

When Model-Based Expectations Mask Pathology: Cerebral Abscessation in a Fontan Sheep

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Background

- Large-animal surgical models frequently require serial anesthesia and invasive monitoring, increasing cumulative risk for perioperative complications, including infection.
- Fontan physiology predisposes animals to altered cerebral perfusion, venous congestion, and thromboembolic events.¹
- Because physiologic alterations can produce nonspecific neurologic signs, **expected Fontan-associated sequelae may mimic unrelated pathology**, complicating diagnosis of incidental neurologic disease.

Fontan Circulation Overview

- Single-ventricle palliation routing systemic venous return directly to pulmonary arteries.
- Passive pulmonary blood flow → chronically elevated CVP, reduced cardiac output, susceptibility to venous congestion.
- Neurologic sequelae in Fontan patients can include altered mentation, ataxia, seizures due to chronic hypoperfusion.



Image 1: Gigi was born on site; pictured at 1d old

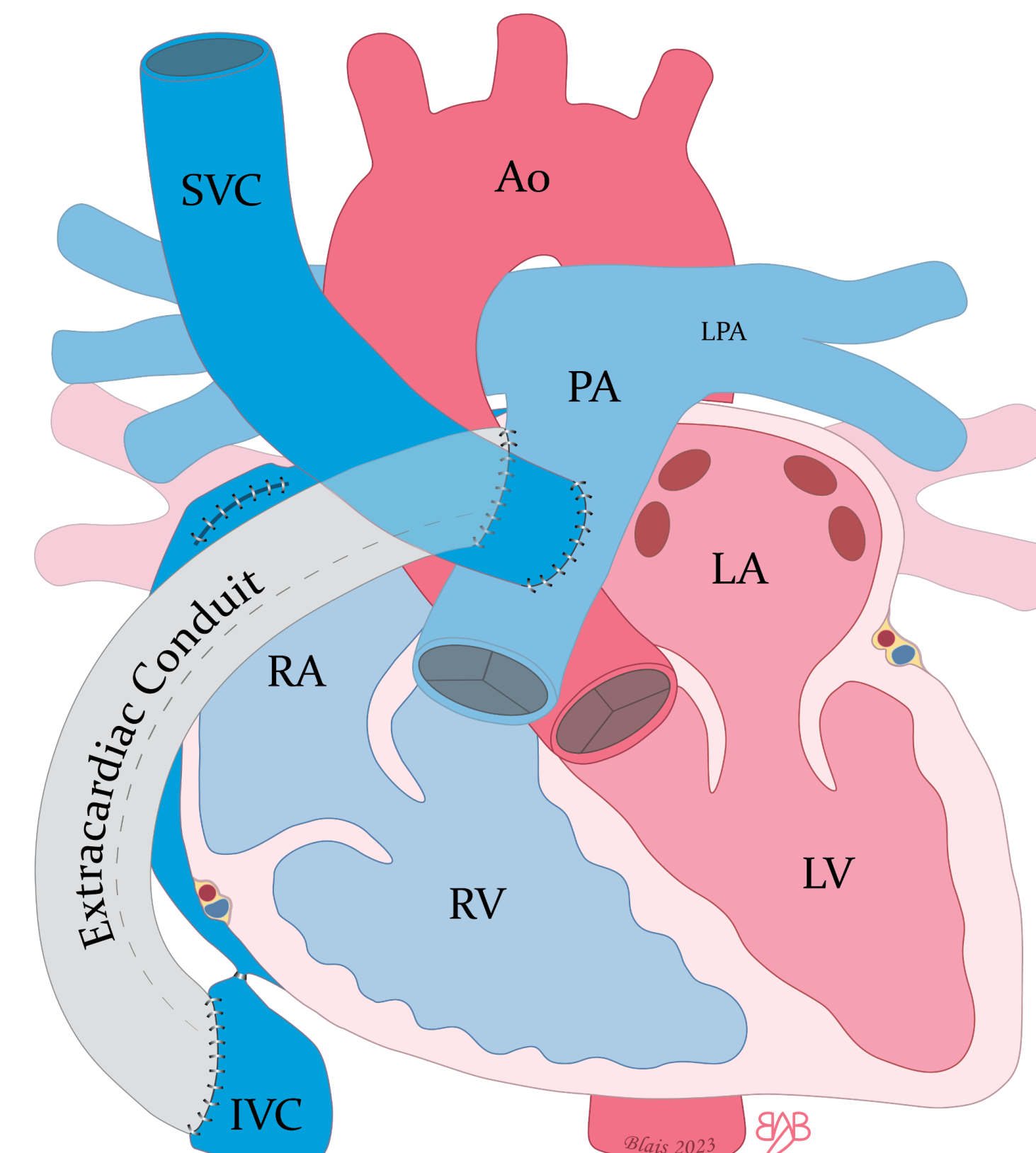
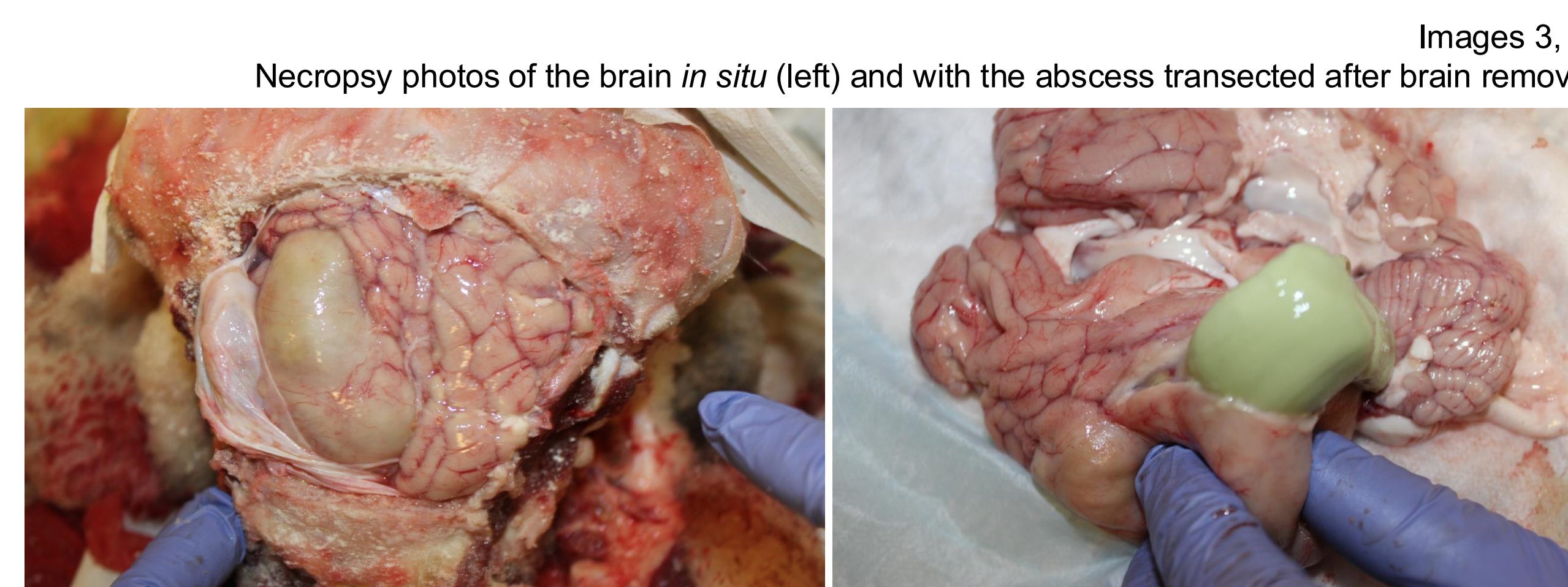


