Myocardial performance index (Tei index) in neonatal respiratory distress and perinatal asphyxia

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ABSTRACT

Objectives*: The aim of the study was to evaluate the role of myocardial performance index (Tei index) in the assessment of ischemic cardiac damage in neonates with respiratory distress and perinatal asphyxia.*

Patients and Methods: *This is a descriptive cross-sectional study conducted on 40 neonates in the NICU of Bab-El Shaarya University Hospital in 6 months period from January 2018 to June 2018. They were 22 males and 18 females with post-natal age 1-7 days, 15 with perinatal asphyxia (group1), 15 with respiratory distress(group2) and 10 normal as a control group(group3). Detailed history, thorough clinical examination, chest x-ray, ECG, Two-Dimensional echo, M- mode and Doppler (pulsed &tissue) echocardiographic examinations with the measurement of myocardial performance index ((ICT "isometric contraction time"-IRT "isometric relaxation time")/ET "ejection time") of the left and right ventricles.*

Results: *There was statistically significant increase in the-myocardial performance index in group 1&2than group3.*

There was inverse relationship between Tei index and each of ejection fraction and fraction shortening and there was statistically significant correlation between LV Tei index and gestational age.

Conclusion: *Tei index was higher in neonates with respiratory distress and neonates with perinatal asphyxia than in normal neonates despite normal or even increased ejection fraction which indicates that these patients may have subclinical ventricular dysfunction which should be followed up carefully.*

Recommendation: *Tei index is recommended to assess ventricular function in neonates with respiratory distress or perinatal asphyxia as our study revealed that it is not affected by age or heart rate and it doesn't depend on ventricular geometry.*

Key words: *Tei index, neonatal respiratory distress, perinatal asphyxia, echocardiography.*

INTRODUCTION

Respiratory distress is a common emergency responsible for 30-40% of admission in the neonatal period. The clinical presentation of neonatal respiratory distress includes nasal flaring, poor feeding, tachypnea (respiratory rate more than 60 beats per minute), grunting, stridor. There may be also retractions in the intercostals, subcostal, or suprasternal spaces, apnea and cyanosis **(Wax et al, 2009)**.

Most cases of neonatal respiratory distress are caused by transient tachypnea of newborn, respiratory distress syndrome, or meconium aspiration syndrome, but other various cases are possible **(Master et al., 2008)**.

Perinatal asphyxia is a common cause of neonatal morbidity and mortality. Perinatal asphyxia can be defined as impaired respiratory gas exchange accompanied by development of acidosis. The incidence of perinatal asphyxia varies from 1 to 8 per 1.000 live births **(Whisett et al, 2005)**.

Among the indicators of perinatal asphyxia commonly used to diagnose this condition are neonatal respiratory distress, delayed onset of spontaneous respiration, low Apgar score (<6 at 5 minutes), need for resuscitation and or ventilation and metabolic acidosis (cord blood PH<7.0 or 7.0 and base deficit > 12 mmoL / L). Post-natal indicators include neonatal encephalopathy, multi organ failure and abnormal findings on brain imaging **(Vento et al, 2005)**.

Cardiovascular compromise is a common complication of neonatal respiratory distress and perinatal asphyxia. This reduced cardiovascular reserve may present clinically with hypotension, which is associated with increased mortality and adverse neurological outcome **(Sugiura et al., 2003)**.

To evaluate cardiac involvement in neonates with respiratory distress, ECG and Echocardiography recording were performed and cardiac enzymes determined. These data were related to clinical presentation and patient’s outcome **(Gurude et al., 2007)**.

Recently the myocardial performance index (MPI) or Tei index has been proposed to be useful indicator of cardiac involvement in neonates with respiratory distress and perinatal asphyxia, as it is useful in evaluation of both systolic and diastolic function of left ventricle in combination, and it provides an objective assessment of persistent pulmonary hypertension of newborn with perinatal asphyxia **(Tei et al., 2011)**.

Tei index is a simple Doppler-derived index, can be easily obtained as non- invasive technique with good diagnostic value of cardiac injury in neonates suffering from perinatal asphyxia **(Huez et al ,2007)**.

AIM OF THE WORK

The aim of this study is to evaluate the role of Doppler derived index combining both systolic and diastolic performance (Tei index) in assessment of cardiac injury in neonates suffering from respiratory distress and perinatal asphyxia.

PATIENT AND METHODS

This study was performed on forty neonates, 22 males and 18 females , their gestational age ranges from 28 weeks to 36 weeks and their post-natal age ranges from 1 day to 7days in neonatal intensive care unit of Bab El Shaarya University Hospital in the period from January 2018 to July 2018.

