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Partial HELLP syndrome: Maternal, perinatal, subsequent pregnancy and long-term maternal outcomes

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Abstract

Aims: Hemolysis, elevated liver enzymes and low platelet count (HELLP) syndrome, in its complete form, is associated with increased risk of maternal mortality and increased rate of serious obstetric complications, such as acute renal failure, hepatic failure, abruptio placentae, pulmonary edema, sepsis, hemorrhage and disseminated intravascular coagulopathy. To compare maternal and perinatal outcomes, we investigated the subsequent pregnancy outcomes and long-term complications of women with partial HELLP (pHELLP) and complete HELLP (cHELLP) syndromes.

Material and Methods: In this retrospective study, patients complicated with HELLP between the years 2002 and 2007 were analyzed. cHELLP syndrome was defined by the presence of all of the three laboratory criteria according to the Tennessee Classification System. pHELLP syndrome was defined by the presence of one or two features of HELLP, but not the complete form.

Results: Sixty-four patients had cHELLP syndrome and 67 had pHELLP syndrome. Maternal complications and neonatal outcomes of the indexed pregnancies were similar. The rate of blood product transfusion was significantly higher in the cHELLP group ($P < 0.0001$). Twenty-eight patients within the cHELLP group and 26 within the pHELLP group had subsequent pregnancies with a mean interpregnancy interval of 2.9 ± 1.5 years and 2.4 ± 1.1 years, respectively. Elective termination of pregnancy (dilatation and curettage) was more frequent in the cHELLP group. Pre-eclampsia recurrence was higher in the pHELLP group than in the cHELLP group (7.1% vs 34.6%).

Conclusions: Partial and complete HELLP syndrome are not distinct groups based on neonatal, long-term and subsequent pregnancy outcomes. They probably represent a continuum in the natural evolution of the same disease.

Key words: HELLP, partial HELLP, pre-eclampsia.

Introduction

The presence of hemolysis, elevated liver enzymes and low platelet count was first defined in 1954[1] and the acronym HELLP syndrome was used by Weinstein in 1982.[2] Sibai suggested strict criteria for the complete or true HELLP syndrome in the Tennessee Classification System; that is, the presence of all three components of hemolysis, elevated liver enzymes and low platelet is required for complete HELLP (cHELLP) syndrome.[3,4] Partial HELLP (pHELLP) syndrome was defined by the presence of one or two features of HELLP, but not the complete form.

HELLP syndrome, in its complete form, is associated with increased risk of maternal mortality and increased rate of serious obstetric complications, such as acute

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renal failure, hepatic failure, abruptio placentae, pulmonary edema, sepsis, hemorrhage and disseminated intravascular coagulopathy. The incidence of HELLP syndrome is 0.5–0.9% in all pregnancies and 2–30% in cases with severe pre-eclampsia. There are no reliable data about pHELLP syndrome incidence.[5,6] Perinatal mortality and morbidity are quite high in cHELLP syndrome. Perinatal mortality rate is between 7.4% and 34%, mainly associated with prematurity.[4,7,8]

A recurrence rate of 5–22% for severe pre-eclampsia and 2–27% for cHELLP syndrome has been reported in several studies. Several studies have proposed an association between hypertensive disorders in pregnancy and cardiovascular diseases in later life.[9–11]

There is minimal data considering long-term outcomes of pHELLP and the subsequent pregnancy outcomes. The aim of this study was to compare maternal and perinatal outcomes, by investigating the subsequent pregnancy outcomes and long-term complications of women with pHELLP and cHELLP syndromes.

Methods

This retrospective observational study took place in the Bakirkoy Women and Children's Training and Research Hospital, which served as a tertiary referral centre in Istanbul, Turkey and has recently been transported to a new building and renamed the Kanuni Sultan Süleyman Research and Training Hospital. A total of 303 patients complicated with hemolysis, elevated liver enzymes and low platelet count between the years 2002 and 2007 were included in the study. This study was approved by the ethics committee, and informed consent was obtained in all cases. Women with gestational age below 24 weeks, multifetal gestations, epilepsy and hepatic and renal diseases were excluded from the study.

cHELLP syndrome was defined by the presence of all of the three following laboratory criteria according to the Tennessee Classification System: (i) hemolysis, characteristic peripheral blood smear, serum lactate dehydrogenase ≥ 600 U/L, total bilirubin ≥ 1.2 mg/dl; (ii) elevated liver enzymes, defined as aspartate aminotransferase (AST) ≥ 70 U/L; and (iii) low platelet count defined as <100 000 μL. pHELLP syndrome was defined by the presence of one or two features of cHELLP, but not the complete form.

