International Journal of Reproduction, Contraception, Obstetrics and Gynecology
Shah D et al. Int J Reprod Contracept Obstet Gynecol. 2025 Mar;14(3):753-759
www.ijrcog.org
pISSN 2320-1770 | eISSN 2320-1789

DOI: https://dx.doi.org/10.18203/2320-1770.ijrcog20250364

Original Research Article

Liver function tests as an indicator of adverse maternal and fetal outcomes in patients with hypertensive disorders of pregnancy

Diya Shah, Madhuri Saha*, Rajini Uday, Ashwini Nayak U., Rusa Mitra, Mahek Fatima

Department of Obstetrics and Gynecology, Sapthagiri Institute of Medical Sciences and Research Centre, Bangalore, Karnataka, India

Received: 24 January 2025
Revised: 10 February 2025
Accepted: 11 February 2025

***Correspondence:**
Dr. Madhuri Saha,
E-mail: madhuri07saha@gmail.com

ABSTRACT

Background: Hypertensive disorders of pregnancy (HDP) are significant contributors to maternal and fetal morbidity and mortality worldwide, with a prevalence in Southeast Asia ranging from 5-15% of pregnancies. In India, the incidence stands at 6.9%. Early detection and management of HDP are vital for improving outcomes. Liver function tests (LFTs) provide a cost-effective tool for assessing HDP severity and predicting complications. This study aims to evaluate the effectiveness of LFTs as a prognostic tool for adverse maternal and fetal outcomes, analyze altered LFT parameters across different HDP types and associated complications, and determine cutoff values for serum glutamic oxaloacetic transaminase (SGOT), serum glutamic pyruvate transaminase (SGPT), and lactate dehydrogenase (LDH) in predicting HDP.
Methods: This prospective study was conducted at a tertiary care referral hospital from January 2023 to January 2024. A total of 186 pregnant women diagnosed with HDP were included, excluding those with pre-existing liver disorders. LFTs were performed, and the results were analyzed using statistical package for the social sciences (SPSS) 20.0.
Results: Gestational hypertension was most common (48.9%), followed by severe preeclampsia (33.9%). Elevated LFTs (SGOT, SGPT, ALP, LDH) were significantly associated with adverse outcomes, with LDH showing high sensitivity (97.6%) and specificity (82.1%) at 150 U/l for maternal complications.
Conclusions: Abnormal LFTs, particularly SGOT, SGPT, and LDH, are key prognostic markers for adverse fetal and maternal outcomes in women with HDP, with LDH having the highest predictive significance. Timely intervention for cases with elevated LFTs can reduce maternal and fetal morbidity and mortality.

Keywords: Hypertensive disorders of pregnancy, Preeclampsia, Adverse maternal and fetal outcomes

INTRODUCTION

Hypertensive disorders of pregnancy (HDPs) remain the most common medical complication leading to a majority of adverse maternal and fetal outcomes.[1] While numerous clinical and biochemical tests have been proposed for early detection of preeclampsia, most are impractical in low-resource settings, particularly in developing and underdeveloped countries, where the disease burden is high, and financial constraints limit accessibility.[2] The incidence of abnormal liver function tests (LFTs) has been noted in 20-30% of pregnancies complicated by pre-eclampsia and are associated with poor maternal and fetal outcome.[3] As performing LFT is easily available even in low resource settings and is also cost effective this study aimed to evaluate the effectiveness of LFT as a prognostic indicator of adverse maternal and fetal outcomes in patients with HDPs; to analyse the LFT parameters that are altered in different types of HDPs and their associated maternal and fetal complications and also to determine the cutoff values of various LFT parameters like serum glutamic oxaloacetic transaminase (SGOT), serum glutamic pyruvate transaminase (SGPT), and lactate

dehydrogenase (LDH) for predicting hypertensive disorders of pregnancy and their complications.

