PREGNANCY – AKI [PRAKI]

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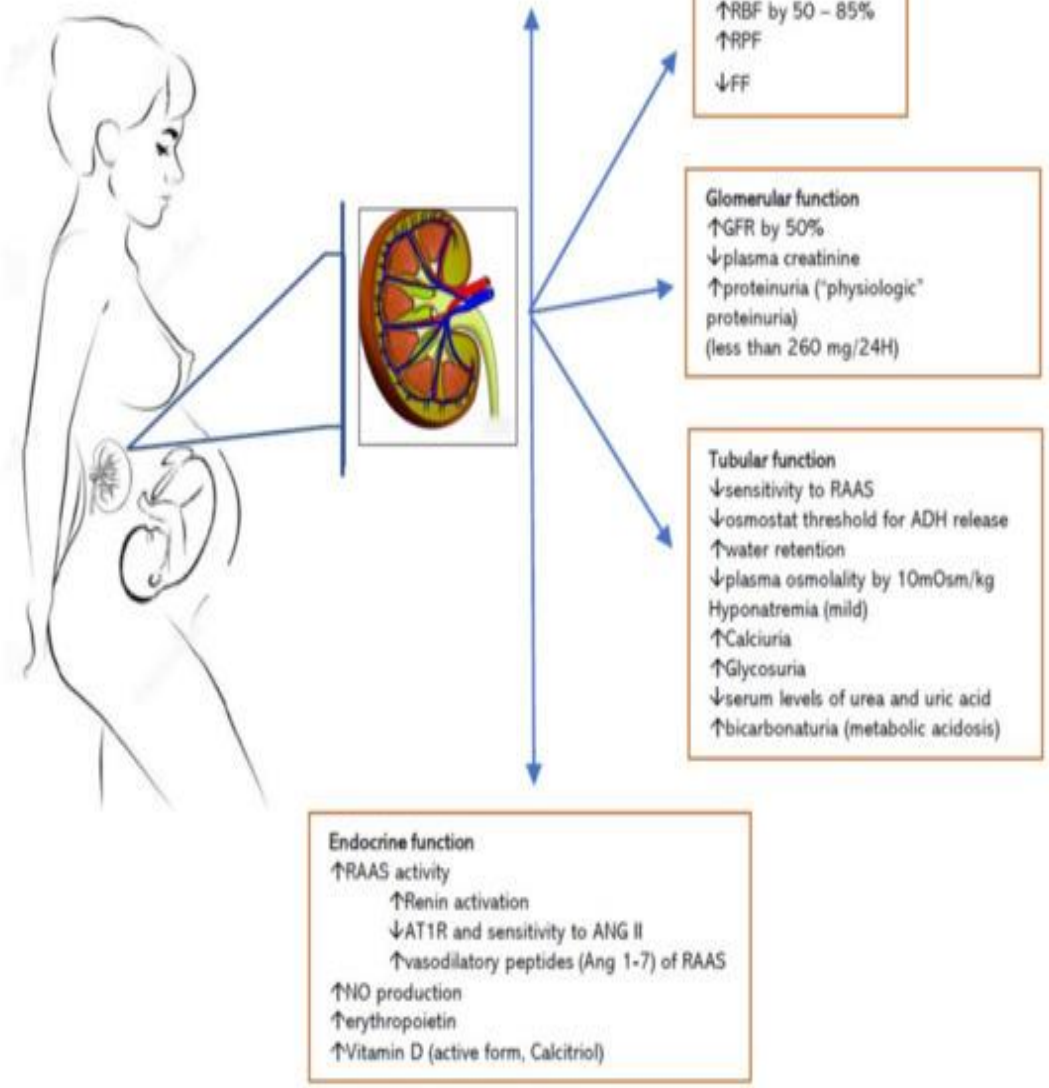
INTRODUCTION

- Pregnancy-related acute kidney injury (Pr-AKI) is a heterogeneous disease entity due to varying underlying etiologies.
- P-AKI in developing countries accounts for 5%–20% of total AKI population.
- Pr-AKI commonly occur in postpartum rather than the post- abortal period, reflecting a decline in septic abortions.
- 24 hr creatinine clearance is closest estimate of GFR in pregnancy.

- Diagnosis of AKI in pregnant women (any one of the three)

(1) Sudden increase in serum creatinine >1 mg/dl,
(2) Oliguria/anuria
(3) Need for dialysis.