Gestational age was determined by using the best-accepted obstetric criteria, including menstrual history, early clinical evaluation and ultrasonography at first trimester. We compared the hospital stay, maternal complications (eclampsia, abruptio placentae and maternal mortality), mode of delivery, preterm delivery, and perinatal outcome (intrauterine growth restriction, stillborn and neonatal death).

The information was collected through telephone surveys, personal interviews and a review of the medical records of the indexed pregnancies. The questionnaire included questions about the indexed pregnancy, number and outcomes of subsequent pregnancies, long-term maternal morbidities, and outcomes of neonates born to HELLP pregnancies. Neonatal data were collected from the records of the neonatology clinic and neonatal intensive care unit (NICU).

Data collected included maternal demographics, clinical findings of the indexed pregnancies with HELLP syndrome, outcomes of subsequent pregnancies, and maternal and neonatal morbidities. Clinical and demographic data included: age, race, gravity and parity, gestational age at the time of the HELLP pregnancy, medical history and family history of HELLP or pre-eclampsia.

Maternal long-term outcomes included: development of new-onset essential hypertension, diabetes mellitus, respiratory disease and psychological disease. Postpartum psychiatric illness (depression, anxiety) was defined as any psychiatric illness diagnosed by a psychiatrist occurring within 1 month of delivery and treated accordingly. Long-term morbidity data and subsequent pregnancy outcomes information were gathered from patient self-reporting; however, confirmation of the reports of morbidity, subsequent pregnancy information and self-reporting was performed.

Complete blood count, liver enzymes, coagulation profile, blood urea nitrogen, creatine and electrolyte were determined on admission. To prevent and control seizures, intravenous magnesium sulfate was used. Oral nifedipine and alpha methyldopa were administered to control severe hypertension. Fetal heart rate monitoring was performed at least six to seven times a day. Blood or blood products were administered as needed to correct severe anemia or coagulation abnormalities.

Our management policy was prompt delivery if the syndrome developed beyond 34 weeks of gestation or earlier in cases with disseminated intravascular coagulopathy (DIC), renal failure, abruptio placentae, or non-reassuring fetal status. Before 34 weeks of gestation, when maternal condition was stable, we administered betamethasone (12 mg intramuscularly

every 24 h) to accelerate fetal lung maturity, and then performed delivery 48 h later. Cesarean section was performed in cases where the maternal and/or fetal condition deteriorated.

We collected the demographic data (including maternal age, parity, prenatal care, and gestational age at admission), laboratory results, signs and symptoms, mode of the delivery, and the duration of stay at the hospital. We recorded adverse maternal outcomes, including eclampsia, abruptio placentae, DIC, acute renal failure, pulmonary edema, need for mechanical ventilation, need for transfusion, intracranial infarct or hemorrhage, and maternal death. Perinatal complications, including intra-uterine growth restriction, oligohydramnios, fetal distress, low Apgar score in the 1st and 5th min, respiratory distress syndrome, sepsis, convulsion and perinatal death were also reported.

Statistical comparisons were performed by χ^2 analysis, Pearson's analysis and Fisher's exact test, when appropriate. A P-value < 0.05 was considered significant. Statistical analysis was performed using SPSS 11.0 for Windows.

Results

There were approximately 65 000 deliveries at this tertiary centre during the study period of 5 years (2002–2007). One hundred and thirty-one (43.2%) of 303 patients who fulfilled the criteria of cHELLP or pHELLP responded to our call for assistance with the research. Patients were interviewed face-to-face or over the telephone.