METHODS

This prospective observational study was conducted in the Department of Obstetrics and Gynaecology from January 2023 to January 2024. Ethical approval was obtained from the hospital's ethical and scientific committee, and written informed consent was secured from all participants prior to enrolment. Patient confidentiality was ensured by anonymizing data and securely storing all records. The inclusion criteria consisted of all pregnant women diagnosed with hypertensive disorders of pregnancy, including gestational hypertension, preeclampsia with or without severe features and chronic hypertension with superimposed preeclampsia in the age group of 18 years to 45 years with singleton pregnancy, whereas the women with pre-existing liver diseases or women unwilling to participate or lost to follow-up were excluded from the study. A cohort of 186 pregnant women between 24-42 weeks diagnosed with hypertensive disorders of pregnancy, were recruited based on the inclusion and exclusion criteria.

Relevant data were recorded in an excel spreadsheet. Information collected included demographic data such as age, parity and gestational age at diagnosis; a detailed clinical history which included symptoms and signs of hypertensive disorders, gestational age at diagnosis of HDP, history of risk factors like history of preeclampsia in previous pregnancy, and family history of HDP. The values of LFT in these patients like total bilirubin, direct bilirubin, indirect bilirubin, aspartate transaminase (SGOT), alanine transaminase (SGPT), alkaline phosphatase (ALP), total proteins, serum albumin, albumin-globulin (A: G) ratio, and lactate dehydrogenase (LDH) were analysed and tabulated. Subsequently the maternal and fetal outcomes were analysed.

Data variables

HDP were categorised as gestational hypertension, preeclampsia without severe features, preeclampsia with severe features, chronic hypertension with superimposed preeclampsia- as per ACOG 2020 guidelines.[4,5] LFT results were categorized into normal and abnormal based on established reference ranges. SGOT, SGPT twice the upper limit of normal >70 U/l, LDH>600 mg/dl, total bilirubin >1.1 mg/dl, direct bilirubin >0.1 mg/dl, indirect bilirubin >0.5 mg/dl, ALP >229 U/l, total protein <5.6 g/dl, and serum albumin <3.5 mg/dl.[4,6] Maternal outcomes were categorized as partial HELLP syndrome, complete HELLP syndrome, eclampsia, cardiomyopathy, acute kidney injury, disseminated intravascular coagulation, oligohydraminos, abruptio placenta, pulmonary edema, pleural effusion, subdural hematoma and maternal death. Fetal outcomes were categorized as preterm birth, intrauterine fetal demise (IUFD), fetal growth restriction (FGR), fetal Doppler changes, fetal distress and neonatal intensive care unit (NICU) admission.

Statistical analysis

Data were initially organized using Microsoft excel and then analyzed using statistical package for the social sciences (SPSS) software version 20.0, with statistical significance set at a p value <0.05. The altered LFT parameters were analyzed to identify patterns of abnormality in different types of hypertensive disorders, and descriptive statistics were used to summarize their frequency and distribution. The effectiveness of LFTs as prognostic indicators for adverse maternal and fetal outcomes was assessed by comparing outcomes in patients with abnormal versus normal LFT results using statistical methods. Additionally, receiver operating characteristic (ROC) curve analysis was performed to determine cutoff values for various LFT parameters, including SGOT, SGPT, and LDH, that best predicted maternal and fetal complications in this study. Sensitivity, specificity, and the area under the curve (AUC) were calculated for each parameter to identify the optimal cutoff values.

RESULTS

In this study out of 186 pregnant women with hypertensive disorders, gestational hypertension was the most common condition, affecting 48.9% of the cohort. A significant portion of the participants (33.9%) experienced preeclampsia with severe features. The majority of patients were multigravidas (60.8%). Notably, most patients (39.78%) were aged between 26 and 30 years. The majority (48.9%) were diagnosed between 37 and 40 weeks of gestation. Emergency lower segment caesarean sections were performed in 72% of cases, as most of the patients were referred to our tertiary care referral hospital in critical condition as depicted in Table 1.

In preeclampsia with severe features, total bilirubin (>1.1 mg/dl) was raised in 7 cases (p=0.0128), direct bilirubin (>0.1 mg/dl) raised in 3 cases (p=0.03585) and indirect bilirubin (>0.5 mg/dl) was raised in 35 cases (p=0.0003), indicating significant liver dysfunction. Additionally, SGOT and SGPT levels were significantly elevated (p=0.0170 and p=0.0141, respectively), along with ALP levels (p=0.0366), while LDH was markedly raised in 13 cases (p<0.000005), indicating hemolysis and tissue damage. Abnormal total proteins and low serum albumin were more prevalent in preeclampsia with severe features, with significant p values of 0.0050 and 0.0110, respectively, underscoring the association of severe preeclampsia with substantial liver dysfunction as shown in Table 2.

