

Maternal and Neonatal Outcomes Following a Fontan Procedure:

A 10-year retrospective study

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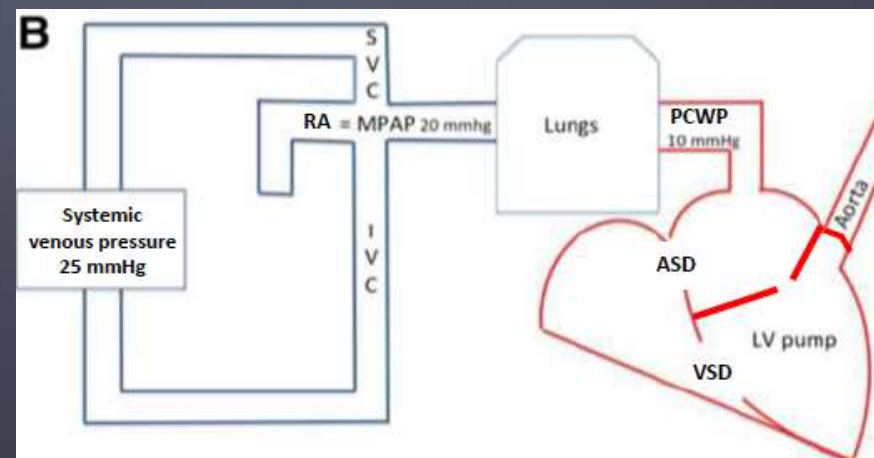
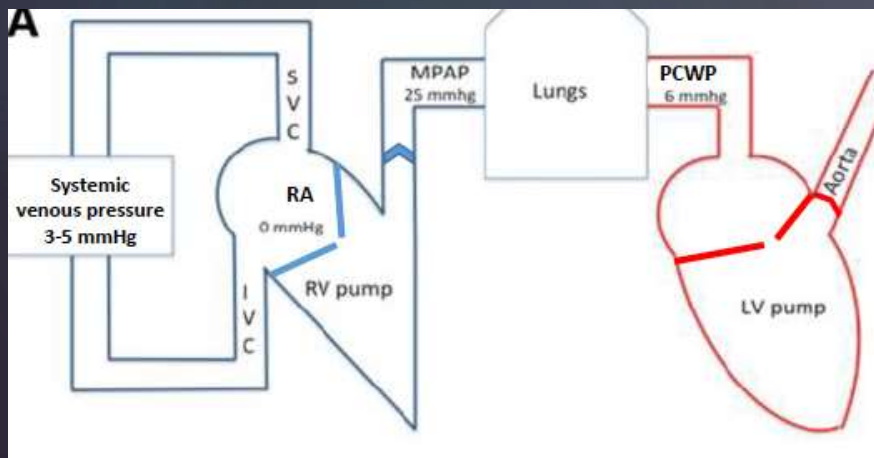
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Background

