

## Functional echocardiography in neonatal intensive-care unit: A need of the hour

Sir,

Functional echocardiography is an emerging tool in day to day practice in busy neonatal intensive-care unit (NICU). It is a bed side longitudinal assessment of fetal cardiac function. Previously echocardiography was done usually by cardiologist to rule out congenital cardiac anomaly and to assess patent ductus arteriosus (PDA). Functional echocardiography is becoming an evolving technology which needs meticulous training and commitment to master. Functional echocardiography is not aiming to replace the experienced cardiologist. It is an extension of much evolving acute neonatal management programme. The initial echocardiography should preferably be aimed at excluding structural and anatomical anomaly if any; which should be done by a professional pediatric cardiologist. After which serial functional assessment becomes very necessary which can be performed by a neonatal physician. A well trained neonatal physician can simultaneously assess the hemodynamics of fetal heart, to correlate them clinically and take appropriate timely measures at critical juncture. The practice guidelines and practice parameters are led by American society of echocardiography in conjunction with European society of echocardiography which is forming a strong base for learning and mastering the art.

There has been a lot of debate in early part of 21<sup>st</sup> century about initiation of official practice of echocardiography in NICU. A prospective echocardiographic study done by Moss et al., [1] concluded that echocardiography in the neonatal unit has a high yield for the diagnosis of structural and functional cardiac abnormalities. This often results in change in the clinical management, and can be a reliable tool in the hand of neonatologist. Echocardiography is not only helpful in the diagnosis of congenital heart disease but also for the complete assessment of cardiovascular system which is unique to the fetus [2,3].

### WHY AT ALL THE NEED?

In 21<sup>st</sup> century, NICU is becoming very busy with respect to increasing number of admissions of premature babies, complicated sick newborns who require intensive care all along. Premature babies are prone to develop numerous complications such as feeding difficulty, systemic hypotension, PDA, intraventricular hemorrhage (IVH), necrotizing enterocolitis etc., for which active monitoring is warranted especially in the 1<sup>st</sup> week of life.

Baseline echocardiography is required to assess the hemodynamics in preterm babies e.g., assessment of superior

vena cava (SVC) flow can help to manage hypotension. Preterm babies may have a persistent PDA which fails to close by 72 h and in these cases, serial monitoring of PDA size, shunt fraction and left atrial overload is necessary. Ductal dependent cardiac lesion is a medical emergency and they are prone to be missed by fetal ECHO. So, it is necessary to pick them after birth and to initiate prostaglandin infusion for survival.

1. PDA is the most common cardiovascular problems in preterm neonates, occurring in about 1/3 infants <30 weeks' gestation and up to 60% of infants <28 weeks gestation. Treatment of PDA is required to reduce short term and long term effects due to high volume shunt. Recently conducted DETECT trial, which assessed the ductal treatment on the basis of transductal diameter, showed no improvement on chronic lung disease (CLD) and IVH.

Now the novel approach is to look for the hemodynamics across the shunt, volume overload, and myocardial performance as a whole in lieu of concentrating only on ductal size for treatment purpose. The recent recommendations are to make a composite scoring system taking the following criteria: (a) Size of PDA, (b) hemodynamics across PDA, and (c) myocardial performance. Studies by Sehgal et al., have shown that higher the composite PDA score, higher will be the incidence of CLD.

2. Primary pulmonary hypertension (PPHN): Measurement of pulmonary artery pressure, pulmonary valve ejection time, myocardial performance, and right ventricular dimension is helpful for starting treatment for PPHN and to follow-up these cases. One can have very simple eyeballing of right ventricular size and deviation of septum at first look in four chamber view. In case of high PPHN, the right ventricle will be globular and septum will be deviated to left side. It is also helpful to decide the endpoint of treatment when pulmonary pressures come down and baby improves clinically.
3. SVC flow: Taking on ventricular output to assess systemic blood flow in preterm infants may be erroneous as they usually have intracardiac shunts, PDA etc., which can also affect the ventricular output. However, it is feasible to concentrate on SVC flow which determines blood flow from upper part of the body and the brain. SVC flow is unaffected by atrial or ductal shunting in preterm infants in 1<sup>st</sup> day of life; therefore, it is a better tool for monitoring blood flow to the brain in preterm infants in initial few days when intracardiac fetal shunts are common. Studies have shown that it corresponds to ventricular output in term infants. It is also useful in sick preterms to assess the preload and decide about the fluid therapy as well.

