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PEARLS OF LABORATORY MEDICINE

Acute Kidney Injury

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Clinical Significance of Acute Kidney Injury (AKI)¹

- Common yet underrecognized syndrome (1.2 Million people/year)
- Heterogenous
- Costly
 - Increased length of stay
 - Increased risk of mortality
 - Increased risk of chronic kidney disease (CKD)



Definition of AKI

Sudden Deterioration of renal function

- What is sudden?
- What is deterioration?

Consensus Guidelines

- RIFLE: **R**isk, **I**njury, **F**ailure, **L**oss, **E**SRD
- AKIN: Acute Kidney Injury Network
- KDIGO: **K**idney **D**isease **I**mproving **G**lobal **O**utcomes

Diagnostic Criteria of AKI

- 1) Reduction in urinary output
 - 2) Increased serum creatinine
- Either of these criteria can be used to define the 3 stages of AKI



Urine Output - Diagnostic Criteria of AKI

AKI Stage ²	Urine Output
1	< 0.5 mL/kg/h for 6–12 hours
2	< 0.5mL/kg/h for ≥ 12 hours
3	<0.3mL/kg/h for ≥ 24 hours OR Anuria for ≥ 12 hours



Serum Creatinine - Diagnostic Criteria of AKI

Stage ²	Serum Creatinine Criteria
1	Increased by x1.5 (within 7 days) OR ≥ 0.3 mg/dL (≥ 26.5 μ mol/L) (within 48hrs)
2	Increased by x2
3	Increased by x3 or ≥ 4.0 mg/dL (≥ 353.6 μ mol/L) or initiation of RRT Or <18 years, a decrease in eGFR < 35 mL/minute/1.73 m ²



Clinical Decision Support for AKI



Study by Al-Jaghbeer et al.³

- **Mortality:** 0.8% reduction
- **Length of stay:** 0.3 days reduction
- **Dialysis Use:** 2.7% reduction

Clinical Management²

- Discontinue or dose-adjust nephrotoxic drugs
- Treat the underlying disease
- Treat electrolyte disturbances
- Optimize fluid balance and hemodynamics



Risk Factors for AKI²

Exposures	Susceptibilities
Sepsis	Dehydration or volume depletion
Critical illness	Advanced age
Circulatory shock	Female Gender
Burns	Black Race
Trauma	CKD
Cardiac surgery (especially with cardiopulmonary bypass)	Chronic diseases (heart, lung, liver)
Major noncardiac surgery	Diabetes Mellitus
Nephrotoxic Drugs	Cancer
Radiocontrast agents	Anemia
Poisonous plants and animals	



The Problem with Serum Creatinine

- Delayed Marker: >50% renal function loss for increase in creatinine⁴
- Good for epidemiological studies, difficult to apply at the bedside
- How often is serum creatinine measured in AKI evaluation?
 - High risk: Measure at least daily²



Small Changes in Kidney Function

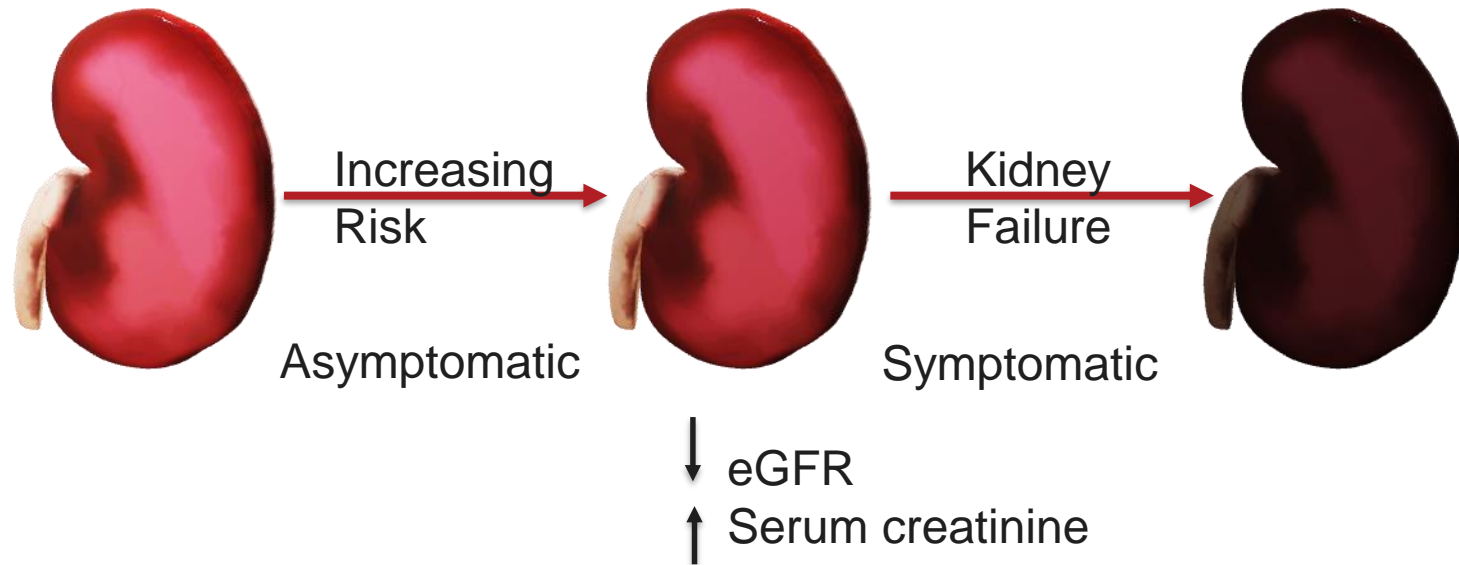
- Associated with significant short & long-term outcomes
 - An increase of 0.1 mg/dL is associated with increased risk⁵
 - In patients with histopathologic evidence, 1/3 of patients could not diagnosed based on KIDGO criteria⁶



