

Role of Platelet Distribution Width and Mean Platelet Volume in Assessment of Severity of Pre Eclampsia - A Prospective Observational Study in Tertiary Care Centre

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Abstract: *Background:* Hypertension and its complications are ranked as a third leading cause of maternal mortality, responsible for 16% of maternal deaths and over half of these hypertension related deaths were preventable. In India the incidence of preeclampsia is reported to be 8-10% of the pregnancies. The progression of preeclampsia is evident by decrease in platelet count. This decrease in platelets is compensated by production of premature platelets which in turn leads to normal platelet count but an increase in MPV and PDW. The aim of this study is to assess the changes occurring in platelet indices in patients with pre-eclampsia and establish their role in assessing the severity of preeclampsia and in turn these parameters could be used for early diagnosis of the severity of the disease. *Methods:* In the present study conducted at Department of Obstetrics and Gynaecology, Government Raja Mirasudhar Hospital, Thanjavur medical college over a period of 18 months A random selection of 400 antenatal mothers with Non severe preeclampsia was made and were followed up serially every 15 days and outcome was analyzed. *Results:* There were increase in platelet indices in 213 (94.7%) among 225 patients who turned out to be severe preeclampsia which is in agreement with the other studies. Even before the fall in platelet counts, platelet indices such as MPV, PDW are altered which is statistically significant. The platelet indices showed a gradual increase in non severe preeclampsia patients who turned out to be severe pre eclampsia and were statistically significant. Among 400 patients, 225 patients turned into severe preeclampsia, among which 213 (94.7%) had abnormal platelet indices and 12 (5.3%) had normal platelet indices. *Conclusion:* In our study the platelet indices found to be increased much earlier before the diagnosis of severe preeclampsia emphasizing their utility in prediction, early diagnosis of severe preeclampsia and risk stratification for optimum fetal maternal outcome in preeclampsia women. Provision of quality antenatal health care services, increasing patient awareness about warning symptoms, investigations, timely delivery and intensive care monitoring in the intrapartum and postpartum period have the potential to improve maternal and perinatal outcome.

1. Introduction

Preeclampsia is the most common hypertensive disorder of pregnancy that affects virtually all organ system and leads to maternal and fetal mortality and morbidity¹. It occurs in approximately 3.8% of pregnancies (Martin 2012)¹

Preeclampsia is a disorder of pregnancy associated with new onset hypertension, which occurs most often after 20 weeks of gestation²

Hypertension and its complications are ranked as a third leading cause of maternal mortality, responsible for 16% of maternal deaths and over half of these hypertension related deaths were preventable^{3, 4, 5}. In India the incidence of preeclampsia is reported to be 8-10% of the pregnancies⁶.

In united states from 2011-2013, 7.4% of pregnancy related, maternal deaths are due to preeclampsia. A similar rate was 10% in France. Moreover, in comparison women giving birth in 1980, those giving birth in 2003 were at 6-7-fold increased risk of severe preeclampsia.¹

Thrombocytopenia is most common hematological abnormality found. Changes in platelet count is well established in preeclampsia and studies show, with evolution

of severe preeclampsia there was a fall in circulating platelet count much earlier than expected.

More severe the thrombocytopenia, greater the maternal and fetal morbidity and mortality^{3,7,8}.

The progression of preeclampsia is evident by decrease in platelet count. This decrease in platelets is compensated by production of premature platelets which in turn leads to normal platelet count but an increase in MPV and PDW.

In this study we assess the changes in platelet indices such as mean platelet volume and platelet distribution width for early detection of platelet count abnormalities in preeclampsia and eclampsia, which is a sign of worsening disease. Thus, facilitating early detection of maternal and fetal complications, thereby its role as prognostic tool in management.

Aim of the study:

To assess the changes occurring in platelet indices in patients with pre-eclampsia and establish their role in assessing the severity of preeclampsia and in turn these parameters could be used for early diagnosis of the severity of the disease.

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Objectives of the study:

To analyze the utility of platelet indices in pre-eclampsia women for early detection, to prevent complication, careful monitoring and appropriate management to reduce maternal and neonatal mortality and morbidity.

