

Marcela Ramirez, MD

# Acute Renal Failure

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# Acute Renal Failure

- Abrupt ( hours or days) deterioration of renal function with decrease in GFR or tubular injury compromising the kidney ability to maintain fluid or electrolyte homeostasis

# Acute Renal Failure

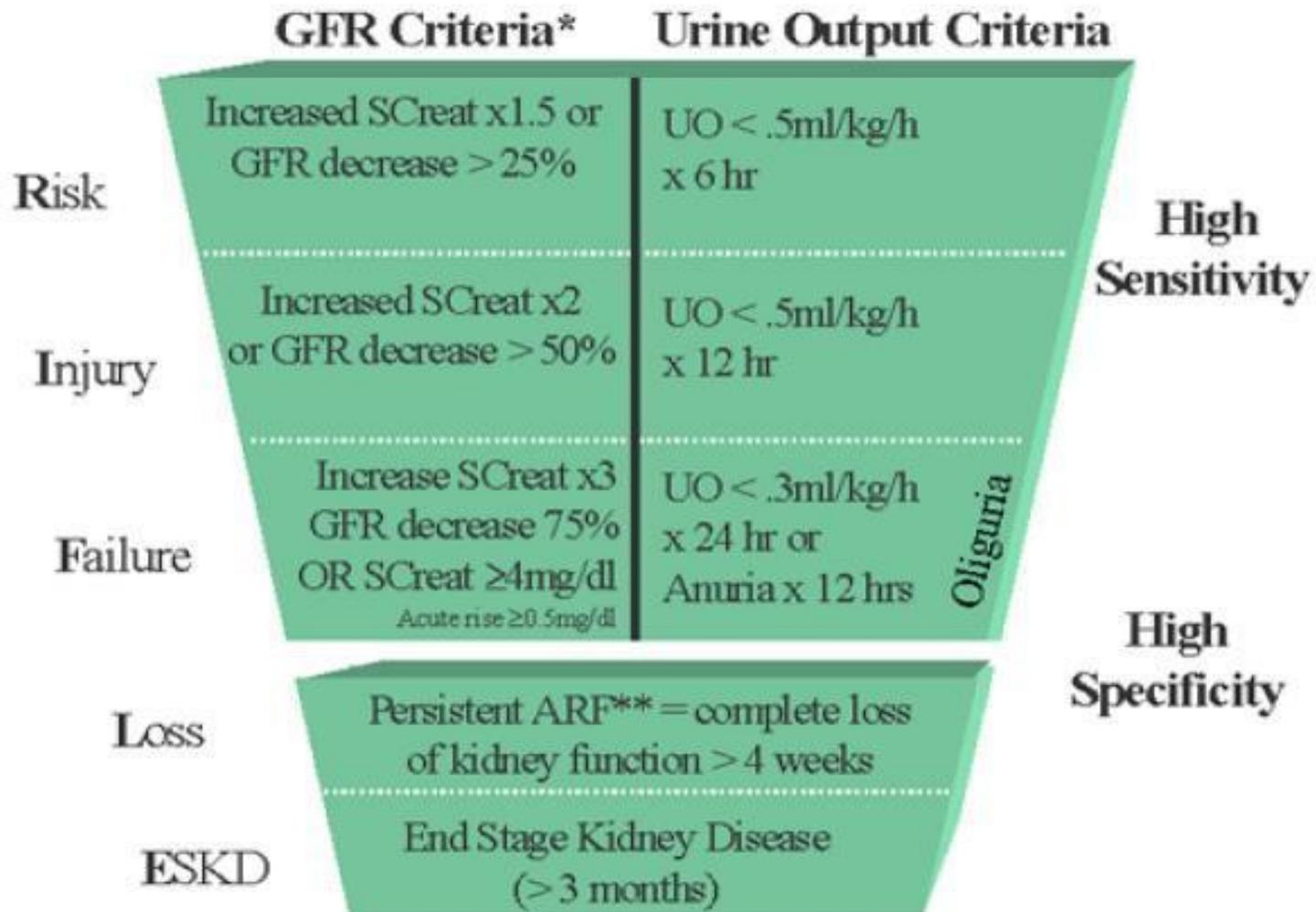
## ARF Definition

1. An increase in serum creatinine of 0.5mg/dl or greater
2. 50% increase in P Cr
3. A 50% reduction in calculated Cr Clearance
4. A decrease in renal function that warrants dialysis