The analysis reveals that severe preeclampsia is associated with the most significant liver enzyme abnormalities in case of both maternal and fetal complications as shown in Table 3.

For maternal complications, among 27 cases of severe preeclampsia, there were 10 each of elevated SGOT, SGPT, and ALP, and 11 of elevated LDH, indicating that SGOT, SGPT and LDH are good markers for assessment of severity of HDP (Table 4). For fetal complications, among the 27 cases preeclampsia with severe features, 12 cases had deranged SGOT, 11 had deranged SGPT, 13 had elevated ALP, and 12 had elevated LDH (Table 4). These findings emphasize that severe preeclampsia is linked to a high incidence of liver enzyme abnormalities, affecting both maternal and fetal outcomes.

Complete HELLP syndrome had deranged SGOT (7 cases), SGPT (6 cases) and LDH (8 cases). Eclampsia and DIC had deranged SGOT (3 cases each) and LDH (3 cases, 2 cases, respectively).

Preterm births had elevated SGOT (15 cases), SGPT (15 cases) and ALP (15 cases). IUFD had deranged SGOT and SGPT (3 cases each). FGR and NICU admissions had deranged ALP (6 cases, 13 cases, respectively) and LDH (5 cases, 9 cases, respectively).

As shown in Figure 1, the ROC curve for predicting maternal complications using SGOT and SGPT demonstrates moderate discriminative performance. The AUC for SGOT is 0.669 (95% CI: 0.564–0.775), while the AUC for SGPT is 0.685 (95% CI: 0.580–0.789), both suggesting fair discriminative ability in identifying maternal complications. In contrast, the ROC curve for LDH demonstrates a good discriminative performance, with an AUC of 0.772 (95% CI: 0.685–0.859), suggesting a stronger discriminative ability. A cutoff value of 150 U/l yielded a sensitivity of 97.6% and a specificity of 82.1%. As presented in Figure 1, the ROC curves for predicting fetal complications using SGOT, SGPT, and LDH demonstrate moderate discriminative performance. The AUC for SGOT is 0.602 (95% CI: 0.520–0.685), for SGPT is 0.612 (95% CI: 0.532–0.693), and for LDH is 0.625 (95% CI: 0.544–0.705), indicating fair discriminative ability.

Table 1: Demographic details.

n=186 cases	Gestational hypertension (91 cases, 48.9%)	PE without severe features (20 cases, 10.8%)	PE with severe features (63 cases, 33.9%)	Chronic hypertension with superimposed PE (12 cases, 6.5%)
Obstetric score (p=0.319)				
Primigravida (n=73, 39.2%)	37	5	28	3
Multigravida (n=113, 60.8%)	54	15	35	9
Age distribution (years) (p=0.033*)				
<20 (n=11, 5.91%)	5	0	6	0
21-25 (n=38, 20.43%)	20	1	15	2
26-30 (n=74, 39.78%)	33	11	29	1
31-35 (n=49, 26.34%)	27	5	10	7
>35 (n=14, 7.52%)	6	3	3	2
Gestational age at termination (weeks) (p<0.001*)				
<28 (n=6, 3.2%)	1	2	2	1
28-32 (n=18, 9.6%)	3	0	11	4
32-34 (n=11, 5.9%)	3	1	7	0
34-37 (n=54, 29%)	21	9	24	0
37-40 (n=91, 48.9%)	59	7	18	7
>40 (n=6, 3.2%)	4	1	1	0
Mode of delivery (p=0.004*)				
PTVD (n=23, 12.3%)	10	4	7	2
FTVD (n=14, 7.5%)	10	2	0	2
Elective LSCS (n=15,8%)	10	2	0	3
Emergency LSCS (n=134, 72%)	61	12	56	5

*Statistically significant.

Table 2: Derangement of LFT variables in different types of hypertensive disorders.