Inclusion criteria:

Neonates with neonatal respiratory distress and perinatal asphyxia with post-natal age ranging from 1-7 days.

Exclusion criteria:

- Neonates with congenital heart diseases.
- Neonates with inborn errors of metabolism.
- Neonates with sepsis.

Neonates under the study were classified into three groups:

Group I: Fifteen neonates with severe asphyxia (Apgar score at 5 min <7, and PH<7.2), with mean gestational age 32 weeks and mean post-natal age 3 days.

Group II: Fifteen neonates with respiratory distress (8 males and 7 females), with mean gestational age 33 weeks and mean post-natal age 5 days (Apgar score at 5 Min ranging between 7 and 9 and PH between 7.2 and 7.3) with signs of respiratory distress.

Group III (control group): Ten apparently healthy neonates without asphyxia nor respiratory distress 5males &5 females, with mean gestational age 36 weeks and mean post-natal age 4 days (Apgar score at 5 min >9 and PH> 7.3).

All neonates included in the study were subjected to the following:

1- Detailed perinatal history special emphasis on the following:

- Maternal diseases and drug intake.
- High risk pregnancy.
- Fetal presentation.
- Mode of delivery.
- Risk factors of prematurely.
- Labor (prolonged, obstructed, abnormal presentation).
- Presence of meconium.
- Antenatal ultrasound.
- Risk factors of infection (e.g. premature rupture of membranes, maternal fever, maternal infection etc).

2- Full clinical examination including:

- Gestational age in weeks.
- Post natal age in days.
- Apgar score at 1 minute and at 5 minutes.
- Anthropometric measures (Weight in Kg, length in Cm, etc.) performed on percentile charts.

General examination, cardiac examination, chest examination, abdominal examination and neurological examination & mean arterial blood pressure.

3- Laboratory investigations include:

- Complete blood count (CBC) by coulter apparatus.
- C reactive protein.
- Arterial blood gases.

4- Radiological investigation includes:

- Chest X-ray (postero - anterior and lateral view) to detect cardiomegaly by measuring cardio thoracic ratio, to show pulmonary vasculature and to detect any lung field abnormalities.

5- Electrocardiogram (ECG):

- using (3 channel 1000 apparatus), to detect cardiac axis and chamber enlargement.

6- Echocardiogram:

- using GE echo Doppler apparatus equipped with a 2.5,3,5 and 5 MHz transducer.

Ethical consideration:

- Approval of the local committee in the pediatrics department, college and university were obtained before the study.
- There is no conflict of interest regarding the research or publication.
- Written consent from parent or caregiver was obtained before the study.

- The results of this research are confidential, and the parent has the right to keep it.

METHODOLOGY

Echocardiographic examination was performed using GE echo Doppler apparatus equipped with 2.5, 3.5 and 5 MHz transducer. Multiple acoustic windows and imaging planes were used. Routinely the examination consisted of M-mode and two-dimensional echocardiography, pulsed, continuous wave, tissue Doppler and color flow mapping. Left ventricular measurements were obtained at end-systole and end diastole according to the recommendation of the American society of echocardiography Left ventricular end-systolic and end-diastolic diameters and volumes (LVESD, LVESV, LVEDD, and LVEDV) were computed using the Simpson rule.

Left ventricular ejection fraction was calculated as: % EF = (EDV- ESV) / EDV.

Left ventricular fractional shortening was calculated as % FS = (EDD- ESD) / EDD.

Peak velocities of early (E) and late (A) filling were derived from atrioventricular valve inflow velocity profiles. The ratio of early to late peak velocities (E/A) was subsequently calculate **(Sam et al, 2002)**.

Measurement of Myocardial Performance Index:

Doppler time intervals were measured from the atrioventricular valve inflow and ventricular outflow tracings, as described by Tie and workers **(Tei et al, 1996)**.

The interval "a" from cessation to the onset of atrioventricular valve inflow is equal to the sum of isovolumic contraction time (ICT), ejection time (ET), and isovolumic relaxation time (IRT). The interval, "b" which equals the ejection time is derived from the duration of ventricular outflow Doppler velocity profile. MPI was calculated as: (a- b) / b which equals (ICT + IRT) / ET **(Sbencer et al, 2004)**.

