Local Anesthetics and Lipid Emulsion

YOU SHOULD BE ABLE TO

- ✓ Explain how pKa, lipid solubility, and protein binding shape onset, potency, and duration
- ✓ Convert percent to mg/mL and calculate a maximum safe dose in mg and mL
- ✓ Recognize LAST and run the ASRA checklist, including lipid emulsion 20% dosing

THE LESSON ON ONE PAGE

Properties

- pKa near 7.4 = fast onset
- Lipid solubility = potency
- Protein binding = duration
- Acidic tissue = weak block

Esters vs amides

- "i" before "-caine" = amide
- Esters: plasma cholinesterase, PABA
- Amides: liver
- Prilocaine, benzocaine: methemoglobin

Max doses

- % × 10 = mg/mL
- Lido 4.5 (300) / 7 (500) mg/kg
- Bupi 2.5 (175) / 3 (225) mg/kg
- Chloro 11 (800) / 14 (1,000) mg/kg

LAST (ASRA 2020)

- Stop, call, oxygen, benzo
- Lipid 20%: 100 mL or 1.5 mL/kg
- Then 0.25 mL/kg/min; max 12 mL/kg
- Epi under 1 mcg/kg; no vasopressin

KEY TABLES

Mechanism

ORDER LOST	FIBER	FUNCTION
1st	B (small, myelinated)	Preganglionic sympathetic
2nd	A delta and C	Pain and temperature
3rd	A beta	Touch and pressure
Last	A alpha (large, myelinated)	Motor and proprioception

Onset, potency, duration

DRUG	CLASS	PKA	PROTEIN BINDING	ONSET / DURATION
Chloroprocaine	Ester	8.7	Low	Fast / short
Tetracaine	Ester	8.5	~75%	Slow / long
Lidocaine	Amide	7.8	~65%	Fast / moderate
Mepivacaine	Amide	7.6	~75%	Fast / moderate
Bupivacaine	Amide	8.1	~95%	Slow / long
Ropivacaine	Amide	8.1	~94%	Slow / long

Esters vs amides

	ESTERS	AMIDES
Metabolism	Plasma cholinesterase (fast)	Liver, CYP450 (slower)

	ESTERS	AMIDES
Metabolite	PABA	Varies; prilocaine makes o-toluidine
Allergy	More likely (PABA)	Rare; often the methylparaben preservative
Toxicity risk up with	Atypical or low cholinesterase	Liver disease, low hepatic blood flow

BOARD TRAPS

"Propofol is a lipid, so it works as lipid rescue."

False. Propofol is only 10% lipid, so the volume needed would be huge, and it depresses the heart. Use it only in small doses for seizures in a stable patient. Give **lipid emulsion 20%**.

"Give standard ACLS epinephrine, 1 mg IV."

Not in LAST. Large epinephrine doses can worsen arrhythmias and blunt the lipid effect. ASRA prefers **small doses, under 1 mcg/kg**.

"Allergic to lidocaine, so avoid all local anesthetics."

Not true. True amide allergy is rare; reactions are often to the **methylparaben** preservative or to epinephrine. Esters and amides do not cross-react. Esters cross-react with each other through **PABA**.

"No seizure yet, so it can't be LAST."

False. With **bupivacaine**, or under general anesthesia, cardiovascular collapse can be the first sign. New arrhythmia or wide QRS after a block is LAST until proven otherwise.

MEMORY DEVICES

LAST response

LIPIDS

- **L** Lower-dose epinephrine: under 1 mcg/kg
- **I** Infuse lipid 20%: bolus, then infusion
- **P** Prevent hypoxia and acidosis: 100% oxygen
- **I** Interrupt seizures: benzodiazepine first
- **D** Don't give vasopressin, CCBs, beta blockers, or more local
- **S** Stay monitored: 2 hours after seizure, 4 to 6 after CV instability

Local anesthetic absorption, highest to lowest

Veins Take In Carefully Placed Extra Blocks, Sparing Skin

- **V** IV (intravenous)
- **T** Tracheal
- **I** Intercostal
- **C** Caudal
- **P** Paracervical
- **E** Epidural
- **B** Brachial plexus
- **S** Sciatic and femoral
- **S** Subcutaneous

Maximum local anesthetic doses (mg/kg)

4.5 and 7, 2.5 and 3, 3, 11 and 14

- **4.5 / 7** Lidocaine: 4.5 plain, 7 with epinephrine
- **2.5 / 3** Bupivacaine: 2.5 plain, 3 with epinephrine
- **3** Ropivacaine: 3
- **11 / 14** Chloroprocaine: 11 plain, 14 with epinephrine

Esters vs amides

Amides have two i's

- **Two i** Amides (lidocaine, bupivacaine, ropivacaine, mepivacaine): liver metabolism, allergy very rare
- **One i** Esters (chloroprocaine, tetracaine, procaine, benzocaine): plasma cholinesterase, PABA allergy