

Role of 2D echo in neonates with perinatal asphyxia and its correlation with cardiac troponin T levels and creatine kinase MB

Divya Mathur¹, Pradeep Kumar Gupta^{2,*}, Ajay Punj³

¹Junior Resident, ²Professor & HOD, ³Associate Professor, Dept. of Pediatrics, Subharti Medical College, Meerut, Uttar Pradesh

***Corresponding Author:**

Email: drgupta_jsr@rediffmail.com

Abstract

Objectives: To evaluate myocardial function in neonates with perinatal asphyxia by 2D Echo and cardiac Troponin T levels and creatine kinase MB.

Methods: 30 term babies with perinatal asphyxia were selected as cases. They were evaluated within 48 hours of birth using clinical echocardiography and cardiac enzymes i.e. Troponin -T and CK-MB levels.

Results: Incidence of cardiac dysfunction in neonates were reported and correlated with cardiac Troponin T levels and creatine phosphokinase MB- levels. In this study overall, 30% cases were reported with cardiogenic shock and cardiovascular dysfunction. 20% cases had clinical evidence of murmur. 16.6% cases had cardiac failure and 3.3% cases were asymptomatic. Cardiac enzymes were significantly increased in babies with perinatal asphyxia. Cardiac Troponin t levels ranges from 0.15- >=0.3ng/ml. CPK-MB levels ranged from 200±110 IU/L in this study. Tricuspid regurgitation seen in 6.7% cases. RV hypokinesia (67% cases) >LV hypokinesia (33.3%) cases. Incidence of cardiac changes and mortality increases with increasing levels of Troponin T. Mortality was seen in 2 out of 30 cases. The mean Troponin -T level in cases with cardiac dysfunction was 0.3ng/ml as compared to without cardiac dysfunction (<=0.1ng/ml). Cardiac Troponin T had higher sensitivity and specificity compared to CK-MB levels. Cardiac Troponin -t levels correlated well with severity and outcome in babies with perinatal asphyxia.

Conclusion: Echocardiography and cardiac enzymes i.e. cardiac troponin T levels and CK-MB levels correlates well with severity and outcome in perinatal asphyxia.

Keywords: Birth asphyxia, Cardiac troponin T, 2 D ECHO

Introduction

Incidence of perinatal asphyxia varies from 0.5% - 2% of live births and is commonly encountered problem.^(1,2) Incidence of cardiac dysfunction in perinatal asphyxia varies from 24%-60%. Perinatal asphyxia leading to hypoxic ischemic encephalopathy is a common problem causing multi organ dysfunction including myocardial involvement which can affect the outcome.⁽³⁾

Cardiovascular changes includes -Myocardial ischaemia, poor contractility, cardiac stunning, tricuspid insufficiency, hypotension. Cardiac Troponin T has a major role in screening and diagnosis of myocardial ischemic injury.⁽⁴⁾ It has highest sensitivity and specificity in diagnosis of acute myocardial infarction.^(4,5)

cTnT is an inhibitory protein complex located on actin filament of cardiac muscle, elaborate in cardiac damage. Its structure is unique to myocardium which allows assessment of cardiac injury even in presence of skeletal one.^(6,7) Another assay is immuno-inhibition of CK-MB, for cardiac care unit patients, and is characterized by simplicity of the procedure and easy availability of results that make a significant contribution to clinical diagnosis. It is reported that elevated CK activity appears within 6 hours of the acute episode.⁽⁸⁾ Role of echocardiography in evaluating the myocardial dysfunction and clinical assessment of

hemodynamic status in neonates with birth asphyxia was done.⁽⁹⁾

Material and Method

The prospective study was conducted in neonates with perinatal asphyxia in neonatal ICU, Subharti Hospital. The cases included 30 term babies delivered in hospital with clinical evidence of asphyxia as per following parameters-

1. APGAR<=6/10 at 5 minutes of birth
2. Gestational history of acute perinatal event(H/O need for resuscitation at birth, H/O delayed cry at birth, clinical examination consistent with HIE in first 24 hours).
3. Meconium stained amniotic fluid
4. Cord blood ph<7.1
5. Organ dysfunction attributable to asphyxia.

Study period- 6months

Sample size- 30

Study design- Prospective study

This study was approved by ethical committee.

Inclusion Criteria

1. Term neonates with perinatal asphyxia within 48 hours of birth.
2. Age>=37 weeks and birth weight >=2500gm.
3. Fetal distress as evidenced by atleast one of the following-
 - Apgar score<=6
 - H/o need for resuscitation at birth.

- Clinical examination consistent with HIE in first 24 hours.