Measurement of the Myocardial Performance Index of the Right Ventricle:

For the evaluation of the RV Tei index the a interval, from the cessation to the onset of tricuspid valve inflow (the interval from the end of the A wave to the start of the E wave), is obtained from the apical 4- chamber view with the pulse-wave Doppler signal is located at the tips of the tricuspid valve leaflets. The b interval (right ventricular ejection time) is measured from the modified parasternal long-axis view, with the sample volume located just below the pulmonary valve **(Tei et al., 1997)**.

Measurement of the Myocardial Performance Index of the Left Ventricle:

For the evaluation of the LV Tei index the interval, from the cessation to the onset of mitral valve inflow (the interval from the end of the A wave to the start of the E wave) is obtained from the apical 4-chamber view with the pulse-wave Doppler signal is located at the tips ofthe mitral valve leaflets. The b interval (left ventricular ejection time) is measured from apical 5-chamber view with the pulse wave Doppler signal is located just below the aortic valve **(Tei et al, 1996)**.

Statistical Analysis:

Data was analyzed using SPSS (statistical program for social solution) version 11.0 statistical peaking. Qualitative data were expressed as mean + standard deviation. Quantitative data were expressed as number and percentage. For quantitative data, comparison between three groups was done using student T- test or the corresponding non-parametric one for variables not normally distributed. Relation between different numerical variables was tested using spearman correlation, probability (P value) less than 0.05 was considered significant and less than 0.01 was considered as highly significant. Pearson's correlation coefficient® test is used to detect association between two quantitative variables. It indicates the type of relationship between these valuables (direct or inversion relationship) **(Wong and Wu, 2002)**.

RESULTS

Table (1): Echocardiographic measurements of the left ventricle (Echo-Doppler)

Criteria	Group I	p-value	Group II	p-value	Group III	p-value
	Mean ± SD		Mean ± SD		Mean ± SD	
L.V E. T	229 ± 4	P1>0.05	228± 27	P3>0.05 P2<0.01	240± 6	P>0.05
ICT+IRT of L.V	85 ± 3	P1<0.05	89 ± 4	P3<0.05 P2>0.05	84± 5	P<0.01 *
L.V MPI	0.49 ±.02	P1>0.05	0.47± .14	P3<0.05 P2<0.01	0.35± .02	P<0.01 *
L.V E/A ratio	1.22 ± .13	P1<0.05	1.33± .14	P3<0.01 P2<0.01	1.50± .08	P<0.01 *
LVD.T	109.67 ± 9.61	PK0.01	121.67 ± 8.80	P3<0.01 P2<0.01	132.50 ± 2.27	P<0.01 *
P1 comparison between groups 1&2Significant at level of 0.05 P2 comparison between groups 1&3Highly significant at level of 0.01 P3 comparison between groups 2&3 P comparison between groups 1,2&3						

LVET = left ventricular ejection time
ICT+IRT of L.V = Isovolumetric contraction time + Isovolumetric relaxation time of left ventricle
MPI= Myocardial performance index
DT= Deceleration time
Left ventricular ejection time was shortened in group I & group II, but the difference between the three groups was statistically non – significant where p -value was >0.05.
There was statistical significant difference between group I, II &III as regard ICT+IRT of L.V, L.V. MPI, L.V. E/ A ratio &L.V.D.T between group I, II, and group III where p- value was <0.01.
(* = statistically significant).

Table (2): Echocardiographic measurements of the right ventricle (Doppler)

Criteria	Group I	p-value	Group II	p-value	Group III	p-value
	Mean ± SD		Mean ± SD		Mean ± SD	
R.V E. T	276.73 ± 6.12	P1>0.05	276.07 ± 5.42	P3>0.05 P2>0.05	280.20 ± 14.87	p>0.05
ICT+IRT of R.V	77.67 ± 2.58	P1<0.01	70.27 ± 7.58	P3>0.05 P2<0.01	65.30 ± 3.80	P<0.01*
R.V MP1	0.27 ± .02	P1>0.05	0.26±.02	P3<0.01 P2<0.01	.23 ±.01	P<0.01*
R.V E/A ratio	21.60 ± 41.96	P1>0.05	1.29±.08	P3>0.05 P2>0.05	1.32 ±.01	p>0.05
RV D. T	101.13 ± 5.97	P1>0.05	101.80± 4.89	P3>0.05 P2>0.05	105.10 ± 2.85	p>0.05
P1 comparison between groups 1&2Significant at level of 0.05 P2 comparison between groups 1&3Highly significant at level of 0.01 P3 comparison between groups 2&3 P comparison between groups 1,2&3						

ET= Ejection time
MPI= Myocardial performance index
ICT= Isovolumetric contraction time
IRT= Isovolumetric relaxation time
DT= Deceleration time

Right ventricular ejection time was slightly decreased in groups I&II in comparison to groups III, but the difference between the three groups was statistically non-significant where p-value was >0.05.
ICT + IRT of the right ventricle was increased in group I& II and there was significant statistical difference between group I, II& III where p-value <0.01.
The mean R.V.MPI was statistically highly significant different between the three studied groups where P value was < 0.01, but with no statistical significant difference between group I and group II where P3 value was > 0.05.
(* = statistically significant).

