

Newborn Management of Prenatally Diagnosed Tetralogy of Fallot and Risk of Ductal Dependency (TET score)

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What is a Clinical Pathway?



- An evidence-based guideline that decreases unnecessary variation and helps promote safe, effective, and consistent patient care.
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Background



- The diagnosis of tetralogy of Fallot carries a wide range treatment possibilities based on the detailed cardiac anatomy.
 - Neonates that are ductal dependent for adequate pulmonary blood flow can be at high risk after delivery if not immediately recognized.
 - Babies that are not ductal dependent may be discharged home with normal oxygen saturations and elective surgery planned at several months of age.
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Objectives of pathway



- Ensure maximal safety for babies with potentially ductal dependent Tetralogy of Fallot
 - Optimize the use of echocardiogram and available resources
 - Decrease ambiguity and variability in evaluation and treatment of newborns with prenatally diagnosed Tetralogy of Fallot in the Neonatal Intensive Care Unit or Well Baby Nursery
 - Minimize unnecessary separation of newborn babies from their mothers
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Why is this pathway necessary



- Ductal dependency in tetralogy of Fallot cannot be reliably diagnosed on prenatal evaluation, but there are findings on fetal echocardiogram that increase suspicion
- Certain features or combinations of features on our fetal evaluation enable us to predict level of risk for ductal dependency
- Ductal dependency, if left untreated can lead to mortality and morbidity
- In some cases, ductal dependency cannot be reliably diagnosed until ductal closure occurs after birth
- In other cases, it is clear that a closure of the ductus will lead to significantly decreased pulmonary blood flow
- Invasive procedures, separation of babies from their mothers, and interruption of feeding practices should be minimized when risk of ductal dependency is low
- Based on our risk assessment, we are able to guide immediate management of newborns after delivery for optimal care.

This is the Newborn Management of Prenatally Diagnosed Tetralogy of Fallot and Risk of Ductal Dependency (TET score) Clinical Pathway.

We will be reviewing each component in the following slides.

CLINICAL PATHWAY: Newborn Management of Prenatally Diagnosed Tetralogy of Fallot and Risk of Ductal Dependency (TET score)

THIS PATHWAY
SERVES AS A GUIDE
AND DOES NOT
REPLACE CLINICAL
JUDGMENT.

Inclusion Criteria: Newborn born at Hartford Hospital prenatally diagnosed with Tetralogy of Fallot and designated with a TET score; clinically stable
Exclusion Criteria: Any signs of clinical instability (oxygen saturations <85%, respiratory distress, apnea, rising lactate, poorly perfused extremities)

Look at mother's medical record in Connecticut Children's Epic for last Cardiology note or ECHO report to determine antenatal risk of ductal dependency with Tetralogy of Fallot based on TET score (Appendix A)

TET Score

Level I:
High Suspicion

- Admit to neonatal intensive care unit (NICU)
- Order STAT Cardiology consult AND page on-service cardiologist
- Order echocardiogram to be done same day

- Access:**
- Insert umbilical lines
- PSG1 0.01 mcg/kg/min:**
- Order prior to delivery (down-time procedures) to start ASAP
- Labs & Monitoring:**
- Pre/post saturations
 - Q2hr arterial blood gas (ABG), lactate
- Feeds:**
- NPO
 - Intravenous fluids (IVF) @ 100 mL/kg/day

Level II:
Moderate-High Suspicion

- Admit to NICU
- Order STAT Cardiology consult AND page on-service cardiologist
- Order echocardiogram to be done same day

- Access:**
- Insert umbilical lines
- PSG1 0.01 mcg/kg/min:**
- Order at the time of delivery to be available at the bedside
- Labs & Monitoring:**
- Pre/post saturations
 - Q2hr ABG, lactate
- Feeds:**
- NPO
 - Intravenous fluids (IVF) @ 100 mL/kg/day

Level III:
Moderate-Low Suspicion

- Admit to NICU
- Order routine Cardiology consult and page on-service cardiologist
- Order echocardiogram to be done within 24 hours

