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Changing Presentation of the Hypertensive Disorders of Pregnancy Over 25-year Period

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Abstract

Background: To determine changes in the incidence, clinical pattern, laboratory parameters, maternal and perinatal complications of hypertensive disorders of pregnancy over a 25-year period. **Methods**: This study compared the incidence, clinical pattern, laboratory parameters, maternal and perinatal complications in two groups of patients. Group I comprises of 75 patients of hypertensive disorders of pregnancy with or without HELLP syndrome, identified out of 1084 pregnant women in the year 1991-92 at the Dept. of Obstetrics and Gynaecology, Government Medical College, Amritsar. Group II includes 200 hypertensive patients selected from 2949 pregnant women studied between 2016-17 in the same department. **Results:** The clinical presentations varied over the years. The Group I had 75(6.92%) cases of hypertensive disorders out of 1084 pregnancies, with 20(26.67%) cases of mild preeclampsia (Subgroup A), 29 (38.67%) cases of severe preeclampsia (Subgroup B) and 26 (34.67%) cases of eclampsia. According to the classification of hypertension in pregnancy twenty five years back, there was no separate category of atypical preeclampsia or posterior reversible encephalopathy syndrome hence no such cases were categorised in Group I. The Group II had 200(6.78%) cases of hypertensive disorders out of 2949, with 66(33.0%) of mild preeclampsia (Subgroup A), 74(37.0%) with severe preeclampsia and 34(17.0%) had eclampsia. Apart from these, 26 patients had atypical preeclampsia. One (0.5%) patient was diagnosed with posterior reversible encephalopathy syndrome. Over the years, better identification parameters and improvement in the management guidelines gave better maternal and perinatal outcome in Group II. The Caesarean section rate was 45.5% in Group II as compared to 33.33% in Group I. The incidence of intrauterine death was 31.7%in partial HELLP and 37.5%in complete HELLP in Group I as compared to 32.44%in partial HELLP and 66.67%in complete HELLP in Group II. Similarly, the maternal complications were less in Group II as compared to Group I, e.g. postpartum haemorrhage being 6.5% in Group II and 18.67%in Group I and disseminated intravascular coagulation being 2.5% in Group II and 5.33% in Group I. **Conclusions:** Atypical preeclampsia and posterior reversible encephalopathy syndrome (PRES) were not included as separate entities in the classification of hypertensive disorders of pregnancy twenty five years back. Over the years the classification has undergone a vast change due to the change in the guidelines and management of this serious obstetrical condition. Awareness of the spectrum of the disease process of hypertensive disorders of pregnancy is necessary so that proper diagnosis is made and therapy initiated as early as possible. The trend in the recent years of earlier termination of pregnancy in complicated cases of hypertensive disorders of pregnancy, especially complete or partial HELLP syndrome by Caesarean section or vaginal route results in better maternal and foetal outcome. Expediting the delivery results in a better prognosis for the mother and the baby, although the postoperative maternal complications were many, due to the basic pathology in hypertensive disorders of pregnancy.

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Keywords:- Preeclampsia, eclampsia, gestational hypertension, HELLP Syndrome.

INTRODUCTION

Hypertensive disorders in pregnancy remain a major cause of maternal, foetal and neonatal morbidity and mortality among the women in the developing countries.[1] This is often related to inadequate or delayed antenatal care. The classification of hypertensive disorders of pregnancy twenty five years back was very different from the newer FOGSI-GESTOSIS classification which states as follows:

Gestational Hypertension
Preeclampsia/Eclampsia
Chronic Hypertension
Preeclampsia superimposed on Chronic Hypertension

Pregnant women with hypertensive disorders are at high risk for serious complications such as eclampsia, abruption placenta, HELLP Syndrome, posterior reversible encephalopathy (PRES), cerebrovascular accident, organ failure and disseminated intravascular coagulation (DIC).[2] The foetus is at risk for intrauterine growth retardation, prematurity and intrauterine death.[3]

