Journal of Obstetrics, Gynecology and Cancer Research | ISSN: 2476-5848

Clinical Profile of Patients with Preeclampsia and Association of Proteinuria with Pregnancy Adverse Outcomes

Vlora Ademi Ibishi[1,2], Hajrullah Latifi[2,3*], Florinda Drevinja[2]

1. *Department of Obstetrics and Gynecology, Medical Faculty, University of Prishtina "Hasan Prishtina", Prishtina, Kosovo*
2. *Obstetrics and Gynecology Clinic, University Clinical Center of Kosova, Prishtina, Kosovo*
3. *Medical Faculty, University of Gjakova "Fehmi Agani", Kosova*

Article Info

10.24200/jogcr.10.11.869

Received: 2025/06/16
Accepted: 2025/07/30
Published Online: 01 Oct. 2025

Corresponding Information:
Hajrullah Latifi,
Department of Obstetrics and Gynecology, University Clinical Center of Kosova, University of Gjakova, Faculty of Medicine, Kosovo

Email: hajrullah.latifi@hotmail.com

ABSTRACT

Background & Objective: Although recent updates in the definition of preeclampsia have expanded beyond proteinuria, the severity of proteinuria still plays a critical role in clinical decision-making for obstetricians and gynecologists. This study was conducted with aim to evaluate the clinical profile of patients with preeclampsia and analyze the association between the amount of 24-hour proteinuria and pregnancy adverse outcomes.

Materials & Methods: This retrospective study included 86 pregnant women diagnosed with preeclampsia and proteinuria, who were admitted for delivery at the Obstetrics and Gynecology Clinic of the University Clinical Center of Kosovo between January and December 2021. Maternal, clinical, and neonatal data were collected and analyzed. Patients were divided into two groups based on the amount of proteinuria, using a threshold of 2.0 g/24 hours. Adverse outcomes of pregnancy were compared between the two groups. $P<0.05$ was considered statistically significant.

Results: Patients with higher levels of proteinuria (≥2.0 g/24 h) had an earlier onset of preeclampsia, earlier gestational age at hospital admission and at delivery, lower neonatal birth weight, higher rates of intrauterine growth restriction (IUGR) and increased use of magnesium sulfate for seizure prophylaxis ($P<0.01$).

Conclusion: In women with preeclampsia, a 24-hour proteinuria level of ≥2.0 gr is significantly associated with adverse maternal and neonatal outcomes. These include earlier onset of disease, preterm birth, low birthweight, IUGR, and a greater need for anticonvulsant therapy. Quantifying proteinuria remains a valuable tool in the management and risk stratification of preeclamptic pregnancies.

Keywords: Pre-eclampsia, Pregnancy, Proteinuria, Outcome, Newborn, Cesarean section

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1. Introduction

Preeclampsia is a multisystem disorder of pregnancy characterized by new-onset hypertension in previously normotensive women, accompanied by proteinuria or, in its absence, by one or more maternal organ dysfunctions. These may include thrombocytopenia, hepatic impairment, renal insufficiency, pulmonary edema, persistent visual disturbances, or headaches unresponsive to medication **(1)**.

Typically, preeclampsia develops in the second half of pregnancy but can also be superimposed on chronic hypertension **(2)**. According to the American College of Obstetricians and Gynecologists (ACOG) (2013), mild preeclampsia is defined as a systolic blood pressure ≥140 mmHg and/or a diastolic blood pressure ≥90 mmHg on at least two occasions, four hours apart. Severe preeclampsia is defined as a systolic pressure ≥160 mmHg and/or diastolic pressure ≥110 mmHg **(3)**. These updated criteria differ from the traditional definition, which required proteinuria as an essential diagnostic criterion.

Currently, the diagnostic criteria for preeclampsia vary between countries. A World Health Organization (WHO) review of 15 international guidelines highlighted a lack of consensus in defining the condition. In July 2025, WHO initiated a global meeting aimed at developing a unified definition for preeclampsia; however, the results have not yet been published **(4)**.

