

Sympathetico-adrenal System in newborn with Hypoxic- ischemic encephalopathy

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By

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List of contents

<u>Contents</u>	<u>page</u>
Acknowledgement	I
List of abbreviations	II
List of tables	III
List of figures	IV
Introduction	□
Aim of the work	□
Review of literature	□
▪ Hypoxic-ischemic Encephalopathy (HIE)	
▪ Sympatho adrenal system	
▪ Effects of perinatal asphyxia and Hypoxic-ischemic Encephalopathy (HIE) on sympatho adrenal system and other systems	
Patient and methods	□ □
Results	□ □
Discussion	□ □ □
Summary and conclusion	□ □ □
Recommendations	□ □ □
References	□ □ □
Arabic summary	

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List of abbreviation

- **ACTH** : Adreno corticotropic hormone
- **AAP** : American academy of pediatric
- **ACOG** : American college of obstetric and gynecology
- **BUN** : Blood urea and nitrogen
- **cAMP** : Cyclic adenosine mono phosphate
- **CBF** : Cerebral blood flow
- **CNS** : Central nervous system
- **CRH** : Corticotropine releasing hormone
- **CTG** : Cardiotocogram
- **CT scan** : Computerized tomography
- **DNA** : Deoxy ribo nucleic acid
- **EEG** : Electro encephalogram
- **FFA** : Free fatty acid
- **FHR** : Fetal heart rate
- **GA** : Gestational age
- **GABA** : Gamma amino butyric acid
- **HIE** : Hypoxic ischemic encephalopathy

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- **IVH** : Intra ventricular hemorrhage
 - **IADH** : Inappropriate anti diuretic hormone secretion
 - **MRI** : Magnetic resonance imaging
 - **MRS** : Magnetic resonance spectroscopy
 - **NST** : None stress test
 - **NPO** : Nothing per os
 - **PET** : Position emission tomography
 - **PVL** : Peri ventricular leukomalacia
 - **SPECT** : Single photon emission tomography
 - **US** : Ultra sonography
 - **VMA** : Vanill mandelic acid

List of tables

Table	Subject	Page
١	Essential criteria of perinatal asphyxia	٥
٢	Apgar scoring system	٢١
٣	Interpretation of Apgar score	٢٢
٤	Factors affecting of Apgar score	٢٣
٥	modified from leuthner and Das staging of HIE:	٢٧
٦	Sarnat and Sarnat stage of hypoxic-ischemic encephalopathy	٢٨
٧	Differential Diagnosis of perinatal Asphyxia	٣٧
٨	Comparison between patient and control regarding clinical and laboratory parameters	٨١
٩	APGAR score at ١ min among patient and control group	٨٣
١٠	Apgar score at Min ٥ among patient and control group	٨٣
١١	The clinical and laboratory parameters among patient with positive cranial U/S finding versus those with negative finding	٨٥
١٢	Clinical and laboratory parameters among patient with different degrees of hypoxia	٨٨
١٣	The clinical and laboratory parameters among died and alive patient	٩١
١٤	The clinical and laboratory parameters among patient with risk and those without risk	٩٤
١٥	Correlation matrix among studied patient	٩٦
١٦	VMA ^١ ,VMA ^٨ among patient and control	٩٧

List of figures

Figure	Subject	Page
١	PVL	١٨
٢	Cerebral edema Coronal scan	٢٩
٣	Cerebral edema Sagittal sonogram	٣٠
٤	Periventricular leukomalacia, Sagittal scan	٣٠
٥	Periventricular leukomalacia, Sagittal sonogram	٣٠
٦	MRI shows bilateral Periventricular hyperintensity.	٣١
٧	Hhemorrhagic Periventricular leukomalacia	٣١
٨	Cystic change in Periventricular white matter	٣٢
٩	High signal intensity in the trigonal region secondary to PVL	٣٢
١٠	Bilateral symmetrical Periventricular hyperintensities	٣٢
١١	Llate-stage Periventricular leukomalacia (PVL)	٣٢
١٢	Distorted occipital horns due to Periventricular leukomalacia	٣٣
١٣	Late-stage Periventricular leukomalacia (PVL). Asymmetrical	٣٣
١٤	Ddilated lateral ventricles, PVL	٣٣
١٥	Severe late-stage Periventricular leukomalacia (PVL)	٣٣
١٦	Axial image of late-stage Periventricular leukomalacia	٣٤
١٧	Axial image shows a distorted right lateral ventricle and cortical atrophy,PVL	٣٤
١٨	Ddistorted occipital horn on the left side with atrophy and deep sulci that almost reach the ventricular margin,PVL	٣٤