MATERIAL AND METHODS

The Bebe Nanki Maternal and Child Health Care (BNMCHC) is a tertiary level district maternity unit which sees a large number of referral obstetric cases, with little change in the demographic makeup of the referred group over the last 25 years. A study was conducted in the period from 1991-1992(Group I) in the Department of Obstetrics and Gynaecology at SGTB Hospital, Amritsar. Out of 1084 pregnant women, both booked and unbooked 75 hypertensive cases, who delivered in the hospital were taken up for study. This study group had both preeclampsia and eclampsia patients. All these cases were followed through antenatal period, labour and postpartum period. Later, the Department of Obstetrics and Gynaecology,GMC was shifted to BNMCHC in 2012. The second group (Group II) studied at BNMCHC over the period from January 2016 to August 2017 constituted 2949 pregnant women with a subset of 200 patients suffering from hypertensive disorders of pregnancy. The various parameters studied to measure the maternal and foetal outcome in both the groups were: age of the mother, parity, socioeconomic status, past obstetrical career, severity of hypertension, the period of gestation, whether antepartum or postpartum, mode of delivery, multitude and severity of maternal and perinatal complications. Perinatal outcome was measured in terms of prematurity, dysmaturity, intrauterine foetal demise, birth asphyxia, Apgar score, neonatal jaundice, hypoglycaemia, hypocalcaemia, sepsis, NICU admission and early neonatal death. Baby was followed till 7 days after delivery.

RESULTS

In our present study, the results were obtained in the two study groups:-

Group I-75 patients-The group was further subdivided into the following subgroups:

Subgroup A – Preeclampsia. Patients with systolic blood pressure 140-160mmHg and diastolic blood pressure between 100-110mmHg.

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Subgroup B- Severe Preeclampsia. Patients with systolic blood pressure 160mmHg and above and diastolic blood pressure of 110mmHg and above.

Subgroup C- Eclampsia

Group II-200 patients-The group was further subdivided into the following subgroups:

Subgroup A- Preeclampsia upto 100mmHg. Patients with systolic blood pressure 140-160mmHg and diastolic blood pressure between 100-110mmHg .

Subgroup B- Severe Preeclampsia. Patients with systolic blood pressure 160mmHg and above and diastolic blood pressure of 100mmHg and above.

Subgroup C- Eclampsia

Atypical Preeclampsia

I. Incidence of patients with hypertensive disorders of pregnancy:

There were 75(6.92%) cases of hypertensive disorders of pregnancy in Group I among 1084 antenatal admissions as compared to 200 patients of hypertensive disorders among the total of 2949 antenatal admissions(6.78%) in Group II.20(26.67%)patients in Group I had mild preeclampsia,29 (38.67%) had severe preeclampsia and 26(34.67%) were eclamptic. 66 patients in Group II(33.0%) had mild preeclampsia(Subgroup A),74(37.0%) were with severe preeclampsia(Subgroup B)and 34(17.0%)had eclampsia (Subgroup C). Apart from these, there were 26 patients of atypical preeclampsia (13.0%).

II. Socio-Demographic Data:

Agewise Distribution:

In Group I, the mean age of patients was 24.2 years.14(18.67%)cases were in the age group of 16-20 years,33(44.0%)between 20-24 years and 18(24.0%) in the age group 25-29 years.10 (13.33%)cases were in the age group of above 30 years. In group II, the mean age of patients was 25.18 years.33(16.5%)patients were in the age group of 16-20years,89(44.5%)of cases were in the age group of 21-25years,56(28.0%)were in age group of 26-30 years and 22(11.0%)were above 30 years of age.

A. Parity:

In the study group I,50(66.67%) were primigravidae and 25(33.33%)were multigravidae. Of the 200 patients in the study group II, 121(60.5%) were primigravidae and 79(39.5%)were multigravidae. The difference was statistically insignificant.

Distribution of cases according to booking status: In Group I, only 5(6.67%) of the patients had received antenatal care as shown in Table I.In Group II,38(19.9%)patients received antenatal care and 162(81.0%)were unbooked.

III. Hellp Syndrome

The incidence of HELLP Syndrome in the study groups is as follows:

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Table 1: summaries the demographic baseline characteristics.

