Myocardial Conditions in Prenatal Life

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Prenatal Myocardial Conditions: Two main categories

Acquired

- Maternal Diabetes
- Twin-Twin Transfusion Syndrome (TTTS)
- Autoimmune mediated myocarditis
- Arrhythmias
- Congenital heart disease (Ebstein, aortic stenosis)
- Infection

More Common

Primary

- Cardiomyopathy
  - Inherited
  - Syndromic

Less Common

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Prenatal Myocardial Conditions: Acquired

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➢ ***Twin-Twin Transfusion Syndrome***

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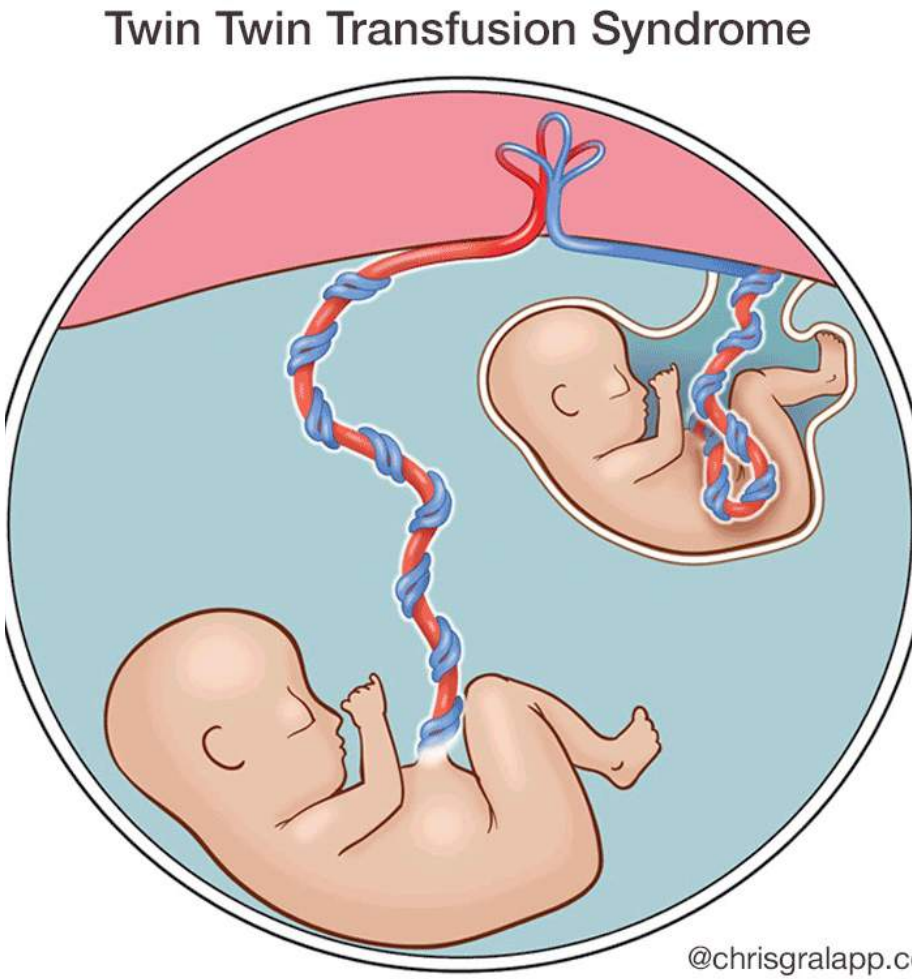
Twin-Twin Transfusion Syndrome

- 10-15% Monochorionic/ Diamniotic twin pairs
- A-A, A-V and V-V connection
- Discordant in growth/amniotic fluid
- Typical presentation 16-24 weeks



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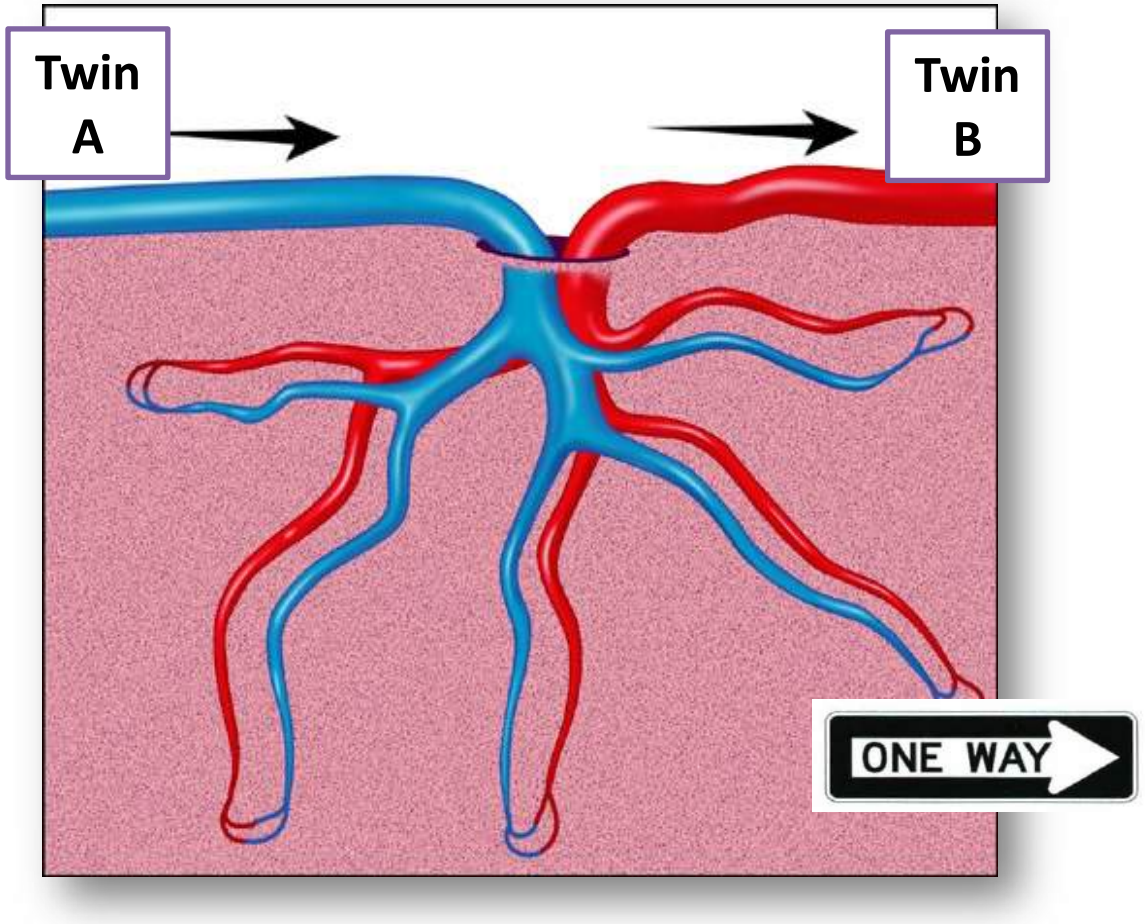
www.fetus.ucsfmedical center.org