- Access:**
- Insert peripheral IV (PIV)
- PSG1:**
- Do not order unless clinically indicated
- Labs & Monitoring:**
- Pre/post saturations
 - Q2hr ABG, lactate
- Feeds:**
- Ad lib PO

Level IV:
Low Suspicion

- Admit to Hartford Hospital Newborn Nursery
- Contact on-service cardiologist regarding timing of consultation (inpatient vs outpatient)

- Access:**
- None indicated
- PSG1:**
- Do not order unless clinically indicated
- Labs & Monitoring:**
- Routine newborn care
- Feeds:**
- Ad lib PO

"If at any time the patient becomes clinically unstable", exit pathway and call on-service cardiologist to discuss initiation of prostaglandins.

**Examples of clinical instability include oxygen saturations <85%, respiratory distress, apnea, rising lactate, poorly perfused extremities*

CONTACTS: ALICIA WANG, MD

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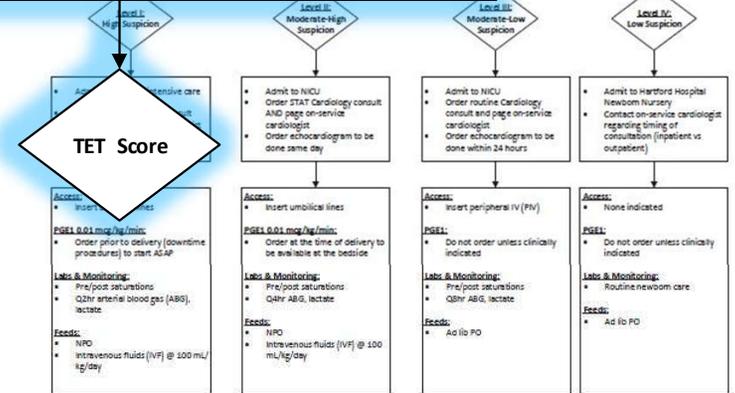


CLINICAL PATHWAY:
Newborn Management of Prenatally Diagnosed Tetralogy

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Inclusion Criteria: Newborns born at Hartford Hospital prenatally diagnosed with Tetralogy of Fallot and designated with a TET score; clinically stable
Exclusion Criteria: Any signs of clinical instability (*oxygen saturations <85%, respiratory distress, acidosis, rising lactate, poorly perfused extremities*)

Look at mother's medical record in Connecticut Children's Epic for last Cardiology note or ECHO report to determine antenatal risk of ductal dependency with Tetralogy of Fallot based on TET score ([Appendix A](#))



"If at any time the patient becomes clinically unstable", exit pathway and call on-service cardiologist to discuss initiation of prostaglandins.
 *Examples of clinical instability include oxygen saturations <85%, respiratory distress, acidosis, rising lactate, poorly perfused extremities

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Mothers of newborns with a prenatal diagnosis of Tetralogy of Fallot will have a chart within Epic. Providers should start by reviewing the mother's chart and the TET score.

See appendix A for the TET Score

CLINICAL PATHWAY:
Newborn Management of Prenatally Diagnosed Tetralogy of Fallot and Risk of Ductal Dependency (TET score)
Appendix A: Antenatal risk of ductal dependent pulmonary blood flow in newborns

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Antenatal Risk of ductal dependent pulmonary blood flow in newborns Tetralogy of Fallot
Management recommendations for suspected Tetralogy of Fallot based on fetal echocardiogram

- All recommendations refer to management/monitoring for PRIOR to cardiology consultation in clinically stable patients
- Clinically stable patients have none of the following:
 - Saturations less than 85%, respiratory distress, acidosis, poorly perfused extremities, rising lactates.
- Any clinical concerns, including the above symptoms, require notification of the on service/on call cardiologist for further discussion.
- The following recommendations only apply prior to consultation. Further management will be based on consult findings.

