

RESEARCH MONOGRAPH . COMPOUND PROFILE

Ropivacaine

The (S)-propyl analog of bupivacaine and mepivacaine, marketed as Naropin, with reduced cardiotoxicity and motor-sparing sensory block profile.

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ABSTRACT

Ropivacaine ((S)-1-propyl-N-(2,6-dimethylphenyl)piperidine-2-carboxamide; CAS 84057-95-4; molecular formula C₁₇H₂₆N₂O; molecular weight 274.40) is an amide local anesthetic developed at AB Astra in the 1990s and approved by the FDA in 1996 (Naropin). The compound is structurally intermediate between mepivacaine (propyl chain, racemic) and bupivacaine (butyl chain, racemic): ropivacaine carries the propyl substituent like mepivacaine but is sold as a single (S)-enantiomer. The shorter alkyl chain reduces lipid solubility relative to bupivacaine, contributing to a less profound motor block at concentrations producing equivalent sensory block (the so-called motor-sparing property exploited in obstetric epidural analgesia and ambulatory regional anesthesia). The (S)-enantiomer purity confers a cardiotoxicity profile favorable to racemic bupivacaine, similar in magnitude to the levobupivacaine advantage. Mechanism is voltage-gated sodium channel block with state-dependent kinetics. Onset is 5 to 15 minutes for infiltration and peripheral nerve block; duration is 3 to 6 hours, generally somewhat shorter than bupivacaine at equivalent doses. Maximum recommended dose is 3 mg/kg, with cumulative doses up to 770 mg/24 hours documented in continuous epidural analgesia. The motor-sparing profile drives ropivacaine selection in obstetric epidural at low concentrations (0.0625 to 0.125 percent) where ambulation during labor is desired, and in ambulatory peripheral nerve block where motor function recovery before discharge is operationally important. Lipid emulsion rescue applies to any LAST event with ropivacaine as for other long-acting amides.

1. Compound Identification

Ropivacaine is described as amide local anesthetic (s-enantiomer propyl analog). The (S)-propyl analog of bupivacaine and mepivacaine, marketed as Naropin, with reduced cardiotoxicity and motor-sparing sensory block profile.

1.1 Class summary

Amide local anesthetic (S-enantiomer propyl analog)

1.2 Subtitle

The (S)-propyl analog of bupivacaine and mepivacaine, marketed as Naropin, with reduced cardiotoxicity and motor-sparing sensory block profile.

2. Abstract

Ropivacaine ((S)-1-propyl-N-(2,6-dimethylphenyl)piperidine-2-carboxamide; CAS 84057-95-4; molecular formula C₁₇H₂₆N₂O; molecular weight 274.40) is an amide local anesthetic developed at AB Astra in the 1990s and approved by the FDA in 1996 (Naropin). The compound is structurally intermediate between mepivacaine (propyl chain, racemic) and bupivacaine (butyl chain, racemic): ropivacaine carries the propyl substituent like mepivacaine but is sold as a single (S)-enantiomer. The shorter alkyl chain reduces lipid solubility relative to bupivacaine, contributing to a less profound motor block at concentrations producing equivalent sensory block (the so-called motor-sparing property exploited in obstetric epidural analgesia and ambulatory regional anesthesia). The (S)-enantiomer purity confers a cardiotoxicity profile favorable to racemic bupivacaine, similar in magnitude to the levobupivacaine advantage. Mechanism is voltage-gated sodium channel block with state-dependent kinetics. Onset is 5 to 15 minutes for infiltration and peripheral nerve block; duration is 3 to 6 hours, generally somewhat shorter than bupivacaine at equivalent doses. Maximum recommended dose is 3 mg/kg, with cumulative doses up to 770 mg/24 hours documented in continuous epidural analgesia. The motor-sparing profile drives ropivacaine selection in obstetric epidural at low concentrations (0.0625 to 0.125 percent) where ambulation during labor is desired, and in ambulatory peripheral nerve block where motor function recovery before discharge is operationally important. Lipid emulsion rescue applies to any LAST event with ropivacaine as for other long-acting amides.

3. Mechanism of Action

Voltage-gated sodium channel block, state-dependent. Reduced lipid solubility versus bupivacaine drives motor-sparing sensory block characteristic.

The mechanistic profile described above represents the consensus position from peer-reviewed literature where available; for compounds with sparse formal characterization, this section reflects vendor-grade reports and structurally-related class pharmacology and should be interpreted with appropriate caution.

4. Pharmacokinetics and Routes of Administration

Pharmacokinetic data are summarized within the abstract for compounds with formal Phase 1 records. Compounds without published human pharmacokinetic studies are noted as such; investigators should treat the absence of data as a research limitation.

5. Reported Research Dose Ranges

Up to 3 mg/kg. Epidural 75 to 150 mg, peripheral nerve block 75 to 300 mg, obstetric labor analgesia 0.0625 to 0.2 percent infusion.

Doses are scaled from clinical use where the compound is approved as a medicine, from Phase 2/3 trials where development advanced, or from rodent dose-response data scaled by allometric assumptions where the compound has no human clinical record. Investigators should treat dose ranges from research-chemical-grade vendors as starting points for their own pharmacokinetic and tolerability characterization rather than validated dosing recommendations.

6. Sourcing and Quality Verification

Investigators should obtain analytical confirmation of identity (mass spectrometry; for peptides, additionally amino acid analysis or N-terminal sequencing) and purity (HPLC area-percent, ideally greater than 95 percent) on every lot. Vendor certificates of analysis vary in quality; third-party analytical confirmation through independent laboratories (e.g., Janoshik Analytical, Anabolic Lab) is the gold standard for research-grade peptides and small molecules.

For compounds with established pharmaceutical-grade marketing in any jurisdiction, sourcing from the marketed product (where legal and accessible) provides the highest quality assurance.

7. Reconstitution and Handling

Peptides should be reconstituted in bacteriostatic water or sterile water for injection in the volume appropriate to the desired concentration; lyophilized peptides should be allowed to come to room temperature before reconstitution to minimize precipitation. Reconstituted peptides should be stored refrigerated and used within the timeframe specified by the manufacturer (typically 14 to 30 days for bacteriostatic water reconstitutions, shorter for sterile water).

Small molecules: storage conditions vary by compound; consult the certificate of analysis for the specific product. Most are stable at room temperature in dry, dark conditions; oxidation-sensitive compounds (e.g., catecholamine precursors) require cool storage and protection from light.

8. Stack Interaction Considerations

Investigators combining this compound with other research substances should consider receptor-level interactions (additive effects at shared targets), enzyme-level interactions (CYP-mediated drug-drug interactions where applicable), and pharmacodynamic interactions (additive sedation, additive serotonergic activity, additive hemodynamic effects).

The stack interaction section in published monographs of well-characterized compounds is necessarily incomplete for any specific combination; investigators should treat novel combinations with elevated caution and titrate gradually.

9. References

1. Markham A, Faulds D. Ropivacaine: a review. *Drugs* 1996.
2. Hansen TG. Ropivacaine: a pharmacological review. *Expert Rev Neurother* 2004.
3. Knudsen K, et al. CNS and cardiovascular effects of i.v. infusions of ropivacaine, bupivacaine and placebo. *Br J Anaesth* 1997.

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