Abnormal connections in MC placenta



- Artery from one twin dives into placenta and connects with a vein from the other twin (instead of making a “u-turn” to the same fetus
- A-V anastomosis
  - Uni-directional

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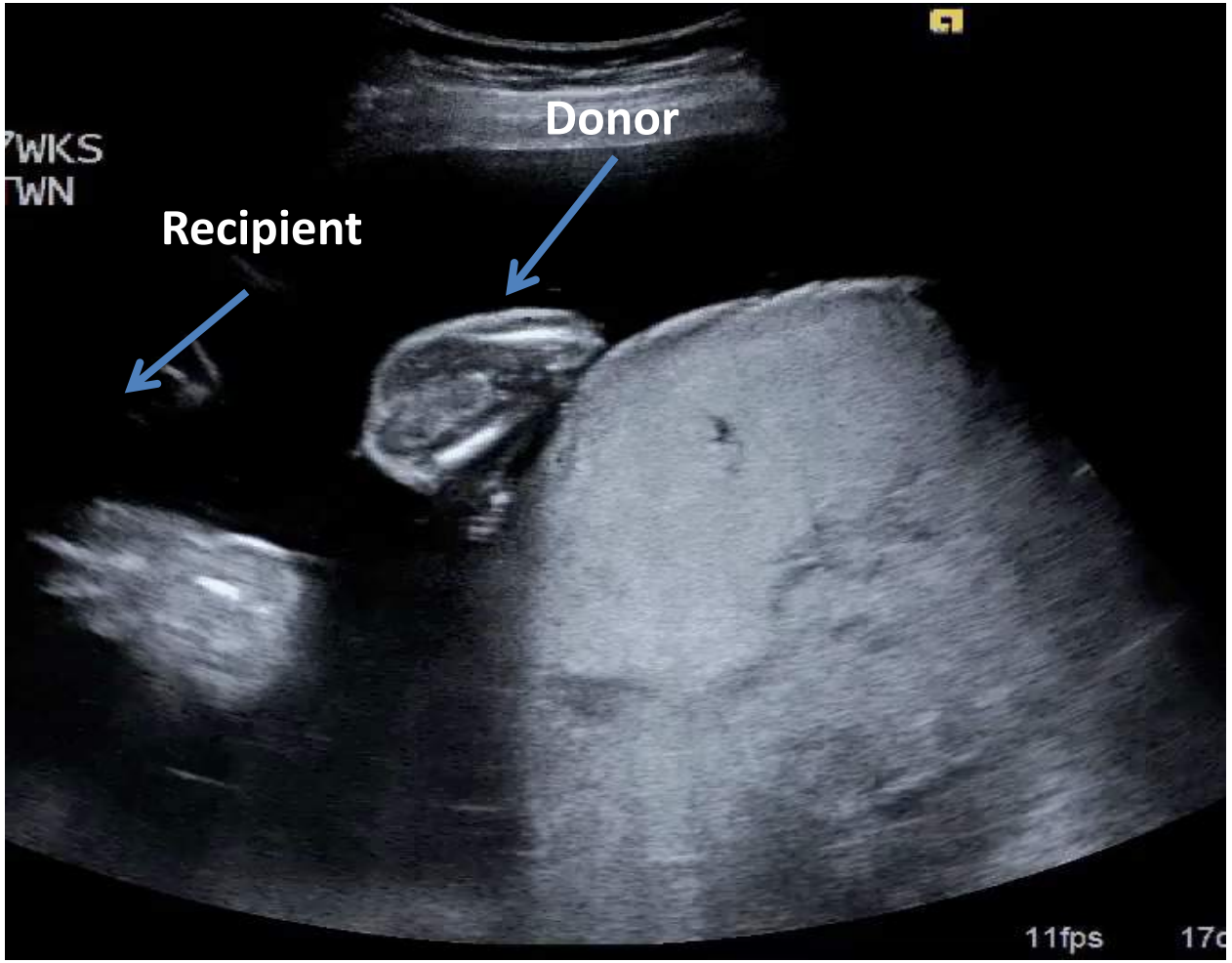

Severity: Quintero Staging

I: Normal Doppler, normal bladders
II: Normal Dopplers, no donor bladder
III: Critically abnormal Dopplers (recipient)
IV: Hydrops in recipient
V: Death of one twin

