Results

Table (1): Degree of hypoxic ischemic encephalopathy in the studied cases

Sarnat score	Cases	%
Stage I "mild"	10	40.0
Stage II "moderate"	7	28.0
Stage III "severe"	8	32.0
Total	25	100.0

Table (1): Shows classification of neurological findings according to Sarnat & Sarnat stages of HIE.

Table (2): The fatality rate in hypoxic ischemic encephalopathy in the studied cases

Studied cases (25)	Number	%
Survivors	22	88.0
Death	3	12.0

Table (2): Shows the fatality rate in hypoxic ischemic encephalopathy in the studied cases.

12% of studied cases of HIE died.

Table (3) : The sex distribution among cases and control

Group	Males		Females		m/F ratio	
	No.	**%**	**No.**	**%**	**No.**	**%**
Cases	12	48.0	13	52.0	25	100.0
Control	12	48.0	13	52.0	25	100.0
Total	24	48.0	26	52.0	50	100.0

$X^2 = 0.08$ $P > 0.05$

Table (3) show that there was no significant difference in sex between cases and control.

Table (4): The GA of cases and control

Gestational age "weeks"	Cases	Control
Range	37-42	37-42
Mean	39.04	38.92
S.D.	1.59	1.47

t= 0.28 P > 0.05

All the studied cases and controls were full term over 37week gestation

Table (4): shows the range mean, and S.D. of the gestational age of cases and control. There was no statistically difference between them.

Table (5): anthropometric measures in cases and control

B.W. 'kgm'	Cases	Control
Range	2.7-4.2	2.8-4.15
Mean	3.397	3.415
S.D.	0.44	0.41
Length	**Cases**	**Control**
Range	48-52	47-53
Mean	49.92	49.98
S.D.	1.35	1.49
H.C. (cm)	**Cases**	**Control**
Range	33.9-39	34-36
Mean	34.99	34.89
S.D.	0.95	.94

Table (5): Shows the mean, range, and standard deviation of birth weight, length, head circumference in cases and control.

The mean birth weight of cases and control was 3.397 and 3.415 respectively, no statistically significant difference between cases and control (t= 0.15 $p > 0.05$).

The mean for length of cases and control was 49.92, 49.92, respectively. There was no significantly difference between cases and control (t 0.15 $p > 0.05$)

The mean for head circumference of cases and control was 34.99 , 34.89, respectively. there was no sig. difference between cases and control (t= 42.4 $P > 0.05$).

Table (6): Fetal and maternal characteristics during labor.

Parity	**Cases**		**Control**		**Total**	
	No.	**%**	**No.**	**%**	**No.**	**%**
Primipara	15	65.2	8	34.8	23	46
Multipara	10	37.1	17	62.9	27	54
Total	25	50.0	25	50.0	50	100
Mode of delivery	**Cases**		**Control**		**Total**	
	No.	**%**	**No.**	**%**	**No.**	**%**
N.V.D.	14	51.8	13	48.2	27	100.0
C.S.	11	47.8	12	52.5	23	100.0
Total (no = 50)	25	50.0	25	50.0	50.0	100
Place of delivery	**Cases**		**Control**		**Total**	
Home	7	43.8	9	56.3	16	100
Hospital	18	52.9	16	47.1	34	100.0
Total	25	50.0	25	50.0	50	100.0
Fetal resentation	**Cases**		**Control**		**Total**	
	No.	**%**	**No.**	**%**	**No.**	**%**
Cephalic	20	52.6	18	47.4	38	100.0
Breech	5	41.7	7	58.3	12	100.0
Total	25	50.0	25	50.0	50.0	100.0

Table (6): shows Fetal and maternal characteristics during labor.

- As regard parity, there was no significant difference between cases and control (X^2= 2.89 P > 0.05).

- As regard mode of delivery there was no significant difference between cases and control (X^2= 0.08 P > 0.05)

- As regard the place of delivery. There was no significant difference between cases and control (X^2 = 0.09 P > 0.05).

- As regard fetal presentation in there was no significant difference in fetal presentation in cases as compaired to control group (X^2= 0.11 P > 0.05).

