The Neonatal Göttingen Minipig Model for Dose Precision in Perinatal Asphyxia and Therapeutic Hypothermia

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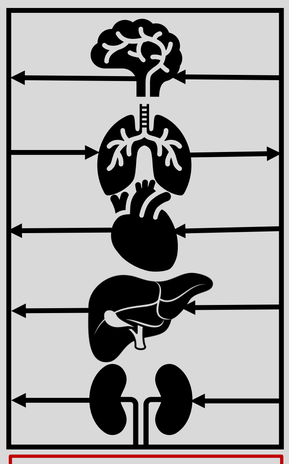
Introduction

Perinatal asphyxia (PA) → **Therapeutic Hypothermia (TH)**: cooling core body temperature (T°) at 33.5°C for 72h → Decreased body T° slows metabolic rate, preventing further **brain damage**

Physiology-Based Pharmacokinetic (PBPK) cooling framework as integrative predictive model in **neonates**



Investigation of TH and systemic hypoxia on **pharmacokinetics (PK)** in **neonatal Göttingen Minipigs**

Add-on drug treatment:
Fentanyl
Midazolam
Topiramate
Phenobarbital

We hypothesized that **TH and PA** have an impact on CYP-mediated drug disposition. Because TH and PA cannot be studied separately in the clinical context, we used the **neonatal Göttingen Minipig** as translational model.

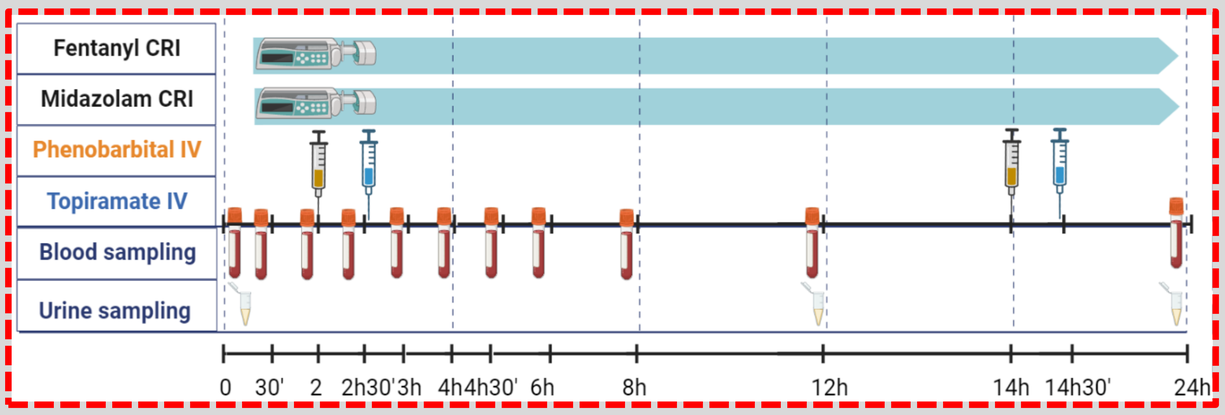
Methods

Control (n=6): Normothermia (38 - 39.5 °C) & Normoxia (21% Oxygen)

Therapeutic hypothermia (n=6): Cooling treatment (33.5°C) & Normoxia (21% Oxygen)

Hypoxia (n=6): Hypoxia (15% Oxygen for ~1h) & Normothermia (38 - 39.5°C)

Hypoxia + Hypothermia (n=6): (15% Oxygen for ~1h) & Cooling treatment (33.5°C)



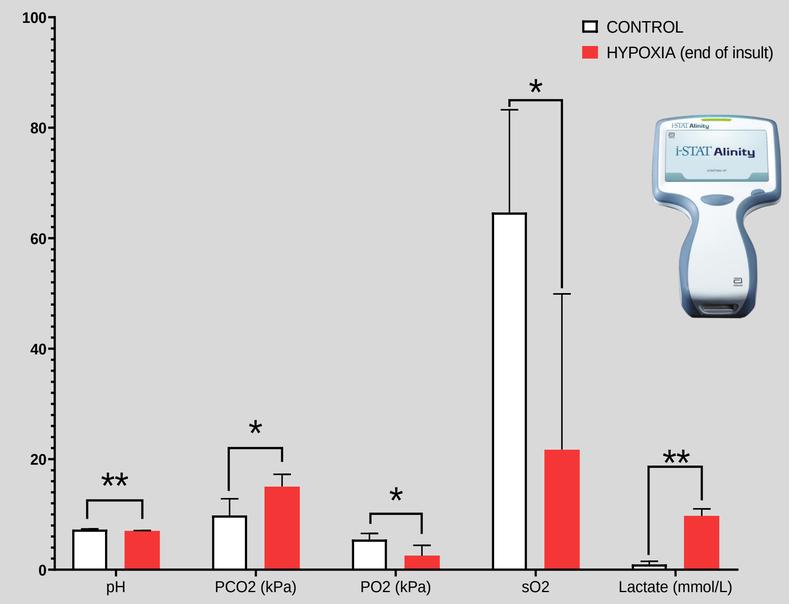
- **Hypoxia** was induced with **a low oxygen gas** mix (15% oxygen and 85% nitrogen), or by combining the gas mix with **asphyxia**, performing the ETT occlusion, for seven min.