Patient characteristics	**Group I (n=75)**					**Group II (n=200)**				
Sub Groups	**A**	**B**	**C**	**Atypical**	**(Age distribution)**	**A**	**B**	**C**	**Atypical**	**(Age distribution)**
Incidence	20	29	26	0		66	74	34	26	
	26.67 %	38.76 %	34.67 %	0.00%		33.00 %	37.00 %	17.00 %	13.00%	
Age (in years)										
16-20	1	7	6	0	18.70%	8	10	9	6	16.50%
21-25	12	13	8	0	44.00%	30	37	13	9	44.50%
26-30	4	6	8	0	24.00%	23	21	6	6	28.00%
Above 30	3	4	4	0	13.30%	5	6	6	5	11.00%
Parity										
Primigravida	15	15	20	0	66.67%	41	43	24	13	60.50%
Multigravida	5	14	6	0	33.33%	25	31	10	13	39.50%
Hospital attendance										
Booked	3	2	0	0	6.67%	19	12	3	4	19.00%
Unbooked	17	27	26	0	93.33%	47	62	31	22	81.00%
Area of residence										
Rural	12	23	28	0	84.00%	35	25	40	23	66.50%
Urban	5	4	3	0	16.00%	29	22	13	13	38.50%

Table 2: Summarises the distribution of complete HELLP and partial HELLP patients among the different subgroups of Group I and Group II based on clinical parameters.

	Group 1 (n=75)		**Group ll (n=200)**	
Subgroup	Partial HELLP	Complete HELLP	Partial HELLP	Complete HELLP
	(n=37)	(n=3)	(n=63)	(n=8)
	No (%age)	No (%age)	No. (%age)	No. (%age)
Gestational Age (Mean)	36.1 wks	35 wks	35.4 wks	36 wks
Clinical Features				
Systolic BP (mm Hg)				
140-160	11	1	44	1
161-180	13	2	16	4
181-200	4	0	3	2
201-220	9	0	0	0

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>220	0	0	0	0
	165.07 S.D.17.65	175.01 S.D.16.65	160.60 S.D.16.63	183.75 S.D.21.33
Diastolic BP				
91-95	0	0	0	0
96-100	0	0	27	1
101-105	8	1	0	0
106-110	13	0	17	3
111-115	0	0	0	0
116-120	10	1	18	3
121-125	0	0	0	0
126-130	5	0	1	1
>131	1	1	0	0
Mean DBP	110.4 S.D.12.54	112.4 S.D.12.68	108.60 S.D. 8.97	115.0 S.D. 9.25
Proteinuria				
+	0	0 (0.0%)	22 (34.92%)	0 (0.0%)
++	3 (8.11%)	0 (0.0%)	20 (31.75%)	0 (0.0%)
+++	10 (27.01)	1 (33.33%)	5 (7.93%)	4 (50.0%)
++++	24 (65.0%)	2 (66.67%)	0 (0.0%)	2 (25.0%)

Table 3: Summarises the laboratory investigations of partial HELLP and complete HELLP in the antepartum (AP) and postpartum period(PP).

Subgroup	**Group I (n=75)**				**Group II (n=200)**			
	Partial HELLP		**Complete HELLP**		**Partial HELLP**		**Complete HELLP**	
	(n=37)		**(n=3)**		**(n=63)**		**(n=8)**	
	AP	PP	AP	PP	AP	PP	AP	PP
Haemoglobin (g/dl)								
<3	0	0	0	0	0	0	0	0
3-5	0	0	1	0	0	0	1	0
5-7	9	3	1	1	9	7	5	1
7-9	19	16	1	1	36	26	2	3
9-11	9	12	0	1	18	29	0	2
>11	0	6	0	0	1	0	0	0
(Mean Hb)	7.90+/-1.07	8.60+/-1.02	5.80+/-1.04	8.10+/-1.04	8.19+/-1.02	8.56+/-1.02	5.97+/-1.07	8.03+/-1.04
Elevated Liver								
Enzymes (EL)								
Serum Bilirubin								
<1	6	20	0	0	17	43	1	1
1-2	4	12	1	2	34	16	2	3
2-3	20	5	1	1	9	2	4	1
3-4	6	0	0	0	2	0	0	0