2. Materials and Methods

- **Study Design:** Prospective observational study
- **Study Place:** Department of Obstetrics and Gynaecology, Government Raja Mirasudhar Hospital, Thanjavur medical college, Thanjavur
- **Study Duration:** January 2020 to December 2020.
- **Study Population:** A random selection of 400 antenatal mothers with Non severe preeclampsia

Inclusion Criteria

Antenatal mothers of more than 20 weeks of gestational age with systolic BP of more than 140mmhg and /or diastolic BP of 90 mmhg on two occasions 6 hours apart with spot PCR more than or equal to 0.3, 24 hour urinary protein > 300mg, urine albumin 1 + in dipstick.

Exclusion Criteria:

- Chronic hypertension
- Hemorrhagic disorder
- Acute leukemias
- Drug intake affecting platelet count
- Hemorrhagic fever
- Renal disease
- Diabetes mellitus
- Chronic alcohol consumption.
- GA > 37 weeks.

Study Procedure

After obtaining Institutional ethical committee (IEC) approval, my study begun from January 2020 to December 2020 in all non severe pre eclampsia antenatal mothers admitted in antenatal ward and labour ward in Govt Raja Mirasudar hospital. After obtaining informed consent patient details, detailed history and investigations are collected and recorded. Patients are followed up serially every 15 days and outcome is analyzed.

All patients who meet the above mentioned criteria were included in the study. Patient's detailed history was taken at first admission and investigations complete blood count with MPV, PDW and renal function test, liver function test with liver enzymes were taken. 24 hour urinary proteins and spot PCR were taken. cardiac and fundus evaluation were done. Remote from term patients were discharged and advised regarding imminent symptoms, educated about daily fetal movement count and was advised to check blood pressure and urine albumin from nearby PHC thrice a week and was followed up once in 15 days at our hospital. At 37 completed weeks in cases of non severe preeclampsia patients or at admission in case of severe pre eclampsia patients, symptoms and signs of severe preeclampsia, imminent eclampsia were noted. General and Obstetric examination was carried out. Investigation such as complete blood count with platelet distribution width, mean platelet volume, urine for albumin, serum bilirubin with SGOT and SGPT, blood urea and

serum creatinine, INR, platelet count, serum uric acid was done on admission and repeated based upon the progression of the disease. Obstetric ultrasound with fetal doppler were performed. In case of any abnormalities like Doppler changes, oligohydramnios and FGR, planned for termination. Details regarding treatment (Antihypertensives, Mgso4, steroids) were noted. Maternal complications were noted. Follow up of mother and neonate done till discharge / death. Collected data were tabulated and statistical analysis performed.

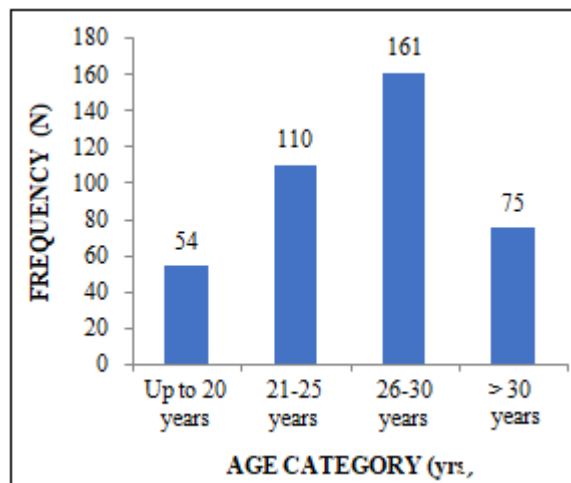
3. Results and Analysis

Table 1: Age Distribution

Age (In years)	Cases	
	N	%
Up to 20 years	54	13.5
21-25 years	110	27.5
26-30 years	161	40.3
> 30 years	75	18.8
Total	400	100
Range	17-39 years	
Mean	26.5 years	
S. D	4.9 years	

Data are expressed as n with proportions (%). Total N: 400

- Most of the women were in the age group 26 to 30 years
- The mean age was 26.5 years with standard deviation of 4.9 years
- The maximum age observed was 39yrs and minimum age observed was 17 years



Bar diagram showing distribution of Age Category

Table 2: Parity

Parity	Cases		Cases with abnormal platelet indices	Cases turned into severe preeclampsia
	No	%		
Primi	272	68	222	176
Multi	128	32	106	49
Total	400	100.0	326	225

- Among 400 cases observed 272 (68%) were primigravida and 128 (32%) were multigravida
- Out of 272 primigravida, 222 patients had abnormal platelet indices and among 222, 176 primigravida developed severe preeclampsia.

