



Approach to Acute Kidney Injury

Med 341

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Objective

- At the end of this tutorial you will be able to:
 - Define **Acute Kidney Injury (AKI)**
 - Discuss the epidemiology of **AKI**
 - Discuss the etiology of **AKI**
 - Describe the management of **AKI**
 - Diagnose **AKI**
 - Treat **AKI**

Learning methods

- ❑ Lecture/material review
- ❑ Interactive case scenarios

Acute Kidney Injury (AKI)

- Deterioration of renal function over a period of hours to days, resulting in
 - the failure of the kidney to excrete nitrogenous waste products and
 - to maintain fluid and electrolyte homeostasis
- Oliguria: <400 ml urine output in 24 hours
- Anuria: <100 ml urine output in 24 hours

Acute renal failure (definition)

- ARF in one study was defined as:
 - as a 0.5 mg/dL increase in serum creatinine if the baseline serum creatinine was ≤ 1.9 mg/dL,
 - an 1.0 mg/dL increase in serum creatinine if the baseline serum creatinine was 2.0 to 4.9 mg/dL, and
 - a 1.5 mg/dL increase in serum creatinine if the baseline serum creatinine was ≥ 5.0 mg/dl

Acute kidney injury

RIFLE definition

	GFR/Creatinine criteria	Urine Output criteria
<i>Risk</i>	Increase in creatinine x1.5 Or GFR decrease >25%	UO < .5ml/kg/hr for 6hrs
<i>Injury</i>	Increase in creatinine x 2 Or GFR decrease >50%	UO < .5ml/kg/hr for 12hrs
<i>Failure</i>	Increase in creatinine x 3 Or GFR decrease >75%	UO < .3ml/kg/hr for 24 hrs or Anuria for 12hrs
<i>Loss</i>	Persistent ARF = complete loss of renal function > 4 weeks	
<i>ESRD</i>	End Stage Renal Disease > 3 months	

Acute Kidney Injury

AKIN definition:

Stage	Creatinine criteria	Urine Output
AKI stage I	1.5-2 times baseline OR 0.3 mg/dl increase from baseline ($\geq 26.4 \mu\text{mol/L}$)	<0.5 ml/kg/h for >6 h
AKI stage II	2-3 times baseline	<0.5 ml/kg/h for >12 h
AKI stage III	3 times baseline OR 0.5 mg/dl ($44 \mu\text{mol/L}$) increase if baseline > 4mg/dl($\geq 354 \mu\text{mol/L}$) OR Any renal replacement therapy given	<0.3 ml/kg/h for >24 h OR Anuria for >12 h

Mehta R et al. Crit Care 2007;11(2):R31

Ostermann *et al. Critical Care* 2008 12:R144

Acute Kidney Injury

Definition:

“Acute kidney injury, mortality, length of stay, and costs in hospitalized patients”

19,982 pts admitted to academic medical centre
in SF 9,205 pts with >1 creatinine results

Rise in creatinine	Multivariable OR (hospital mortality)
≥ 0.3 mg/dl (26.4 µmol/L)	4.1
≥ 0.5 mg/dl (45 µmol/L)	6.5
≥ 1.0 mg/dl (90 µmol/L)	9.7
≥ 2.0 mg/dl (180 µmol/L)	16.4

Acute kidney injury

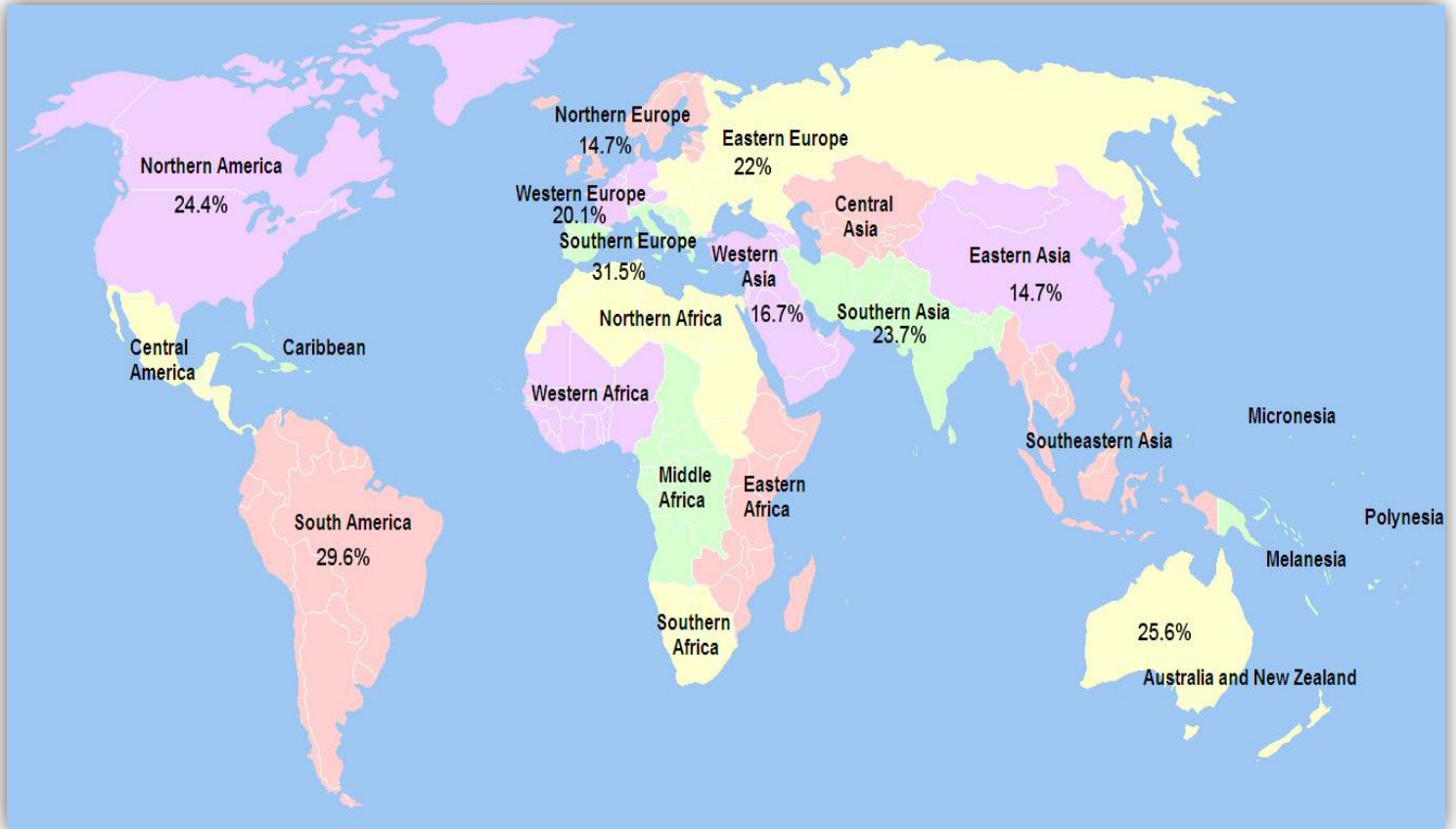
KDIGO Definition:

An abrupt (within 48 hours)

- absolute increase in creatinine by 0.3 mg/dl
(26.4 $\mu\text{mol/l}$) or
- percentage increase of $>50\%$ from base line
or
- urine output <0.5 ml/hour for 6 hours

Acute kidney injury

Incidence:

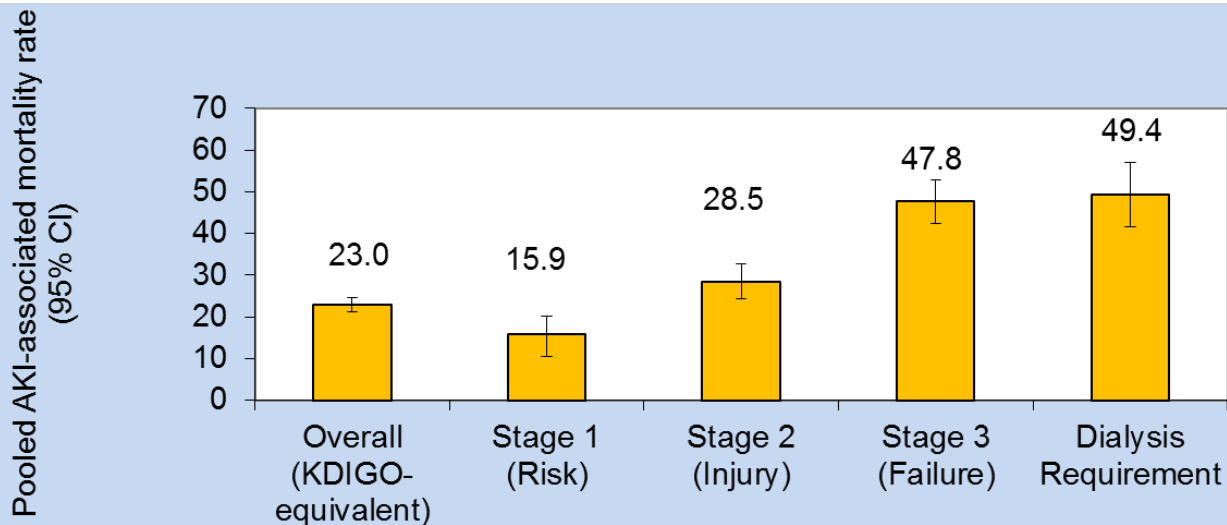


Epidemiology

- It occurs in
 - 5% of all hospitalized patients and
 - 35% of those in intensive care units
- Mortality is high:
 - up to 75–90% in patients with sepsis
 - 35–45% in those without

Acute kidney injury

Outcome:



No. studies	110	26	25	25	31
No. subjects with AKI	429,535	8,226	42,354	42,354	6,534

Acute Kidney Injury

Impact

Correlation between AKI classification and outcome

22,303 adult patients admitted to 22 ICUs in UK and Germany
between 1989–1999 with ICU stay \geq 24 hours

	No AKI	AKI I	AKI II	AKI III
	65.6%	19.1%	3.8%	12.5%
Mean age	60.5	62.1	60.4	61.1
ICU mortality	10.7%	20.1%	25.9%	49.6%
Hospital mortality	16.9%	29.9%	35.8%	57.9%
Length of stay in ICU (median)	2 d	5 d	8 d	9 d

Acute Kidney Injury

CKD risk

Risk of CKD

Increasing evidence that episodes of AKI leave permanent renal damage

Long-term prognosis after AKI requiring RRT

- ❑ 206 ICU patients with RRT for AKI
- ❑ Single centre in Geneva
- ❑ 90 day survival: 46%
- ❑ 3 years post ICU:
 - 60/206 (29.1%): alive
 - 25/60 (41.7%): new CKD
 - 9/60 (15%): ESRD, on dialysis

Acute Kidney Injury

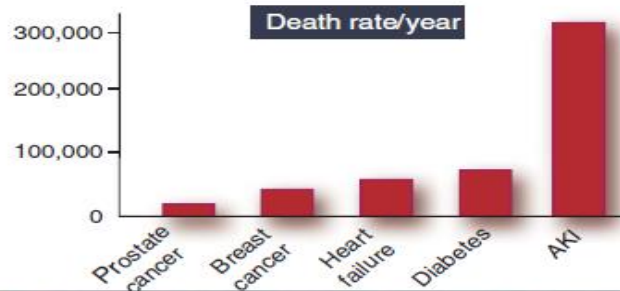
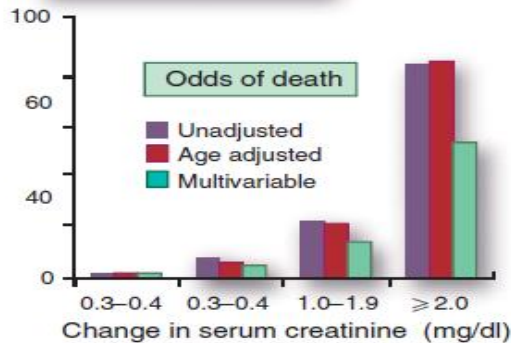
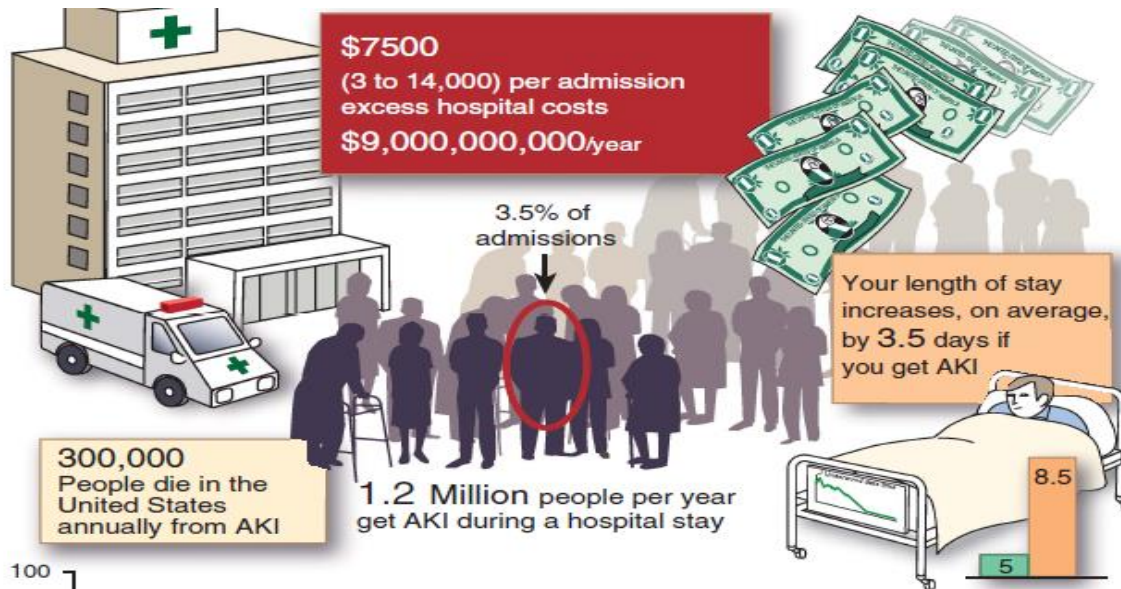
Impact