Correlations

Table (3): Correlation between L.V. MPI and R.V. MPI and each of postnatal age, gestational age, Apgar score, EF% and FS% in Group I

Criteria	L.V MPI		R.V MPI	
	Correlation Pearson	P-value	Correlation Pearson	P-value
R.V MPI	0.259	>0.05		>05
post natal age (days)	0.245	>0.05	0.286	>05
Gestational age(weeks)	0.511	>.05	0.475	<0.05*
Apgar at 5 min	0.186	>0.05	0.179	>0.05
EF%	0.129	>0.05	0.203	>0.05
FS%	0.283	>0.05	.395	>0.05

As regard group I: There was no statistical significant correlation between L.V. MPI or R.V. MPI and each of Apgar score, EF %, FS% and post-natal age.
There was statistical significant correlation between L.V. MPI and R.V.MPI an gestational age.
(* = statistically significant).

Table (4): Correlation between L.V MPI and R.V MPI and each of post-natal age, gestational age, Apgar score, EF% and FS% in Group II

Criteria	L.V MPI		R.V MPI	
	Pearson Correlation	P-value	Pearson Correlation	P-value
R.V MPI	0.358	>0.05		
post-natal age (days)	0.405	<0.05	0.080	>0.05
Gestational age(weeks)	0.458	<0.05	0.530	<0.05*
Apgar at 1 min	0.403	>0.05	0.046	>0.05
Apgar at 5 min	0.357	>0.05	0.305	>0.05
EF%	0.213	>0.05	0.130	>0.05
FS%	0.224	>0.05	0.271	>0.05

As regard group II: There was no significant correlation between L.V MPI or R.V MPI and each of postnatal age, Apgar score at 1 min and at 5 min and EF% but there was significant correlation between L.V MPI and gestational age and statistical significant correlation between R.V MPI and gestational age.
(* = statistically significant).

Table (5): Correlation between L.V MPI and R.V MPI and each of post-natal age, gestational age, Apgar score, EF% and FS% in Group III

Criteria	L.V MPI		R.V MPI	
	Pearson Correlation	P-value	Pearson Correlation	P-value
R.V MPI	0.235	>0.05		
post-natal age (days)	0.122	>0.05	0.007	>0.05
Gestational age(weeks)	0.468	<0.05	0.473	<0.05
Apgar at 1 min	0.298	>0.05	0.121	>0.05
Apgar at 5 min	0.277	>0.05	0.159	>0.05
EF%	0.109	>0.05	0.386	>0.05
FS%	0.213	>0.05	0.339	>0.05

As regard group III: There was no significant correlation between L.V MPI or R.V MPI and each of postnatal age, Apgar score at and at 5 min, EF% and FS%. There was statistical significant correlation between L.V MPI and gestational age and statistical significant correlation between R.V MPI and gestational age.
(* = statistically significant).

DISCUSSION

Neonatal respiratory distress is a common emergency responsible for 30 - 40 % of admission in the neonatal period **(Wax et al, 2009)**.

Perinatal asphyxia is a common cause of neonatal morbidity and mortality; it commonly results in multi organ damage and cardiovascular dysfunction. The incidence of hypoxic cardiac damage in neonates with perinatal asphyxia is 30- 40%. To evaluate cardiac involvement in neonates with respiratory distress or perinatal asphyxia clinical examination, radiological examination, cardiac enzymes, ECG and echocardiography were performed **(Walsh and Strode, 2007)**.

Echocardiographic observations demonstrated that most fetuses and newborns with dominant right ventricles had flattened or even indented inter ventricular septa during systole and diastole. Their septa ducked into their left ventricles which changed left ventricular shape into an ellipse. Diastolic mitral valve opposition to the flattened septum was frequently observed in newborns **(Brudi et al., 2009)**.

In contrast, left ventricular shapes in infants were round, like shapes described in older children and adults. Newborn left ventricular shapes are similar to shapes seen in various pathologic conditions of right ventricles their left ventricular shape and diastolic pressure are affected by alterations in right ventricular volume and pressure **(Tanqka et al, 1998)**.

