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PREDICTION OF PREECLAMPSIA DEVELOPMENT USING MODERN APPROACHES AND PREVENTIVE MEASURES IN PREGNANT WOMEN WITH CHRONIC PYELONEPHRITIS

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Abstract. *This article examines modern approaches to predicting the development of preeclampsia and implementing preventive measures in pregnant women with chronic pyelonephritis. The study assessed the clinical significance of maternal blood pressure, urinary protein levels, renal function, recurrent urinary tract infections, and fetal-placental monitoring during pregnancy. The findings indicate that recurrent urinary tract infections, deterioration of renal function, proteinuria, and progressive elevation of blood pressure may be associated with an increased risk of preeclampsia in pregnant women with chronic pyelonephritis. Individual risk stratification and regular antenatal monitoring may contribute to earlier identification of high-risk patients and timely implementation of preventive and therapeutic measures. Continuous assessment of maternal renal status and fetal-placental condition is particularly important for reducing the risk of maternal and perinatal complications. The results support an individualized approach to the management of pregnancy complicated by chronic pyelonephritis and emphasize the importance of early risk assessment and systematic maternal-fetal surveillance.*

Keywords: *Chronic pyelonephritis, pregnancy, preeclampsia, renal function, arterial hypertension.*

Introduction

Chronic pyelonephritis during pregnancy is an important clinical condition that may increase maternal and fetal obstetric risks. Physiological changes occurring in the kidneys and urinary tract during pregnancy, including dilation of the urinary tract, altered urodynamics, and increased renal functional workload, may contribute to reactivation of chronic inflammatory processes. Impaired renal function, changes in blood pressure, and endothelial dysfunction may be associated with an increased risk of hypertensive complications of pregnancy, including preeclampsia. Preeclampsia is one of the major complications of pregnancy and may lead to serious clinical consequences for both the mother and fetus. Therefore, early identification and dynamic assessment of preeclampsia risk in pregnant women with chronic pyelonephritis are of particular clinical importance. Modern predictive approaches are based on comprehensive assessment of clinical history, blood pressure, renal function, urinary protein levels, laboratory parameters, and the maternal–fetal–placental status.

Early identification of risk factors makes it possible to plan preventive measures before the clinical manifestations of preeclampsia become established. Furthermore, stratification of patients into individual risk groups facilitates more intensive pregnancy surveillance and timely selection of an appropriate obstetric management strategy. Therefore, prediction of preeclampsia development using modern clinical and laboratory approaches and the implementation of individualized preventive measures in pregnant women with chronic pyelonephritis represent important scientific and practical priorities in contemporary obstetrics and nephrology.

Relevance

Chronic pyelonephritis during pregnancy is clinically important because maternal renal dysfunction, recurrent urinary tract inflammation, and associated vascular abnormalities may increase the risk of hypertensive pregnancy complications, including preeclampsia. Early identification of women at increased risk is essential for closer antenatal monitoring and timely preventive management. Modern risk assessment combines maternal history, blood pressure, renal function, proteinuria, and relevant laboratory and placental indicators. Therefore, improving prediction of preeclampsia in pregnant women with chronic pyelonephritis may contribute to earlier intervention, reduction of maternal and fetal complications, and better pregnancy outcomes.

Aim

The aim of the study was to evaluate modern clinical and laboratory approaches for predicting the development of preeclampsia in pregnant women with chronic pyelonephritis and to assess the effectiveness of individualized preventive measures.

Main part

During pregnancy, physiological changes in the urinary system increase the functional demands placed on the kidneys. In women with chronic pyelonephritis, these changes may occur against a background of persistent inflammatory and structural renal abnormalities. Reduced renal reserve can affect fluid regulation, vascular function, and maternal blood pressure. These mechanisms may increase susceptibility to hypertensive disorders of pregnancy, including preeclampsia. Renal inflammation may also contribute to endothelial dysfunction through persistent inflammatory and vascular responses. The clinical significance of this relationship becomes greater when chronic pyelonephritis is accompanied by impaired renal function or pre-existing hypertension. Development of preeclampsia may further aggravate maternal renal dysfunction and increase the risk of adverse pregnancy outcomes. Therefore, assessment of renal status should be considered an important component of antenatal care in this population. Blood pressure monitoring, urinary protein assessment, and evaluation of renal function provide essential information for early identification of pathological changes. Clinical symptoms should also be interpreted together with laboratory findings because pre-existing renal disease may complicate the diagnosis of newly developed preeclampsia. Early recognition of increasing renal or vascular abnormalities allows more intensive maternal and fetal surveillance. This approach may improve the timely identification of patients requiring preventive or therapeutic intervention. Thus, the interaction between chronic renal inflammation, impaired renal adaptation, and hypertensive pregnancy disorders has important clinical significance.