Preeclampsia poses significant health risks to both mother and fetus, with potential complications arising during pregnancy, delivery, and postpartum period. Globally, the incidence of preeclampsia ranges from 2% to 8%, with rates reaching as high as 16% in

developing countries (5-7). It remains one of the leading causes of maternal and fetal morbidity and mortality. The burden is particularly high in low- and middle-income countries, often due to limited access to preconception care, delayed antenatal visits, late diagnosis, and inadequate treatment (8-10).

In Kosovo, hypertensive disorders of pregnancy alongside postpartum hemorrhage and infections are among the main three causes of maternal and perinatal morbidity and mortality (11). The Ministry of Health of Kosovo published an evidence-based clinical guideline in 2018 "titled Management of Severe Preeclampsia and Eclampsia", which outlines recommended protocols for care. Despite these efforts, there remains a scarcity of research specific to preeclampsia in the Kosovar population. Recent studies have primarily focused on hypertensive complications in IVF pregnancies and identifying predictive factors for preeclampsia (12,13). Therefore, this study was conducted with aim to evaluate the clinical profile of patients with preeclampsia and analyze the association between the amount of 24-hour proteinuria and pregnancy adverse outcomes.

2. Materials and Methods

This retrospective study was conducted at the Obstetrics and Gynecology Clinic of the University Clinical Center of Kosovo, a tertiary referral center with approximately 9,000 deliveries annually. Medical records of 86 pregnant women diagnosed with preeclampsia and proteinuria with gestational age ≥24 weeks, admitted and delivered between January 2021 and December 2021, were reviewed.

Inclusion criteria were pregnant women with new-onset hypertension (systolic ≥140 mmHg and/or diastolic ≥90 mmHg) and presence of proteinuria confirmed by a 24-hour urine collection. Exclusion criteria were chronic hypertension or onset of hypertension before 20 weeks of gestation, pre-existing renal disease, confirmed fetal death at admission, absence of 24-hour proteinuria analysis. Maternal, clinical, and neonatal data were collected for evaluation.

Maternal data included: age, parity and body mass index (BMI). Clinical data included: gestational age at admission, blood pressure during hospitalization liver function tests (AST and ALT elevation), platelet count (<100,000/μL considered low), 24-hour urine protein level, administration of antihypertensive and anticonvulsant therapy, mode of delivery and indication for cesarean section and duration of hospitalization.

Maternal Adverse Outcomes Recorded Were

Placental abruption, eclamptic seizures, renal failure and respiratory failure.

Perinatal Adverse Outcomes Included

preterm birth (<37 weeks), gestational age at birth, birth weight, intrauterine growth restriction (IUGR)-defined as estimated fetal weight or actual birth weight below the 10th percentile, Apgar scores at 1 and 5 minutes and fetal death.

Participants were categorized into two groups based on the amount of 24-hour proteinuria:

Group 1: Low proteinuria <2.0 g/24 h (n=57)

Group 2: High proteinuria ≥2.0 g/24 h (n=29)

Data were presented as Means±Standard deviation (SD) or percentages. Comparative analyses between the two groups were performed using Student's t-test for continuous variables and Chi-square test for categorical variables. Correlations were assessed using Pearson's correlation coefficient. To evaluate the association between proteinuria severity and adverse maternal and neonatal outcomes, a multivariable logistic regression analysis was conducted. A binary proteinuria variable (≥2.0 g/24 h vs. <2.0 g/24 h) was used as the main predictor. Separate regression models were constructed for outcomes including preterm birth (<37 weeks), low birth weight (<2500 g), IUGR, and administration of magnesium sulfate. All models were adjusted for maternal age and gestational age at birth. Adjusted Odds Ratios (aORs) with 95% Confidence Intervals (CIs) were reported. P<0.05 was considered statistically significant.

