Preeclampsia Incidence and Its Maternal and Neonatal Outcomes With Associated Risk Factors

Bisma Khan, Razia Allah Yar, Ayesha Khan Khakwani, Sajilah Karim, Hafiz Arslan Ali

Abstract

Background and objective

Preeclampsia is a hypertensive disorder that usually arises after 20 weeks of pregnancy. It is considered a major cause of maternal and fetal mortality worldwide. High blood pressure and high proteinuria are two main characteristics of preeclamptic patients. Preeclampsia leads to either severe or mild condition, but in both cases, it affects the organs of the mother and fetus. This study was conducted to determine the prevalence of preeclampsia and associated risk factors (family history, age, hypertension, and diabetes) and to investigate its fetal and maternal outcomes.

Methodology

This prospective study was conducted at three healthcare units in the Multan district and involved patients with gestational hypertension. Patients were diagnosed on the basis of blood pressure values, urine tests, and Doppler ultrasonogram. Further investigations were conducted, including a complete hemogram and 24-hour test for proteinuria. Results for preeclamptic-related maternal and perinatal outcomes were documented and statistical analysis was performed to analyze the data.

Results

A total of 142 patients were diagnosed with gestational hypertension and preeclampsia during the two-year study period. Our findings showed 5.67% cases of gestational hypertension and 3% of preeclampsia. The majority of the preeclamptic patients were less than 36 years of age (75.5%), belonged to lower socioeconomic classes (84.4%), and had low educational levels (81.1%). A close association of family history (54.67%) with diabetes (15.2%) and chronic hypertension (15.5%) was observed in these patients. Maternal and fetal outcomes were related to maternal blood pressure. A significant incidence of preterm births (61%) and a majority of cesarean cases (63.4%) with severe complications were observed. Data from preeclamptic patients showed high albumin levels (42.5%) with problems like renal failure, pulmonary edema, and severe anemia. During the study period, a neonatal death rate of 11.1% was observed as well as issues like respiratory tract syndrome, asphyxia, and growth retardation.

Conclusion

This study showed that low economic and educational levels are significantly associated with this disease. A high rate of maternal and neonatal morbidity with maternal mortality was investigated. Mild to severe outcomes were observed in the form of cesarean deliveries and preterm births. Severe complications lead to ICU admissions causing a serious burden on healthcare units. Paying more attention to the healthcare needs of pregnant women helps to identify preeclampsia early and also minimizes the complications associated with it.

Keywords: maternal and fetal outcomes, proteinuria, hypertension, preeclampsia, fetal mortality, antihypertensive medications

Introduction

Preeclampsia is a major medical condition associated with maternal and fetal mortality and morbidity. Preeclampsia is spreading worldwide, especially in underdeveloped and developing countries including Pakistan [1]. It is a pregnancy-associated disease that affects the heart and other body organs such as kidneys and lungs, and further damages liver functions in severe cases. This condition is linked to the complexities of hypertension and proteinuria (albuminuria). Preeclampsia usually begins after 20 weeks of pregnancy [2].

An expecting woman has high blood pressure during preeclampsia, which is higher than or equal to 140/90 mm Hg of systolic and diastolic blood pressure, as well as albumin protein in the urine. The albumin that is normally present in the blood during kidney damage is released into the urine. More than 30 mg/L of albumin indicates kidney damage and the presence of these two crucial complications at the same time in pregnancy may point to preeclampsia [3].

Preeclampsia entails either severe or mild manifestations. Mild symptoms include pain in the chest, vomiting, high blood pressure, low amount of urine, and obesity whereas severe pains in the abdomen, low breathing, kidney failure, edema, blurred vision, and eye irritation are the symptoms of severe preeclampsia, which can evolve to eclampsia in some cases. Eclampsia is a harmful stage in which pregnancy birth and, occasionally, fetal death occur. Blood pressure is not controlled by medication in eclampsia in some cases, leading to mental abnormalities and for this reason, this complication is also referred to as the last stage of preeclampsia [4].