# Acute Renal Failure

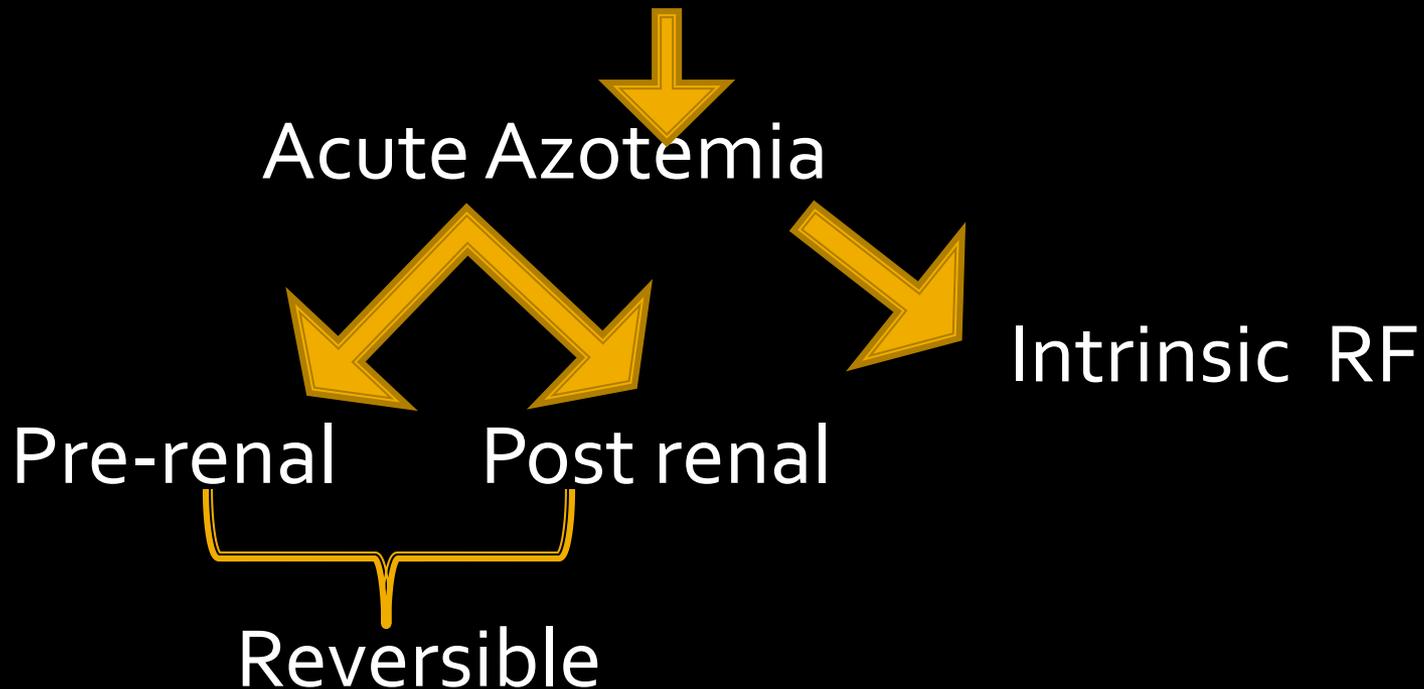
- The Acute Dialysis Quality Initiative Group proposed the **RIFLE system** classification:
  - Three severity categories:
    - Risk
    - Injury
    - Failure
  - 2 clinical outcomes categories:
    - Loss
    - ESRD

# Acute Renal Failure



# Acute Renal Failure

- An increase in BUN and creatinine  $>/50\%$  over baseline in 24h



# Acute Renal Failure

<b>Oliguria</b>	<b>U/O &lt; 400ml/ 24h</b> <b>Associated with ATN</b> <b>Rarely Progresses to anuria unless it is associated with sepsis</b>
<b>Anuria</b>	<b>U/O &lt;50ml/24h</b> <b>Abrupt development suggest other conditions:</b> <ul style="list-style-type: none"><li>-Renal vascular occlusion</li><li>- obstructive uropathy</li><li>- Severe cortical necrosis</li></ul>

