7. We often use Marcaine in tonsillectomies for longer acting analgesia. What is the dose? What are the particular side effects?

Marcaine dosing per uptodate is Local anesthesia: Infiltration: 0.25% infiltrated locally. Maximum 175mg.

<table>
<thead>
<tr>
<th>Bupivacaine (Marcaine)</th>
<th>Long (120-240 min)</th>
<th>Without epinephrine: 2.5 mg/kg; not to exceed 175 mg total dose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bupivacaine with epinephrine</td>
<td>Long (180-420 min)</td>
<td>With epinephrine: Not to exceed 225 mg total dose</td>
</tr>
</tbody>
</table>

Side effects per emedicine confirmed with uptodate. All the side effects seemed to be similar to those of the other amide local anesthetics. Info is from the table of local anesthetic complications.

Adverse reactions may occur following administration of local anesthetics and usually result from administration of too much drug. Adverse reactions may also occur following injection of very vascular sites or from accidental direct intravascular injection of the drug. Deaths following local anesthetic administration are always a result of overdosage.

Tissue toxicity can be achieved by all local anesthetics if “high” concentrations are used. Adverse reactions occur primarily in the CNS (neurotoxicity) and cardiovascular system (myotoxicity) because these tissues are also composed of excitable membranes, the target of local anesthetic action.

In the CNS, a progression of signs and symptoms may be observed in the patient. The patient may report lightheadedness, tinnitus, circumoral numbness, a metallic taste, or double vision. Upon examination, the patient may become drowsy or slur speech and may develop nystagmus. At higher levels of anesthetics, the patient may become anxious and develop fine tremors of the muscles of the hands and/or face. These tremors may worsen and coalesce into a grand mal seizure. Ultimately, the patient may experience generalized CNS depression leading to hypoxia, acidosis, and respiratory arrest.

Local anesthetics decrease the rate of depolarization of cardiac tissue, which is the rationale behind the use of lidocaine in treatment of ventricular arrhythmias. At higher concentrations, amplitude of the cardiac action potential is decreased, and the velocity of conduction is reduced. At toxic doses, the negative inotropic effects of local anesthetics may lead to bradycardia, ventricular fibrillation, or asystole. Other cardiovascular effects include hypotension, which occurs via the direct vasodilating effects of local anesthetics on peripheral arteriolar smooth muscle.

Recognizing signs and symptoms of an adverse reaction to local anesthetics and administering emergency care in relation to the severity of the reaction are essential. With severe life-threatening reactions, immediately curtail the procedure. Activate advanced cardiac life support (ACLS) protocols immediately, including intubation and
defibrillation if indicated. Hypotension may require intravenous fluids and vasoconstrictor drugs for circulatory support. Control seizure activity with diazepam 5-10 mg IV. Succinylcholine may be required to stop ongoing tremors, but its use requires intubation and mechanical ventilation. Atropine and epinephrine may be indicated to treat bradycardia.


Paper by Judkins et al.
Retrospective analysis (at uvm) of 311 patients who underwent tonsillectomy over an 18 month period.
19% intraoperative ketorolac
17% bleeding complications with ketorolac
Control had 4.7% bleeding complications P<0.003
Patients with any positive medical history had 57% bleeding rate after tonsillectomy with ketorolac P<0.002

In Adults
Control group 1.9% vs ketorolac group 27.2%  P<0.001

Conclusions:
Intraoperative ketorolac significantly increases postoperative bleeding rates after tonsillectomy Especially in patients with preexisting medical conditions or adults

9. You need to sedate a child in the ER to repair a laceration. What is now recommended?

From Emedicine

Opioid analgesic agents
Opioid analgesic agents are frequently used to control pain. They may be used as single agents or in combination with sedative/anxiolytic agents. In some scenarios, they can be used as hypnotic agents; however, the risk of respiratory depression is greater with this use. The analgesic effect occurs at the mu opioid receptor.
Other opioid receptors (eg, kappa, delta) have been implicated in other effects (ie, some sedation and no amnestic properties). These effects are dose-related.
When using opioid analgesics, a reversal agent should be readily available. Naloxone (Narcan) is an opioid reversal agent that can be administered as 0.1 mg/kg IV, IM, SC, ET q2-3min until response in children aged 5 years or younger or who weigh 20 kg or less. Naloxone's dose for children older than 5 y (or weighing >20 kg) is 2 mg IV, IM, SC, ET q2-3min until response. Naloxone's half-life is 1-2 h. Rebound sedation and apnea may occur.
Morphine sulfate
Morphine sulfate is indicated for analgesia because of its reliable and predictable effects, safety profile, and ease of reversibility with naloxone. It elicits analgesia and possesses
some sedative effect, but has no amnestic properties. Its peak effect is observed 15-30 min following IV administration and 30-60 min following IM administration.