- Out of 128 multi gravida, 106 patients had abnormal platelet indices and among 106, 49 primigravida developed severe preeclampsia.

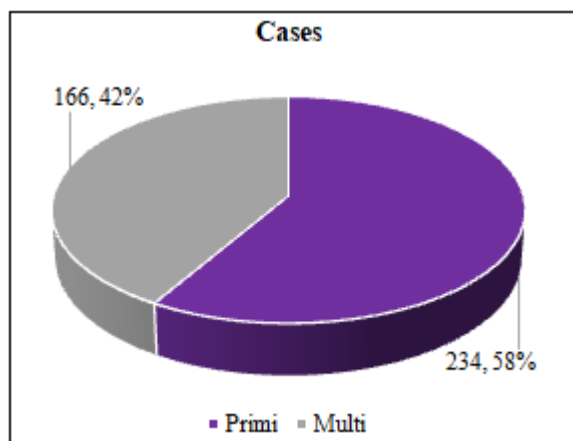


Figure: Pie Chart showing distribution of Parity

Table 3: Platelet Count at each visit

Platelet Count	Cases N (%)			
	1 st Visit	2 nd visit	3 rd visit	>4 visit
>1.5	400	400	400	370 (92.5)
1-1.5	0	0	0	29 (7.3)
50000-100000	0	0	0	1 (0.3)
<50000	0	0	0	0

Among 400 patient at 4 or more visits, 370 (92.5%) had normal platelet counts, 29 (7.3 %) had platelet counts between 1 to 1.5 lakhs, 1 (0.3%) had platelet counts 50, 000 to 1lakh.

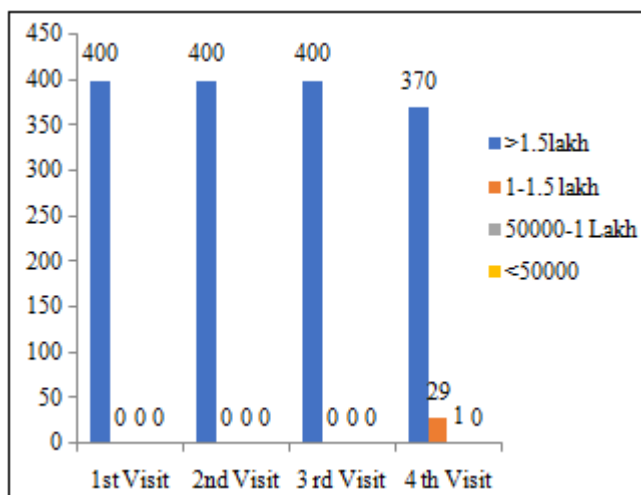


Figure: Bar diagram showing distribution of platelet counts in each visit

Table 4: Platelet Distribution Width and Mean Platelet Volume at each visit

Among 400 patients

- In first visit 400 patients had normal PDW and MPV
- In 2nd visit among 400 patients, 387 (96.8%) had normal PDW and MPV and 13 (3.2%) had abnormal PDW and MPV
- In 3rd visit among 400 patients, 95 (23.8%) had normal PDW and MPV and 305 (76.3%) had abnormal PDW and MPV

- At 4th visit and above among 400 patients, 74 (18.5%) had normal PDW and MPV and 326 (81.5%) had abnormal PDW and MPV.