Sixty-four (48.9%) had cHELLP syndrome and 67 (51.1%) had pHELLP syndrome. The demographic and clinical characteristics of the indexed pregnancies are presented in Table 1. The mean ages were 28.1 ± 5.6 and 29 ± 6.7 in the cHELLP and pHELLP groups, respectively. The majority of the women (70.2%) were in the 20–34-year-old age range. Twelve (18.8%) women in the cHELLP group and 18 (26.9%) women in the pHELLP group were over 34 years old. Thirty-two women (50%) were nulliparae and two (3.1%) were three parity in the cHELLP group, and 28 (41.8%) were nulliparae and 10 (14.9%) were multiparae, with more than three parity in the pHELLP group.

Among these women, six had chronic hypertension – two (3.1%) in the cHELLP group and four (6%) in the pHELLP group. Body mass indexes were similar. Mean systolic pressure was 176 mmHg and 165 mmHg in the cHELLP and pHELLP groups, respectively, and this is statistically significant ($P = 0.04$). Mean diastolic pressure was 111 mmHg in the cHELLP group and 106 mmHg in the pHELLP group. Frequency of prodromal symptoms, such as headaches, visual change and epigastric pain, were similar in both groups. Laboratory results are shown in Table 2.

Table 3 describes the maternal and neonatal outcomes of the indexed pregnancies. Mean gestational ages at the delivery in the cHELLP and pHELLP

Table 1 Demographic and baseline characteristics of women with cHELLP and pHELLP syndrome

	cHELLP $n = 64$	pHELLP $n = 67$	P
Age (years)	28.1 (18–44)†	29.0 (18–52)†	0.4
<20	5 (7.8%)	4 (6%)	
20–34	47 (73.4%)	45 (67.2%)	
>34	12 (18.8%)	18 (26.9%)	
Gravida	2.2 (1–6)†	2.6 (1–12)†	0.4
Parity	0.8 (0–3)†	1.3 (0–11)†	0.2
Nullipara	32 (50%)	28 (41.8%)	
<3	30 (46.9%)	29 (43.3%)	
>3	2 (3.1%)	10 (14.9%)	
Max systolic pressure (mmHg)	176 (140–210)†	165 (110–230)†	**0.04**
Max diastolic pressure (mmHg)	111 (90–130)†	106 (60–150)†	0.2
Smoking *n* (%)	10 (%15.6)	9 (%13.4)	0.8
History of chronic hypertension *n* (%)	2 (3.1%)	4 (6%)	0.7
Body mass index	27.0	27.4	0.4
Prodromal symptoms *n* (%)	12	11	0.8

†Range. cHELLP, complete hemolysis, elevated liver enzymes and low platelet count; pHELLP, partial hemolysis, elevated liver enzymes and low platelet count.

Table 2 Laboratory findings

	cHELLP	pHELLP	*P*
AST (IU/L)	249 (50–1386)†	118 (34–814)†	<0.0001
ALT (IU/L)	174 (50–697)†	120 (16–858)†	0.03
LDH (IU/L)	1080 (600–2250)†	893 (255–2841)†	0.05
Platelet (1000/μL)	57 571 (10 000–10 000)†	109 253 (26 000–263 000)†	<0.0001
Creatinine (mg/dL)	1.1 (0.5–4.7)†	0.9 (0.3–3.9)†	0.1
Urea (mg/dL)	43 (12–130)†	37 (10–153)†	0.2
Proteinuria *n* (%)	7 (10.9%)	6 (9%)	0.8
Platelet ≤ 50 000 *n* (%)	29 (45.3%)	6 (9%)	<0.0001

†Range. AST, aspartate aminotransferase; ALT, alanine aminotransferase; LDH, lactate dehydrogenase; cHELLP, complete hemolysis, elevated liver enzymes and low platelet count; pHELLP, partial hemolysis, elevated liver enzymes and low platelet count.