Table (7): Medical and obstetric problems among mothers of the studied cases and control

Medical and obstetric problems	**Cases**		**Control**		Z	p
	No.	%	No.	%		
Pregnancy induced hypertension	4	16.0	1	4.0	1.41	> 0.05
Diabetes	2	8.0	1	4.0	0.6	> 0.05
Cardiac disease	3	12.0	1	4.0	1.04	> 0.05
Broncheal asthma	1	4.0	1	4.0	-	-
Premature rupture of the membrane	5	20.0	2	4.0	1.74	< 0.05
Antipartum haemarhage	3	12.0	-	-	-	-
Prolonged 2nd stage of labour.	11	44.0	-	-	-	-

Table (7) show that the premature rupture of the membrane was significantly higher in cases than in control.

Table (8): Clinical manifestations suggestive of other systemic affection among cases of HIE.

System affected	No.	%
Respiratory system	16	64.0
Respiratory distress	14	56.0
Meconium aspiration	10	40.0
Urinary system	13	52.0
Oligurea	9	36.0
Renal failure	8	32.0
Gastrointestinal tract	12	48.0
Feeding problems	9	36.0
Hepatomegally	4	16.0
Necrotizing enterocolitis	2	4.0
Cardio vascular system	10	40.0
Hypotension	9	36.0
Bradycardia	8	32.0
Heart failure	1	4.0
Cardiogenic shock	1	4.0

Table (8): Shows clinical manifestations suggestive of other systemic affection among studied cases.

Table (9): Neurological abnormalities among studied cases

Neurological findings	**No.**	**%**
Impaired conscious level		
Irritability	12	48.0
Lethargy	5	20.0
Coma	8	32.0
Abnormal tone		
Hypotonia	15	60.0
Hypertonia	10	40.0
Abnormal neonatal reflex		
Moro	18	72.0
Sukling	20	80.0
Seizures		
Tonic-clonic	7	28.0
Subtle	8	32.0

Table (9): Shows the neurological abnormalities among studied cases.

Table (10): Apgar scoring at 1 minute in cases and control

Apgar/score	**Cases**	**Control**
Range	0-2	3-9
Mean	1.12	6.2
S.D.	0.73	1.73

T= 13.5 P < 0.001

Table (10): Shows the mean, range, and standard deviation of Apgar scoring at 1 minute in cases and control. Apgar score was significantly lower at 1 minute in cases than in control.

Table (11): Apgar score at 5 minutes in cases and control

Apgar score	Cases	Control
Range	2-7	5-10
Mean	4.72	5.16
S.D.	1.37	1.34

T= 8.98 P < 0.001

Table (11): Shows the mean, range and standard deviation of the apgar score at 5 minutes in cases and control

Apgar score is significant lower at 5 min in cases than control.

Table (12): The relation between the incidence of seizures and apgar score at 5 min in all cases and control

Apgar at 5 minutes	More than 6		Less than or equal to 6		Total	
	No.	%	No.	%	No.	%
Cases with seizures (n=6)	0.0	0.0	15	10.0	15	30.0
Cases without seizures (n=35)	30	85.7	5	14.3	35	70.0
Total (no = 50)	30	60	20	40.0	50	100.0

Adjusted chi square = 28.67 P < 0.001

Table (12): Shows the relation between the incidence of seizures and apgar score at 5 min in all cases and control

There is significant increase in the number of cases with low apgar score who developed seizures when compaired to cases with high apgar score.

It was found that 100% of cases with seizures had 5 minute apgar score <6 .

Table (13): NPBI in control and HIE cases

St. group	NPBI	X ±S.D.
Control	25 (m mol/dl)	6.74±5.9
Mild	10	30.79±10.17
Moderate	7	58.28±34.9
Severe	8	84.31±16.18

One way anova	F= 52.37	P < 0.001
t1= control vs mild	t_1= 7.02	P < 0.001
t2= control vs moderato	t_2= 3.89	P < 0.001
t3= control vs sever	t_3= 13.3	P < 0.001

There is statistically signifiant difference between mild, moderate and severe cases and control.

Table (14): Level of serum lactate in cases and control

The lab test (lactate)	Cases	Control
Range	7.4-12.8 (m mol/dl)	1.9-5.3
Mean	9.66	3.8
S.D.	1.67	0.98

$t = 15.13$ $P < 0.001$

Table (14): Shows the range, mean and standard deviation of lactate in cases and control. Lactate was significantly higher in cases than control.

Table (15): lab Parameters among studied cases.

