ARTPLAC – THE DEVELOPMENT OF AN INNOVATIVE ARTIFICIAL PLACENTA DEVICE WITH COMBINED LUNG AND KIDNEY SUPPORT FOR PRETERM NEONATES

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Introduction

Despite a decline in neonatal mortality in recent years, preterm birth remains the leading cause of death among newborns [1]. Many cases are caused by immaturity of the lungs, often exacerbated by renal failure [2,3]. Current lung and kidney therapies are highly invasive, associated with lifelong disability, and limit family care integration [4,5].

Objectives

With ArtPlac, we are developing a combined lung-kidney assist device that addresses the needs of extremely preterm infants (>24 weeks gestational age) through a less invasive and family-centered approach.

Methods

User requirements were defined by stakeholder analysis (clinicians, parents, etc.) and converted into design requirements. Design concepts for the device were developed and manufactured. Hexagonal hollow-fiber-membrane bundles were produced. Device performance will be tested in vitro according to ISO standards.

Results

The ArtPlac device is intended for neonates aged 24 to 40 weeks of gestational age. The device will be connected like in a fetus through the umbilical vessels. The system will operate pumpless to reduce the risk of hemolysis and platelet activation. The hexagonal shaped membrane bundle contains a 60° angle between respective layers of oxygenation and dialysis hollow fiber mats. This allows the device to provide both lung and kidney support in customizable proportions in one device. Various device sizes will be developed to ensure compatibility with all targeted neonates.

Conclusion

This novel hexagonal design combines oxygenation and dialysis in a single housing. ArtPlac represents a groundbreaking treatment approach for enhancing survival rates and quality-of-life in neonatal intensive care.

References

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