PDW and MPV	Cases N (%)			
	1 st Visit	2 nd visit	3 rd visit	>4 visit
Normal	400	387 (96.8)	95 (23.8)	74 (18.5)
Increased	0	13 (3.2)	305 (76.3)	326 (81.5)

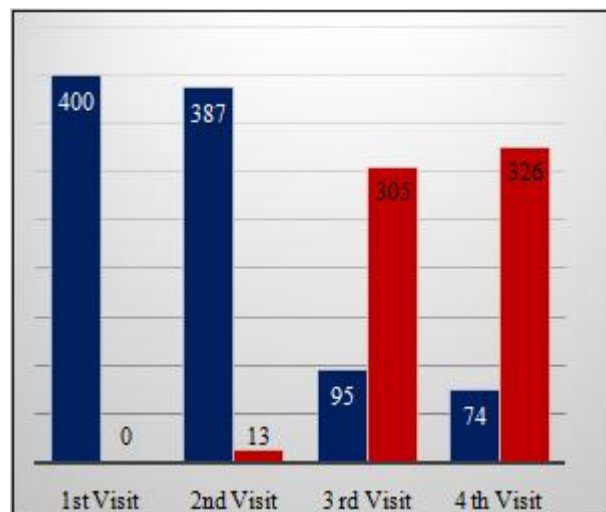


Figure: Bar diagram showing distribution of PDW and MPV at each visit

Table 5: Platelet Indices in Severe Preeclampsia

Platelet Indices	Cases	
	Abnormal Platelet Indices N (%)	Normal Platelet Indices N (%)
Severe Preeclampsia (N=225)	213 (94.7)	12 (5.3)

Among 400 patients, 225 patients turned into severe preeclampsia, among which 213 (94.7%) had abnormal platelet indices and 12 (5.3%) had normal platelet indices.

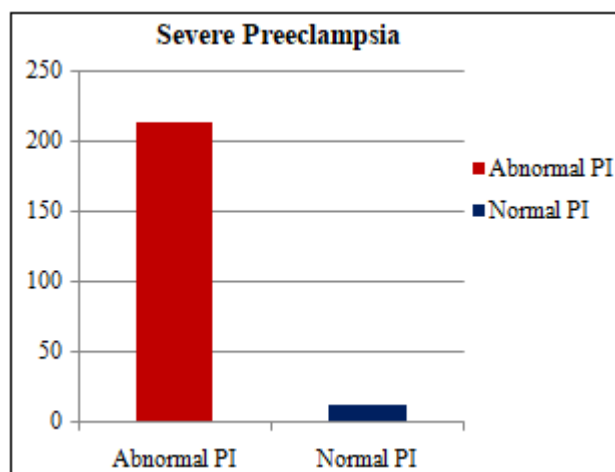


Table 6: Total no of visits, gestational age at abnormal platelet indices

	Severe eclampsia	Non severe pre eclampsia	P value
	Mean ±SD	Mean ±SD	
Total no of Visits	2.9±1.1	2.6 ± 0.9	<0.05*
Gestational age at abnormal indices	30 ± 9.8	24 ± 15.2	<0.05*
Prolongation interval	1.7 ± 1.08	1.3 ± 1.15	<0.05*

*p value<0.05 significant by applying student T test

- Maximum no of visits for patient required for follow up were 6 visits and minimum number visits were 2 visits.
- Maximum weeks for prolongation of pregnancy from abnormal platelet indices to termination of pregnancy were 5 weeks and minimum weeks for prolongation of pregnancy from abnormal platelet indices were 1 week.
- Maximum gestational age at abnormal platelet indices were detected was 36 weeks and minimum gestational age at abnormal platelet indices were detected was 28 weeks.

Table 7: Maternal Complications

Maternal Complications	Cases		Maternal complications with abnormal platelet indices
	No	%	
Severe preeclampsia	225	56.3	213
Abruption:			
24 to 28 weeks	1	0.25	1
28 to 32 weeks	4	1	3
32 to 34 weeks	3	0.75	3
34 to 37 weeks	2	0.5	2
Renal dysfunction	10	2.5	10
HELLP	18	4.5	18
DIVC	2	0.5	2
Eclampsia	3	0.8	3
Nil	132	33	71
Total	400	100.0	326

Among 400 patients, 268 (67.1%) experienced complications and among 268 who had complications 255 patients had abnormal platelet indices.

Among 132 patients who had no complications, 71 had abnormal platelet indices.

13 patients had complications even without the abnormality in platelet indices.