3. Results

Maternal demographic characteristics are summarized in Table 1. Among the total of 86 patients, the mean maternal age was 34 years, with 47.6% classified as advanced maternal age (≥35 years). The majority of women (65.1%, n=56) were nulliparous, and the mean Body Mass Index (BMI) was 29.0±5.1 kg/m². No statistically significant differences were observed in maternal characteristics when comparing patients with low versus high proteinuria levels (Table 1).

The clinical profile and pregnancy management of the preeclamptic patients are presented in Table 2. Of the 86 patients, 61.6% (n=53) were admitted at or beyond 34 weeks of gestation. The mean systolic and diastolic blood pressures were 164.5±15.2 mmHg and 104.0±10.1 mmHg, respectively. Laboratory abnormalities included thrombocytopenia in 7.0% of cases, and elevated liver enzymes defined as a doubling of Aspartate Aminotransferase (AST) and alanine Aminotransferase (ALT) in 20.9% and 18.6% of cases, respectively.

Combined oral antihypertensive therapy was administered in 57.0% of patients, while intravenous antihypertensive agents were used in 29.1%. Anticonvulsant therapy with magnesium sulfate was given in 34.9% of cases. Pregnancy was terminated 34

weeks before gestation in 37.2% of patients. The overall cesarean delivery rate was 97.7%, with maternal indications accounting for 42.9% of procedures, followed by fetal indications (34.5%) and combined feto-maternal indications (22.6%).

The proportion of patients with early-onset preeclampsia (<34 weeks of gestation) was significantly higher in the high proteinuria group compared to the low proteinuria group (58.6% vs. 28.1%, P<0.05). Similarly, early preterm birth (<34 weeks of gestation) was more frequent in the high proteinuria group (51.7% vs. 29.8%, P<0.05).

There were no significant differences between the two groups regarding the route (oral vs. intravenous) or regimen (monotherapy vs. combination therapy) of antihypertensive treatment. However, using magnesium sulfate was significantly more common in the high proteinuria group compared to the low proteinuria group (58.6% vs. 22.8%, P<0.05) (Table 2).

Maternal adverse outcomes by proteinuria severity are presented in Table 3. While the overall cesarean section rate was approximately 37% of 9,000 annual deliveries, the cesarean delivery rates among preeclamptic patients in this study were notably higher: 98.2% in the low proteinuria group and 96.6% in the high proteinuria group.

The most frequently observed maternal adverse outcomes in both groups were placental abruption (15.8% in the low proteinuria group vs. 13.8% in the high proteinuria group), followed by eclamptic seizures (8.8% vs. 10.3%, respectively). Kidney failure occurred in 3.4% of patients in the high proteinuria group, while respiratory failure was noted in 1.8% of patients in the low proteinuria group.

The overall mean duration of hospitalization was 14.8±12.5 days, with an average stay of 12.9±12.8 days in the low proteinuria group compared to 18.3±11.3 days in the high proteinuria group (Table 3).

The association between proteinuria severity and adverse perinatal outcomes is summarized in Table 4. Statistically significant differences were observed between the low and high proteinuria groups regarding birthweight, intrauterine growth restriction (IUGR), and preterm birth.

The mean birthweight was significantly lower in the high proteinuria group compared to the low proteinuria group (1,728.0±615.5 g vs. 2,488.9±867.2 g, P<0.05). The prevalence of IUGR was significantly higher in the high proteinuria group (69.0% vs. 28.1%, P<0.05). Similarly, the rate of preterm birth was markedly greater in patients with high proteinuria compared to those with low proteinuria (58.6% vs. 33.3%, P<0.05).

A total of four fetal deaths were recorded, with two occurring in each proteinuria group.

Multivariable logistic regression analysis, adjusted for maternal age and gestational age at delivery, revealed that high proteinuria was significantly associated with increased odds of adverse outcomes (Table 5). Specifically, high proteinuria was associated with significantly higher likehood of low birthweight (adjusted odds ratio [aOR]=6.2,95% CI:1.4-28.3, P=0.019), intrauterine growth restriction (IUGR) (aOR=4.2, 95% CI: 1.5-11.8, P=0.006), and administration of magnesium sulfate (MgSO4) (aOR=3.8, 95% CI: 1.3-10.9, P=0.015).