“Long-term risk of mortality and other adverse outcomes after AKI: A systematic review and meta-analysis”

- 48 studies, 47,017 patients with AKI (varying criteria)
Length of follow-up: 6 months – 17 years
- AKI associated with:
 - increased risk of CKD
 - increased risk of CV event
 - increased long-term mortality

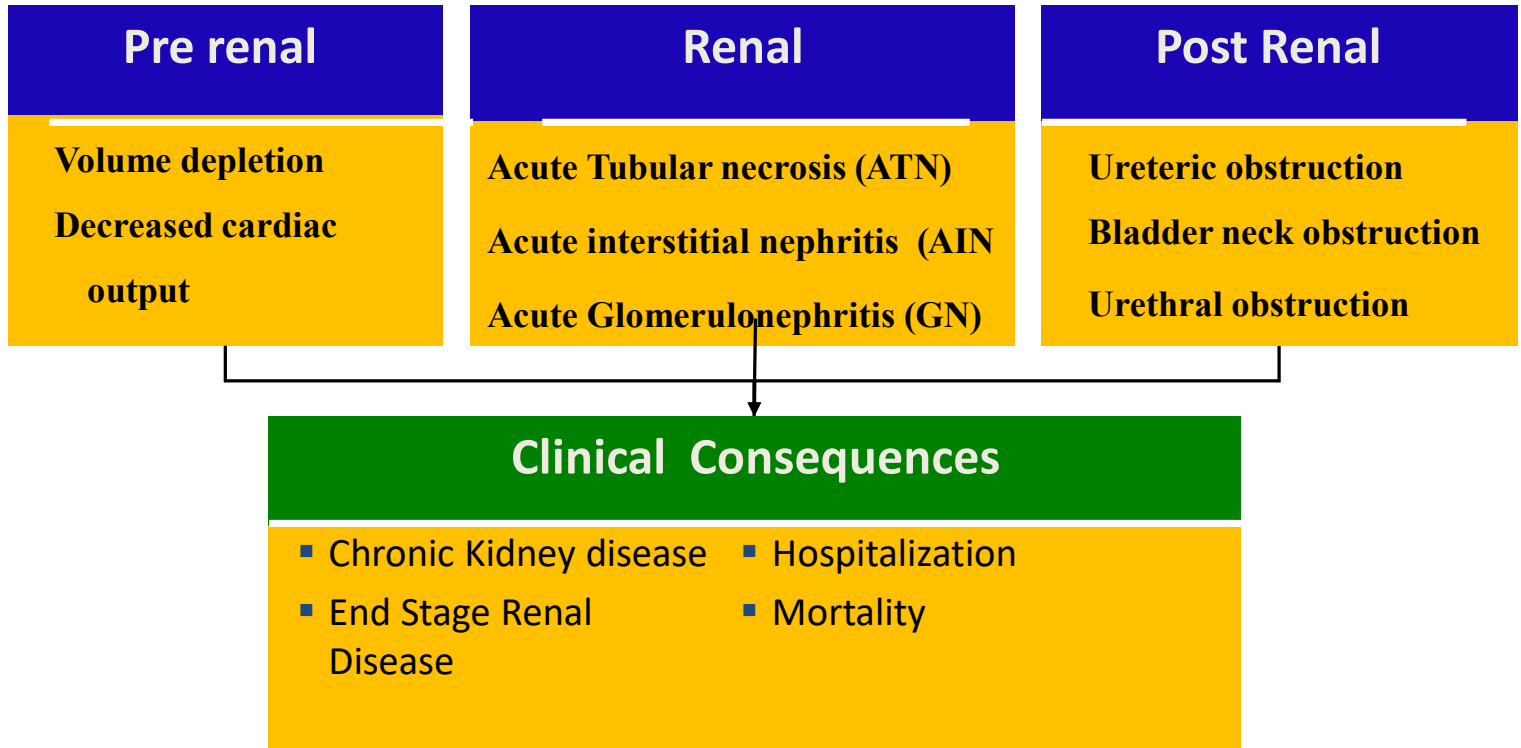
Acute Kidney Injury

Clinical outcome:



Acute kidney injury

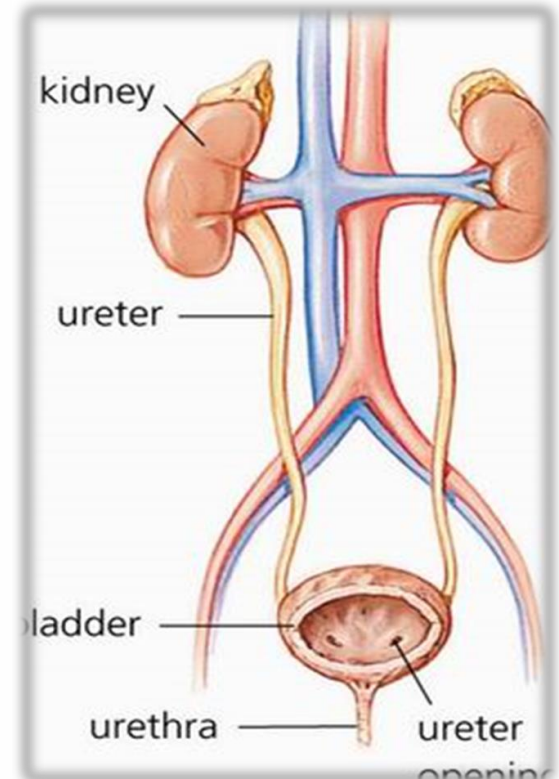
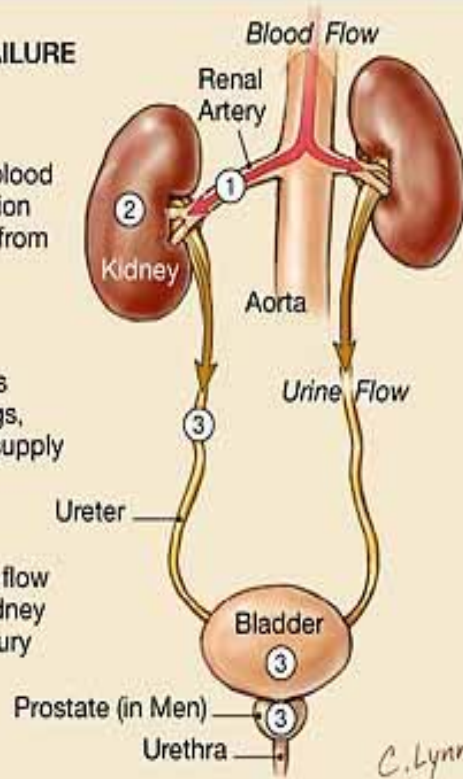
Types and consequences:



Etiology of ARF

CAUSES OF ACUTE RENAL FAILURE

- 1 Prerenal**
Sudden and severe drop in blood pressure (shock) or interruption of blood flow to the kidneys from severe injury or illness
- 2 Intrarenal**
Direct damage to the kidneys by inflammation, toxins, drugs, infection, or reduced blood supply
- 3 Postrenal**
Sudden obstruction of urine flow due to enlarged prostate, kidney stones, bladder tumor, or injury



Acute Kidney Injury

Scenario 1

50 years old Saudi male s/p Right hemicolectomy 6 hours ago for colon cancer intra operative course complicated by bleeding and hypotension required 6 units of blood transfusion urine output decreased significantly serum creatinine $285\mu\text{mol/l}$?

- How would you approach this patient?
- What other information you need to know?

Acute Kidney Injury

Scenario 1

- Previously healthy
- And urine output for the last 3 hours is <10 cc and dark colour

Acute Kidney Injury

Scenario 1

Vital Signs	Result	Normal Range
Pulse	134/min	60-100/min
Blood pressure	80/55 mmHg	130/80 mmHg
Temperature	37.0°C	36.6-37.2°C

Jugular venous pressure was low, cold periphery,

Cardiovascular examination:

Normal first and second heart sound no added sound or murmurs.

Respiratory system examination:

Lungs are clear to percussion and auscultation

Abdominal examination:

No tenderness, liver and spleen were not palpable.

Acute Kidney Injury

Scenario 1

Test	Value	Normal values
Creatinine	350 $\mu\text{mol/L}$	62-115 $\mu\text{mol/L}$
Urea	29 mmol/L	2.5-6.4 mmol/L
Potassium	6.2 mmol/L	3.5-5.1 mmol/L
Sodium	137 mmol/L	135-145 mmol/L
Bicarbonate	16	22-26 mmol/l

Acute Kidney injury

Scenario 1

Complete blood count (CBC)	Result	Normal reference ranges
Hemoglobin	70 g/L	Male : 135-175 g/L (13.5-17.5 g/dl) Female : 120-155 g/L (12-15.5 g/dl)
White cell count	12 x 10 ⁹ /L	4.5-11.0 x 10 ⁹ /L
Platelet count	198 x 10 ⁹ /L	140-450 x 10 ⁹ /L

Acute Kidney Injury

	Result	Normal values
Color	Dark	Amber yellow
Character	clear	clear
PH	6.0 acidic	4.8-8.0
Specific gravity	1.003	1.015-1.025
Protein	+2	(-)
Glucose	(-)	(-)
Red blood cells	1-2 /hpf	(-)
Hemoglobin	Negative	(-)
Pus cells (WBC)	1-2 /hpf	(-)
Epithelial cells	(-)	(-)
Amorphus phosphate	(-)	(-)
Bacteria	(-)	(-)
Granular cast	seen	(-)

Acute Kidney Injury

Scenario 1

- What is your diagnosis?
 - Acute Kidney Injury
- Where is the etiology?
- Renal?
 - ATN (acute tubular necrosis)
 - AIN (acute interstitial nephritis)
 - GN (glomerulonephritis)
- Diagnosis:
 - Acute Kidney Injury secondary to Acute tubular necrosis due to shock

Acute Kidney Injury

Acute Tubular Necrosis (ATN)

Ischemia:

- Hypotension, sepsis, prolonged pre-renal state

Toxic

- Heme pigment (rhabdomyolysis, intravascular hemolysis)
- Crystals (tumor lysis syndrome, seizures, ethylene glycol poisoning, megadose vitamin C, acyclovir, indinavir, methotrexate)
- Drugs (aminoglycosides, lithium, amphotericin B, pentamidine, cisplatin, ifosfamide, radiocontrast agents)