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4-5	1	0	1	0	1	0	0	0
>5	0	0	0	0	0	0	1	1
(Mean Value)	2.23	1.78	2.83	1.83	1.43	0.95	2.48	2.16
Serum Transaminase								
(SGOT; SGPT)								
<40	7;6	17;15	0;0	3;3	24;24	25;29	1;1	0;1
40-80	19;18	11;14	1;0	0;0	25;23	27;25	1;0	4;3
80-120	11;12	9;8	2;3	0;0	7;11	8;6	5;5	2;2
120-160	0;1	0;0	0;0	0;0	1;2	1;1	1;1	0;0
160-200	0;0	0;0	0;0	0;0	2;2	0;0	0;1	0;0
200-240	0;0	0;0	0;0	0;0	2;1	0;0	0;0	0;0
>240	0;0	0;0	0;0	0;0	0;0	0;0	0;0	0;0
(Mean Value)	59.0;59.46	20.4;19.6	106;84.67	14.3;16	58.9;60.1	50.7;49.5	93.6;97.8	74.2;67.3
Low Platelet								
Count (LP) (lac/cu mm)								
<1	1	0	1	0	18	8	7	5
1-1.5	8	0	2	0	0	2	0	1
1.5-2	6	1	0	0	27	22	1	0
2-2.5	19	13	0	1	18	26	0	0
2.5-3	2	18	0	1	0	3	0	0
>3	1	5	0	1	0	0	0	0
Mean Platelet count (lac/cu.mm)	1.89	2.89	1.12	2.87	1.58	1.8	0.66	0.77

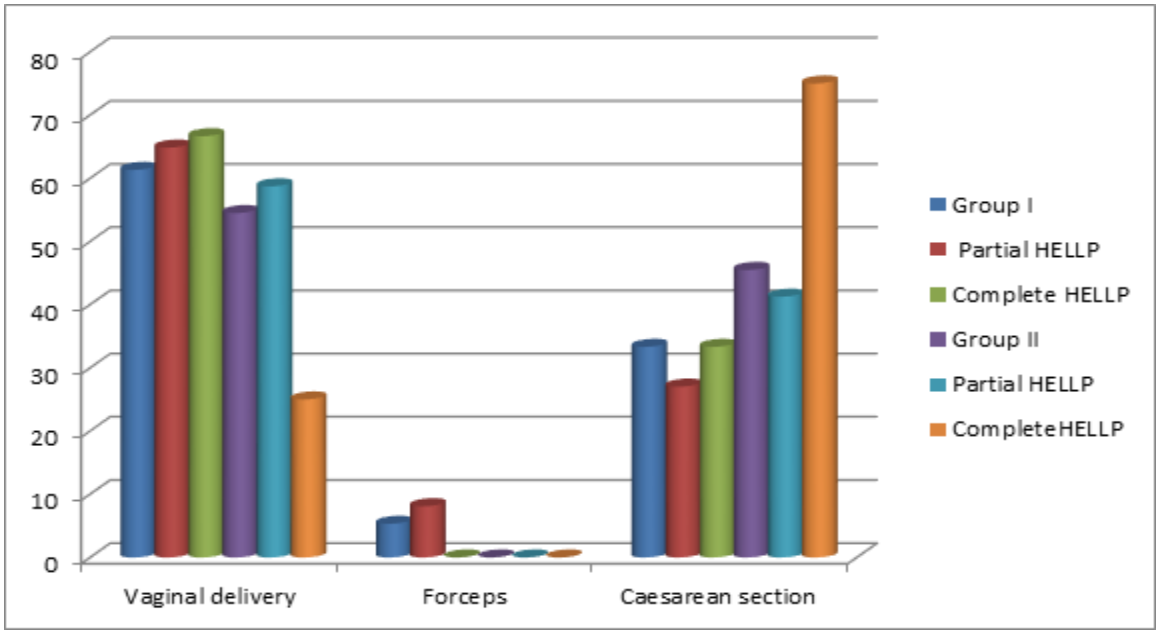

Figure 1: shows the mode of delivery in the patients of Group I&II, including partial HELLP and complete HELLP