Severe preeclampsia (225, 56.3%) and HELLP (18, 4.5%) were the most common complication

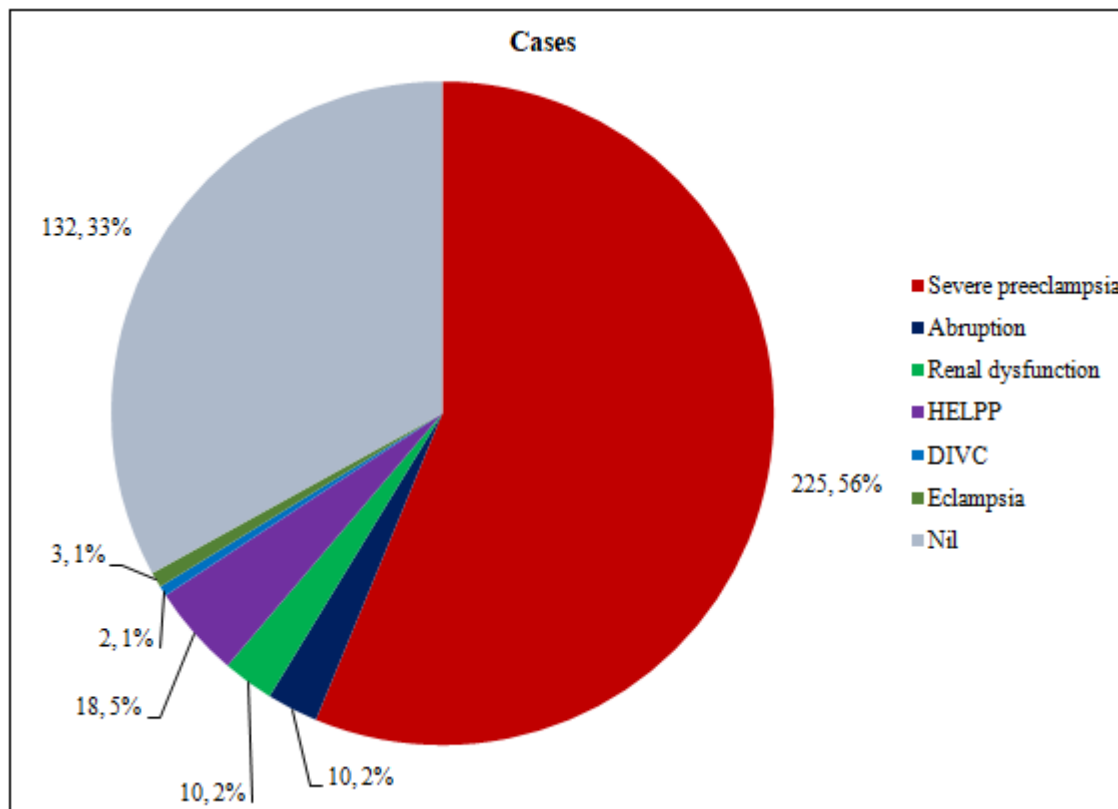


Fig: Pie Chart showing distribution of Maternal Complication

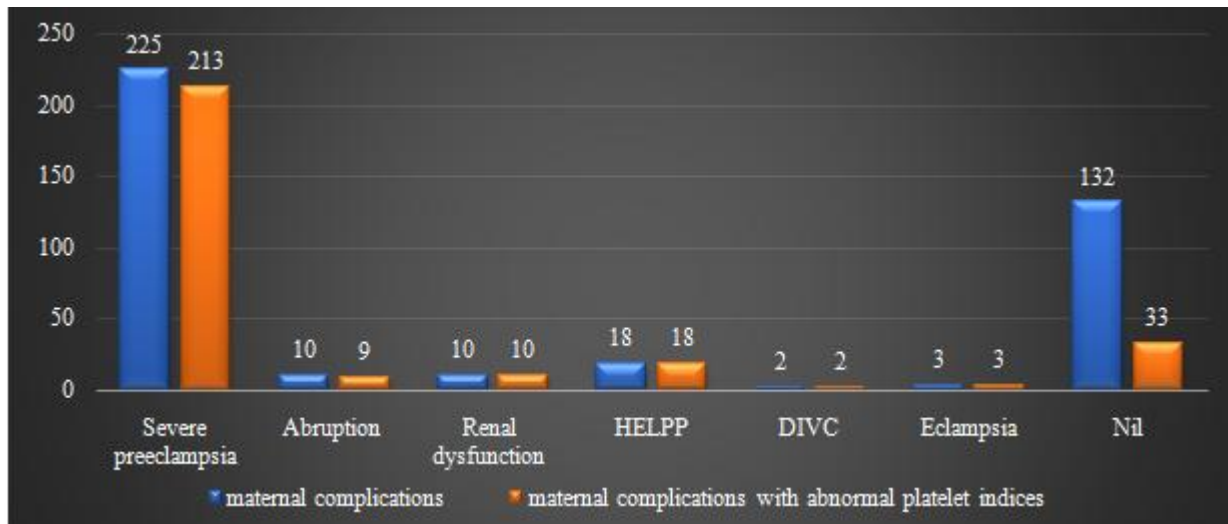


Figure: maternal complications with comparison to abnormal platelet indices.

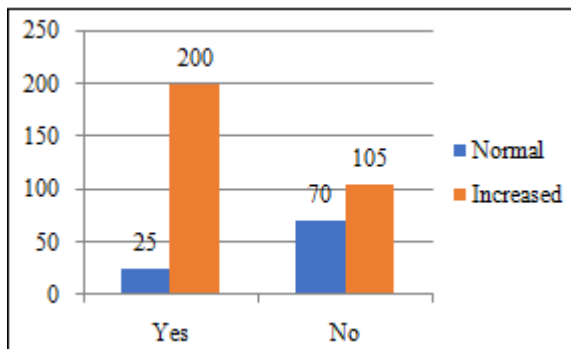
4. Comparison

Table 8: Platelet count at 3rd visit vs severe preeclampsia

	Severe preeclampsia	
	Yes	No
Normal	225	175
Decreased	0	0

Table 9: Platelet distribution width and Mean Platelet volume at 3rd visit vs severe preeclampsia

	Severe preeclampsia		P value
	Yes	No	
Normal	25 (11.1)	70 (40)	<0.05*
Increased	200 (88.9)	105 (60)	



Platelet distribution width and mean platelet volumes are increased in 200 (88.9%) women who turned as severe pre eclampsia with P value of <0.05 which is significant by Chi square test. Even before the fall in platelet counts, platelet indices such as MPV, PDW are altered which is statistically significant.

