The role of serum lactate and enzymes in predicting perinatal asphyxia

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Abstract

Background: Perinatal asphyxia is a deficiency of blood flowing or gas exchanging to or from the fetus in the time just earlier, during, or afterward the labour processes. Perinatal asphyxia could result in profound systemic and neurologic sequelae owing to reduced blood flowing and/or oxygen to a fetus or infant throughout the peripartum time.

Objectives: the aim of the study was toevaluate the role of serum lactate and enzymes in predicting perinatal asphyxia.

Patients and methods: the current work was a cross-sectional study performed at Qena University Hospital including 30 cases and 30 controls included of asphyxiated and non-asphyxiated babies respectively.

Results: There was a statistically significant change ($p<0.001$) among groups regarding levels of serum lactate, lactate dehydrogenase (LDH),creatine kinase muscle-brain fraction (CK-MB),aspartate aminotransferase (AST), and alanine aminotransferase(ALT).

Conclusion:Perinatal asphyxia is a fundamental driver of neonatal death and long haul neurological harm still without prescient diagnostics, preventive as well as treatment of agreement.Estimation of lactate,CK-MB,LDH,AST, and ALT could be utilized as a biomarker for diagnosing of perinatal asphyxia.

Keywords: **Blood Flow, Fetus, Marker, Perinatal Asphyxia, Peripartum, Serum Enzymes.**

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Introduction

Perinatal asphyxia is a deficiency of blood flowing or gas exchanging to or from the fetus in the time just earlier, during, or afterward the labour processes. Perinatal asphyxia could result in profound systemic and neurologic sequelae owing to reduced blood flowing and/or oxygen to a fetus or infant throughout the peripartum time. Neonatal hypoxic-ischemic encephalopathy referred definitely to the neurological sequelae of perinatal asphyxia **(Sugiura-Ogasawara et al., 2019; Hakobyanet al., 2019).**

Hypoxic damage can occur to most of the infant's organs (heart, lungs, liver, gut, kidneys, etc.). But brain damage is of most concern and perhaps the least likely to quickly or completely heal **(Clohertyet al., 2012)**.

Perinatal asphyxia could happen because of maternally hemodynamic compromising (amniotic fluids embolus), uterine condition (like ruptures), or placenta and umbilical cords (placental abruption, umbilical cord knot or compressing), and infections. The asphyxia could happen before labour or could happen just after birthing in a compromising case demanding resuscitation **(Viaroliet al.,2018).**

The incidences of perinatal asphyxia are 2 every 1000 labours in developed republics, but the percentage is raised to 10-fold higher in developing republics where there might be restricted admission to maternal and neonatal caring. Of those infants influenced, 15-20% die in the neonatal interval, and up to 25% of survivors are left with lasting neurologic deficits **(Oddet al., 2017).**

Examinations of Various biomarkers had been performed to detect perinatal hypoxia, involving electronic fetal heart monitor, low Apgar score, cord pH, electro-encephalogram, computed tomography, MRI-scan, and Doppler-flowing test. Between these biomarkers, the best prognosticator was not determined and this condition led researchers to study further tests **(Nagdymanet al., 2001).**

Enzyme leak as a consequence of hypoxia-ischemia-made cell-damaging in influenced organs is well-known. Lactate dehydrogenase (LDH), lactate, aspartate aminotransferase (AST), and raised normoblast count are better prognosticators of birth asphyxia (**Karlsson et al., 2010).**

Lactate production is buffered intra-cellularly, e.g. the lactate-producing enzyme lactate dehydrogenase binds one hydrogen cation per pyruvate molecule converted. When such buffer systems become saturated, cells will transport lactate into the bloodstream. Hypoxia certainly causes both build-up of lactate and acidification, and lactate is, therefore, a good "marker" of hypoxia, but lactate itself is not the cause of low pH **(Robergs et al., 2004).**

Measurement of plasma LDH, ALT, and AST levels during the first 12 hr. after birth may predict the development of hypoxic-ischaemic encephalopathy (HIE) and long term adverse neurodevelopment outcome in term newborn infants with intrapartum signs of fetal distress **(Karlsson et al., 2010).**

Transient myocardial ischemia (TMI) with myocardial dysfunction may occur in any neonate with a history of perinatal asphyxia. An elevated serum creatine kinase muscle-brain fraction (CK-MB) level may be useful in determining the presence of myocardial harm**(Hansen et al., 2012).**

Patients and Methods

This was across-sectional study performed in Pediatric departments, Qena university hospital cases, and controls that included asphyxiated and non-asphyxiated babes.

