Fetal Ductus Arteriosus: The Good, Bad, and the Ugly

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Tampa, Florida
7th Annual Fetal Echocardiography Course
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Etiology:
Maternal medications (such as nonsteroidal antinflammatory drugs like indomethacin) or maternal diet can cause constriction of the fetal ductus or it can occur spontaneously.

Fetal Ductal Constriction

Fetal Ductus Arteriosus
First diagnosis of ductal constriction

Intracardiac findings

Fetal Ductal Constriction
Fetal ductal constriction due to indomethacin in the management of preterm labor. Tricuspid regurgitation associated.

Animal model: Fetal Lamb


**Fetal Ductal Constriction**

Ductal constriction: can occur either in singleton or multiple pregnancies.

**Course:** Ductal constriction can lead to total ductal occlusion in utero. Chronic constriction can lead to ductal changes.

**Treatment:** Withdrawal of causative medicine.

**Post natal:** Persistent PDA is reported.

**Physiology**

During constriction the RV pressure rises, and the RV end diastolic and RA pressures rise resulting in atrial shunting to the left heart (if the foramen ovale is nonrestrictive).

Systolic and diastolic PA pressure rise forcing more flow through the lungs if the pulmonary resistance if unchanged.

**Fetal Ductal Constriction**

Withdrawal of the medicine should result in resolution of constriction/occlusion within 2-3 days.

**Perinatal Management**

Pulmonary hypoplasia

Chronic spontaneous constriction could lead to changes in the pulmonary vascular bed from fetal pulmonary hypertension and pulmonary arteriolar muscularization.

The maternal hyperoxygenation test is suggested after 30 weeks gestation in such cases to exclude pulmonary vascular abnormal reactivity.
**Fetal Ductus Arteriosus**

- Increased aortic flow
- RV dilation and hypertrophy
- TR
- Signs of RV dysfunction

**Fetal Ductus in CHD**

- HLHS – ductal arch
- PI-IS, Tet-PA
- When could tocolysis be used?

**On maternal O2**

**Fetal Tetralogy**
Tet Abs Valve con PDA

Tet Abs Valve with PDA

Tet Abs Valve syndrome With PDA

Diastolic Steal in utero with Tet Abs Valve and PDA

Tetralogy R arch L ductus
"IDIOPATHIC DUCTAL CONSTRICTION"
Speculation on the etiology
Maternal ingestion of polyphenol-rich foods during the third trimester of pregnancy...

...could their antioxidant and antiinflammatory components interfere with prostaglandin metabolism and thus influence fetal ductus arteriosus dynamics?

CONSTRICTION OF DUCTUS ARTERIOSUS

143 NORMAL FETUSES FROM NORMAL MOTHERS IN THE THIRD SEMESTER OF PREGNANCY

28.4 ± 3.1 wks (23-38 wks)

102 FETUSES WITH MATERNAL INGESTION OF POLYPHENOLS (> 75th PERCENTILE, 1089 MG)

41 FETUSES WITHOUT MATERNAL INGESTION OF POLYPHENOLS (< 25th PERCENTILE, 127 MG)

FETAL DOPPLER ECHOCARDIOGRAM

IN NORMAL FETUSES, DUCTAL FLOW DYNAMICS AND RIGHT VENTRICULAR SIZE ARE INFLUENCED BY MATERNAL CONSUMPTION OF POLYPHENOL-RICH FOODS (CASE-CONTROL STUDY)

ORIGINAL ARTICLE
Maternal consumption of polyphenol-rich foods in late pregnancy and fetal ductus arteriosus flow dynamics


Paediatric Cardiology Unit, Policlinico Tor Vergata, Rome, "G. d'Annunzio" University of Chieti-Pescara, Chieti, and "Pio Alberini" University of L'Aquila, L'Aquila, Italy; Department of Obstetrics and Gynecology, University of Rome "Tor Vergata", Rome, Italy; and "Pio Alberini" University of L'Aquila, L'Aquila, Italy.
**Food Frequency Questionnaire for Quantification of Daily Ingestion of Polyphenols**

**Orientation to Withdraw Foods with More Than 30mg/100g**

Complete Reversion in 96.5% (48/52 Fetuses with Ductal Constriction) (3 Weeks After Suspension of the Substances)

**Construction of Ductus Arteriosus**

**Daily Consumption of Polyphenols**

- GA: 32 ± 2 wks (28 - 38 wks)
- 1509.05 mg/day (>perc 75)
- 80.05 mg/day (<perc 25)

**Pulsatility Index**

- Pre: 1.70 ± 0.41
- Post: 2.19 ± 0.43
- \( P = 0.001 \)

**Warn Mothers about this...**

**Antinflammatory and Antioxidant Effects of Common Foods**

- Green Tea
- Black Tea
- Mate Tea
- Orange Juice
- Dark Chocolate
- Resveratrol

**In Normal Fetuses, Ductal Flow Dynamics and Right Ventricular Size are Influenced by Maternal Consumption of Polyphenol-Rich Foods (Case-Control Study)**

**Original Article**

Maternal consumption of polyphenol-rich foods in late pregnancy and fetal ductus arteriosus flow dynamics


**Warn mothers about this...**

*zielinsky@cardiol.br*
**STUDY SETUP**

**SUFFOLK SHEEP (90-100kg) >120 DAYS GESTATION**

- **BASAL**
- **14 DAYS**

Habitual diet (basic polyphenol ingestion)

PRF supplementation (basic ingestion + 3100 mg/day)

**Fetal Lamb experiments in third trimester**

Doppler before and after green tea

- **SYST VEL**
- **DIAST VEL**

**Heart specimen of a fetal lamb exposed to green tea**

RV hypertrophic and dilated RV/LV ratio

**DUCTAL HISTOLOGY IN FETAL LAMB EXPOSED TO GREEN TEA**

- Decreased ductal lumen and increased medial avascular zone thickness

**DUCTAL HISTOLOGY**

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**DOPPLER BEFORE AND AFTER INGESTION OF WATER (CONTROLS)**

- NS
- NS
- NS

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Fetal ductal constriction
detection in fetal CHD

Consider the possibility of mild ductal constriction in any fetal left heart disease (HLHS) with a decreasing CV Profile score (TR, decreasing RV function)

Counsel mothers on polyphenol foods early after fetal diagnosis

Use of Maternal Indomethacin and Fetal Ductal Constriction

- Indomethacin doses of 25 mg PO BID or TID are effective for tocolysis
- Short course of 48 hours is well tolerated
- Some types of ductal dependent CHD can have short-course indomethacin tocolysis safely i.e. pulmonary atresia, Tetralogy of Fallot, etc.

Will there be a tomorrow without the children?
The Perinatal Cardiologist

Barness LA. Pediatrics 1985 Sep;76(3):459-60

Approach to the fetus with CHD and preterm labor

- Early identification
- Address the cause (i.e. infection, consider indocin for poly)
- Aggressive management of cervical incompetence, Redefine “viability”
- Screen for CHF
- Consider tocolysis early