Preeclampsia is associated with several sociodemographic and environmental factors, which often accelerate the development of the disease, such as a family history of hypertension, heart disease, kidney disease, and diabetes [5]. Regular consumption of an unhealthy diet before and during pregnancy also leads to preeclampsia. It is important to avoid using alcoholic products in diet [6]. A diabetic woman is at a higher risk of pregnancy-associated preeclampsia as compared to non-diabetic pregnant women. Diabetes that already exists before pregnancy (preexisting diabetes) is associated with a more complicated pregnancy and higher severity in preeclamptic patients [7].

Hypertension is the major factor based on which preeclampsia is diagnosed, and it is controlled by antihypertensive medications in pregnancy. Specialists also recommend magnesium sulfate and corticosteroids to reduce the rate of eclampsia and associated complications that in turn lead to rectifying fetal health and help with the growth of the baby [8]. Obesity (abnormal weight gain) is a factor that is not only related to preeclampsia but also a major cause of cardiac diseases. Obesity in pregnant women can also have a negative impact on fetal outcomes (premature birth, abnormal growth) on top of maternal outcomes such as diabetes, heart disease, and hypertension. Maternal age, multiple pregnancies, kidney dysfunctions, and in utero fertilization are some other factors that increase the risk of preeclampsia [9].

Preeclampsic incidents are on the rise worldwide, and the condition’s prevalence is greater in developing countries as compared to the developed world [10]. According to the World Health Organization (WHO), the incidence of preeclampsia ranges between 2% and 10% of pregnancies worldwide. Among 1.5–4.7% of the incidents are reported in developing countries, while in developed countries, the rate is 4% [11]. Pakistan is a developing country and it accounts for high levels of preeclamptic incidents (up to 7%) in pregnant women [12].

Materials And Methods

The present study was conducted at Sewal Medical Centre, Aghaur Tariq Hospital, and Nobhar Hospital in the Multan district in the Punjab province of Pakistan for two consecutive years (2020-2022). The study focused on patients with more than 20 weeks of gestation. To investigate the rate of preeclampsia, risk factors, and neonatal and maternal outcomes, all patients visiting the Obstetrics and Gynecology
department during the study period were included in the study, while for studying gestational hypertension, a separate, shorter study was conducted during this time period with a limited number of patients. The research work involved diagnosis, data collection, and case study observations. The selected patients were admitted to the Department of Obstetrics and Gynecology of the referred healthcare units. Admitted patients were consulted directly and through their attendants to collect data on their sociodemographic variables such as age, family history, economic status, educational level, physical activity, any type of social support, and obstetric history including signs and symptoms, number of pregnancies, and other complications. Blood pressure, urine test, and Doppler ultrasounds were performed at local centers in the presence of specialists and technicians for the purpose of disease diagnosis. Further testing was performed, including a complete hemogram, coagulation profile, renal and liver function tests, and a 24-hour proteinuria test. The same protocol was followed for obstetric management at all healthcare units. The details of labor pertaining to whether it was induced or spontaneous along with the mode of delivery were recorded. Maternal complications before and after delivery were observed in detail along with neonatal complications. Patients with severe cases, multiple pregnancies, cardiac disease, kidney failure, and neurological disorders were excluded from the study. Ethical approval (Individual Consent Letter with reference number ICL-111) from concerned departments was obtained as well as informed oral consent from the participants to share their data for research purposes. At the end of the study, the results were compiled and analyzed.

Results
A total of 52 out of 600 patients were observed to have hypertension during pregnancy; of these, 32.69% were preeclampsia cases. A total of 90 preeclampsia cases were observed among 2,800 patients visiting the Obstetrics and Gynecology departments of the concerned hospitals. Family history, chronic hypertension, gestational diabetes, and patient age were analyzed as associated risk factors for hypertensive patients (Tables 1-2).

| Variable          | N   | %   |
|-------------------|-----|-----|
| Gestational Hyper| 21  | 40.38 |
| Chronic Hyperten | 9   | 17.3 |
| Preeclampsia      | 17  | 32.69 |
| Eclampsia         | 5   | 9.6  |
| Gestational Diab  |     |      |