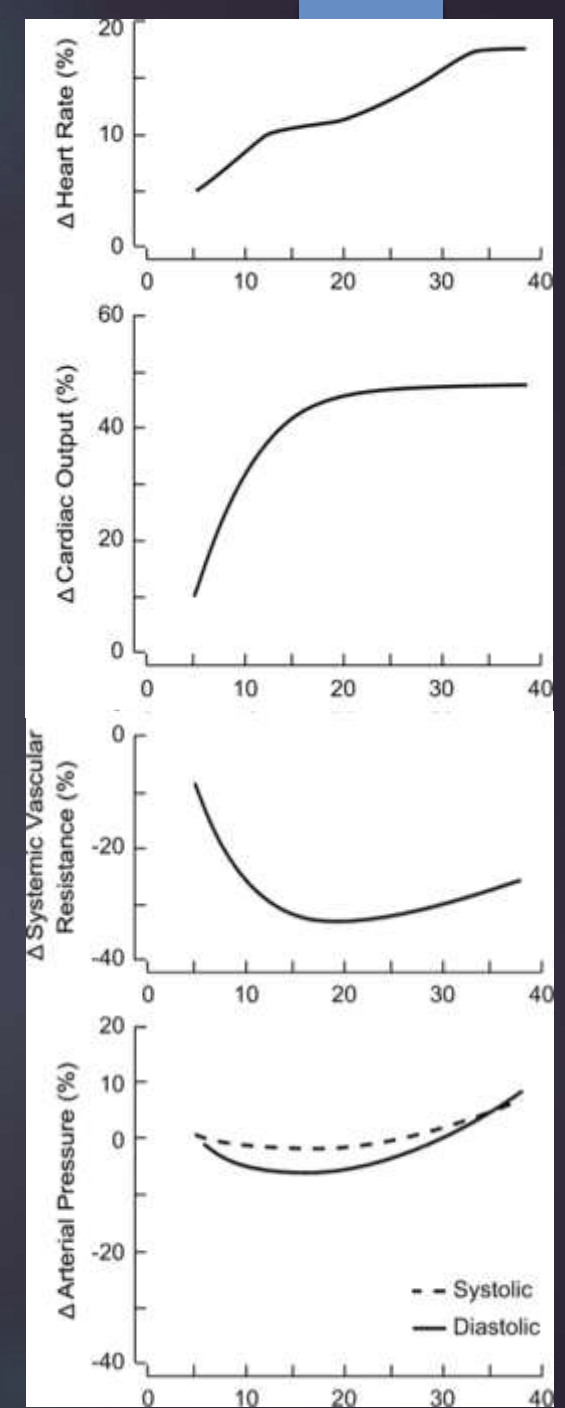
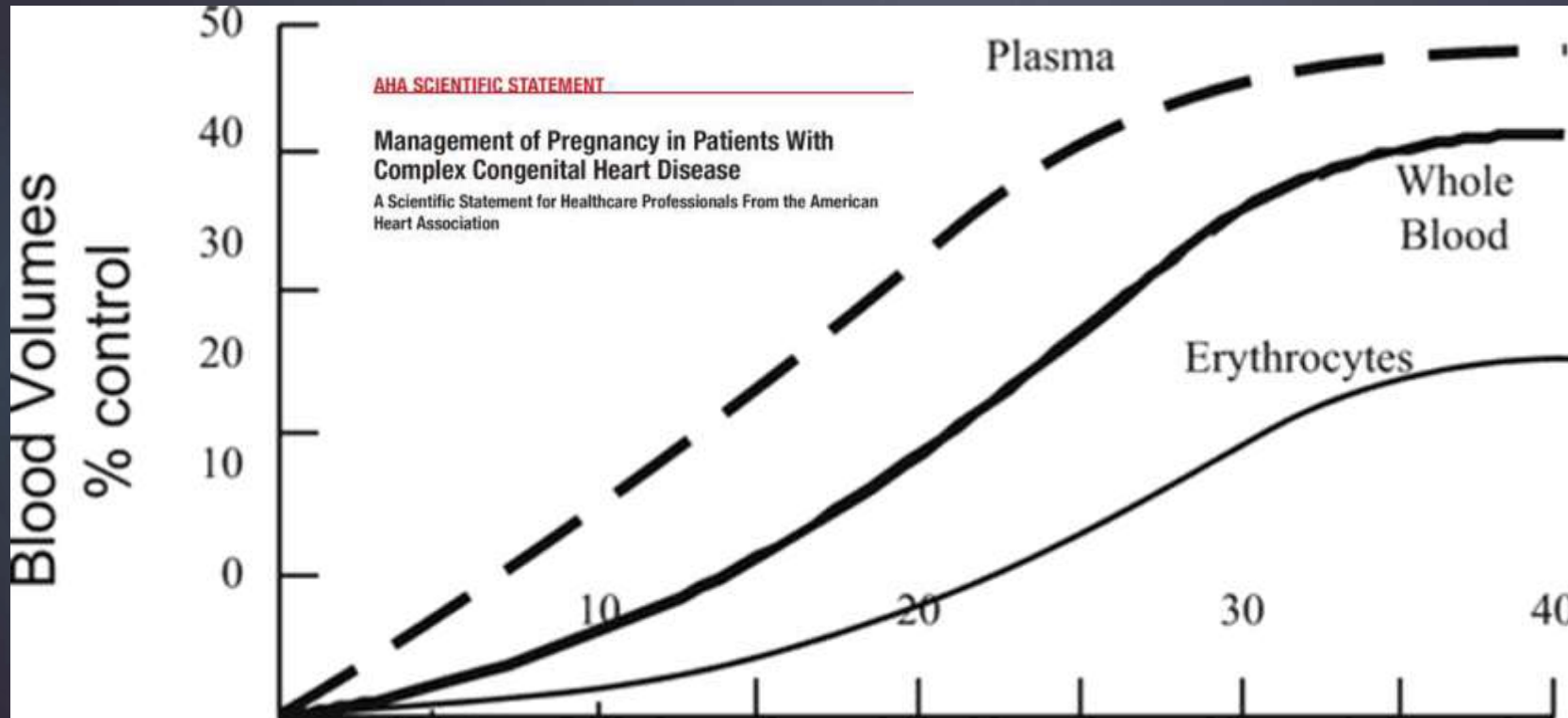