(blood urea)	**Cases**	**Control**
Range	40-80 gm/dl	17-40
Mean	52.96	25-0.4
S.D.	9.59	6.92
(serum creatinin)	**Cases**	**Control**
Range	0.7-1.5 mg/dl	0.4-0.8
Mean	1.02	0.66
S.D.	0.26	0.09
Serum K^+	**Cases**	**Control**
Range	4.8-6.9 meq/l	3.9-5
Mean	5.8	4.42
S.D.	± 0.58	± 0.33
Serum Na^+	**Cases**	**Control**
Range	122-136 meq/l	141-154
Mean	129.53	147.84
S.D.	± 4.43	± 3.66
Serum Ca^+	**Cases**	**Control**
Range	6.9-9.2 mg/dl	9.1±10.5
Mean	7.9	10.02
S.D.	± 0.8	± 0.4

- Blood urea was significantly higher in cases than control ($t = 11.65$ $P < 0.001$)
- Serum creatinin was significantly higher in cases than control ($t= 6.54$ $P < 0.001$)
- Serum K^+ in cases is statistically significant higher than in control ($t= 10.34$ $P < 0.001$)
- Serum Na^+ in cases is statistically significant lower than in control ($t= 15.9$ $P < 0.001$)
- Serum Ca in cases is statistically significant lower than in control ($t= 11.9$ $P < 0.001$)

Table (16): Comparison of mean values and S.D. of PH, PaO2, PaCO2, HCO3 in cases and control.

Lab	Cases	Control
pH ± SD T P	 7.02 ± 0.09 4.04 P< 0.01	 7.25 ± 0.27
PaO_2 ± SD T P	 39.12 ± 2.48 32.2 P<0.001	 72.86 ± 4.61
$PaCo_2$ ± SD T P	 62.68 ± 6.3 20.3 P<0.001	 33.8 ± 3.3
HCO_3 ± SD T P	 15.01 ±0.87 21.4 P<0.001	 21.66 ± 1.29

This table show the lab parameter of the studied cases and their control From the studding of this table, cases suffering metabolic acidosis and hypoxia than control.

Table (17): Comparison between different stages of HIE as regard pH, Pao_2, $PaCO_2$, HCO_3.

Arterial blood gas	Mild (10 cases)	Moderate (7 cases)	Severe (8 cases)	F	p
pH	7.1±0.04	7.04±0.06	6.9±0.03	1.13	> 0.05
PaO2	40.1±1.9	38.2±1.87	38.7±3.3	1.49	> 0.05
PaCO2	57.4±3.7	63.14± 5.3	68.9±3.1	2.39	< 0.05
HCO3	14.7 ± 0.5	15.14±0.99	15.3±1.1	1.38	> 0.05

Table (17): Shows comparison between different stages of HIE as regard pH, PO_2, PCO_2, HCO_3.

- PaCO2 were significantly higher in sever cases when compaired to mild cases.
- Non significant difference in the mean values of pH, PaO2, HCO3 among different stages of HIE.

Table (18): Comparison between different stages of HIE as regard Lactate and NPBI.

Lactate and NPBI	mild (10 cases)	Moderate (7 cases)	Severe (8 cases)	F	P
Lactate	10.7 ± 1.4	10 ± 1.4	8 ± 0.6	2.73	<0.05
NPBI	30.8 ± 1.2	55.4 ± 36.7	83.6 ± 15.1	3.49	< 0.05

Table (18): shows comparison between different stages of HIE as regard lactate and NPBI.

- Lactate were significantly higher in sever cases when compaired to mild cases.
- NPBI were significantly higher in sever cases when compaired to mild cases.

Table (19): Outcome of cases according to HCO_3

K^+ / Outcome	X ± S.D.	t	p
Died (n=3)	15.5± 0.5	0.79	> 0.05
Handicap (n = 9)	15.14±1.06	1.51	> 0.05

Table (19): Shows $\overline{X}$ ± SD of HCO_3 among cases according to outcome

- No statistical difference between level of HCO3 among different cases.

Table (20): Outcome of cases according to NPBI

K^+ / Outcome	$\bar{X}$ ± S.D.	t	p
Died (n=3)	82.37±12.7	1.38	> 0.05
Handicap (n = 9)	63.51±34.67	10.3	< 0.01

Table (20): Shows $\bar{X}$ ± SD of NPBI among cases according to outcome

- The mean of NPBI among died cases is higher than that among handicaps with no statistical difference.

Table (21): Outcome of cases according to lactate

Lactate / Outcome	No.	$\bar{X}$ ± SD	t	p
Died	3	8.1 ± 0.6	1.32	> 0.05
Handicap	9	8.87±1.4	0.59	> 0.05

Table (21): Shows $\bar{X}$ ± SD of lactate among cases according to outcome

No statistical difference between level of lactate among different cases.