These alterations can make echocardiographic assessment of left ventricular contractility and volume based on standard geometric models unreliable **(American academy, 2010)**.

Tei index has shown to be a reliable indicator of all changes in left ventricular myocardial performance **(Bruch et al, 2009)**.

A myocardial performance index (MPI) has been reported in adults and children that is a Doppler- derived non-geometric measure of ventricular function. The MPI measures the ratio of isovolumic time intervals (isovolumic contraction time plus isovolumic relaxation time) to ventricular ejection time **(Eidem et al., 2006)**.

Previous studies have shown the sensitivity of the Tei index in measuring the myocardial performance **(Spencer et al., 2004)**.

It incorporates both systolic and diastolic functions of the global myocardial contractility **(Eto et al, 2005)**.

In our study, there was no statistical significant difference between the three studied groups as regard postnatal age, gender, consanguinity and mode of delivery but there was statistical significant difference between them as regard gestational age, history of PROM and history of delayed first cry where P value was <0.05 . The mean gestational age in the three studied groups was 32 weeks, 33 weeks and 36 weeks in groups I, II and III respectively, this means higher incidence of hypoxia resulting from neonatal respiratory distress or neonatal asphyxia in preterm than full term neonate. This is in agreement to **(Kim et al., 1999)** study which reported that the incidence of neonatal hypoxemia increases with decrease of gestational age.

As regard gender, the percentage of males in the three studied groups was 60%, 53.3% and 50% in groups I, II and III respectively, this indicates that the incidence of neonatal respiratory distress or Perinatal asphyxia is higher in males than female .This is in agreement to **(Schmitz et al., 2004)** study which reported that males are more risky to develop respiratory distress and perinatal asphyxia than females of the same gestational and postnatal ages. In our study, there was higher incidence of history of PROM and history of delayed first cry in groups I& II in comparison to group III, this is in agreement with **(Sciliton et al., 1998)** and **(El Shenawy et al., 2009)** studies which reported that there is direct association between presence of history of PROM or history of delayed first cry and occurrence of neonatal hypoxemia (distress or asphyxia). As regard consanguinity between parents of our patient, it was present in 33.3% in group II and 40% in group I, but this percentage did not reach the statistical significant value.

In agreement with our results, studies done by **(Eidem et al., 2006)** which showed that there was no significant association between consanguinity and occurrence of neonatal respiratory distress or perinatal asphyxia. In our study, there was statistical significant difference between the three studied groups as regard weight with higher incidence of neonatal respiratory distress and perinatal asphyxia in neonates with LBW where the percentage of neonates with LBW was 53.3% in group II and 60% in group I. This showed that there was significant association between LBW and occurrence of neonatal respiratory distress or Perinatal asphyxia. These results agree with those obtained by **(Eidem et al., 2006)** study as this study showed that 60% of neonates with respiratory distress had LBW. As regard Apgar score at 1 minute and at 5 minutes, there was highly statistical significant difference between the three studied groups where P value was < 0.01, this indicates higher incidence of neonatal respiratory distress and perinatal asphyxia in neonates with low Apgar score than those with normal Apgar score, this agrees with **(Kim et al., 1999)** who found the same results.

In our study, 53.3% of neonates with respiratory distress had higher heart rate (HR>97th percentile) in comparison to neonates with perinatal asphyxia where the percentage was 26.7% in group I. These results agree with those obtained by **(Schwartz et al., 2008)** who reported higher heart rate value in neonates with respiratory distress than others without distress. Our present work showed higher incidence of heart failure in neonates with respiratory distress or perinatal asphyxia in comparison to the normal (control) group of neonates without hypoxia, where the percentage of neonates with signs of heart failure was 60% in group II and 53.3% in group I. This agrees to **(Schmitz et al., 2004)** study which reported that the incidence of heart failure was about 60% in neonates with respiratory distress and about 55% in neonates with perinatal asphyxia. As regard grades of respiratory distress, tachypnea occurred in 66.7% of neonates in group II and 26.7% of neonates in group I, also grunting occurred in 40% of neonates in group II and 20% of neonates in group I where cyanosis occurred in 6.7% of neonates in group II and 93.3% of neonates in group I. This agrees with results obtained by **(Eto et al., 2006)** who found that tachypnea occurred in about 70% of neonates with respiratory' distress however cyanosis occurred in about 90% of neonates with perinatal asphyxia. This means that the degree of respiratory distress is directly proportionate to the degree of hypoxia. In our study, laboratory data show statistical significant difference between the three studied groups as regard PH, P02& PC02 where the levels of PH, P02, PC02 were lower in neonates with hypoxia than others without hypoxia in neonates with hypoxia than others without hypoxia. These results agree with results obtained by **(Schmitz et al., 2004)** who found the same results. As regard cardiac troponin1, there was statistical significant difference between the three studied groups, where P-value was <0.05 with higher level in neonates with respiratory distress and neonates with perinatal asphyxia than neonates of the control group. Similar results were obtained by **(El shenawy et al., 2005)** study.