Inclusion criteria:

Case-group (asphyxiated):

Neonates delivered ≥32 weeks of gestation with birth weight ≥1500 g; who became symptomatic within 6 hours of birth with at least **1** non-specific sign of sickness–tachypnea, chest retractions, grunt, lethargy, poor feeding, hypotonia, irritability, central cyanosis, cardiac gallop rhythm, cardiac murmur, shock, and abdominal distension.

Cases were subjects with a minute Apgar score of <7 and fetal bradycardia, meconium-stained liquor, or cord pH <7; and without any other independent cause for the clinical signs.

Control group (non-asphyxiated):

Neonates with normal fetal heart rate patterns, clear liquor, and 1 min Apgar score ≥7.

Exclusion criteria: for both of the study groups:

Neonates delivered<32 wks. of gestation or birth wt.< 1500 g, neonates with major malformations, those born to mothers who had received pethidine, or magnesium sulphate within 4 h before delivery or who had obvious signs of HIE.

Operational design: All patients in this study had been subjected to the following:

A- Comprehensive history-taking with special emphasis on:

1-Personal history: Names, ages, genders, and residency**.**

2-Perinatal history: Maternal age, parity, maternal diseases during pregnancy, drugs during pregnancy, and Fetal HR.

3-Natal history: Type of delivery: normal vaginal delivery or cesarean section, prolonged rupture of membrane, Apgar score at 1 minute, 5 minute, and 10 minute**,** History of meconium-stained amniotic fluid, and resuscitation history.

B- Clinical examination :

1. Estimation of gestational age using modified Ballard score (**Ballard et al., 1991**).

2. Estimation of birth weights, lengths, and head circumferences at birth and growing charts plotting.
3. Vital data: heart rate, respiratory rate, oxygen saturation, capillary refilling time, and core temperature.

4. Complete examination including chest, cardiac, abdominal, and neurological systems.

Laboratory investigations

Blood Samples: 6 mL of venous blood and 2 ml of arterial blood in heparinized full plastic syringes were collected from each patient. Samples were stored on ice till the time of the assay (stable for up to 30 minutes).

1. **Complete blood count (CBC):**2 ml blood collected on EDETA tubes to perform CBC using CellTac Mek-6510 (Nihon Kohden corporation-Japan).

2. **C–Reactive protein (CRP):** Quantitative determination of CRP in the whole blood was done using Quik Read go® Instrument- Espoo-Finland**.**

3. **Lactate, blood gases:** were assayed on GEM premier 3000 (Instrumentation Laboratory–Bedford, MA-USA), lactate levels measurement through enzymatic detection by Lactate oxidase**.**

4. **Serum LDH,CK-MB, AST, and ALT levels.** Using a spectrophotometric kinetic assay on COBAS c311 (Roche company–Germany).

Administrative and Ethical design: A printed clear agreement was gotten from all cases parents of the study after being notified about the objectives and processes of the work as well as applicable objectives. The study had been permitted by the local ethics committee on research including human subjects of Faculty of Medicine, Qena University Hospitals. There were no harmful influences in the study on the cases as well as the service provided. There were no additional fees were paid by the participated cases and the researchers paid all the charges in this respect.

Data management and Statistical Analysis: the Data analysis was performed via IBM SPSS-20**.** (Armonk, NY: IBM Corp)**.**Qualitative data was introduced in the form of numbers and percentages. Kolmogorov-Smirnov testing was utilized to validate the distributing normality. Quantitative data was introduced in the form of range (min & max), mean, and standard deviation (SD).