Dosing: For procedural analgesia and sedation in children, dosing is 0.08-0.1 mg/kg/dose IV/IM/SC before procedure and q5-10min prn.

Fentanyl (Sublimaze)
Fentanyl is a synthetic opioid that is 75-200 times more potent than morphine sulfate and has a much shorter half-life. It has less hypotensive effects and is safer in patients with hyperactive airway disease than morphine because of minimal to no associated histamine release. By itself, it causes little cardiovascular compromise, although addition of benzodiazepines or other sedatives may result in decreased cardiac output and blood pressure.

Fentanyl is an excellent choice for pain management and sedation with short duration (30-60 min) and is easy to titrate. Its onset of action is immediate following IV administration. It is easily and quickly reversed by naloxone.

Dosing: In children younger than 6 years, dosing is 0.3-1.5 mcg/kg/dose slow IV push (over 1-2 min); it may be repeated q1-2h. In children aged 6 years and older, dosing is 1-5 mcg/kg/dose slow IV push (over 1-2 min); IV dose may be repeated q1-2h (dosage range varies 1-10 mcg/kg/dose).

Benzodiazepines
Benzodiazepines are used as sedative-hypnotic agents. They have anxiolytic, amnestic, and skeletal muscle relaxant properties. However, they do not have any analgesic properties. They exert effects on GABA receptors and potentiate GABA neuron inhibitory actions, as well as result in chlorine channel opening and postsynaptic neuronal hyperpolarization.

Midazolam is commonly used because of its short half-life and prompt onset of action. Diazepam may be given but has a long half-life and active metabolites. Lorazepam is a poor choice for procedural sedation because of its long duration of action. The benzodiazepine reversal agent is flumazenil (pediatric dose is 0.01-0.02 mg/kg IV, which may be repeated every minute to a maximum cumulative dose of 1 mg). Flumazenil can precipitate seizures in patients who ingested TCAs or have chronic benzodiazepine use.

Midazolam (Versed)
Midazolam is favored in procedural sedation as a sedative-hypnotic agent because its water solubility allows versatile routes of administration (eg, PO, IV, IM, intranasal, PR). It elicits rapid onset when administered IV (2-5 min), is easily titrated, is associated with less pain at the injection site, and has a shorter duration of action than other commonly used benzodiazepines. The dose-response curve is highly variable in children; weight-based dosing produces variable levels of sedation in agitated children of the same weight; this is common with IM and PO dosing.

Dosing in children younger than 6 months is not established. IV: Allow 2-3 min after dose before administering additional doses.

Dosing in children aged 6 months to 12 years is 0.05-0.1 mg/kg IV; titrate to desired effect. Younger children (ie, <5 y) may require higher cumulative doses, up to 0.6 mg/kg or 6 mg.

Dosing in children older than 12 years is 0.01-0.05 mg/kg IV (approximately 0.5-4 mg); it may be given slowly or infused over several min and may be repeated q10-15min. Do
not exceed a cumulative dose of 10 mg. PO dosing is 0.25-1 mg/kg/dose PO, not to exceed 20 mg/dose. IM dosing is 0.1-0.15 mg/kg/dose IM 30-60 min before procedure or surgery, not to exceed 10 mg/dose. Intranasal dosing is 0.2-0.5 mg/kg.

Diazepam (Valium)
Diazepam modulates postsynaptic effects of GABA-A transmission, resulting in an increase in presynaptic inhibition. It appears to act on part of the limbic system, thalamus, and hypothalamus, to induce a calming effect. The peak effect for rectal administration is 1.5 h. The negative attributes for pediatric sedation are that it has a long half-life, with active metabolites, and erratic absorption. Additionally, it causes pain with injection. IV/IM dosing depends on age. Dosing is not established in neonates younger than 30 days. In children aged 30 days or older, dosing is 0.25 mg/kg/dose IV/IM; administer over 3 min to avoid respiratory depression. It may be repeated after 15-30 min, not to exceed 10 mg/dose.
Rectal gel dosing also depends on age. Dosing is not established in children younger than 2 years. In children aged 2-5 years, dosing is 0.5 mg/kg/dose PR. In children aged 6-11 years, dosing is 0.3 mg/kg PR. In children aged 12 years and older, dosing is 0.2 mg/kg PR.

Barbiturates
Barbiturates elicit action at GABA receptors and hyperpolarize nerve cell membrane via chlorine channels. They produce sedation and amnesia and reduce anxiety, but they have no analgesic effects. This class of medication produces a reproducible dose-response effect, based on weight. Additionally, these agents provide neuroprotective properties by the ability to lower intracranial pressure and anticonvulsant properties. Disadvantages include hypotension, hypoventilation, and apnea.

