



Acute Renal Failure in Pregnancy: Understanding Causes, Risks, and Management



**Assistant Professor of Nephrology
Department of Internal Medicine, School of Medicine
Kidney Research Center**



Overview of Acute Renal Failure in Pregnancy

Significant medical concern due to its association with **high rates** of maternal and fetal morbidity and mortality.

The **incidence** of pregnancy-related AKI has been rising, particularly in developed nations, attributed to factors such as:

- 1-Advanced maternal age
- 2-Diabetes
- 3-Hypertension



Key Adaptations in Renal Vasculature During Pregnancy



Increased Renal Blood Flow (RBF):

There is a substantial increase in **renal blood flow**, which can rise by approximately **40-80%** compared to non-pregnant levels. This increase is crucial for meeting the metabolic demands of the mother and fetus. and is facilitated by systemic vasodilation.



Enhanced Glomerular Filtration Rate (GFR):

GFR increases by about 40-50% during pregnancy, which leads to lower serum creatinine and urea levels. This increase in GFR is essential for efficient waste removal and fluid balance.



Decreased Renal Vascular Resistance (RVR)

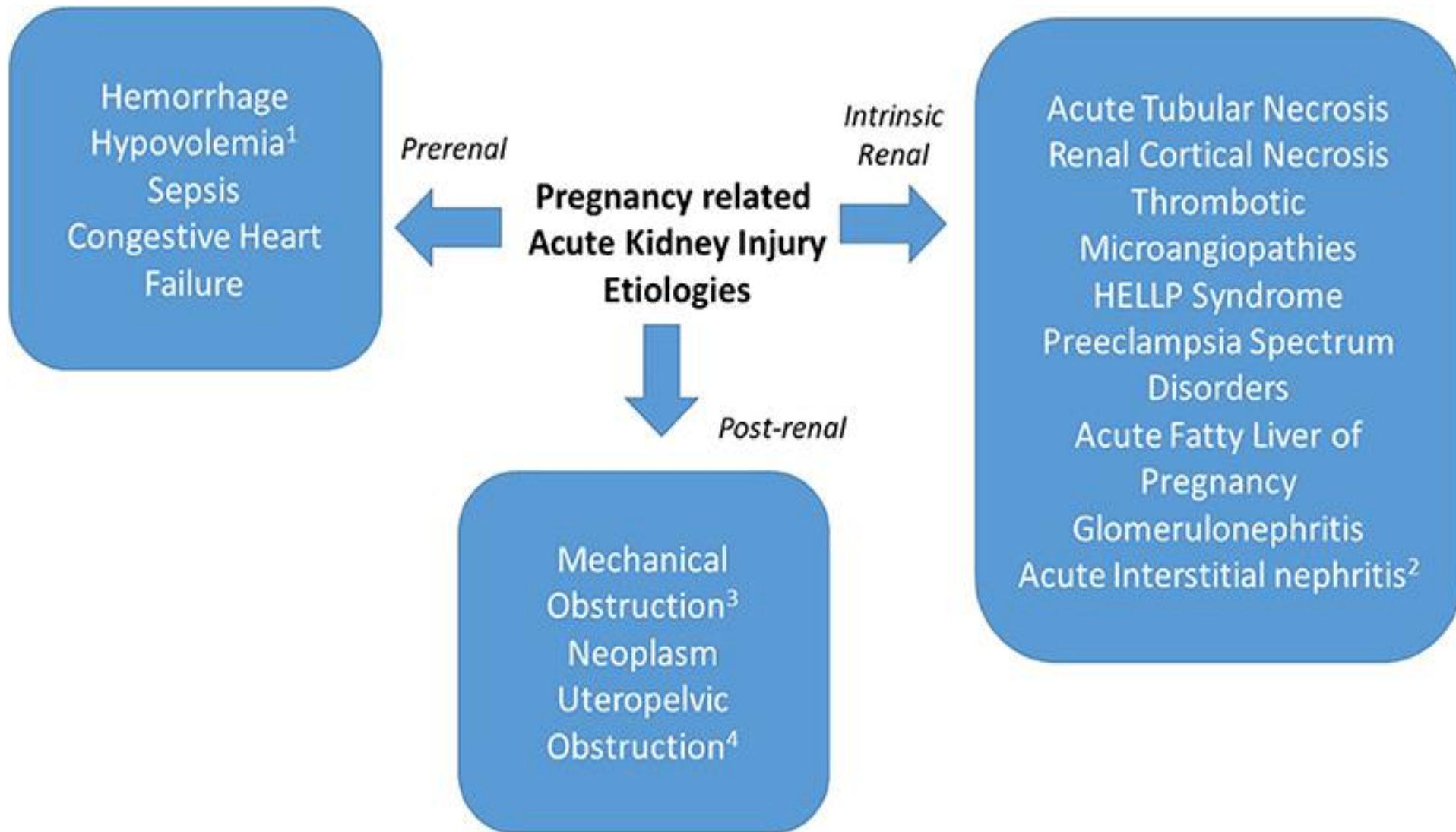
Pregnancy induces a reduction **in renal vascular resistance** due to vasodilation of the renal arteries. This decrease is mediated by several factors, including the upregulation of nitric oxide (NO) pathways, which promote vasodilation.



