

## Urinary System and Pregnancy

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### ABSTRACT

During pregnancy structural and functional changes occur in organs to meet the changing needs of the fetus. Naturally, the kidneys and urinary tract also change during pregnancy. Firstly, physiological changes in pregnancy will be emphasized then pathologies will be mentioned.

**Keywords:** Urinary system; Pregnancy.

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### Introduction

#### Changes associated with the kidneys

Both kidney size increases about 1-1.5 cm during pregnancy (1). Renal size increases by 30% due to increased renal blood flow and interstitial volume (2). There was no change in the number and histology of the nephrons. However, glomerular filtration rate (GFR) increases. Dilatation of the kidney pelvis and ureters occurs as a result of the effect of progesterone and the mechanical pressure of the ureters in the pelvic inlet. Hemodynamically increased systemic arterial compliance decreased peripheral resistance, increased blood flow combined with decreased blood pressure result in systemic vasodilatation. These changes increase glomerular filtration rate and renal perfusion.

Kidney plasma flow increases by 80% in the 12th week of pregnancy (3). However, it decreases in the third trimester. The increase in glomerular filtration rate is observed within the first month. It increases by 40-50% in the early stages of the second trimester and slightly decreases in the third trimester (4). Lying in the left lateral position during late pregnancy increases glomerular filtration rate and sodium excretion (5).

Physiological increase in glomerular filtration rate during pregnancy decreases serum creatine levels on average by 0.4mg / dL, causing it to remain between 0.4-0.8mg / dL (6) and the blood urea nitrogen decreases to 8-10mg / dL levels. Creatine level of 1mg / dL in a normal person is considered

pathological for pregnancy. For this, caution should be exercised against small increases and fluctuations in serum creatinine level. During pregnancy, especially in the third trimester, urinary protein excretion increases by 100-200mg / day (7). Protein excretion above 300mg / day is considered abnormal and needs further evaluation (8). Protein excretion in urine may be even higher in uncomplicated twin pregnancies. This may lead to misinterpretations of preeclampsia.

Glucosuria occurs in approximately 50% of pregnant women, so it is not correct to be a screening tool for diabetes mellitus (9). Glucosuria is thought to result from a decrease in glucose absorption from the proximal tubule.

Serum uric acid level decreases to 2.0-4.0mg / dL due to the increase in GFR in early gestational weeks, and it is similar to until 22-24 weeks (10). Then uric acid levels begin to rise and reach non-pregnancy values with term period. Serum anion gap and albumin levels decrease during pregnancy and the cause of this condition is not clearly understood. Physiological hypoalbuminemia in pregnancy leads to an increase in the circulating levels of protein-bound drugs. Therefore, we should pay attention to chronic drug use in pregnancy.

### **Changes In The Urinary System**

Dilatation of ureters and renal pelvis (hydronephrosis) occurs during pregnancy. These changes can be seen by ultrasonography in the second trimester and continue up to 6th-12th weeks after birth. As a result of dilation, the dilated parts are capable of accumulating 200-300 mL of urine. Dilated segments may be a reservoir area for bacteria that may cause pyelonephritis during pregnancy.

Hydronephrosis in pregnancy can be seen due to external mechanical compression, changes in the ureteral wall and hormonal effects. Increased progesterone leads to relaxation of the bladder wall and increased capacity. But, pregnancy expands the uterus also, causing the bladder to move up and down and reduces its capacity. Pollakiuria, nocturia, dysuria, urgency and stress incontinence are common in pregnancy (11). Specifically, more than 7 urination during the day, 2 or more nocturia can

be the complaints of 80-95% of women during pregnancy (12). Especially in the last trimester, increased cardiac output in the left lateral position causes an increase in diuresis.

Trauma to the bladder and urinary tract inevitably occurs at birth and after birth. Mucosal obstructions and submucosal haemorrhage, especially in the trigone region, are common (13). Bladder sensitivity decreases as a result of traumas. On postnatal days, detrusor muscle atony results in increased post-functional residual urine, excessive bladder contraction, and urinary retention. These complaints are usually mild and transient and regress completely during follow-up. All these physiological changes in pregnancy return to pre-pregnancy status within 4-6 weeks postpartum (14,15).

### **Urinary Tract Infection During Pregnancy**

Urinary tract infections (UTI) are common in pregnant women and the most common forms are acute cystitis or acute pyelonephritis. Bacteriuria rates are the same as in non-pregnant women, but recurrent bacteriuria is more common in pregnant women. Asymptomatic bacteriuria rate is 2-7% and typically occurs early period (16). 20-35% of untreated pregnant women with asymptomatic bacteriuria face symptomatic urinary tract infection including pyelonephritis (17,18). If bacteriuria is treated, this rate decreases by 70-80%.