۱۹	MRI shows an atrophied, irregular corpus callosum and atrophic brain parenchyma,PVL	۳۴
۲۰	MRI of late-stage Periventricular leukomalacia (PVL)	۳۵
۲۱	Anatomy of adrenal glands	۵۲
۲۲	Anatomy of adrenal glands	۵۲
۲۳	Relations of adrenal gland	۵۴
۲۴	Embryology of adrenal gland	۵۵
۲۵	Histology of adrenal gland	۵۸
۲۶	Synthesis of the Catecholamines from tyrosine	۶۱
۲۷	Mechanisms of action of epinephrine	۶۳
۲۸	Metabolism of the catecholamine	۶۵
۲۹	The median and interquartile ranges of VMA at day ۱ and day ۸ among patients and controles	۸۲
۳۰	Tthe median and interquartile range of the rate of change of VMA at day ۱ and day ۸ among patients and controles	۸۲
۳۱	The percentage frequency of patient having +ve U/Sfinding and –ve U/S finding	۸۴
۳۲	the median and interquartile ranges of VMA ^۱ and VMA ^۸ among patient having +ve U/Sfinding and –ve U/S finding	۸۶
۳۳	The median and interquartile range of the rate of change of VMA at day ۱ and day ۸ among patients with +ve and –ve cranial U/S finding	۸۶
۳۴	The percentage frequency of different degrees of hypoxia among studied patients	۸۷
۳۵	The median and interquartile range of VMA at day ۱ and day ۸ among patients with different degrees of hypoxia	۸۹

۳۶	The median and interquartile range of the rate of change of VMA at day ۱ and day ۸ among patients with different degrees of hypoxia	۸۹
۳۷	The percentage frequency among dead and alive patient	۹۰
۳۸	The median and interquartile range of the rate of change of VMA at day ۱ and day ۸ among patients who discharged alive and those were dead	۹۲
۳۹	The median and interquartile rate of change of VMA at day ۱ and day ۸ among patients who discharged alive and those were dead	۹۳
۴۰	The percentage frequency of patients having +ve and –ve risk factors	۹۳
۴۱	The median and interquartile range of the rate of change of VMA at day ۱ and day ۸ among patients with +ve and –ve risk factors	
۴۲	The median and interquartile rate of change of VMA at day ۱ and day ۸ among patients with +ve and –ve risk factors	۹۵
۴۳	Roc curve for differentiation between diseased and none diseased newborns	۹۸
۴۴	Roc curve to asses the prognosis of newborns with HIE	۹۹

Introduction

Neonatal hypoxic ischemic encephalopathy (HIE) is an important clinical problem in infancy associated with neonatal mortality, morbidity and long term unfavorable neurodevelopmental outcome (**Kamel et al., ١٩٩٨**).

Perinatal asphyxia is a condition of impaired blood gas exchange, that if persists leads to progressive hypoxemia and hypercapnia with metabolic acidosis. (**Avery et al; ١٩٩٩**). Perinatal asphyxia causes neurological manifestations as hypoxic ischemic encephalopathy (HIE), and evidence of multi-organ system dysfunction (**Ancel et al; ١٩٩٥**). The incidence of hypoxic ischemic encephalopathy is about ١-٢ in ١٠٠٠ in live term birth. The common causes includes interruption of umbilical circulation as in cord compression, inadequate perfusion of maternal side of placenta as in maternal a placental diseases and abnormal uterine contractions as well as impaired maternal oxygenation in case of anemia. (**Gomella et al., ٢٠٠٤**).

Adrenaline is a hormone and a neurotransmitter. It's synthesized in neurons of the adrenal medulla and stored in the chromaffin granula; tow enzymes are responsible for adrenaline degradation: the Catecholamine-o-methyltransferase (COMT) and the monoamineoxydase (MAO). It's released by nervous stimulation in response to physical and mental stress affecting

Sympathetic nervous system. Their effects are like increasing heart rate and bronchodilatation. (Oellien; 1999)

Few studies were done about the effect of HIE on adrenal gland. **Mialksoo et al.**, 1988 found that the full-term newborn responds to asphyxia with graded catecholamine release. The epinephrine concentration in newborns with moderate HIE is lower than in newborns with mild HIE, which may reflect decreased sympathetic-adrenal function due to prolonged asphyxia.