Hormonal Influences:

Hormones such as relaxin and progesterone play significant roles in mediating these vascular changes. Relaxin promotes vasodilation and increases compliance of blood vessels, while progesterone contributes to decreased vascular resistance and enhanced renal perfusion.





Causes of ARF in Pregnancy

First Trimester:

- Hyperemesis Gravidarum
- Septic Abortion



Causes of ARF in Pregnancy

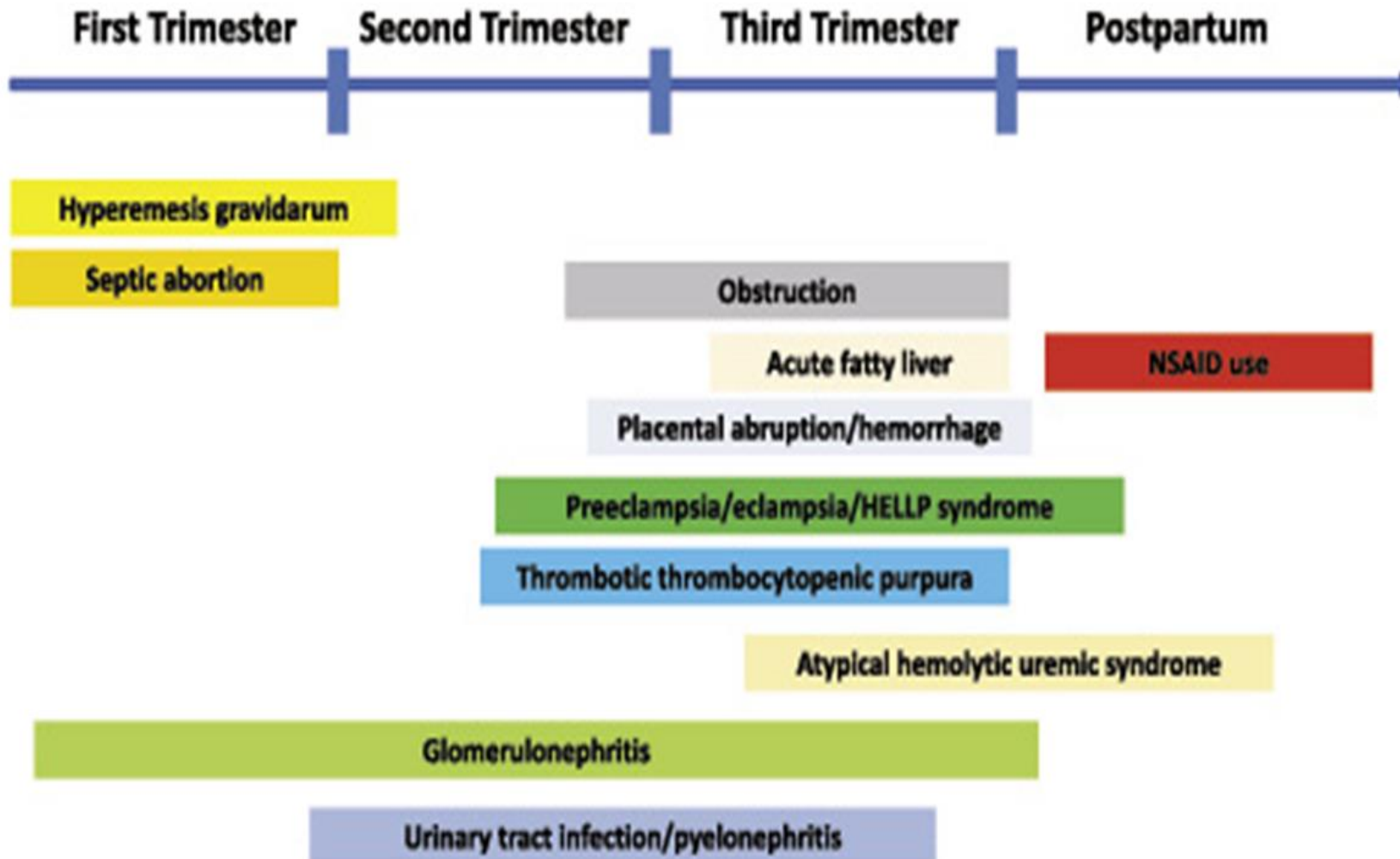
Second and Third Trimesters:

Preeclampsia/Eclampsia (most common cause)

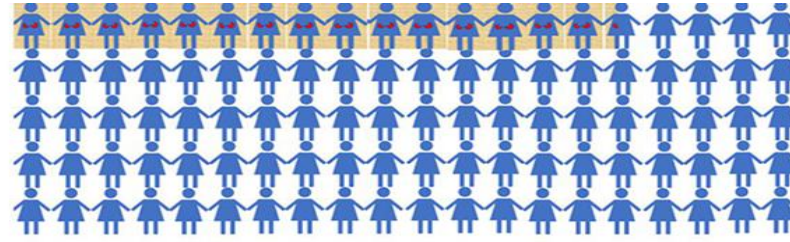
HELLP Syndrome

Thrombotic Microangiopathy





15.3% Of pregnant women hospitalised with **pre-eclampsia** had **acute kidney injury (AKI)**.