Level	Fetal findings - examples	Admit	Umbilines	PGE1	Labs and monitoring	Feed	Consultation
I High suspicion	<ul style="list-style-type: none"> Pulmonary atresia Retrograde main pulmonary artery blood flow Reversal of flow in the ductus arteriosus 	NICU	Yes	Order prior to delivery (downtime procedures) to start ASAP	<ul style="list-style-type: none"> Pre/post sats q2h ABG, lactate 	NPO IVF@100ml/kg/d	Call for immediate consult. Echo to be done same day.
II Mod-high suspicion	<ul style="list-style-type: none"> High velocity antegrade flow across the pulmonary valve Hypoplastic pulmonary arteries Bidirectional/Unclear flow in the ductus arteriosus Vertical or tortuous ductus arteriosus Hypoplastic pum valve annulus 	NICU	Yes	Order PGE at the time of delivery to be available at the bedside	<ul style="list-style-type: none"> Pre/post sats q4h ABG, lactate 	NPO IVF@100ml/kg/d	Order immediate consultation. Notify cards attending. Echo to be done on same day.
III Mod-low suspicion	<ul style="list-style-type: none"> Antegrade flow across the pulmonary valve Abnormal appearance of the pulmonary valve Normal or borderline pulmonary valve annulus dimension Antegrade flow across the ductus arteriosus 	NICU	No	Do not order unless clinically indicated	<ul style="list-style-type: none"> Pre/post sats q8h ABG, lactate 	Ad lib PO	Order routine consultation. Notify cardiology attending. Echo to be done within 24 hours
IV Low suspicion	<ul style="list-style-type: none"> Misaligned ventricular septal defect Normal appearing pulmonary valve and annulus dimension Normal, unrestrictive pulmonary valve flow Normal ductus morphology and flow 	WBN	No	Do not order unless clinically indicated	None	Ad lib PO	Evaluate either in the newborn nursery or shortly after discharge

CONTACTS: ALICIA WANG, MD

LAST UPDATED: 06/24/16

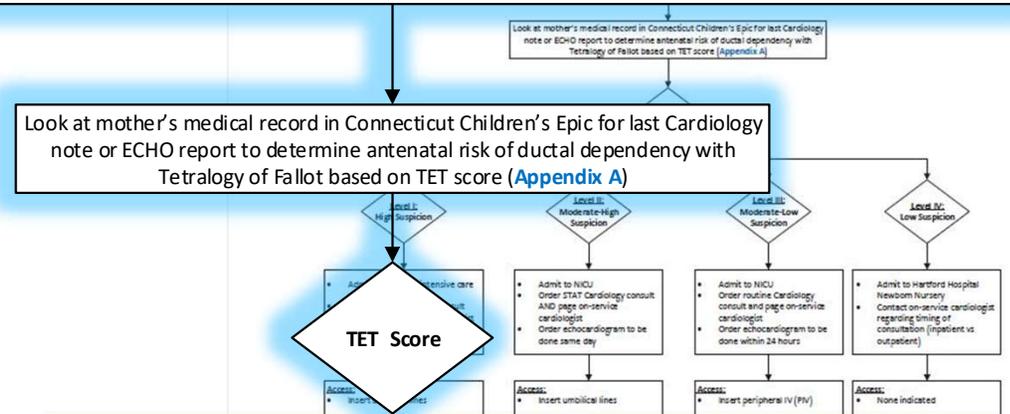
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CLINICAL PATHWAY:
Newborn Management of Prenatally Diagnosed Tetralogy

THIS PATHWAY SERVES AS A GUIDE AND DOES NOT REPLACE CLINICAL JUDGMENT.

Newborns born at Hartford Hospital prenatally diagnosed with Tetralogy of Fallot and designated with a TET score; clinically stable with no signs of clinical instability (oxygen saturations <85%, respiratory distress, acidosis, rising lactate, poorly perfused extremities)