Significance results were considered at the 5% level.

Results

This is across-sectional study was conducted on 60 neonates admitted to the NICU(neonatal intensive care unit) in Qena university hospital. Demographic data of both groups were presented in **(Table 1).** There was a highly significant change among the study groups regarding fetal HR (p<0.001). (86.7% of cases had fetal bradycardia).

Table 1. Demographic data in cases and controls

Variables	Cases (n = 30)		Control (n = 30)		Test of sig.	p-value
	No.	%	No.	%		
Sex						
Male	19	63.3	20	66.7	χ^2=0.073	0.787
Female	11	36.7	10	33.3		
Age (days)						
Min. – Max.	3.0 – 3.0		3.0 – 3.0		NS	NS
Mean ± SD.	3.0 ± 0.0		3.0 ± 0.0			
Median	3.0		3.0			
Fetal HR						
Normal	4	13.3	30	100.0	χ^2= 45.882*	<0.001*
Bradycardia	26	86.7	0	0.0		

χ^2: **Chi-square test** *: Statistically significant at p ≤ 0.05

Comparing perinatal history among the studied groups **(Table 2)**,No significant differences were found. Comparing natal history among the study groups **(Table 3).**

Table 2. Comparing perinatal history among cases and controls

Perinatal history	Cases (n = 30)		Control (n = 30)		Test of sig.	p-value
	No.	%	No.	%		
Maternal age (yrs.)						
Min. – Max.	20.0 – 45.0		20 – 41.0		t=0.232	0.817
Mean ± SD.	32.10 ± 6.45		32.47 ± 5.78			
Median (IQR)	31.0(28.0 - 37.0)		31.50(29.0 - 38.0)			
Parity						
Primipara	17	56.7	15	50.0	χ^2= 0.791	MCp= 0.734
Multipara	10	33.3	13	43.3		
Grand multipara	3	10.0	2	6.7		
Maternal diseases during pregnancy						
No	28	93.3	30	100.0	χ^2= 2.069	FEp= 0.492
Yes	2	6.7	0	0.0		
Drugs during pregnancy						
No	28	93.3	30	100.0	χ^2= 2.069	FEp= 0.492
Yes	2	6.7	0	0.0		
Residence						
Rural	17	56.7	17	56.7	χ^2= 0.0	1.000
Urban	13	43.3	13	43.3		

χ^2: **Chi-square test;**FE**: Fisher Exact;** MC: **Monte Carlo; t: Student t-test;** *: Statistically significant at p ≤ 0.05

Table 3. Comparing natal history among cases and controls

Natal history	Cases (n = 30)		Control (n = 30)		Test of sig.	p
	No.	%	No.	%		
Type of delivery						
Normal vaginal delivery	6	20.0	23	76.7	χ^2= 19.288*	<0.001*
Cesarean section	24	80.0	7	23.3		
Prolonged rupture of membrane						
No	24	80.0	28	93.3	χ^2=2.308	FEp= 0.254
Yes	6	20.0	2	6.7		
Apgar score At 1minute						
Min. – Max.	0.0 – 6.0		8.0 – 10.0		t= 17.301*	<0.001*
Mean ± SD.	3.07 ± 1.78		9.27 ± 0.83			
Median (IQR)	3.0 (2.0 – 4.0)		9.50(9.0 - 10.0)			
Apgar score At 5 minute						
Min. – Max.	1.0 – 8.0		10.0 – 10.0		t= 13.468*	<0.001*
Mean ± SD.	4.77 ± 2.13		10.0 ± 0.0			
Median (IQR)	5.0 (3.0 – 6.0)		10.0(–)			
Apgar score At 10 minute						
Min. – Max.	4.0 – 10.0		10.0 – 10.0		t=7.581*	<0.001*
Mean ± SD.	7.37 ± 1.90		10.0 ± 0.0			
Median (IQR)	7.0 (6.0 – 8.0)		10.0(–)			
Ambu& Bag resuscitation						
No	5	16.7	30	100.0	χ^2= 42.857*	<0.001*
Yes	25	83.3	0	0.0		
Chest compression						
No	12	40.0	30	100.0	χ^2= 25.714*	<0.001*
Yes	18	60.0	0	0.0		
Intubation						
No	13	43.3	29	100.0	χ^2= 23.085*	<0.001*
Yes	17	56.7	0	0.0		
Meconium stained amniotic fluid						
No	24	80.0	30	100.0	χ^2= 6.667*	FEp= 0.024*
Yes	6	20.0	0	0.0		
Gestational age (Weeks)						
Min. – Max.	32.0 – 40.0		32.0 – 38.0		t= 3.213*	0.002*
Mean ± SD.	36.93 ± 1.84		35.47 ± 1.70			
Median(IQR)	37.0(37.0 - 38.0)		35.0(34.0 - 37.0)			

