Ex-vivo Uterine Environment Therapy

Research overview

Despite significant advances in perinatal medicine, the past decade has seen only modest improvements in the outcomes for extremely preterm infants; those born at or below 25 weeks of gestation. We have suggested that rather than trying to force pulmonary oxygenation on the structurally and functionally immature fetal cardio-respiratory system, an alternative means of oxygenating the extremely preterm infant is required.

Our approach, termed EVE (Ex-vivo uterine environment) therapy allows for oxygenation of the extremely preterm infant using the umbilical vasculature, and is not dependent on the highly immature fetal lung. Briefly, the infant is connected to a parallelised circuit comprised of artificial veins and arteries that supply blood to two membranous oxygenation devices, and submerged in a carefully controlled bath of artificial amniotic fluid. The membranous oxygenators allow gas exchange (removal of CO_2 and addition of oxygen) before the blood returns via the circuit to the fetus. Nutrients and other medications are delivered directly to the fetus, which is under round-the-clock monitoring.

Research highlights

In just two years, our team has developed this model to the point where lambs can be maintained in outstanding health for at least 48 hours - the designated length of our experiments. With the invaluable help of WIRF and the Channel 7 Telethon Trust, we are now able to further refine this exciting technology to allow for life support periods of at least one week to be achieved. This research is exciting, not only from a clinical perspective, but because it provides a unique 'placental knock-out system' with which key questions regarding the role of maternal and placental factors in fetal development can be answered.

Research achievements

Working closely with collaborators at Tohoku University (Sendai, Japan) and Nipro Corporation (Osaka, Japan), the research team undertook the first EVE experiments in Perth in 2014. Since then, we have greatly improved the efficacy of this system. We are now in a position to undertake experiments with a targeted support duration of at least one week.

THE TEAM

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