Appendix A: TET Score

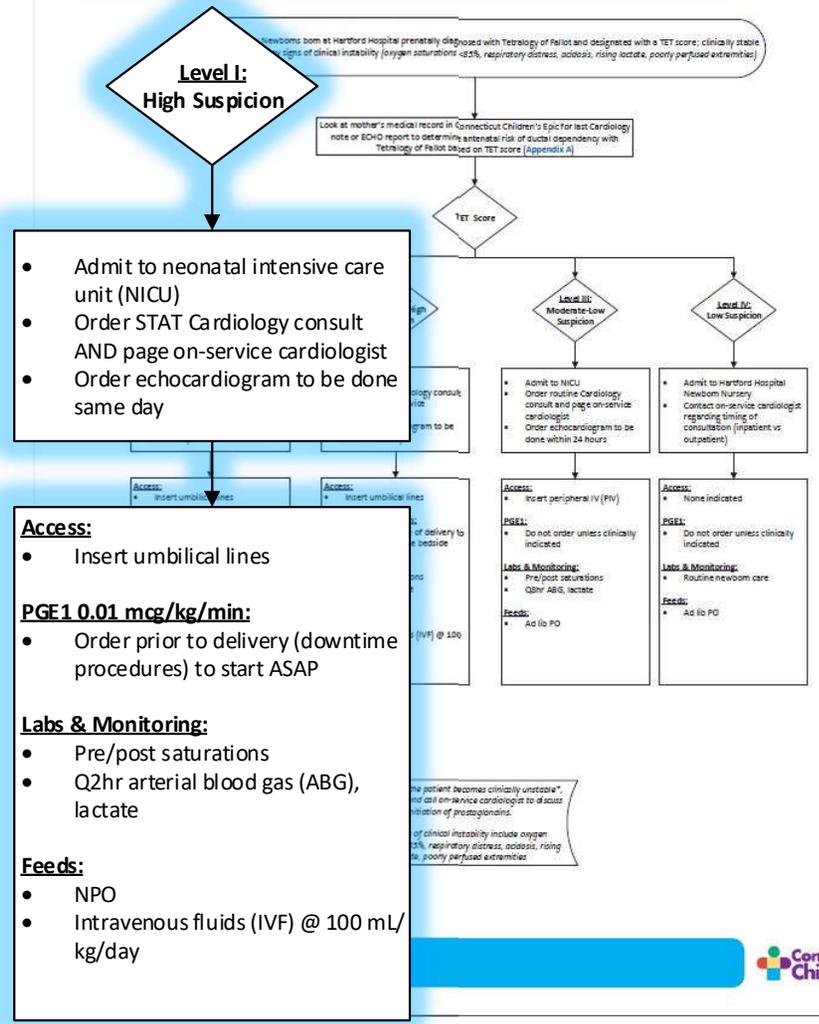
- Describes the antenatal risk of ductal dependent pulmonary blood flow in newborns.
- A score of I-IV assigned prenatally based on fetal echocardiogram

TET score directs management of a clinically stable neonate PRIOR to Cardiology consultation.

- Further management will be based on findings at the time of consult

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Newborn Management of Prenatally Diagnosed Tetralogy of Fallot and Risk of Ductal Dependency (TET Score)

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Level I: High suspicion of ductal dependence

Neonates are admitted to the NICU with STAT Cardiology consultation

PGE is initiated ASAP through an Umbilical line

- PGE should be ordered prior to delivery

Level II: Moderate-High suspicion of ductal dependence

Neonates are admitted to the NICU with STAT Cardiology consultation

Umbilical line is placed and PGE is ordered at the time of delivery to be kept at the bedside

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**Level II:
Moderate-High
Suspicion**

Inclusion Criteria: Newborns with Tetralogy of Fallot and designated with a TET score; clinically stable
Exclusion Criteria: Any neonate with respiratory distress, apnoea, rising lactate, poorly perfused extremities

Look at mother's records in Connecticut Children's Epic for last Cardiology note or ECHO report to determine antenatal risk of ductal dependency with Tetralogy of Fallot based on TET score (Appendix A)

- Admit to NICU
- Order STAT Cardiology consult AND page on-service cardiologist
- Order echocardiogram to be done same day

Level II: High Suspicion

- Admit to neonatal unit (NICU)
- Order STAT Cardiology consult AND page on-service cardiologist
- Order echocardiogram to be done same day

