Anesthetic toxicity in the pediatric brain

Greg Stratmann, UCSF
Outline

• Does it happen in humans?

• Implications for my practice

Outline

Does it happen in humans?

• Yes (maybe): Wilder, Kalkman, DiMaggio, DiMaggio

• No: Sprung, Hansen, Bartels, DiMaggio

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• Human literature controversial. Animal literature clearer. What to believe?

• Scepticism far more comfortable than credulity

• Why wouldn’t anesthesia cause ill effects in infants? (Nature, nurture)

Hypothesis

• Environmental enrichment rescues function.

Methods

P7 male Sprague Dawley rats (n=100)

Control (n=50)
4h maternal separation, FiO2=0.5

Sevoflurane (n=50)
4h, 1 MAC (Clamp 50%) FiO2=0.5

3 weeks (P28)

Regular housing (n=17)
Environmental Enrichment (n=18)

5 weeks (P63)

Regular housing (n=20)
Environmental Enrichment (n=18)

Fear conditioning, Working memory, Short term memory, Long term memory
Results

• Sevoflurane impairs spatial short term memory.

• Environmental enrichment rescues function.
Conclusion

• In rats, anesthesia-induced neurocognitive dysfunction is treatable.

• In rats, a lifestyle change long after anesthesia trumps anesthetic exposure.

Implications for your practice - some quotes

• “Surgery might be the problem, not anesthesia”
• “Don’t waste time under anesthesia” (What duration of anesthesia is safe?)
• “Delay elective surgery if possible” (Until when? What is the vulnerable period?)
• “Do not use mixed agents” (Equipotency)
• “Avoid multiple anesthetics”

Results

• Sevoflurane impairs spatial working memory.

• Environmental enrichment rescues function.

• Tissue trauma adds nothing to anesthesia-induced deficit.
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Implications for your practice - some quotes
- “Surgery might be the problem, not anesthesia”
- “Don’t waste time under anesthesia” (What duration of anesthesia is safe?)
- “Delay elective surgery if possible” (Until when? What is the vulnerable period?)
- “Do not use mixed agents” (Equipotency)
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Implications for your practice - Unanswered questions
- Does it happen in humans? (Smart Tots, Panda, GAS)
- Can it be prevented?
- Can it be treated?
- What is the safest anesthetic?

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What I really think