## Letter to the Editor

4. Focused Echocardiography: Echocardiography can be a useful tool for other conditions as well such as:
  - i. Pericardial effusion, tamponade
  - ii. Position of central line, umbilical lines, peripherally inserted central catheter line
  - iii. Cannulation for extracorporeal membrane oxygenation
  - iv. Mesenteric vessel position and flow in case of malrotation, congenital diaphragmatic hernia etc.

## EXTENDED APPROACH

### Module and Components

Training programmes have been already initiated in Australia, UK, Canada, and Newland [4]. Targeted neonatal echocardiography guidelines have been laid by American society of echocardiography, European association of echocardiography in collaboration with European Pediatric cardiologists [5]. To start such initiative in India is a challenge and more so in a resource limited settings. There is also an urgent need to form guidelines in our scenario which will pave way to help budding neonatologists.

### Main Components

Basic training and workshop can be initiated in a tertiary care level.

- a. Modular training with hands on echocardiogram should be conferred by the experienced pediatric cardiologists
- b. Small groups of motivated neonatologist can be sub-grouped for well interactive teaching session
- c. Basic knowledge of anatomy, physiology and fetal circulation is necessary for which adequate care should be taken to teach
- d. Assessment with practical application should be done at the closure session
- e. Neonatologist should be motivated to do daily ECHO bedside in NICU and should have direct access to pediatric cardiologist as and when required
- f. Success depends on daily practice and continuous involvement and teaching the fellows about daily experiences with sharing the knowledge among colleagues.

### Core Training

1. Core knowledge of anatomy, and physiology of fetal and neonatal circulation
2. Knowledge on echocardiogram machine, piezoelectric probe, and standard frequency
3. Idea about all possible axis for image like parasternal long axis, short axis, apical, subcostal view, and four chamber view
4. Chambers and vessels to look for in each view

5. Practical experience on two-dimensional view, color flow monitor, M-mode etc.
6. Introduction to Doppler flow assessment.

### What is Expected from 1<sup>st</sup> Training?

1. A neonatologist should know how to focus on heart chambers and vessels in each view
2. Should be able to delineate for chambers, ventricular outlets, intra-arterial and intraventricular septum, and valves
3. Should be well trained to look for aorta, pulmonary artery and ductus arteriosus
4. Measurement of ductal diameter, direction of flow and left atria/aorta ratio.

Neonatologist who are already trained and satisfy above criteria should be put into targeted programme. The section for the targeted programme should be strict.

Targeted Neonatal Echocardiography programme:

- More hemodynamics should be introduced into like assessment of pulmonary arterial pressure, and pulmonary valve ejection time for PPHN.
- Over all idea and measurement of SVC flow.
- Assessment of left ventricular output, ejection fraction, and myocardial performance index.
- Pulmonary venous flow, assessment of aorta for co-arcuation, transposition of the great arteries/transposition of the great vessels assessment, and fallot's physiology assessment.

Targeted echocardiography programme is an optimum hypothesis now but continuous progression and motivation will lay stepping stone in this purpose. Involvement of pediatric cardiology in every aspect of the step is a must which should parallel with the involvement of motivated neonatologists.

## CONCLUSION

Echocardiography is safe for official practice in NICU and it will enable to enhance appropriate neonatal care in emergency situations. The scope is extensive and is evolving day by day. So an hour has reached to accept the clarion call and lay a stepping stone in this regard in our country and so as to create an environment for the better neonatal and perinatal care in our subcontinent.

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