# Acute Renal Failure

## Risk Factors ARF

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Severity and duration of renal hypoperfusion

Exposure to nephrotoxins

Pre-existing renal insufficiency

Age

Injury Severity score >17

Comorbidities (DM, PVD)

Bone Fractures

GCS <10

ALI requiring mechanical ventilation

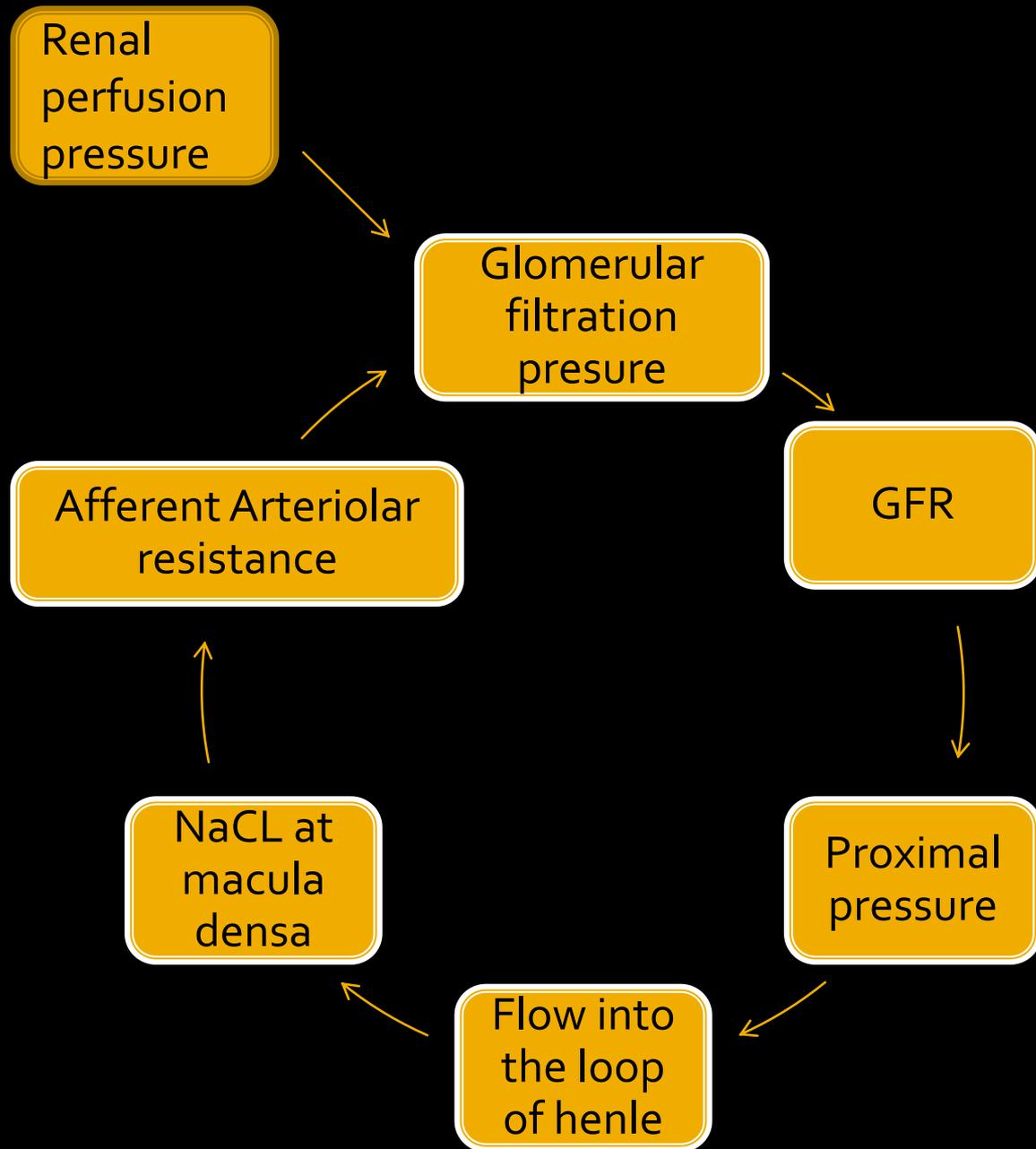
# Acute Renal Failure

Renal ischemia

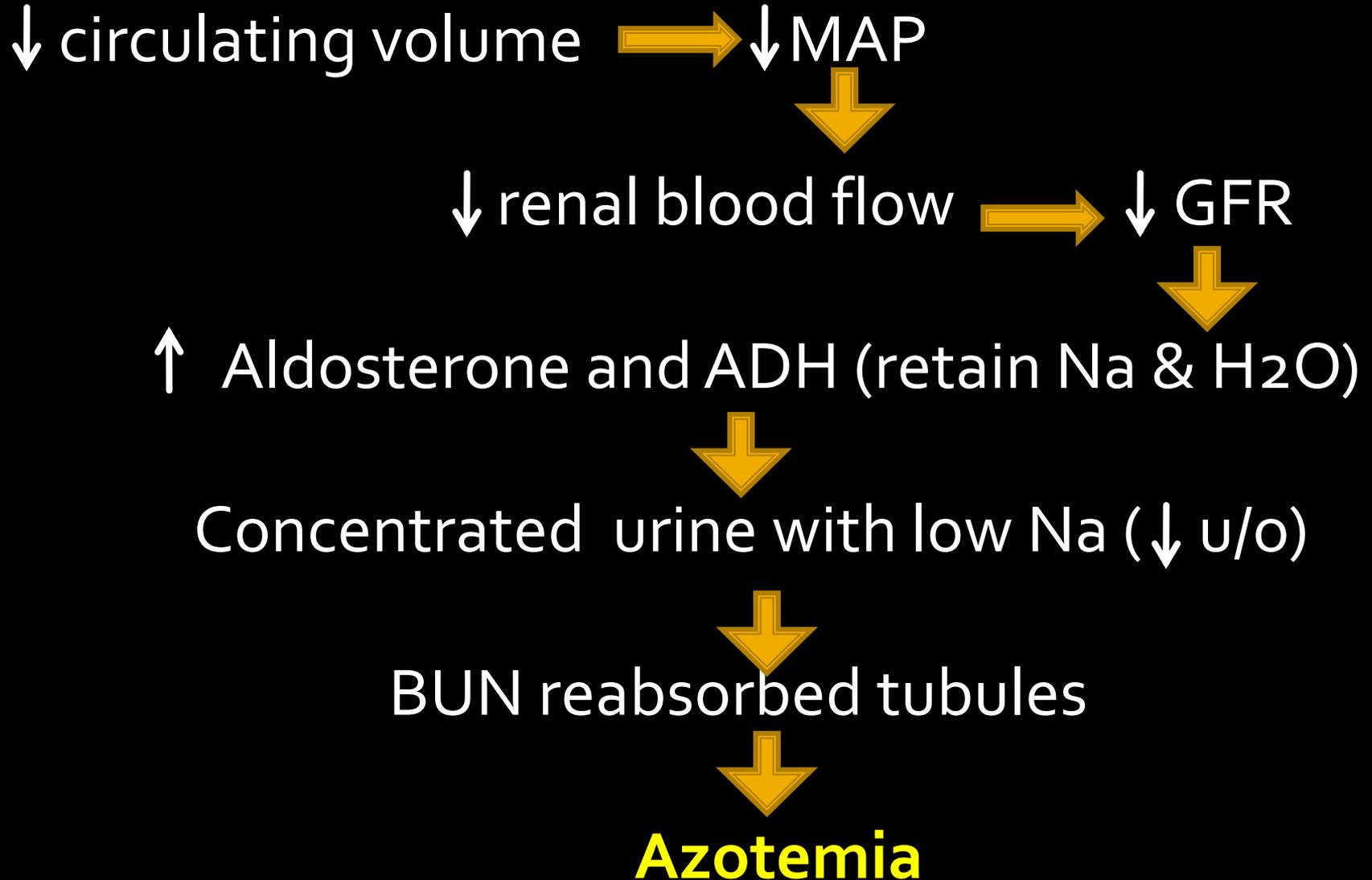


central contributor in at least half of the cases of ARF.