- Single-ventricle physiology
- Surgical palliation: vascular shunts to pulmonary artery
 - Blalock-Taussig shunt, Fontan procedure
- The Fontan procedure is considered definitive repair.
 - Deoxygenated systemic venous flow → pulmonary arterial circulation w/o intervening pump
 - Sequelae: chronically elevated SVP, decrease CO and decreased cardiac reserve



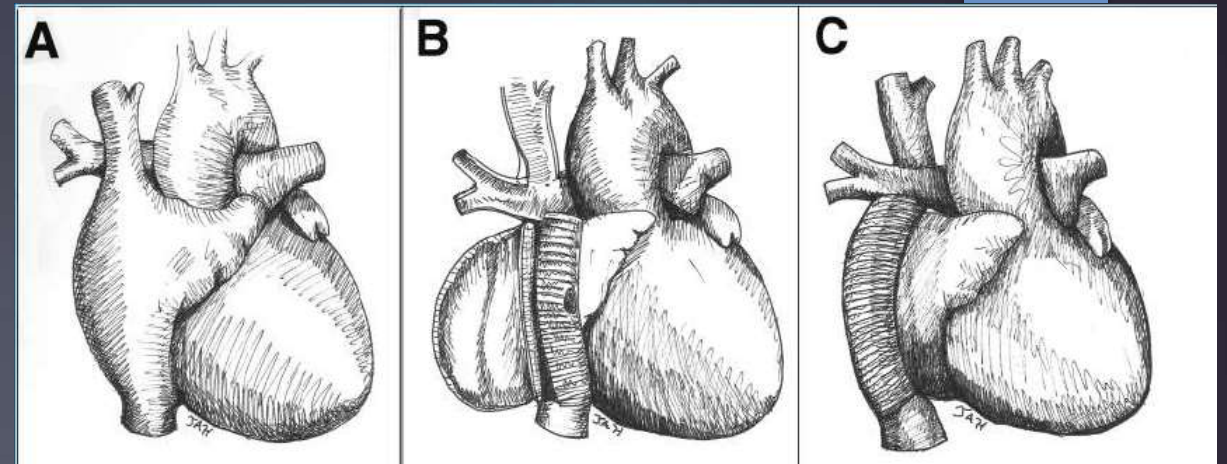
Aboulhosn JA, et al. Congenit Heart Dis. 2009.
Gewillig M. Heart. 2005.
Elder RW, et al. Congenit Heart Dis. 2015.
Drenthen W, et al. Heart. 2006.