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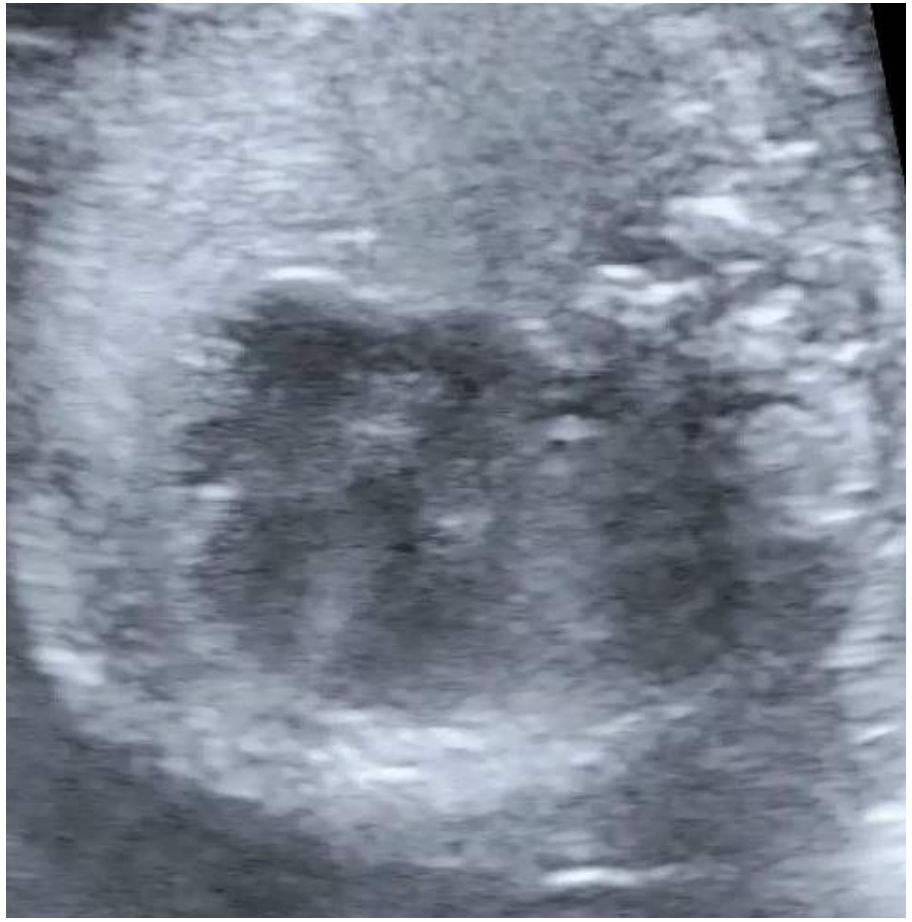
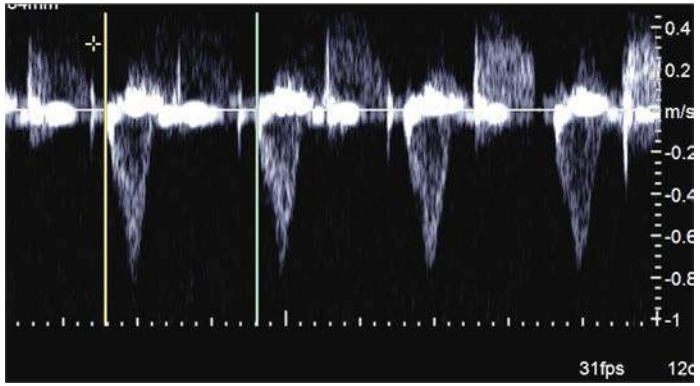
TTTS: Cardiac Manifestations

- High risk of CHD
  - Mostly due to acquired PS
- Cardiac manifestations appear even in early stages
  - Recipient cardiomyopathy

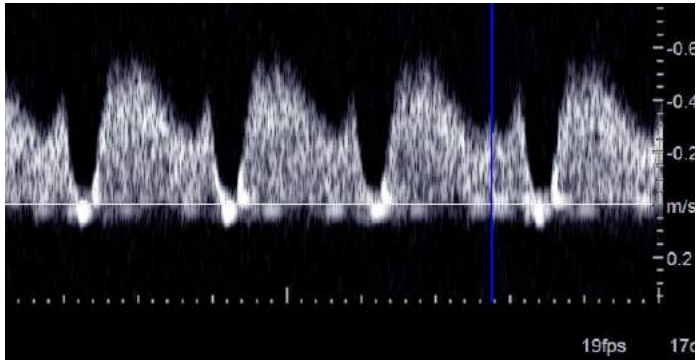
Recipient Twin Cardiomyopathy: Early findings



Fused tricuspid inflow



Abnormal ductus venosus



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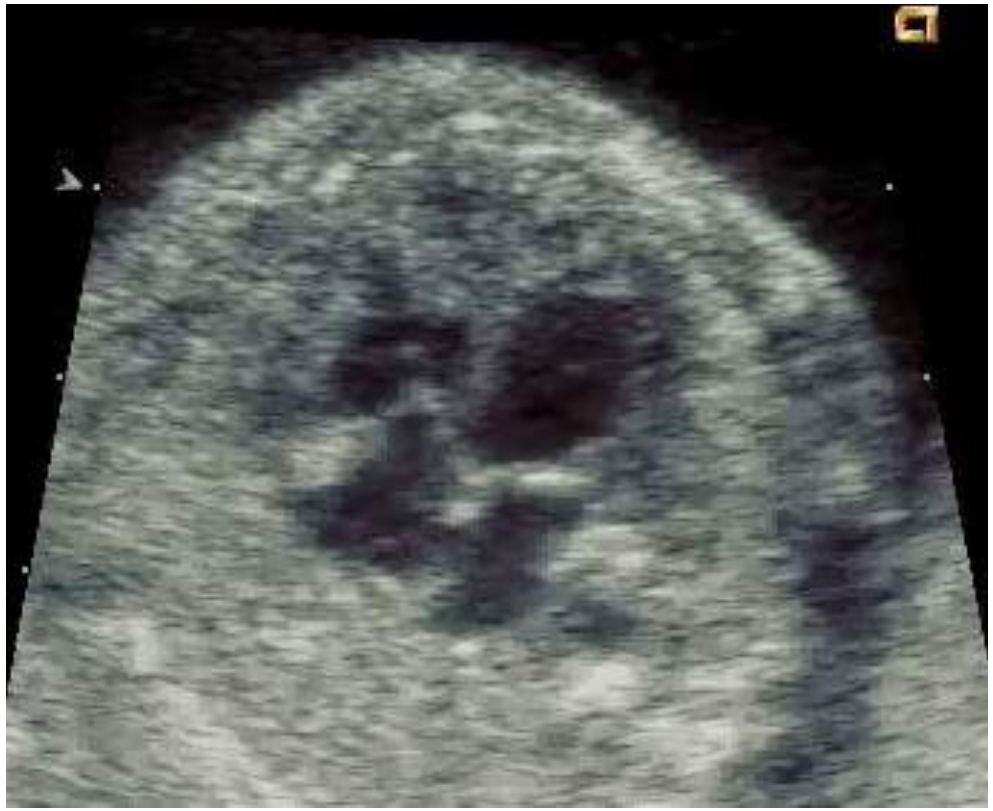
Recipient Twin Cardiomyopathy: Late findings