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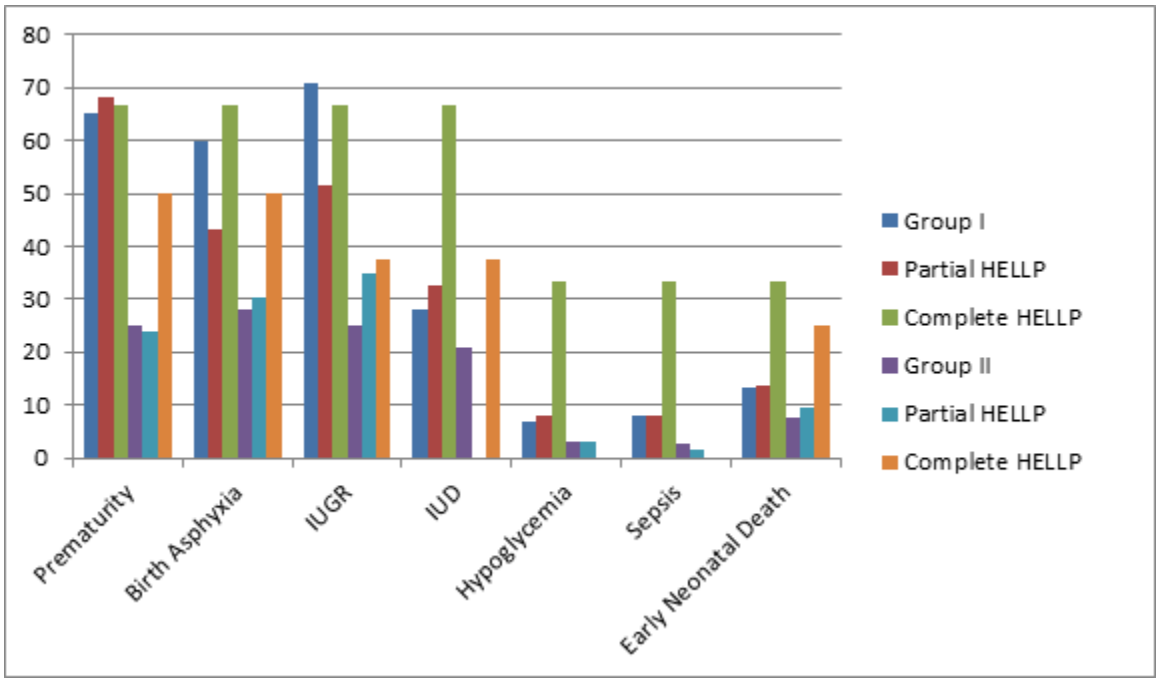

Figure 2: shows the perinatal complications of complete HELLP and partial HELLP patients in Group I and II.