Pregnancy changes in blood volume and hemodynamics

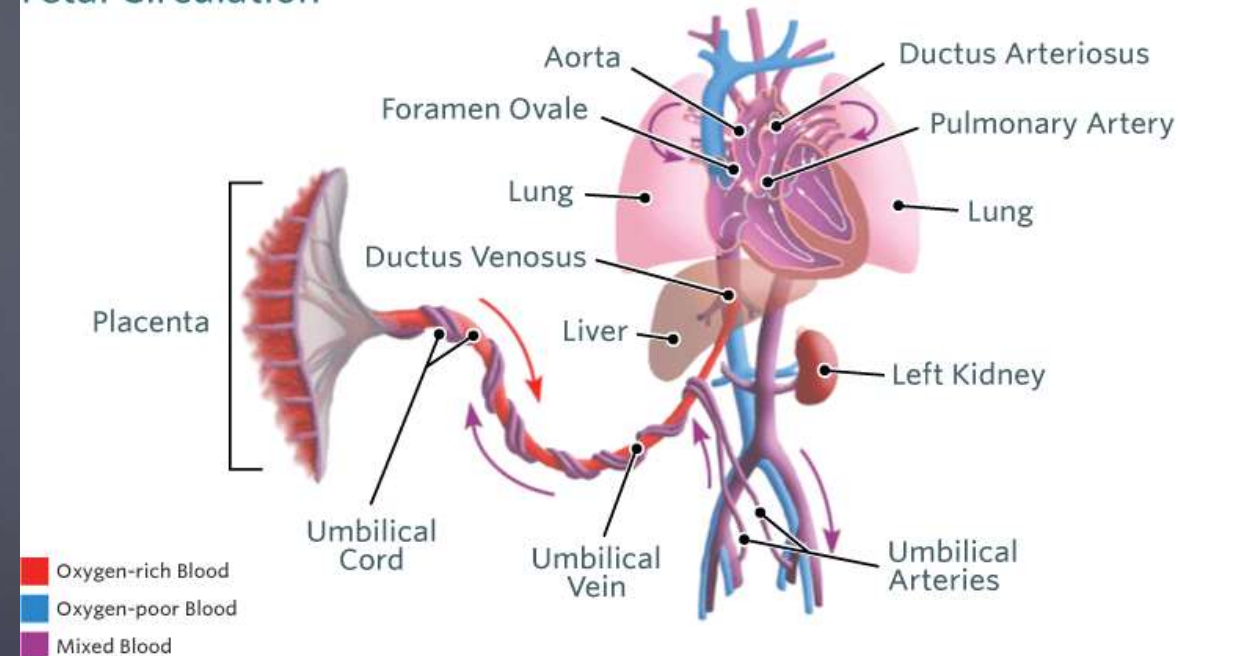


Background

- **Challenge of Fontan circulation in the setting of pregnancy.**
 - Obligatory increase in HR, CO and plasma volume.
 - During L&D: increases in CVP and CO, affect of anesthesia, fluid shifts, concern for arrhythmia.
 - Fetal oxygenation.



Fetal Circulation



Objective / Hypothesis



- **Objective:** To determine a relationship between maternal cardiac function through gestation and a SGA neonate.
- **Hypothesis:**
 - ↓ CO in early pregnancy linked to
 - ↓ fetal growth
 - ↑ preterm delivery

Methods



- Single-center (University of California, Los Angeles) retrospective cohort study.
- Deliveries of women with Fontan circulation between 2006 – 2016 were included.
- All pregnancies >24 0/7 weeks were evaluated for differences in maternal and neonatal characteristic and outcomes.
- Echocardiograms were reviewed from pre-pregnancy (>1 year before pregnancy) up to 10-years post-partum.
 - EF estimated using Simpson's method of disk. dP/dT and RIMP/Tei index was also calculated.
- Statistical analysis: Student t-test and chi-squared used to compare categorical variables/means. Inter-correlation was investigated by Spearman rank correlation. Significance was set at a p-value<0.05.