χ^2: **Chi-square test;** FE**: Fisher Exact; t: Student t-test; ***: Statistically significant at $p \leq 0.05$

Comparison clinical manifestations and examination between the two studied groups **(Table 4),**There was a highly statistically significant difference between groups as regard level of consciousness, muscle tone, Moro reflex, pupils, seizures, suckling reflex, the pattern of respiration, and HR (P<0.001). There were statistically significant differences between groups as regard shock (P<0.05).

Table 4. Comparing clinical manifestations and examination among case &control groups

Examinations		Cases		Control		χ^2	p
		No	%	No	%		
Level of consciousness	Normal	0	0.0	30	100.0	71.148*	^{MC}p <0.001*
	Hyper alert	13	43.3	0	0.0		
	Lethargic	7	23.3	0	0.0		
	Coma	10	33.3	0	0.0		
Muscle tone	Normal	1	3.3	29	96.7	59.216*	^{MC}p <0.001*
	Hypertonic	12	40.0	1	3.3		
	Hypotonic	7	23.3	0	0.0		
	Flaccid	10	33.3	0	0.0		
Moro reflex	Good	0	0.0	30	100.0	71.148*	^{MC}p <0.001*
	Exaggerated	13	43.3	0	0.0		
	Incomplete	7	23.3	0	0.0		
	Absent	10	33.3	0	0.0		
Pupils	Normal	0	0.0	30	100.0	71.148*	^{MC}p <0.001*
	Mydriasis	13	43.3	0	0.0		
	Miosis	7	23.3	0	0.0		
	Unequal	10	33.3	0	0.0		
Seizures	No	13	43.3	30	100.0	23.721*	<0.001*
	Yes	17	56.7	0	0.0		
Suckling reflex	Active	13	43.3	0	0.0	17.188*	<0.001*
	Weak	7	23.3	16	53.3		
	Absent	10	33.3	14	46.7		
Respiration	Regular	13	43.3	30	100.0	25.160*	^{MC}p <0.001*
	Periodic	7	23.3	0	0.0		
	Apnoeic	10	33.3	0	0.0		
HR	Normal	1	3.3	30	100.0	67.524*	^{MC}p <0.001*
	Tachycardia	2	6.7	0	0.0		
	Bradycardia	27	90.0	0	0.0		
Shock	No	23	76.7	30	100.0	7.925*	^{FE}p= 0.011*
	Yes	7	23.3	0	0.0		
Abdominal distention	No	24	80.0	29	96.7	4.043	^{FE}p= 0.103
	Yes	6	20.0	1	3.3		
Organomegaly	No	28	93.3	30	100.0	2.069	^{FE}p= 0.492
	Yes	2	6.7	0	0.0		

χ^2: **Chi-square test** FE**: Fisher Exact** MC: **Monte Carlo***: Statistically significant at $p \leq 0.05$

Comparing serum lactate and enzymes among the studied groups (**Table 5&Fig.1**), There was a statistically significant increase (p<0.001) in serum lactate, LDH, CK-MB, AST, and ALT levels in asphyxiated babies.

