

RESEARCH MONOGRAPH . COMPOUND PROFILE

Desflurane

The fully fluorinated successor to isoflurane with the lowest blood-gas coefficient of any clinical volatile, enabling the fastest induction and emergence in the class.

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ABSTRACT

Desflurane (1,2,2,2-tetrafluoroethyl difluoromethyl ether; CAS 57041-67-5; molecular formula $C_3H_2F_6O$; molecular weight 168.04) is a fully fluorinated methyl ethyl ether developed by Ross Terrell at Anaquest in the 1980s and approved by the FDA in 1992 (Suprane). The minimum alveolar concentration (MAC) at age 40 is 6.0 percent in oxygen, the highest of the clinical volatile anesthetics; the blood-gas partition coefficient is 0.42, the lowest in the class, producing the fastest induction and emergence kinetics among approved inhalational agents. The high vapor pressure (664 mmHg at 20 degrees Celsius, near the boiling point of 23 degrees Celsius) requires a heated, pressurized vaporizer (Tec 6 or equivalent) rather than the variable-bypass design used for isoflurane and sevoflurane. Mechanism is the standard halogenated ether profile: GABA-A positive allosteric modulation, K2P channel activation, glycine and NMDA modulation. Hepatic metabolism is minimal (less than 0.02 percent of an absorbed dose), the lowest among inhalational anesthetics, virtually eliminating fluoride-related nephrotoxicity and trifluoroacetylated hepatotoxicity. The principal clinical limitations are airway irritation that precludes inhalational induction (coughing, breath-holding, laryngospasm at concentrations above 6 percent in non-anesthetized patients) and sympathetic stimulation with rapid concentration increases producing transient tachycardia and hypertension. The high MAC and high vapor pressure make desflurane the most expensive volatile per case at typical fresh gas flows, though low-flow techniques mitigate cost. Environmental concerns about high global warming potential (GWP100 approximately 2540 versus

130 for sevoflurane and 510 for isoflurane) have driven institutional restrictions on desflurane use in several health systems.

1. Compound Identification

Desflurane is described as halogenated ether volatile general anesthetic. The fully fluorinated successor to isoflurane with the lowest blood-gas coefficient of any clinical volatile, enabling the fastest induction and emergence in the class.

1.1 Class summary

Halogenated ether volatile general anesthetic

1.2 Subtitle

The fully fluorinated successor to isoflurane with the lowest blood-gas coefficient of any clinical volatile, enabling the fastest induction and emergence in the class.

2. Abstract

Desflurane (1,2,2,2-tetrafluoroethyl difluoromethyl ether; CAS 57041-67-5; molecular formula $C_3H_2F_6O$; molecular weight 168.04) is a fully fluorinated methyl ethyl ether developed by Ross Terrell at Anaquest in the 1980s and approved by the FDA in 1992 (Suprane). The minimum alveolar concentration (MAC) at age 40 is 6.0 percent in oxygen, the highest of the clinical volatile anesthetics; the blood-gas partition coefficient is 0.42, the lowest in the class, producing the fastest induction and emergence kinetics among approved inhalational agents. The high vapor pressure (664 mmHg at 20 degrees Celsius, near the boiling point of 23 degrees Celsius) requires a heated, pressurized vaporizer (Tec 6 or equivalent) rather than the variable-bypass design used for isoflurane and sevoflurane. Mechanism is the standard halogenated ether profile: GABA-A positive allosteric modulation, K2P channel activation, glycine and NMDA modulation. Hepatic metabolism is minimal (less than 0.02 percent of an absorbed dose), the lowest among inhalational anesthetics, virtually eliminating fluoride-related nephrotoxicity and trifluoroacetylated hepatotoxicity. The principal clinical limitations are airway irritation that precludes inhalational induction (coughing, breath-holding, laryngospasm at concentrations above 6 percent in non-anesthetized patients) and sympathetic stimulation with rapid concentration increases producing transient tachycardia and hypertension. The high MAC and high vapor pressure make desflurane the most expensive volatile per case at typical fresh gas flows, though low-flow techniques mitigate cost. Environmental concerns about high global warming potential (GWP100 approximately 2540 versus 130 for sevoflurane and 510 for isoflurane) have driven institutional restrictions on desflurane use in several health systems.

3. Mechanism of Action

Standard halogenated ether profile (GABA-A, K2P, glycine, NMDA). Minimal hepatic metabolism distinguishes it from older agents.

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

MAC 6.0 percent in oxygen at age 40; clinical maintenance 4 to 7 percent end-tidal.

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. Eger EI 2nd. Pharmacokinetics of desflurane. Anesth Analg 1992.
2. Jones RM. Desflurane and sevoflurane: inhalation anaesthetics for this decade? Br J Anaesth 1990.
3. Sulbaek Andersen MP, et al. Inhalation anaesthetics and climate change. Br J Anaesth 2010.
4. Ebert TJ, Muzi M. Sympathetic hyperactivity during desflurane anesthesia in healthy volunteers. Anesthesiology 1993.

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