- Cardiac Hypertrophy
- Diastolic function pathology (Filling time abnormalities)
- Declining systolic function
- RVOTO, dynamic or valvar (some)



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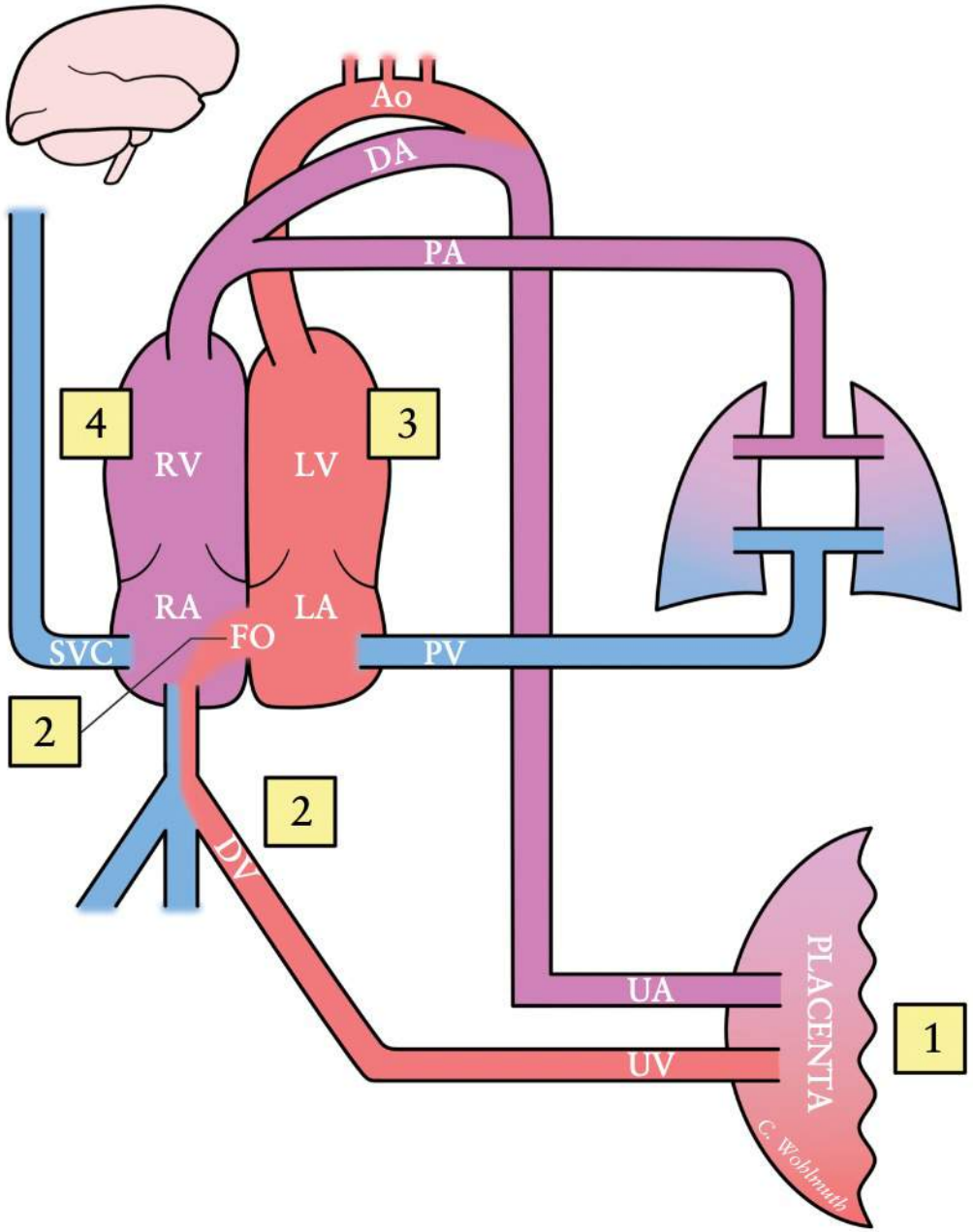
Pathophysiology

1) Neuroendocrine dysfunction of placenta with elevated vasoactive mediators (renin-angiotensin, endothelin-III) --> increased afterload to both ventricles
2) Reduction in early filling times of both ventricles and hypertrophy
3) Impaired LV filling → RV volume loading→ dilation → tricuspid regurgitation
4) Systolic dysfunction