Table 5. Comparison of serum enzymes and lactate between case & control groups

Investigations		Cases (n = 30)	Control (n = 30)	Test of sig.	p
Lactate	Min. – Max.	10.0 – 130.0	5.0 – 12.0	t=9.377*	<0.001*
	Mean ± SD.	72.10 ± 37.36	8.0 ± 2.48		

	Median (IQR)	62.50 (40.0 – 110.0)	8.0 (5.0 – 10.0)		
LDH	Min. – Max.	400.0 – 900.0	88.0 – 315.0	t= 18.515*	<0.001*
	Mean ± SD.	730.67 ± 140.94	193.20 ± 73.60		
	Median (IQR)	710.0 (600.0 – 900.0)	210.0 (120.0 – 232.0)		
CK-MB	Min. – Max.	19.0 – 130.0	12.0 – 25.0	t=7.401*	<0.001*
	Mean ± SD.	66.57 ± 34.50	19.77 ± 3.07		
	Median (IQR)	65.0 (40.0 – 99.0)	20.0 (18.0 – 22.0)		
ALT	Min. – Max.	50.0 – 198.0	13.0 – 40.0	t= 9.879*	<0.001*
	Mean ± SD.	102.03 ± 42.86	22.93 ± 9.31		
	Median (IQR)	94.0 (68.0 – 121.0)	19.50 (15.0 – 31.0)		
AST	Min. – Max.	140.0 – 219.0	15.0 – 58.0	t= 26.139*	<0.001*

χ^2: **Chi-square test;** FE**: Fisher Exact;** **t: Student t-test;** *: Statistically significant at p ≤ 0.05

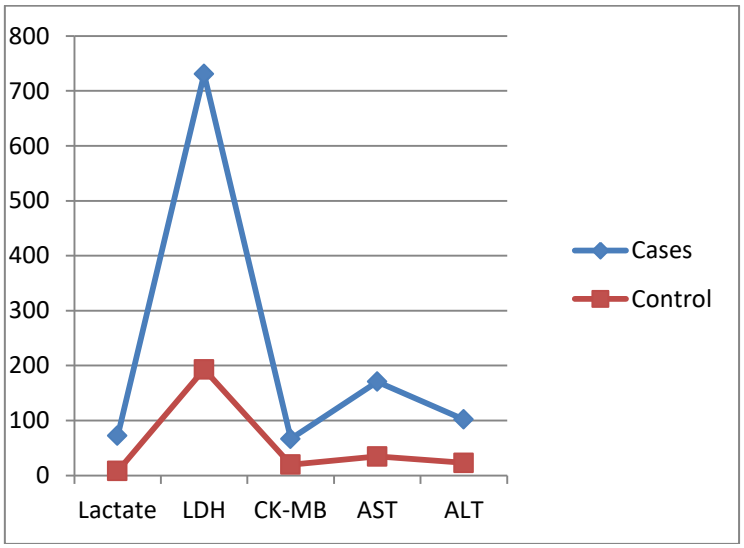

Fig.1. Line charts showing the distribution of lactate, LDH, CK- MB, AST, and ALT levels in the studied groups.

Comparing among the groups of the study regarding CBC parameters as shown in**(Table 6), (Fig.2).**Statistically significant changes were found amongst groups as regard HB level(p<0.05). A high statistically significant change was found among groups as regard platelets count(p<0.001),but an insignificant change was found among groups regarding WBC count.

Table 6.Comparison CBC parameters between case &control groups

Investigations		Cases (n = 30)	Control (n = 30)	Test of sig.	p
HB	Min. – Max.	8.0 – 18.30	12.30 – 18.0	t= 2.795*	0.007*
	Mean ± SD.	14.15 ± 2.41	15.62 ± 1.60		
	Median (IQR)	14.50(13.20 – 16.10)	15.85(14.80 – 17.0)		
WBC	Min. – Max.	3.80 – 15.80	4.0 – 11.0	t= 1.149	0.256
	Mean ± SD.	7.73 ± 3.23	6.92 ± 2.06		
	Median (IQR)	7.0 (4.70 – 11.0)	6.70 (5.70 – 8.20)		
PLT	Min. – Max.	20.0 – 326.0	150.0 – 411.0	t= 7.067*	<0.001*
	Mean ± SD.	107.37 ± 51.72	234.07 ± 83.47		
	Median (IQR)	109.0(90.0 – 122.0)	199.50(179 – 311.0)		