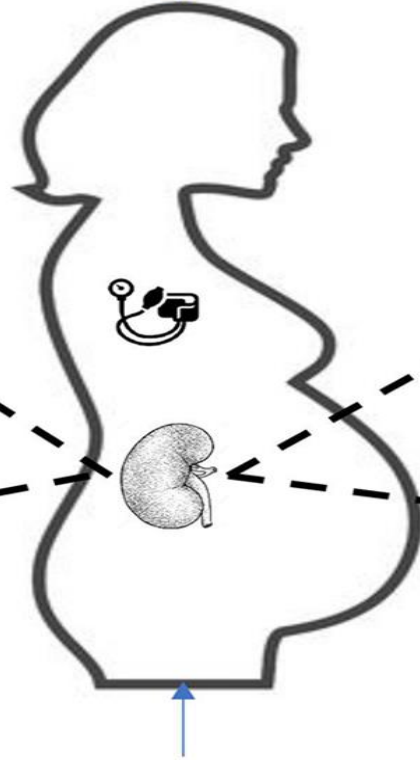


Risk of:

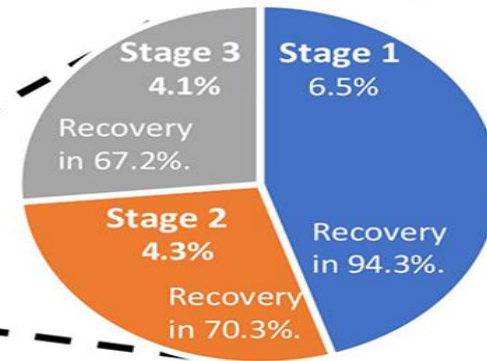
Maternal death

ITU admission

Stillbirth



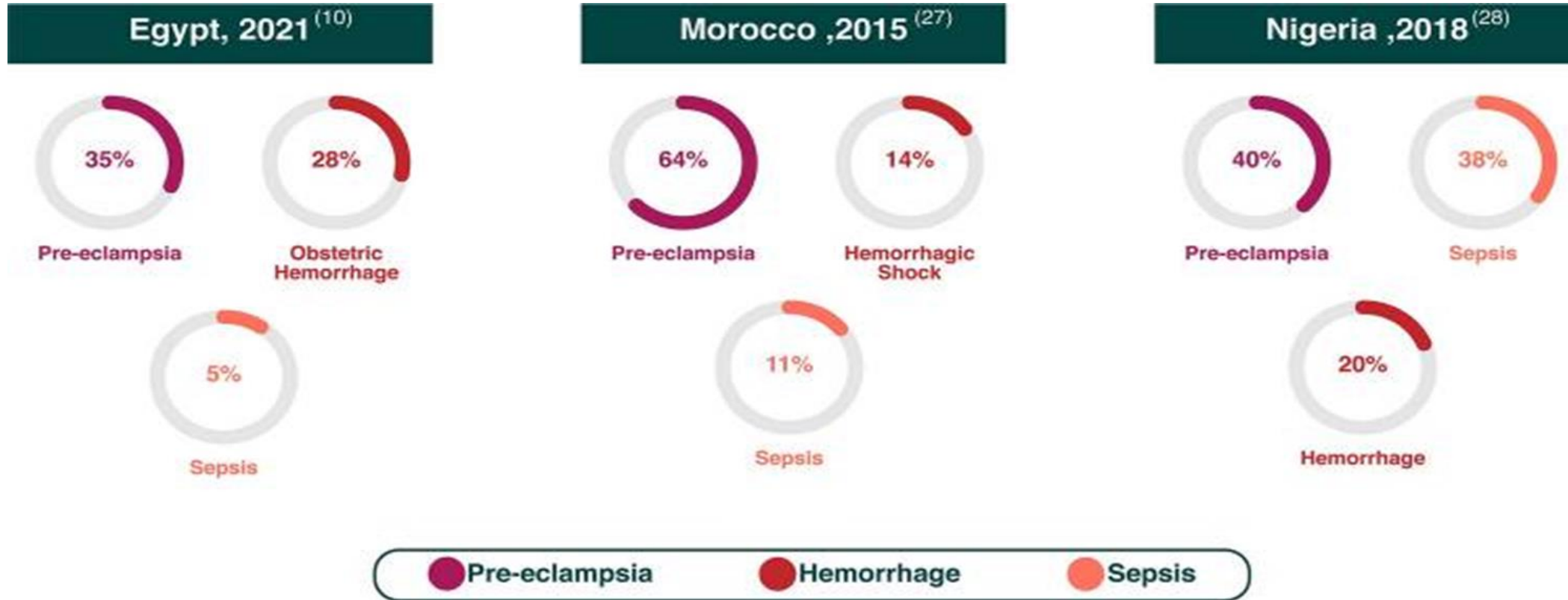
KDIGO AKI Stage



History of **hypertension** in a **previous pregnancy** was the strongest **predictor** of AKI.