TABLE 1: Association between hypertensive disorders and diabetes among pregnant women (n=52)

| Factors          | N   | %   |
|------------------|-----|-----|
| Age (years)      |     |     |
| <20              | 6   | 11.5 |
| 20-30            | 28  | 53.8 |
| 31-40            | 13  | 25   |
| >40              | 5   | 9.6  |
| Educational status|    |     |
| Primary          | 18  | 34.6 |
| Secondary        | 25  | 48.07 |
| Above secondary  | 9   | 17.3 |
| Family history   |     |     |
| Yes              | 14  | 26.92 |
| No               | 38  | 73.07 |

TABLE 2: Sociodemographic characteristics of patients with hypertension (n=52)

| Factors                     | N   | %   |
|-----------------------------|-----|-----|
| Patient’s blood pressure at the time of diagnosis (mmHg) |     |     |
| ≤140/90                     | 19  | 36.54 |
| >140/90-160/110             | 27  | 51.9 |
| ≥160/110                    | 5   | 9.6  |
| Patient’s pulse at the time of diagnosis (bpm) |     |     |
| ≤86                         | 7   | 13.46 |
| >86-90                      | 13  | 25   |
| 91-98                       | 23  | 44.23 |
| ≥98                         | 9   | 17.3 |
| Proteinuria                 |     |     |
| Yes                         | 22  | 40.38 |
| No                          | 30  | 59.6 |

TABLE 3: Hypertensive clinical features among pregnant women (n=52)
patients were further investigated for sociodemographic characteristics, clinical features, and maternal and neonatal outcomes. The predominant age group was ≤24 years, and more than half of the subjects (62.2%) were from urban areas. A high percentage of middle-(n=42, 46.7%) and low-income (n=40, 44.4%) patients were observed to have preeclampsia as compared to patients of high economic status (n=8, 8.89%). In this study, 35 (36.47%) women had a family history of preeclampsia. Severe preeclampsia was diagnosed in 20 (22.23%) patients, and 52 (55.56%) had mild stage while 38 (42.22%) subjects were at the normal stage of preeclampsia (Tables 4–5).

| Factors                          | N  | %   |
|---------------------------------|----|-----|
| Age (years)                     |    |     |
| ≤24                             | 30 | 33.3|
| 25-29                           | 26 | 28.9|
| 30-34                           | 14 | 15.5|
| ≥35                             | 20 | 22.2|
| Residence                       |    |     |
| Rural                           | 34 | 37.8|
| Urban                           | 56 | 62.2|
| Economic status                 |    |     |
| High                            | 8  | 8.9 |
| Middle                          | 42 | 46.7|
| Low                             | 40 | 44.4|
| Family history of preeclampsia  |    |     |
| Yes                             | 33 | 36.67|
| No                              | 57 | 63.33|
| Stages of disease               |    |     |
| Normal                          | 38 | 42.23|
| Mild                            | 32 | 35.56|
| Severe                          | 20 | 22.23|

**TABLE 4:** Sociodemographic characteristics of participants with preeclampsia (n=90)

| Variable                        | N  | %   |
|---------------------------------|----|-----|
| Patient's educational status    |    |     |
| Primary                         | 29 | 32.2|
| Secondary                       | 44 | 48.9|
| Above secondary                 | 17 | 19.9|
| Patient's occupational status   |    |     |
| Housewife                       | 47 | 52.3|
| Private teacher                 | 16 | 17.8|
| Government employee             | 6  | 6.7 |
| Laborer                         | 12 | 13.3|
| Saleswoman                      | 4  | 4.4 |
| Nurse                           | 2  | 2.2 |
| Banker                          | 3  | 3.33|
| Husband's educational status    |    |     |
| Primary                         | 37 | 41.11|
| Secondary                       | 32 | 35.6|
| Above secondary                 | 21 | 23.4|
| Husband's occupational status   |    |     |
| Laborer                         | 29 | 32.3|
| Farmer                          | 8  | 8.9 |
| Private job                     | 34 | 37.8|
| Government job                  | 15 | 16.7|
| Businesswoman                   | 4  | 4.4 |

**TABLE 5:** Demographic characteristics of preeclamptic patients (n=90)

Most of the respondents (n=44, 48.9%) had received at least a secondary level of education (excluding those with only primary levels). A high number of the patients (n=47, 52.3%) were housewives whereas the life partners of a high number of patients (n=34, 37.8) had private jobs; among the life partners of patients, 41.11% (n=37) had only a primary level educational (Table 5) while 32 had received a secondary-level education.