t: Student t-test*: Statistically significant at p ≤ 0.05

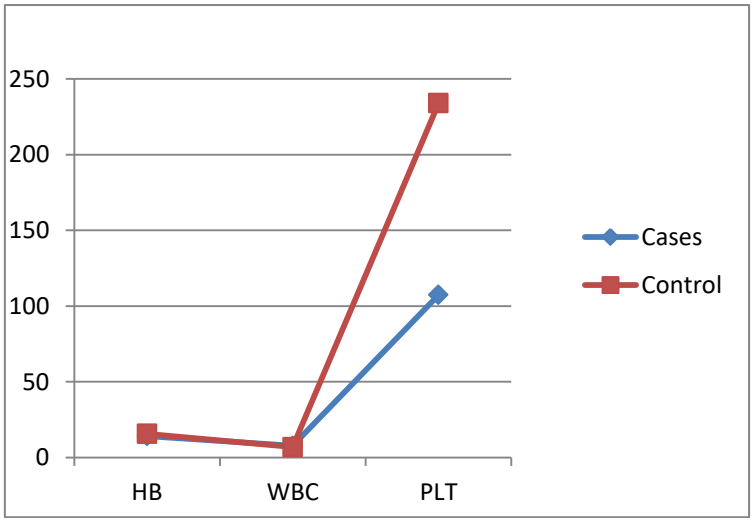

Fig.2. Line charts show the distribution of HB level, WBC count, and PLT count in the studied groups.

Comparing ABG parameters among the studied groups **(Table 7& Fig.3),**There was a highly significant change among groups as regard pH and HCO_3levels (p<0.001)**.**

Table 7.ComparisonABG parameters between case &control groups

Investigations		Cases (n = 30)	Control (n = 30)	Test of sig.	p
PH	Min. – Max.	6.10 – 7.29	7.32 – 7.45	t= 9.698*	<0.001*
	Mean ± SD.	6.83 ± 0.32	7.39 ± 0.04		
	Median (IQR)	6.89 (6.72 – 7.01)	7.39 (7.37 – 7.43)		
PCO_2	Min. – Max.	14.20 – 70.20	35.0 – 45.0	t= 0.982	0.330
	Mean ± SD.	42.41 ± 14.76	39.70 ± 3.22		
	Median (IQR)	40.0(35.0 – 50.30)	39.50(37.0 – 42.0)		
HCO_3	Min. – Max.	8.0 – 36.0	22.0 – 26.0	t= 6.095*	<0.001*
	Mean ± SD.	17.50 ± 5.69	24.06 ± 1.54		
	Median (IQR)	18.45(12.30 – 21.0)	24.0(23.0 – 25.80)		

t: Student t-test *: Statistically significant at p ≤ 0.05

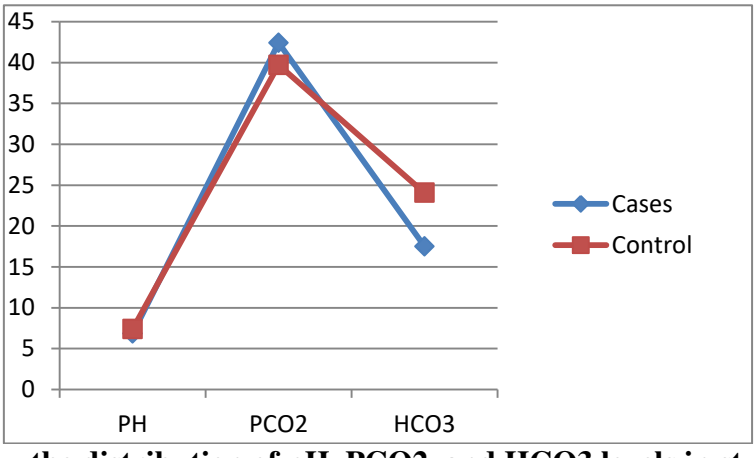

Fig .3. Line charts show the distribution of pH, PCO2, and HCO3 levels in studied groups