Table 3 Maternal complications and neonatal outcomes of the index pregnancy with cHELLP and pHELLP syndrome

	cHELLP *n* (%)	pHELLP *n* (%)	*P*
Maternal outcomes and complications			
Delivery mode			NS
Vaginal delivery	17 (26.6%)	16 (23.9%)	
Cesarean	47 (73.4%)	51 (56.1%)	
Gestational week (range)	33.7 (26–40)†	33.5 (18–52)†	NS
<28	4 (6.3%)	4 (6%)	
28–34	28 (43.8%)	26 (38.8%)	
>34	32 (50%)	37 (55.2%)	
Maternal mortality	0	0	
Maternal complications	6 (9.4%)	3 (4.5%)	NS
ARF	4	2	
Pulmonary edema	0	1	
Delirium	1	0	
Liver rupture	1	0	
Eclampsia	5 (7.8%)	2 (3%)	NS
Received blood products	53 (%82.8)	9 (%13.4)	$P < 0.0001$
ICU admission	11 (17.2%)	6 (9%)	NS
Hospital stay (days)	6.4	5.8	NS
Neonatal outcomes			
Birthweight (g)	1755 (640–3200)†	1707 (470–2950)†	NS
Perinatal mortality	2 (3.1%)	3 (4.5%)	NS
Neonatal mortality	0	2 (3%)	NS
Perinatal morbidity	17 (26.6%)	16 (23.9%)	NS
RDS	9	7	
Jaundice	2	2	
Hypoglycemia	5	4	
PDA	0	1	
Convulsion	0	1	
Hypospadias	1	0	
NEC	0	1	
NICU admission	28 (43.8%)	25 (37.3%)	NS
NICU stay (days)	28.1 ± 6.9	26.9 ± 7.6	NS

†Range. ARF, acute renal failure; cHELLP, complete hemolysis, elevated liver enzymes and low platelet count; ICU, intensive care unit; NEC, necrotizing enterocolitis; NICU, neonatal intensive care unit; NS, not significant; PDA, patent ductus arteriosus; pHELLP, partial hemolysis, elevated liver enzymes and low platelet count; RDS, respiratory distress syndrome.

groups were 33.7 ± 3.3 and 33.5 ± 3.5 weeks, respectively. Cesarean delivery rate was higher (73.4%) in the cHELLP group than in the pHELLP group (56.1%), but it was statistically insignificant. Fetal distress was the most frequent indication; and other indications were breech presentation, previous cesarean, failed induction and rapidly deteriorating disease. There were no maternal mortalities. The overall incidence of maternal complication was 6.9%, with a slightly higher but statistically non-significant rate in the cHELLP group (9.4% vs 4.5% $P = 0.3$). Acute renal failure was the major complication, which was reversed without long-term complication. Sixty-three patients required transfusion of blood products, including platelets, red blood cells and fresh frozen plasma. The rate of transfusion was significantly higher (82.8% vs 13.4%) in the cHELLP group. In the cHELLP group, 29 (45.3%) women had platelet count below 50 000 and in the pHELLP group only six women had a platelet count ≤50 000. All pre-eclamptic patients with high blood pressure and prodromal symptoms were treated with oral antihypertensive and given intravenous magnesium sulfate for prevention of seizures. Eclampsia was more frequent in the cHELLP group than in the pHELLP group, but there was no statistically significant difference ($P = 0.2$). All eclamptic patients were treated with no residual neurological deficit. Intensive care admissions were higher in the cHELLP group with 11 (17.2%), compared with the women in the pHELLP group with six (9%) admissions. There was no significant difference in length of hospital stay between groups (6.4 vs 5.8 days).

Among these patients, prematurity was the major complication. Fifty-two women (81.2%) had gestations of less than 34 weeks and four of them had gestations less than 28 weeks in the cHELLP group; 49 women (73.2%) were <34 weeks of gestation and similarly four of them <28 weeks of gestation in the pHELLP group. Mean birthweights were 1755 g and 1707 g, respectively, in the cHELLP and pHELLP groups. The perinatal mortality rate was similar in both groups (two in the cHELLP and three in pHELLP group). There were two neonatal deaths in the pHELLP group. Reported reasons were respiratory arrest due to respiratory distress and sepsis secondary to prematurity. The perinatal morbidity rates, such as respiratory distress syndrome, jaundice, necrotizing enterocolitis, sepsis and hypoglycemia incidence, were similar. Twenty-eight babies were admitted to the NICU with a mean duration of NICU stay of 28.1 ± 6.9 days in the cHELLP group; similarly there were 25 admissions with a mean duration of 26.9 ± 7.6 days in the pHELLP group.