Pentobarbital (Nembutal)
Pentobarbital is widely used for procedural sedation. It is a short-acting barbiturate with sedative, hypnotic, and anticonvulsant properties. It has a prompt onset of sedation when used intravenously (within 3-5 min), and the duration of action lasts 15-45 min. When administered IM, it produces sedation in 10-20 min and has a duration of action of 1-2 h. Dosing in children is 2-5 mg/kg/dose slow IV push, not to exceed 100 mg/dose. IM dosing is 2-6 mg/kg/dose IM, not to exceed 100 mg/dose.

Methohexital (Brevital)
Methohexital is an ultra–short-acting barbiturate. Its onset of action is less than 1 min and duration of action is about 10 min.
Induction dosing is 0.75-1 mg/kg/dose IV. Maintenance dosing is 0.5 mg/kg/dose IV q2-3min.

Thiopental (Pentothal)
This medication can be used as an induction agent for endotracheal intubation. It decreases ICP. Its onset of action is 30-40 sec, while its half-life is 3-8 h (may be prolonged with repeat doses due to accumulation in fatty tissues). Dosing is 2-5 mg/kg/dose IV for induction (no recommended initial dose due to great variability of response). Age, sex, and body weight affect dose. Larger doses (ie, mg/kg) than those used in adults and/or elderly persons are often needed.

Miscellaneous sedative-hypnotics
Induction/hypnotic agents that provide rapid loss of consciousness include nitrous oxide, ketamine, and propofol. Ketamine also provides analgesia and amnestic effects. Etomidate (Amidate), an ultra–short-acting sedative agent, is used frequently in adults for rapid sequence induction. It appears to have neuroprotective properties and minimal cardiovascular effects.

Although studies in pediatrics using etomidate are emerging and have shown efficacy, its use in pediatrics has not been fully established.

A small 2010 study compared the effects of etomidate/fentanyl versus ketamine/midazolam during orthopedic reductions in a pediatric ED. The results indicated that the incidence of adverse reactions to ketamine, including emergence phenomenon, is lower than previously thought.

Nitrous oxide
Nitrous oxide elicits anxiolytic, amnestic, and mild-to-moderate analgesia. However, the analgesic property is variable, requiring additional analgesic agents. It has little effect on the cardiovascular or respiratory system. In addition, there is minimal effect on the airway reflex. The peak onset of action occurs within 30-60 seconds and maximum effect within 5 min. Effects are rapidly lost once inhalation ceases, and recovery occurs within 5 min.

A 1:1 mixture of oxygen and nitrous oxide is administered as an inhalant via handheld mask or mouthpiece. Typically, patients are to maintain the seal to ensure adequate inhalation; once sedation is approached, the patient will lose seal and allow the mask/mouthpiece to fall.

Ketamine (Ketalar)
Ketamine is a dissociative agent that induces catalepsy. It exhibits sedative, analgesic, and amnestic properties. This agent is related to phencyclidine (PCP) and has shown a history of efficacy. It preserves the airway reflexes and has minimal effect on the respiratory drive. Ketamine has bronchodilatory effects and is especially effective with bronchospasms. In addition, it has a history of a good safety profile in children.

Following IV administration of ketamine, its peak onset is 1 min and duration of action is about 10-15 min. When administered IM, its peak onset is about 5-10 min and duration of action is 15-30 min.

Ketamine is rarely used in adults because of hypertension, dysphoria, and agitation. Ketamine in pediatric patients may (rarely) cause laryngospasm. The reaction appears to be idiosyncratic and not a function of age, dose, coadministration of anticholinergics, or other clinical variables.

Dosing is 1-1.5 mg/kg slow IV push (not to exceed 0.5 mg/kg/min). Additional doses may be administered at 0.5 mg/kg IV q10-15min (depending on response and duration of procedure). Alternatively, 4 mg/kg IM may be used; additional doses of 2-4 mg/kg may be administered (depending on response and duration of procedure).

Propofol (Diprivan)
Propofol has no relationship to either of the usual agents, benzodiazepines and barbiturates. Propofol is a purely sedative agent. It has no analgesic or amnestic properties. Initially, it was used as an induction agent in general anesthesia. However, it has been used for sedation in intubated patients in the ICU setting and in patients undergoing radiographic studies, such as CT and MRI.
Propofol has a quick onset of action because of the agent's high lipid solubility. It provides rapid onset, within 40 seconds. The duration of action is 1-3 min. Preliminary pediatric studies show the efficacy in terms of sedation and ease of use.
Monitored anesthesia care (MAC) sedation dosing is 0.5-1 mg/kg IV push infused over 2 min initially. Maintenance dosing is 0.5-1 mg/kg IV q3-5min prn or, alternatively, as a continuous IV infusion of 50-150 mcg/kg/min.