Liver function tests	Gestational hypertension (91 cases, 48.9%)	PE without severe features (20 cases, 10.8%)	PE with severe features (63 cases, 33.9%)	Chronic hypertension with superimposed PE (12 cases, 6.5%)
Total bilirubin (mg/dl) (p=0.0128)				
Raised >1.1	1	0	7	0
Normal ≤1.1	90	20	56	12

Continued.

Liver function tests	Gestational hypertension (91 cases, 48.9%)	PE without severe features (20 cases, 10.8%)	PE with severe features (63 cases, 33.9%)	Chronic hypertension with superimposed PE (12 cases, 6.5%)
Direct bilirubin (mg/dl) (p=0.03585)				
Raised >0.1	1	0	3	0
Normal ≤0.1	90	20	60	12
Indirect bilirubin (mg/dl) (p=0.0003*)				
Raised >0.5	22	4	35	3
Normal ≤0.5	69	16	28	9
SGOT (U/l) (p=0.0170*)				
Raised ≥70	4	3	13	1
Normal <70	87	17	50	11
SGPT (U/l) (p=0.0141*)				
Raised ≥70	3	2	12	1
Normal <70	88	18	51	11
ALP (U/l) (p=0.0366*)				
Raised ≥229	11	4	17	0
Normal <229	80	16	46	12
LDH (U/l) (p<0.000005*)				
Raised ≥600	0	0	13	0
Normal <600	91	20	50	12
Total proteins (g/dl) (p=0.0050*)				
Abnormal <5.6	6	4	21	3
Normal ≥5.6	65	16	42	9
Serum albumin (g/dl) (p=0.0110*)				
Abnormal ≤3.5	66	15	59	10
Normal >3.5	25	5	4	2
A: G ratio (p=0.6218)				
Abnormal <1.1	1	1	1	0
Normal ≥1.1	90	19	62	11

*Statistically significant.

