Approach to Acute Kidney Injury

Med 341

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October 2017

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

Kellum JA, et al. Curr Opin Crit Care 2002; 8: 509–514

Acute kidney injury

RIFLE definition

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

Am J Kidney Dis. 2005 Dec;46(6):1038-48

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 (≥ 26.4 µmol/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 µmol/L) increase if baseline > 4mg/dl(≥ 354 µmol/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

Chertow et al. JASN 2005; 16:3365-3370

Acute kidney injury

KDIGO Definition:

An abrupt (within 48 hours)

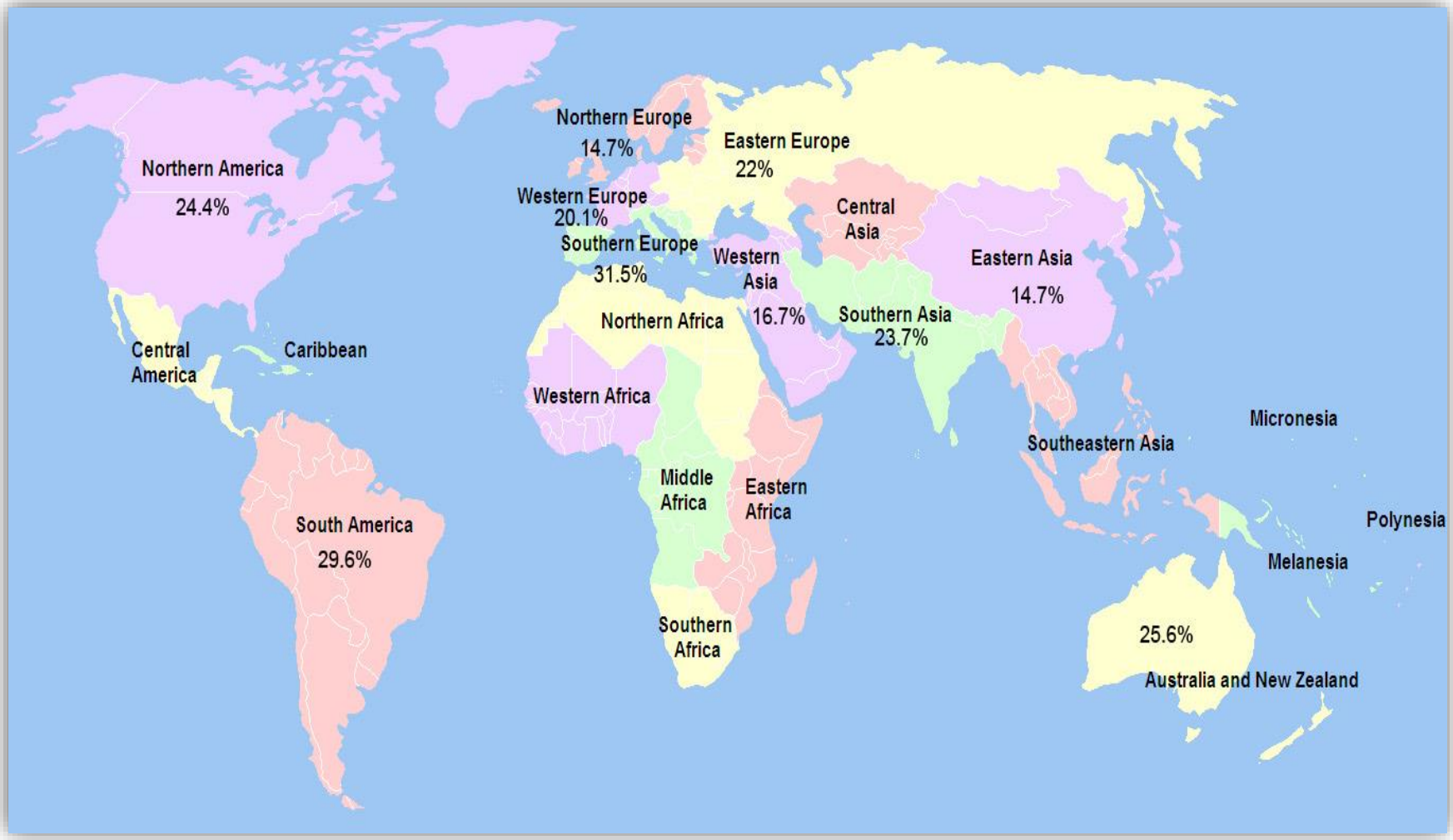
- absolute increase in creatinine by 0.3 mg/dl (26.4 µmol/l) or
- percentage increase of >50% from base line

or

- urine output <0.5 ml/hour for 6 hours

Acute kidney injury

Incidence:



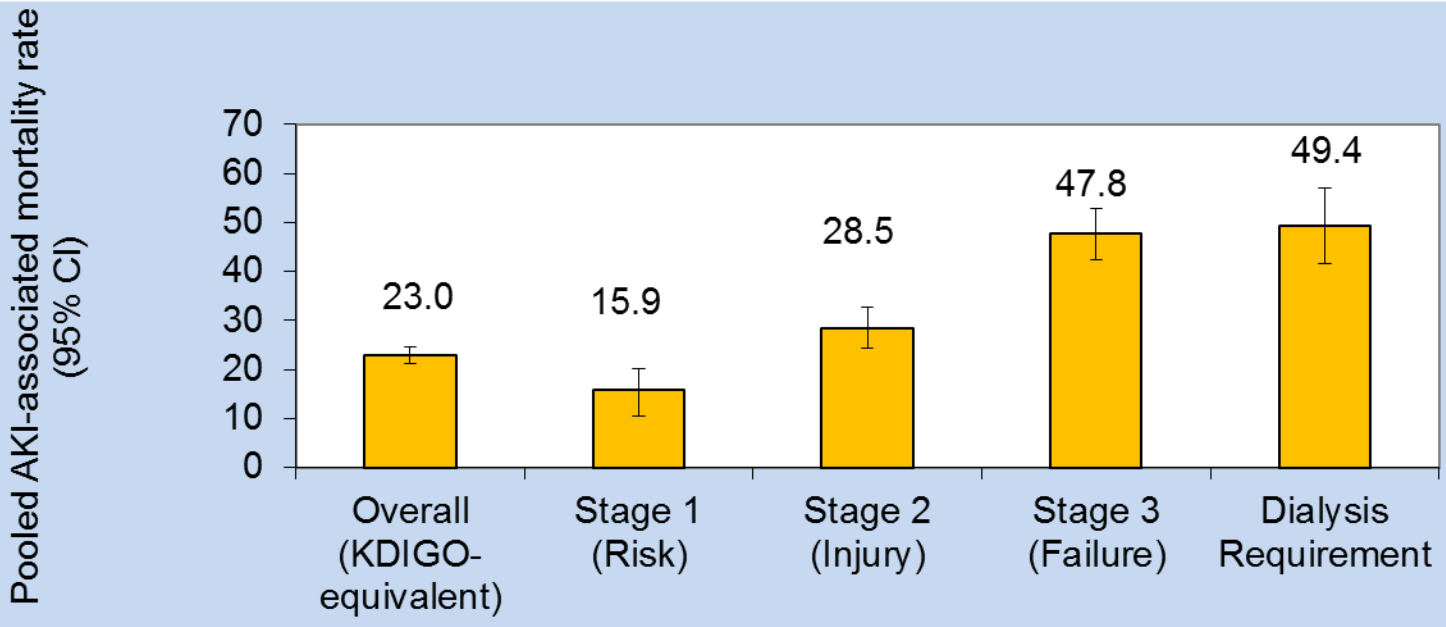
Susantitaphong P, et al. CJASN 2013, June 6

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

Susantitaphong P, et al. CJASN 2013, June 6

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 ≥24 hours

	No AKI 65.6%	AKI I 19.1%	AKI II 3.8%	AKI III 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

Ostermann et al, Critical Care 2008;12:R144

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

Triverio et al. NDT 2009

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)

