

Designing for Delayed Cord Clamping < 34 Weeks Gestation

Facilitating Delayed Cord Clamping and CPAP Resuscitation for Pre-term Infants During C-Section or Vaginal Delivery



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BACKGROUND

- A recent Cochrane review (15 trials, 738 pre-term infants) showed that delayed cord clamping (DCC), compared with immediate cord clamping (ICC), resulted in higher hematocrits, less exposure to blood products, lower incidence of necrotizing enterocolitis and an almost 50% lower risk of intraventricular hemorrhage (IVH) in pre-term infants.
- DCC presents a circumstance when healthcare professionals (HCPs) on the obstetric and neonatal teams must work in close proximity to each other for a defined period of time, taking care of two patients that are connected by an umbilical cord. Issues such as sterility, obstruction, and communication are key factors to consider when implementing this practice.
- There is increasing evidence that continuous positive airway pressure (CPAP) immediately after birth reduces the need for intubation and exogenous surfactant, and may reduce morbidity and mortality.

HYPOTHESIS

Given the challenges of performing DCC (human factors, sterility, incorporating CPAP resuscitation when necessary), the creation of an effective bedside cart with a flat surface upon which CPAP can be delivered will improve outcomes for pre-term infants.

METHODS

Design Thinking Methodology:

- Empathize (with the user)
- Define (the problems)
- Ideate (brainstorm)
- Prototype (build)
- Test (simulate the medical environment for testing prototypes)

* REPEAT *

Once all design objectives are met at our simulation lab, *The Center For Advanced Pediatric & Perinatal Education (CAPE)*, we will bring our finalized device into the hospital for a one-year clinical trial enrolling about 100 patients.

STANDARD PRACTICE



Currently, HCPs at Stanford and many other institutions hold full term newborns or lay them on whatever surface is available during cord-clamping. Pre-term newborns are held and stimulated for 30 seconds, the umbilical cord is cut, and the patient transferred manually to a radiant warmer for additional care.

INITIAL PROTOTYPES FOR IMPROVING WORK-FLOW AND SAFETY



SIMULATION: A RESEARCH TOOL

- We use simulation to inform our design solutions. By watching clinicians use various prototypes, we discover the barriers to performing this procedure in a safe and effective manner.
- After each simulation we debrief as a group. Our team is interdisciplinary, incorporating HCPs, engineers and designers.
- Our team synthesizes the feedback and identifies methods for product improvement.

FINDINGS

A total of 18 HCPs were recruited for participation in this study over 5 sessions. The main themes revealed during the sessions included:

- Maintaining sterility is challenging, and there is a lack of sterile equipment designed for neonatal resuscitation.
- It is important to create a stable, yet adjustable surface upon which to place the newborn so that there can be seamless transfer from the mother's bedside, to the resuscitation bed, and finally to the neonatal intensive care unit. How might we create one bed to accommodate all resuscitation steps, as well as delayed cord clamping?
- The DCC cart needs to easily dock with resuscitation equipment for a seamless transfer to the NICU.
- "Integrating a delayed cord clamping cart during C-section or vaginal birth is going to influence our culture across the board."
-Susan Crowe, MD, OB/GYN

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