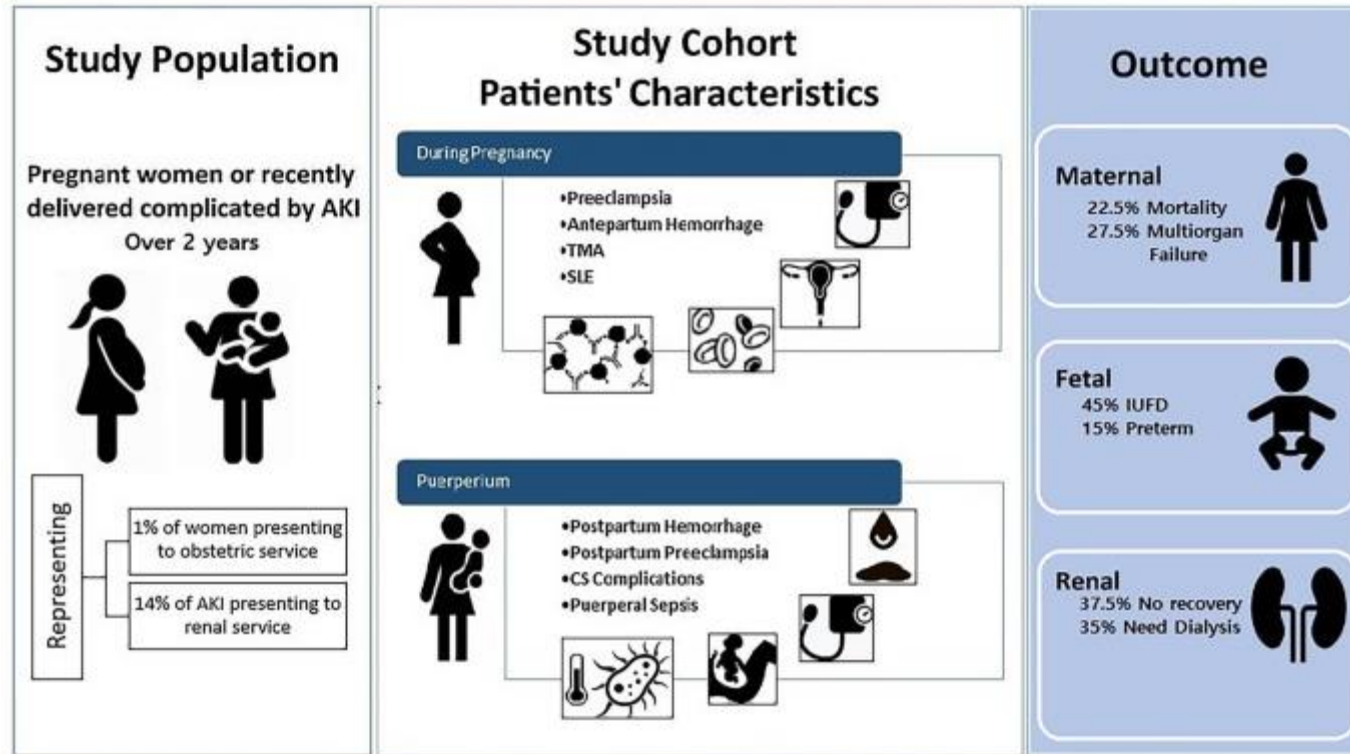


Pregnancy-related acute kidney injury in the African continent: where do we stand? A systematic review



Shalaby AS, Shemies RS. Pregnancy-related acute kidney injury in the African continent: where do we stand? A systematic review. J Nephrol. 2022

Acute Kidney Injury during Pregnancy and Puerperium: An Egyptian Hospital-Based Study



Conclusion: PRAKI represents a continuous burden with potential ominous outcomes; obstetric hemorrhage and preeclampsia being the main predisposing factors. Prudent strategies should be implemented to reduce the incidence of this problem.

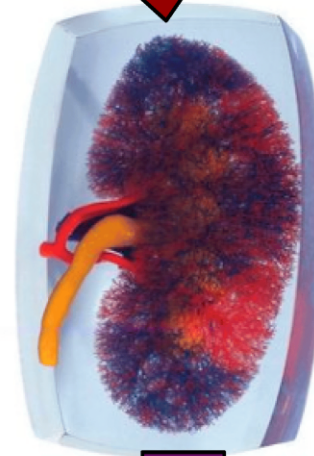


From the placenta to the kidney
PE may induce permanent kidney damage, via AKI, tubular damage, podocyte loss

Placenta and kidney are highly vascularized; filter blood; divide components; are sophisticated metabolic machines

Pregnancy is a precious occasion to diagnose CKD.

