



Perimortem Cesarean Section: Has Time Run out for the Four-Minute Rule?

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Resuscitation in the Third Trimester



- Incidence: 1 in 20,000 to 1 in 30,000 pregnancies
- Survival rate: 6.9%?
- Katz, 2005:
 - 34 out of 38 infants survived
 - 12 out of 20 mothers survived
- Focus of this talk will be on maternal survival, although principles here are generally applicable to delivery of fetus as well

The 4-Minute Rule



- First Described by Katz, et al, 1986 and then affirmed in 2005, 2012
- “We know from multiple medical studies that brain damage begins at about 4-5 minutes after the cessation of blood flow. . . In that sense, we should start the Cesarean delivery within 4 minutes so the baby can be delivered within 5 minutes. . .”

First False Premise



- Brain damage begins at 4-5 minutes after cessation of blood flow:
 - Data based on non-pregnant adults
 - Pregnant adults NOT = Non-pregnant adults
- Physiologic Differences in Pregnancy:
 - Increased maternal metabolic rate
 - Changes in distribution of blood flow
 - Fetal metabolic rate and oxygen consumption
- There are no data on relationship of brain damage as function of time in pregnant women
- Pregnant women have sufficiently different physiology to believe that data cannot be extracted from non-pregnant adults

Second False Premise



- Cesarean Section: Decision to Incision to Birth in One-Minute
- No study—ever—to support this incision to birth in one minute or less.
- Nearly universal assumption among obstetricians that this is actually reasonable.
- Consider maternal arrest outside operating room:
 - Poor light
 - No assistant surgeon
 - No equipment
 - No firm operating table
- One-minute—Really??

Theoretical Considerations: Increased Oxygen Demands of Pregnancy

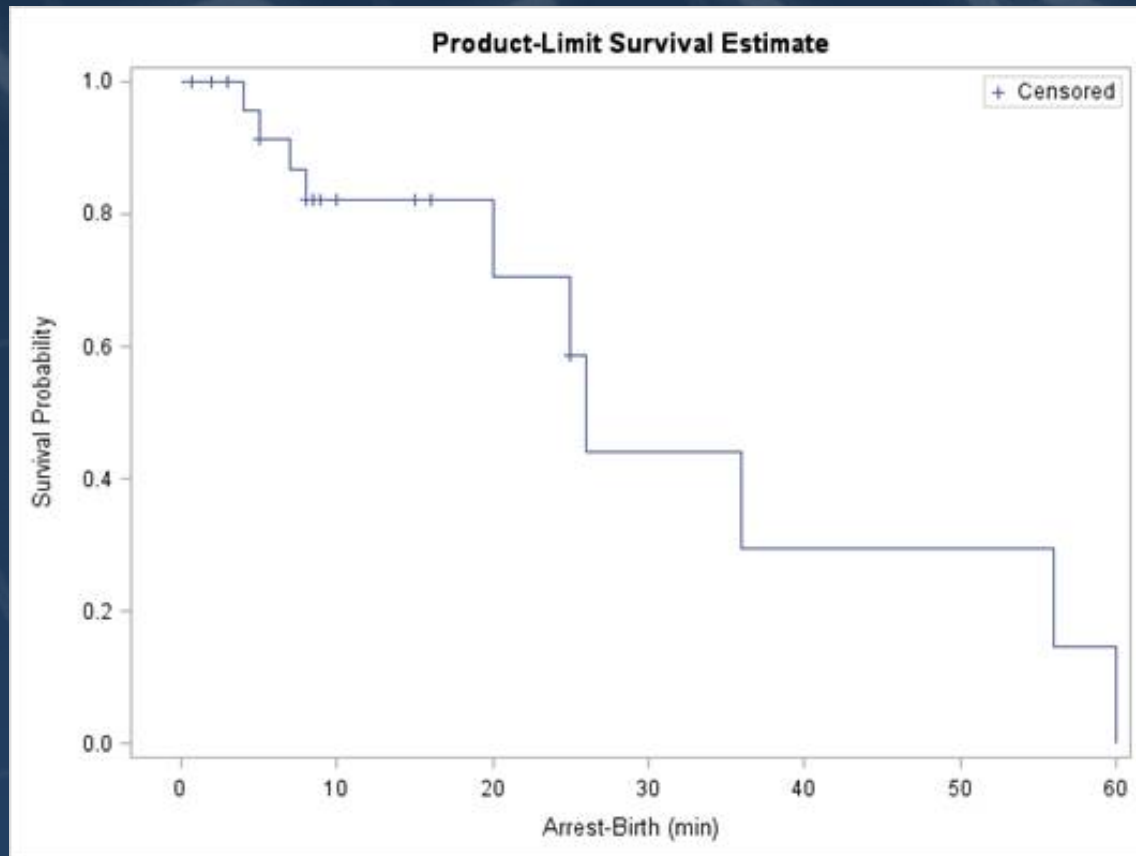


- Maternal oxygen consumption increases over course of pregnancy by 20-30%
- Estimate: removal of fetus and placenta should result in 18% improvement in oxygen consumption and 17% improvement in cardiac output
- Caveats
 - Much of data based on animal studies; however human fetus has:
 - Larger brain
 - More adipose tissue
 - Lives at lower body temperature
 - Grows more slowly
 - Glucose levels/consumption

Studies



- Katz's Data does not show a demarche at 4 minutes
- Preliminary data:



One Minute Incision to Birth Interval?



- Three bodies of evidence
 - Katz's Data
 - Perimortem Cesarean Drill Study
 - > One dozen Cesarean section studies
- No body of evidence supports an expectation of one minute incision to birth interval—typically interval is several minutes

The Two Assumptions—Another Look



- “Adults start suffering brain damage at 4-5 minutes of cessation of circulation. . . .”
 - Pregnant women are different —estimated 18% high oxygen consumption—In theory, LESS time than 4-5 minutes
 - Katz data: While 13 out of 20 women who had potentially survivable events survived, no data presented on brain injury as function of time
 - Our preliminary data found a nearly linear decrease in normal brain function as arrest to delivery interval increase
- One minute incision to birth interval: not usually possible:
 - Katz data
 - Drill data
 - General (large) body of Cesarean time interval data

Conclusions



- Time intervals of 4 minutes to initiate cesarean and one minute to complete have no basis in theory or available evidence—no reference to these times should be offered in any discussion of maternal resuscitation
- With injury free survival directly related to arrest-birth interval, delivery should be accomplished as quickly as possible
- DELIVERY is an integral, vital part of maternal resuscitation in the third trimester—as important as Airway, Breathing and Circulation