Subsequent pregnancy outcomes are shown in Table 4. Among 131 pregnancies complicated with a history of hemolysis, elevated liver enzymes and low platelet, a total of 56 (28 in the cHELLP group and 26 in the pHELLP group) had subsequent pregnancies with a mean interpregnancy interval of 2.9 ± 1.5 years and

Table 4 Subsequent pregnancy outcomes

	cHELLP *n* (%)	pHELLP *n* (%)	*P*	Sum *n* (%)	OR (95%CI)
Sequential pregnancy	28 (43.8%)	26 (38.8%)	NS	54	54
Spontaneous abortion	0	1 (3.8%)	NS	1 (1.9%)	
Dilatation and curettage	9 (32.1%)	1 (3.8%)	0.01	10 (18.5%)	0.08 (0.01–0.72)
IUMF	2 (7.1%)	3 (11.5%)	NS	5 (9.2%)	1.69 (0.26–11.05)
PE	2 (7.1%)	9 (34.6%)	0.01	11 (20.4%)	6.88 (1.32–35.82)
HELLP	1 (3.6%)	4 (15.4%)	NS	5 (9.2%)	4.91 (0.51–47.16)
E	1 (3.6%)	0	NS	1 (1.9%)	
Abrubtio	0	0		0	
Preterm birth	5 (17.9%)	6 (24%)	NS	11 (20.4%)	1.45 (0.38–5.51)
PPROM	0	1 (3.8%)	NS	1 (1.9%)	
Overall pregnancy complication	8 (28.6%)	14 (%53.8%)	NS	22 (40.7%)	2.91 (0.94–8.98)
IUGR	1 (3.6%)	2 (7.7%)	NS	3 (%5.6)	2.25 (0.19–26.4)
Term	13 (46.4%)	14 (53.8%)	NS	27 (%50)	1.34 (0.46–3.92)
Live birth	16 (57.1%)	20 (%76.9)	NS	36 (66.6%)	2.5 (0.76–8.13)
Gestational age (weeks)	36.0	34.6	NS	35.2 (SD 5.5)	35.2 (SD 5.5)
NICU admission	5	4	NS	9	9
Birthweight (g)	3015	2630	NS	2801 (SD 731)	2801 (SD 731)
Pregnancy interval mean (years)	2.9 ± 1.5	2.4 ± 1.1	NS		

CI, confidence interval; E, eclampsia; IUGR, intra-uterine growth restriction; IUMF, *in utero mort fetalis*; NICU, neonatal intensive care unit; NS, not significant; OR, odds ratio; PE, pre-eclampsia; PPROM, preterm premature rupture of the membranes; SD, standard deviation.

2.4 ± 1.1 years, respectively. One woman in the cHELLP group and seven patients in the pHELLP group had a third pregnancy without any maternal or neonatal complications. Elective termination of pregnancy (dilatation and curettage) was more frequent in the cHELLP group. Among the 28 pregnancies in the pHELLP group, pre-eclampsia developed in nine (34.6%) of them. Only one woman developed pre-eclampsia in the cHELLP group. Recurrent HELLP syndrome that fulfils all criteria of the complete form was detected in the subsequent pregnancies of four of the women who had pHELLP and one woman who had cHELLP. The overall incidence of preterm birth was 20.4% (11/54 women). There were two stillbirths and one intrauterine growth retardation in the cHELLP group. Overall pregnancy complication incidence in the subsequent pregnancy was higher in the pHELLP group (53.8%) than in the cHELLP group (28.6%, odds ratio 2.91; 95% confidence interval 0.94–8.98).

Long-term maternal complications are listed in Table 5. The mean follow-up time was 5.7 ± 1.4 years. Among these women, 15 (22.4%) had essential hypertension in the cHELLP group and 15 (23.4%) had hypertension in the pHELLP group. Depression and anxiety disorders were commonly seen in both groups (14.1% vs 12%). Incidence of thyroid diseases was higher in the pHELLP group, but it was statistically non-significant (1.6% vs 7.5%). Immunological diseases, such as systemic lupus erythematosus, rheumatoid arthritis and antiphospholipid syndrome, were common among these patients.