From the kidney to the placenta
CKD may induce placental dysfunction with an increased risk of pre-term delivery, hypertensive disorders of pregnancy and PE



Glomerular diseases in pregnancy: pragmatic recommendations for clinical management



Fadi Fakhouri¹, Nora Schwotzer¹, Gianfranca Cabiddu^{2,3}, Jonathan Barratt⁴, H el ene Legardeur⁵, Vesna Garovic^{6,7}, Alejandra Orozco-Guillen⁸, Jack Wetzels⁹, Eric Daugas^{10,11}, Gabriella Moroni^{12,13}, Marina Noris¹⁴, Vincent Audard^{15,16}, Manuel Praga¹⁷, Elisa Llurba^{18,19}, Gr egoire Wuerzner¹, Rossella Attini²⁰, David Desseauve⁵, Elena Zakharova^{21,22}, Claudio Luders²³, Kate Wiles²⁴, Filomena Leone²⁵, Shilpanjali Jesudason^{26,27}, Nathalie Costedoat-Chalumeau^{28,29}, Andrea Kattah⁶, Virgilia Soto-Abraham³⁰, Alexandre Karras³¹, Jai Prakash³², Liz Lightstone^{33,34}, Pierre Ronco^{35,36}, Claudio Ponticelli³⁷, Gerald Appel³⁸, Giuseppe Remuzzi¹⁴, Vassilis Tsatsaris^{39,40} and Giorgina Barbara Piccoli³⁶