PHYSIOLOGICAL CHANGES IN PREGNANACY

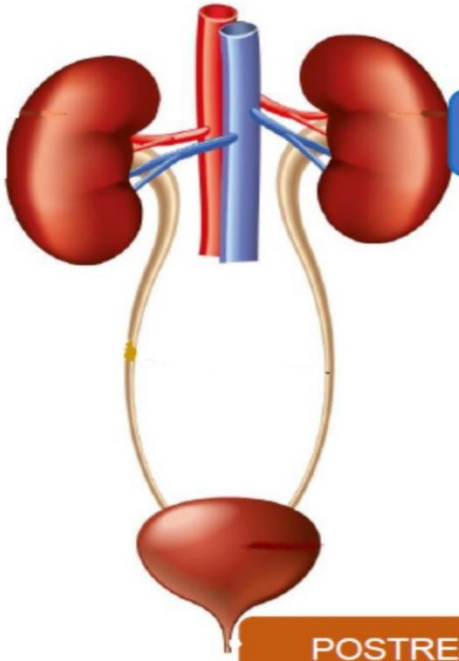


CAUSES OF P-AKI

PRERENAL

Transient decrease in renal perfusion→↓GFR

- ➢ Intravascular volume depletion = hypovolemia
  - Hyperemesis gravidarum
  - OHSS
  - Diarrhea
  - Blood loss (extrarenal loss)
    - Miscarriage
    - Antepartum haemorrhage
    - Postpartum haemorrhage
  - Diuretics (renal loss from overuse)
- ➢ Decreased arterial pressure/Decrease effective circulating volume
  - Sepsis postabortal, puerperal, urosepsis
  - Heart failure
- ➢ Impaired renal autoregulation/intrarenal vasoconstriction
  - NSAIDs
  - ACE inhibitors, ARB
  - Cyclosporin, Tacrolimus



INTRARENAL/ INTRINSIC

Glomerulonephritis

- ➢ Acute glomerulonephritis

Interstitial

- ➢ Sepsis/Infection postabortal, puerperal, urosepsis, pyelonephritis
- ➢ Ischemia
  - miscarriage/abortion
  - antepartum haemorrhage-placenta praevia, abruptio placentae, uterine rupture
  - postpartum haemorrhage- atonia, perineal tears and lacerations

Vascular

- vasculitis
- hypertension - Preeclampsia/HELLP
- thrombotic microangiopathy (TMA)
  - thrombotic thrombocytopenic purpura (TTP)
  - atypical haemolytic uremic syndrome (aHUS)
  - disseminated intravascular coagulation (DIC)

Medication - nephrotoxicity, acute interstitial nephritis
antibiotic aminoglycosides, iodinated contrast
Acute fatty liver of pregnancy (AFLP)
Lupus nephritis
Antiphospholipid syndrome (APS)
Pulmonary embolism
Amniotic fluid embolism

POSTRENAL

Bilateral obstruction and hydronephrosis due to uterine compression of ureters/bladder
Unilateral ureter obstruction due to nephrolithiasis
Bladder outlet obstruction (tumor, lithiasis)
Iatrogenic injury of the bladder/ureter/urethra during caesarean section or vaginal delivery
Spontaneous injury of the urethra/bladder during vaginal delivery

1st trimester | 2nd trimester | 3rd trimester | D Postpartum

Septic Abortion

Clinical Features

- Prerenal azotemia or ATN

Treatment

- Volume resuscitation, antibiotics

Hyperemesis Gravidarum

Clinical Features

- Prerenal azotemia or ATN
- Evaluate for molar pregnancy

Treatment

- Volume resuscitation

Preeclampsia/ HELLP

Clinical Features

- Hypertension and proteinuria* after 20 weeks of gestation
- Headache, visual disturbance, seizures, abdominal pain
- Hemolytic anemia, transaminitis, thrombocytopenia, high LDH

Treatment

- Delivery, i.v. magnesium for seizure prevention

TTP/aHUS

Clinical Features

- TTP more common in 2nd/3rd trimester, aHUS more common in postpartum period
- Neurological involvement is more common in TTP than aHUS
- Hemolytic anemia, thrombocytopenia, elevated LDH and bilirubin

Laboratory testing

- TTP: ADAMTS-13 activity <10%
- aHUS: genetic testing for complement cascade gene mutations

Treatment

- TTP: plasma exchange
- aHUS: plasma exchange + eculizumab

Acute Fatty Liver of Pregnancy

Clinical Features

- Nausea, vomiting, abdominal pain, jaundice, ascites
- Transaminitis, low platelets, hypoglycemia, lactic acidosis

Laboratory Testing

- Maternal and fetal testing for LCHAD gene mutation

Treatment

- Delivery, plasmapheresis and/or liver transplant in severe cases

Lupus nephritis and/or Antiphospholipid antibody syndrome

Clinical Features

- Dysmorphic red blood cells on urine sediment, extra-renal lupus manifestations
- Low complements, positive anti-dsDNA, anti-cardiolipin antibodies, and/or anti-β2 glycoprotein antibodies
- Kidney biopsy is only recommended if pathology will change management

Treatment

- Lupus nephritis: steroids + hydroxychloroquine + azathioprine/tacrolimus
- Antiphospholipid antibody syndrome: aspirin +/- low molecular weight heparin

PREECLAMPSIA

- **Definition** : Characterized by

✓ New-onset hypertension (blood pressure >140/90 mmHg)

✓ Proteinuria (>300 mg/dl) after 20 weeks of gestation.

