTIC AND THERAPEUTIC PROCEDURES

DRUG	USE	CLASS & MECHANISM OF ACTION	ADVANTAGES/ DISADVANTAGES	ONSET & DURATION OF ACTION	DOSING GUIDELINES	ADVERSE EFFECTS	REVERSAL
Chloral hydrate (Noctec®)	sedation only use for nonpainful procedures of long duration	active TCE metabolite/ (general CNS depression)	A: little respiratory depression with doses < 75 mg/kg, long duration D: paradoxical agitation, erratic or delayed onset and recovery, bitter taste	onset: 1/2-1 hr duration: 4-9 hrs	neonates: 25 mg/kg/dose children: 50-100 mg/kg/dose PO or PR up to 2 grams max	CNS and respiratory depression rare but possible, arrhythmias, paradoxical agitation, urticaria potential for prolonged effect with repeat dosing	none
Diphenhydramine (Benadryl®)	sedation only use for nonpainful procedures	antihistamine (blocks H ₁ receptors) with anticholinergic properties	A: little respiratory depression D: paradoxical agitation	onset: 1/2-1 hr duration: 4-7 hrs	1-2 mg/kg/dose PO or IV 300 mg/24 hr maximum	hypotension, dizziness nausea, vomiting, dry mucous membranes, urinary retention, blurred vision, tremor	none
Diazepam (Valium®)	sedation & amnesia; no analgesia use for short procedures	benzodiazepine (potentiates GABA neural inhibition effect)	A: rapid onset of action D: respiratory depression, poor IV compatibility	onset: 5-15 min duration: 1-2 hrs	0.04-0.3 mg/kg/dose IV at a rate < 2 mg/min IM route not recommended	respiratory depression hypotension, arrhythmias, vomiting, dizziness, blurred vision, agitation, muscle weakness	flumazenil 0.01 mg/kg every 60 sec, up to a total of 1 mg ^a
Lorazepam (Ativan®)	sedation & amnesia; no analgesia use for longer procedures	benzodiazepine	A: longer acting D: respiratory depression; poor IV compatibility	onset: 1/2-1 hr duration: 6-8 hrs	0.03-0.05 mg/kg IV	see diazepam	flumazenil 0.01 mg/kg every 60 sec, up to a total of 1 mg ^a
Midazolam (Versed®)	sedation, amnesia, anxiolysis; no analgesia useful for many types of procedures; can combine with an analgesic	benzodiazepine	A: short duration minimal cardiovascular effects D: respiratory depression (rate-dependent; give IV slowly), duration may be prolonged with oral doses > 0.5 mg/kg	onset: 5-15 min (20 with PR) duration: 1/2-2 hrs	0.02-0.05 mg/kg IV every 2-3 min to effect or to a total of 0.2 mg/kg 0.07-0.15 mg/kg IM 0.25-0.75 mg/kg PO (doses up to a total of 1 mg/kg may be necessary) 0.25-0.75 mg/kg PR 0.2-0.4 mg/kg intranasal (repeat as needed)	see diazepam If using with an opioid: decrease dose by 25-50% to avoid respiratory depression	flumazenil 0.01 mg/kg every 60 sec, up to a total of 1 mg ^a
Thiopental (Pentothal®)	sedation only use only for intubation	barbiturate (nonspecific GABA potentiation)	D: respiratory depression, hypotension; cannot be used during painful procedures (hyperalgesic)	onset: 3-15 min duration: 1-3 hrs	25-45 mg/kg PR 2 mg/kg IV	dose-dependent myocardial depression , hypotension, CNS and respiratory depression, vomiting, laryngospasm, bronchospasm, hypothermia	none
Pentobarbital (Nembutal®)	sedation only use for longer, nonpainful procedures	barbiturate	D: hypotension; cannot be used during painful procedures (hyperalgesic); respiratory depression with large doses	onset: IV/IM 10-15 min PO/PR 15-60 min duration: 1-4 hrs	1-6 mg/kg/dose IV,IM,PO,PR may be repeated up to a max dose of 100 mg	dose-dependent CNS depression, myocardial depression , hypotension, vomiting, laryngospasm, bronchospasm, hypothermia; may cause apnea or respiratory depression with rapid administration of large doses	none
Morphine	Sedation and analgesia	opioid	A: inexpensive	onset: 5-60 min	0.1-0.2 mg/kg/dose SC,IV,IM	CNS and respiratory depression,	naloxone