As regard cardiomegaly (detected by increased cardiothoracic ratio in plain chest X-ray), there was higher incidence of cardiomegaly in neonates with respiratory distress or perinatal asphyxia than others without hypoxia where the percentage of neonates with cardiomegaly was 53.3% in both group I and group II. This agrees with results obtained by **(Borzoe and Kheirandish 2004)** who found that about 60% of neonates with respiratory distress had cardiomegaly. In our present work, M- mode echocardiographic study showed that the mean values of AO, LAD, IVSD, LVPWD, LVEDD, RVD, EF% and FS % were 1.05, 1.33, 0.37, 0.35, 1.92, 1.06, 68.5% and 36.3 % respectively in the control group and were 1.06, 1.44, 0.4, 0.36, 2.25, 1.08, 55.7% and 28.1 % respectively in group II and the values were 1.15, 1.44, 0.40, 0.38, 2.32, 1.06, 49.1% and 22.1% respectively in group I. These values are like those obtained by

(Kampmann et al., 2000) and **(El Shenawy et al., 2005)**.

The mean left L.V. MPI in the three studied groups was 0.49, 0.47and 0.35 in groups I, II and III respectively, this is in comparison to value of L.V. MPI of normal neonate obtained by other studies shown in the next table below. This shows that the value of MPI of both left and right ventricles is higher in neonates with respiratory distress or perinatal asphyxia than the control group. These results agree with results obtained by **(Brush et al., 2009)**.

MPI of the left ventricle in different studies on normal Neonates:

Study	No of patients	LV MPI
Borzoe and Kheirandish, 2004	108	0.36± 0.11
Kim et al, 1999	26	0.38± 0.04
Eidem et al, 1998	152	0.35± 0.03
Dujardinetal. ,1998	75	0.37±0.05
Williams et al., 2000	30	0.32± 0.1
Bruch et al., 2000	38	0.39± 0.31

Our study demonstrated that there was no significant correlation between MPI of both left and right ventricles and each of weight, length ventricular geometry and heart rate in the three studied groups. Similar results were found by **(Cui and Roberson, 2006)** who reported that the effects of body surface area, ventricular geometry and heart rate on Tei index were not significant. Major advantage of the Tei index is that it is independent of both ventricular geometry and heart rate **(Brush et al., 2009)**. Little was known about Tei index being influenced by aging **(Eidem et al., 2000)** and so its diagnostic utility in newborns was unclear, however our study reported that Tei index of both left and right ventricles is not influenced by post-natal age, this is in agreement to **(Tsutsumi et al., 1999)** who concluded that Tei index of the left and right ventricles increased immediately and transitory after birth then decreased and stabilized after 24 hour of birth in apparently healthy 50 neonates. It was suggested that the early increase of MPI immediately after birth is due to intrapartum hypoxia then the decrease in the Tei index most likely reflects the alterations in cardiac loading that result from the increase in pulmonary blood flow attendant to the onset of pulmonary ventilation. Thetransition to postnatal circulation includes a sudden decrease in pulmonary vascular resistance and shift of cardiac output from the right to left ventricle **(Harada et al., 2004)**.

In our study, it was proved that MPI of both left and right ventricles was influenced by gestational age, where there is statistical significant correlation between Tei index and maturity of neonates, this is in contrast to (Brush et al., 2009) study which reported no significant correlation between MPI and gestational age. As regard MPI and gender, no statistical significant difference was found on comparing males with females of the same gestational and postnatal ages. These results agree with those obtained by **(Overbeek et al., 2006)** who reported no significant correlation between MPI and gender.

CONCLUSION

1. Neonatal respiratory distress and perinatal asphyxia are very serious problems in neonatal period especially in preterm babies as they cause many early and late complications to the affected neonates so these problems should be early diagnosed and early treated properly.
2. Tei index was higher in neonates with respiratory distress and neonates with Perinatal asphyxia than in normal neonates despite normal or even increased ejection fraction which indicates that these patients may have subclinical ventricular dysfunction which should be followed up carefully
3. The myocardial performance index (MPI) is used to assess ventricular function. The index is independent of heart rate and blood pressure and does not rely on geometric assumptions.

