

Supplemental Material

Data S1.

Supplemental Methods (SCAMP Protocol)

UCfC Congenital Heart Disease Delivery Management SCAMP

Background

A prenatal diagnosis of congenital heart disease (CHD) has been associated with lower birth weights and earlier gestational age at birth,^{1,2} which have both been linked to decreased survival and neurodevelopmental outcomes in these neonates.^{3,4} The UCfC study also noted these findings in addition to a higher rate of caesarean deliveries in mothers whose fetus had a prenatal diagnosis of CHD.

Prenatally diagnosed infants were born earlier (38.1 \pm 0.11 vs 39 \pm 0.14 weeks, $p < 0.001$), had lower birth weights (2852 \pm 49 vs 3074 \pm 58g, $p = 0.005$), and were more likely to be born by cesarean, both planned (37.2 vs 24.5%, $p = 0.004$) and after a trial of labor (12.6 vs 7.6%, $p = 0.017$).⁵

Goals:

1. Identify triggers leading to “early-term” deliveries
2. Identify triggers leading to cesarean deliveries
3. Decrease the rate of “early-term” deliveries in those with a prenatal diagnosis of CHD without other indications for early-term delivery
4. Decrease the rate of caesarean delivery in those with a prenatal diagnosis of CHD
5. Decrease length of stay and hospital costs in mothers of infants and infants with prenatal diagnosis of CHD

Inclusion: Women carrying a singleton fetus with a diagnosis of CHD starting at 32 wks gestation

CHD Diagnostic Categories:⁶

1. CHD w/o predicted risk of hemodynamic instability in the delivery room or first days of life
 - a. VSD
 - b. AVSD
2. CHD with minimal risk of hemodynamic instability in the delivery room but requires postnatal catheterization/surgery
 - a. Ductal-dependent lesions, including:
 - i. HLHS
 - ii. Critical coarctation
 - iii. Severe aortic stenosis
 - iv. Interrupted aortic arch
 - v. Pulmonary atresia with intact ventricular septum
 - vi. Severe tetralogy of Fallot

- b. Other lesions:
 - i. Truncus arteriosus
- 3. CHD with likely hemodynamic instability in the delivery room requiring immediate specialty care for stabilization
 - a. D-TGA with concerning atrial septum (reasonable to consider all d-TGA w/o ASD at risk)
 - b. Uncontrolled arrhythmias
 - c. Complete heart block with heart failure
- 4. CHD with expected hemodynamic instability with placental separation requiring immediate catheterization/surgery to improve survival
 - a. HLHS w/ restricted or intact atrial septum
 - b. D-TGA with restricted or intact atrial septum
 - c. Obstructed TAPVR
 - d. Ebstein's w/hydrops
 - e. TOF w/ absent pulmonary valve and severe airway obstruction
 - f. Uncontrolled arrhythmias with hydrops
 - g. Complete heart block with low ventricular rate, EFE, and/or hydrops

Guidelines and implementation of a pathway will result in the following when compared with historical controls (2011-2013, n= 186 prenatally diagnosed, required intervention w/in 30 days)

- Reduction in % of infants with a prenatal diagnosis of CHD that are born < 39 0/7 wks from *** to ***
- Reduction in % of infants with a prenatal diagnosis of CHD undergoing planned cesarean delivery by 25% (from 37% to 28%).

Recommendations:

Do not recommend routine delivery or induction <39+0 weeks

- Unless required for any other medically-indicated obstetrical reason

Recommend vaginal delivery with cesarean delivery only for obstetrical indications

- Unless required for delivery planning for CHD category 4 lesions
- With the exception of a fetus with complete heart block

Recommend prenatal genetic counseling

Overall Summary of Prenatal Testing

Visit	OB/MFM Testing ^{7,8}	Cardiology Testing
32, 34, 36 wks gestation	ANT starting at 32 0/7, twice weekly until delivery with Q4 week growth scan*	Fetal Echo q 4 wks

* Unless growth restricted and/or any other medical co-morbidities that require more frequent monitoring, i.e. weekly UA Dopplers with fetal growth restriction.

OBSTETRICIAN (VISIT AT 32, 34, 36 wks)

Recommendations

Do not recommend routine delivery or induction <39 0/7 weeks

- **Unless required for any other medically-indicated obstetrical reason**

Recommend vaginal delivery with Cesarean section only for obstetrical indications

- **Unless required for delivery planning for CHD category 4 lesions**
- **With the exception of a fetus with complete heart**

Recommend prenatal genetic counseling

CHD Diagnostic Category:

__ Category 1: CHD w/o predicted risk of hemodynamic instability in the delivery room or first days of life.

(Examples: VSD, AVSD)

__ Category 2: CHD with minimal risk of hemodynamic instability in the delivery room but requires postnatal catheterization/surgery

