Approach to Acute Kidney Injury

Med 442

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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

- Electrolyte balance; potassium (destruction will cause hyperkalemia) , phosphorus and Calcium
- Hormonal regulation of BP and erythrocyte production (erythrocyte stimulating hormone)

- 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

Many definitions —> there no consistency of data due to different measure so they come with up with : RIFLE criteria (next slide)

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

After modification on RIFLE they end with :

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**

they bring these number depending on next slide litreture that indicate mortality

UO: 1st sign that change in AKI

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

serum Cr is the best marker for now

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

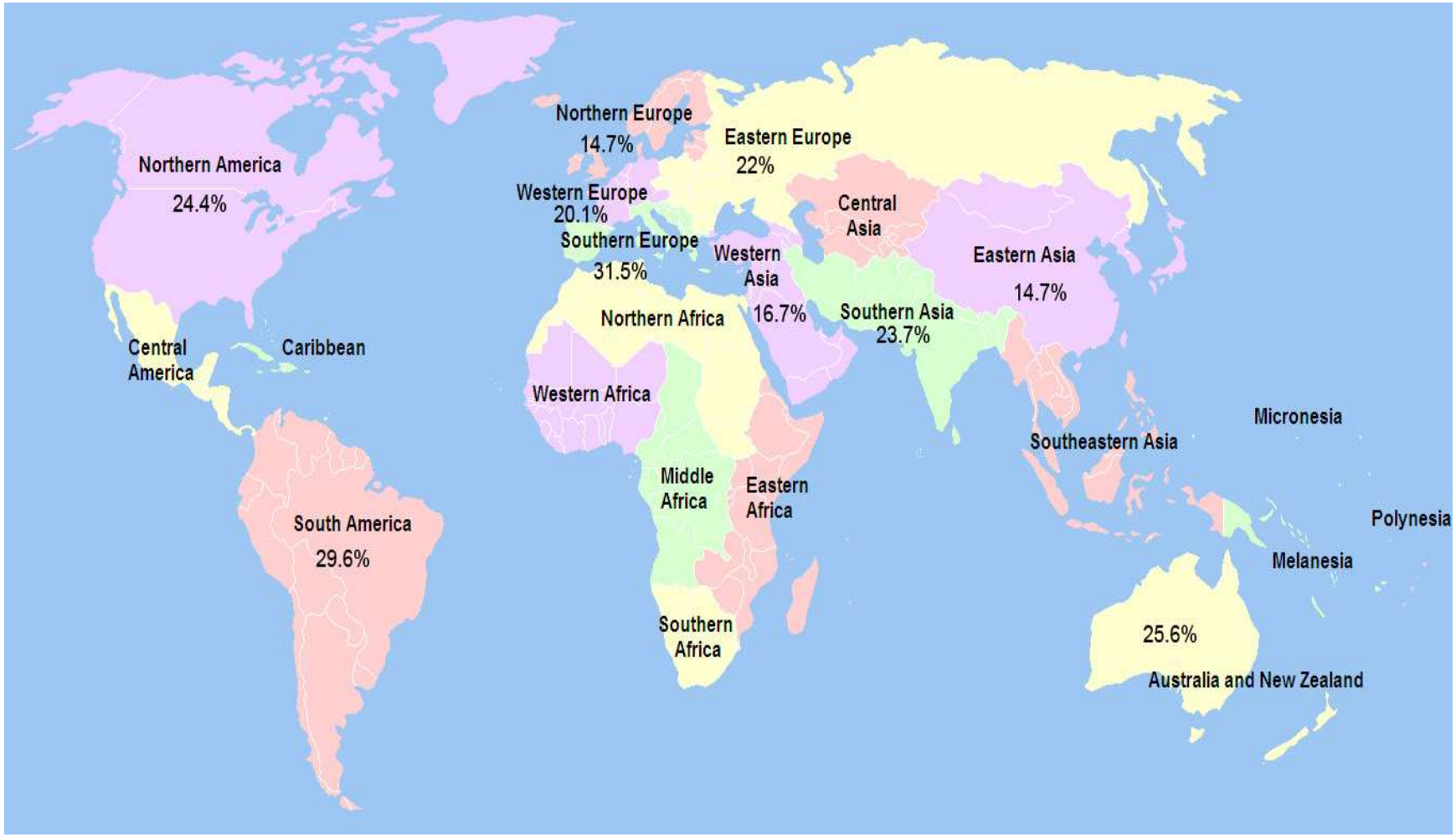
base line : we get it from the patient or the system

or

- urine output <0.5 ml/hour for 6 hours

Acute kidney injury

Incidence:



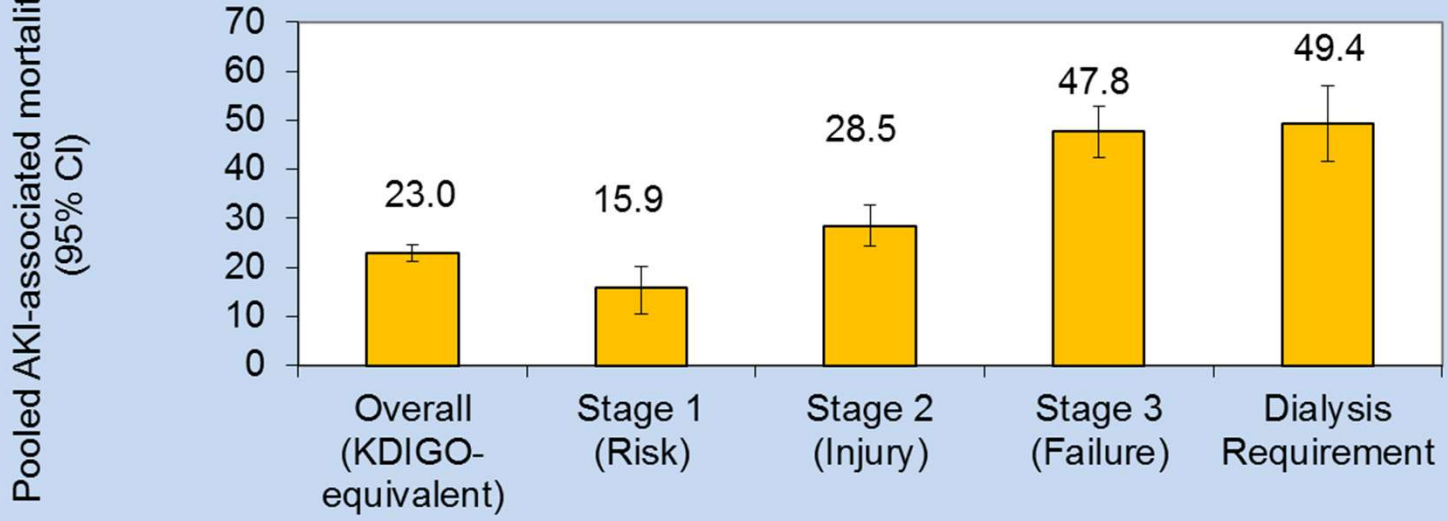
Susantitaphong P, et al. CJASN 2013, June 6

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

The problem is mortality

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

We care cause it cause :
- Mortality
- CKD
- ESRD

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)

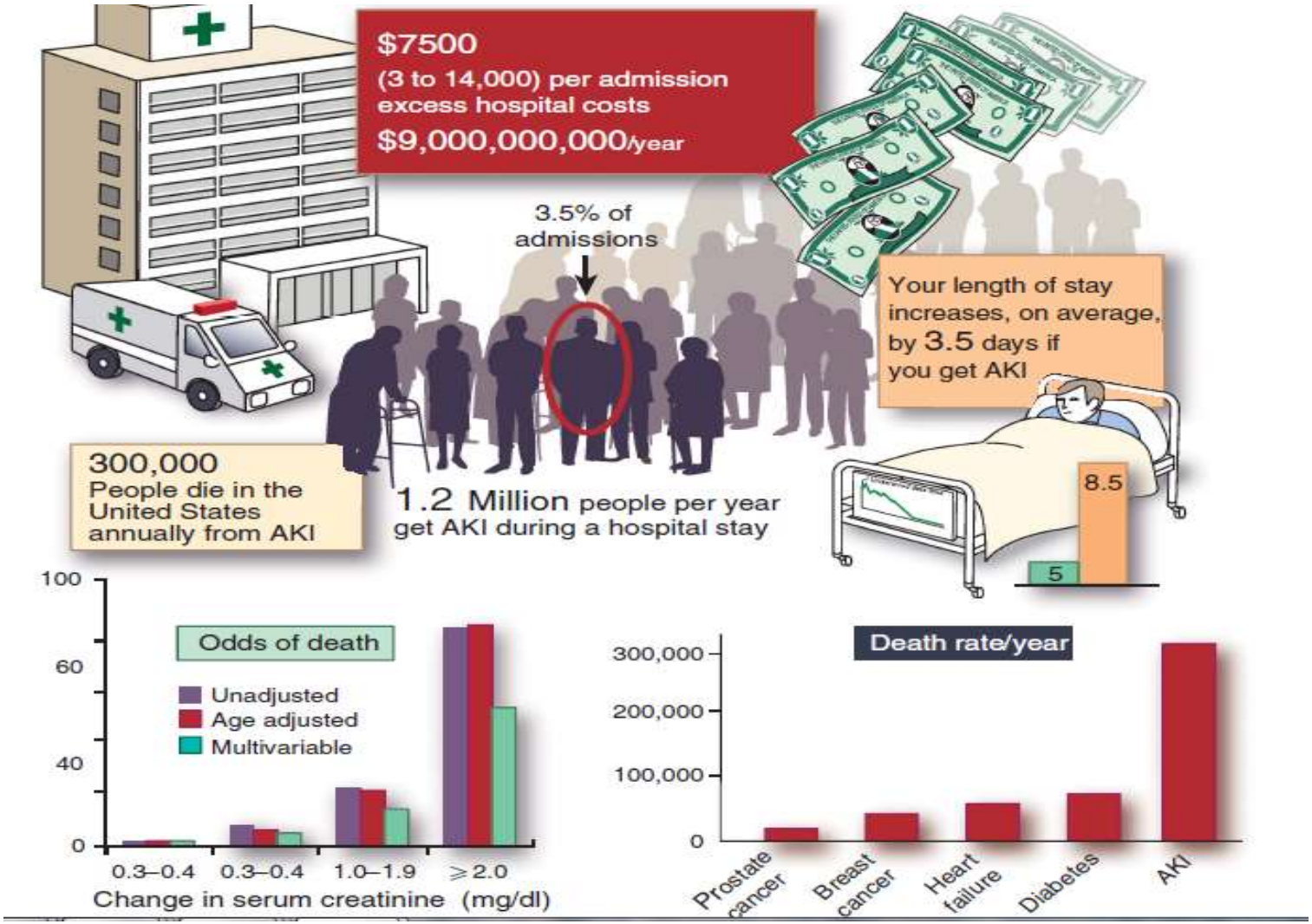
Length of follow-up: 6 months – 17 years