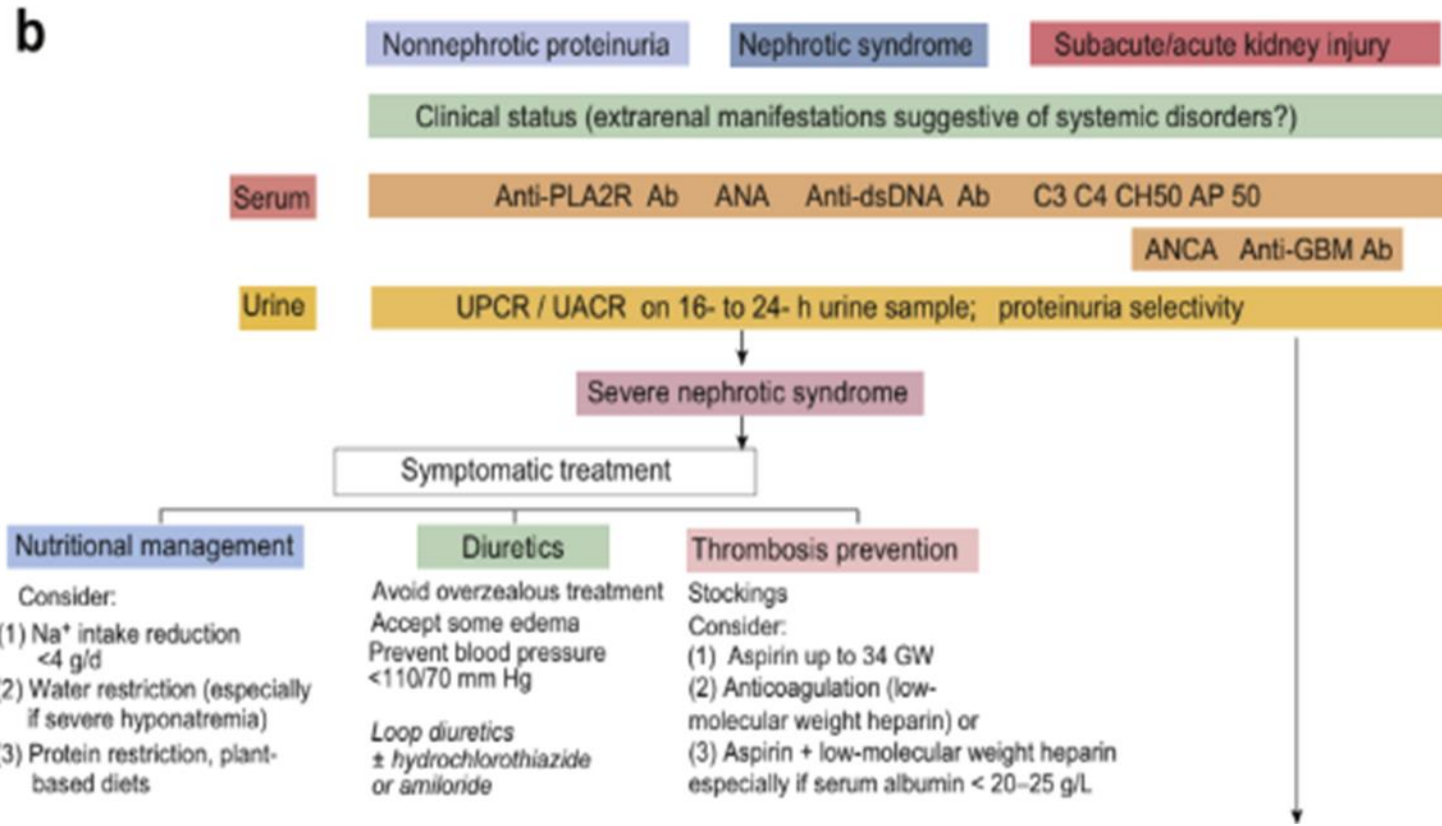
TOOLS FOR THE DIAGNOSIS AND MONITORING OF GDs IN PREGNANCY

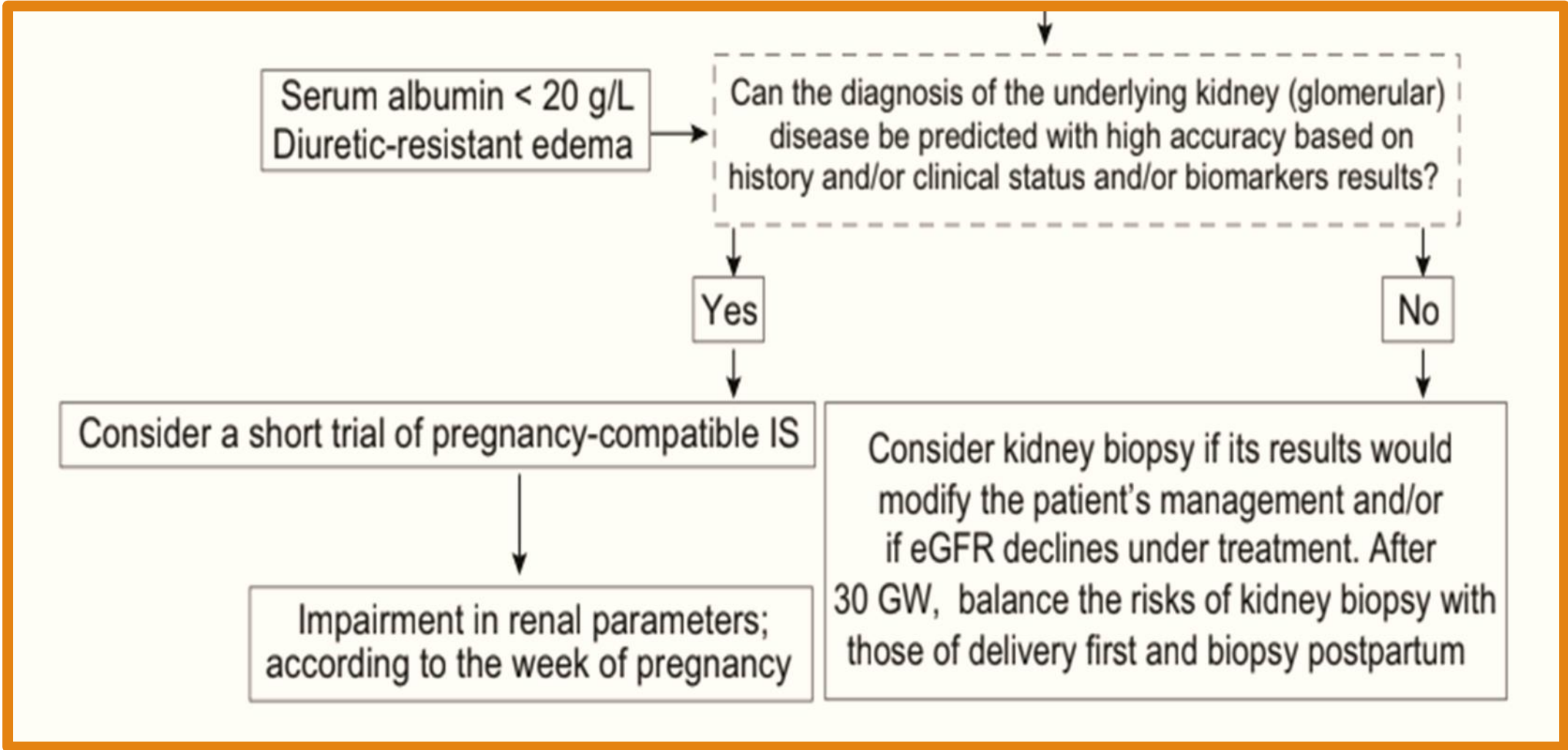
- **No consensus** regarding the **best** method.
- Spot urinary protein-to-creatinine ratio (UPCR) is usually preferred to timed urine collections because of the possibility of underestimation, variability, and inconvenience, and the potential for treatment delay
- The UPCR is practical for screening for hypertensive disorders of pregnancy, for which new onset of proteinuria (UPCR >30 mg/mmol) is still **one discriminating parameter** between preeclampsia and gestational hypertension.



Renal abnormalities discovered during pregnancy

a Isolated microscopic hematuria → Present in up to 20% of healthy pregnant women → Monitor kidney function and proteinuria in pregnancy
Control at least 2–3 mo postpartum





Kidney biopsy during pregnancy: a difficult decision. A case series reporting on 20 patients from Mexico

Bernardo Moguel González ¹, Marcos Garcia Nava ^{2 3}, Oralia Alejandra Orozco Guillén ⁴,
Virgilia Soto Abraham ⁵, Enzo Vasquez Jimenez ⁶, Bernardo Rodriguez Iturbe ^{1 7},
Magdalena Madero Rovalo ¹

The only series published in the last 5 years, from the largest referral center for complicated pregnancy in Mexico, encompasses only 20 kidney biopsies performed over a period of 5 years.



