



*Problem
Based
Learning*



first case:

**postoperative
reduction in
urine output .. !**

Color Index



Key points from the Scenario:

- Saleh a 65-years old businessman has been suffering from painful knee joint for many years due to **osteoarthritis**.
- Lately he noticed his mobility has decreased significantly and visited his doctor.
- The doctor told that he requires knee replacement due to the excessive damaged knee joint.
- During the surgery, he suffered from an excessive blood loss and his BP dropped suddenly.
- He went into hypovolemic shock, which was corrected by blood transfusion.
- **Post-operatively**, his **urine output** decreased to 300 ml.
- The surgeon decided to seek advise from consultant nephrologist

History:

- He is diabetic and hypertensive for almost 6 years.
- No history of: hospital admission, allergies and smoking.
- He was treated with:
Ibuprofen (NSAIDs), **Lisinopril** (ACE inhibitors) and mixed **insulin**.

Examination

He is conscious and not distress, tends to sleep most of the time and speaks **coherently**.

Cardiovascular system: Normal 1st and 2nd heart sound no added sound or murmur.

Respiratory system: Lungs are clear to **percussion** and **auscultation**.

Abdominal examination: No **tenderness**, liver and spleen were not **palpable**.

Investigations:

Height: 182 cm

Body weight: 86 Kg

Vital sign	Result	Normal
Pulse	116/min	60-100/min
Blood pressure	90/55 mmHg	130/80 mmHg
Temperature	37.0 C	36.6-37.2 C
Respiratory rate	15/min	16-22/min

JVP was low

	Result	Normal 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	5.6 x 10 ⁹ /L	4.5-11 x 10 ⁹ /L
Platelet count	198 x 10 ⁹ /L	140-450 x10 ⁹ /L

Diagnosis:

Acute kidney injury (Acute renal failure) Due to the sudden drop in his blood pressure during the surgery which seriously effect the blood flow to the kidneys leading to acute tubular necrosis.

Management:

- 1- Optimize volume status we give patient IV fluid (prerenal)
- 2- With fluid overload we use diuretics such as **furosemide**
- 3- **Norepinephrine** and **dobutamine** to improve cardiac output
- 4- Prevention of some **nephrotoxic** drugs such as **NSAIDs; ibuprofen**
- 5- Nephrostomy or urinary catheter in case of obstruction (postrenal)
- 6- Frequent monitoring of renal function (serial serum creatinine) and urine output
- 7- **Hemodialysis** usually for two weeks (Because of the worsening acidosis) (refractory Volum over load)
- 8- Renal replacement

Other test :

Complete urine analysis:

Examination made	Result	Normal value	Clinical significance
Color	Yellow	Amber yellow	Normal
Character	Clear	Clear	Normal
PH	6.0 Acidic	4.8-8.0	Normal
Specific gravity	1.003	1.1015-1.025	
Protein	+2	(-)	Proteinuria
Sugar	-	-	Normal
Red blood cells	2/ hpf	-	Infection
Hemoglobin	+1	-	Hemoglobinuria
Pus cells	12/hpf	-	Infection
Epithelial cells	-	-	Normal
Amorphous phosphate	-	-	Normal
Bacteria	-	-	Normal
Granular cast	Seen	-	Infection

Renal function test:

Examination made	Preoperative	Postoperative	Normal value
Creatinine	98 umol/L	350 umol/L	62-115 umol/L
Urea	3,5 mmol/L	29 mmol/L	2.5-6.4 mmol/L
Potassium	4,36 mmol/L	6.2 mmol/L	3.5-5.1 mmol/L
Sodium	138 mmol/L	137 mmol/L	135-145 mmol/L

Arterial blood gases (ABGs):

Examination made	Result	Normal value
PH	7.24	7.35-7.45
HCO ₃	14	22-26 mEq/L
PaCO ₂	36	35-45 mm Hg
Base excess	-13	(-2 to +2 mEq)

Acute renal failure

- **Definition:** sudden loss of kidney function, which is reversible cellular injury.
Why it is a reversible condition?
- The renal cells are **stable cells** that have capability to regenerate after injury.
What is the general symptoms?
 - 1- Increase in serum creatinine more than 0.3 mg/dl
 - 2- Reduction in urine output less than 0.5 ml/h