- 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

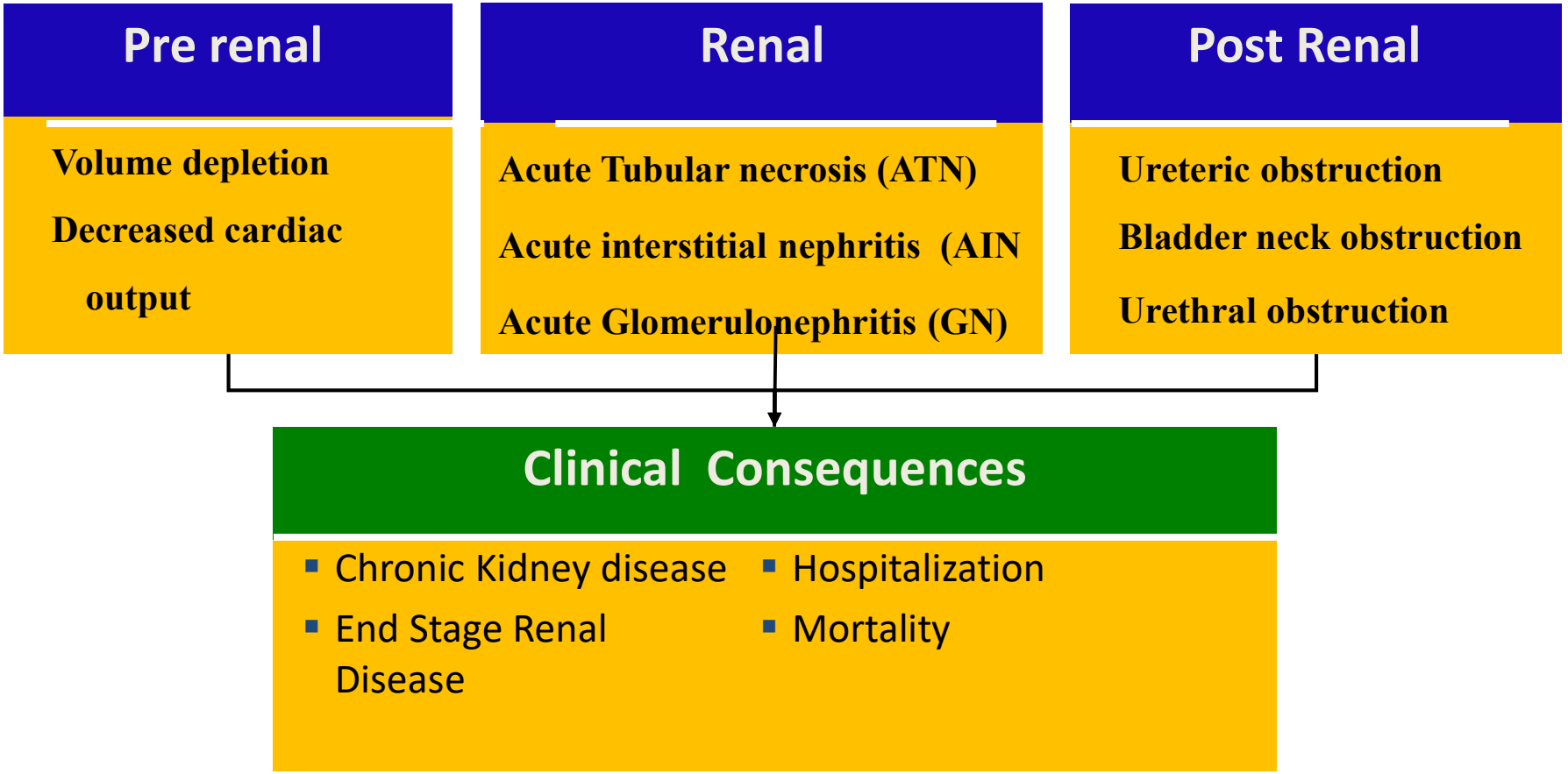
Acute Kidney Injury

Clinical outcome:



Acute kidney injury

Types and consequences:



Pre renal :
anything happen above the kidney (heart, vessels)

Cause :
- Cardiogenic shock
- septic shock cause the pt will be hypotensive —> vasodilation —> less perfusion to kidney
- hypovolemic shock

Symptoms & signs :
Dehydrated :
Hypotensive
Low JVP
Dry mucus membrane
Urine concentrated —> high osmolality—>
Na urine low<10

In case of HF as post volume depletion:
Hypotension
High JVP
Urine concentrated —> high osmolality—>
Na urine low<10

Post renal :
anything happen below the kidney (Ureter, bladder, urethra)

Cause :
Ureter : should be bilateral to cause AKI
intrinsic —> stone, tumor
Extrinsic —> tumor compressing or peritoneal fibrosis
or
Bladder tumor, Prostate, Urethral problem

Symptoms & signs :
could be asymptomatic
Over-flow iincontinence
supra-pubic pain or flank pain

Urineanalysis :
Usually normal but you may see some RBC in the urine

Renal :

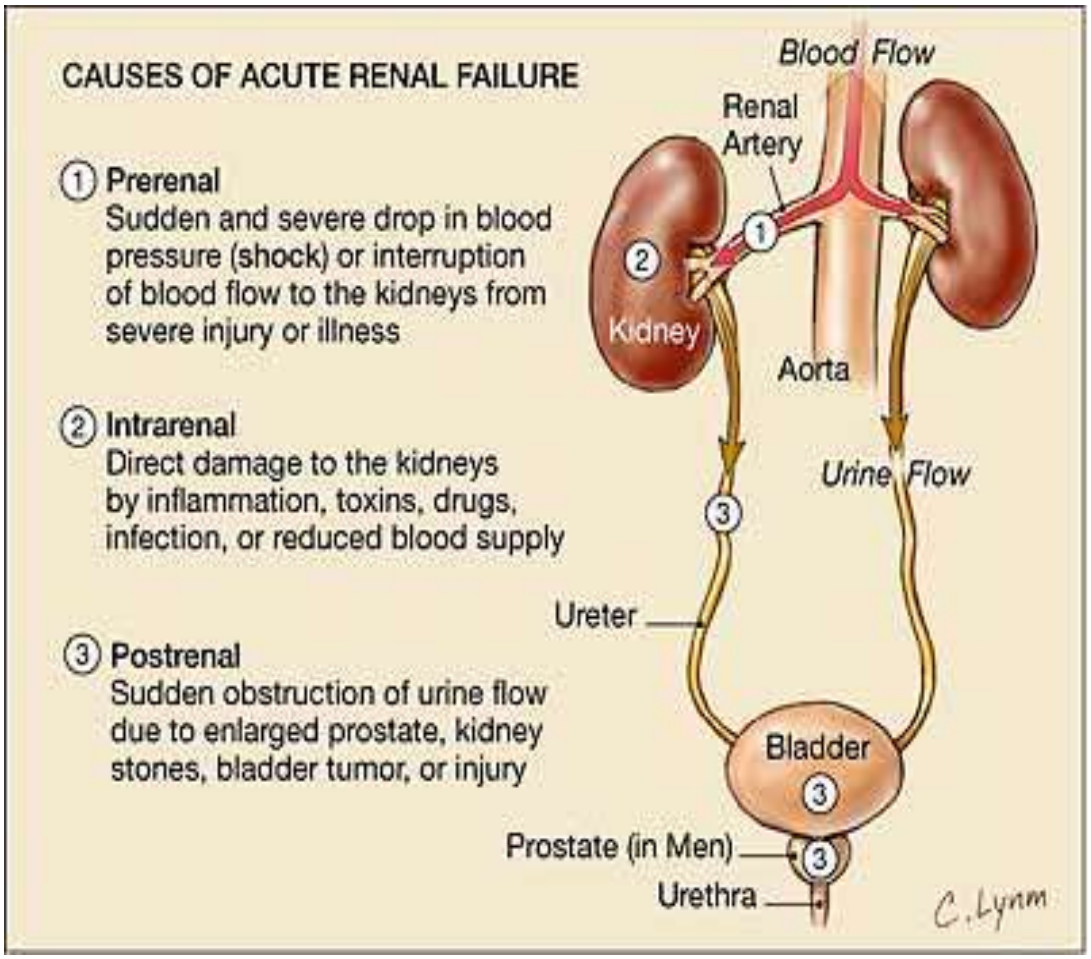
Cause :
Acute Tubular Necrosis —> pt present with anuria or muddy brown urine
Etiology
- Direct toxicity; by medications as NSAIDs and contrast
- hypo-perfusion; tubules are supplied by vasa recta (very thin vessels) —> hypo-pefusion—> 1st affected
Signs : tubule won't function —> no water reabsorption—> urine will be diluted with high urine sodium