Exclusion Criteria

1. Neonates with congenital anomalies or major central nervous system malformations.
2. Neonates having cardiac disease.
3. Neonates with sepsis.
4. Preterm babies and IUGR.

Informed consent was taken from the parents of all babies included in the study.

1ml of cord blood from umbilical artery for pH estimation at birth, and 4ml of venous blood was collected for cardiac enzymes estimated in each asphyxiated neonates within 24 hours of admission as well as for Cardiac Troponin T (Chemiluminescence Enzyme Immunoassay) done using 1cardiac troponin t kit. Roche Elecsys, third generation-0.01 and Creatine phosphokinase-MB using Vitros-250. An echocardiogram was performed within 48 hours of birth to assess the cardiac function and was repeated before discharge if initial ECHO was abnormal. The incidence of cardiac dysfunction using clinical and echocardiographic criteria was calculated.

Results

Neonates with birth asphyxia were evaluated within 24 and 48 hours of birth according to age, sex, HIE staging (Table 1). ECHO was done as a baseline investigation and cardiac enzymes were evaluated. Out of 30 cases, 5 (16.6%) had cardiac failure. cTn T levels in this group >0.3ng/ml.CK-MB levels were >200±30 IU/L. 2 babies with severe cardia dysfunction and significantly raised cardiac enzymes did not survive.

9 cases (30%) had ventricular dysfunction .RV hypokinesia >LV hypokinesia. Incidence of Tricuspid regurgitation is 6.7%. Cardiac troponin T levels ranged from 0.15-0.28ng/ml. Values of CK-MB ranged from 200±110 IU/L.

In 9 cases out of 30(30%), developed cardiogenic shock and required inotropic support. Echo findings were suggestive of significant bradycardia, mild pericardial effusion. TROPONIN t levels ranged between 0.28±0.1ng/ml. CK-MB levels were >120±80 IU/L in this group.

In 6 cases out of 30 (20%) had evident murmur with cTn t levels >0.28ng/ml.CK-MB levels ≥100IU/L in this group.

Incidence of cardiac dysfunction in neonates was seen according to HIE staging. In HIE stage I 2 out of 10 cases (20%) reported with ventricular dysfunction. 3 cases(30%) had cardiogenic shock and 4 out of 10 cases(40%) had murmur. In HIE stage II 4 out of 17 cases(23.5%) had cardiac failure. 7 out of 17 cases had ventricular dysfunction(41%). 5 cases had cardiogenic shock(29.4%). In HIE stage III 33.3% cases had cardiac failure, cardiogenic shock and clinical evidence of murmur. In this study overall, 30% cases were reported with cardiogenic shock and cardiovascular dysfunction. 20% cases had clinical evidence of murmur. 16.6% cases had cardiac failure and 3.3% cases were asymptomatic.

Chisquare value is 10.56 which is not significant. P value is 0.227 which is not significant.

Table 1: Distribution according to age, sex and HIE staging

Variables	Frequency	%	
Age (Hours)	<24	21	70.0
	24-48	9	30.0
Sex	F	10	33.3
	M	20	66.7
HIE Stage	I	10	33.3
	II	17	56.7
	III	3	10.0
Total	30	100.0	

Table 2: Incidence of cardiac dysfunction according to HIE staging

Clinical Criteria	HIE Stage							
	I		II		III		Total	
	Frequency	%	Frequency	%	Frequency	%	Frequency	%
Cardiac Failure	0	0	4	23.5	1	33.3	5	16.6
Ventricular dysfunction	2	20	7	41	0	0	9	30
Cardiogenic shock	3	30	5	41	1	33.3	9	30
Murmur	4	40	1	5.8	1	33.3	6	20
Asymptomatic	1	10	0	0	0	0	1	3.3
Total	10		17		3		30	

Chi square value = 10.56; p value = 0.227 (ns)

Discussion

Neonates with birth asphyxia were evaluated within 24 hours of birth for cardiac dysfunction by clinical features like respiratory distress, congestive cardiac failure, cardiogenic shock and any murmur. Most common feature seen was respiratory distress which in some cases was subsided within 24 hours of birth indicating it might have been due to transient tachypnoea of newborn. Echo was done as a baseline investigation in all asphyxiated neonates within 48 hours of birth and findings were compared with levels of cardiac enzymes like cardiac Troponin T and CK-MB levels. By this approach in this study it was possible to categorise the severity of birth asphyxia and correlating it with Sarnat and Sarnat staging of HIE and consequence of myocardial damage due to perinatal asphyxia secondary to inadequate tissue perfusion.