Causes of acute renal failure:

Prerenal: (Any cause that decrease blood flow to the kidney)

- 1- **Volume depletion due to:** hemorrhage, severe burns, Steven Johnson syndrome, vomiting ..etc
- 2- **Decreased cardiac output due to:** any heart problem such as myocardial infarction
- 3- **Renal artery stenosis**
- 4- **Renal vein thrombosis**

Postrenal :(due to obstruction of urinary tract)

- **Stones**
- **Tumors**
- **Benign prostatic Hypertrophy**
- **Ligation during pelvic surgery.**

Renal "intrinsic" :(can be due to damage of glomeruli, renal tubules or interstitium)

• Glomerular:

- **Anti-GBM disease (such as Goodpasture syndrome)**
- **ANCA-associated glomerulonephritis (such as microscopic polyangitis)**
- **Immune complex glomerulonephritis (such as poststreptococcal glomerulonephritis)**

• Tubular:

- **Ischemia**
- **Toxic such as :**
 - **Drugs (aminoglycosides)**
 - **Heme pigments (Rhabdomyolysis)**
 - **Crystals (ethylene glycol poisoning)**

• Interstitial:

- **Drugs (NSAIDS)**
- **Infection (pyelonephritis)**
- **Systemic disease (leukemia)**

- **The patients will pass these steps in AKI:**

- 1- **Oliguria:** "when a patient passing less than 400 ml per 24 hours"
- 2- **Anuria:** "no urine"
- 3- **Polyuria:** "the patient lose a lot of urine and lead to disturbance of electrolyte."

- The difference between Acute and chronic renal failure:

	Acute	Chronic
History	Short (days-weeks)	Long (months-years)
Hemoglobin concentration	Normal	Low
Kidney size	Normal	Reduced
Serum creatinine level	reversible	irreversible

- **Diagnosis of acute renal failure by:**

- 1- Check of urine volume
- 2- Blood urea and creatinine levels in the blood "the patient will have **azotemia** which is elevated **blood urea nitrogen**" (**important**)
(The urea is highly affected by **dehydration**)
- 3- Measure the electrolytes
- 4- Urine test stick

- **When should we use further tests such as renal biopsy and ultrasound ?**

- 1- Unexplained AKI
- 2- AKI in presence of nephritic syndrome
- 3- Systemic disease associated with AKI

- **Morphology** : hemorrhagic with pale cortex and degenerated nuclei in proximal and distal tubules

- **Complications:**

- 1- Hyperkalemia
- 2- Metabolic acidosis
- 3- Pulmonary edema

These require medical treatment with :
sodium bicarbonate , **antihyperkalemic** ,
diuretics

INDICATION OF RENAL REPLACEMENT THERAPY (HEMODIALYSIS) ?

Refractory metabolic acidosis, uremic pericarditis, symptoms of uremia (encephalopathy), refractory volume overload and refractory hyperkalemia.

Questions:

What are the changes in the urinalysis, you suspect to see in this case?

Proteinuria and Granular casts.

What changes do you expect to see in the blood?

Elevated urea nitrogen and creatinine (azotemia)

Why his urine output reduced post operative?

Because damage of the kidney due to acute tubular necrosis

How can we avoid the fluid overload?

By using central venous catheter

New terms :

Urine output : The amount of urine excreted by the kidneys.

Coherently: Able to speak clearly.

Percussion : Tapping on a surface to determine the underlying structure

Auscultation: Listening to the internal sounds of the body, usually using a stethoscope questions

Tenderness : Sensitive to pain.

Palpable : Able to be touched or felt.

Urinary catheter: It is a tube placed in the body to drain and collect urine from the bladder.

Nephrostomy: the placement of a small, flexible rubber catheter (tube) through the skin into the kidney to drain urine

Fluid overload: Excessive amount of circulating fluid in the bod

Uremia: It is a clinical syndrome associated with fluid, electrolyte and hormone imbalances and metabolic abnormalities, which develop in parallel with deterioration of renal function

The word (refractory) means: Difficult to control or deal with.