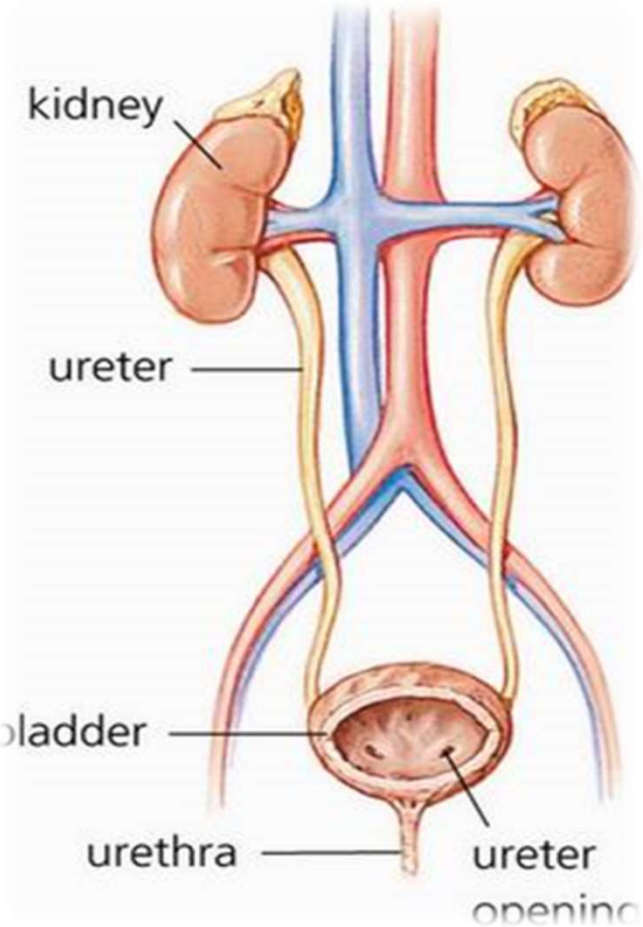
Acute Interstitial Nephritis —>
Etiology
- Medications as PPI, NSAIDs and Antibiotic
- Systemic: lupus, sjogren's syndrome,…..
Signs : usually asymptomatic but for any reason if u do urine analysis you will find high WBC and casts
Treatment : stop the offending agent or treat the systemic disease

Acute glomerulonephritis —>
Etiology
- Primary : membranous, minimal change, IgA, ……
- Secondary : DM,…..
Signs : primary disease or Lower limb swelling, frothy urine, hematuria with RBC cast
Diagnosis : clinical + biopsy and serology
Treatment : depend on diagnosis

*** Different between Pre-renal and ATN due to hypovolemia is —> Duration and severity
Pre renal —> short hypotension duration —> during correction —> Urine osmolality will be low while the urine sodium will be low cause the Tubules are still functioning
Renal —> long hypotension —> tubules Destruction —> after correction of hypovolemia —> urine Na will be still be high cause there is no reabsorption

Etiology of ARF





Acute Kidney Injury

Scenario 1

Status post

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?

6 units —> this indicate sever hypoperfsion

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

Answers on the next slide

Acute Kidney Injury

Scenario 1

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

1- need the creatinine baseline
2- Signs I will see on examination : pale, cold extremities, hypotention, dehydration, tachycardia, low JVP
Urine output: depend on :
So if the kidney still normal the physiological responce is to be concentrated urine with low Na urine —> pre renal
But if the tubules is destructed --> Urine dilute, Urine Na will be high —> renal

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**

He's in Shock

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

He's going to AKI

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

this indicate Urine Dilution while it should be concentrated in case of hyperperfusion due to reabsorbtion of water

so we have here +ve 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	(-)

+ve kidney injury that why we he have protein in Urine

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)

اذا الجسم يحتاج موية ويحتاج صوديوم وكلهم قاعدين ينزلون بالبول معناها في مشكلة بالكلية

- Diagnosis:
  - Acute Kidney Injury secondary to Acute tubular necrosis due to shock