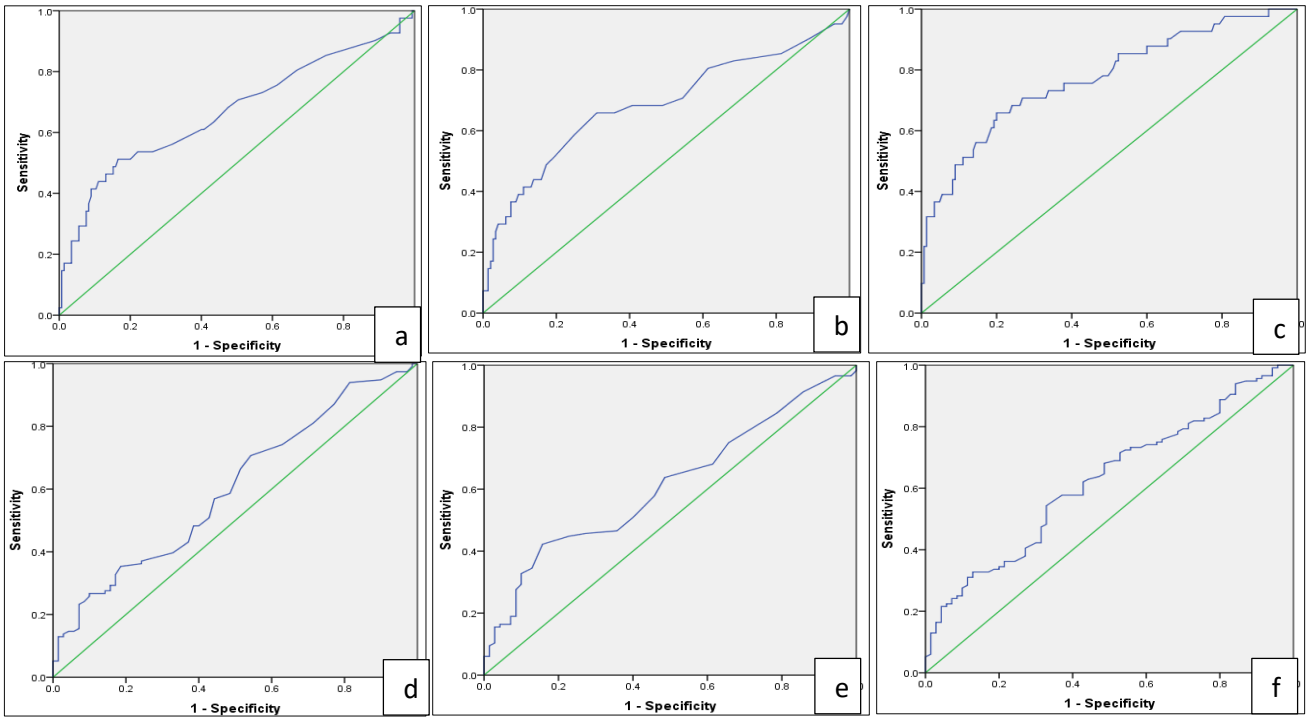

Figure 1: ROC curve to predict complications with SGOT, SGPT and LDH values – (a-c) maternal complications, (a) SGOT, (b) SGPT, and (c) LDH; and (d-f) fetal complications, (d) SGOT, (e) SGPT, and (f) LDH.

Table 3: Incidence of maternal and fetal complications in the present study.

Complications	GHTN	PE without severe features	PE with severe features	Chronic hypertension with superimposed PE
Maternal complications (n=41)	9 cases (21.9%)	4 (9.7%)	27 (65.8%)	1 (2.4%)
Fetal complications (n=116)	43 (37%)	13 (11.2%)	52 (44.8%)	8 (6.8%)
Maternal complications	**N=41**		**Fetal complications**	**N=116**
Partial HELLP syndrome	4		Preterm	89
Complete HELLP syndrome	8		Intrauterine fetal demise	13
Eclampsia	6		Fetal growth restriction	23
Cardiomyopathy	3		Fetal Doppler changes	14
Acute kidney injury	2		Fetal distress	13
Disseminated intravascular coagulation	4		NICU admission	57
Oligohydramnios	14			
Abruptio placenta	7			
Pulmonary edema	4			
Pleural effusion	2			
Subdural hematoma	1			
Maternal death	2			

Preeclampsia with severe features contributed to the highest number of both maternal and fetal complications, indicating a significant burden in these cases

Table 4: Association of maternal and fetal complications with deranged LFT and hypertensive disorder of pregnancy.

Hypertensive disorder of pregnancy and complications present	Deranged SGOT (≥70 U/l)	Deranged SGPT (≥70 U/l)	ALP (≥229 U/l)	LDH (≥600 mg/dl)
GHTN (9 cases)				
Maternal	1	1	3	0
Fetal	3	3	8	0
PE without severe features (4 cases)				
Maternal	1	1	1	0
Fetal	1	1	1	0
PE with severe features (27 cases)				
Maternal	10	10	10	11
Fetal	12	11	13	12
Chronic hypertension with superimposed PE (1 case)				
Maternal	0	0	0	0
Fetal	1	1	0	0

Table 5: Correlation of maternal and fetal complications with deranged LFT parameters.

Complications	Deranged SGOT (≥70 U/l)	Deranged SGPT (≥70 U/l)	Deranged ALP (≥229 U/l)	Deranged LDH (≥600 U/l)
Maternal complications				
Partial HELLP syndrome	1	1	2	3
Complete HELLP syndrome	7	6	4	8
Eclampsia	3	3	2	3
Cardiomyopathy	1	1	1	0
AKI	1	1	0	1
DIC	3	2	0	2
Oligohydraminos	2	2	4	0
Abruptio placenta	2	1	2	2
Pulmonary edema	0	0	0	0
Plueral effusion	0	0	0	0
Subdural hematoma	0	0	0	0

Continued.

Complications	Deranged SGOT (≥70 U/l)	Deranged SGPT (≥70 U/l)	Deranged ALP (≥229 U/l)	Deranged LDH (≥600 U/l)
Maternal death	1	1	0	0
Fetal complications				
Preterm	15	14	15	8
IUFD	3	3	2	1
FGR	3	3	6	5
Fetal Doppler changes	1	1	4	0
Fetal distress	1	1	4	1
NICU admission	8	6	13	9

DISCUSSION

The patients in this study comprised a well-defined group diagnosed with any one of the hypertensive disorders of pregnancy. All data were collected prospectively, following strict inclusion and exclusion criteria. LFTs were monitored throughout the study. Maternal and fetal outcomes were assessed in real-time based on the clinical course of each case.