Among 30 cases in our study, 33.3% cases - HIE stage I, 56.6% cases -HIE stage II, 10% cases HIE stage III. This is less than reported by Dr. Pankaj Pal 75% cases -HIE stage I, 25% cases-HIE stage II.⁽¹⁰⁾ Kanik E et al (2009) studied the predictive value of myocardial involvement in the assessment of mortality for the neonates with hypoxic-ischemic encephalopathy (HIE).⁽¹¹⁾ Rajkumar PS et al also categorised severity of birth asphyxia and correlation with cardiac enzymes.⁽¹²⁾ In this study 2 out of 5 cases with cardiac failure expired while remaining 3 were normal without any cardiac dysfunction at discharge. Out of these 2 cases one case had bidirectional shunt more R to L side with right ventricular hypertrophy with right ventricular dysfunction and mild to moderate tricuspid regurgitation. Cardiac troponin T levels were significantly raised i.e. >0.3ng/ml and CK-MB levels >200IU/l. Other baby who expired had tricuspid regurgitation with tricuspid gradient >50mmHg suggestive of severe Pulmonary Arterial Hypertension. Cardiac enzymes were significantly raised in this patient. Incidence of Tricuspid regurgitation was → 6.7%. This is less than reported in previous studies by Rowe et al, Flores et al and Martein et al who documented 12%, 7% and 21% respectively.^(1,2,13) However Herdy et al have observed these changes in 7% cases⁽¹⁴⁾ Mitral regurgitation has never been reported in previous studies, none of the babies in present study had MR(1). 9 out of 30 cases (30%) had ventricular dysfunction due to myocardial ischemia and ejection fraction was <40% in these patient. Incidence of Right ventricular hypokinesia > Left ventricular hypokinesia i.e. 67% and 33.3% respectively. This observation was compared with Perlman et al who reported LV dysfunction in 10% cases and RV dysfunction in 30% cases⁽¹⁵⁾ Bennhagen et al and Mandal Ravi et al have observed higher incidence of ventricular dysfunction i.e. 50% and 56% respectively.^(16,17) 9 out of 30 cases (30%) developed cardiogenic shock i.e. cardiac failure with hypotension or poor circulation requiring inotropic support. These

cases had high troponin T values ranging from 0.2ng/ml to 0.28ng/ml. CK-MB values in this group >120 IU/L. Echo done in this group of babies had significant bradycardia. This is less than the incidence quoted by Mandal Ravi (44%).^(2,13,17) These babies were succumbed either due to cardiac problem or due to associated renal and neurological problems. Pansystolic murmur was reported in 6 cases (20%) along left sternal border. Incidence in this study was higher than quoted by Martein et al and Ravi et al, which were 2% and 12% respectively.^(12,13) Herdy et al have quoted a very high incidence of 50% systolic murmur in their study.⁽¹⁴⁾ CK-MB levels among cases were 125± 76 IU/L. These values were lower than as reported by Wartburton et al and Mandal Ravi et al who reported CK-MB values as high as 328IU/L and 823.5IU/L respectively.⁽¹⁹⁾ Usefulness of Transient Myocardial Ischemia in newborns with asphyxia was reported by Tapia Rombo et al.⁽¹⁸⁾ CK-MB is present in skeletal muscles in newborn period. Elevation of this enzyme could be due to its non-specific nature. But cardiac troponin T levels were elevated in 83.3% cases. 16% cases had Tnt levels ≤0.1ng/ml with no myocardial dysfunction with good neurological outcome.

Cardiac Troponin t has higher sensitivity and specificity than CK-MB in diagnosing myocardial dysfunction in perinatal asphyxia. In cases with myocardial damage the mean troponin T levels were significantly higher as compared to cases without cardiac dysfunction. Cases who expired and were at high risk i.e. have significant bradycardia, hypotension, ventricular dysfunction and requiring inotropic support have significantly higher levels than in cases without cardiac dysfunction. 2 of the cases who expired had significant myocardial damage with very high Troponin T levels. Linear relationship was seen between increasing cardiac Troponin T levels and myocardial dysfunction and mortality rates. Relationship between CK-MB levels and myocardial dysfunction could not be well established. So the mortality and outcome in perinatal asphyxia is predicted by Troponin T levels. Boo et al quoted that unlike CK-MB levels in asphyxiated neonates serum cardiac Troponin T levels are significantly higher in those cases who die or develop cardiac dysfunction.⁽²⁰⁾

Conclusion

Echocardiography and cardiac enzymes i.e. cardiac troponin T levels and CK-MB levels correlates well with severity and outcome in perinatal asphyxia.

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