UC DAVIS HEALTH | CHILDREN'S HOSPITAL

Echocardiography, Targeted Neonatal Echocardiography (TNE) and Cardiac POCUS use in the NICU

Joint guideline developed in collaboration with Pediatric Cardiology, Neonatology, Neonatal Hemodynamics and POCUS Teams

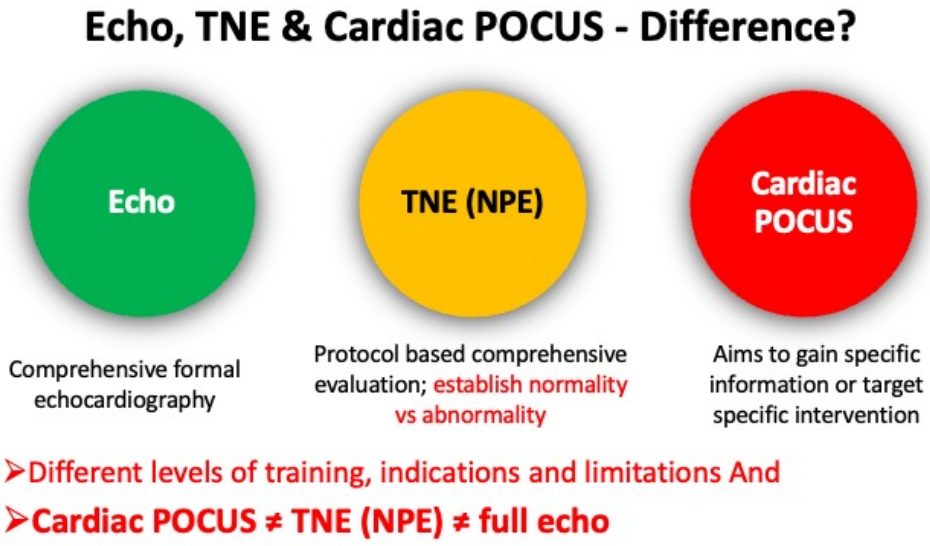
A) Defining terms Echocardiography, TNE and Cardiac POCUS

1. **Echocardiography** refers to formal structural or functional echocardiography performed or read by the pediatric cardiologist.

2. **Targeted Neonatal Echocardiography** (TNE or TnECHO or functional echocardiography) refers to a limited echocardiography performed by a neonatologist formally trained in functional echocardiography, such as a comprehensive assessment or hemodynamic evaluation of patent ductus arteriosus (PDA), pulmonary hypertension (PH or PPHN), Hypoxic Ischemic Encephalopathy (HIE), or shock. This entails a structured assessment and evaluation using a standardized scanning protocol.
   - **First echocardiography, performed or read by a pediatric cardiologist,** should have a comprehensive structural assessment to rule out congenital heart defects (CHDs) and ideally it should be performed before TNE.
   - If the first echocardiography is performed by a TNE-trained person, a formal echocardiography should be obtained by cardiologists within 24 hours.
   - All TNE echo images should be stored and available for review. The findings and interpretation report should be documented in the EPIC.
   - All TNE evaluations should be performed by person trained in TNE who should make clinical decision in the clinical context and hemodynamic evaluation. When TnECHO performed by TNE trainee, then it should be for educational purpose only and should be reviewed by TNE expert to make a clinical decision.

3. **Cardiac POCUS** refers to a targeted, focused cardiac assessment to answer any clinical-specific question, such as qualitative assessment of cardiac function, detection of pericardial effusion or tamponade, detection of line position, and other urgent evaluations.

- **Cardiac POCUS** has a limited scope, with indications that are usually used in emergency situations or when a specific clinical question needs to be answered.
- Cardiac POCUS should not be used for screening of CHDs or comprehensive hemodynamic evaluation.
- If abnormality is detected on cardiac POCUS or the patient needs intervention, it should be promptly discussed with pediatric cardiology.



Indications and Scope of Practice:

A). Formal echocardiography in the NICU: The following are the common indications of requesting a formal echocardiography in the NICU. In addition to these common indications, a formal echocardiography should be discussed with a pediatric cardiologist if there are any cardiac concerns by the attending neonatologist.