Preterm neonates with evidence of perinatal asphyxia or neonatal respiratory distress have an increased MPI compared with a group of control neonates without evidence of asphyxia or distress.

Recommendations

1. Tei index is recommended to assess ventricular function in neonate with respiratory distress or perinatal asphyxia as our study revealed that it is not affected by age or heart rate and it does not depend on ventricular geometry.
2. Tei index is simple and attractive in its application. However, further studies are needed to determine its value in

clinical practice and the boundaries of normal ranges according to age, and to examine the significance of changes under pharmaceutical or other interventions.

3. A large number of neonates may be needed with longer period of follow up to validate the diagnostic and prognostic value of Tei index in detection of hypoxic cardiac damage resulting from neonatal respiratory distress or perinatal asphyxia.

4. Pulsed wave Doppler tissue imaging (DTI) is recommended in calculation of Tei index in further studies.

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مؤشر أداء عضلة القلب (تى) فى الاطفال حديثى الولادة المصابين بضيق بالتنفس و اختناق فى فترة ما حول الولادة

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تعد أمراض ضيق التنفس فى الأطفال حديثى الولادة من الأسباب الحرجة التى تتسبب فى دخول (30-40 %)من هؤلاء الاطفال الى العناية المركزة الخاصة بالاطفال حديثى الولادة وتتمثل أعراض ضيق التنفس فى هؤلاء الأطفال فى توقف التنفس لثوانى أو حدوث زرقة ، نهجان (زيادة عدد مرات التنفس لأكثر من 60 دورة بالدقيقة) أو رفض وتوقف الرضاعة.

ولقد ثبت أن ضيق التنفس فى الأطفال يتسبب فى وفاة نسبة كبيرة منهم وخاصة الأسفيكسيا أثناء الولادة والتى تعنى نقص شديد بالأكسجين نتيجة نقص فى عملية تبادل الغازات وزيادة فى حموضة الدم . وتتراوح نسبة حدوث الاصابة بالاسفيكسيا أثناء الولادة فى الاطفال حديثى الولادة 1-8 لكل 1000 مولود ولهذا يحتاج هؤلاء الاطفال سرعة التدخل بالاكسجين وقد يتطلب ذلك وضع الطفل على جهاز التنفس الصناعى.

ولقد وجد أن بعض هؤلاء الاطفال يعانون من مضاعفات فى الجهاز العصبى والقلب نتيجة هذه الاصابة ولكى نحد مدى اصابة القلب الناتجة عن نقص الاكسجين فى هؤلاء الاطفال لابد من عمل رسم قلب ، أشعة تليفزيونية على القلب وانزيمات القلب .

وحديثا تم استخدام مؤشر أداء عضلة القلب (Tei index) لتحديد مدى اصابة القلب فى هؤلاء الاطفال وذلك عن طريق قياس كفاءة البطينين الايسر والايمن للقلب أثناء الانقباض والانبساط وهذه طريق سهلة وممتازة لتشخيص الاصابة القلبية الناتجة عن أمراض ضيق التنفس فى الاطفال حديثى الولادة وهذا هو موضوع البحث .

الهدف من البحث: وتهدف هذه الدراسة الي تقييم دور استخدام مؤشر كفاءة عمل عضلة القلب لتحديد الاصابة القلبية الناتجة عن نقص الاكسجين في الاطفال حديثي الولادة الذين يعانون من صعوبة في التنفس أو اسفكسيا عند الولادة

طريقة البحث:

عدد الاطفال حديثي الولادة الذين تم اخضاعهم لهذه الدراسة اربعون طفلا تتروا ح اعمارهم من يوم الي سبعة ايام وذلك في وحدة العناية المركزه للاطفال حديثي الولاده بمستشفي باب الشعرية الجامعى فى الفترة من يناير 2018 الى يونيو 2018.

وقد تم تقسيم الاطفال حديثي الولادة الخاضعين للدراسة الي ثلاث مجموعات :

المجموعة الاولي : 15 طفلا حديثي الولادة يعانون من نقص شديد بالاوكسجين (اسفكسيا) عند الولادة (9ذكور – 6 اناث).

المجموعة الثانية : 15 طفلا حديثي الولادة اصحاء لا يعانون من مشالك بالتنفس (5ذكور - 5اناث).

المجموعة الضابطه : 10 اطفال حديثي الولادة لا يعانون من مشاكل بالتنفس (5ذكور - 5اناث).