In this study, 14 (15.5%) of the preeclamptic subjects were diabetic, 10 (11.1%) were diagnosed with anemia, and obesity was observed in six (6.7%) women. Eight (8.9%) patients had hypocalcemic-complicated pregnancies, four (4.5%) were anemic, and three (3.3%) subjects had hypertension. Among the remaining patients, five (5.55%) had hyperlactemia at the time of diagnosis. Two women (2.22%) had a hernia, and nine (10.1%) had multiple complications (preeclampsia with diabetes and anemia, preeclampsia with anemia and hypocalcemia, preeclampsia with diabetes, hernia, and anemia) whereas 28 (31.1%) had preeclampsia without other comorbidities (Table 5).
The predominant clinical features among the participants were elevated blood pressure, pulse, and proteinuria levels. Forty-six (51.1%) participants had systolic/diastolic blood pressure of less than or equal to 140/90 mmHg; whereas 38 (42.3%) women had a blood pressure of more than 140/90 mmHg; there were six (6.7%) severely hypertensive patients. About 30 (33.3%) subjects had abnormal pulse rates ranging from 91 to 98; 22 patients (24.5%) had a history of abdominal surgery, with higher chances of premature birth. Seven (7.8%) women had a history of abortion, while 15 (16.6%) women had a history of kidney disease, which is a risk factor for preeclampsia. The majority of the patients (n=52, 57.8%) had more than 0.3-3 g/L protein levels in the urine based on 24-hour urine testing (Table 7).

TABLE 6: Prevalence of multiple disorders among preeclamptic women (n=90)

| Variable              | N   | %    |
|-----------------------|-----|------|
| Preeclamptic only     | 28  | 31.1 |
| Diabetes              | 14  | 15.5 |
| Anemia                | 10  | 11.1 |
| Obesity               | 6   | 6.7  |
| Hypocalcemia          | 8   | 8.9  |
| Arrhythmia            | 3   | 3.3  |
| Asthma                | 4   | 4.5  |
| Thrombocytopenia      | 1   | 1.1  |
| Hypertension          | 5   | 5.5  |
| Hernia                | 2   | 2.2  |
| Multiple comorbidities| 9   | 10.0 |

TABLE 7: Clinical features related to preeclampsia among pregnant women (n=90)

| Variables                          | N   | %    |
|------------------------------------|-----|------|
| Patient’s blood pressure at the time of diagnosis (mmHg) |     |
| ≤140/90                            | 46  | 51.1 |
| >140/90-160/110                     | 38  | 42.3 |
| ≥160/110                           | 6   | 6.7  |
| Patient’s pulse at the time of diagnosis (bpm) |     |
| ≤86                                | 23  | 25.6 |
| >86-90                             | 20  | 22.3 |
| 91-98                              | 30  | 33.3 |
| >98                                | 17  | 18.9 |
| Gestational diabetes               |     |
| Yes                                | 35  | 38.9 |
| No                                 | 55  | 61.1 |
| Abdominal surgery history          |     |
| Yes                                | 22  | 24.5 |
| No                                 | 68  | 75.6 |
| Abortion history                   |     |
| Yes                                | 7   | 7.8  |
| No                                 | 83  | 92.2 |
| Kidney disease history             |     |
| Yes                                | 13  | 14.5 |
| No                                 | 77  | 85.5 |
| Proteinuria (g/24h)                |     |
| <0.3 g/L                           | 52  | 57.8 |
| <1.0 g/L                           | 38  | 42.2 |

No maternal mortality was observed in this study. Maternal outcomes like mode of delivery and clinical complications like pulmonary and renal diseases leading to admissions to ICU were reported. It was observed that most of the women (n=57, 63.4%) had cesarean deliveries as compared to vaginal (n=33, 36.7%). Fifty-six (62.2%) patients fully recovered without any severe outcomes after delivery, 12 (13.3%) patients had low HB levels and seven (7.8%) had kidney infections. Pulmonary edema was reported in six (6.6%) patients. Four (4.4%) patients faced seizure conditions and were hence admitted to ICU for closer observation (Table 7).