- Suspicion of CHDs including in infants of diabetic mothers, suspected trisomy 21 or syndromic association.
- Antenatal diagnosis or suspicion of CHDs.
- Diagnosis of PH and subsequent serial echocardiography as per PH or pediatric cardiology team.
- Subsequent echocardiography to guide management in infants with confirmed with CHDs.
- All cases with moderate to severe HIE needing therapeutic hypothermia with hemodynamic instability should have an echocardiography performed within 12 hours after birth, preferably soon after starting cooling.
- All cases with moderate to severe PH should have an echo performed as soon as possible after clinical diagnosis, especially if they need iNO or inotropic support.

- All cases with congenital diaphragmatic hernia (CDH) should have a formal echocardiography performed as soon as possible after birth.
- All extremely preterm infants <29 weeks of gestation should have a formal echocardiography done between 48-96 hours after birth.

B). TNE or TnECHO indications: Preferably, the 1st echo should be performed by pediatric cardiology before limited TNE assessments. When TNE is performed before a formal echocardiography, it should by obtained within 24 hours after performing TNE. The common indications of preforming TNE include the following:

- **Diagnosis and hemodynamic evaluation of PDA** – all cases should have a formal echocardiography performed before medical treatment on intervention. Subsequent formal echocardiography should be obtained as requested by pediatric cardiology, before transcatheter device closure, surgical ligation, or clinical concerns from the neonatologist or TNE expert.
- **Diagnosis and hemodynamic evaluation of PPHN or acute pulmonary hypertension** - all cases should have a formal echocardiography as soon as possible after diagnosis or within 24 hours when 1st assessment is done on TNE. Subsequent formal echocardiography should be obtained as requested by pediatric cardiology, pulmonary hypertension team, or clinical concerns from the neonatologist or TNE expert.
- Diagnosis and hemodynamic evaluation of patients with shock or hypotension
- Diagnosis and hemodynamic evaluation of patients with HIE
- Qualitative or quantitative assessment of cardiac function
- Detection of pericardial effusion or cardiac tamponade
- Guide pericardiocentesis in an emergency

C). Cardiac POCUS indications: Targeted limited non-protocolized cardiac assessment for specific indication:

- Qualitative assessment of cardiac function / cardiac contractility
- Qualitative assessment of cardiac filling in an emergency
- Detection of cardiac tamponade or pericardial effusion
- Guide pericardiocentesis in an emergency
- Central line (PICC or UVC) tip position
- Limited assessment of pulmonary hypertension or ductal patency in emergency

Scope of TNE or cardiac POCUS assessment in children with known or suspected CHDs: TNE and cardiac POCUS may be utilized by trained neonatologists for rapid hemodynamic assessment in critically ill infants. However, for all patients with:

- Known or suspected congenital heart disease,
- Moderate or greater ventricular dysfunction, or

- Moderate or greater atrioventricular valve regurgitation,
- Moderate or greater ventricular hypertrophy
- Moderate or greater pericardial effusion

the first-line cardiac imaging must be a comprehensive formal echocardiogram performed and interpreted by pediatric cardiology.

If urgent imaging is needed for hemodynamic instability or uncertainty, pediatric cardiology should be contacted immediately to determine the most appropriate and time-sensitive diagnostic pathway and be actively involved in the management of the patient and subsequent imaging.

Escalation of Findings on TNE or cardiac POCUS assessment

Neonatologists should promptly escalate cardiac POCUS or TNE findings to the on-call pediatric cardiology attending if any of the following are identified:

- Unclear or concerning ductal or atrial level shunting
- Unexplained ventricular hypertrophy or decreased function
- Evidence of pulmonary hypertension unresponsive to initial therapy
- Structural abnormalities not previously documented

Continued Training, Quality Assurance, and Governance

- Joint quality review with pediatric cardiology - quarterly meetings to review images, discuss diagnostic variability, and ensure best practices as a QI measure.

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