Wohlmuth et al, 2018

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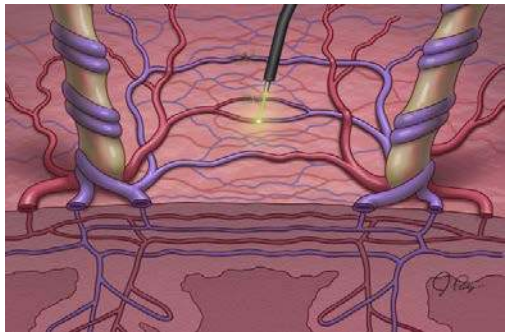
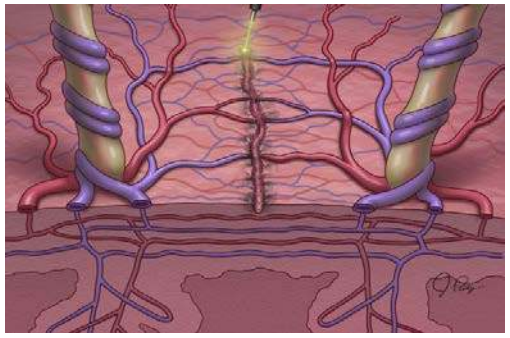
Treatment Options

- Conservative Management
- Amnioreduction
- Septostomy
- Selective reduction/termination

- Selective laser photocoagulation → Changing the natural history of disease





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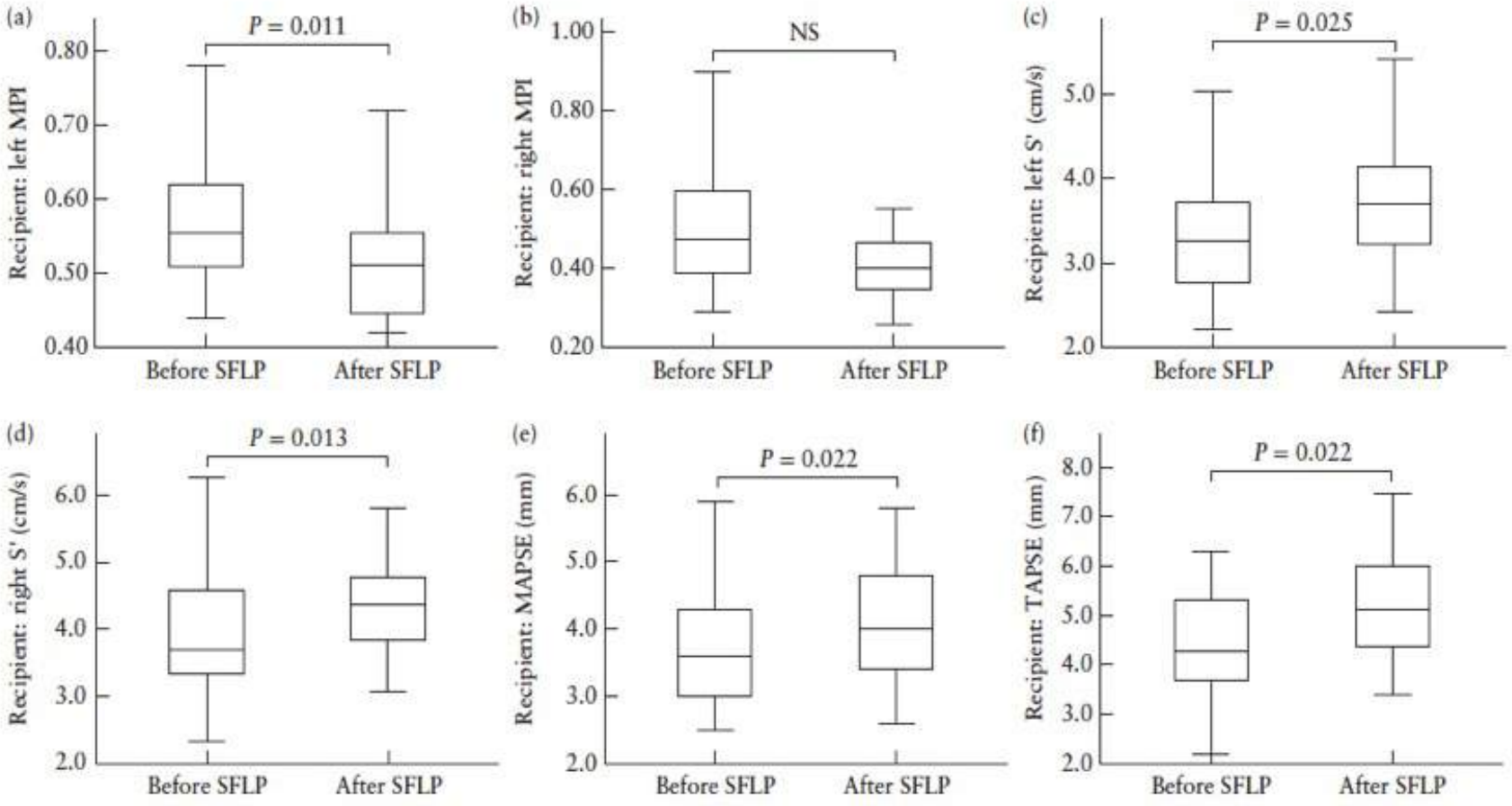
https://women.texaschildrens.org/program/texas-childrens-fetal-center/twin-twin-transfusion-syndrome-ttts

