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Original Research Article

Association of Serum Lactate Level with Severity of Pre-Eclampsia and Maternal Complications: An Observational Study

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Abstract

Background: Pregnancy-related hypertensive problems are the most prevalent medical conditions. It increases mortality and morbidity rates for pregnant women and newborns. Incidence ranges from 5 to 10%. Complications can be minimised by identifying high risk patients and closely monitoring them. A helpful biochemical marker called lactate dehydrogenase can be used to assess maternal complications like disseminated intravascular coagulation (DIC), HELLP syndrome (haemolysis, elevated liver enzymes, and lowered platelets), pulmonary edema, renal failure, and foetal complications like foetal growth restriction (FGR) with an APGAR score ≤7 at five minutes and NICU admissions. Estimating serum Lactate dehydrogenase (LDH) levels in pre-eclampsia patients and examining the relationship between elevated LDH levels and maternal and foetal outcomes were the two main goals of this study.

Methods: It was a prospective study from March 2022 to August 2022 at Sri Krishna Medical College and Hospitals, Muzaffarpur, Bihar.

Results: Higher serum LDH concentrations were associated with an increased risk of maternal and foetal problems. The incidence of HELLP syndrome, DIC, and pulmonary edema was statistically significant when serum LDH was more than 600 IU/l. It also showed a p value of <0.001 correlation between lower platelets and higher creatinine levels. Apgar scores below 7 at 5 minutes and FGR NICU hospitalisation were considered statistically severe foetal problems. LDH levels rose in correlation with serum creatinine and liver enzymes.

Conclusions: Raised LDH levels increase maternal and foetal problems, and it can be utilised as a biochemical marker to improve outcomes.

Keywords: Abruptio placenta, Disseminated intravascular coagulation, Foetal growth restriction, HELLP syndrome, Lactate dehydrogenase, Pre-eclampsia

Introduction

Hypertension is one of the most common medical complications during pregnancy and a leading cause of maternal and perinatal mortality. The incidence of hypertensive disorders in pregnancy varies between 5 to 10% and it is rising as women are postponing their first

pregnancy to a later age and increasing pre-pregnancy weight.

Hypertensive disorders in pregnancy with haemorrhage and infection make up the fatal trio that significantly increases maternal morbidity and mortality. The most serious of these illnesses is the preeclampsia syndrome, whether it occurs on its own or in conjunction with persistent hypertension [1]. Preeclampsia's key etiopathogenesis include endothelial dysfunction and faulty placentation, despite the fact that its exact aetiology is unclear [2].

Numerous ideas have proposed that substances secreted from an ischemic placenta may promote endothelial dysfunction, which may contribute to disease aetiology [3].

Abruptio placentae, HELLP syndrome, DIC, hepatic failure, renal failure, retinal detachment, and cerebral haemorrhage are some of the side effects of preeclampsia. FGR, intrauterine foetal death, an Apgar score below seven at five minutes, and NICU admissions are some of the foetal problems.

Clinical risk factors can assist us in exercising caution in the absence of reliable screening methods [4]. Pre-eclampsia must be detected early, and non-invasive diagnostic techniques based on biomarkers show promise.5 When absolute or relative anoxia is present, lactate dehydrogenase (LDH), a glycolytic enzyme, is responsible for the reversible conversion of pyruvate to lactate [6]. Elevated levels of LDH are a sign of intracellular death and enzyme exocytosis. Extreme preeclampsia was shown to be associated with high levels.

LDH is a helpful biochemical indicator of preeclampsia severity and the development of preeclampsia-related problems [7]. Estimating and monitoring serum LDH may help to improve maternal and foetal outcomes by reducing preeclampsia problems.

This study sought to determine whether serum LDH levels may be used as a prognostic indicator in the treatment of preeclampsia. This study's goals were to (a) calculate the blood LDH levels in preeclampsia patients and (b) investigate the relationship between elevated serum LDH levels and maternal and foetal outcomes.