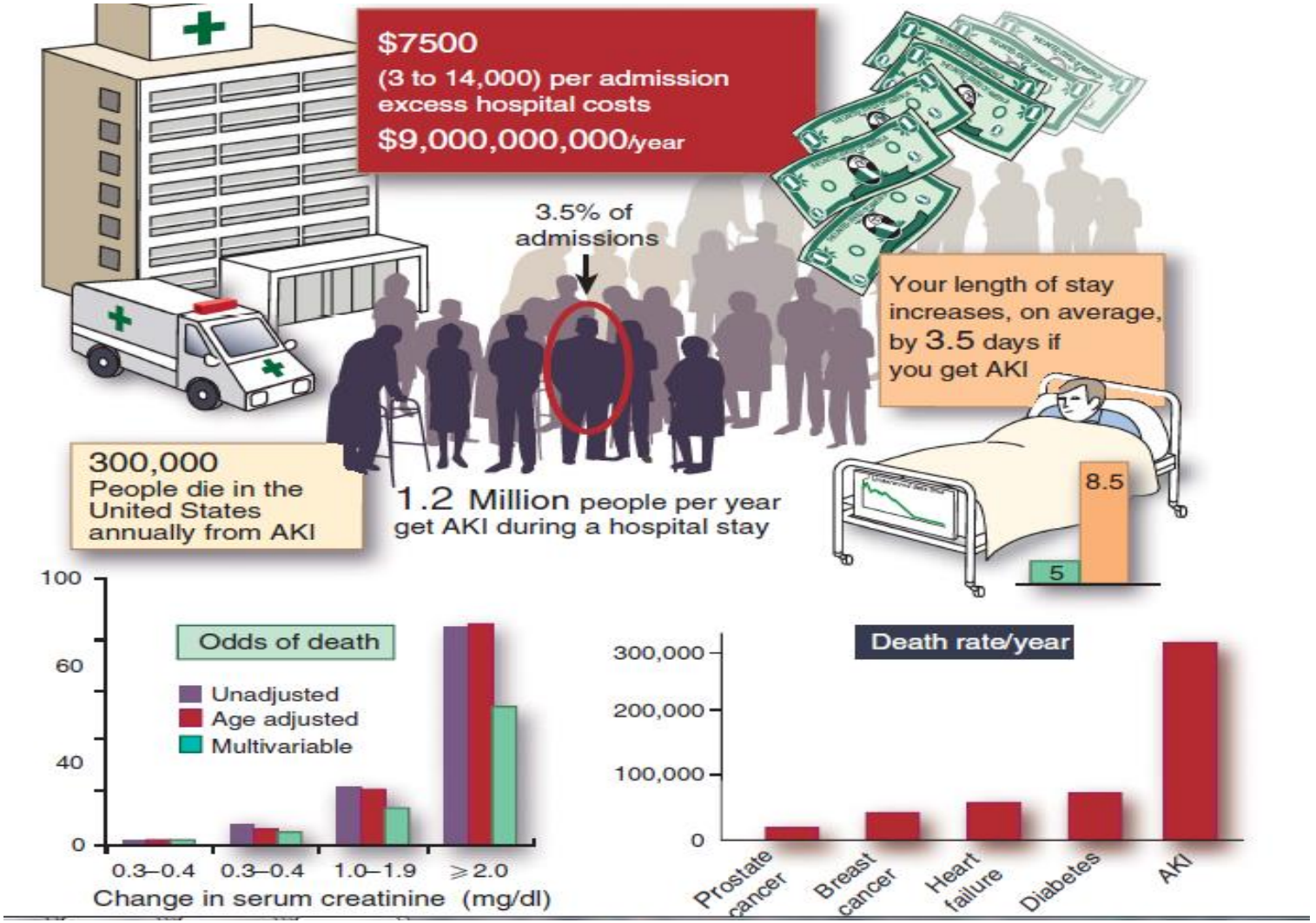
Length of follow-up: 6 months – 17 years

- AKI associated with: increased risk of CKD
  increased risk of CV event
  increased long-term mortality

Coca S et al, Am J Kidney D, June 2009

Acute Kidney Injury

Clinical outcome:



Acute kidney injury

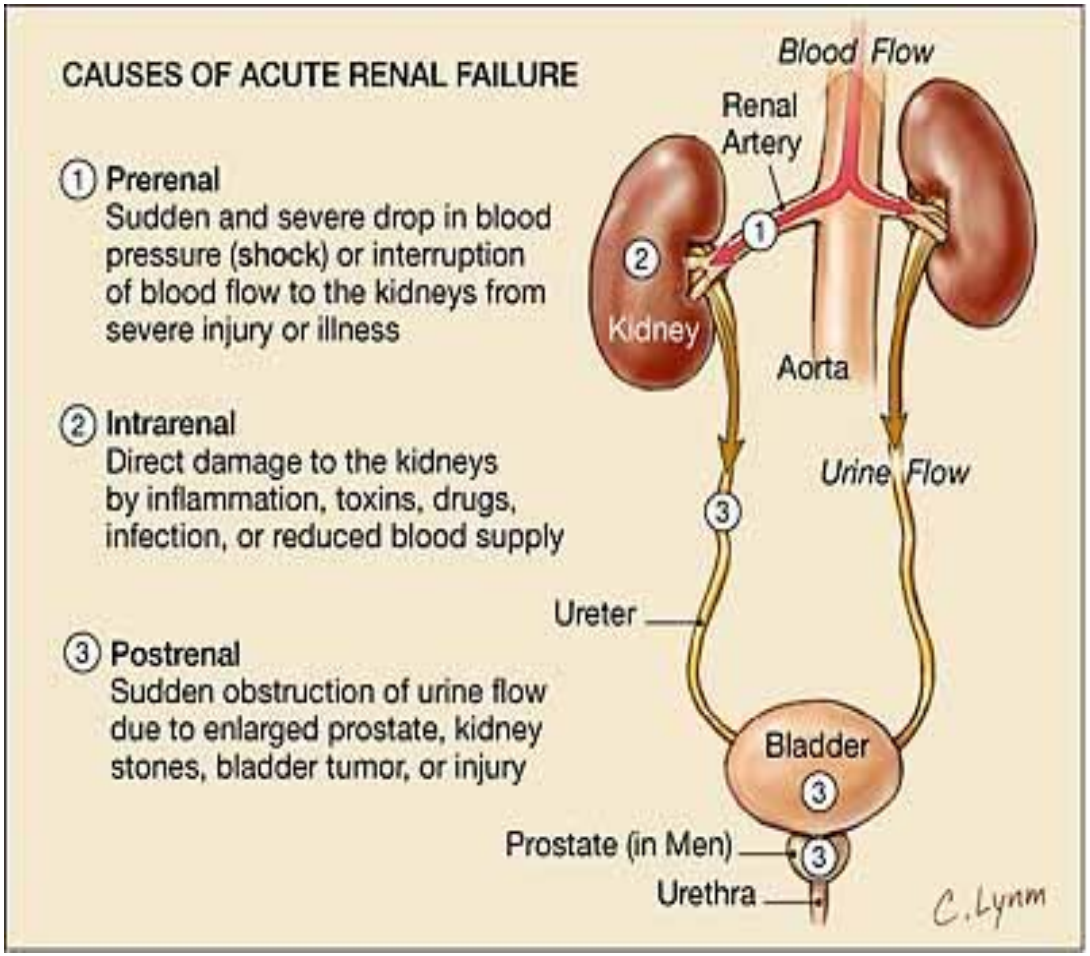
Types and consequences:

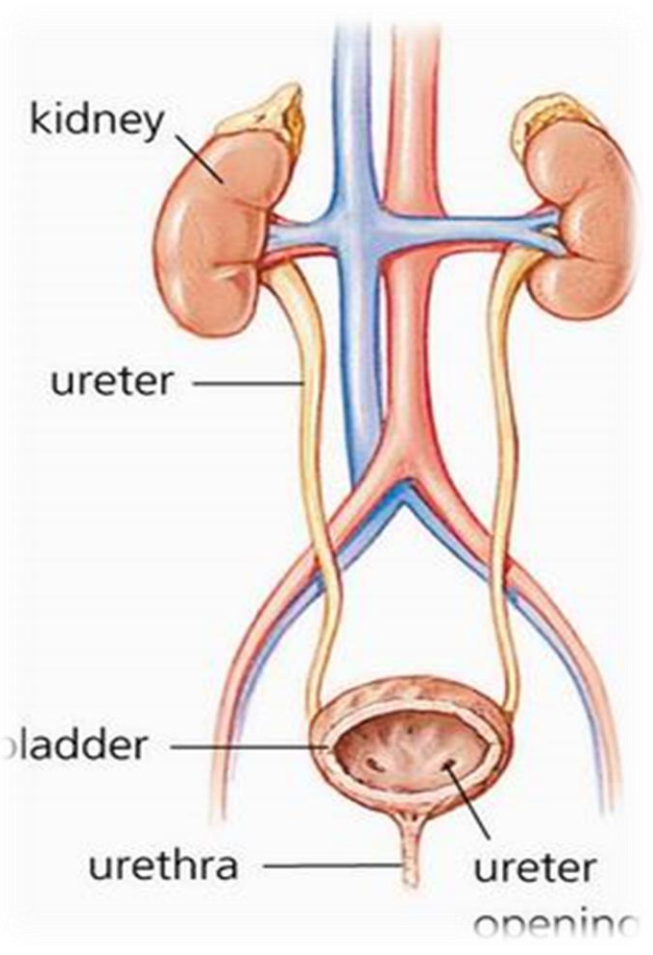
Pre renal	Renal	Post Renal
Volume depletion Decreased cardiac output	Acute Tubular necrosis (ATN) Acute interstitial nephritis (AIN Acute Glomerulonephritis (GN)	Ureteric obstruction Bladder neck obstruction Urethral obstruction

Clinical Consequences

- Chronic Kidney disease
- End Stage Renal Disease
- Hospitalization
- Mortality

Etiology of ARF





Acute Kidney Injury

Scenario 1

50 years old Saudi male s/p Right hemicoloectomy 6 hours ago for colon cancer intra operative course complicated by bleeding and hypotension required 6 units of blood transfusion urine out put decreased significantly serum creatinine 285µmol/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 µmol/L	62-115 µmol/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

Totoxic

• 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, ↑ FE_{Na} (>2%) sediment with coarse granular casts,

Treatment is supportive care:

▪Maintenance of euvolemia (with diuretics, IVF, as necessary)