In the present study, it was observed that 41 (45.6%) births were premature, and 19 (21.1%) of these preterm babies were delivered between 34 and <37 weeks. Six (6.7%) of the babies had extremely premature births. There were 10 (11.1%) neonatal deaths, and four (4.4%) of these deaths were due to low birth weight. Among the total 90 births, 46 (51.1%) had normal birth weights, ranging from 2.5 kg to 4 kg. Among the 80 babies who survived, 52 (55.6%) had breathing problems, eight (8.8%) were growth-retarded, and 12 (13.3%) were mentally abnormal (Table 8).
TABLE 8: Maternal outcomes among the study respondents (n=90)

| Variables               | N  | %   |
|-------------------------|----|-----|
| Mode of delivery        |    |     |
| Cesarean                | 57 | 63.4|
| Vaginal                 | 33 | 36.7|
| Maternal death          | 0  | 0.0 |
| Complications           |    |     |
| Kidney infection        | 7  | 7.8 |
| Admission in ICU        | 4  | 4.4 |
| Pulmonary edema         | 6  | 6.6 |
| Low Hb levels           | 17 | 18.9|
| Fully recovered         | 56 | 62.2|

TABLE 9: Fetal outcomes of preeclampsia among pregnant women (n=90)

Data comparison revealed that elevated blood pressure increased the chances of cesarean deliveries and premature birth rates. High blood pressure had a great impact on the mode of delivery: all six (6.6%) patients with ≥160 mmHg systolic and 110 mmHg diastolic blood pressure had cesarean deliveries; 27 (30%) patients with greater than 140/90 mmHg to 160/110 mmHg blood pressure had cesareans. However, 22 (24.5%) of women who had vaginal deliveries had ≤140 mmHg systolic and 90 mmHg diastolic values (Table 11).

| Variables              | N  | %   | N  | %   |
|------------------------|----|-----|----|-----|
| Patient’s blood pressure at the time of diagnosis (mmHg) | Cesarean | Cesarean | Vaginal | Vaginal |
| ≤140/90 (n=46)         | 24 | 52.17| 22 | 47.83|
| >140/90-160/110 (n=38) | 27 | 71.05| 11 | 28.95|
| ≥160/110 (n=6)         | 6  | 100  | 0  | 0.0 |

TABLE 10: Association between mode of delivery and maternal blood pressure levels (n=90)

High blood pressure levels also had an effect on premature birth rates. A total of 61 premature births were documented in this study. Among these, 12 (15.3%) of newborns had preterm births due to the mother’s blood pressure being ≤140/90 mmHg, and mothers of 23 (28.8%) premature babies had a mild blood pressure of 140/90 mmHg to 160/90 mmHg. However, all women with extremely high blood pressure levels (≥160/90 mmHg) had premature births (n=6, 4.4%) (Table 11).
Discussion
This two-year study was conducted at three healthcare units in the Multan district. This study focused on finding incidences and complications linked with preeclampsia and their effect on maternal and fetal mortality rates. Due to hypertensive disorders during pregnancy, there are high incidences of maternal and fetal mortality in Pakistan. In developing countries, the estimated rate of preeclampsia is 1.8–1.67%. In the current study, it was much lower than the peak value (7%) and also much lesser than that found in another study conducted in Pakistan. In the Multan district, where it was 5% [10]. A study conducted in Okha, Bangladesh showed a 1% incidence with less incidence in the rural areas (0.1%) compared to urban areas (7%), which slightly contrasts with the present study. The present study revealed a 37.0% incidence in rural areas and 62.2% in urban areas [15]. In a study conducted in Ethiopia, 12.4% of the patients were pre-eclamptic. In contrast to the present study, they included only those cases who were older than 35 years (more likely to have preeclampsia because of lack of a good diet, awareness, and low economic status). Moreover, in the present study, the predominant age group was 25–29 years, which is in line with the findings by Mou et al. [15] and also comparable with the studies conducted by Soomro et al. [14], Belay and Wudad [16], Wasse and Aremu [17], Ugwu et al. [18], and Belay and Shagb [19].