Material and Methods

This prospective study was conducted over the six-months period from March 2022 to August 2022 in the department of obstetrics and gynaecology at Sri Krishna Medical College and Hospital in Muzaffarpur, Bihar.

All pregnant women attending prenatal clinics and those admitted to Department of Obstetrics and Gynaecology, SKMCH, Muzaffarpur, Bihar who had proteinuria after 20 weeks of gestation with a blood pressure reading of ≥140/90 mmHg were included in the study. 115 people made up the sample.

The lab technique employed involved measuring serum LDH quantitatively using an ELISA kit, which works on the theory that it catalyses the interaction between pyruvate and NADH. The patients were split into two groups based on LDH levels. Serum LDH values in groups 1 and 2 are 600 IU/l and greater, respectively. Researchers studied the prevalence of maternal problems such as placental abruption, eclampsia, DIC, HELLP syndrome, liver failure, renal failure, retinal detachment, and cerebral haemorrhage. In each group, the prevalence of foetal problems such as FGR, intrauterine foetal death (IUFD), Apgar score 7 at 5 minutes, and NICU hospitalisation was examined. All patients with gestational ages greater than 20 weeks, blood pressure readings greater than and equal to 140/90 mmHg, and proteinuria were included in the study. High blood pressure readings taken before 20 weeks of gestation were omitted. Pre-existing medical conditions such as-

diabetes mellitus, renal disorders, liver disorders, connective tissue disorders, cardiac disease, musculoskeletal disorders, haemolytic anaemia, epilepsy and thrombophilia were excluded in the study.

Statistical analysis

In the current study, descriptive and inferential statistical analysis was employed. Results for categorical measurements were reported in number (%) whereas results for continuous measurements were shown as mean±SD (min-max). The 5% level of significance was used to determine significance. The following data assumptions were made.

To compare the importance of the study parameters on a categorical scale between the two groups, the Chi square/Fischer exact test was utilised. When cell samples were tiny, a non-parametric setup and the Fischer exact test were applied.

In order to create the tables, Microsoft Word and Excel were utilised along with the statistical software SPSS 18.0 and R environment version 3.2.2.

Results

In our study, 36.8% of participants were aged 25–29, and 43.9% were between the ages of 19 and 24. This revealed that 80.7% of the population was under 30. 60.5% of the patients were unbooked, while 39.5% were scheduled. Since we are a tertiary facility, we received more unbooked referrals.

It was discovered that primigravidae, who made up 65.8% of the population, had a higher prevalence of hypertension. 36 percent of pregnancies were between 28 and 32 weeks, and 37.7 percent were between 33 and 36 weeks. 11.4% of cases involved antepartum eclampsia, 8.7% involved HELLP syndrome and 7.9% involved abruption.

LSCS was used for delivery in 51.8% of cases whereas vaginal delivery was used in 48.2%. In 16.7% of the patients, serum LDH levels more than 600 IU/l were seen. 49.1% of babies were found to weigh less than 1.5 kg. To avoid maternal problems, the majority of cases were induced before term. 39.1% of study participants had FGR, and 54.4% had NICU hospitalizations. Maternal problems were shown to be more prevalent in patients with elevated serum LDH levels.

In the current study, the overall incidence of HELLP syndrome was 8.7%, and 73.3% of the participants had increased serum LDH levels. This and the p value <0.001 were connected. 15.8% of this cohort had high LDH, which correlated with a 1.7% overall incidence of DIC and a p value <0.004 significance. In this study, the prevalence of pulmonary edema was 2.6% overall, while 10.5% of the population had increased LDH levels. This was significant at the p value <0.072.