Acute cystitis is seen in approximately 1-2% of pregnancy and acute pyelonephritis is 0.5-2% in pregnancy (19). Most cases of pyelonephritis occur in the second and third trimesters. Microorganisms that cause bacteriuria and UTI in pregnant women are of the same type as non-pregnant women. However, immunosuppressive physiology during pregnancy may pose additional risks. The predominant uropathogen is E.coli in both bacteriuria and UTI. In the case study of pyelonephritis pregnant women, the most common factor was E.coli (70%), other responsible microorganisms were Enterobacter (3%), Klebsiella (3%) strains, Proteus (2%) and B group streptococci (10%) (20).

### **Asymptomatic Bacteriuria**

Asymptomatic bacteriuria is defined as high bacterial growth in urine culture without UTI symptoms. Pregnant women should be screened at least once during the 12th-16th week of pregnancy (if not possible it should be done at the first prenatal visit) (21).

For diagnosis,  $\geq 10^5$  cfu/mL bacteria must be isolated in two consecutive urine or  $\geq 10^2$  cfu/mL bacteria must be isolated in urine obtained by urinary catheterization. Asymptomatic bacteriuria during pregnancy increases the risk of pyelonephritis and has been associated with adverse pregnancy outcomes such as preterm birth and low birth weight infants. Treatment should be as short as possible to minimize exposure to the fetus. A control culture should be performed 1 week after the treatment is completed.

### Acute Cystitis

Acute cystitis is a symptomatic bladder infection and may present with dysuria, pollakiuria, urgency, hematuria and pyuria. Urgency and pollakiuria are expected to physiologically during pregnancy. Pregnant women with new-onset dysuria should undergo complete urinalysis and urine culture. The diagnosis of acute cystitis is confirmed by bacterial growth in urine culture. Before confirming the diagnosis, empirical treatment should typically be initiated in any patient with consistent symptoms and pyuria. Vaginitis, urethritis and other sexually transmitted diseases should be kept in mind in the differential diagnosis of pregnant women with dysuria.

### Proteinuria and Nephrotic Syndrome in Pregnancy

Urinary protein excretion in non-pregnant individuals is less than 150 mg. Protein excretion in urine increases during pregnancy. Exceeding the 300 mg daily is necessary for pathologic protein excretion. Proteinuria is one of the most important features of preeclampsia and it is a serious complication of pregnancy. In the initial evaluation, determination of proteinuria onset time and the amount of proteinuria is very important.

Preeclampsia is possible if proteinuria is onset after the 20th week. Before the 20th week of proteinuria, it is inevitable to examine and treat primary or

secondary kidney disease. Currently, the gold standard method is to examine protein excretion in 24-hour urine. However, UPCR has become the preferred method because it is practical, reliable and reproducible (22). Nephrotic syndrome (3g/24hr) is a sign of glomerular disease. However, if only renal tubule or interstitium is involved and glomerular involvement is not present, proteinuria may remain below 3g/24 hours. Concomitant edema, hypoalbuminemia, hyperlipidemia are clues for the diagnosis of nephrotic syndrome. Preeclampsia is the most common cause of nephrotic proteinuria during pregnancy. In women with known renal disease, worsening of arterial blood pressure and progression of proteinuria may mean exacerbation of the underlying disease. Nephrotic syndrome is associated with an increased risk of deep venous thrombosis. Patients with severe nephrotic syndrome (especially those with membranous nephropathy) who do not have a high risk of bleeding and have low serum albumin levels will benefit from prophylactic anticoagulation.

### Pregnancy and Chronic Kidney Disease

The risk of developing both fetal and maternal complications is high in pregnant women with chronic kidney disease (CKD), especially in advanced kidney disease. The possibility of conception in women under dialysis treatment is already very low. However, it is recommended that counselling and appropriate birth control methods be applied to minimize both fetal and maternal risks.

Pregnancy can accelerate the progression of chronic kidney disease. This risk depends on hypertension, proteinuria and basal glomerular filtration rate (23). Hypertension and proteinuria during pregnancy increase the risk of CKD progression (24). Pregnant women with CKD have a high prevalence of chronic hypertension and are often treated with antihypertensive drugs. Hemodialysis can be initiated if the GFR falls below 20ml / min / 1.73m<sup>2</sup> or if the BUN exceeds > 50-60mg/dL. If there are signs and symptoms of uremia, refractory edema, refractory acidosis, hyperkalemia or hyperphosphatemia, hemodialysis can be initiated as in the normal patient population. However, under all

circumstances, the hemodialysis decision should be personalized on a patient-specific basis.

### Conclusion

We tried to explain the common urinary system diseases during pregnancy in this review. Possible diseases should be examined and treated with a multidisciplinary approach. It should be kept in mind that knowing the physiological changes that occur in the urinary system will be both guiding for clinicians and will prevent misinterpretations.

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