Considerations regarding the use of kidney biopsy in pregnant women



Clinicians are usually **reluctant** to perform a kidney biopsy during pregnancy. This is because of the increased risk of complications, estimated in a systematic review to be as high as **7%**, compared **with 1%** after delivery). The bleeding risk has been attributed to the increase in kidney blood flow and is thought to be reversible within **,3 months** after delivery.



Chen TK, Gelber AC, Witter FR, et al. Renal biopsy in the management of lupus nephritis during pregnancy. *Lupus*.2015;24:147–154.

More recent reports indicate that the risks of a kidney biopsy during pregnancy are **minor when performed by an experienced physician and suggest that this procedure may be more frequently considered.**

Chen TK, Gelber AC, Witter FR, et al. Renal biopsy in the management of lupus nephritis during pregnancy. *Lupus*.2015;24:147–154



The availability of laboratory tests, including antibody workup for LN, ANCA, and anti-PLA2R antibodies, or the presence of highly selective proteinuria, may lead **first to empiric treatment** with postponement of biopsy to the postpartum period. A normal ratio of soluble fms-like tyrosine kinase 1/placental growth factor may be useful in ruling out severe or superimposed preeclampsia.



Timing is crucial when considering kidney biopsy. In early pregnancy (<12 weeks), the **risks** of kidney biopsy are **relatively low**, and the advantages of precisely knowing the kidney disease are high..



In kidney transplantation, the technically easier access to the grafted kidney may positively affect the risk-to-benefit ratio.



Patient with history of a glomerular disease

Prepregnancy counseling

(1) Assess disease history and current status

- MN Take into consideration positivity/titer of anti-PLA2R Ab
- LN Assess lupus activity with clinical and biological parameters, including complement dosage but not anti-dsDNA Ab titer

Remission >12-18 mo
No IS

Low added risk

Remission <12-18 mo
Current IS

Medium added risk

Active NS
Deteriorating renal function
Remission <6 mo

High added risk



Management of Pregnancy-Related AKI

The management of pregnancy-related AKI is challenging due to its associated risk with 2 lives of both the mother and baby and should be performed by a **multidisciplinary team** consisting of a nephrologist, an obstetrician, and a neonatologist.



Causes of AKI during pregnancy	Treatment
Hyperemesis gravidarum/prerenal causes	Hydration
Septic abortion/urinary tract infection	Antibiotics
Preeclampsia/HELLP/acute fatty liver of pregnancy	Delivery
Thrombotic thrombocytopenic purpura	Plasma exchange, rituximab
Atypical hemolytic uremic syndrome	Eculizumab
Obstructive uropathy	Analgesics, stent, nephrostomy
Placental abruption and hemorrhage	Control bleeding, delivery
Glomerulonephritis	Steroids, immunosuppression
HELLP, hemolysis, elevated liver enzymes, and low platelets.	



EFFECTS OF PREGNANCY ON KIDNEY ALLOGRAFT FUNCTION

Increase in the GFR causes **physiological proteinuria** of pregnancy, and women with kidney transplants have a higher 24-hour urine protein excretion as compared to healthy women. Protein excretion may increase up to **threefold** by the **third trimester**, exceeding **500 mg** as compared to **200 mg** in healthy pregnant women and returns to baseline levels **by 3 months postpartum**.



Immunologic:

Acute cellular rejection, acute antibody-mediated rejection, combined rejection

Recurrent disease:

C3 glomerulopathy, thrombotic thrombocytopenic purpura, atypical hemolytic uremic syndrome, IgA nephropathy, recurrent or de-novo glomerulopathy, such as focal segmental glomerulosclerosis, membranous nephropathy, pauci-immune glomerulonephritis, lupus nephritis, anti-phospholipid antibody syndrome, disseminated intravascular coagulation, progression of chronic kidney disease.



Medication-induced: calcineurin inhibitor, intravenous contrast dye exposure, antibiotics, antivirals

Infection-related: polyomavirus nephropathy, cytomegalovirus systemic infection, pyelonephritis, chorioamnionitis, sepsis

Tubulointerstitial disease: acute tubular necrosis, acute interstitial nephritis, acute cortical necrosis



Acute renal failure in pregnancy and kidney transplant

Pregnancy-related complications: acute fatty liver of pregnancy, preeclampsia, HELLP syndrome, amniotic fluid embolus

Malignancy: post-transplant lymphoproliferative disease or any other malignancy (infiltrative or obstructive)

Vascular: renal artery thrombosis, renal vein thrombosis, kidney allograft thrombosis, thrombotic microangiopathy



