



Electroencephalogram Indices for Clinical Endpoints during Propofol Anesthesia in Young Toddlers



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BACKGROUND

- Propofol lacks a **biomarker** for its brain effect site concentration (C_e).
- Electroencephalogram (EEG) can serve as a biomarker of anesthetic depth in adults and older children, but proprietary EEG indices are not validated in **younger children**.
- EEG spectral edge frequency (SEF95)**, a non-proprietary EEG parameter, can serve as a potential biomarker for propofol anesthesia in young toddlers.

OBJECTIVES

- Determine the SEF95 ranges for three endpoints of anesthetic depth (consciousness-pacifier placement, pain-electrical nerve stimulation, and intubation-laryngoscopy).
- Determine the correlation between SEF95 and steady state propofol plasma concentration.
- Identify responses during laryngoscopy under propofol anesthesia.

METHODS

- Prospective interventional study in toddlers (13-24mo).
- Dixon's Up-Down method was used to set target SEF95 for each clinical endpoint for each patient.
- Centered isotonic regression determined the dose-response function of SEF95 where 50% and 90% of patients (ED50 and 10) did not respond to the stimulus.
- Linear regression determined correlation of propofol plasma concentration and SEF95.

RESULTS

Figure 1. Dixon's Up-Down Method for SEF95 at Target Points

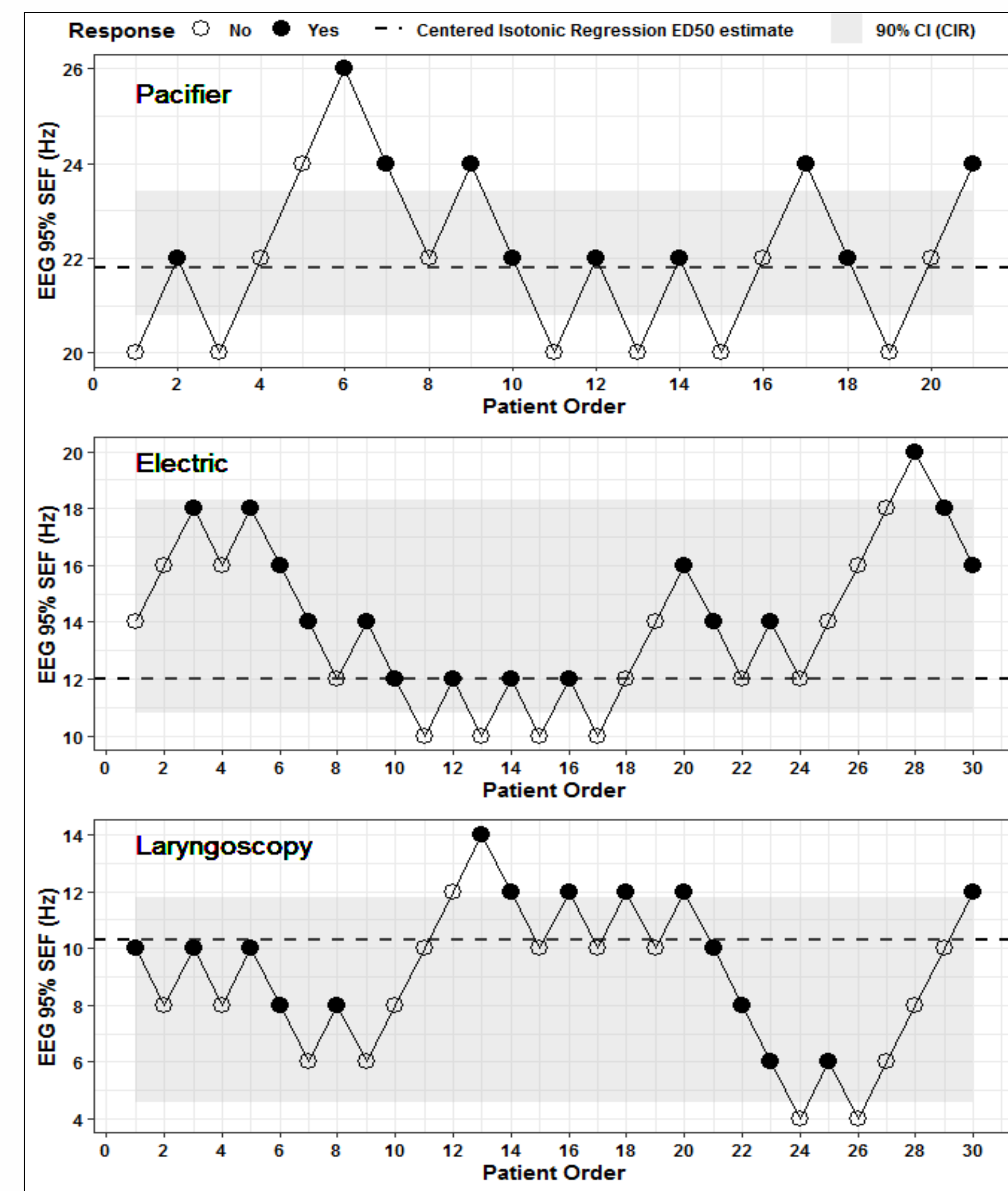


Figure 2. Centered Isotonic Regression with Adaptive Shrinkage

Effective dose for SEF95 estimated using Centered Isotonic Regression			
Stimuli	CIR ED50 estimate (90% CI)	CIR ED10 estimate (90% CI)	CIR ED90 estimate (90% CI)
Pacifier	21.8 (20.8, 23.4)	20.3 (19.1, 20.7)	24.9 (24.2, 29.6)
Electrical	12 (10.8, 18.3)	10.4 (8.7, 11.3)	19.1 (18, 23.1)
Laryngoscopy	10.3 (4.6, 11.8)	4.4 (1.5, 5.4)	12.7 (12.2, 17.7)