In this study of 186 pregnant women with hypertensive disorders, gestational hypertension was the most common condition, affecting 48.9% of the cohort, while 33.9% experienced preeclampsia with severe features which is in par with other studies done in the same arena such as Peralta et al.[7] The majority (60.8%) were multigravidas, and 39.78% were aged between 26-30 years, with most diagnosed between 37-40 weeks of gestation (48.9%). Emergency lower segment caesarean section was performed in 72% of cases, which was comparable to the study done by Gyawali et al.[8]

In this study, LFTs revealed significant abnormalities, particularly in cases of preeclampsia with severe features.[9] Total bilirubin was elevated in 7 cases (p=0.0128), indirect bilirubin in 35 cases (p=0.0003), and SGOT/SGPT levels were frequently raised (p=0.0170 and p=0.0141). LDH showed a marked increase (p<0.000005), while total proteins were abnormal in 21 cases (p=0.0050) and serum albumin was consistently lower (p=0.0110), all of which were statistically significant. These findings suggest that abnormal LFTs are more frequent in patients with preeclampsia with severe features, indicating significant liver dysfunction in such cases and was in comparison to studies done by Nidya et al and Kozic et al.[10,11] It was observed that elevated ALT and AST, when accompanied by abdominal pain, are strong indicators of severe disease progression.[12,13]

Oligohydramnios was the most common maternal complication (14 cases), followed by complete HELLP syndrome (8 cases), abruptio placenta (7 cases), eclampsia (6 cases), and partial HELLP, DIC, and pulmonary edema (4 cases each). There were two cases of maternal death in the study cohort. Fetal complications primarily included preterm deliveries (89 cases), FGR (23 cases) and NICU admissions (57 cases). These complications were notably significant in patients with preeclampsia with severe features, consistent with findings from Nidya et al.[10] Notably, perinatal outcomes were primarily influenced by the gestational age at delivery, with improved fetal outcomes observed as gestational age increased.[11,15,16]

In this study, The ROC analysis shows that SGOT and SGPT have moderate discriminative performance for predicting maternal complications, with AUCs of 0.669 and 0.685, respectively. In contrast, LDH demonstrates stronger performance, with an AUC of 0.772 and a 150 U/l cutoff yielding high sensitivity (97.6%) and good specificity (82.1%), indicating that LDH is a more reliable biomarker for maternal complications. For predicting fetal complications, SGOT, SGPT, and LDH show modest performance, with AUCs of 0.602, 0.612, and 0.625, respectively.

When evaluating women with preeclampsia, liver function tests represent just one aspect of assessment. While they offer some understanding of the disease's impact, a more comprehensive multivariate model that considers the involvement of other affected organ systems is necessary. The recently published full PIERS model serves as such a comprehensive tool.[17]

Limitations

The study was conducted at a single center with a limited sample size and focused exclusively on South East Asian women, which may restrict the generalizability of the findings. Additionally, most participants were recruited in the late trimester or at term, when pathological consequences had already manifested, limiting opportunities for early detection and prevention. A larger, multicentric study including women of diverse ethnic backgrounds is recommended to enhance the applicability of the results. Furthermore, assessing liver function tests in high-risk women during the early second trimester may offer better opportunities for early intervention and improved management.

CONCLUSION

In this study, we identified a significant association between deranged LFTs and adverse feto-maternal outcomes in women suffering from various types of HDP. Our findings highlight the importance of monitoring liver enzymes, particularly elevated SGOT, SGPT, and LDH

levels, as they serve as critical prognostic indicators of such patients.

Women presenting with abnormal LFTs necessitate careful evaluation and prompt management and heightened surveillance to reduce the risk of severe complications. In our study, LDH levels exceeding 150 U/L showed a higher incidence of maternal and fetal complications, necessitating prompt and immediate action. This proactive approach can be considered for reducing both maternal and fetal morbidity and mortality.