Treatment : blood and fluids but excess fluid will cuase —> pulmonary edema

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

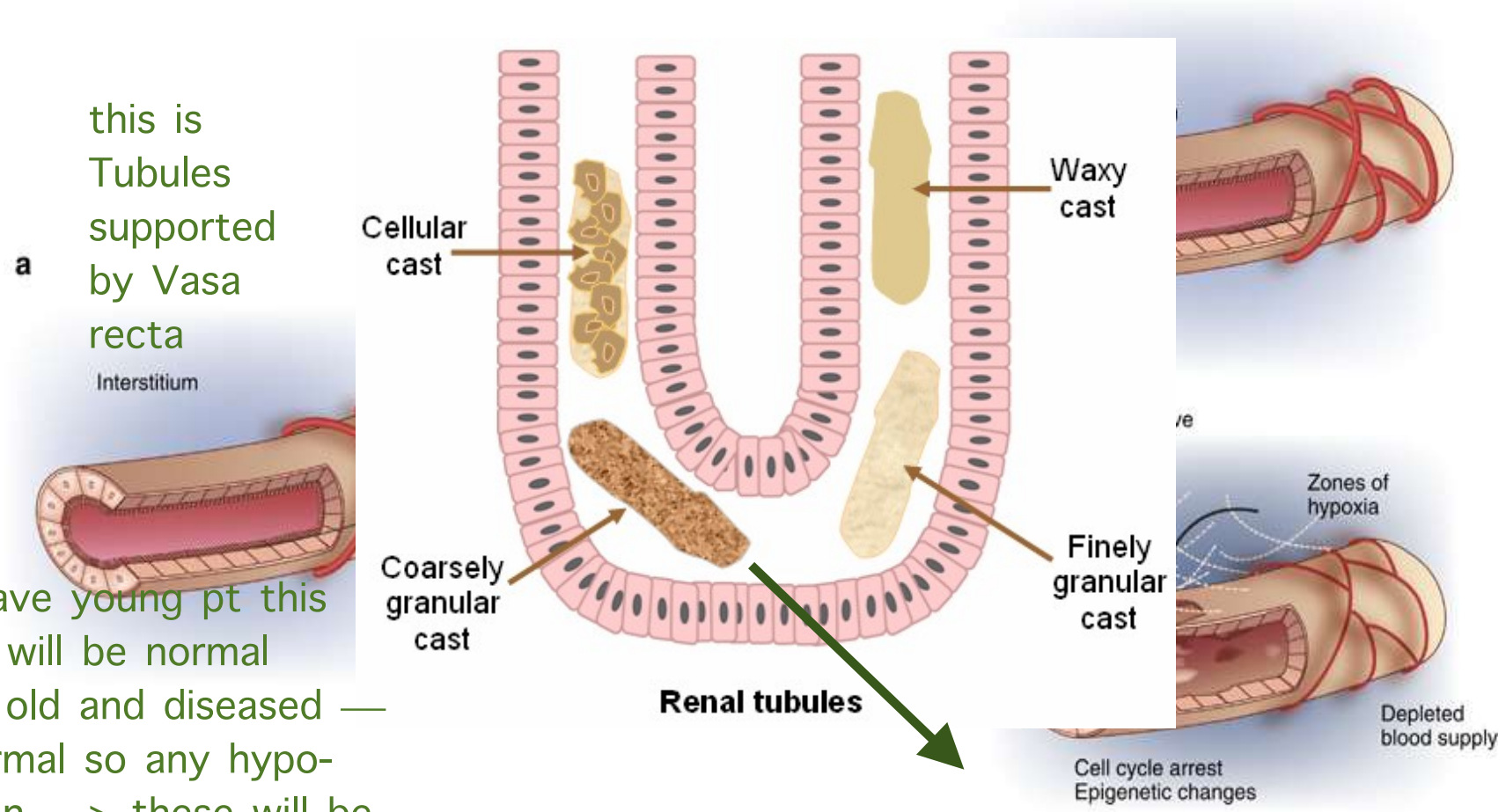
▪ Avoidance of nephrotoxic medications (including NSAIDs and ACE-I)

▪ Dialysis, if necessary

80% will recover, if initial insult can be reversed

Acute tubular necrosis

this is Tubules supported by Vasa recta



If we have young pt this tubules will be normal while if old and diseased —> abnormal so any hypo-perfusion —> these will be affected —> and the tubules will sluff —> causing muddy brown urine

these are Tam horsfall proteins (the buses) that hold either WBC, RBC and become —> WBC cast or RBC cast

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

Refratory mean —> not respond to medication

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

Diagnosis :
1st of all know the baseline of the creatinine
if her Cr baseline was 50 so —>
Acute Kidney injury due to prerenal
Treatment : fluids

Acute Kidney Injury

Acute vs Chronic

	Acute	*Chronic*
History	Short (days-week)	Long (month-years)
Haemoglobin	Normal	Low Cause kidney is excreting erythropoietin
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 mean: No WBC or RBC casts
- 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 on top of chronic