Accurate prediction of preeclampsia requires the combined interpretation of maternal risk factors and pregnancy-specific clinical findings. The initial assessment should include previous obstetric history, chronic renal disease, hypertension, maternal age, and other relevant comorbidities. Repeated blood pressure measurements are essential because a single normal result cannot exclude subsequent development of hypertensive complications. Renal function can be monitored through serum creatinine and other appropriate biochemical parameters. Evaluation of urinary protein provides additional information when preeclampsia is suspected. Laboratory assessment may also include platelet count and liver function tests when clinically indicated.

Ultrasound examination contributes to evaluation of fetal growth, amniotic fluid volume, and placental characteristics. Doppler studies may provide additional information regarding uteroplacental and fetal circulation in selected high-risk pregnancies. Combining several indicators may improve risk stratification compared with relying on one parameter alone. The main purpose of prediction is to identify women who require increased surveillance before severe clinical manifestations appear. Risk classification can also help determine the frequency of antenatal visits and additional investigations. Women identified as high risk may benefit from individualized preventive measures and closer maternal-fetal monitoring.

Regular surveillance of maternal renal status is particularly important when pregnancy occurs in the presence of chronic pyelonephritis. Changes in serum creatinine, urinary findings, blood pressure, and clinical symptoms may provide early evidence of deterioration. Proteinuria should be interpreted carefully because baseline renal abnormalities may be present before pregnancy. Persistent hypertension or a new increase in blood pressure requires repeated evaluation and correlation with other clinical findings. Maternal symptoms such as headache, visual disturbances, upper abdominal pain, or sudden edema may indicate progression toward preeclampsia and require immediate assessment. Fetal monitoring is equally important because maternal renal and hypertensive disorders may interfere with placental function and fetal growth.

Ultrasound can be used to assess fetal development and amniotic fluid volume during follow-up. Doppler examination may be considered when fetal growth restriction or placental dysfunction is suspected. The frequency of monitoring should be adjusted according to gestational age and the severity of maternal disease. High-risk pregnancies may require closer collaboration between obstetric and renal specialists. A continuous assessment strategy allows changes from the patient's baseline condition to be recognized promptly. Such monitoring facilitates timely modification of preventive and obstetric management.

Prevention begins with early recognition of women who have an increased probability of developing preeclampsia. Chronic kidney disease is considered a high-risk condition, and appropriate patients may be candidates for low-dose aspirin prophylaxis according to current obstetric recommendations. Appropriate management of maternal blood pressure is also important, particularly in women with pre-existing hypertension. Control of urinary infection and prevention of recurrent renal inflammation are relevant components of care in patients with chronic pyelonephritis. Clinical management should also include regular assessment of renal function and maternal symptoms.

Patient education has an important role because early recognition of warning signs can facilitate timely medical evaluation. Pregnant women should be informed about persistent headache, visual disturbances, sudden edema, severe upper abdominal pain, and elevated blood pressure as symptoms requiring assessment. Fetal growth and well-being should be monitored when clinically indicated. Preventive treatment should be continuously reassessed according to changes in maternal and fetal condition. Such an approach allows preventive measures to be modified when the patient's risk profile changes.

A personalized management strategy is particularly important because the severity of chronic pyelonephritis and the risk of hypertensive complications vary substantially between pregnant women. Establishing a reliable baseline before the development of complications allows subsequent changes to be identified more accurately. Blood pressure, renal function, urinary protein, maternal symptoms, and fetal condition should therefore be evaluated repeatedly throughout pregnancy. Any significant deviation from baseline should prompt further clinical assessment. Patients with greater renal impairment or multiple risk factors may require intensified antenatal surveillance and specialist care. The timing and frequency of fetal assessment should be adapted to maternal disease severity and fetal growth. If preeclampsia develops, the management plan should depend on gestational age, maternal symptoms, laboratory abnormalities, and fetal condition. The principal objective of risk stratification is to enable intervention before severe maternal or fetal complications occur. Combining clinical, laboratory, and instrumental findings provides a more reliable basis for decision-making than isolated measurements. Continuous reassessment also allows treatment and monitoring strategies to be modified as pregnancy progresses. This individualized model may improve the detection of early deterioration and facilitate timely obstetric intervention. Ultimately, structured risk assessment and personalized follow-up are important components of preventing severe complications in pregnancies complicated by chronic pyelonephritis.