- Causes:
- Absolute loss of IV volume (hemorrhage)
  - Decreased effective IV volume (sepsis)
  - Diminished CO
  - Meds (NSAIDs, ACE-I, contrast)



# Pathophysiology Pre Renal



# Post Renal or Obstructive

Blockage of both ureters or urethra



Obstruction of urine flow



↓ renal basal vascular tone

↓ renal blood flow



Reversible atrophy



**CRF**

# Acute Intrinsic RF

Can be categorized according to the primary site of injury within the renal parenchyma:

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Glomerular disease (drugs & infections)

Interstitial nephritis (drugs, allergies, vascular injury)

Vasculopathy

ATN

# Diagnosis

- Sudden drop U/O ( $< 0.5\text{ml/Kg/h}$  in 4h) or  
↑ daily Cr level ( $\geq 0.25\text{mg/dl}$  from baseline)

- ↑ Cr  $1.5\text{mg/dl}$  (represent a 50% ↓ in GFR)



R/O obstruction (foley, US)

R/O prerenal dysfunction

# Acute Renal Failure

- Surgical patients  $\implies$  ↓ Renal perfusion (mcc of oliguria)

- ↑ Renal work (O<sub>2</sub> Consumption) + ↓ Renal perfusion (↓ O<sub>2</sub> delivery)



Hypovolemia is the most common cause

## ➤ Indications of PA catheter

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- Dependence of inotropes
- Poor baseline CO
- Evidence of large volume shifts

➤ Decrease filtration ↓ creatinine  
↓ BUN

➤ Because Cr is not reabsorbed, Cr level rises more slowly during low tubular flow rates.

- Serum BUN increases more quickly than Cr.
- A ratio BUN: Cr  $\geq 15$   Renal hypoperfusion
- BUN is influenced by the patients metabolic state.
- BUN can also be  $\uparrow$  : - Excessive protein intake  
(nl renal Function) - Steroids

# Lab indices of Intrinsic Renal Dysfunction and Prerenal Azotemia / Oliguria

	<b>Prerenal azotemia</b>	<b>Renal Dysfunction</b>
Plasma BUN:Cr	>20	<10
Urine Osmolality	>500 or >100 over plasma	<350 or < plasma
U specific gravity	>1.020	<1.010
U Na	<20meq/L	>30meq/L
FENa	<1%	2%
U Cr/ P Cr	>40	<20