Although the rate of preterm birth was higher in the high proteinuria group (59.0%, 17/29) compared to the low proteinuria group (33.3%, 19/57), however, the difference was not significant that may be attributed to the limited number of term births in the high proteinuria group (12/29). Nevertheless, the direction of the effect (aOR=1.7) suggests a trend toward increased odds of preterm birth associated with higher proteinuria levels.

Table 1. Maternal characteristics stratified by proteinuria severity

*Mean±SD; n, (%), **Student t-test; Fisher's exact test; Pearson's Chi-squared test

ariable		Overall sample (n=86)1		Severity of proteinuria				P-value**
				Low proteinuria <2.0 g/24h (n=57)*		High proteinuria ≥2.0 g/24h (n=29)*		
Maternal age (mean±SD)		34.5±6.07		53.21±6.90		33.70±5.08		P=0.29
Parity (n, %)	Multiparous	30	34.9	17	29.8	13	44.8	P=0.168
	Nulliparous	56	65.1	40	70.2	16	55.2	
BMI (n, %)	Healthy	12	14.0	9	15.8	3	10.3	P=0.51
	Obese	29	33.7	17	29.8	12	41.4	
	Overweight	45	52.3	31	54.4	14	48.3	
Maternal BMI (mean±SD)		29.0±5.1		28.9±5.5		29.2±4.2		

Table 2. Clinical profile and pregnancy management stratified by proteinuria severity

Variable		Overall sample (n=86)[1]		Severity of proteinuria				P-value**
				Low proteinuria <2.0 g/24h (n=57)*		High proteinuria ≥2.0 g/24h (n=29)*		
SBP (mean±SD)		164.5±15.2		162.8±15.4		167.9±14.5		
DBP (mean±SD)		104.0±10.1		102.9±9.9		106.0±10.3		
Elevated AST (n, %)		18	20.9	12	21.1	6	20.7	P=0.968
Elevated ALT (n, %)		16	18.6	11	19.3	5	17.2	P=0.816
IV Antihypertensives (n, %)		25	29.1	14	24.6	11	37.9	P=0.196
MgSO4 Admission (n, %)		30	34.9	13	22.8	17	58.6	P=0.000986
Thrombocytopenia <150×109/L (n, %)		6	7.0	3	5.3	3	10.3	P=0.381
Oral antihypertensives (n, %)	Single agent	37	43.0	26	45.6	11	37.9	P=0.49
	Combined	49	57.0	31	54.4	18	62.1	
Gestational week at admission (n, %)	<34 weeks	33	38.4	16	28.1	17	58.6	P=0.0058
	≥34 weeks	53	61.6	41	71.9	12	41.4	
Gestational week at birth (n, %)	<34 weeks	32	37.2	17	29.8	15	51.7	P=0.024
	34-36 weeks+6 days	30	34.9	19	33.3	11	37.9	
	≥ 37 weeks	24	27.9	21	36.8	3	10.3	
Delivery mode (n, %)	C-section	84	97.7	56	98.2	28	96.6	P=0.62
	Vaginal	2	2.3	1	1.8	1	3.4	
Cesarean Section Indication (n, %)	Maternal	36	42.9	28	50.0	8	28.6	P=0.08458
	Fetal	29	34.5	15	26.8	14	50.0	
	Fetomaternal	19	22.6	13	23.2	6	21.4	

*Mean±SD; n, (%), **Student t-test; Fisher's exact test; Pearson's Chi-squared test