Demographics



- 23 women involving 26 pregnancies.
- Mean age at pregnancy was 25.1 ± 4.1 years.
- Mean BMI was 26.4 ± 2.8 kg/m².
- Women were racially and ethnically diverse.

Maternal Complications and Obstetrical Management

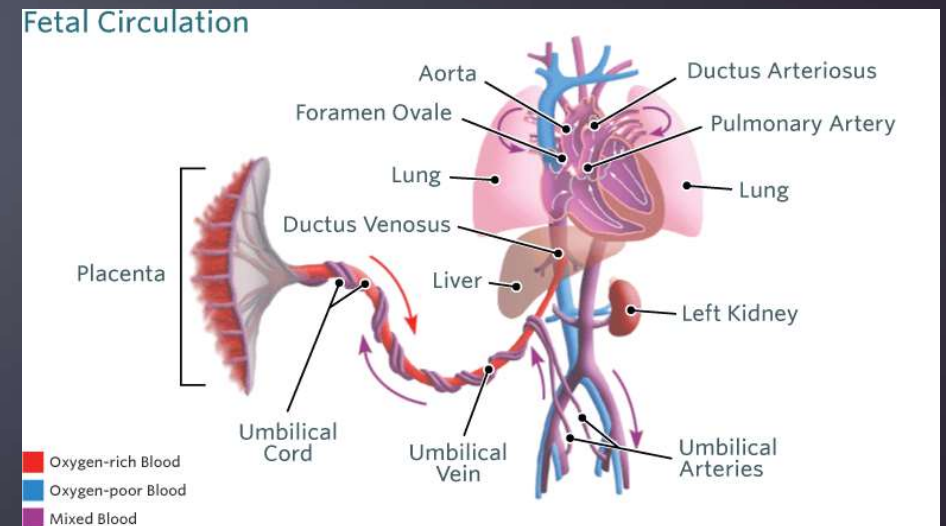


- Sustained arrhythmia (36%)
- Decompensated heart failure (21%)
- No maternal deaths
- Vaginal delivery 46% (58% operative VD)
- Regional anesthesia 95%

Neonatal Outcomes



- Fetal demise 2/26 (7.7%) – 30 and 37 4/7 weeks
- Preterm delivery (<37 weeks) 50%
- Gestational age 34 5/7 \pm 4 5/7 weeks
- Birth weight 2.29 \pm 0.55 kg
- 29% Neonatal ICU admissions