Table 1: Age distribution

Age in years	No. of cases (n=115)	Percentage (%)
19-24	50	43.9%
25-29	43	36.8%
30-34	16	14.0%
35-40	6	5.3%

Table 2: Booked verses unbooked

Type	No. of cases (n=115)	Percentage (%)
Booked	46	39.5%
Unbooked	69	60.5%

Table 3: Gravidity distribution

Gravidity distribution	No. of cases (n=115)	Percentage (%)
Primigravida	75	65.8%
Multigravida	40	34.2%

Table 4: Period of Gestation (POG) of patients

POG (in weeks)	No. of cases (n=115)	Percentage (%)
28-32	41	36%
33-36	43	37.7%
37-40	31	26.3%

Table 5: Maternal complications

Maternal complications	No. of cases (n=115)	Percentage (%)
HELLP syndrome	10	8.7%
DIC	2	1.7%
Pulmonary edema	3	2.6%
Abruption	9	7.9%
Antepartum eclampsia	13	11.4%

Table 6: Mode of delivery

Mode of delivery	No. of cases (n=115)	Percentage (%)
Vaginal delivery	56	48.2%
Lower segment caesarean section (LSCS)	59	51.8%

Table 7: Serum LDH levels

Serum LDH levels	No. of cases (n=115)	Percentage (%)
<600	96	83.4%
>600	19	16.7%

Table 8: Birth weight

Birth weight (kg)	No. of cases (n=115)	Percentage (%)
<1.5	56	49.1%
1.5-2.5	49	42.1%
>2.5	10	8.8%

Table 9: Fetal outcome

Fetal outcome	No. of cases (n=115)	Percentage (%)
FGR	45	39.1%
NICU admissions	62	54.4%
IUFD	8	7%
Apgar ≤7 at 5 min	46	40.4%
Still birth	8	7%
Meconium stained liquor	36	31.6%
RDS	15	13.2%
Neonatal death	8	7%
Stable	37	32.2%

Table 10: Complications in relation to serum LDH levels

Complications	Serum LDH				p-value (Fisher exact test)
	<600 IU/l		>600 IU/l		
	No.	%	No.	%	
HELLP syndrome	0	-	10	73.7%	<0.001 significant**
DIC	0	-	2	15.8%	0.004 significant*
Pulmonary edema	1	1.1%	2	10.5%	0.072 significant+
Abruption	6	6.3%	3	15.8%	0.171 insignificant

Note: +-significance (p value: $0.05<p<0.10$); *-moderately significant (p value: $0.01<p<0.05$); and **-strongly significant (p value: $p\leq0.001$)

Discussion

Pre-eclampsia is multisystem disorder specific to pregnancy and puerperium, which manifests by onset of hypertension and protenuria after 20 weeks of gestation (earlier with gestational trophoblastic diseases as multiple pregnancies) and resolves by 12 weeks postpartum. Preeclampsia rises maternal and foetal morbidity and mortality and may be life-threatening for both mother and child [8]. Both perinatal and maternal problems are brought on by the hemodynamic change, activation of the coagulation cascade, and microthrombi [9].

Complications can be avoided with early detection and management. The delivery's timing is crucial. Serum LDH levels have been found to rise in correlation with the severity of the condition, and several recent research investigations have revealed that serum LDH may serve as a possible indicator of preeclampsia [3,8-11].

Due to cellular dysfunction, the severe preeclampsia's multiorgan dysfunction—including the mother's liver, kidney, lungs, neurological system, blood, and coagulation system—will result in high serum LDH levels [14]. Primigravida and young age are well-known risk factors for pre-eclampsia [16].

Newborn intensive care units and birth gestational age have been connected to the neonatal prognosis [18]. Foetal growth restriction and preeclampsia continue to be major causes of morbidity and mortality [19]. Low levels of placental growth factor (PlGF), a pro-angiogenic factor, are linked to the later onset of pre-eclampsia as early as 11–13 weeks gestation. Anti-angiogenic sFlt-1 (Soluble fms-like tyrosine kinase 1) levels were enhanced up to 5 weeks before the clinical onset of the disease. Both have been assessed as diagnostic tools, but neither is sensitive enough to be helpful in clinical settings [20].