Table 10: Platelet count at 4th visit and above vs Maternal Complications.

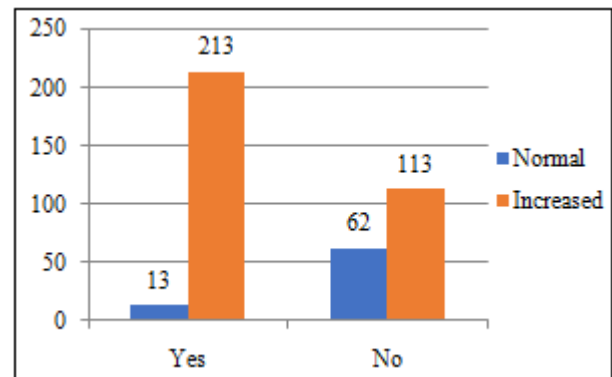
	Severe preeclampsia		P value
	Yes	No	
>1.5	211 (93.8)	159 (90.9)	>0.05
1-1.5 lakh	14 (6.2)	15 (8.6)	
50000-1 lakh	0	1 (0.6)	

p value >0.05 not significant by applying Chi square test

Table 11: Platelet distribution width and Mean Platelet volume at 4th visit and above vs Maternal Complications

	Severe preeclampsia		P value
	Yes	No	
Normal	12 (5.3)	62 (35.4)	<0.05*
Increased	213 (94.7)	113 (64.6)	

*p value<0.05 significant by applying Chi square test



Platelet distribution width and mean platelet volumes are increased in 213 (94.7%) women who turned as severe pre eclampsia with P value of <0.05 which is significant by Chi square test.

