



Effect of Perinatal Asphyxia on Myocardial Function in Term Neonate

Authors

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Abstract

Perinatal Asphyxia is a common problem with incidence varying from 0.5- 2% of live births. It is a third most common cause of neonatal death (23%) after preterm birth (28%) and sepsis (26%). The asphyxia injury involve virtually every organ system of body. In this study clinical parameters, Electrocardiographic changes and Cardiac enzymes studied to evaluate the myocardial function in newborns with perinatal asphyxia. In general myocardial function is often under diagnosed and requires high index of suspicion. Neonates with severe hypoxic damage reflected significant changes in ECG and enzymes levels.

Introduction

Perinatal asphyxia is a common problem with the incidence varying from 0.5–2% of live births^{1,2}. Four out of five newborns deaths result from three treatable conditions: Complications during childbirth (including birth asphyxia), newborn infections, and complications from prematurity. Perinatal asphyxia is a condition wherein there is an impairment of transfer of the respiratory gases resulting in hypoxemia and hypercapnea, accompanied by metabolic acidosis. The WHO defines Perinatal Asphyxia as “Failure to initiate or sustain breathing at birth.” Perinatal asphyxia is a third most common cause of neonatal death (23%) after preterm birth (28%) and sepsis (26%). The asphyxia injury may involve virtually every organ system of the body, but hypoxic-ischemic encephalopathy (HIE) is the most common sequelae⁴. Sarnat and Sarnat classified HIE into three clinical stages: Mild (Stage 1), moderate

(Stage 2), and severe (Stage 3) encephalopathy. HIE infants have various levels of consciousness and the behavioural changes ranging from irritability to stupor or coma⁷. In most cases, systemic hypoxia-ischemia results in multi organ dysfunction. The lungs of asphyxiated newborns can be compromised - as a result of aspiration of meconium, secondary to cardiac dysfunction, or due to pulmonary hypertension. Accordingly, gas exchange is impaired and assisted ventilation may be needed⁷.

Clinical evaluation and laboratory values are used to assess and manage the asphyxiated babies. The best indicator for intrapartum asphyxia is severe metabolic acidosis (pH <7.0 and base deficit \geq 12 mmol/L) in umbilical cord arterial blood at delivery⁹. Cranial and Doppler ultrasonography, computerized tomography, and magnetic resonance imaging are the most used brain imaging techniques.

Apart from the clinical presentation, electrocardiography (ECG), echocardiogram and determination of cardiac enzymes are useful tools to detect myocardial involvement. In contrast to adults, recognition of myocardial ischemia is far more difficult in neonates. Only few studies have assessed the myocardial dysfunction with assay of cardiac enzymes and ECG abnormalities^{19,20}. Severe Perinatal Asphyxia has been known to cause ischemic myocardial injury with potentially fatal outcomes^{28,29}. An elevated serum Creatine kinase muscle-brain fraction (CK-MB) fraction or Cardiac Troponin T (cTnT) level may be helpful in determining the presence of myocardial damage. Serum Cardiac Troponin (cTnT) is a reliable marker of myocardial injury.

Aims and Objectives

The Aims and Objectives were to study the usefulness of selected Clinical parameters and Electrocardiographic changes in evaluating myocardial function in newborns with Perinatal Asphyxia and to study Cardiac Enzymes in evaluating myocardial function in newborns with Perinatal Asphyxia.

Materials and Methods

Neonates fulfilling the inclusion criteria were enrolled in the study after Approval from Institutional Ethics Committee. Subjects were enrolled after obtaining informed consent from the lawful guardian. Neonates with Major Congenital malformations, chromosomal anomalies (trisomy 13,18,21) and neonates with Congenital Heart disease were excluded. The required data collection and investigations were done within 72 hours of admission to the NICU. Study was conducted in a Neonatal Intensive Care Unit of a tertiary care centre in a metropolitan city over a period of 18 months. The required data collection and investigations were done within 72 hours of admission to NICU.