Level II: Low Suspicion

- Order echocardiogram to be done same day

Level II: Low Suspicion

- Admit to Hartford Hospital Newborn Nursery
- Contact on-service cardiologist regarding timing of consultation (inpatient vs outpatient)

Access:

- Insert umbilical lines

PGE1 0.01 mcg/kg/min:

- Order prior to procedures to be done

Labs & Monitoring:

- Pre/post saturations
- Q4hr arterial lactate

Feeds:

- NPO
- Intravenous fluids @ 100 mL/kg/day

Access:

- Insert umbilical lines

PGE1 0.01 mcg/kg/min:

- Order at the time of delivery to be available at the bedside

Labs & Monitoring:

- Pre/post saturations
- Q4hr ABG, lactate

Feeds:

- NPO
- Intravenous fluids (IVF) @ 100 mL/kg/day

Access:

- None indicated

PGE1:

- Do not order unless clinically indicated

Labs & Monitoring:

- Routine newborn care

Feeds:

- Ad lib PO

CONTACTS: ALICIA WALKER
LAST UPDATED: 06/24/19

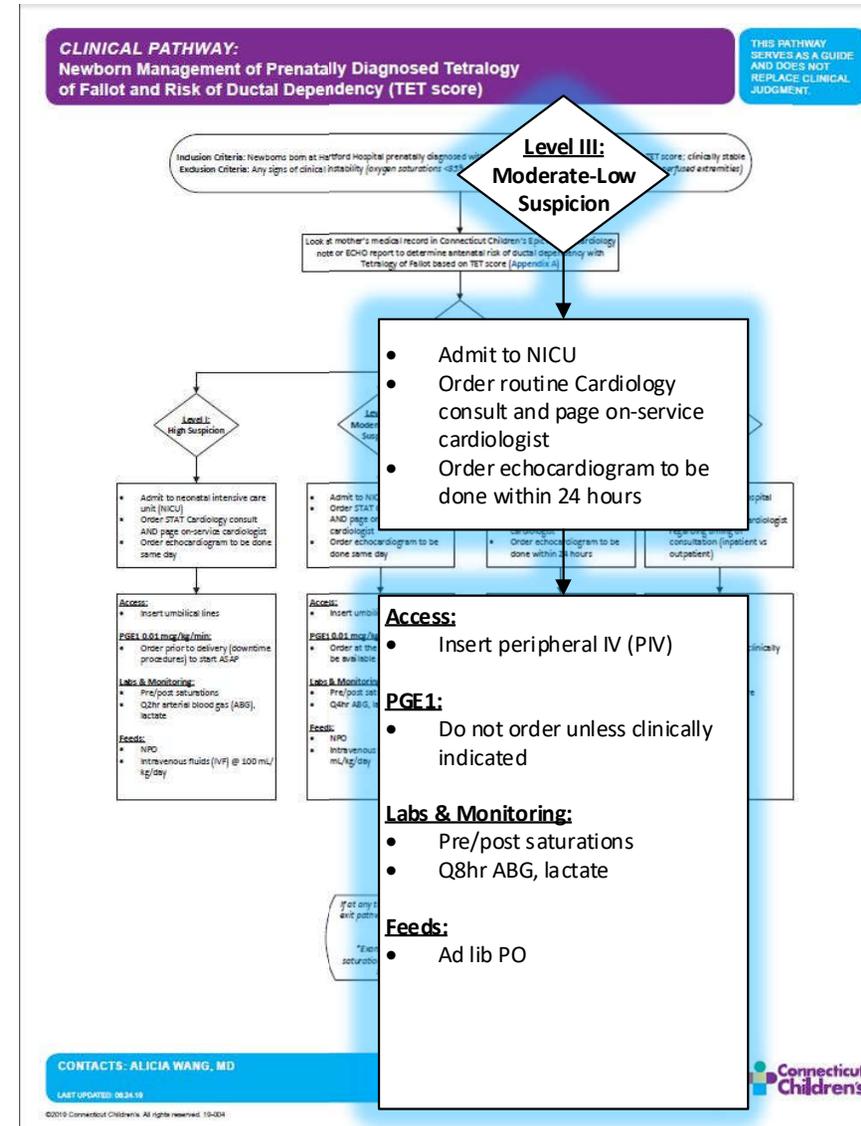


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Level III: Moderate-Low suspicion of ductal dependence

Neonates are admitted to the NICU with routine Cardiology consultation.