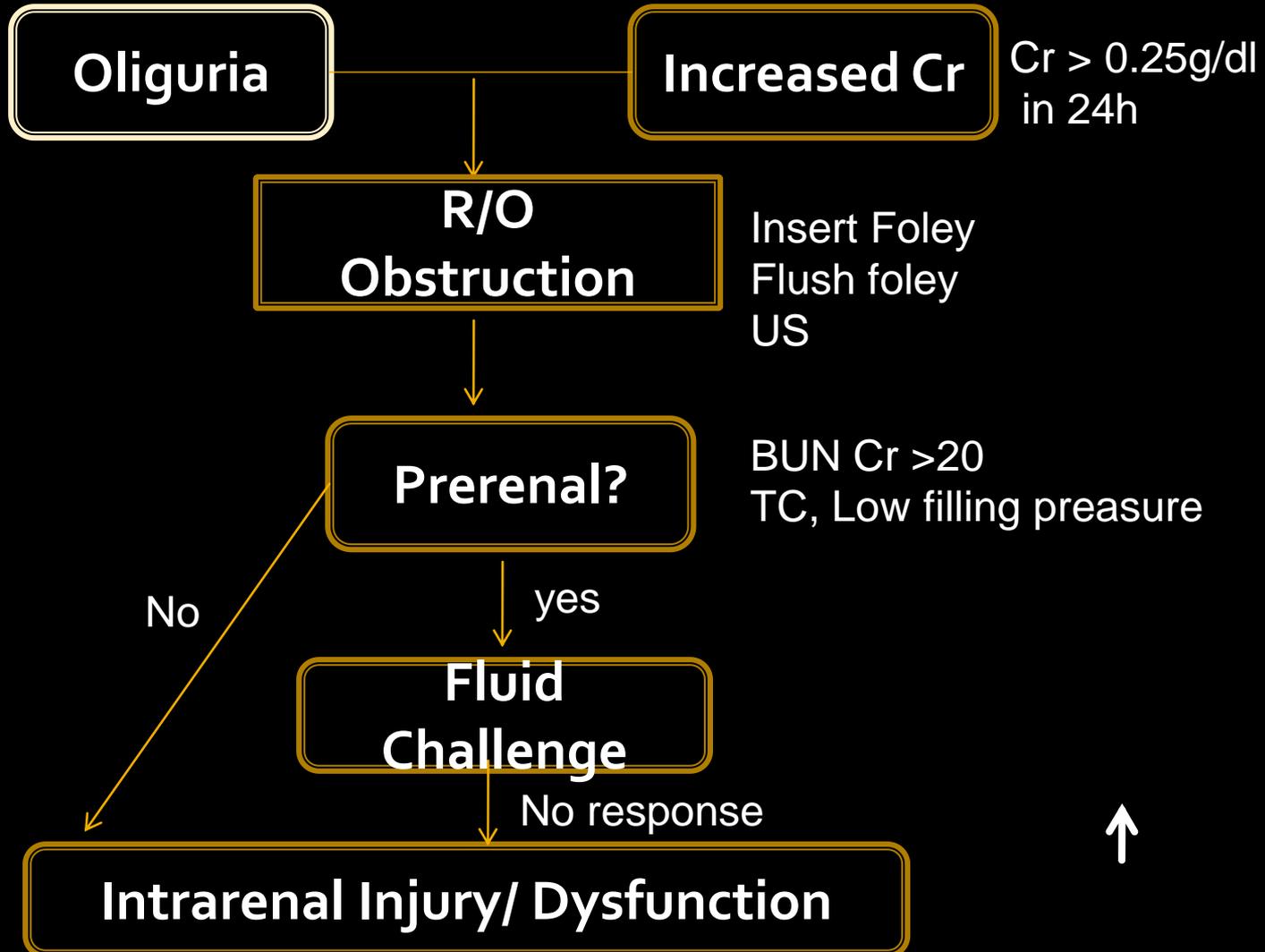
# Acute Renal Failure

- FENa:  $\frac{U \text{ Na} \times P \text{ Cr}}{P \text{ Na} \times U \text{ Cr}}$
- Accuracy decreases:
  - Pre-existing renal insufficiency
  - Recent diuretic use
  - Elderly patients

## Diagnosis of Renal Parenchyma injury

GFR	<ul style="list-style-type: none"><li>•the best measure of proportion of functional nephron</li><li>•Can be estimated by Cr Clearance</li><li>•Maybe overestimated by CCr in early stages</li></ul>
Creatinine	good marker for filtration through the glomerulus
Cr Clearance	$(140 - \text{Age}) \times \text{Kg} / \text{PCr} \times 72$ Female $95 \pm 20$ ml/min Male $120 \pm 25$ ml/min

# Diagnosis and Treatment of Oliguria and Azotemia



# Intrarenal Injury/ Dysfunction

U Na >20  
U osm <300-400  
FENa >1  
Cast in urine

Transfuse  
Optimize preload  
MAP >80

## Increased DO<sub>2</sub>I

## Diuretic trial

### Requires renal replacement

### Nonoliguric renal injury

### Hemodynamically stable

yes

no

## IHD

## Continues renal replacement

## Indications of Dialysis

Fluid overload

Severe uremia

Critical electrolyte abnormalities

Metabolic acidosis (pH 7.2)

Some toxins

# Acute Renal Failure

## Management of ARF

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- Prevention ( most important)
- Maintenance of IV volume
- Avoidance of hypotensive episodes
- Minimization of toxic exposure
- Aggressive treatment of infections
- Early intervention
- Nutrition (protein 2.5g/kg/day)