Cardiac Outcomes

- Post-laser recipient cardiac findings can normalize



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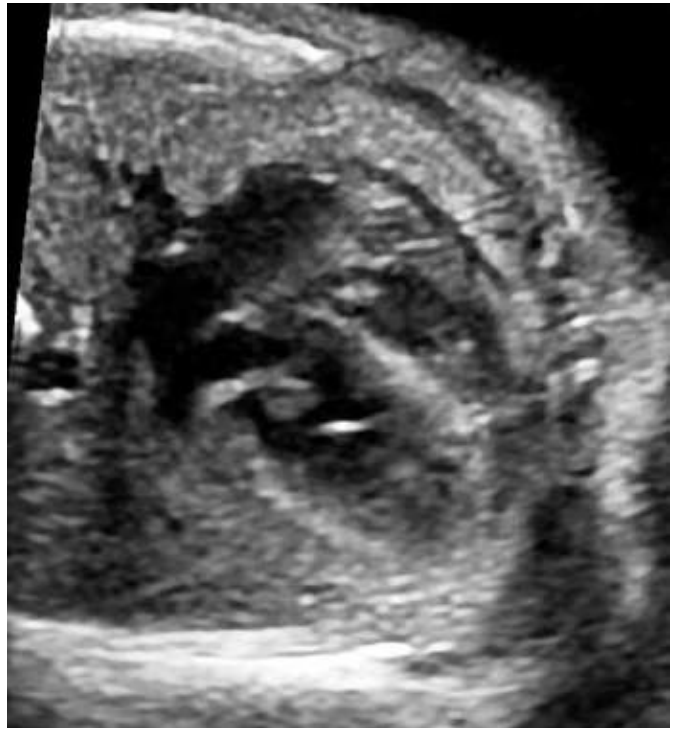
Wohlmuth et al, 2018

Prenatal Myocardial Conditions: Primary Myocardial Disease

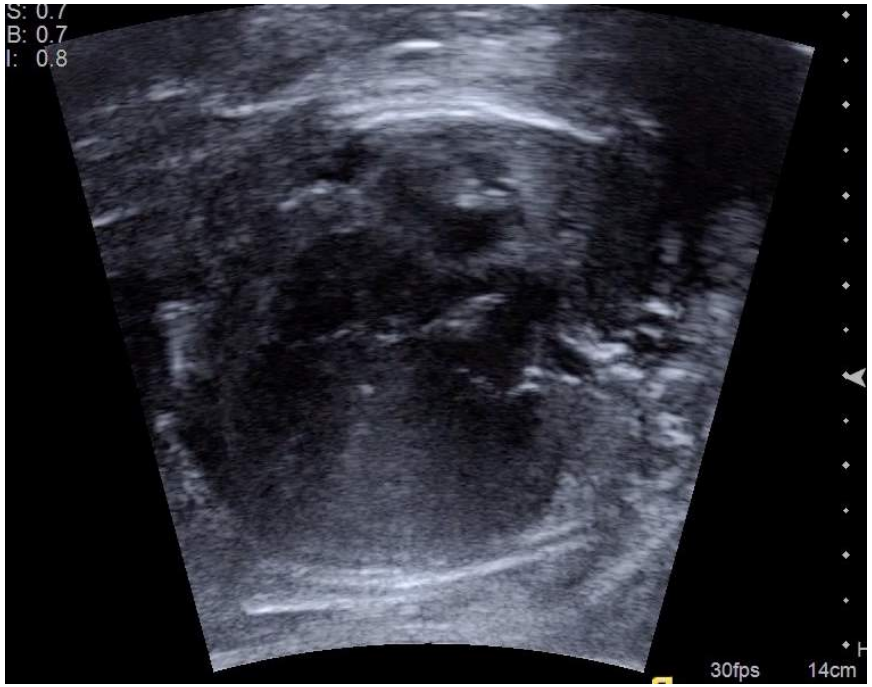
Primary

- Cardiomyopathy
  - Genetic (Inherited/De novo)
  - Syndromic
  - Metabolic
  - Mitochondrial

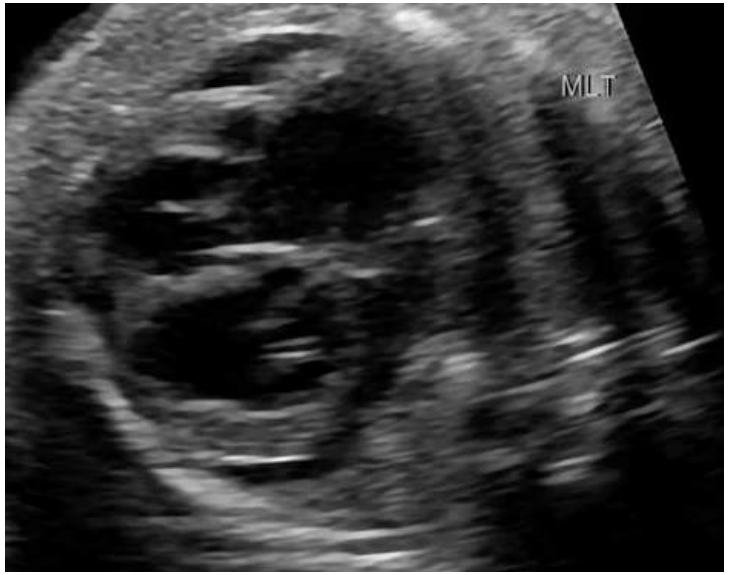
Three examples



Hypertrophic Cardiomyopathy
RASopathy (Noonan/Costello)
Outcome: TOP



Dilated Cardiomyopathy
Compound heterozygote mutation ACAD9 (mitochondrial function)
Outcome: Fetal demise



Dilated Cardiomyopathy
Pathogenic variant TPM1
Outcome: neonatal demise

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Fetal Primary Cardiomyopathy

- Fetal presentation rare
- Single center studies:
  - 38 cases in 17 year period (*Edementon, Trakmulkichkarn et al, 2022*)
  - 25 cases in 12 year period (Texas, Ezon et al, 2016)
  - 50 cases in 12 year period *(Toronto, Weber R et al, 2014)*

Fetal Primary Cardiomyopathy

- High rates of genetic diagnosis
  - 63% overall
  - 76% in current era vs. 38% in older cohort
- High risk for mortality and morbidity
  - Liveborn: 50%
  - Alive at follow-up: 63%
  - No obvious era difference