- **Eclampsia** is defined as preeclampsia with the presence of seizure.

Table 5: Severe feature of preeclampsia (one or more of these findings)
Systolic blood pressure ≥160 mmHg or diastolic blood pressure ≥110 mmHg on two occasions at ≥4 h apart while the patient is on bed rest
Platelet count <100,000/mm^3
Elevated liver enzymes (twice normal concentrations)
Renal insufficiency (serum creatinine concentration >1.1 mg/dl or doubling of serum creatinine concentration) or oliguria (<500 ml in 24 h)
Pulmonary edema or cyanosis
New-onset cerebral or visual disturbances
Severe persistent right upper quadrant or epigastric pain

Clinical feature	HELLP*	AFLP**	aHUS***	TTP
Time of onset	3T	3T	Postpartum	2T/3T
Hypertension	80%-100%	25%-50%	+	0/+
AKI	Mild/moderate	Moderate	Severe	Mild/moderate
Renal prognosis	Recovery	Recovery	76% ESRD	Fair
CNS findings	+	Absent	Absent	Dominant
Hemolytic anemia	+	0/+	+	++
Thrombocytopenia	+	0/+	++	++
Coagulopathy	0/+	+	0	0
Liver transminases increase	++	++	0	0
LDH (IU/L)	+	0/+	++	++
Ammonia	Normal	High	Normal	Normal
ADAMTS-13 activity <10%	0	0	+	++
Alternative complement pathway	0/+	0/+	++	0
Management	Support measures/ delivery	Support measures/ delivery	Plasma infusion/ exchange	Plasma infusion/ exchange
Effect of delivery on diseases	Recovery	Recovery	None	None

*Urine sediment is bland in preeclampsia/HELLP syndrome, **Coagulopathy, hepatic injury, and hypoglycemia are the key feature of AFLP, ***Isolated LDH increase with normal hepatic transaminase is characteristics of HUS/TTP (P-TMA). 0: Absence, 0/+: Occasionally present, +: Sometimes present, ++: Always present, HELLP: Hemolysis, elevated liver enzymes, and low platelet count, AFLP: Acute fatty liver of pregnancy, aHUS: Atypical hemolytic-uremic syndrome, TTP: Thrombotic thrombocytopenic purpura, AKI: Acute kidney injury, CNS: Central nervous system, LDH: Lactate dehydrogenase, ESRD: End-stage renal disease, P-TMA: Thrombotic microangiopathy of pregnancy

RENAL CORTICAL NECROSIS

- Rare condition resulting from severe reduction of renal perfusion caused by vascular spasm, microvascular injury, or intravascular coagulation.

- Abrupt onset of oliguria, gross hematuria, flank pain and hypotension.
- Causes :Placental abruption , placenta previa , septic abortion . prolonged intrauterine fetal death and amniotic fluid embolism.

- Hypercoagulable state with increased level of coagulation factors with repressed fibrinolytic state.

- Prognostic factors : extent of necrosis, duration of oliguria, and severity of associated conditions.

- **Ultrasound**: Hypoechoic Rim and Renal Cortical Rim Sign**:** The hypoechoic rim seen on ultrasound, potentially with an echogenic (brighter) layer outside the rim.
- **CT Scan:** Lack of Cortical Enhancement and Reverse Rim Sign**:** A specific CT finding where the cortex appears hypo attenuating (darker) and non-enhancing, while the medulla enhances.

- Dialysis as indicated and treatment of the underlying diseases.

HD Prescription during Pregnancy

Frequency	5–6 time/week
Duration of dialysis	>36 h/week (>6 h/day)
Dry weight	Increase by 0.5 kg/week during the second and third trimesters
UF rate	6–8 mL/kg/h
Dialysate	K = 3 mmol/L, Ca = 1.5 mmol/L, HCO_3 = 28–32 mmol/L
Anticoagulation	Low-dose unfractionated heparin

HD: hemodialysis; UF: ultrafiltration.