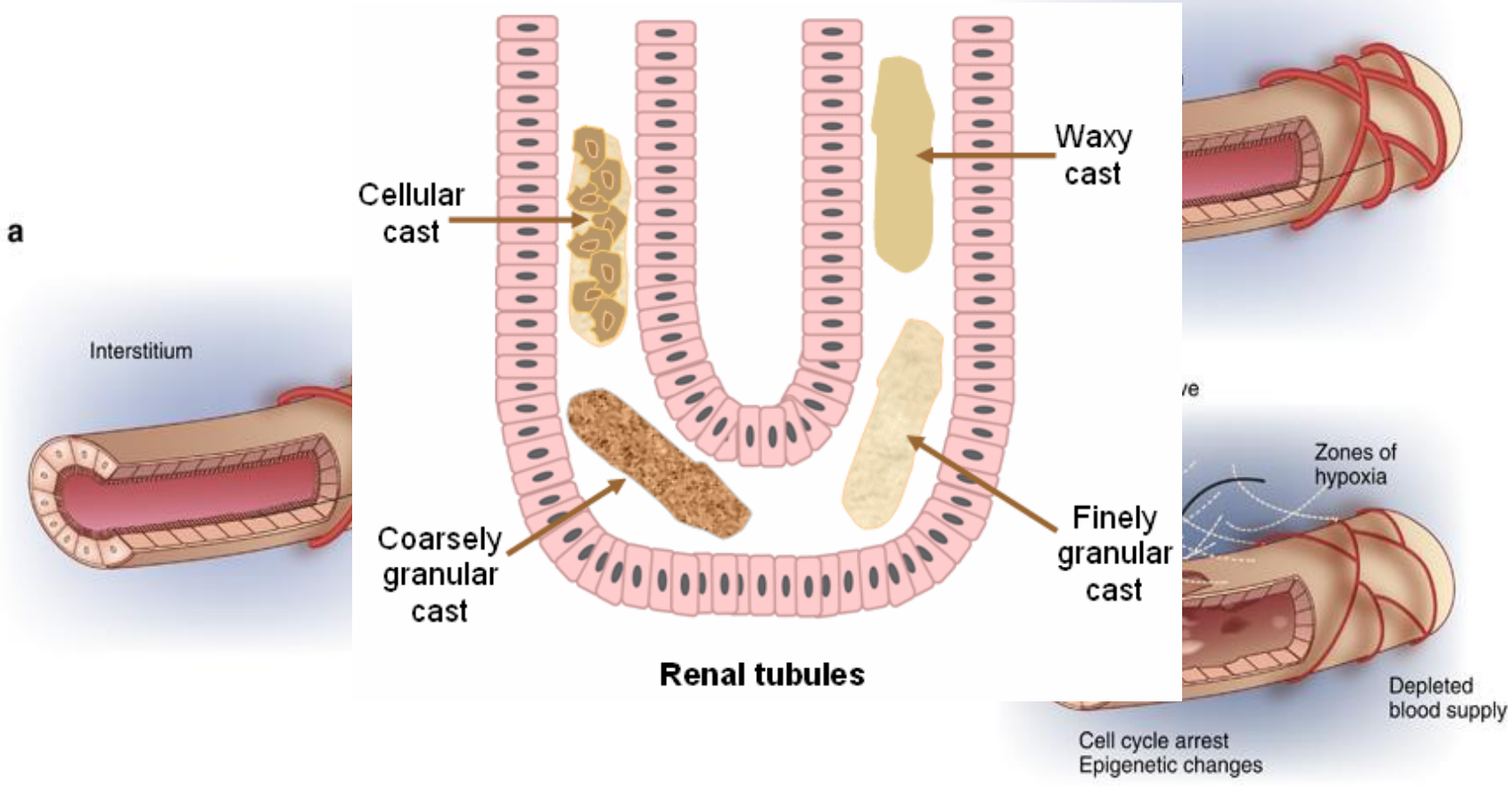
▪ Avoidance of hypotension

▪ 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%**

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

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 µmol/L	62-115 µmol/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

	Acute	*Chronic*
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 fined 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 esinophilia**	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