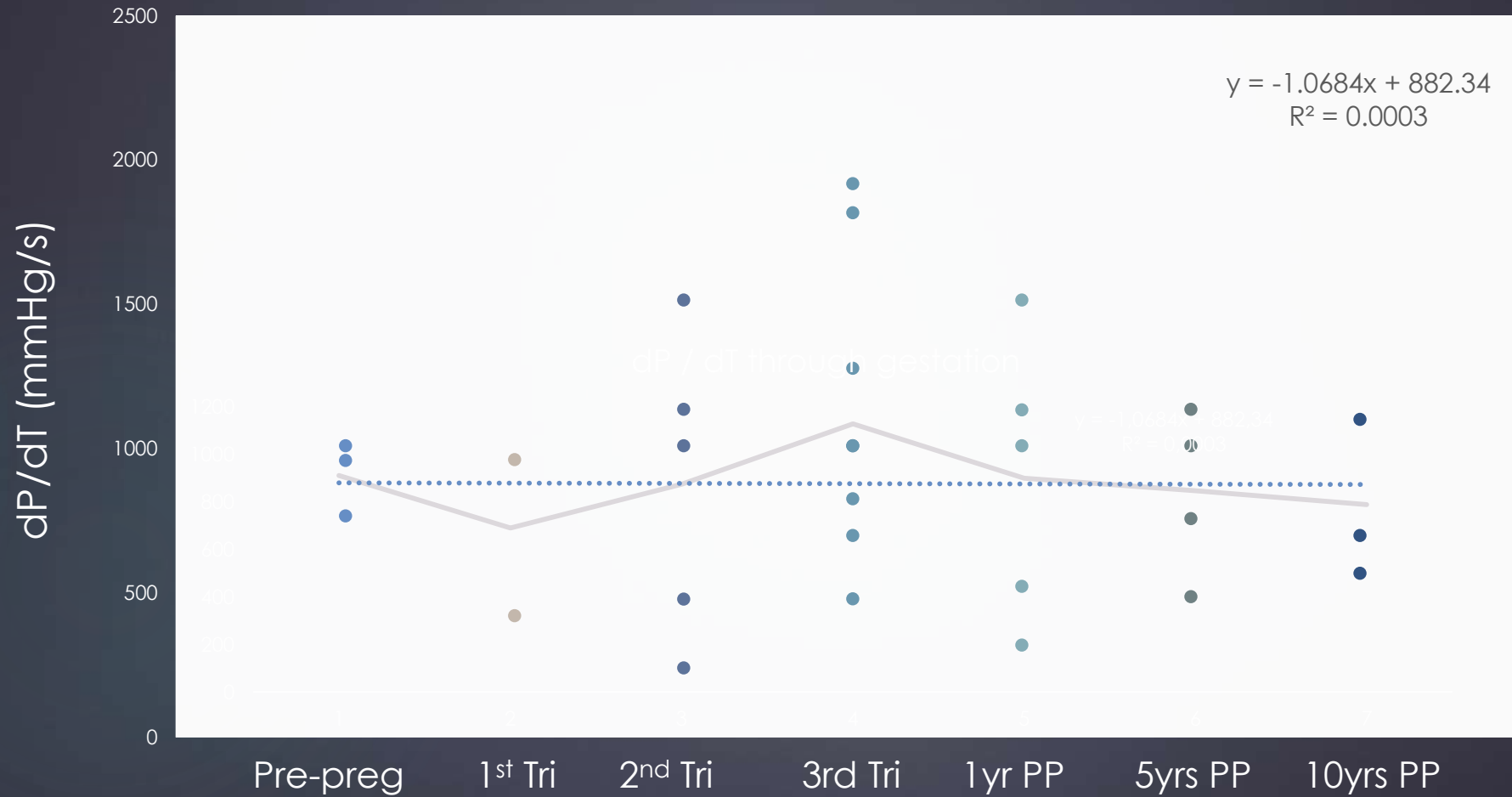
EF through gestation



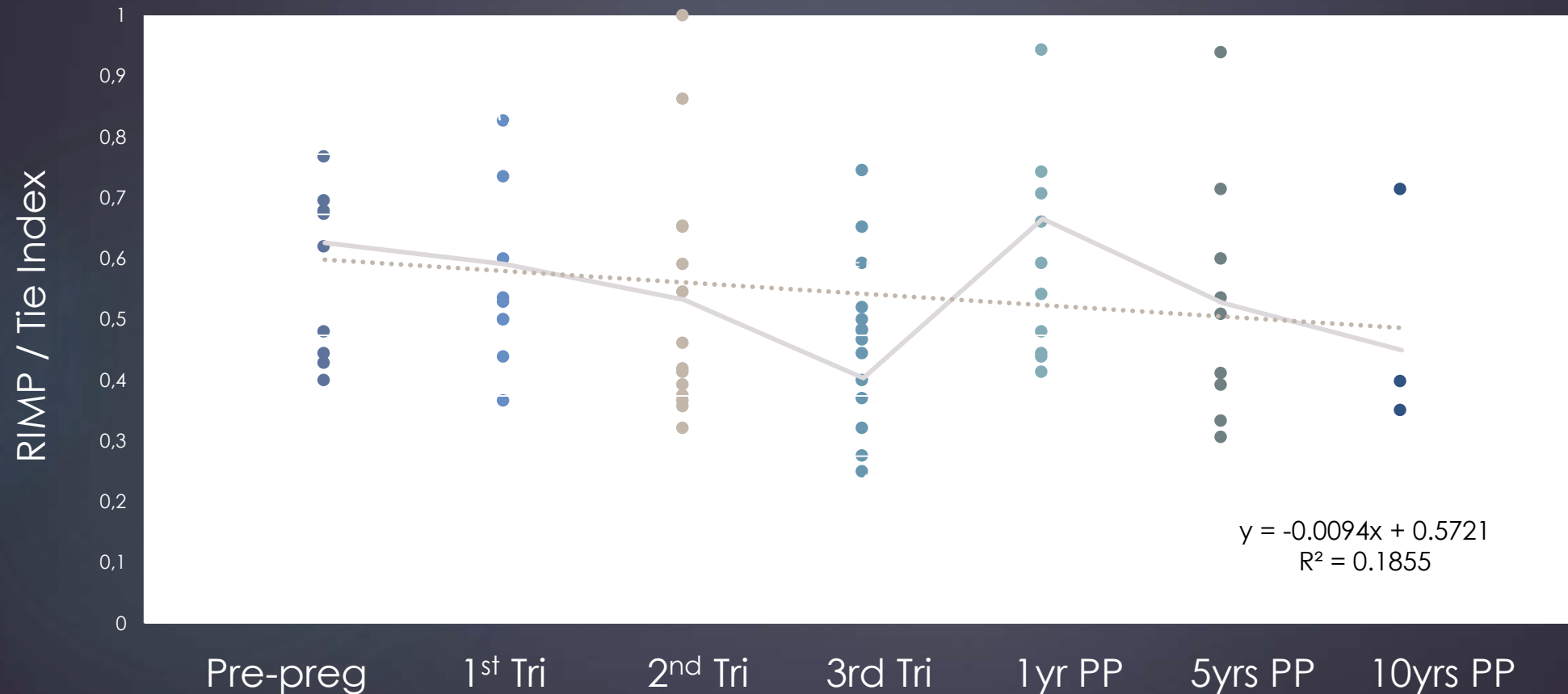
- EF declined from pre-pregnancy to the first-trimester ($p < 0.05$).