In the current study, 36.67% of women had a family history of preeclampsia. A study conducted based on the National Health Insurance Database of Taiwan in 2015 found that 12.1% of the cases had a family history of preeclampsia, and these women were also at great risk for hypertension [5]. The obstetric characteristics (diabetes mellitus) of the respondents were similar to the study conducted by Belay and Wudad [15].

It has been observed that maternal and fetal outcomes are linked to risk factors associated with preeclampsia. Elevated systolic and diastolic values also affect prenatal birth and mode of delivery. Severe neurological and maternal complications are related to the onset and severity of disease including cases to varying numbers of maternal and neonatal death rates as reported in various studies. A study conducted in 2021 by Wasse and Aremu on eclampsia outcomes reported three maternal deaths [14]. This result was almost comparable to that in the study conducted in Lagos, Nigeria, which reported seven maternal deaths [15] and less comparable with those studies where 8% and 10% of maternal deaths were reported [13, 16]. In contrast to these two studies but similar to the Nigerian study, we found no maternal deaths in our study, which may be attributed to the fact that the disease was diagnosed on time and quick treatment was initiated in our cohort.

During the study period, various maternal complications were reported, including renal infection, pneumonia, and respiratory problems, with a zero death rate, which is comparable to the study performed in western Kenya. In the present study, cesarean cases were higher (approximately 65.4%) due to complications during pregnancy induced by preeclampsia, while vaginal deliveries amounted to 34.6%, which is comparable to the above-mentioned study, which also reported a high proportion of pregnancies (more than two-thirds) resulting in cesarean sections. These authors also reported 8.4% of fetal deaths associated with severe complications, which is similar to our findings; we noted that 11.1% of neonatal deaths were due to respiratory distress syndrome, low birth weight, and other related complications [17]. In a study conducted at the El-Shatby Maternity University Hospital in Alexandria, it was concluded that 4.4% of the babies had low birth weights, and this aligns with the findings of the present study in which 4.4% of the babies had low birth weights [18].

The current study has some limitations. Primarily, our findings cannot be generalized to the whole population as in this case, we had a hospital-based study with a limited number of patients. Two different cohorts of populations were used for assessing preeclampsia and hypertensive disorders incidence with a much lower number for the latter one, which was conducted as a supplemental work. Moreover, the present observational design could not provide deeper insights as to which type, how much, and in what extent an educational intervention would help in knowledge improvement regarding preeclampsia or reduce adverse clinical outcomes. Furthermore, more research work in the current field is required to estimate the potential maternal-neonatal benefits of improved dietary intake and home-monitoring interventions for pre- and post-delivery preeclampsia management.

For data collection, two different questionnaires were designed for the two conditions (hypertension and preeclampsia) by reviewing past work with related research objectives. The questionnaires were investigated/administration approved and used for data collection from enrolled participants. The information collected included patient history, sociodemographic characteristics, and clinical characteristics with maternal and neonatal complications/outcome details (see Appendices).

Conclusions
In the current study, the incidence of preeclampsia was relatively low. Based on our findings, family history, maternal age, economic status, low education level, severe anemia, chronic hypertension, and gestational diabetes were the major factors associated with disease onset and severity. A high number of cesarean cases were reported in this study, and 41 (45.6%) deliveries were premature. During the study period, no maternal complications were reported.