Diagnose by history, \uparrow FE_{Na} (>2%)
sediment with coarse granular casts,

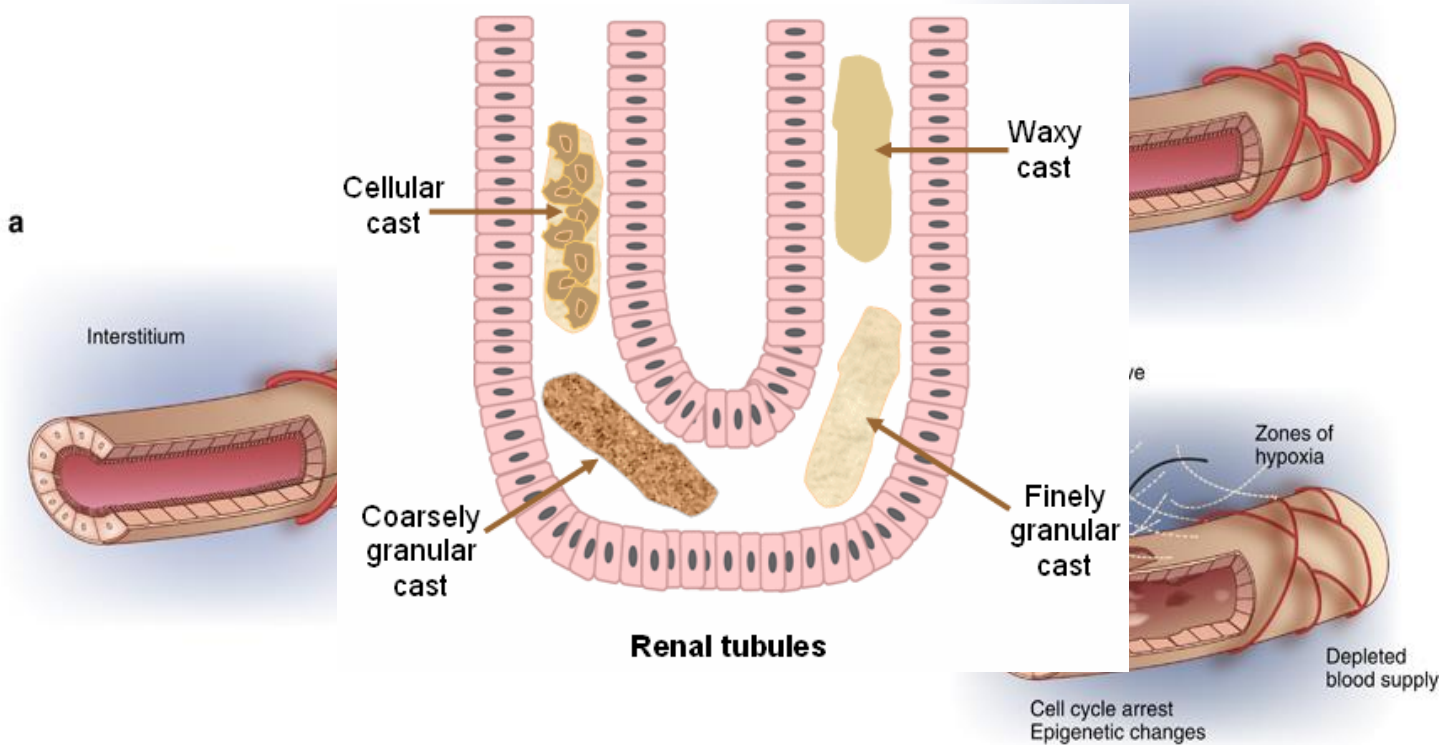
Treatment is supportive care:

- Maintenance of euvolemia (with diuretics, IVF, as necessary)
- Avoidance of hypotension
- Avoidance of nephrotoxic medications (including NSAIDs and ACE-I)

- Dialysis, if necessary

80% will recover, if initial insult can be reversed

Acute tubular necrosis



Acute Kidney Injury

Pre renal vs ATN

	Pre renal	Acute Tubular necrosis (ATN)
Urea/ Creatinine ration	>20:1	10-15:1
Urine	Normal	Muddy brown casts
Urine Osmolality	> 500	<350
Urine Na	<20	>20
Fractional excretion of Na	<1 %	> 1%

$$\text{FENa} = \frac{\text{UNa} \times \text{PCr}}{\text{PNa} \times \text{UCr}} \times 100$$

FENa < 1% (Pre-renal state)

- Contrast nephropathy
- Acute GN
- Myoglobin induced ATN

FENa > 1% (intrinsic cause of AKI)

Acute Kidney Injury

Scenario 1

Indication for dialysis in acute kidney injury setting:

- Symptoms of uremia (encephalopathy,...)
- Uremic pericarditis
- Refractory volume over load
- Refractory hyperkalemia
- Refractory metabolic acidosis

Acute Kidney Injury

Scenario 2

75 years old female, known to have:

- DM II
- HTN
- Presented with nausea, vomiting and diarrhea for 3 days
- Medication: Insulin, lisinopril,

Acute Kidney Injury

Scenario 2

Vital Signs	Result	Normal Range
Pulse	95/min	60-100/min
Blood pressure	112/67 mmHg	130/80 mmHg
Temperature	37.0°C	36.6-37.2°C

Jugular venous pressure was low, dry mucus membrane

Cardiovascular examination:

Normal first and second heart sound no added sound or murmurs.

Respiratory system examination:

Lungs are clear to percussion and auscultation

Abdominal examination:

No tenderness, liver and spleen were not palpable.

Acute Kidney Injury

Scenario 2

Test	Value	Normal values
Creatinine	154 $\mu\text{mol/L}$	62-115 $\mu\text{mol/L}$
Urea	23 mmol/L	2.5-6.4 mmol/L
Potassium	4.3 mmol/L	3.5-5.1 mmol/L
Sodium	137 mmol/L	135-145 mmol/L
Bicarbonate	20	22-26 mmol/l

Acute Kidney Injury

Acute vs Chronic

	<i>Acute</i>	<i>Chronic</i>
History	Short (days-week)	Long (month-years)
Haemoglobin	Normal	Low
Renal size	Normal	Reduced
Serum Creatinine	Acute reversible increase	Chronic irreversible

Acute Kidney injury

Scenario 2

Complete blood count (CBC)	Result	Normal reference ranges
Hemoglobin	134 g/L	Male : 135-175 g/L (13.5-17.5 g/dl) Female : 120-155 g/L (12-15.5 g/dl)
White cell count	12 x 10 ⁹ /L	4.5-11.0 x 10 ⁹ /L
Platelet count	198 x 10 ⁹ /L	140-450 x 10 ⁹ /L

Acute Kidney Injury

	Result	Normal values
Color	Dark yellow	Amber yellow
Character	clear	clear
PH	6.0 acidic	4.8-8.0
Specific gravity	1.025	1.015-1.025
Protein	+1	(-)
Glucose	(-)	(-)
Red blood cells	1-2 /hpf	(-)
Hemoglobin	Negative	(-)
Pus cells (WBC)	1-2 /hpf	(-)
Epithelial cells	(-)	(-)
Amorphus phosphate	(-)	(-)
Bacteria	(-)	(-)
Granular cast	(-)	(-)

Acute Kidney Injury

Scenario 2

- What is your diagnosis?
 - Acute Kidney Injury.
- What is the etiology of AKI?
 - Pre renal (dehydration)
- What do you expect to find in urine analysis?
 - Normal
- What do you expect urinary Na, osmolality?
 - Urinary Na < 10
 - Osmolality > 300
 - Fractional excretion of Na < 1%

Acute Kidney Injury

Scenario 3

19 years old girl

known to have:

- Inflammatory bowel disease
- Referred for evaluation of high
- serum creatinine 320
- Creatinine (base line 90) July 2015
- Creatinine (160) June 2017
-

Acute Kidney Injury

Scenario 3

Vital Signs	Result	Normal Range
Pulse	95/min	60-100/min
Blood pressure	123/67 mmHg	130/80 mmHg
Temperature	37.0°C	36.6-37.2°C

Jugular venous pressure was normal , maculopapular rash all over the body

Cardiovascular examination:

Normal first and second heart sound no added sound or murmurs.