- EF returned to pre-pregnancy levels within 1-5 yrs post-partum



Ventricular Contractility (dP/dT)



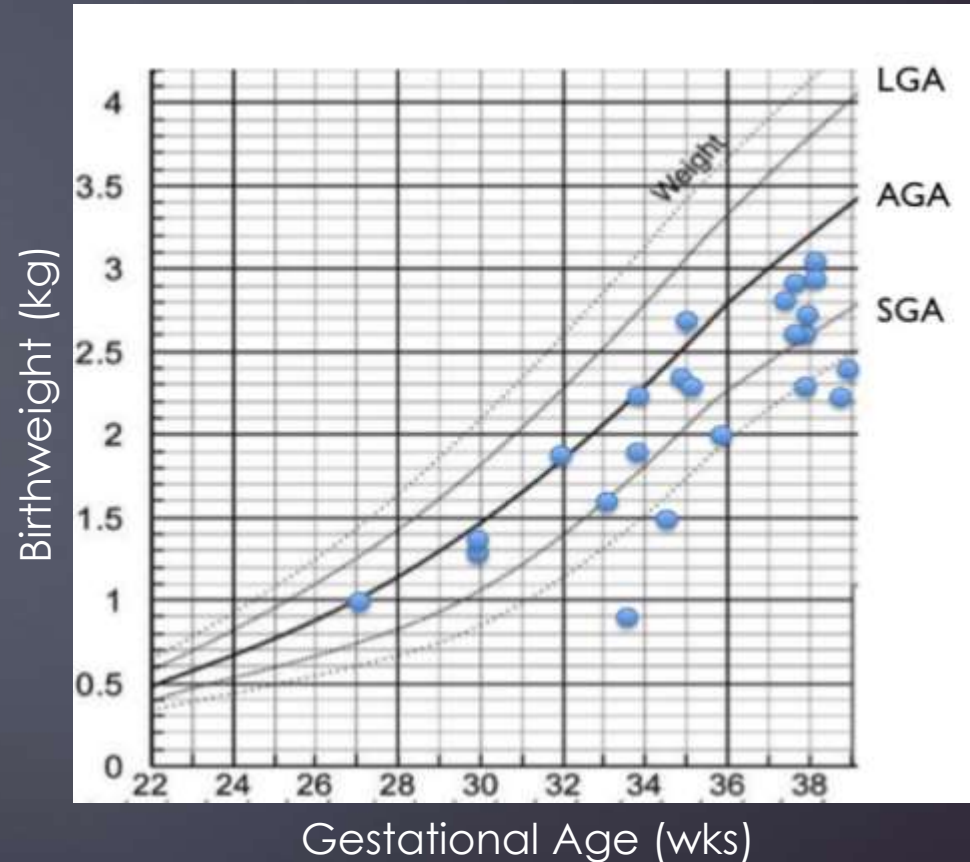
Myocardial Performance Index: RIMP / Tei index