وقد تم استبعاد الاطفال حديثي الولادة الذين يعانون من عيوب خلقية بالقلب او مشاكل بالتمثيل الغذائي او التسمم الدموي من هذه الداراسة.

تم اخضاع الثلاث مجموعات الي الاتي :

أولا: دراسة لفترة ما قبل الولادة من حيث الامراض التي اصابت الام اثناء الحمل او الادوية التي اخذتها الام اثناء الحمل، وضع الجنين ،طريقة الولادة واذا كان هناك مشاكل قد حدثت للطفل اثناء الولادة مثل بلغ الطفل للبراز،الاشعة التلفزيونية للام اثناء الحمل وهل كان هناك عوامل تشكل خطورة علي الام اثناء الحمل مثل الاصابة بحمي او ارتفاع في ضغط الدم او ارتفاع السكر بالدم .... الخ.

ثانيا : الفحص الاكلينيكي الشامل للطفل.

ثالثا : الفحصل المعملي للطفل ويشمل صورة دم كاملة غازات بالدم الشرياني.

رابعا : الاشعبة التشخيصية وتشمل اشعة عادية علي الصدر رسم قلب اشعة تليفزيوننية علي القلب.

وكانت النتائج كالتالي :

1- اظهرت الدارسة ان المجموعة الثانية تعاني من صعوبة بالتنفس وان حوالي 70% من هؤلاء الاطفال اطفال مبتسرين وكذلك المجموعة الاولي تعاني من اختناق او ضيق ضديد في التنفس وان حوالي 90% من هؤلاء الاطفال اطفال مبتسرين وذلك مقارنة بالمجموعة الضابطة مما يؤكد اهمية اكتشاف المبكر لعيوب التنفس عند الاطفال المبتسرين لانها تسبب في نقص الاكسجين للمخ وعضلة القلب ومشالك علي الجهاز العصبي للطفل.

2- نسبة ضخ الدم من البطين ومعامل قصور عمل عضلة القلب كانا اعلي في المجموعة الاولي و الثانية بالمقارنة بالمجموعة الضابطة مما يعطي انطباعا خاطئا عن وظيفة عضلة القلب ويؤكد عدم امكانية استخدام هذه الطرق في الاكتشاف المبكر للقصور في وظيفة عضلة القلب.

3- معامل اداء عضلة القلب للبطين الايسر و الايمن كان اعلي في المجموعة الاولي و الثانية بالمقارنة بالمجموعة الضابطة ولكن لم يكن هناك اختلاف احصائي بين المجموعات مما يؤكد ان زيادة التحميل علي عضلة القلب لا يؤثر علي معامل اداء عضلة القلب وانه يمكن استخدامه في الاكتشاف المبكر للقصور في وظيفة عضلة القلب في الاطفال الذين يعانون من مشاكل بالتنفس في الاطفال حديثي الولادة خاصة المبتسرين علي نقل الدم من الدورة الجهازية الي الدورة الرؤية.

4- عدم تأثر معامل اداء عضلة القلب بنبض المريض او عمره او جنسه (ذكور او اناث).

وقد اسفرت الدراسة عن النتائج الاتية:

1- اظهرت الدراسة ان معامل اداء عضلة القلب لا يتأثر بزيادة التحميل علي عضلة القلب في الاطفال حديثي الولادة خاصة المبتسرين الذين يعانون من ضيق شديد بالتنفس او اسفيكسيا الولاده.

2- معامل اداء عضلة القلب وسيلة سهلة وآمنه تعطي فكرة عن وظيفة عضلة القلب في كل من البطين الايمن و الايسر علي السواء.

وتوصي الدارسة بالأتي :

1- استخدام معامل عضلة القلب لقياس وظيفة عضلة القلب في الاطفال حديثي الولادة الذين يعانون من مشاكل بالتنفس حيث أنه لا يتأثر بزيادة التحميل علي عضلة القلب ولا يتأثر بنبض المريض او عمره ايضا لا يتأثر بشكل البطين.

2- استخدام وسائل اخري لتحديد مدي دقة وكفاءة معامل اداء عضلة القلب في قياس وظيفة عضلة القلب.

3- يجب اجراء دراسة طويلة المدي وعلي عدد كبير من المرضي وذلك لتحديد مدي فاعلية معامل اداء عضلة القلب وكذلك لتحديد قدرته علي التشخيص و التنبؤ بحدوث قصور في وظيفة عضلة القلب.

4- يوصي باستخدام النسيج الدوبللري المصور من دورة قلبية واحدة في قياس معامل اداء عضلة القلب حيث اظهرت العديد من الدراسات دقته في قياس المعامل.