Image 2 – Extracardiac Conduit:
A vascular implant connects the inferior vena cava (IVC) directly to the pulmonary artery (PA), allowing deoxygenated blood from the lower body to reach the lungs without entering the hypoplastic ventricle.

Case Description

- Gigi, a F Suffolk/Dorset lamb born Dec. 2022, underwent carotid telemetry implantation at 3 months of age, followed by Fontan surgery in early 2023.
- Over subsequent months, she underwent fluoroscopy, ultrasound, MRI, and serial venipuncture per study design.
- Jan. 2024: Gigi was less interactive, separated from the herd, and had mild intermittent nystagmus.
- Diagnostics were unremarkable, including clinicopathologic data, radiographs, and blood gas analysis.
- Neurologic signs progressed to circling, head pressing, and ataxia. Multimodal analgesia was given for discomfort.
- Neurological signs progressed to cluster seizures refractory to midazolam and phenobarbital; euthanasia was performed.
- Necropsy revealed:
 - Normal, intact extracardiac conduit
 - No presence of thrombi
 - No evidence of hypoxic-ischemic injury
 - **6 x 3cm cerebral abscess in left parietal lobe**, ~60mL caseous material cultured as *Fusobacterium*



Images 3, 4:
Necropsy photos of the brain *in situ* (left) and with the abscess transected after brain removal

Discussion

- Hypoxic–ischemic brain injury and progressive neurocognitive impairment are well characterized in human Fontan patients.³ In the animal Fontan model, multi-organ sequela can develop as early as 6 months post-operatively.¹
- Serial invasive procedures increase cumulative risk of bacteremia⁴ and immunomodulatory stress.²
- ***Fusobacterium* is a commensal anaerobe of the oral and gastrointestinal mucosa** and a known pathogen in ovine footrot, providing multiple potential portals for bacteremia.
- Hematogenous spread establishes **large, insidious abscesses in poorly perfused or congested tissues**, indicating that Fontan physiology may have exacerbated the clinical presentation.

Implications for Complex Large Animal Surgical Models

- Experimental timelines **must balance data collection needs, animal welfare, and cumulative anesthetic risk.**
- A complete necropsy can distinguish expected physiologic sequelae from incidental disease, essential for data integrity.
- This case underscores the need for **rigorous perioperative asepsis and minimization of anesthetic frequency.**

References

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