Results

The study included 30 pregnant women with chronic pyelonephritis, who were prospectively followed during pregnancy to evaluate the risk of preeclampsia and the clinical value of combined risk assessment. The mean maternal age was 29.1 ± 4.8 years, and the mean gestational age at the initial assessment was 16.4 ± 2.3 weeks. During follow-up, 9 women (30.0%) developed preeclampsia, whereas 21 women (70.0%) remained without hypertensive complications. Recurrent urinary tract infection during pregnancy was documented in 10 women (33.3%), with a higher frequency among those who subsequently developed preeclampsia. At baseline, the mean systolic blood pressure was 121.6 ± 8.4 mmHg and diastolic blood pressure was 76.3 ± 6.1 mmHg. By the third trimester, women who developed preeclampsia demonstrated a more pronounced increase in blood pressure, with mean systolic and diastolic values reaching 148.2 ± 9.6 mmHg and 94.1 ± 6.8 mmHg, respectively. In the group without preeclampsia, the corresponding values were 124.7 ± 7.5 mmHg and 78.2 ± 5.7 mmHg. Proteinuria was detected in 8 women (26.7%), and 7 (23.3%) demonstrated worsening renal laboratory parameters during follow-up.

Elevated inflammatory activity or recurrent urinary infection was more frequently observed among women who later developed preeclampsia. Ultrasound and Doppler-based fetal assessment demonstrated signs requiring closer surveillance in 8 women (26.7%), particularly in the subgroup with hypertensive complications. More intensive antenatal monitoring was performed in women with multiple risk factors, including recurrent pyelonephritis, rising blood pressure, urinary abnormalities, and impaired renal function. Early identification of these changes allowed modification of the follow-up strategy and closer maternal-fetal observation. The combined assessment of clinical history, blood pressure, urinary findings, renal function, and fetal-placental parameters provided a more complete estimation of individual risk than evaluation of a single parameter alone. Overall, the findings demonstrated that pregnant women with chronic pyelonephritis represent a clinically significant risk group for preeclampsia and require systematic assessment throughout pregnancy.

Parameter	Total (n=30)	Preeclampsia (n=9)	No preeclampsia (n=21)
Mean age, years	29.1 ± 4.8	29.8 ± 4.5	28.8 ± 4.9
Initial gestational age, weeks	16.4 ± 2.3	16.1 ± 2.2	16.5 ± 2.4
Recurrent urinary infection	10 (33.3%)	6 (66.7%)	4 (19.0%)
Third-trimester systolic BP, mmHg	131.8 ± 13.5	148.2 ± 9.6	124.7 ± 7.5
Third-trimester diastolic BP, mmHg	83.0 ± 8.9	94.1 ± 6.8	78.2 ± 5.7
Proteinuria	8 (26.7%)	7 (77.8%)	1 (4.8%)
Worsening renal parameters	7 (23.3%)	5 (55.6%)	2 (9.5%)
Additional fetal-placental surveillance	8 (26.7%)	6 (66.7%)	2 (9.5%)
Developed preeclampsia	9 (30.0%)	9 (100%)	.

Discussion

The findings suggest that pregnant women with chronic pyelonephritis may have an increased risk of developing preeclampsia, particularly when renal dysfunction, recurrent urinary tract infection, and progressive increases in blood pressure are present. In the present analysis, women who developed preeclampsia more frequently demonstrated elevated blood pressure, proteinuria, and deterioration of renal parameters during pregnancy. Recurrent urinary tract infection was also more common in this group, suggesting that persistent inflammatory activity may contribute to an unfavorable maternal clinical course. Regular monitoring of blood pressure is important for identifying early hypertensive changes, while assessment of urinary protein and renal function provides additional information for evaluating the development and severity of preeclampsia. Maternal renal status should therefore be assessed dynamically rather than relying on a single baseline measurement. Evaluation of fetal and placental condition by ultrasound and Doppler examination is also important because maternal renal and hypertensive abnormalities may influence placental function and fetal development. The combined assessment of clinical history, blood pressure, urinary findings, renal function, and fetal-placental parameters provides a more comprehensive evaluation of individual risk than the use of a single predictor.

These findings support the importance of individualized antenatal surveillance in pregnant women with chronic pyelonephritis. Early recognition of increasing risk may allow closer monitoring and timely preventive or obstetric interventions. Overall, systematic risk assessment and continuous maternal-fetal monitoring are important components of managing pregnant women with chronic pyelonephritis who are at increased risk of preeclampsia.

Conclusion

Chronic pyelonephritis during pregnancy is associated with an increased risk of developing preeclampsia, particularly in the presence of recurrent urinary tract infection, rising blood pressure, proteinuria, and impaired renal function. Early assessment of these clinical and laboratory indicators allows pregnant women to be classified according to individual risk and followed more closely during pregnancy. Regular monitoring of maternal blood pressure, renal function, urinary protein, and fetal-placental status is important for timely detection of complications. Individualized preventive management and systematic maternal-fetal surveillance may help reduce the risk of severe preeclampsia and improve maternal and perinatal outcomes.

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