A peripheral IV is placed instead of Umbilical line PGE is not ordered unless it is clinically indicated.

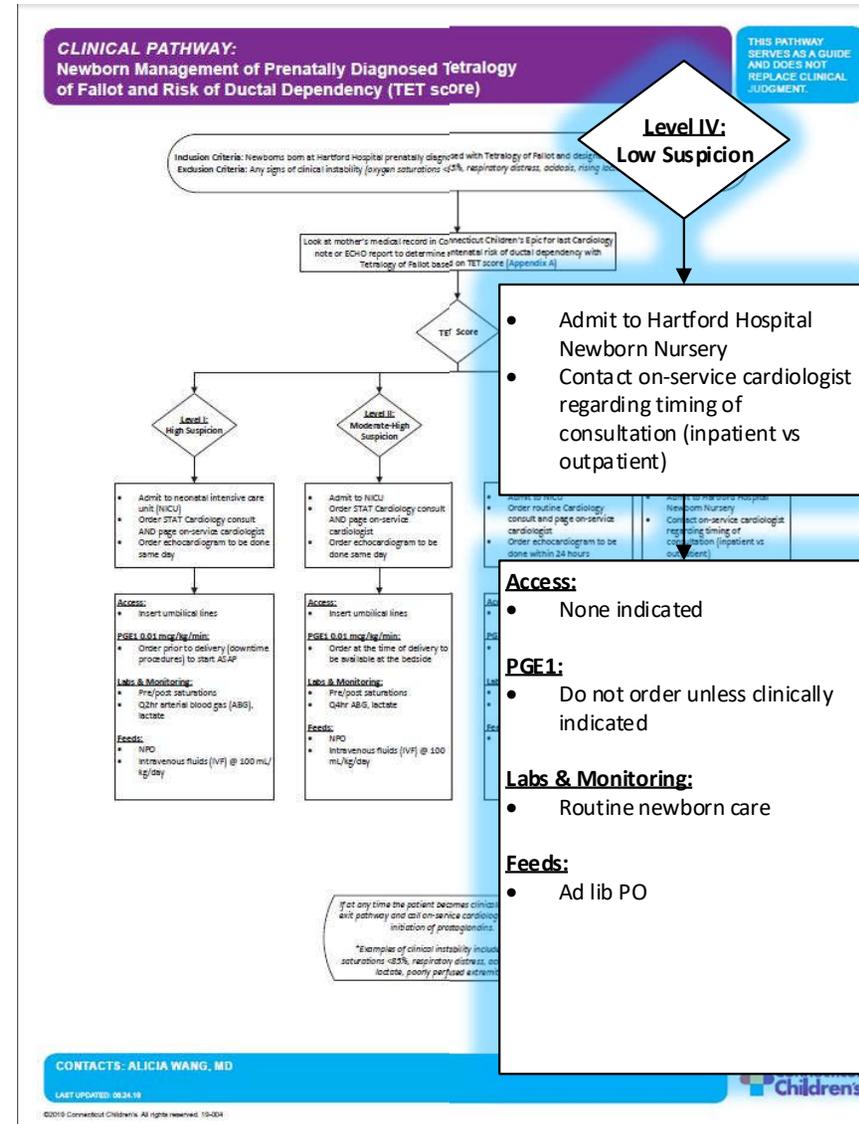


Level IV: Low suspicion of ductal dependence

These neonates may be admitted to the Hartford Hospital Newborn Nursery.

Timing of consultation will be determined by discussion with on call Cardiologist

They require no access and no PGE unless clinically indicated.



Should the patient become unstable at any time, exit the pathway and discuss with Cardiology.