⁵Newsome BB et al., 2008, Archives of internal medicine, 168(6):609-16

⁶Chu R et al, 2014; Clinical Journal of the American Society of Nephrology, CJN-06150613

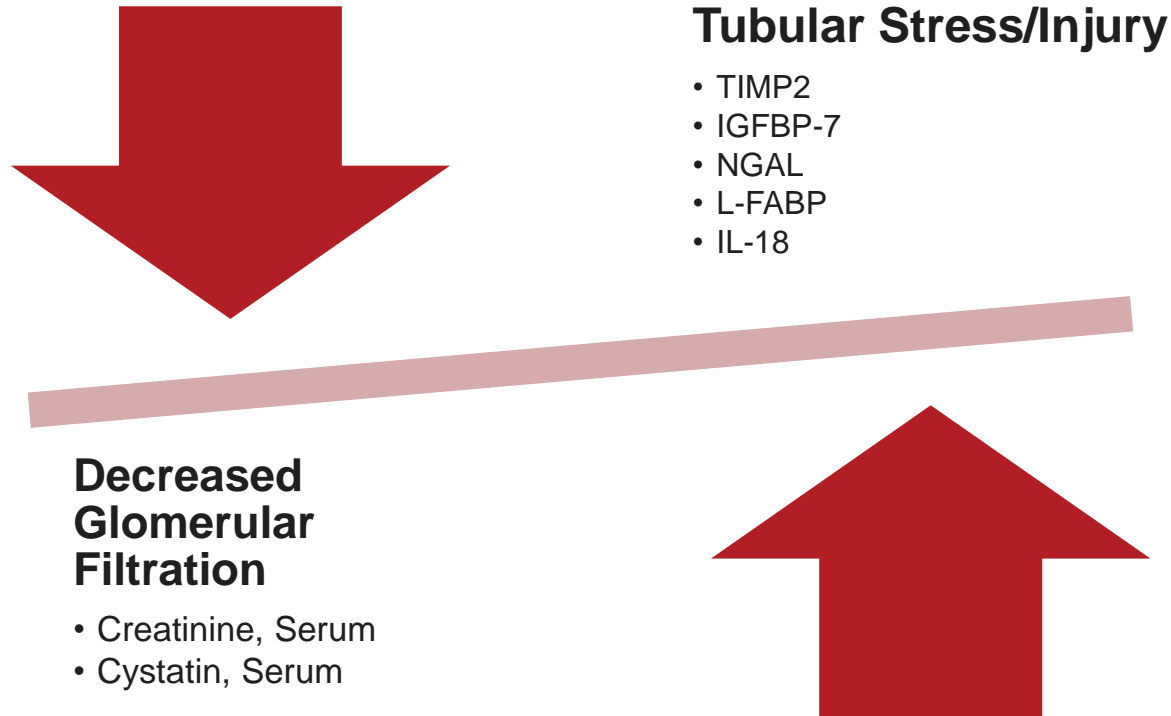
Future of AKI Diagnosis: From Reactive to Proactive



Proactive
Measures

Reacting to
Manage the
Damage

Other Markers of AKI



Kinetics of Urinary Markers of AKI⁷

Biomarker	Kinetics
KIM-1	Detected within 12-24h post injury, peaks at 48-72h
IL-18	Detected within 6h post injury, peaks at 12-18h
TIMP-2 + IGFBP-7	Detected within 12h post injury
NGAL	Detected within 3h post injury, peaks at 6h
L-FABP	Detected within 1h post injury, peaks within 6h



Impact of New AKI Markers

1. Promising Research
 - Need more clinical outcomes
2. Timing and frequency for biomarker measurements is unclear
 - Exposure specific?
3. How will AKI be addressed in the context of pre-existing chronic kidney disease?



Conclusion/Summary

- AKI is defined by changes in serum creatinine and urinary output – KDIGO Guidelines
- A syndrome that is highly variable in severity, etiology, and timing of the acute insult
- Early indications of AKI by novel markers to enable optimal management



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Disclosures/Potential Conflicts of Interest

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