### Table 11: Association of premature birth rate (n=41) with maternal blood pressure levels

| Blood pressure level | Urban study (%) | Rural study (%) |
|----------------------|-----------------|-----------------|
| 140/90               | 12              | 26.06           |
| 160/110              | 6               | 100             |

### Table 12: A comparison of sociodemographic characteristics of preeclamptic women among various studies

| Factors                    | Present study | Soomro et al. [14] | Mou et al. [15] | Ugwu et al. [18] |
|---------------------------|---------------|--------------------|-----------------|------------------|
| Preeclampsia percentage   | 3%            | 5%                 | 14.4%           | 3.3%             |
| Rural residence           | 37.6%         | Rural study        | 26.1%           | Rural study      |
| Urban residence           | 62.4%         | 73%                | 73%             | Urban study      |
| Age group                 | 20–28 years   | 20–28 years        | <5 years        | 20–28 years      |
| Educational level         | Secondary (69.0%) | Uneducated (63.3%) | Secondary (37.7%) | Secondary (67.6%) |
| Occupation (housewife)    | 52.3%         | 98.3%              |                  |                  |
| Maternal mortality        | 0%            |                    |                  |                  |
| Neonatal mortality        | 11.1%         |                    |                  |                  |

Educational level, occupation, and economic standards affect the rise of preeclampsia cases [16, 17]. A study held at the Gandhi Memorial Hospital in Ethiopia concluded that preeclampsia was associated with sociodemographic characteristics such as gestational weeks, age, and economic status [16]. In the present study, 52.2% of patients were housewives by occupation, and this was lower (%) than the findings in the study at the El-Shatby Maternity University Hospital in Alexandria where 53.0% of women were housewives [15]. A much higher figure was observed in Mou et al. in 2021 [15], which is in line with the present study, 56.67% of women had a family history of preeclampsia. A study conducted based on the National Health Insurance Database of Taiwan in 2015 found that 12.1% of the cases had a family history of preeclampsia, and these women were also at great risk for hypertension [5]. The obstetric characteristics (diabetes mellitus) of the respondents were similar to the study conducted by Belay and Wudad [15].

It has been observed that maternal and fetal outcomes are linked to risk factors associated with preeclampsia. Elevated systolic and diastolic values also affect prenatal birth and mode of delivery. Severe neurological and maternal complications are related to the onset and severity of disease including cases to varying numbers of maternal and neonatal death rates as reported in various studies. A study conducted in 2021 by Wasse and Aremu on eclampsia outcomes reported three maternal deaths [14]. This result was almost comparable to that in the study conducted in Lagos, Nigeria, which reported seven maternal deaths [15] and less comparable with those studies where 8% and 10% of maternal deaths were reported [13, 16]. In contrast to these two studies but similar to the Nigerian study, we found no maternal deaths in our study, which may be attributed to the fact that the disease was diagnosed on time and quick treatment was initiated in our cohort.

During the study period, various maternal complications were reported, including renal infection, pneumonia, and respiratory problems, with a zero death rate, which is comparable to the study performed in western Kenya. In the present study, cesarean cases were higher (approximately 65.4%) due to complications during pregnancy induced by preeclampsia, while vaginal deliveries amounted to 34.6%, which is comparable to the above-mentioned study, which also reported a high proportion of pregnancies (more than two-thirds) resulting in cesarean sections. These authors also reported 8.4% of fetal deaths associated with severe complications, which is similar to our findings; we noted that 11.1% of neonatal deaths were due to respiratory distress syndrome, low birth weight, and other related complications [17]. In a study conducted at the El-Shatby Maternity University Hospital in Alexandria, it was concluded that 4.4% of the babies had low birth weights, and this aligns with the findings of the present study in which 4.4% of the babies had low birth weights [18].

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Conclusions
In the current study, the incidence of preeclampsia was relatively low. Based on our findings, family history, maternal age, economic status, low education level, severe anemia, chronic hypertension, and gestational diabetes were the major factors associated with disease onset and severity. A high number of cesarean cases were reported in this study, and 41 (45.6%) deliveries were premature. During the study period, no maternal complications were reported.
death was observed, although there was a fetal mortality rate of 11.1% as well as major complications like low birth weight, growth restriction, and respiratory tract syndrome. Maternal and fetal outcomes were highly related to elevated blood pressure levels.