Discussion

Controversies persist regarding the incidence, diagnosis, management and prognosis of HELLP syndrome. Although HELLP syndrome has objective diagnostic parameters, such as hemolysis, low platelet and elevated liver enzymes, diagnostic criteria used for the syndrome are variable and inconsistent. This uncertainty exists partly because of disagreement about the criteria used to define the HELLP syndrome. Different laboratory criteria for the diagnosis of HELLP syndrome have been proposed by Weinstein,[12] Martin *et al*.,[13] Sibai *et al*.[14] and Audibert *et al*.[5] There are two major classification systems for diagnosis. In the Tennessee Classification System, Sibai has proposed strict criteria for the 'complete' HELLP syndrome.[3,4] In the Mississippi Classification System, the syndrome is classified into three classes according to nadir platelet count during the course of the disease.[15] We used the Tennessee Classification System to define the group of women with HELLP syndrome. Our clinic does not have different management protocol according to platelet count. Previous studies have used less strict criteria, therefore we included in this study women who we would have considered to have only pHELLP syndrome. Thus the hypothesis of this study is partial. The complete form of HELLP syndrome is a distinct disease, and the outcome of cHELLP syndrome is worse that that of pHELLP.

Our findings identified cHELLP and pHELLP syndrome in terms of maternal complications, perinatal

Table 5 Long-term maternal morbidities

	cHELLP *n* (%)	PHELLP *n* (%)	*P*
Maternal morbidity	31 (48.4%)	43 (64.2%)	0.07 (NS)
Depression	4 (6.3%)	5	NS
Anxiety	5 (7.8%)	3	NS
New-onset hypertension	15 (22.4)	15 (23.4)	NS
Diabetes	1 (1.6%)	0	NS
Thyroid disease	1 (1.6%)	5 (7.5%)	0.2 (NS)
Retinal disorder	2 (3.1%)	1	NS
Cerebrovascular occlusion	0	1	NS
Morbid obesity	0	2	NS
SLE-APS	1(1.6%)	2	NS
Coronary disease	0	1	NS
Cholecystitis	1 (1.6%)	2	NS
Rheumatoid arthritis	1 (1.6%)	0	NS
Primary biliary cirrhosis	0	1	
Follow-up (years)	5.9 ± 1.5	5.6 ± 1.4	0.2

NS, not significant, SLE-APS, systemic lupus erythematosus antiphospholipid syndrome.

outcomes, long-term and subsequent pregnancy outcomes. cHELLP syndrome may be underestimated as a result of a lack of complete laboratory results. Consequently, pHELLP could be an appropriate diagnosis when the criteria for cHELLP are not met. The strength of our study is that in evaluating the outcomes associated with complete and pHELLP syndrome, all of our data were from a single tertiary care medical centre, which used the same protocols for the management of HELLP syndrome. Another advantage of this study was that our perinatal centre serves as the main referral centre for a population of 1 000 000 inhabitants.

Many authors have shown that HELLP syndrome is a complication of pre-eclampsia and hypertension, and proteinuria may be absent in 10–20% of the cases.[3,16] There were no data in the literature about pHELLP and accompanying proteinuria. We observed in our study that 10.9% of women in the cHELLP group and 9% in the pHELLP group had no proteinuria. Mean systolic pressures were higher in the cHELLP syndrome group.

In a large retrospective study, the maternal mortality rate was 1.1% among 442 HELLP syndrome women, which is consistent with other reports.[3,5,17–19] Although high maternal mortality, up to 25%, has been reported in other reports,[20] there was no maternal mortality in our clinic during the study period. This may be due to immediate delivery, early management protocols and high-dose magnesium sulfate for seizure prophylaxis. In addition, in our study population, 3% in the pHELLP group and 7.8% in the cHELLP group developed eclampsia, a condition that raised the mortality rate in previous studies. The rate of eclampsia was consistent with previous studies.[21,22]