Table 3 Outcome of 38 cases of fetal cardiomyopathy, overall and according to era of diagnosis

Variable	*Overall: 2003–2019 (n = 38)*	*2003–2012 (n = 13)*	*2013–2019 (n = 25)*	P*
Confirmed/strongly suspected genetic etiology	24 (63)	5 (38)	19 (76)	0.04
Outcome				
TOP	10 (26)	2 (15)	8 (32)	0.44
IUD	9 (24)	5 (38)	4 (16)	0.23
Live birth	19 (50)	6 (46)	13 (52)	0.73
Alive at follow-up	12/19 (63)	3/6 (50)	9/13 (69)	0.6
NND	3/19 (16)	1/6 (17)	2/13 (15)	1.00
Late death	4/19 (21)	2/6 (33)	2/13 (15)	0.56

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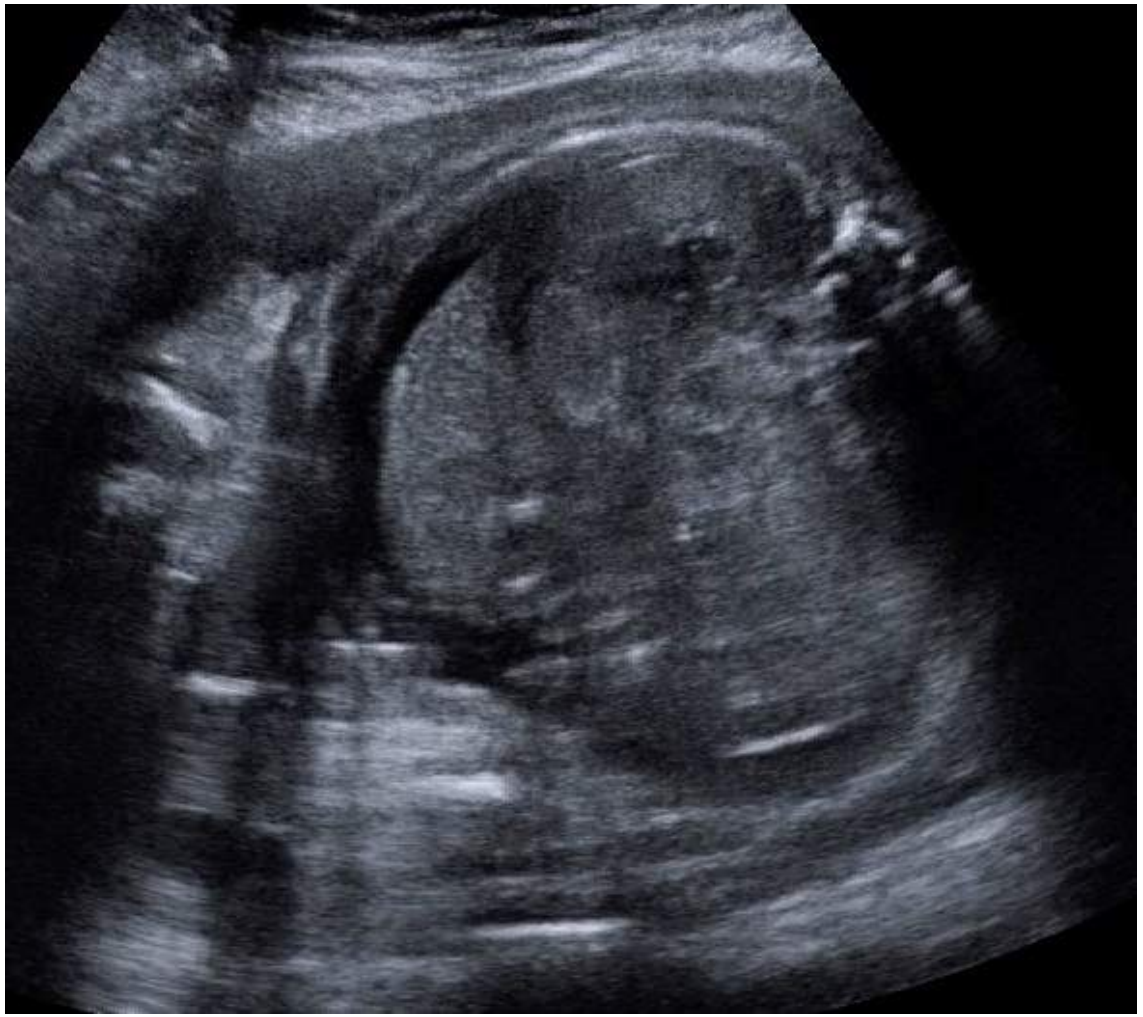
Trakmulkichkarn et al, 2022

Fetal Primary Cardiomyopathy

- Fetal echo parameters of poor outcome:
  - Hydrops
  - Low Cardiovascular Profile score
  - Moderate AV valve regurgitation