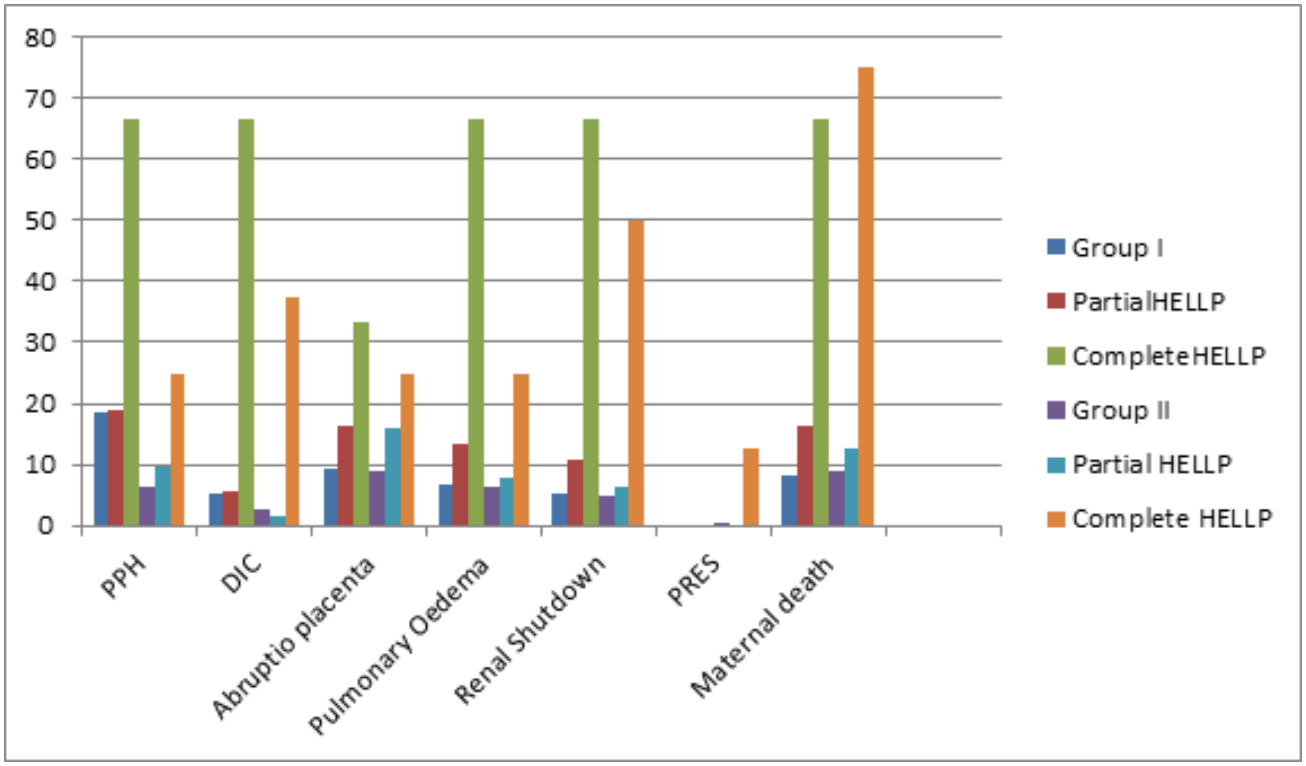

Figure 3: showing incidence of maternal complications in Group I&II, Partial HELLP and Complete HELLP in both the groups.

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As is evident from [Figure 2], the incidence of perinatal complications of prematurity, birth asphyxia, intrauterine growth retardation, hypoglycaemia, sepsis and early neonatal death in Group I and its subsets of partial HELLP and complete HELLP is much higher than in Group II.

DISCUSSION

The present study was undertaken to determine changes in the incidence and clinical pattern of hypertensive disorders of pregnancy, including partial HELLP and total HELLP patients, over a 25-year period. Also a comparison of the laboratory parameters and maternal and perinatal complications of such patients was undertaken.

The clinical presentations were varied over the period of two and a half decades.[1,2] Atypical preeclampsia and posterior reversible encephalopathy syndrome (PRES) were not included as separate entities in the classification of hypertensive disorders of pregnancy twenty five years back, hence no cases of atypical preeclampsia or posterior reversible encephalopathy syndrome (PRES) were recognised in Group I. There were 3(4.0%) patients of complete HELLP syndrome, and 37(49.33%) of partial HELLP.[4] In Group II, there were 200 patients of hypertensive disorders among the total antenatal admissions of 2949 patients (6.78%). 66 of these patients (33.0%) had mild preeclampsia (Subgroup A), 74 (37.0%) were with severe preeclampsia(Subgroup B)and 34(17.0%)had eclampsia (Subgroup C). Apart from these, there were 26 patients with atypical preeclampsia (13.0%) and 6(3.0%) had postpartum hypertension. One (0.5%) patient was diagnosed with posterior reversible encephalopathy syndrome (PRES along with postpartum eclampsia.[3] The incidence of complete HELLP patients was 8(4.0%) and of partial HELLP 63(31.5%). The incidence is significantly higher because of lack of antenatal care, late diagnosis and late referral to tertiary centre. Substandard care at peripheral hospitals usually had diagnostic errors and failure in timely appreciation of the severity of the condition. Lack of special expertise in the peripheral centres also contributed to the late diagnosis and late referral to higher centres. This incidence is low as compared to the study by Kumari S et al (2014) at S V Medical College, Tirupathi, Andhra Pradesh where it is 32.1%. The incidence of partial HELLP was 72.9% and complete HELLP was 27.1%.In the study conducted by Tiwari P et al(2015), out of 8(75.0%) cases of HELLP syndrome had eclampsia while 2 (25.0%) had severe preeclampsia.[4,5,6,7]

The baseline demographic characteristics of the two study groups were very similar to each other. The mean age of all the patients with HELLP syndrome (partial and complete) in the Group I was 24.2 years while it was 25.36+/-5.0 years in the Group II.The mean age of patients with partial HELLP was 25.33+/-5.03 years and with complete HELLP syndrome was 25.63+/-5.15.This was comparable with the study done by Chawla S et al(2013)in which mean ageof HELLP patients was 24.25+/-3years.[8]