-

Start with History
Pre renal —> N/V, diarrhea,
renal —> medication, systemic
post renal—> flank pain

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 ,

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	**8 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

Scenario 3

Test	Value	Normal values
Creatinine	320 µmol/L	62-115 µmol/L
Urea	27 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	17	22-26 mmol/l

Acute Kidney Injury

Most likely cause :
Acute interstitial due to IBD history and WBC cast

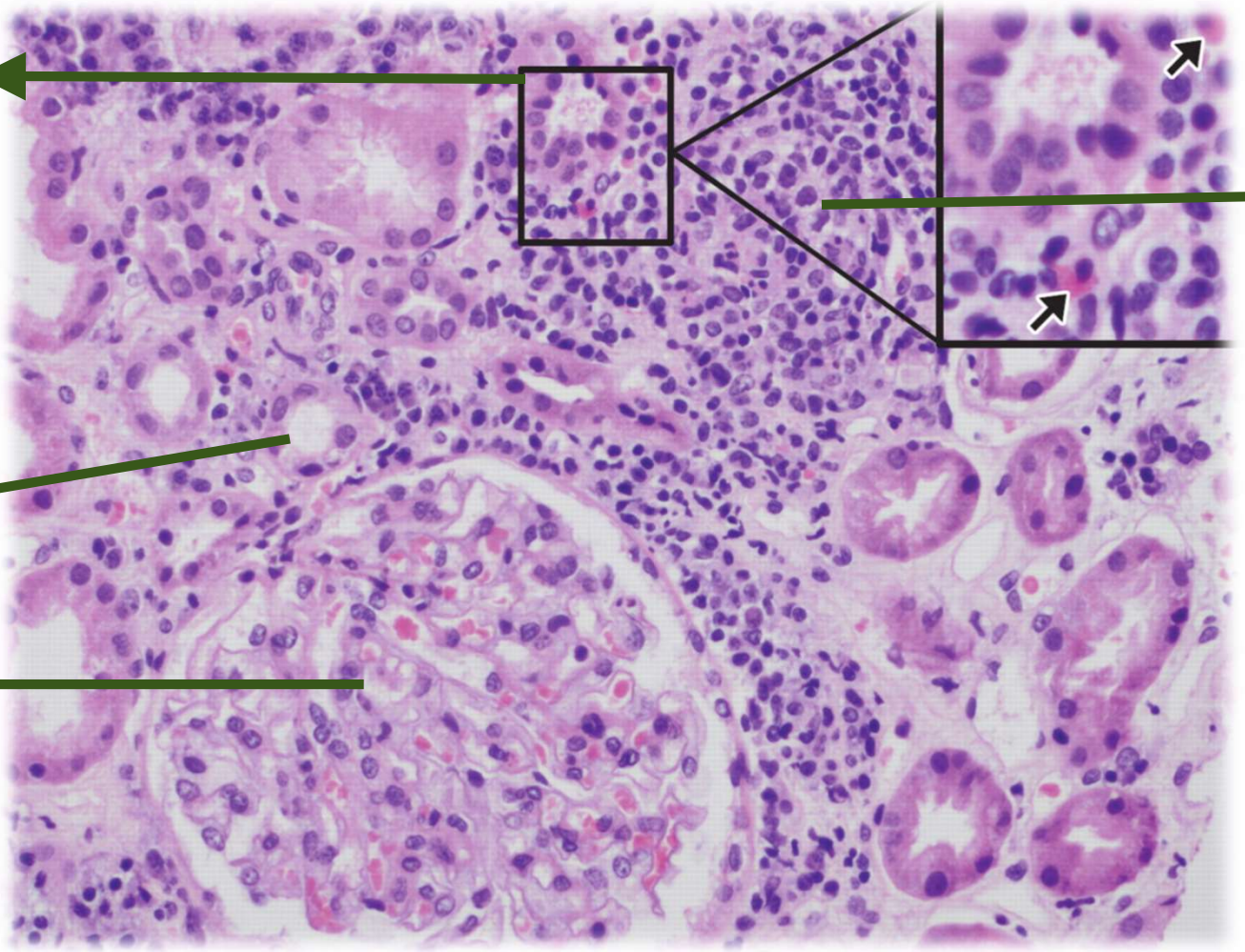
if +ve pus with no cast ddx will be UTI or TB

	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

what happen here?
WBC come out from Interstitial to tubules and then connect with Tamm-horsfall protien (the bus) become WBC casts



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

this pt was taking infliximab so stop the infliximab

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 (Internal urethra 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

Acute high level Creatinine

What is next?

always start taking all history : pre-renal-post symptoms

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

this exclude pre renal cause it should be concentrated and ATN cause there is no Dilution

	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	(-)	(-)

