

Perioperatively Inhaled Hydrogen Gas Diminishes Neurologic Injury Following Experimental Circulatory Arrest in Swine (2019)

Background/why this study: Newborns with severe congenital heart disease often need major heart surgery that requires stopping their circulation temporarily (using a heart-lung bypass machine). This can starve the brain and other organs of blood/oxygen, causing brain injury — one of the most feared complications in these babies.

What they did:

- Researchers used baby pigs (piglets) as a stand-in for human newborns, since pig brains are similar in size and development.
- They put the piglets through a period of "circulatory arrest" (blood flow stopped, mildly cooled) — mimicking what happens during complex neonatal heart surgery.
- One group breathed regular ventilator gas; the other group breathed the same gas mixed with **a small amount (2.4%) of hydrogen gas**, before and after the circulatory arrest.
- They then compared the two groups on brain injury, kidney function, and heart performance.

Key Findings

- **Brain protection** — Pigs that breathed hydrogen gas had: Better neurological function scores after surgery. Lower blood markers of brain damage. Smaller areas of brain injury visible on imaging (MRI). Less brain tissue damage seen under the microscope. Kidney protection — Hydrogen-treated pigs also had lower creatinine levels (a marker of kidney stress/damage), suggesting the gas may protect kidneys too.
- **Heart function** — No meaningful difference between the two groups in heart-related measures (like blood oxygen saturation) — hydrogen didn't seem to help or hurt the heart specifically.
- **Safety** — Delivering hydrogen gas through a standard ventilator appeared safe, with no adverse effects reported in the treated group during the study.
- **Notably**, in the control group (no hydrogen), 2 piglets died from severe, hard-to-control seizures before the study's day-3 endpoint — the hydrogen group had no such deaths.

Why it matters

- This adds to evidence that inhaled hydrogen gas — a simple, low-cost gas — could be a practical way to protect the brain (and possibly kidneys) during high-risk surgeries where blood flow to the body is intentionally stopped.
- Because it can be added directly into a standard ventilator circuit, it could be relatively easy to fit into existing hospital procedures without needing special new equipment.
- The authors suggest potential future uses beyond neonatal heart surgery: cardiac arrest, ECMO/life support, heart attacks, stroke, and organ transplants — anywhere blood flow is cut off and then restored.

Limitations to keep in mind

- Small study — only a handful of animals per group, so rarer side effects might not have been caught. The authors specifically call for a larger, dedicated safety study.
- Animal model, not humans — pigs, not people. Results are promising but need to be confirmed in human trials before this becomes real clinical practice.

To Read The Full Study Please Click Here