Despite the fact that the majority were under 30, there was no discernible association between age and the outcomes of the current study. In our hospital, there were 60.5% of unscheduled patients, indicating that the majority were referrals (Table 2). Primigravidae made up 65.8%. (Table 3). This was comparable to the study of Hak *et al*., where 74% of the participants were primigravida [3].

26.3% of the women in our study were between 37 and 40 weeks pregnant (Table 4). 53% of the pregnant women in a research by Doddamani *et al*. were at term. In our study, 64% of cases of severe preeclampsia. In a research by Hak *et al*., 40% of the cases had severe pre-eclampsia [3]. Delivery was scheduled based on the severity of the mother's and the foetus' conditions. The Caesarean section rate was 51.8%, while vaginal delivery was 48.2%. (Table 6). In a research by Hak and colleagues, 46.4% received LSCS. 42.8% of subjects in an Anupama *et al*. research underwent LSCS [11]. Foetal discomfort was the main indicator of LSCS in our

investigation, with pathological NST and aberrant Doppler also playing a role.

Prenatal eclampsia (11.4%), HELLP syndrome (8.7%), abruptio placenta (7.9%), pulmonary edema (2.6%), and DIC (1.7%) were the maternal problems in our study (Table 5). Maternal mortality was nonexistent.

In 16.7% the serum LDH level was greater than 600 IU/l (Table 7). 54.4% of newborns in our research were transferred to the NICU, and 39% had FGR (Table 9). 40.4% of infants in a research by Hall *et al*. were moved to the NICU [18]. In our study, 7% of patients had IUFD upon presentation, and 7% had stillbirths. Neonatal mortality was 7%. 49.1% of newborns weighed under 1.5 kg, 42.7% between 1.5 to 2.5 kg, and 8.8% weighed more than 2.5 kg (Table 8).

In our investigation, 16.7% of the patients had serum LDH levels greater than 600 IU/L. HELLP syndrome was observed in 8.7% of cases, with a statistically significant p value 0.001. (Table 10). This was comparable to a research by Hak *et al*. where 6.9% of patients had the HELLP syndrome [3]. Urvashi *et al* reported that 9% of patients have HELLP syndrome. DIC was observed in 1.7% of our patients and was statistically significantly linked with serum LDH levels >600 IU/l (p = 0.004). Similar findings were observed by Urvashi *et al*. [8].

2.6% of our patients experienced pulmonary edema, which had a statistically significant p value of 0.072.

Patients in our study with serum LDH >600 IU/l had serum creatinine above 0.71 mg/dl with a statistically significant p value of 0.001. There was a correlation between elevated serum LDH levels and other indicators such urine albumin and platelet count.

In the current study, the incidence of FGR was 39.1%, and 84.2% of those who had blood LDH levels above 600 IU/l were considered to be significantly affected (p value 0.001).

Additionally, there were higher NICU admissions and babies with APGAR scores below seven at five minutes in the statistically significant LDH>600 IU/l group. With a significant p value of 0.001, the mean AST and ALT values were higher in the group with LDH > 600 IU/l.

In our study, there was no maternal mortality.

Limitations

Investigations for thrombophilia were not done.

Conclusion

Pre-eclampsia is a multisystem illness with a multifactorial aetiology that only occurs during pregnancy. Preeclampsia can increase maternal and neonatal morbidity and mortality and is linked to problems. Maternal problems such HELLP syndrome, DIC, pulmonary edema, thrombocytopenia, and renal failure were associated with elevated LDH levels. Fetal problems such FGR, APGAR Score below 7 at 5 minutes, and NICU hospitalisation were all associated with elevated LDH levels. Hemi Serum LDH is a helpful biochemical marker that can be tracked to stop preeclampsia problems, improving outcomes for both the mother and the baby.

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