Single ventricle physiology predisposes premature SGA neonate



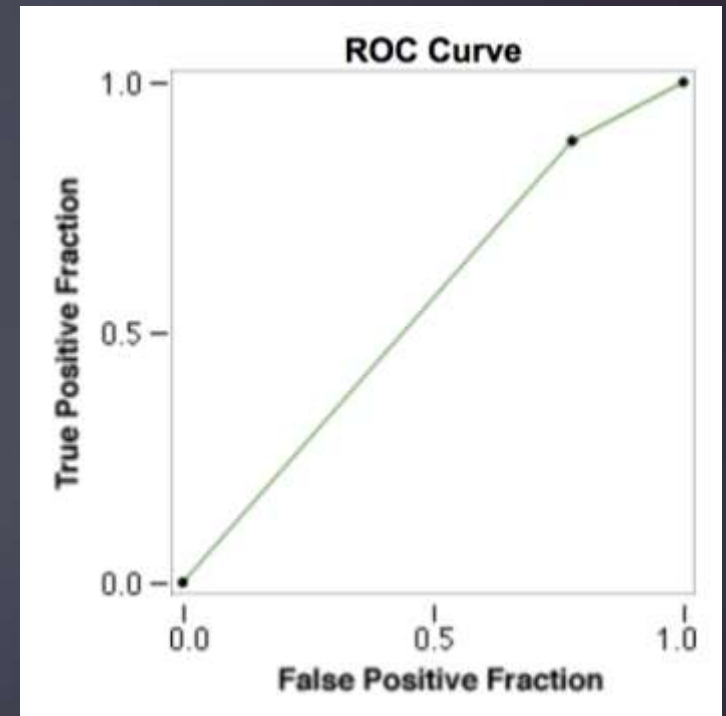
- 77% of the neonates were SGA at delivery (<10th %ile).
- Odds ratio (OR) of SGA neonate:
 - OR 10.1, 95% CI (2.9 – 48)
 - aOR 11.7 (95% CI 2.1 – 72)



First trimester EF changes is associated with a SGA neonate



- Reduced 1st trimester EF correlated with a SGA neonate (Spearman rank correlation ($r=0.60$, $p<0.05$)) adjusted for gestational age.
- Sensitivity: 88.2%, Specificity 22.2%



Conclusions



- Pregnancies with single ventricle physiology is associated with increased adverse maternal and neonatal outcomes.
- Women with a Fontan procedure have a significant decline in EF during the first trimester.
- Decreased first trimester EF predicts SGA neonate.
- Further research is needed to determine components and timing of cardiac reserve and neonatal outcome. Epigenetics?

Acknowledgments



Francis Fontan
1929 - 2018

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