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TET Score

Level I:
High Suspicion

- Admit to neonatal intensive care unit (NICU)
- Order STAT Cardiology consult AND page on-service cardiologist
- Order echocardiogram to be done same day

- Access:**
- Insert umbilical lines
- PSG1:** 0.01 mcg/kg/min
- Order prior to delivery (down-time procedures) to start ASAP
- Labs & Monitoring:**
- Pre/post saturations
 - Other arterial blood gas (ABG), lactate
- Feeds:**
- NPO
 - Intravenous fluids (IVF) @ 100 mL/kg/day

Level II:
Moderate-High Suspicion

- Admit to NICU
- Order STAT Cardiology consult AND page on-service cardiologist
- Order echocardiogram to be done same day

- Access:**
- Insert umbilical lines
- PSG1:** 0.01 mcg/kg/min
- Order at the time of delivery to be available at the bedside
- Labs & Monitoring:**
- Pre/post saturations
 - Other ABG, lactate
- Feeds:**
- NPO
 - Intravenous fluids (IVF) @ 100 mL/kg/day

Level III:
Moderate-Low Suspicion

- Admit to NICU
- Order routine Cardiology consult and page on-service cardiologist
- Order echocardiogram to be done within 24 hours

- Access:**
- Insert peripheral IV (PIV)
- PSG1:**
- Do not order unless clinically indicated
- Labs & Monitoring:**
- Pre/post saturations
 - Other ABG, lactate
- Feeds:**
- Ad lib PO

Level IV:
Low Suspicion

- Admit to Hartford Hospital Newborn Nursery
- Contact on-service cardiologist regarding timing of consultation (inpatient vs outpatient)

- Access:**
- None indicated
- PSG1:**
- Do not order unless clinically indicated
- Labs & Monitoring:**
- Routine newborn care
- Feeds:**
- Ad lib PO

If at any time the patient becomes clinically unstable, exit pathway and call on-service cardiologist to discuss initiation of prostaglandins.*

**Examples of clinical instability include oxygen saturations <85%, respiratory distress, acidosis, rising lactate, poorly perfused extremities*

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Quality Metrics



- Number patients managed with the pathway
 - Percentage of patients on the pathway for which the pathway was followed appropriately
 - Number of patients requiring surgery for Tetralogy of Fallot prior to discharge
 - Stratified by TET risk score
 - Number of patients who had umbilical lines placed or who were made NPO who did not require surgery prior to discharge
 - Stratified by TET risk score
 - Number of patients who had prostaglandins started who did not require surgery prior to discharge
 - Stratified by TET risk score
 - Length of stay (days)
 - Number of echocardiograms performed either prior to discharge or prior to surgery
-

Pathway contacts



- Alicia Wang, MD
 - Pediatric Cardiology at Connecticut Children's

References



- Quartermain MD, Glatz AC, Goldberg DJ, Cohen MS, Elias MD, Tian Z, Rychik J. Pulmonary outflow tract obstruction in fetuses with complex congenital heart disease: predicting the need for neonatal intervention. *Ultrasound Obstet Gynecol.* 2013 Jan;41(1): 47-53.
- Tuo G, Volpe P, Buffi D, De Robertis V, Marasini M. Assessment of the ductus arteriosus in fetuses with tetralogy of Fallot and the implication for postnatal management. *Congenit Heart Dis.* 2014 Sept,9(5):382-390.
- Donofrio MT, Moon-Grady AJ, Hornberger LK, et al. Diagnosis and treatment of fetal cardiac disease: a scientific statement from the American Heart Association. *Circulation.* 2014 May;129(21):2183-242.

Thank You!



About Connecticut Children's Clinical Pathways Program

Clinical pathways guide the management of patients to optimize consistent use of evidence-based practice. Clinical pathways have been shown to improve guideline adherence and quality outcomes, while decreasing length of stay and cost. Here at Connecticut Children's, our Clinical Pathways Program aims to deliver evidence-based, high value care to the greatest number of children in a diversity of patient settings. These pathways serve as a guide for providers and do not replace clinical judgment.