Comparing Apgar scoring among the case group (**Table 8**), at 1-min showed an insignificant negative association with lactate and CK-MB, while there is a significant negative correlation between Apgar score at 1 minute in the case group and each of LDH,AST, and ALT. Sensitivity, specificity, cut-off level and predictive value of lactate were presented in (**Table 9 and Fig.4**).

Table 8.Correlation between Apgar score and investigations in each group

Variables	Apgar scoring [At 1 min]		Apgar scoring [At 5 min]		Apgar scoring [At 10 min]			
	r_s	p	r_s	p	r_s	p	r_s	p
Lactate	-0.335	0.070	0.252	0.180	-0.283	0.130	-0.359	0.051
LDH	-0.549*	0.002*	-0.026	0.891	-0.566	0.001*	-0.443	0.014*
CK-MB	-0.226	0.229	0.044	0.817	-0.262	0.162	-0.204	0.279
AST	-0.422*	0.020*	0.080	0.675	-0.384	0.036*	-0.341	0.065
ALT	-0.403*	0.027*	-0.043	0.822	-0.417	0.022*	-0.248	0.187

r_s: Spearman coefficient
*: Statistically significant at $p \leq 0.05$

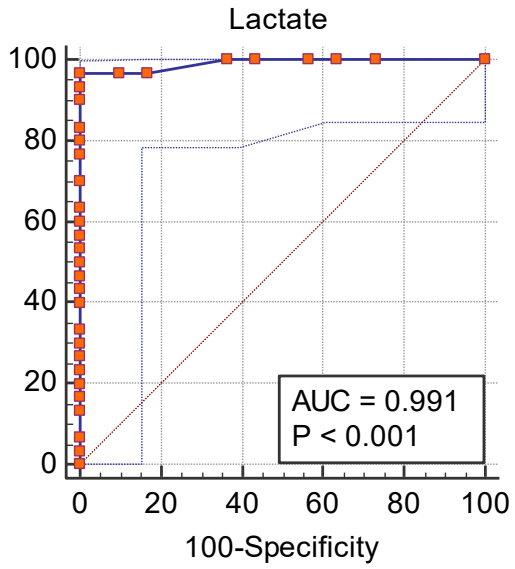

Fig 4. ROC curve of lactate

Table 9. Sensitivity, specificity, cut-off level and predictive value of lactate

AUC	0.991
S.E.	0.00964
95% Confidence interval	0.924 to 1.000
Significance level P	<0.0001
Cut off	24.2
Sensitivity	93.3%
Specificity	100%
PPV	79%

Discussion:

Perinatal asphyxia is described as the failure of initiation and with stand the breath at birthing. It is also defined as a temporal interrupting of oxygen accessibility that implying a dangerous metabolic challenge, even when the insulting doesn't lead to a serious consequence (**Morales et al., 2011).**

In the current study**,** a non-significant change was found among the groups of the study regarding gender, ages, and residences. This result agrees with the results of (**Meena et al., 2017).**

The present work exhibited that a highly significant change was found among the groups regarding fetal HR(86.7 % of cases had fetal bradycardia). This result was in accordance with the results of **(Reddy et al., 2008)**who reported that 92% of cases had fetal bradycardia.

