

Myocardial ischemia in neonate with perinatal asphyxia

As per the India Newborn Action Plan, India aims at attaining single-digit neonatal mortality rate by 2030 by focusing on ending the preventable newborn deaths, improving the quality of care and care beyond survival [1]. Four out of five newborn deaths result from three treatable conditions: Complications during childbirth (including birth asphyxia), newborn infections, and complications from prematurity. Perinatal asphyxia is a common problem with the incidence varying from 0.5% to 2% of live births [2]. It is an important cause of admission to the Neonatal Intensive Care Units (NICU) with multiorgan dysfunction including clinical cardiac dysfunction in 24-31% cases [3,4].

Apart from the clinical presentation, electrocardiography (ECG), echocardiogram, Doppler, and determination of cardiac enzymes are useful tools to detect myocardial involvement. Until date, many studies have assessed the myocardial dysfunction with the assay of cardiac enzymes and ECG abnormalities, but none of them has been accepted widely and used only for prognostication purpose only. None of the intervention has been proved to alter the course of the disease and outcome other than echocardiography. Furthermore, not enough data are available from Indian NICUs [5,6]. The authors of the research paper published in this issue of "Indian Journal of Child Health" have made a good effort to find out the incidence of cardiac dysfunction in Indian newborns [7].

The authors of this study found severe ECG changes (Grade 3 and 4), elevated creatine kinase-MB (CK-MB) levels and reduced fractional shortening as reliable markers of myocardial ischemia in perinatal asphyxia. In this study, ECG changes were present in quite high (70, 77.7%) of cases as reported by other Indian studies [5,6]. However, authors from other countries found much less incidence of ECG changes in babies with similar degrees of perinatal asphyxia. This needs to be interpreted with great caution as neonatal ECGs are difficult to interpret and prior special training reading neonatal ECGs may affect the results. Second, normal ECG changes took place over a period of a month to years. "T" wave inversion in ECG indicates significant myocardial ischemia, but T wave normally is quite variable in the 1st week of life. Moreover, artifacts can occur because of various types of fine muscle tremors or jitteriness random limb movement common in newborn ECGs and include limb lead reversal and incorrect chest lead positioning. In addition, electrical interference can occur in hospital settings from bedside monitors, warmers or other equipment [8].

Biochemical markers like CK-MB levels are elevated in birth asphyxia indicate heart muscle damage. However, CK-MB is also found in skeletal muscle in the newborn period; hence, the elevation of the enzyme in these babies could be explained by their nonspecific nature. Authors of the current study found a positive correlation of elevated CK-MB levels with increasing severity of the asphyxia. However, no similar relationship could be established between CK-MB level and cardiac dysfunction in other studies. Cardiac troponin T is more specific and sensitive than CK-MB in the diagnosis of cardiac dysfunction in perinatal asphyxia [6].

If there are clinical manifestations suggesting poor end-organ perfusion, comprehensive echocardiography may be helpful for identifying possible underlying structural or functional heart disease. If abnormalities are detected, standard targeted neonatal echocardiography can be used to monitor functional recovery and the hemodynamic effects of the treatment. The conventional index

of myocardial functions in neonates and used in this study is the fractional shortening, the relative change in the diameter of the left ventricle. However, birth asphyxia can lead to impaired myocardial function which is not always detected by fractional shortening.

Strain and strain rate by tissue Doppler are novel indices of myocardial function. The strain is the relative change in the length of the myocardial wall and strain rate is strain per unit of time. In tissue doppler, we can assess - (a) peak systolic strain rate and early diastolic strain rate, (b) strain rate during atrial systole, (c) peak systolic strain, and (d) fractional shortening. These parameters lower in birth asphyxia. The new myocardial function indices are found to be more sensitive than the conventional index of myocardial function for assessing the impaired function in asphyxiated term neonates [9].

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