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	use for longer procedures	(mu receptor agonist)	D: hypotension possible	duration: 3-7 hrs	0.2-0.5 mg/kg/dose PO may repeat at 1/2 dose If using with a benzodiazepine: decrease dose by 25-50% to avoid respiratory depression	hypotension, bradycardia, nausea, vomiting, pruritus, urinary retention	(Narcan [®]) 5-10 mcg/kg/dose every 2-3 min ^b
Fentanyl (Sublimaze [®])	sedation and analgesia use for shorter procedures	opioid	A: less cardiovascular effects than morphine	onset: 1-3 min duration: 30 min-2 hrs	1-3 mcg/kg/dose IV/IM may repeat in 30-60 min If using with a benzodiazepine: decrease dose by 25-50% to avoid respiratory depression	see morphine, also muscle rigidity with rapid bolus doses	naloxone (Narcan [®]) 5-10 mcg/kg/dose every 2-3 min ^b
Ketamine (Ketalar [®])	sedation, analgesia, and amnesia use for long or very painful procedures	dissociative anesthetic; mechanism unknown	A: relieves bronchospasm; bronchodilation D: adverse effect profile often limits use; may be associated with long-term effects such as nightmares and flash-backs	onset: 1-5 min duration: 1-2 hrs (produces 15-20 minutes of dissociative effect)	0.5-2 mg/kg/dose IV 3-7 mg/kg/dose IM Administer atropine (0.01 mg/kg) before dose to decrease oral secretions. Give midazolam 15-20 min after ketamine to reduce likelihood of emergence phenomena.	respiratory depression with rapid bolus, hypotension or hypertension, arrhythmias, enhanced muscle tone, laryngospasm (rare); hypersalivation Contraindication: increased ICP	none
Propofol (Diprivan [®])	sedation mild antiemetic effect use for intubation, brief procedures (may redose for longer procedures)	alkylphenol (mechanism unknown; may involve GABA potentiation)	A: very rapid return to baseline after discontinuing use D: limited experience in children, use with caution	onset: 1 min duration: 5-10 min	2-3 mg/kg/dose IV may be repeated Give with lidocaine to reduce pain of injection	apnea, hypotension or hypertension, nausea, twitching or movement, burning or stinging at infusion site	none
Nitrous Oxide gas	sedation, analgesia, and amnesia use for painful procedures or for anxiety reduction & amnesia; use with opioids for highly painful procedures	dissociative anesthetic; mechanism unknown	A: minimal effects on respiratory or cardiovascular function; rapid onset, short duration, useful when local anesthesia is impractical; no IV access required; useful for sexual abuse exams or burn debridement D: not useful with young or uncooperative children	onset: 3-5 min duration: 5 min after withdrawal of gas	50% N ₂ O/ 50% O ₂ mixture; self-administered by mask as needed	nausea, vomiting, expansion of gas-filled pockets, hypoxia Contraindications: middle ear effusion, pneumothorax, bowel obstruction, head injury or altered consciousness	none

^a Flumazenil has limited efficacy in reversing benzodiazepine-induced respiratory depression due to its short duration of action; provide adequate ventilatory support and repeat as needed.

^b Narcan (naloxone) doses listed above are used for partial reversal; for a rapid, full reversal, use 2 mg.

- Notes:**
1. Use of IM route is possible with many of these sedatives, but is not recommended unless other routes are unavailable.
 2. Meperidine (Demerol) and lytic cocktails (meperidine, promethazine, chlorpromazine) are not recommended for use in children due to their potential adverse effects.
 3. Primary reference: Taketomo CK et al. Pediatric Dosage Handbook. 11th ed. Hudson: Lexicomp, 2004.

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