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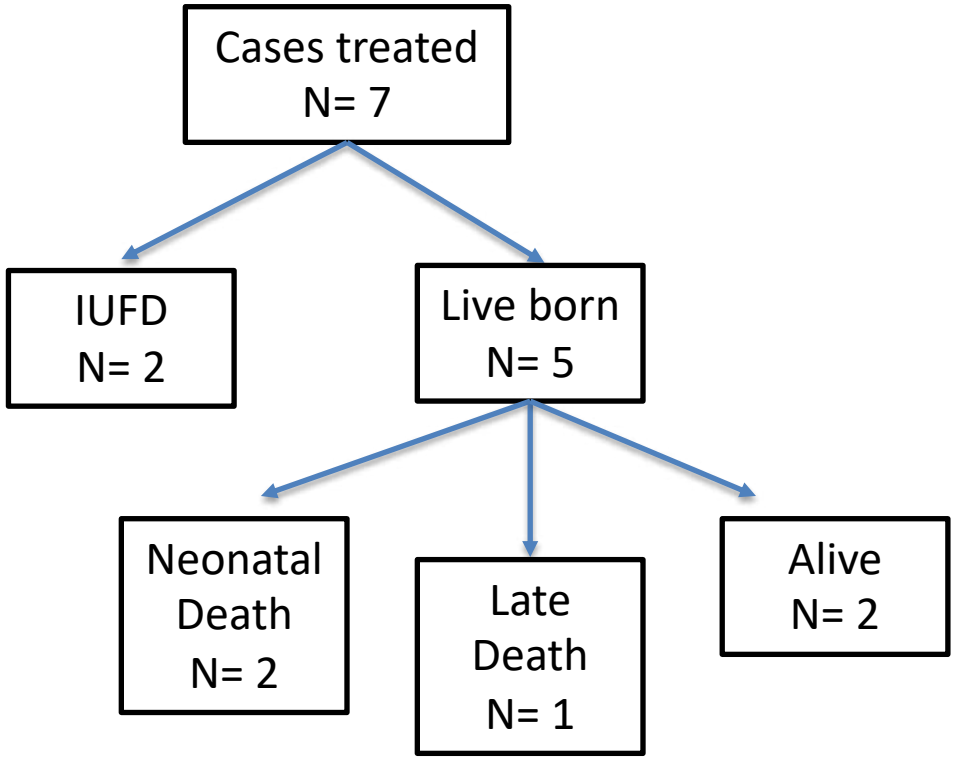
Ezon D et al, 2016
Weber R et al, 2014

Fetal Primary Cardiomyopathy

- Treatment?
  - Prenatal Digoxin (limited experience)



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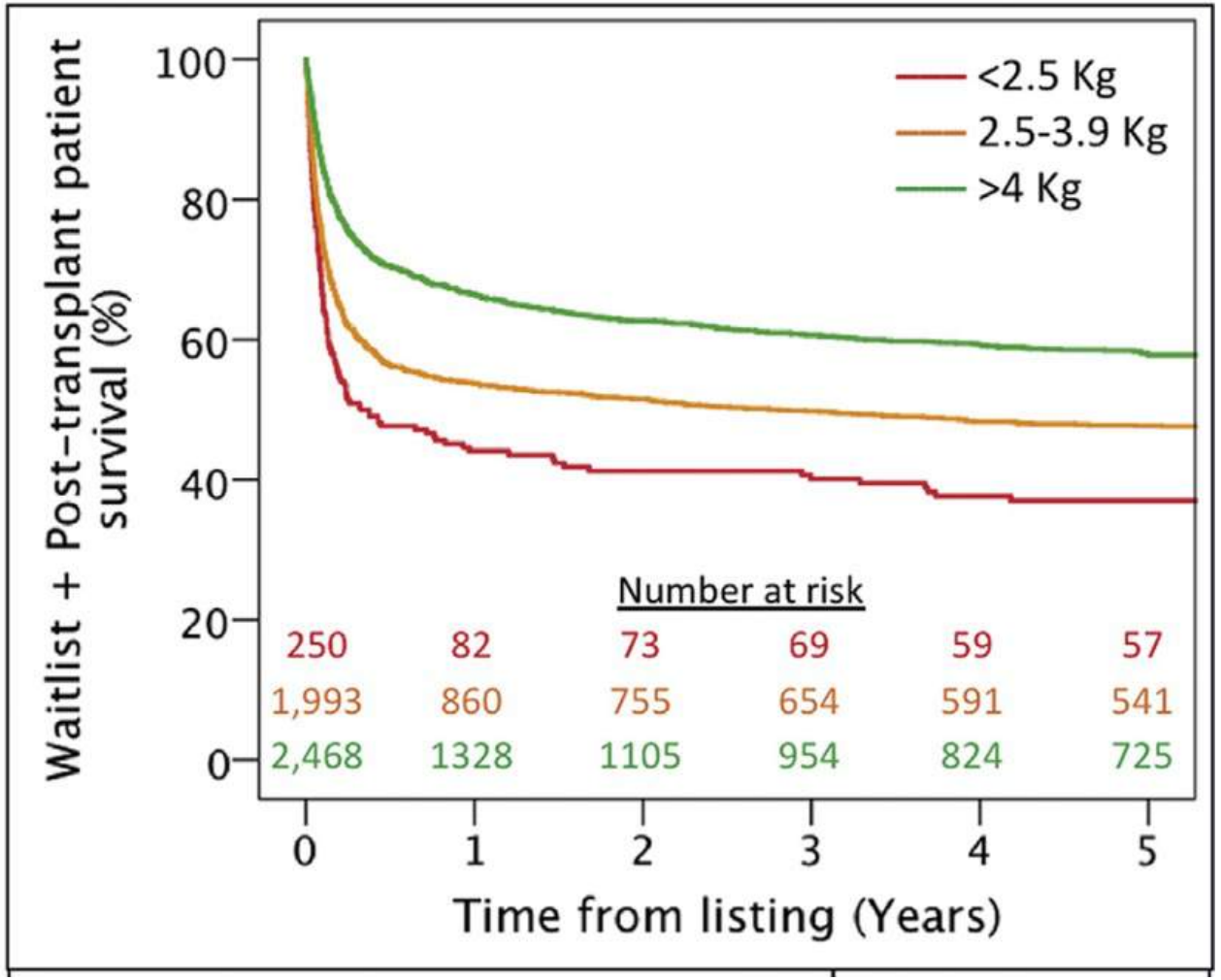
Trakmulkichkarn et al, 2022

Fetal Primary Cardiomyopathy

- Treatment?
  - Delivery for hydropic fetus:
    - Depends on viability (GA) and neonatal support options
    - Weight appears to be an important factor
    - High center variability



Rizwan et al, 2018

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Thank you

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