Gorbachev et al; 1976, made a study on urinary catecholamine excretion in 100 newborn boys on the 1st-10th day after birth. It was shown that at the time of birth the noradrenaline level prevailed over the adrenaline level, but as soon as the 10th day the noradrenaline content displayed a relative reduction in both groups.

Aim of the work

The main objectives of this study are to:

- - Evaluate catecholamines level in the urine of newborn babies subjected to asphyxia.

- - Investigate a possible association between the severity of hypoxic ischemic encephalopathy and the degree of adrenal gland affection.

Perinatal asphyxia & Hypoxic ischemic encephalopathy

Definition:

Perinatal asphyxia is an insult to the fetus or newborn due to lack of oxygen (hypoxia) and/or lack of perfusion (ischemia) to various organs. It is associated with tissue lactic acidosis. If accompanied by hypoventilation, it also may be associated with hypercapnia (**Aurora and Snyder, ٢٠٠٤**).

Hypoxic-ischemic encephalopathy (HIE) implies the interruption of supply of vital nutrients to the brain, mainly oxygen and glucose, sufficiently substantial to cause irreversible damage. (**Korthals and Colon, ٢٠٠٥**).

HIE is the hypoxic ischaemic brain injury as a result of perinatal asphyxia. Although HIE is not the most frequent complication of hypoxia ischaemia, but it is the most important consequence of perinatal asphyxia and it is one of the serious neurological problems of the perinatal period. Also HIE is the single most important perinatal cause of neurological morbidity in both full-term and premature infants (**Volpe, ٢٠٠١**).

There is no single tool that can yield a precise definition of perinatal asphyxia but the American Academy of pediatrics(AAP) and the American college of obstetrics and Gynecologists (ACOG)

committees of maternal fetal Medicine and fetus and Newborn in 1993 defined certain criteria that must be present to confirm the occurrence of perinatal asphyxia. In cases in which such evidence is lacking, it can not be concluded that perinatal asphyxia exists (AAP and ACOG, 1996).

Table (1): Essential criteria of perinatal asphyxia:

1).Profound metabolic or mixed acedemia ($\text{pH} < 7.35$) on an umbilical cord arterial blood sample.
2).Persistence of an Apgar score of 0 to 3 > 5 minutes.
3).Clinical neurologic sequelae in the neonatal period (e.g., seizures, hypotonia, coma or HIE).
4).Evidence of multiorgan system dysfunction in the immediate neonatal period.

(AAP and ACOG, 1996)

Incidence:

The risk for perinatal asphyxia is present in every pregnancy. However, consensus on the incidence of perinatal asphyxia has been difficult because of the non uniform clinical criteria on which different institutions based definition (Thompson, 1994).

The incidence of perinatal asphyxia is about 1-3% in most centers and is usually related to gestational age and birth weight (Aurora and Snyder, 2004).

Etiology and risk factors:

Placental insufficiency is responsible for 10% of asphyxial insults that occur in the antepartum / intrapartum periods as a result of inability to provide O_2 and remove CO_2 and H^+ from the fetus. The remainder is postpartum, usually secondary to pulmonary, cardiovascular or neurological insufficiency (**Aurora and Snyder, 2004**).

Perinatal asphyxia could be exacerbated by any of the following conditions: impairment of maternal oxygenation, decrease of blood flow from mother to placenta or from placenta to fetus, impairment of gas exchange across placenta or in the fetal tissue and increase in fetal oxygen requirements (**Aurora and Snyder, 2004**).

These conditions may be classified into:

1. Intrauterine conditions:

Neonatal asphyxia may have its origin in utero, and is characterized by inadequate oxygenation and inadequate CO_2 elimination therefore; the lower respiratory centers are paralysed (**EL-Sherbini, 1999**) as in:

- Inadequate oxygenation of maternal blood as a result of cardiac failure or pulmonary disease.
- Low maternal blood pressure in hypotensive mothers or due to compression of inferior vena cava and descending aorta by gravid uterus.
- Maternal hypertension and toxemia of pregnancy.