Table 3. Maternal adverse outcomes stratified by proteinuria severity

Variable	Overall sample (n=86)*		Severity of Proteinuria			
			Low proteinuria <2.0 g/24h (n=57)*		High proteinuria ≥2.0 g/24h (n=29)*	
Duration of hospital stay (mean±SD)	14.8±12.5		12.9±12.8		18.3±11.3	
Cesarean section (n, %)	84	97.7	56	98.2	28	96.6
Placental abruption (n, %)	13	15.1	9	15.8	4	13.8
Eclamptic seizures (n, %)	8	9.3	5	8.8	3	10.3
Kidney failure (n, %)	1	1.2	0	0.0	1	3.4
Respiratory failure (n, %)	1	1.2	1	1.8	0	0.0

*Mean±SD; n, (%)

Table 4. Perinatal adverse outcomes stratified by proteinuria severity

Variable		Severity of proteinuria						P-value[2]
		Overall sample (n=86)[1]		Low proteinuria<2.0 g/24h (n=57)[1]		High proteinuria ≥2.0 g/24h (n=29)[1]		
1st minute Apgar Score (mean±SD)		5.9±2.0		6.1±2.3		5.7±1.3		P=0.388
5th minute Apgar Score (mean±SD)		7.06±2.06		7.14±2.41		6.9±1.11		P=0.612
Newborn birth weight (mean±SD)		2,232.4±866.8		2,488.9±867.2		1,728.0±615.5		
Birth weight (n, %)	<1,500 g	19	22.1	10	17.5	9	31	P=0.0001
	<2,500-1,500 g	33	38.4	17	29.8	16	55.2	
	>2,500 g	34	39.5	30	52.6	4	13.8	
IUGR (n, %)		36	41.9	16	28.1	20	69	P=0.00027
Premature birth (n, %)		36	41.9	19	33.3	17	58.6	P=0.043

*Mean ± SD; n, (%), **Student t-test; Fisher's exact test; Pearson's Chi-square test

Table 5. Multivariable logistic regression of adverse outcomes associated with high proteinuria

Proteinuria severity	Outcome	Adjusted OR (aOR)	CI 95%	P-value
High proteinuria ≥2.0 g/24h	Premature birth (<37 gestational week)	1.7	0.0-∞	1.000
	Low birthweight	6.2	1.4-28.3	0.019
	IUGR	4.2	1.5-11.8	0.006
	Administration of MgSO4	3.8	1.3-10.9	0.015

4. Discussion

Despite the evolving definition of preeclampsia particularly the removal of proteinuria as a mandatory diagnostic criterion proteinuria continues to be regarded as a critical indicator of disease severity. It plays a significant role in clinical decision-making and management of preeclamptic patients by obstetricians and gynecologists. Numerous studies across various populations have explored the relationship between proteinuria and pregnancy outcomes, with diverse and sometimes conflicting findings **(14,15)**.

The present study is among the first researches which aimed to investigate the association between the amount of proteinuria and pregnancy outcomes in preeclamptic women admitted and delivered at the Obstetrics and Gynecology Clinic in Kosovo. Our findings indicate that preeclamptic women with proteinuria ≥2 g/24 h had significantly worse pregnancy outcomes compared to those with proteinuria <2 g/24 h. These adverse outcomes included earlier disease onset, earlier gestational age at birth, lower neonatal birth weight, increased rates of Intrauterine Growth Restriction (IUGR), and greater use of magnesium sulfate. The mean age of patients was 34 years, with 52.3% under 35 and 47.7% aged ≥35, supporting existing literature showing increased preeclampsia risk with advancing maternal age **(16,17)**. Additionally, 65.1% of the women were nulliparous, and the mean BMI was 28.9±5.5 kg/m^2, with over half classified as overweight. While maternal age, nulliparity, and elevated BMI are recognized risk factors for preeclampsia, statistical analysis did not reveal significant differences in these variables between the low and high proteinuria groups in the present study. Nonetheless, our findings are consistent with studies from other regions identifying these factors as contributors to preeclampsia risk **(15,18)**.