Regarding the clinical parameters, the mean systolic blood pressure of all the patients with partial and complete HELLP syndrome in the present study in Group I was 165.07+/-17.65

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and 175.01+/-16.65 and diastolic 110.4+/-12.54 and 112.4+/-12.68. The mean systolic blood pressure of all patients with partial and complete HELLP syndrome in Group II was 160.60+/-16.63 mmHg and 183.75+/-21.33mmHg and diastolic 108.60+/-8.97 and 115.0+/-9.25 respectively. This was comparable with mean systolic and diastolic blood pressure in the study by Chawla S et al(2013)among the patients of HELLP i.e.166+/-18.65 and 110.5+/-12.7,respectively.[9]

Regarding the laboratory parameters, mean values of Hb, platelet count, liver function tests in the two study groups were almost similar. The mean Hb concentration of patients with partial HELLP and complete HELLP in Group I was7.90+/-1.07g/dl and 5.80+/-1.04 and in Group II 8.19+/-1.02 and 5.97+/-1.07 respectively. The mean level of platelet count among all HELLP patients(partial and complete) in Group I and II was 1.58+/-0.55 lac/cumm and 1.48+/-0,59 lac/cumm respectively. This was less as compared to the study conducted by Rakshit A et al(2014)in which mean platelet count was 1.71+/-0.56 in complete HELLP and 1.97+/- 0.78 among partial HELLP patients.[10]

The mode of delivery in the two study groups showed a significant shift towards Caesarean section in the recent years because it makes it a safer method especially in complete HELLP syndrome where pregnancy is terminated without undue prolongation in view for better maternal and foetal outcome. The Caesarean section rate in partial HELLP and complete HELLP in Group I was 27.03% and 33.33%respectively while it was 41.27% and 75.0% in the respective subsets in Group II. This is comparable to the study by Rakshit A et al(2014)in which the Caesarean section rate in complete HELLP patients was 72.72%.[10]

Regarding the foetal outcome, the number of IUDs seen among the hypertensive patients in Group I and II was comparable,i.e.21.33 and 21.0 respectively.In partial HELLP patients, it was 32.44% and 31.7% but in complete HELLP, it was 66.67% and 37.5%respectively.Higher number of IUDs are seen among patients of partial HELLP because of late diagnosis and late referral to tertiary health care centre. Still there were lesser number of IUDs in complete HELLP syndrome in Group II,because of the trend in the recent years of earlier termination of pregnancy for better maternal outcome by Caesarean sections, which, of course, helps to improve foetal morbidity and decrease foetal mortality. As per Gupta T et al(2014),incidence of IUD in partial HELLP was 14.3%and in complete HELLP 50.0%.[11]

Studying the maternal complications in the HELLP patients(partial and complete)of the two study groups showed a significant difference in the incidence and severity of the various morbidities like PPH ,DIC, abruption placenta, renal shutdown and pulmonary oedema. The incidence of PPH was 18.9%and 66.67% in partial HELLP and complete HELLP patients in Group I and it was 9.5%and 25.0% in the two subsets in Group II. This was comparable to the study by Ara S et al (2014)who reported 8.1% incidence of PPH among HELLP patients.[12] The higher incidence of DIC in HELLP patients of Group I,i.e.5.41% and 66.67% as compared to Group II which was 1.6%and 37.5% respectively, indicates a better maternal outcome due to adoption of Caesarean section as a means of

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earlier termination of pregnancy in HELLP patients of Group II. However, the studies by Bang NO et al and Rakshit A et al showed lower rates of 3.34% and 9.09% respectively.[10,13] Some severe complications were noted in HELLP patients of Group II like posterior reversible encephalopathy syndrome(PRES) whereas not a single case of PRES was noted in the corresponding subgroup in Group I.[14,15]

CONCLUSIONS

The classification of hypertensive disorders of pregnancy over the years had undergone a vast change due to the change in the guidelines and management of this serious obstetrical condition. Twenty five years back, it did not recognize atypical preeclampsia and posterior reversible encephalopathy syndrome (PRES)as separate entities. Awareness of the spectrum of the disease process of hypertensive disorders of pregnancy is essential to reach a proper diagnosis and manage the patient as early as possible. The trend in the recent years of earlier termination of pregnancy in complicated cases of hypertensive disorders of pregnancy, especially complete HELLP syndrome by Caesarean section or vaginal route resulted in a better maternal and foetal outcome. Expediting the delivery resulted in a better prognosis for the mother and the baby, although the postoperative maternal complications were many, due to the basic pathology in hypertensive disorders of pregnancy.