Table (22): Outcome of cases according to pH

pH / Outcome	No.	$\bar{X}$ ± **SD**	t	p
Died	3	6.92±0.02	1.54	> 0.05
Handicap	9	6.96±0.07	5.03	< 0.001

Table (22): Shows $\bar{X}$ ± SD of pH among cases according to outcome
The mean of PH among died cases is higher than that among handicaps with no statistical difference

Table (23): Outcome of cases according to Ca

Ca / Outcome	No.	$\bar{X}$ ± SD	t	p
Died	3	7.07 ± 0.06	1.82	> 0.05
Handicap	9	7.41±0.55	8.49	< 0.001

Table (23): Shows $\bar{X}$ ± SD of Ca among cases according to outcome

- The mean of Ca among died cases is higher than that among handicaps with no statistical difference.

Table (24): Outcome of cases according to Na

Na / Outcome	$\bar{X}$ ± **SD**	t	p
Died (n=3)	131.67±3.79	1.3	> 0.05
Handicap (n = 9)	1.28±5.34	2.77	< 0.01

Table (24): Shows $\bar{X}$ ± SD of Na among cases according to outcome

- The mean of Na among died cases is higher than that among handicaps with no statistical difference.

Table (25): Outcome of cases according to K^+

K^+ / Outcome	$\bar{X}$ ± S.D.	t	p
Died (n=3)	5.58±0.21	1.31	> 0.05
Handicap (n = 9)	5.8±0.5	4.27	< 0.01

Table (25): Shows $\bar{X}$ ± SD of K^+ among cases according to outcome

The mean of K^+ among died cases is higher than that among handicaps with no statistical difference.

Table (26): Relation between serum lactate and neurological manifestations

Lactate / Neurological manifest	**No**	**Range**	**X ± SD**	**t**	**p**
Irritable	10	8.9 12.3	10.7 ± 1.4	3.15	< 0.01
Convulsion	15	7.4 – 11.2	8.9 ± 1.4	5.5	< 0.01
Coma	8	7.4 – 9.1	8 ± 0.9	2.15	< 0.05

Table (26): Shows the relation between serum lactate and neurological manifestations

There is statistical significant difference between the degree of neurological manifestation and lactate.

Table (27): Relation between serum NPBI and neurological manifestations

Lactate / Neurological manifest	No	Range	X ± SD	t	p
Irritable	10	15.1- 46.9	30.8± 10.2	4.71	< 0.001
Convulsion	15	15.2-112	70.4± 30.05	8.47	< 0.001
Coma	8	68.3- 10.68	83.6±15.1	1.21	> 0.05

Table (27): Shows the relation between NPBI and neurological manifestations

There is statistical significant difference between moderate and mild cases. The mean value of severe cases is higher than moderate cases, but with no statistical significant difference.

Also there is statistical significant difference between severe and mild cases.

Table (28): The developmental outcome of all the studied cases with and without seizures at the age of 6 months.

DDST	Normal DDST		Abnormal DDST		Total	
	No.	%	No.	%	No.	%
Cases with seizures (n=15)	3	25.0	9	75	12	100.0
Cases without seizures (n=35)	35	100.0	0	0.0	35	100.0
Total (no = 50)	38	80.8	9	19.2	47	100.0

Adjusted $X^2 = 27.8$ $P < 0.001$

N.B.: 3 cases died before 6 months of age.

Table (28): Shows the developmental outcome of all the studied cases with and without seizures to the age of 6 months according denever developmental scoring test.

75% of cases with seizures had abnormal DDST at 6 months age.

Table (28`): The developmental outcome of all the studied cases with and without seizures at the age of 1 year.

DDST	Normal DDST		Abnormal DDST		Total	
	No.	%	No.	%	No.	%
Cases with seizures (n=15)	2	18.2	9	81.8	11	100.0
Cases without seizures (n=35)	35	100.0	0	00.0	35	100.0
Total (no = 50)	37	80.4	9	19.6	46	100.0

Adjusted $X^2 = 30.59$ $P < 0.0001$

N.B. : 1 cases of normal at 6 months become delayed at 1 year and one case of delayed at 6 months died before 1 year.

Table (28`): Shows the developmental outcome of all the studied cases with and without seizures to the age of 1 year according denever developmental scoring test.

81.8% of cases with seizures had abnormal DDST at 1 year age.