Gestational age at admission is often considered an indicator of disease onset. In our study, 58.6% of women in the high proteinuria group were admitted before 34 weeks, compared to 28% in the low proteinuria group, supporting the hypothesis that higher proteinuria correlates with earlier onset. A similar trend was observed regarding gestational age at delivery. Patients in the high proteinuria group delivered significantly earlier, aligning with findings from Newman et al., who reported that increased proteinuria is associated with earlier admission and delivery **(19)**. Okamoto et al., also demonstrated that proteinuria≥2.2 g/24 h was associated with severe maternal symptoms (e.g., hypertension, headache) and poor neonatal outcomes, including low birthweight and higher NICU admissions **(3)**.

Interestingly, our study did not find a significant association between higher proteinuria levels and maternal complications such as elevated liver enzymes, low platelet counts, or extreme hypertension. This finding is consistent with results from Kim et al., who concluded that the amount of proteinuria is not necessarily predictive of severe maternal complications **(20)**. However, we observed a significantly higher rate of magnesium sulfate administration in the high proteinuria group (58.6% vs. 22.8%). This finding is supported by other studies, which found that preeclamptic women with proteinuria were more likely to receive magnesium sulfate and to deliver earlier with lower birthweight infants **(21,22)**.

The mean duration of hospital stay was also longer in the high proteinuria group, suggesting a more complicated clinical course. The most frequently observed maternal complications were placental abruption, eclamptic seizures, renal failure, and respiratory failure. Cesarean section was recorded in 97.5% of cases although not directly associated with proteinuria levels, this high rate likely reflects combined maternal and fetal indications, including older maternal age and clinical compromise.

Overall, our data support that proteinuria≥2 g/24h is independently associated with adverse fetal outcomes, particularly IUGR, low birthweight, and greater need for anticonvulsant therapy. These findings are consistent with those reported by Rensburg et al., and Hu et al., who also identified high proteinuria as a marker for poor perinatal outcomes **(23,24)**. In our study, the diagnosis of IUGR was made based on ultrasound measurements or birth weight. This does not necessarily mean that any growth restriction was due to placental insufficiency. In order to concretely identify the subset of IUGR of placental etiology, the integration of ultrasound with angiogenic markers such as sFlt-1/PIGFt is recommended **(25)**.

Although preterm birth did not reach statistical significance in multivariable regression (due to perfect prediction), the observed trend reinforces proteinuria's importance as a clinical risk indicator.

A notable limitation of our study is its relatively small sample size, which constrained some of the statistical modeling (e.g., logistic regression for preterm birth). This is a recognized limitation in

retrospective studies, particularly those conducted at single centers.

5. Conclusion

In pregnant women diagnosed with preeclampsia, proteinuria ≥2 g/24 h is significantly associated with adverse outcomes including earlier onset of disease, preterm delivery, lower birthweight, intrauterine growth restriction, and higher rates of magnesium sulfate administration. These findings highlight the ongoing clinical relevance of quantifying proteinuria, even under revised diagnostic criteria. While preeclampsia alone is not an absolute indication for cesarean delivery, the high cesarean rate observed in this study likely reflects the combined impact of maternal and fetal complications as well as advanced maternal age.

6. Declarations

Acknowledgments

The authors would like to express their gratitude to the director and staff of the Obstetrics and Gynecology Clinic at the University Clinical Center of Kosovo for their support throughout this study.

Ethical Considerations

Ethical approval was obtained from the Ethics Committee of the Faculty of Medicine, University of Prishtina "Hasan Prishtina," Kosovo.

Authors' Contributions

V.A.I.: Conceptualization, study design, data collection, literature search, and manuscript writing; H.L.: Study design, statistical analysis, and manuscript editing; F.D.: Literature search, and manuscript writing and editing. All authors have read and agreed to the published version of the manuscript.

Conflict of Interest

The authors declare no conflict of interest.

Fund or Financial Support

The authors declare no financial support or external funding for this study.

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How to Cite This Article:

Ademi Ibishi, V., Latifi, H., Drevinja, F. Clinical Profile of Patients with Preeclampsia and Association of Proteinuria with Pregnancy Adverse Outcomes. J Obstet Gynecol Cancer Res. 2025;10(11):869-75.

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