(Examples: Ductal-dependent lesions such as HLHS, severe AS, coarctation, interrupted aortic arch, PA/IVS, severe pulmonary stenosis, tetralogy of Fallot, others such as truncus arteriosus)

__ Category 3: CHD with likely hemodynamic instability in the delivery room requiring immediate specialty care for stabilization

(Examples: D-TGA, uncontrolled arrhythmias, complete heart block with heart failure)

__ Category 4: CHD with expected hemodynamic instability with placental separation requiring immediate catheterization/surgery to improve survival

(Examples: HLHS or D-TGA w/ restrictive of intact atrial septum, obstructed TAPVR, Ebstein's w/ hydrops, TOF w/ absent pulmonary valve and severe airway obstruction, uncontrolled arrhythmias with hydrops, complete heart block with low ventricular rate, EFE, or hydrops)

CHD diagnosis: _____

Estimated Gestational Age (EGA) at visit: ___ weeks ___ days

Planning antenatal testing twice weekly? Yes ___ No

If no, specify why _____

Type of antenatal testing? _____

Planning growth scan every 4 weeks? ___ Yes ___ No

If no, specify why _____

Planning to deliver < 39 0/7 wks? Yes No

If yes, specify why _____

Planned Mode of Delivery: Vaginal Cesarean

If cesarean delivery, indication (check all that apply):

Elective repeat cesarean delivery

Malpresentation

Cesarean delivery on maternal request

Necessary for care team coordination at delivery (CHD category 3 or 4)

Lives too far away from delivery center to allow natural onset of labor

Fetus with complete heart block

Other, please specify? _____

Did the patient receive prenatal genetic counseling? Yes No

OBSTETRICIAN (AT DELIVERY)

Recommendations

Do not recommend routine delivery or induction <39 0/7 weeks

- **Unless required for any other medically-indicated obstetrical reason**

Recommend vaginal delivery with cesarean delivery only for obstetrical indications

- **Unless required for delivery planning for CHD category 4 lesions**
- **With the exception of a fetus with complete heart block**

CHD Diagnostic Category:

 Category 1: CHD w/o predicted risk of hemodynamic instability in the delivery room or first days of life.

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CHD diagnosis: _____

Estimated Gestational Age (EGA) at Delivery: weeks days

If EGA <39 weeks, why (check all that apply)?

 Spontaneous labor

 Growth Restriction (EFW: < 10th %ile or AC < 5th %ile) Yes No Unknown

 Non-Reassuring Fetal Status (Based on Non-Stress Test or Biophysical Profile)

 Other, specify? _____

Elective Induction: Yes No

If induction, indication (check all that apply):

Maternal

- Preeclampsia with or without severe features
- Gestational Hypertension with or without severe features
- Chronic Hypertension with or without severe features
- Diabetes (Type 1 or Type 2)
- Diabetes (Gestational, A1 or A2)
- Other, specify: _____

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- Intrauterine growth restriction (EFW: < 10%ile or AC <5th %ile)
- Abnormal interval growth
- Abnormal umbilical artery Doppler assessment
- Non-Reassuring Fetal Status (e.g. Based on Non-Stress Test or Biophysical Profile)
- Necessary for care team coordination at delivery
- Lives too far away from delivery center to allow natural onset of labor
- Other, specify? _____

Mode of Delivery: ___Vaginal ___CesareanIf

Cesarean section, indication (check all that apply):

___Repeat cesarean delivery

___Malpresentation

___Arrest of Dilation

___Arrest of Descent

___Non-Reassuring Fetal Status

___Caesarean delivery on Maternal Request

___Necessary for care team coordination at delivery

___Lives too far away from delivery center to allow natural onset of labor

___Fetus with complete heart block

Table S1. Hypertensive (HTN) disease of pregnancy* by CHD category.

	No HTN disease of pregnancy n=270 % (n)	HTN disease of pregnancy* n=34 % (n)	p-value[#]
Low-risk	36% (96)	41% (14)	0.32
High-risk			
Minimal risk of hemodynamic instability	50% (134)	56% (19)	
Likely hemodynamic instability	9% (26)	0% (0)	
Expected hemodynamic instability	4% (13)	3% (1)	
Unknown	1% (1)	0% (0)	

*HTN disease of pregnancy = gestational hypertension (HTN), preeclampsia, and HELLP

[#]Fisher's exact

Table S2. Fetal growth restriction (FGR) by CHD category.

	No FGR n=290 % (n)	FGR n=14 % (n)	p-value[#]
Low-risk	37% (106)	29% (4)	0.89
High-risk			
Minimal risk of hemodynamic instability	50% (144)	64% (9)	
Likely hemodynamic instability	8% (25)	7% (1)	
Expected hemodynamic instability	4% (14)	0% (0)	
Unknown	1% (1)	0% (0)	

#Fisher's exact