Risk factors for pregnancy-related AKI in kidney transplant recipients

1-Solitary kidney

2-Susceptibility to volume depletion due to autoregulation impairment

3-Immunological risk factors

4-Increased risk of abdominal compartment syndrome depending on the number of transplants or multiorgan transplants, etiology of end-stage kidney disease such as polycystic disease

5-Long term exposure to medications such as calcineurin inhibitors that cause acute vasoconstriction and nephrotoxicity



Risk factors for pregnancy-related AKI in kidney transplant recipients

6-Increase of urinary reflux during pregnancy in addition to inherent risk with transplant ureter

7-Increased risk of acute urinary retention and ureteral strictures

8-Increased likelihood for post-transplant lymphoproliferative disorder and requiring nephrotoxic chemotherapy agents

Exposure to nephrotoxic antimicrobials and immunoglobulins





Contents lists available at [ScienceDirect](#)

Microbial Pathogenesis

journal homepage: www.elsevier.com/locate/micpath



Progression of renal damage and tubular regeneration in pregnant and non-pregnant adult female rats inoculated with a sublethal dose of Shiga toxin 2

Lilian K. Fischer Sigel^{a,b}, Daiana S. Sánchez^{a,b}, Flavia Sacerdoti^{b,c}, Elsa Zotta^{b,c,d},
Claudia Silberstein^{a,b,*}

^a Universidad de Buenos Aires (UBA), Facultad de Ciencias Médicas, Departamento de Ciencias Fisiológicas, Laboratorio de Fisiología Renal, Buenos Aires, Argentina

^b Universidad de Buenos Aires – Consejo Nacional de Investigaciones Científicas y Tecnológicas (CONICET), Instituto de Fisiología y Biofísica Bernardo Houssay (IFIBIO Houssay), Buenos Aires, Argentina

^c Universidad de Buenos Aires, Facultad de Ciencias Médicas, Departamento de Ciencias Fisiológicas, Laboratorio de Fisiopatología, Buenos Aires, Argentina


^d Universidad de Buenos Aires, Facultad de Ciencias Médicas, Departamento de Ciencias Fisiológicas, Laboratorio de Patología, and Facultad de Farmacia y Bioquímica, Cátedra de Fisiopatología, Buenos Aires, Argentina



Activate Windows

Adaptive mechanisms that lead to systemic and intrarenal vasodilatation during pregnancy **could protect** the kidney from Stx2



► Sci Rep. 2018 Sep 28;8:14534. doi: [10.1038/s41598-018-32801-8](https://doi.org/10.1038/s41598-018-32801-8) 

Pregnancy protects the kidney from acute ischemic injury

[Vasily A Popkov](#)^{1,2,3}, [Nadezda V Andrianova](#)², [Vasily N Manskikh](#)¹, [Denis N Silachev](#)^{1,3}, [Irina B Pevzner](#)^{1,3},
[Ljubava D Zorova](#)^{1,3}, [Gennady T Sukhikh](#)³, [Egor Y Plotnikov](#)^{1,3,4,✉}, [Dmitry B Zorov](#)^{1,3,✉}

► [Author information](#) ► [Article notes](#) ► [Copyright and License information](#)

PMCID: PMC6162317 PMID: [30266919](#)



Hormonal changes during pregnancy, including increased levels of growth factors like vascular endothelial growth factor (VEGF) and erythropoietin, play a pivotal role in enhancing renal regeneration. These hormones promote cellular survival, proliferation, and angiogenesis, which are vital for effective tissue repair following acute kidney injury.



Understanding these processes can inform **therapeutic strategies** aimed at **improving** renal recovery in both pregnant and non-pregnant individuals experiencing acute kidney injury.



ORAL/FRIDAY: WOMEN'S HEALTH AND KIDNEY DISEASES: FROM BENCH TO BEDSIDE

Pregnancy Protects against Kidney Injury in Aged Female Mice Lacking G Protein-Coupled Estrogen Receptor FR-OR93

Singh, Ravneet¹; Almutlaq, Rawan N.²; Sugahara, Sho¹; Brooks, Craig R.¹; Curtis, Lisa M.²; Gohar, Eman Y.¹

[Author Information](#)

Journal of the American Society of Nephrology 35(10S):10.1681/ASN.2024xx879fpz, October 2024. | DOI: 10.1681/ASN.2024xx879fpz



Advertisement

ASN
Wolters Kluwer

READ OUT LOUD
Listen to articles on the go

Start Listening

Look for the LISTEN button



Histological assessments revealed that pregnant mice had lower acute tubular necrosis (ATN) scores following I/R injury. While non-pregnant mice showed severe necrosis and damage, pregnant mice retained more of their kidney tissue structure, with only focal necrotic areas observed.



P-AKI is an iceberg

P-AKI identified, referred-followed-up

HDP
Preeclampsia-HELLP

Obstetric
haemorrhage/Infections

Maternal age
Too old-Too young

Maternal
Malnutrition-obesity

Unrecognized CKD

Maternal comorbidities

History of obstetric complications

- Pollution
- Food insecurity
- Lack of resources
- Lack of awareness
- Poverty
- Poor Sanitation
- Environmental factors
- Discrimination