Respiratory system examination:

Lungs are clear to percussion and auscultation

Abdominal examination:

No tenderness, liver and spleen were not palpable.

Acute Kidney injury

Scenario 3

Complete blood count (CBC)	Result	Normal reference ranges
Hemoglobin	146 g/L	Male : 135-175 g/L (13.5-17.5 g/dl) Female : 120-155 g/L (12-15.5 g/dl)
White cell count	13 x 10 ⁹ /L eosinophilia	4.5-11.0 x 10 ⁹ /L
Platelet count	198 x 10 ⁹ /L	140-450 x 10 ⁹ /L

Acute Kidney Injury

Scenario 3

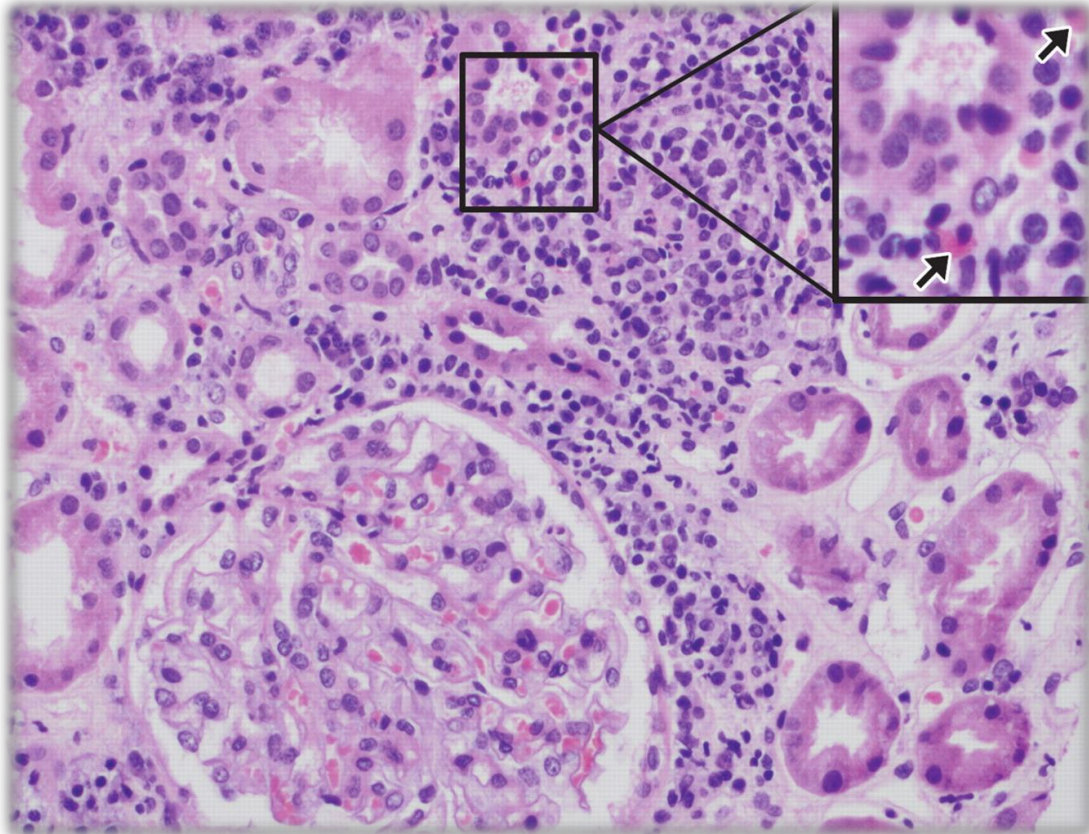
Test	Value	Normal values
Creatinine	123 $\mu\text{mol/L}$	62-115 $\mu\text{mol/L}$
Urea	10 mmol/L	2.5-6.4 mmol/L
Potassium	4.3 mmol/L	3.5-5.1 mmol/L
Sodium	137 mmol/L	135-145 mmol/L
Bicarbonate	22	22-26 mmol/l

Acute Kidney Injury

	Result	Normal values
Color	Dark yellow	Amber yellow
Character	clear	clear
PH	6.0 acidic	4.8-8.0
Specific gravity	1.025	1.015-1.025
Protein	+1	(-)
Glucose	(-)	(-)
Red blood cells	1-2 /hpf	(-)
Hemoglobin	Negative	(-)
Pus cells (WBC)	30-40 /hpf	(-)
Epithelial cells	(-)	(-)
Amorphus phosphate	(-)	(-)
Bacteria	(-)	(-)
Granular cast	WBC cast	(-)

Acute Kidney Injury

Scenario 3



Acute Kidney Injury

Scenario 3

What is your diagnosis?

Acute Kidney Injury secondary to interstitial nephritis

What is the treatment of this condition?

- Look for offending agent
- Steroid

Acute Kidney Injury

Acute Interstitial Nephritis (AIN)

Causes of AIN:

- Drugs:
- Infection:
- Systemic diseases:

Diagnosis of AIN:

- History of systemic disease known to be associated with AIN
- Skin rash
- Eosinophilia
- WBC cast (urine)
- Eosinophiluria
- Renal biopsy

Treatment of AIN:

- D/c offending agent
- Conservative
- May use steroids

Acute Kidney Injury

Scenario 4

19 years old Saudi male,

- s/p road traffic accident 7 months ago ,
bedridden , on foley's catheter

- you have been called to see because of
- high serum creatinine is 198 $\mu\text{mol/l}$
- Baseline creatinine 45 $\mu\text{mol/l}$ 2 days ago
- Urine output 1.2 liter/day

What is next?