5. Discussion

Age:

271 (67.8%) of the women in the study group are in the age group of 21 to 30 years, which correlates with the studies of savitharanisinghal and alpanasingh in which the mean age was 26 years. In my study mean age is 26.5 years.

Parity:

Preeclampsia is common in first pregnancy. More than half the women in my study are Nulliparous 234 (58%). Shobapillai and Savitharani Singhal said preeclampsia is predominant in nulliparous.

Maternal Outcome:

Ultimate goal in the management of severe preeclampsia must first be the safety of the mother and second the

delivery of a live infant who will not require prolonged neonatal care. In my study maternal morbidity is seen in 67%. Severe pre eclampsia, HELLP and Renal dysfunction were highest accounting to 225 (56.3%), 18 (4.5%) and 10 (2.5%) respectively. Other complications are abruption, DIVC, eclampsia and pulmonary edema.

Among 400 patients, 268 (67.1%) experienced complications and among 268 women who had complications 255 patients had abnormal platelet indices. 13 patients had complications even without the abnormality in platelet indices. Among 132 patients who had no complications, 71 had abnormal platelet indices.

Relationship Between Severity Of Pre Eclampsia And Increasing Platelet Indices:

In this study we have serially analysed platelet counts and platelet indices in non severe pre eclampsia women. There were increase in platelet indices in 213 patients (94.7%) among 225 patients who turned out to be severe pre eclampsia which is in agreement with the other studies.

There were increase in platelet indices in 255 patients among 268 patients who experienced complications.

The platelet indices showed a gradual increase in non severe preeclampsia patients who turned out to be severe pre eclampsia and were statistically significant. Even before the fall in platelet counts, platelet indices such as MPV, PDW are altered which is statistically significant

As compared to Saini et al study there was a significant increase in MPV compared to PDW.

In my study there are 400 patients of non severe preeclampsia.

- Most of them are in the age group of 21 – 30 years (67.8%)
- Among 400 cases observed 272 (68%) were primigravida and 128 (32%) were multigravida
- Maximum weeks for prolongation of pregnancy from abnormal platelet indices to termination of pregnancy were 5 weeks and minimum weeks for prolongation of pregnancy from abnormal platelet indices were 1 week.
- There were increase in platelet indices in 213 (94.7%) among 225 patients who turned out to be severe preclampsia which is in agreement with the other studies. Even before the fall in platelet counts, platelet indices such as MPV, PDW are altered which is statistically significant. The platelet indices showed a gradual increase in non severe preeclampsia patients who turned out to be severe pre eclampsia and were statistically significant.
- Among 400 patients, 225 patients turned into severe preeclampsia, among which 213 (94.7%) had abnormal platelet indices and 12 (5.3%) had normal platelet indices.
- Among 400 patients, 268 (67.1%) experienced complications and among 268 who had complications 255 patients had abnormal platelet indices.
- 13 patients had complications even without the abnormality in platelet indices.

- Among 132 patients who had no complications, 71 had abnormal platelet indices.
- 67% women experienced complications, and highest accounting to

Severe preeclampsia	225	56.3%
HELLP	18	4.5%
Renal dysfunction	10	2.5%

6. Conclusion

The Hypertensive disorders complicating pregnancy still remains the major problem in developing countries. The fact that pregnancy induced hypertension is largely a preventable condition is established by observing the negligible incidence of pre-eclampsia and eclampsia with the institution of early management.

Simple and routine tests like CBC with platelet count and platelet indices are highly helpful in suspecting a derangement early in the course of the disease and plan preemptive management strategies.

In our study the platelet indices found to be increased much earlier before the diagnosis of severe preeclampsia emphasizing their utility in prediction, early diagnosis of severe preeclampsia and risk stratification for optimum fetal maternal outcome in preeclampsia women

Provision of quality antenatal health care services, increasing patient awareness about warning symptoms, investigations, timely delivery and intensive care monitoring in the intrapartum and postpartum period have the potential to improve maternal and perinatal outcome. Education and empowerment of women and accessible health care especially to the socioeconomically deprived and rural populations is the need of the hour.

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