Results

This study included a total of 100 subjects of which 53 were male patients while there were a total of 47 female patients included. Ratio of Males to Females being 1.1:1. According to Sarnat staging 63% of the neonates belonged to stage I as per Sarnat classification, 17% neonates belonged to Stage II, while 20% of the neonates belonged to Stage III as per Sarnat classification. The ECG findings of our study-13% of the neonates showed Grade I ECG findings while 38% of the neonates showed Grade II findings. Grade III ECG findings were found in 38 % of the neonates while 11 % of the neonates showed Grade IV ECG findings. All of the 13 neonates showing Grade I ECG findings belonged to the Stage I as per the SARNAT staging. Of the 38 neonates depicting Grade II ECG findings, 35 neonates i.e. 92.1% of the neonates were included in Stage I as per SARNAT staging while 3 neonates (7.9%) belonged to Stage II as per the SARNAT staging. None of the neonates with Grade I and II ECG findings was part of Stage III SARNAT staging. Of the total 38 neonates with Grade III findings, 15 neonates (39.5%) presented in SARNAT stage I, 13 neonates (34.2%) present in SARNAT stage II while 10 neonates (26.3%) in SARNAT stage III. As far as the Grade IV ECG findings were concerned, of the 11 neonates, 1 neonate belonged to SARNAT Stage II while 10 neonates (90.9%) presented with findings of SARNAT Stage III. Association of Cardiac Troponin-T and SARNAT Staging. Of the 63 neonates presenting in SARNAT stage I, 41.3% neonates showed normal levels of Troponin-T while 58.7 % neonates showed raised levels of Troponin-T. Of the 17 neonates presenting in Stage II SARNAT, all the 17 neonates showed raised levels of Troponin-T. The 20 neonates which presented in stage III as per the SARNAT classification, all the 20 neonates showed raised levels of Troponin-T. Association of CPK-MB and SARNAT Staging- Of the 63 neonates presenting in SARNAT stage I, 9.5% neonates showed normal levels of CPK-MB while 90.5%

neonates showed raised levels of CPK-MB. Of the 17 neonates presenting in SARNAT stage II, 5.9% neonates showed normal levels of CPK-MB while 94.1% neonates showed raised levels of CPK-MB. The 20 neonates which presented in stage III as per the SARNAT classification, all the 20 neonates showed raised levels

Discussion

Perinatal Asphyxia (PA) has a high impact on neonatal mortality and morbidity. The clinical research in the last few years has centred mainly on two major topics: early detection of subclinical cardiac involvement in new-borns with diagnosed PA and early detection of the subset of neonates with high risk of poor clinical outcome or death. The various clinical features related to cardiac dysfunction that are commonly documented are respiratory distress, congestive cardiac failure, cardiogenic shock and systolic murmur. The clinical diagnosis of perinatal asphyxia is based on several criteria, the two main ones being evidence of cardiorespiratory and neurological depression (defined as an Apgar score remaining less than 3 at 5 minutes after birth) and evidence of asphyxic insult with acidemia (defined as an arterial blood pH of less than 7 or base excess greater than 12 mmol/L). In the immediate postpartum period when resuscitation is being undertaken, it may not be possible to determine whether the neurological and cardiorespiratory depression is secondary to hypoxia-ischemia, or to another condition such as fetomaternal infection, or metabolic disease. Consequently, resuscitation and early management will often be of suspected rather than confirmed perinatal asphyxia.

A significant association between Cardiac Troponin T and Severity of Perinatal asphyxia as graded by Sarnat Staging of HIE was established with p value (<0.001) being very highly significant. Likewise, A significant association between ECG and Severity of Perinatal asphyxia as graded by Sarnat and Sarnat Staging of HIE was established with p value (<0.001) being very highly significant. CPK-MB levels were less

significant compared to Cardiac Troponin T Levels in evaluating myocardial dysfunction in asphyxiated neonates

Conclusion

In general, myocardial dysfunction is often under diagnosed and requires a high index of suspicion. The measurement of CK-MB and cardiac Troponin T as evidenced by present study may have a role in the early identification of neonates with myocardial damage secondary to ischemia. In present study, there is a clear relationship between clinical pattern of asphyxiated newborns and alterations of enzymatic and electrocardiographic parameters. Neonates with severe hypoxic damage reflected significant changes in ECG and enzyme levels. It can be concluded that unlike CK-MB, Serum Cardiac Troponin-T concentrations are significantly higher in asphyxiated neonates who develop cardiac dysfunction.

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