Figure 3. Airway responses during initial laryngoscopy attempt

	Overall	Yes	No	p
Response to Laryngoscopy	30	15	15	
Response to jaw thrust	13 (68.4)	11 (91.7)	2 (28.6)	0.019
Vocal cords open	21 (77.8)	8 (61.5)	13 (92.9)	0.136
Intubated on first attempt	16 (59.3)	5 (33.3)	11 (91.7)	0.008
Cough during tube placement	14 (53.8)	8 (61.5)	6 (46.2)	0.694

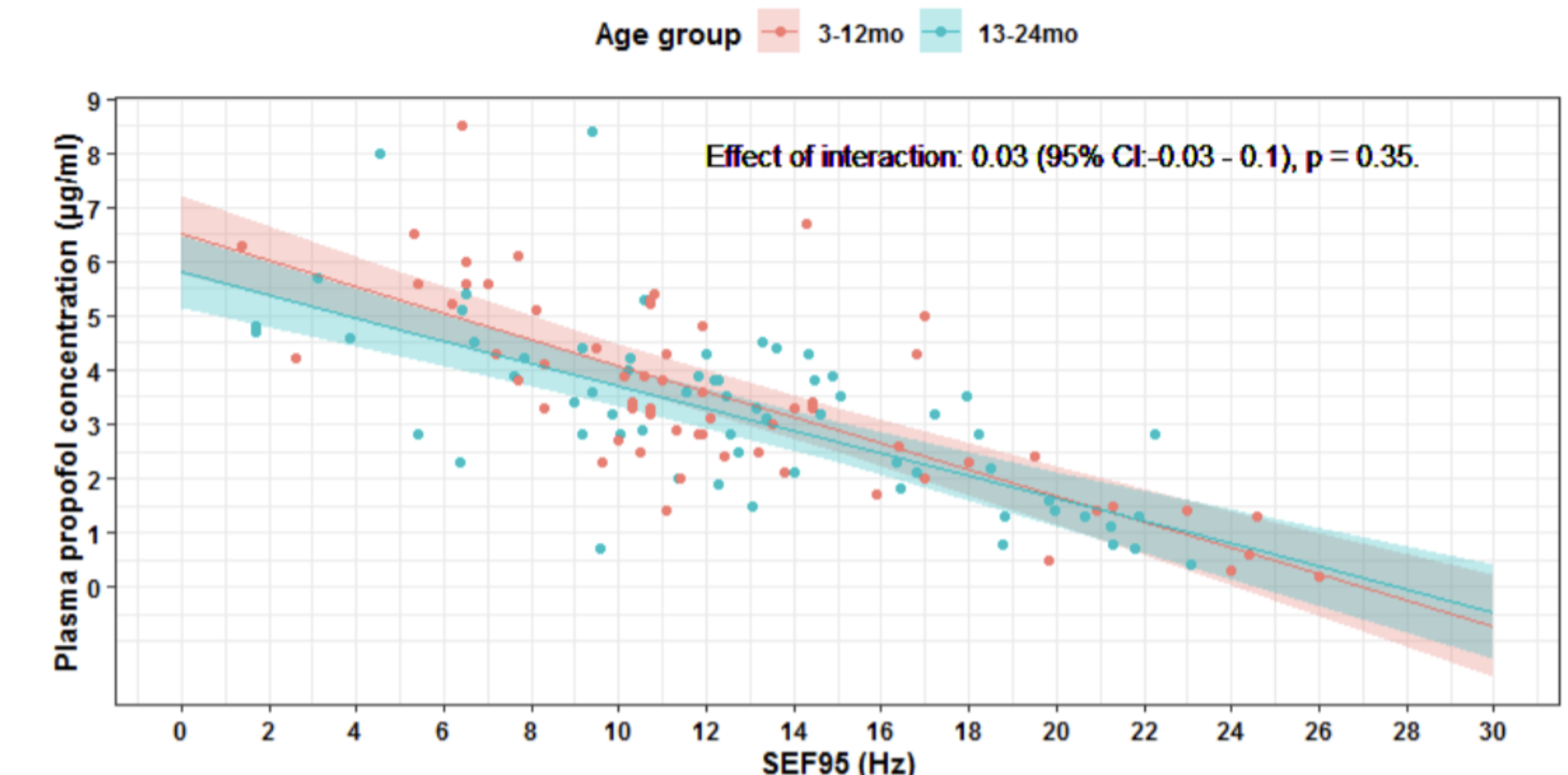
DISCUSSION

- Young toddlers exhibited **similar SEF95** targets compared to the younger infants (3–12 months) for the same stimuli.
- Associations between **SEF95 and propofol concentration** were similar across both age groups.
- A **positive laryngoscopy** response was associated with positive jaw thrust and lower first-attempt intubation success.

CONCLUSIONS & IMPLICATIONS FOR PRACTICE

- In young toddlers, EEG SEF95 can be used as a reliable **biomarker** for assessing propofol anesthesia depth.
- EEG guidance may provide **individualized** anesthetic dosing and potentially improve **patient safety**.

Figure 4. Correlation of Plasma Propofol Concentration and SEF95



REFERENCES

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- Yuan I, Garcia-Marcinkiewicz A, et al. Electroencephalographic Indices for Clinical Endpoints during Propofol Anesthesia in Infants: An Early-phase Propofol Biomarker-finding Study. Anesthesiology. 2024;141:353–364.