Table (29): The relationship between the 5 minutes apgar score and the DDST at 6m of age in the studied groups.

Apgar score	Normal		Delayed		Total	
	No.	%	No.	%	No.	%
> 6	30	100.0	0	0.0	30	100.0
Less than or equal to 6	8	47.1	9	52.9	17.0	100.0
Total	38	80.8	9	19.2	47	100.0

Adjusted chi square 16.4 P < 0.01

N.B. : 3 cases died before 6 months of age

Table (29): Shows the relationship between the 5 minutes apgar score and the DDST at 6m of age in the studied groups.

All cases who were delayed DDST at 6 months had low apgar score at birth.

Table (29`): The relationship between the 5 minutes apgar score and the DDST at 1year of age in the studied groups.

Apgar score	Normal		Delayed		Total	
	No.	%	No.	%	No.	%
> 6	30	100	0	00.0	30	100.0
Less than or equal to 6	7	43.8	9	56.3	16	100.0
Total	37	80.4	9	19.6	46	100.0

Adjusted chi square 17.56 P < 0.001

N.B. : 1 cases of normal at 6 months become delayed at 1 year and one case of delayed at 6 months died before 1 year.

Table (29`): Shows the relationship between the 5 minutes apgar score and the DDST at 1 year of age in the studied groups.

All cases who were delayed DDST at 1 year had low apgar score at birth.

Table (30): The relation between time of occurrence of seizures and DDST at 6 months of age

Timing	Normal outcome		Delayed outcome		Total	
	No.	%	No.	%	No.	%
Less than 24 hours	0	00.0	9	100.0	9	100.0
More than 24 hours	3	100.0	0	00.0	3	100.0
Total	3	25.0	9	75.0	12	100.0

$X^2 = 7.26$ $P < 0.001$

N.B.: 3 cases died before age of 6 months

Table (30): Shows the relation between time of occurrence of seizures and DDST at 6 months of age,

All cases with delayed outcome at 6 months developed seizures in the first day of life and 25% developed seizures after the first day of life.

Table (30`): The relation between time of occurrence of seizures and DDST at 1 year of age

Timing	Normal outcome		Delayed outcome		Total	
	No.	%	No.	%	No.	%
Less than 24 hours	0	0	8	100	8	100
More than 24 hours	2	66.7	1	33.3	3	100
Total	2	18.18	9	82.82	11	100

$X^2 = 6.52$ $P < 0.05$

N.B. : 1 cases of normal at 6 months become delayed at 1 year and one case of delayed at 6 months died before 1 year.

Table (30`): Shows the relation between time of occurrence of seizures and DDST at 1 year of age,

88.9 % of cases with delayed outcome at 1 year developed seizures in the first day of life and 11.1% developed seizures after the first day of life.

Table (31): Correlation coefficient "r" between NPBI different values

NPB	r	P
HCO3	0 .3568	< 0.05
K	0.0855	< 0.05
pH	0.5794	< 0.001
Na	0.06084	< 0.05
Ca	0.7511	< 0.001
Apgar at 1 minute	0.5766	< 0.001
Apgar at 5 minute	0.5248	< 0.001
Lactate	0.5927	< 0.001
Urea	0.2681	< 0.05
Creatinine	0.5552	< 0.001
Po2	0.2668	< 0.05
PCO2	0.6053	< 0.001
HCO3	0.3568	< 0.05

Table (31): Shows the correlation coefficient "r" between NPBI different values.

- We found a negative correlation coefficient between level of NPBI and pH, Na^+, Ca^+, apgar at 1 minute, apgar at 5 minute, PO_2 as increase level of NPBI is associated with decrease the level of them.
- But we found a positive correlation coefficient between the level NPBI and HCO_3, urea, creatinine, PCO_2, lactate, K as increase the level of NPBI is associated with increase the level of them.

Table (32): The developmental outcome of all cases of asphyxia at 6 months, 1 year.

AGE	**6 months**		**1 year**	
DDST	Normal	Delayed	Normal	Delayed
	13	9	12	9
	59.1	40.9	57.1	40.9
Z	0.87		0.76	

There is no significant difference between the outcome of cases at 6 months and 1 year

N.B. : 1 cases of normal at 6 months become delayed at 1 year and one case of delayed at 6 months died before 1 year.

Cases were categorized for the outcome as normal with no evidence of handcaps, delayed with evidence of handcaps as convulsion, spastic diplegia, quadriplegia, mental retardation, neurosensory deafness or blindness.