HELLP syndrome is associated with major maternal complications, such as eclampsia, abruptio placentae, DIC, acute renal failure, pulmonary edema, liver rupture and cerebral hemorrhage. The incidence of such complications varies according to study populations. There were no reliable data of complications among women with pHELLP syndrome. Abbade *et al*. observed eclampsia in 14.6% of pHELLP syndrome cases, although there were no maternal deaths or abruptio placentae in that study.[23] In our study, the overall incidence of maternal complication was 6.9%, higher in the cHELLP group, but this is not statistically significant. The major pregnancy complications were acute renal failure and eclampsia. As expected, the blood product transfusion rate was higher in the complete form. One of the weak points of the study was a lack of the definition of DIC and a lack of transfusion protocols.

Overall pregnancy complication incidence in subsequent pregnancy was higher in the pHELLP group (53.8%) than in the cHELLP group (28.6%). This unexpected result can be explained by lower mean gestational age or birthweight of subsequent pregnancy, lower pregnancy interval, gestational age at the diagnosis of the indexed pregnancy, undiagnosed thrombophilia and the sample size of the studied population. Women with cHELLP syndrome were subject to recurrence of hypertensive disorders in their subsequent pregnancies. The risk of recurrence of HELLP syndrome is reported to be 3–27%.[24–27] In our study, the recurrence risk of HELLP syndrome was 3.6% in the cHELLP group and 15.4% in the pHELLP group, which corresponds with some studies, but which contradicts others. More interestingly, in our study the incidence of pre-eclampsia in subsequent pregnancies was higher in the pHELLP group (34.6% in pHELLP vs 7.1%). Differences in recurrence rates might be explained by differences in the gestational age of the indexed pregnancies, the studied population and sample size.

Cardiovascular diseases and HELLP syndrome share many risk factors, such as endothelial dysfunction, dyslipidemia, obesity and insulin resistance.[28–32] The long-term maternal health consequences of cHELLP and pHELLP in the indexed pregnancies were what we were hoping to uncover. The risk of chronic hypertension was reported to be 6.2% and 8% in different studies. Habli *et al*. reported a 33% risk of developing new-onset chronic hypertension.[22] In our study, the risk of developing chronic hypertension in about 5 years was 22.4% in the cHELLP group and 23.45% in the pHELLP group. Although the risk of hypertension in our study was higher than in previous studies, it is consistent with Habli *et al*.[22] This inconsistency could be because of screening, changes in diagnostic criteria of hypertension and early prevention measures. The higher incidence of hypertension in both groups could be parallel to the overall hypertension incidence trends.

There are few reports in the literature addressing the psychological effects of HELLP syndrome on patients. It is unsurprising that women with a history of HELLP who have had their babies die, who have had poor neonatal outcomes or who have had long ICU stays suffer anxiety of a recurrence, and this could explain the higher rate of elective terminations of pregnancies in subsequent pregnancies among the cHELLP patients. The higher rates of pregnancy termination in the cHELLP group can be explained by the severe nature of the complete form of HELLP and anxiety of

recurrence. To avoid psychiatric disorders, women who had either cHELLP or pHELLP, and their relatives, may need counseling and close follow-ups beyond the postpartum period.

Audibert *et al*. reported that women with pHELLP syndrome should be studied and managed separately from women with cHELLP syndrome or severe preeclempsia.[5] Other authors stated that the management of women with pHELLP syndrome must be distinct from the management of women with severe preeclampsia or cHELLP syndrome. This may be achieved by clinical management and it may not necessarily interrupt the pregnancy. According to our findings, partial and complete HELLP syndromes are not two distinct groups based on neonatal, long-term and subsequent pregnancy outcomes. They probably represent a continuum in the natural evolution of the same disease. The difference between the complete and partial form of HELLP syndrome may be due to the timing of diagnosis, corticosteroid treatment before the diagnosis, either for fetal lung maturation or HELLP syndrome, or the natural speed of progression of the disease. The diagnostic criteria and categories, and management strategies related to HELLP syndrome still vary. Standard guidelines with regard to diagnosis, treatment and long-term follow-up do not exist, and further studies are recommended to evaluate the pathophysiology of recurrence and cardiovascular health for the prevention of complications.

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Disclosure

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of this paper.

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