Appendices

Preeclampsia study sample proforma

Concerned hospital: …………………………………………………………………………..

Date:  --------------                Proforma serial no: …………

Patient’s oral consent:
(Oral permission for ethical purposes)

Statement:
Before the beginning of the study, an informed oral consent should be taken from the women after explaining the aims of the study and its phases. The participants should be assured of the confidentiality of their personal information.

Personal Details:                                      Clinical features:

Date of 1st visit:
1. District/city/Teh.:  …………………………  BP:                     Pulse
2. Residency:                                                    2nd visit:
   Rural/Urban                                                    BP:                     Pulse
3. Age:       …………………..                                                3rd visit:
4. Pregnancy week: …………………………….                                                BP:                     Pulse
5. Education Level:
   Primary/Middle/secondary school level/Above
6. Occupation:
   Housewife/Private Job/Govt. Job
7. Husband education level:
   Primary/Middle/secondary school level/Above
8. Husband Job:
   Labour/Private Job/Govt. Job
9. Per month family earning:  (value in Rs)
10. Economic level:
    High (> 50K) _________
    Middle (20 to 50K) _______
    Low (< 20K) _________
11. Pregnancy:
    1st/2nd/3rd/other
12. Siblings no:
13. Diabetes:             Yes/No                      Type:…………………………………………
14. Chronic hypertension:     Yes    No
15. Any cardiac disease:         Yes    No
   One          multiple          (mention all)
16. Any surgery in past:          Yes    No
   Abdominal           cardiac             other
17. Any other disease:
18. Proteinuria report:  add value

Maternal and neonatal outcomes
19. Type of delivery:
   Normal               cesarean               preterm               full term
20. In case of preterm’ gestational week:   ……………………………
21. Maternal complication/s after delivery:……………………………………
22. Neonatal complication/s:…………………………………………………………
   Fetal/birth weight (gms)
23. NICU admission:                   Yes           No   (specify)
24. NICU admission reason: 1.                      ……………………………………………………………………………………………………………………………
    2.
25. Neonatal death:  Yes  No
Reason: 

26. Maternal death:  Yes  No
Reason: 

27. Any other significant activity:

**Hypertension and preeclampsia (data collection proforma)**

Concerned hospital: 

Date:  -

Patient’s oral consent:

(Oral permission for ethical purposes)

Statement:

Before the beginning of the study, an informed oral consent should be taken from the women after explaining the aims of the study. The participants should be assured of the confidentiality of their personal information.

**Personal Details:**

| Date of 1st visit: | BP: |
|-------------------|-----|
| 1. District/city/Teh.: | 
| 2. Residency: Rural/Urban | 
| 3. Age: | 
| 4. Pregnancy week: | 
| 5. Education Level: Primary/Middle/Secondary school level/Above | 
| 6. Occupation: Housewife/Private Job/Govt. Job | 
| 7. Husband education level: Primary/Middle/Secondary school level/Above | 
| 8. Husband Job: Labour/Private Job/Govt. Job | 
| 9. Economic level: Low/middle/high | 
| 10. Per month family earning: (value in Rs) | 
| 11. Pregnancy: 1st/2nd/3rd/other | 
| 12. Siblings no: | 
| 13. Diabetes: Yes/No | 
| 14. Chronic hypertension: Yes/No | 
| 15. Any cardiac disease: Yes/No | 
| 16. Any surgery in past: Yes/No | 
| 17. Any other disease: | 
| 18. Proteinuria report: | 
| 19. Any other significant activity: | 
| 20. Additional Information | 

**Disclosures**

*Human subjects:* Consent was obtained or waived by all participants in this study. Individual Consent Letter from Concerned Departments issued approved ICL-111. *Animal subjects:* All authors have confirmed that this study did not involve animal subjects or tissue. *Conflicts of interest:* In compliance with the ICMJE uniform disclosure form, all authors declare the following: Payment/services info: All authors have declared that no financial support was received from any organization for the submitted work. *Financial relationships:* All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work. *Other relationships:* All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

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