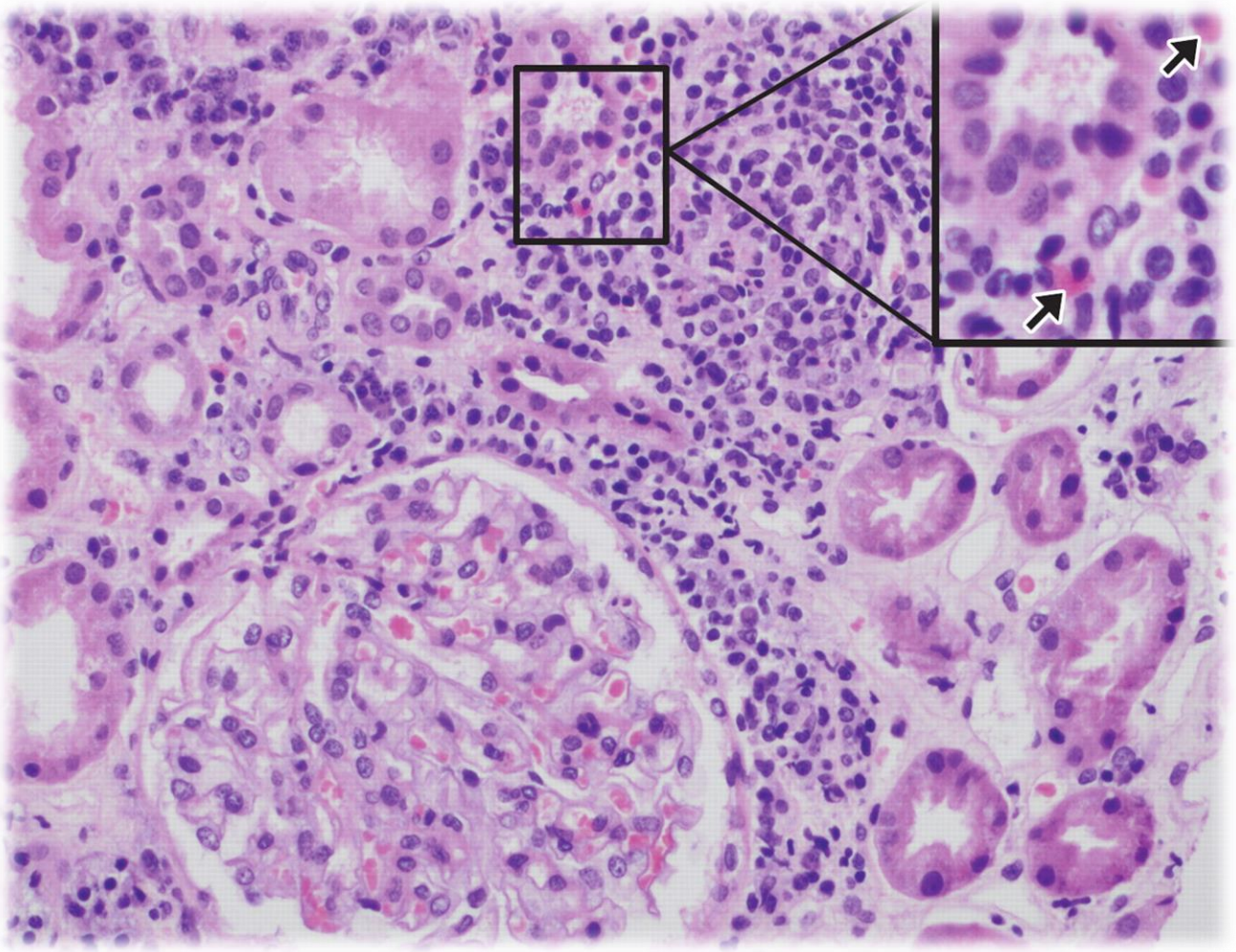
Test	Value	Normal values
Creatinine	123 µmol/L	62-115 µmol/L
Urea	10 mmol/L	2.5-6.4 mmol/L
Potassium	4.3 mmol/L	3.5-5.1 mmol/L
Sodium	137 mmol/L	135-145 mmol/L
Bicarbonate	22	22-26 mmol/l

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
- Esinophilia
- WBC cast (urine)
- Esinophiluria
- 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 folly's catheter

- you have been called to see because of
- high serum creatinine is 198 µmol/l
- Baseline craetinine 45 µmol/l 2 days ago
- Urine out put 1.2 litter/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 µmol/L	62-115 µmol/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
	Volume depletion ▪ Renal losses (diuretics, polyuria) ▪ GI losses (vomiting, diarrhea) ▪ Cutaneous losses (burns, Stevens-Johnson syndrome) ▪ Hemorrhage ▪ Pancreatitis **Decreased cardiac output** ▪ Heart failure ▪ Pulmonary embolus ▪ Acute myocardial infarction ▪ Severe valvular heart disease ▪ Abdominal compartment syndrome (tense ascites)	**Ureteric obstruction** ▪ Stone disease, ▪ Tumor, ▪ Fibrosis, ▪ Ligation during pelvic surgery **Bladder neck obstruction** ▪ Benign prostatic hypertrophy [BPH] ▪ Cancer of the prostate ▪ Neurogenic bladder ▪ Drugs (Tricyclic antidepressants, ganglion blockers) ▪ Bladder tumor, ▪ Stone disease, hemorrhage/clot) **Urethral obstruction** (strictures, tumor)

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
  - Immunosuppresive 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 µmol/L	62-115 µmol/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-acetyle cystein 600 BID pre/post (4 doses)
- Monitoring of urine out put
- Creatinine and lytes

Acute Kidney Injury

Scenario 6

34 years old man

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

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 µmol/L	62-115 µmol/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 Myoglobulin
- 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