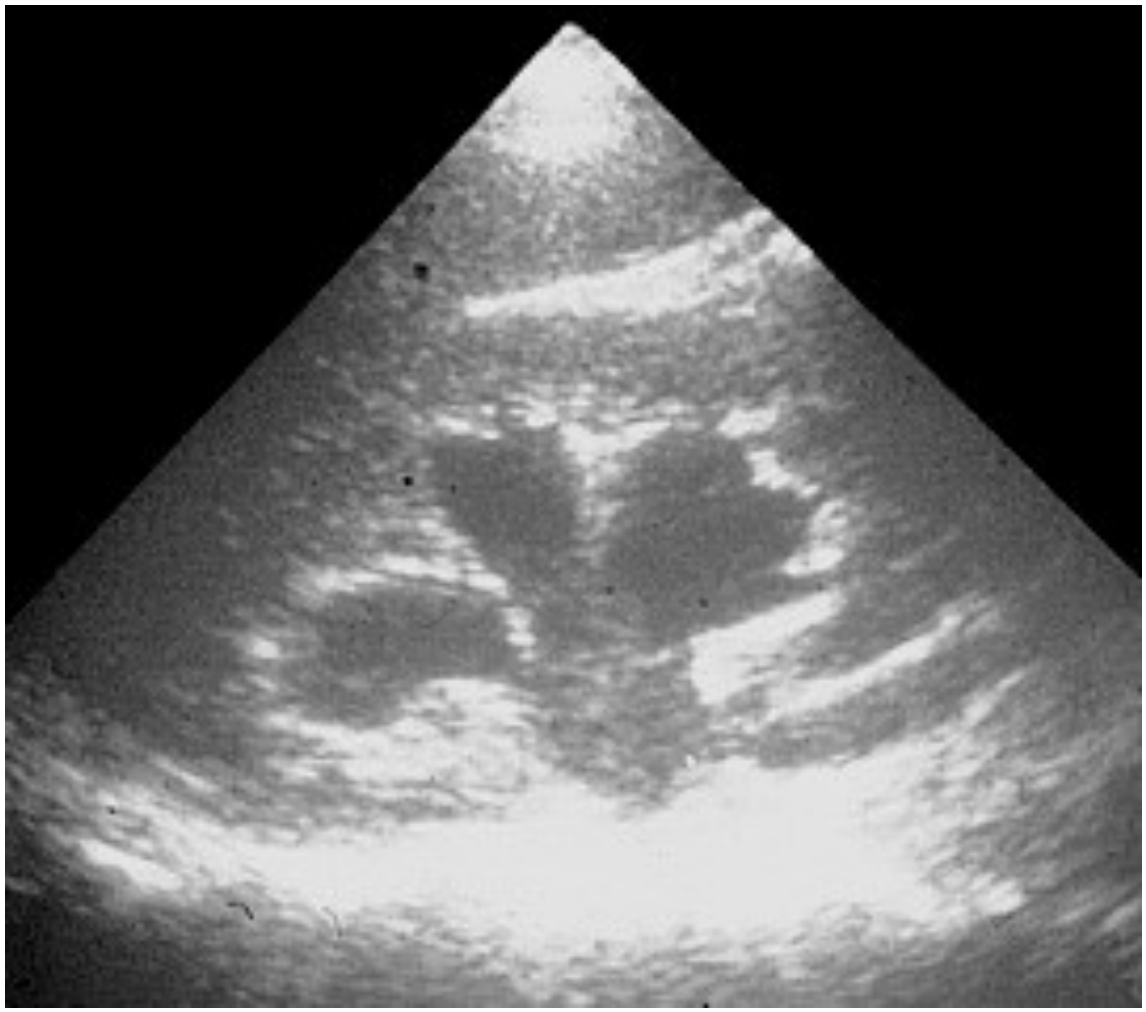
AIN is excluded :
no medication
no systemic disease
no rash
no Casts

AGN excluded :
should be chronic

Acute Kidney Injury

Scenario 4

After re-examination he was found to be on common catheter (which is external) that's mean someone replace the folly with common and since he's paraplegic he have neurogenic bladder. with the external catheter he's having obstruction (urine accumulation) —> overflow incountinous



US showed:
bilateral hydronephrosis

Acute Kidney Injury

Scenario 4

Treatment :
back to folly catheter

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 on top of chronic cuz: baseline was already high but also have marked increase

From history most likly AKI due to contrast
but there is no choice other than cardiac cath so we should decrease contrast concentration and stop meds that cause nephrotoxicity. eventully Cr will drop

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

If we change scenario

cuase differs—> after ACS= thromboembolic disease usually happen

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

signs: absent pulse, cold —> gangeren

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 — thromboembolic affecting blood vessels in the kidney

What your differential diagnosis?

Athero embolic disease — if Cr increase after 12D

Contrast induced AKI — if Cr increase after 2D

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

- Pre renal exclude in history and PE
- Post : no stone and he's young

	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	(+)	(-)

Renal —> Need to do serology

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