Acute Kidney Injury

Scenario 4

Vital Signs	Result	Normal Range
Pulse	65/min	60-100/min
Blood pressure	124/67 mmHg	130/80 mmHg
Temperature	37.5°C	36.6-37.2°C

Jugular venous pressure was normal ,

Cardiovascular examination:

Normal first and second heart sound no added sound or murmurs.

Respiratory system examination:

Lungs are clear to percussion and auscultation

Abdominal examination:

no tenderness liver and spleen were not palpable.

Acute Kidney injury

Scenario 4

Complete blood count (CBC)	Result	Normal reference ranges
Hemoglobin	146 g/L	Male : 135-175 g/L (13.5-17.5 g/dl) Female : 120-155 g/L (12-15.5 g/dl)
White cell count	9 x 10 ⁹ /L	4.5-11.0 x 10 ⁹ /L
Platelet count	178 x 10 ⁹ /L	140-450 x 10 ⁹ /L

Acute Kidney Injury

Scenario 4

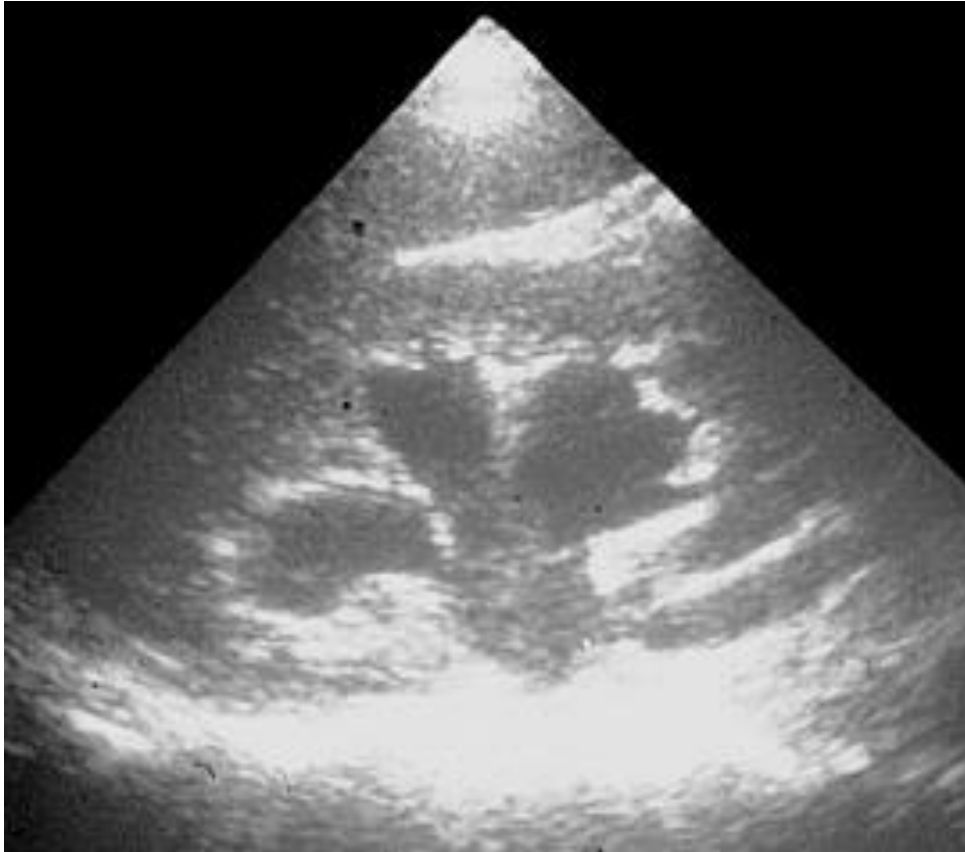
Test	Value	Normal values
Creatinine	198 $\mu\text{mol/L}$	62-115 $\mu\text{mol/L}$
Urea	16 mmol/L	2.5-6.4 mmol/L
Potassium	3.9 mmol/L	3.5-5.1 mmol/L
Sodium	137 mmol/L	135-145 mmol/L
Bicarbonate	23	22-26 mmol/l

Acute Kidney Injury

	Result	Normal values
Color	Dark	Amber yellow
Character	clear	clear
PH	6.0 acidic	4.8-8.0
Specific gravity	1.021	1.015-1.025
Protein	(-)	(-)
Glucose	(-)	(-)
Red blood cells	0 /hpf	(-)
Hemoglobin	Negative	(-)
Pus cells (WBC)	0 /hpf	(-)
Epithelial cells	(-)	(-)
Amorphus phosphate	(-)	(-)
Bacteria	(-)	(-)
Granular cast	(-)	(-)

Acute Kidney Injury

Scenario 4



Acute Kidney Injury

Scenario 4



Acute Kidney Injury

Causes

	Pre renal	Post Renal
	<p>Volume depletion</p> <ul style="list-style-type: none">▪ Renal losses (diuretics, polyuria)▪ GI losses (vomiting, diarrhea)▪ Cutaneous losses (burns, Stevens-Johnson syndrome)▪ Hemorrhage▪ Pancreatitis <p>Decreased cardiac output</p> <ul style="list-style-type: none">▪ Heart failure▪ Pulmonary embolus▪ Acute myocardial infarction▪ Severe valvular heart disease▪ Abdominal compartment syndrome (tense ascites)	<p>Ureteric obstruction</p> <ul style="list-style-type: none">▪ Stone disease,▪ Tumor,▪ Fibrosis,▪ Ligation during pelvic surgery <p>Bladder neck obstruction</p> <ul style="list-style-type: none">▪ Benign prostatic hypertrophy [BPH]▪ Cancer of the prostate▪ Neurogenic bladder▪ Drugs (Tricyclic antidepressants, ganglion blockers)▪ Bladder tumor,▪ Stone disease, hemorrhage/clot) <p>Urethral obstruction (strictures, tumor)</p>

Acute Kidney Injury

Causes

	Renal		
	(ATN)	(AIN)	(GN)
Symptoms	???????	???????	?????
Signs	Hypovolemia , hypotension	Skin rash,	Presentation of primary disease
Urine	Muddy brown casts	WBC casts Eosinophils	RBC casts
Urine Osmolality	<350	Variable >350	>350 variable
Urine Na	<20	variable	variable

Acute Tubular necrosis (ATN)

Acute interstitial nephritis (AIN)

Acute Glomerulonephritis (GN)

Acute Kidney Injury

Acute Glomerulonephritis (GN)

Causes:

Mainly GN causes AKI if the presentation is Rapidly progressive GN:

Anti-GBM antibody Immune complex

- Post-infectious
- Connective tissue disease:
 - Lupus nephritis
 - Henoch-Schönlein purpura
- MPGN

Pauci-immune

- Wegener granulomatosis (WG)
- Microscopic polyangiitis (MPA)
- Churg-Strauss syndrome

Clinical feature:

- Symptoms and signs of systemic disease
- Non specific: lower limb swelling, hematuria, frothy urine
- Symptoms and signs of ESRD

Treatment:

- General
- Disease specific:
 - Steroid
 - Immunosuppressive agents
 - Plasmapheresis

Acute Kidney Injury

Scenario 5

76 years old man

Known to have:

- Long standing diabetes and hypertension
- Ischemic heart disease

Presented with acute chest pain and shortness of breath diagnosed to have Acute coronary syndrome, underwent cardiac catheterization

Baseline creatinine 120 , 2 days later creatinine has increased to 560 with oliguria

Acute Kidney Injury

Scenario 5

76 years old man

Known to have:

- Long standing diabetes and hypertension
- Ischemic heart disease

Presented with acute chest pain and shortness of breath diagnosed to have Acute coronary syndrome, underwent cardiac catheterization

Baseline creatinine 120 , **12 days** later creatinine has increased to 560 with oliguria

Acute Kidney Injury

Scenario 5

Vital Signs	Result	Normal Range
Pulse	98/min	60-100/min
Blood pressure	146/67 mmHg	130/80 mmHg
Temperature	37.5°C	36.6-37.2°C

Jugular venous pressure was normal ,skin lesion over lower limbs and absent dorsalis pedia and posterior tibial arteries, black toes bilateraly

Cardiovascular examination:

Normal first and second heart sound no added sound or murmurs.

Respiratory system examination:

bilateral basal crackles

Abdominal examination:

soft and lax , liver and spleen were not palpable.

Acute Kidney Injury

Scenario 5



Acute Kidney Injury

Scenario 4

Test	Value	Normal values
Creatinine	560 $\mu\text{mol/L}$	62-115 $\mu\text{mol/L}$
Urea	26 mmol/L	2.5-6.4 mmol/L
Potassium	5.7 mmol/L	3.5-5.1 mmol/L
Sodium	134 mmol/L	135-145 mmol/L
Bicarbonate	13	22-26 mmol/l

Acute Kidney Injury

Scenario 5

What is your diagnosis?

Acute kidney injury

What your differential diagnosis?

Athero embolic disease

Contrast induced AKI

Acute Kidney Injury

Athero embolic AKI

- 1-2 weeks post procedure, creatinine peaks
- Commonly occur after intravascular procedures or cannulation (cardiac cath, CABG, AAA repair, etc.)
- Associated with emboli of fragments of atherosclerotic plaque

- **Diagnose by history, physical findings** (evidence of other embolic phenomena-- CVA, ischemic digits, “blue toe” syndrome, absent pulses, livedo reticularis, low serum C3 and C4, peripheral eosinophilia, Eosinophiluria)
- **Treatment is supportive**
- **In general prognosis is poor**

Acute Kidney Injury

Contrast induced AKI

12-24 hours post exposure,

Creatinine peaks in 3-5 days

- Non-oliguric, FE Na <1% !!
- Risk Factors:
 - CKD,
 - Older age
 - Hypovolemia ,DM,CHF

**▪ Treatment /Prevention:
▪ Alternative procedure if
feasible**

- 1/2 NS 1 cc/kg/hr 12 hours pre/post
- N-acetylcysteine 600 BID pre/post (4 doses)
- Monitoring of urine output
- Creatinine and electrolytes

Acute Kidney Injury

Scenario 6

34 years old man

Presented with lower limb swelling and SOB for
2 week and fatigue

Found to have high creatinine

Acute Kidney Injury

Scenario 6

Vital Signs	Result	Normal Range
Pulse	88/min	60-100/min
Blood pressure	167/94 mmHg	130/80 mmHg
Temperature	37.1°C	36.6-37.2°C

Jugular venous pressure was normal , bilateral lower limb edema

Cardiovascular examination:

Normal first and second heart sound no added sound or murmurs.

Respiratory system examination:

Lungs are clear to percussion and auscultation

Abdominal examination:

soft and lax, liver and spleen were not palpable

Acute Kidney Injury

Scenario 6

Test	Value	Normal values
Creatinine	245 $\mu\text{mol/L}$	62-115 $\mu\text{mol/L}$
Urea	17 mmol/L	2.5-6.4 mmol/L
Potassium	4.9 mmol/L	3.5-5.1 mmol/L
Sodium	139 mmol/L	135-145 mmol/L
Bicarbonate	17	22-26 mmol/l

Acute Kidney injury

Scenario 6

Complete blood count (CBC)	Result	Normal reference ranges
Hemoglobin	146 g/L	Male : 135-175 g/L (13.5-17.5 g/dl) Female : 120-155 g/L (12-15.5 g/dl)
White cell count	9 x 10 ⁹ /L	4.5-11.0 x 10 ⁹ /L
Platelet count	178 x 10 ⁹ /L	140-450 x 10 ⁹ /L

Acute Kidney Injury

	Result	Normal values
Color	yellow	Amber yellow
Character	clear	clear
PH	6.0 acidic	4.8-8.0
Specific gravity	1.021	1.015-1.025
Protein	(+++)	(-)
Glucose	(-)	(-)
Red blood cells	11 /hpf	(-)
Hemoglobin	Negative	(-)
Pus cells (WBC)	1-2 /hpf	(-)
Epithelial cells	(-)	(-)
Amorphus phosphate	(-)	(-)
Bacteria	(-)	(-)
RBC cast	(+)	(-)

Acute Kidney Injury

Scenario 6

What is your diagnosis?

Acute kidney injury

Renal: most likely glomerulonephritis

How would you investigate this patient further?

Acute Kidney Injury

Scenario 6

- Blood urea nitrogen and serum creatinine
- CBC, peripheral smear, and serology
- Urinalysis, 24 hours urine collection for proteins
- Urine electrolytes
- U/S kidneys
- Serology: ANA, ANCA, Anti DNA, HBV, HCV, Anti GBM, cryoglobulin, CK, urinary Myoglobin
- Kidney biopsy

Acute Kidney Injury

Summary

- **Acute kidney injury** is a syndrome characterised by the rapid loss of the **kidney's** excretory function
- **Acute kidney injury** is common and serious health problem which carry high mortality and morbidity
- **Acute kidney injury** is amenable to prevention, early detection and treatment