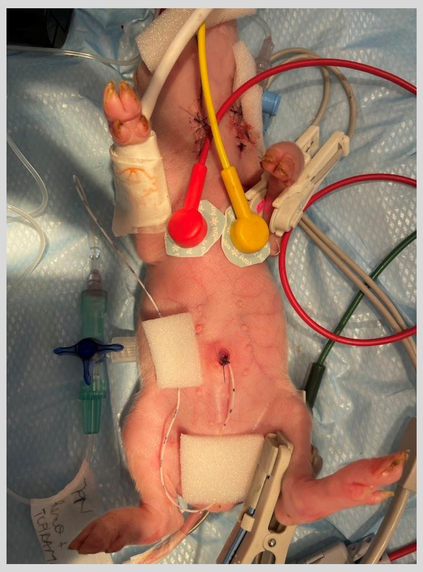
Conclusions

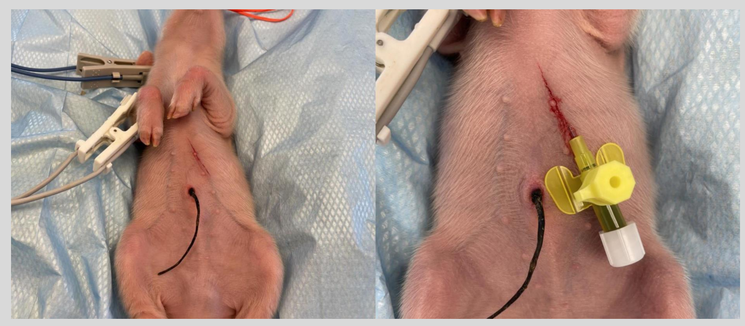
- We showed that **systemic hypoxia** can be induced in **the neonatal Göttingen Minipig**, in a setting comparable to human **NICU,** and the effects of **hypoxia** and **TH on drug disposition** can be studied separately, **for 24h**.
- These data reveal the potential of the neonatal Göttingen Minipig as **promising in vivo animal model** in safety assessment for conditions for the human pediatric population.

Results

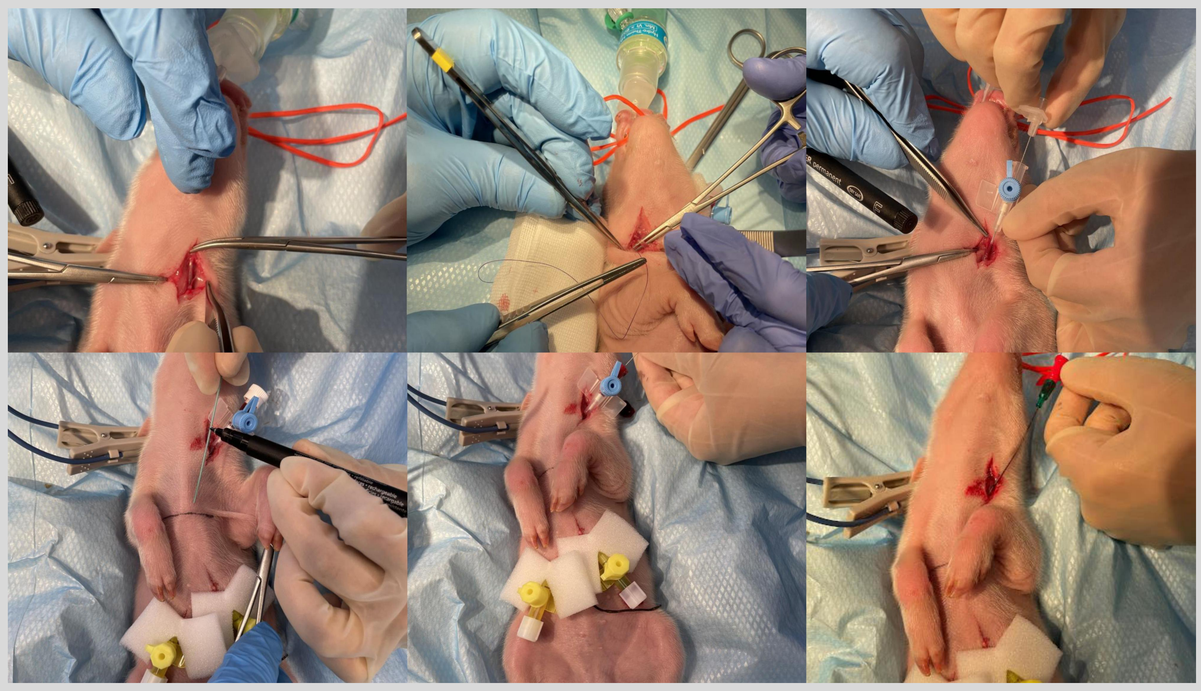
Study procedures were well tolerated for **24h** in **24 neonatal Göttingen Minipigs** of **551.12g (± 60.32g)**. **TH** was easy to control and to maintain at a target rectal temperature of **33.5°C**. **Hypoxia** could be established for **51 (±34.82) min**. **Increased** blood **lactate 9.56 (±2.27) mmol/L** and **decreased pH 7.00 (±0.16)** were used as biochemical biomarkers in the hypoxia assessment.







- **Peripheral catheterization** was easiest in the **epigastric vein,** whereas catheterization of the **umbilical vein** depended on whether the umbilical cord was still wet or not.
- **Central venous catheterization via Modified Seldinger technique, showed to be the main method for vascular access, either for sampling or administration.**



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