REFERENCES

1. Olson-Chen C, Seligman NS. Hypertensive Emergencies in Pregnancy. Crit Care Clin. 2016;32(1):29-41. doi: 10.1016/j.ccc.2015.08.006.
2. Umesawa M, Kobashi G. Epidemiology of hypertensive disorders in pregnancy: prevalence, risk factors, predictors and prognosis. Hypertens Res. 2017;40(3):213-220. doi: 10.1038/hr.2016.126.
3. Ankumah NE, Sibai BM. Chronic Hypertension in Pregnancy: Diagnosis, Management, and Outcomes. Clin Obstet Gynecol. 2017;60(1):206-214. doi: 10.1097/GRF.0000000000000255.
4. Rahmayanti S, Nurdiati DS:HELLP syndrome in severe preeclampsia:the perinatal outcomes. Pregnancy Hypertens. 2017;7:61. https://doi.org/10.1016/j.preghy.2016.10.017.
5. Li X, Zhang W, Lin J, Liu H, Yang Z, Teng Y, et al. Hypertensive disorders of pregnancy and risks of adverse pregnancy outcomes: a retrospective cohort study of 2368 patients. J Hum Hypertens. 2021;35(1):65-73. doi: 10.1038/s41371-020-0312-x.
6. Weinstein L. Syndrome of hemolysis, elevated liver enzymes, and low platelet count: a severe consequence of hypertension in pregnancy. Am J Obstet Gynecol. 1982;142(2):159-67. doi: 10.1016/s0002-9378(16)32330-4.
7. Kumari S,Bhavani,Himabindu et al: Clinical study on HELLP syndrome-Maternal and perinatal outcome. J Dent Med Sci. 2016;15(1):71-6.
8. Tiwari P,Bhalavi S,Nayak S,Tiwari R. A study of HELLP syndrome among cases of preeclampsia and eclampsia:Incidence and correlation of laboratory parameters. OALib J. 2015;2(09):1.
9. Chawla S, Marwaha A, Agarwal R. HELLP or help:a real challenge. J Obstet Gynaecol India. 2015;65(3):172-5.
10. Rakshit A, Lahiri S, Biswas SC,Dey R,Roy BR,Saha MM. A study to detect HELLP syndrome and partial HELLP syndrome among preeclamptic mothers and their impact on fetomaternal outcome. Al Am een J Med Sci. 2014;7(1):20-5.
11. Gupta T, Gupta N, Jain J, Gupta S, Bhatia P, Bagla J. Maternal and perinatal outcome in patients with severepreeclampsia/eclampsia with and without HELLP syndrome. J Universal College Med Sci. 2014;1(4):7-12.
12. Ara S,Singh BB,Birla N,Jyothi D.Incidence of HELLP syndrome in preeclampsia and eclampsia&maternal and perinatal outcome including morbidity and mortality. Paripex Indian J Res. 2015;7(4):65-7.

13. Bang NO, Satia MN, Poonia S. Obstetric and neonatal outcome in pregnancies complicated by haemolysis,elevated liver enzymes,low platelet count syndrome at a tertiary care centre in Indi. Int J Reprod Contracept Obstet Gynecol. 2017;5(7):2407-12.
14. Burton GJ, Redman CW, Roberts JM, Moffett A. Pre-eclampsia: pathophysiology and clinical implications. BMJ. 2019;366:l2381. doi: 10.1136/bmj.l2381.
15. Tranquilli AL, Dekker G, Magee L, Roberts J, Sibai BM, Steyn W, et al. The classification, diagnosis and management of the hypertensive disorders of pregnancy: A revised statement from the ISSHP. Pregnancy Hypertens. 2014;4(2):97-104. doi: 10.1016/j.preghy.2014.02.001.

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