In the current work, statistically insignificant changes were found among the groups regarding maternal age (yrs.), parity, maternal diseases during pregnancy, and drugs during pregnancy. This result was in accordance with the results of(**Patra et al., 2016).**

The present work presented that a significantly higher change was found among the groups regarding the delivery type (in the case group 80% were born by CS and 20% were delivered by vaginal delivery, whereas in the control group 23.3% were delivered by CS and 76.7% by vaginal delivery). This agrees with the results of(**Reddy et al ., 2008**),but this was in disagreement with **(Kariya et al., 2020)**, who reported that 50 (66.67%) out of 75 neonates with birth asphyxia were born by vaginal delivery, 22(29.33%) by lower segment cesarean section (LSCS), and 3 (4%) using forceps, whereas in the control group, 109(72.67%) neonates were born by NVD, 38(25.33%) were delivered by LSCS, and 3(2%) using forceps.

In our study, a significantly higher change was found among the groups regarding Ambu & bag resuscitation, chest compression, and intubation (83.3% of cases need Ambo &bag resuscitation,56.7% intubation, and 60% chest compression (P<0.001). In the study of (**Reddy et al., 2008),** 84% of patients need ventilating by bag & mask, 20% intubating, and 8% chest compressing.

The present results revealed that a high statistically significant change was found among groups regarding the level of consciousness, muscle tone, Moro reflex, pupils, suckling reflex, seizures, and pattern of respiration (P<0. 001).A significant change was found among groups regarding HR (P<0.001). A significant change was found among the groups regarding shock (P<0.05),but an insignificant change was found among the groups as regard abdominal distention and organomegaly, this is was in agreement with the results of (**Kariya et al., 2020**), that found that out of the 75 cases with birth asphyxia, 31 cases had no evidence of HIE whereas 22(29.3%) had Stage 1 HIE, 15(20%) had Stage 2, and 7(9.3%) had stage 3 HIE.

Our results were supported by the study of (**Meena et al., 2017)** as they reported that the mean CK-MB level at 8±2 hr. significantly higher in cases (86.98±16.94 U/L) compared to controls (47.42±6.53U/L)(P<0.001). The mean LDH levels at 72±2 hrs. significantly higher in cases(548±67.69 U/L)compared to controls(372.6±67.69 U/L)(P<0.001).The number of neonates with LDH levels >580 U/L significant difference in patients in comparison to controls (P<0.001).

The present work presented that lactate was significantly higher in asphyxiated babes with 93.3% sensitivity and 100% specificity. This agrees with the results of **Shah S et al., 2004** who reported that blood lactate is an important predictor of intrapartum asphyxia with a sensitivity of 94% and specificity of 97%.

Rajakumar et al.(2008)observed that the cardiac enzymes, cTnT and CK-MB, were significantly elevated in cases when compared with controls.

Furthermore, **Saha et al., (2016)** found significant increase in the serum level of LDH, CK, CK-MB, and uric acid (UA) within the first 12 to 24 hours in an asphyxiated newborn infant suffering from HIE 1 compared to a normal subject. However, with progress to HIE 2 from HIE 1, only the level of UA shows a statistically significant change.

In our study, a statistically significant change was found among groups regarding the level of AST, ALT, pH, and HCO3 (P<0.001),but an insignificant change was found among the groups as regard PCO2 level.

Our results were in line with the results of (**DeepthiRamuet al., 2016)** as they reported that mean enzyme levels of LDH, AST and ALT were significantly higher among cases in comparison with the controls at 12 hrs. and on day3 of life.

Also, **Patra et al. (2016)** reported that serum AST, ALT, LDH, and ALP were significantly higher in asphyxiated babies in comparison to controls (P<0.05). The increase of AST, ALT, and LDH as well revealed a significant positive association with the severity and outcomes of asphyxia.

We found that cases had low levels of platelets count than controls with a mean value (107.37±51.72 vs. 234.07±83.47), this was in agreement with the results of (**Boutaybi et al., 2014)** who reported that neonates afterward birth

asphyxia had an elevated risk (51%) of early beginning thrombocytopenia

Conclusions:

Perinatal asphyxia is a fundamental driver of neonatal death and long haul neurological harm still without a prescient diagnostics, preventive as well as treatment of agreement. Estimation of lactate, CK-MB, LDH, and hepatic enzymes could be employed as a marker for diagnosing the existence of birth asphyxia.

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