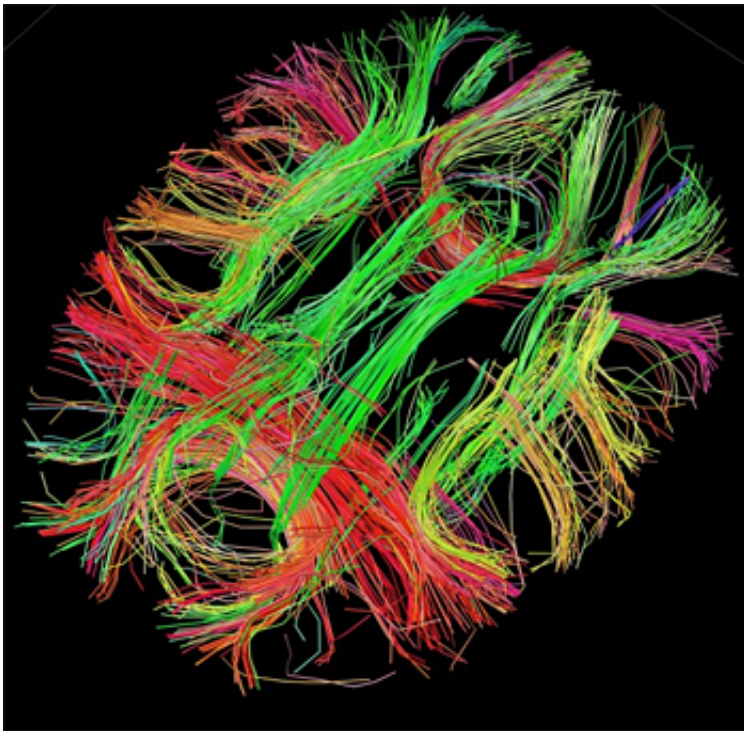


Surgical anesthesia in young children linked to effects on IQ, brain structure

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White matter fiber architecture of the brain. Credit: Human Connectome Project.

Children who received general anesthesia for surgery before age 4 had diminished language comprehension, lower IQ and decreased gray matter density in posterior regions of their brain, according to a new study in the journal *Pediatrics*.

Researchers from Cincinnati Children's Hospital Medical Center report their findings in the journal's June 8 online edition. The authors recommend additional studies to determine anesthesia's precise molecular effects on the brain and contribution to diminished brain function and composition. Researchers say this knowledge could make it possible to develop mitigating strategies for what the authors describe as a potential dilemma for child health.

"The ultimate goal of our laboratory and clinical research is to improve safety and outcomes in [young children](#) who have no choice but to undergo surgery with anesthesia to treat their serious health concerns," said Andreas Loepke, MD, PhD, FAAP, lead study author and an anesthesiologist in the Department of Anesthesiology at Cincinnati Children's. "We also have to better understand to what extent anesthetics and other factors contribute to learning abnormalities in [children](#) before making drastic changes to our current practice, which by all measures has become very safe."

Loepke and his research colleagues have published previous studies showing widespread cell death, permanent deletion of neurons and neurocognitive impairment in [laboratory rats](#) and mice after exposure to [general anesthesia](#). Those studies have raised concerns about similar effects in young children during a particularly sensitive neurodevelopmental period in early life, which researchers say could interfere with the refinement of neuronal networks and lead to long-term functional abnormalities.

For their current retrospective study, the authors compared the scores of 53 healthy participants of a language development study (ages 5 to 18 years with no history of surgery) with the scores of 53 children in the same age range who had undergone surgery before the age of 4.

The authors stress that average test scores for all 106 children in the

study were within population norms, regardless of surgical history. Still, compared with children who had not undergone surgery, children exposed to anesthesia scored significantly lower in listening comprehension and performance IQ. Researchers also report that decreased language and IQ scores were associated with lower gray matter density in the occipital cortex and cerebellum of the brain.

Researchers, who used extensive analysis of surgical and other medical records, said the children were matched for age, gender, handedness and socioeconomic status - all confounding factors of cognition and brain structure. The authors also factored into their calculations the types of surgeries and length of exposure to anesthetics. The anesthetics used during the surgeries included common agents such as sevoflurane, isoflurane or halothane (used alone or in combination) and nitrous oxide.

Children included in the study did not have a history of neurologic or psychological illness, head trauma or any other associated conditions. Neurocognitive assessments included the Oral and Written Language Scales and the Wechsler Intelligence Scale. Brain structural comparisons were conducted by MRI scans.

Estimated Social Cost

Extending their study a step beyond the medical data, the research team also considered the potential societal impact of their findings. Earlier research from 2008 had estimated the loss of 1 IQ point to decrease a person's lifetime earnings potential by \$18,000. Factoring in the potential loss of 5 or 6 IQ points found in their current study, the researchers report that, based on the estimated 6 million children who undergo surgery in the United States each year the lifetime potential earnings loss could total \$540 billion.

Emphasis on Safety

Although data in the current study highlight the need to look for improved methods of administering anesthesia, Loepke and his colleagues emphasize that current methods are very safe. Loepke advises parents who are concerned to discuss with their pediatrician and surgeon the risks of a surgical procedure - and the potential risk of anesthetic exposure - versus the risks of not having a surgery.

"It is important to note that no surgeries are truly elective in young children," Loepke said. "Many surgical procedures early in life treat life-threatening conditions, avert serious health complications, or improve quality of life. These cannot be easily postponed or avoided."

Loepke also stressed that researchers at Cincinnati Children's are actively looking for alternative anesthetic techniques in their ongoing laboratory studies. Drugs are being tested that show potential for lessening the harmful effects of anesthetics in laboratory rats and mice, and this research is ongoing. Additionally, the medical center is participating in an international clinical trial to test an alternative anesthetic regimen in young children undergoing urological procedures.

Provided by Cincinnati Children's Hospital Medical Center

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