Overall, our study proves beyond doubt that regular assessment of liver function is a highly effective strategy for early prediction and improved management of patients with HDP. By adopting a vigilant monitoring protocol and responding promptly to derangements in liver function, it is possible to procure better health outcomes and decrease the associated risks for both mothers and their babies.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Solomon CG, Seely EW. Brief review: hypertension in pregnancy: a manifestation of the insulin resistance syndrome? Hypertension. 2001;37(2):232-9.
2. Mehta B, Kumar V, Chawla S, Sachdeva S, Mahopatra D. Hypertension in pregnancy: a community-based study. Indian J Comm Med. 2015;40(4):273-8.
3. Prakash J, Pandey LK, Singh AK, Kar B. Hypertension in pregnancy: hospital based study. J Assoc Physicians India. 2006;54:273-8.
4. Gestational Hypertension and Preeclampsia: ACOG Practice Bulletin, Number 222. Obstet Gynecol. 2020;135(6):e237-60.
5. Magee LA, Helewa M, Moutquin J-M, von Dadelszen P. Diagnosis, evaluation, and management of the hypertensive disorders of pregnancy. SOGC Clinical Practice Guideline, No. 206, March 2008. J Obstet Gynaecol Can. 2008;30(1):S1-48.
6. Abbassi-Ghanavati M, Greer LG, Cunningham FG. Pregnancy and laboratory studies: a reference table for clinicians. Obstet Gynecol. 2009;114(6):1326-31.
7. Peralta Pedro ML, Basavilvazo R, Cruz Avalar A, Sanchez Ambroz S, Guzman A, Martinez G. Clinical significance of the laboratory determinations of preeclamptic patients. Gynecologia y Obstetriciade. 2004;72:57-62.
8. Gyawali M, Khadka RR, Jada S, Haider K. Pregnancy induced hypertension and its associated factors among women attending delivery center. Int J Multidiscip Res. 2024;6(1):1-9.
9. Menzies J, Magee LA, Li J, MacNab YC, Yin R, Stuart H, et al. Instituting surveillance guidelines and adverse outcomes in preeclampsia. Obstet Gynecol. 2007;110:121-7.
10. Nidya K, Tirankar VR. Prognostic significance of liver function tests and platelet indices in predicting maternal and fetal outcomes in pregnancy induced hypertension cases. MedPulse Int J Gynaecol. 2020;13(3):81-6.
11. Kozic JR, Benton SJ, Hutcheon JA, Payne BA, Magee LA, von Dadelszen P. Abnormal liver function tests as predictors of adverse maternal outcomes in women with preeclampsia. J Obstet Gynaecol Can. 2011;33(10):995-1004.
12. Alonso AG. Effect of pregnancy on pre-existing liver disease physiological changes during pregnancy. Ann Hepatol. 2006;5(3):184-6.
13. Sarmah J. Evaluation of serum aspartate aminotransferase (AST), Alanine aminotransferase (ALT), alkaline phosphatase (ALP), lactate dehydrogenase (LDH) and uric acid in preeclampsia. IOSR J Dent Med Sci Ver. 2015;3(14):2279-861.
14. Yadav S, Saxena U, Yadav R, Gupta S. Hypertensive disorders of pregnancy and maternal and foetal outcome: a case controlled study. J Indian Med Assoc. 1997;95(10):548-51.
15. Ye RW, Li HT, Ma R, Ren AG, Liu JM. Prospective cohort study of pregnancy-induced hypertension and risk of preterm delivery and low birth weight. Chinese J Prev Med. 2010;44(1):70-4.
16. Gaugler-Senden IP, Huijssoon AG, Visser W, Steegers EA, de Groot CJ. Maternal and perinatal outcome of preeclampsia with an onset before 24 weeks' gestation: audit in a tertiary referral center. Eur J Obstet Gynecol Reprod Biol. 2006;128(1-2):216-21.
17. von Dadelszen P, Payne B, Li J, Ansermino JM, Pipkin FB, Côté AM, et al. Prediction of adverse maternal outcomes in pre-eclampsia: development and validation of the fullPIERS model. The Lancet. 2011;377(9761):219-27.

Cite this article as: Shah D, Saha M, Uday R, Ashwini NU, Mitra R, Fatima M. Liver function tests as an indicator of adverse maternal and fetal outcomes in patients with hypertensive disorders of pregnancy. Int J Reprod Contracept Obstet Gynecol 2025;14:753-9.