# MECHANISMS OF HUMAN DISEASE AND PHARMACOLOGY & THERAPEUTICS

# MHD I Session VIII

**Renal Disease** 

November 6, 2013

# **STUDENT COPY**

## Case #1

Chief Complaint: "I have been feeling just lousy over the past several weeks"

The patient is a 61 year-old man who has a longstanding history of hypertension and diabetes mellitus, type 2, and chronic kidney disease who presents with multiple issues of concern. Over the past several weeks he has developed nausea and emesis of food; he denies emesis of blood or coffee grounds. He has been feeling more tired and feels as if he just has no energy. He feels itchy although his skin is not dry. Over the past several weeks he has also noticed more swelling of both of his legs. He denies fever, chest pain, shortness of breath, or abdominal pain. His medications include enalapril 10mg BID, hydrochlorothiazide 25mg daily, metoprolol 50mg BID, glargine insulin 25 units qhs, and aspirin 81mg daily. His medications and dosages have not been changed recently, though he admits he is "quite overdue for a check-up". He rarely drinks alcohol. He smoked 1 pack of cigarettes a day since the age of 18 but stopped 3 years ago after a hospitalization for chest pain.

On physical exam the patient is a well-developed, well-nourished male who appears uncomfortable. Blood pressure 180/110, pulse 80, respirations 24, temperature 98.4<sup>o</sup>F, body weight 76.5 kg, height 5'6". HEENT exam was remarkable for funduscopic findings of A-V nicking and copper wire changes. Cardiac exam had an S1, S2 and S4. There was no rub. There was no jugular venous distention. Lungs were clear to auscultation bilaterally. Abdominal exam was normal with no masses or hepatosplenomegaly or bruits. The remainder of the exam was remarkable for 2+ bilateral lower extremity edema up to the knees and superficial excoriations of his skin from scratching.

#### Laboratory Data

<u>Complete Metabolic Panel</u>			<u>Reference Range</u>	
Sodium		133	136-146 mmol/L	
Potassium*		6.3	3.5-5.3 mmol/L	
*Critical Result				
Dr. T. Smith notif	ïed on 9-	15-13 at	4:45pm	
Chloride		100	98-108 mmol/L	
$CO_2$		15	23-27 mmol/L	
BUN		170	7-22 mg/dl	
Creatinine		16.0	0.7-1.4 mg/dl	
Glucose		198	70-100 mg/dl	
Calcium		7.2	8.9-10.3 mg/dl	
Albumin		3.2	3.6-5.0 gm/dl	
Bilirubin, Total		1.1	0.2-1.4 mg/dl	
Alkaline Phosphatase		306	30-110 iu/l	
AST (SGOT)		43	5-40 iu/l	
ALT (SGPT)		37	7-35 iu/l	
Protein, Total		5.9	6.5-8.3 gm/dl	
CBC				
WBC	8.3		[4.0-10.0] k/ul	
RBC	2.99		[3.60-5.50] m/ul	
Hgb	8.6		[12.0-16.0] gm/dl	
Hct	27.4		[34.0-51.0] %	
MCV	88		[85-95] fl	
MCH	23.6		[28.0-32.0] pg	
MCHC	32.7		[32.0-36.0] gm/dl	
RDW	15.1		[11.0-15.0] %	
Plt Count	166		[150-400] k/ul	

UA w/Micro		
Color	AMBER	[YELLOW]
pH	6.0	[4.5-8.0]
Spec Gravity	1.010	[1.003-1.035]
Protein	4+	[NEG]
Blood	NEG	[NEG]
Glucose	2+	[NEG]
Ketones	NEG	[NEG]
Bilirubin	NEG	[NEG]
Urobilinogen	0.2	[0.2-1.0] eu/dl
NITRATE	NEG	[NEG]
LEUKOCYTES	NEG	[NEG]
RBC	0-2	[0-2] /hpf
WBC	0-2	[0-5] /hpf
Waxy Casts	Moderate	_

## **Educational Objectives**

1. Develop a problem list

The physician orders additional laboratory tests:

Protein, urine600mg/dlCollection start9-16-13 0800Collection end9-17-13 0800Volume 850ml

Creatinine, urine 180mg/dl Collection start 9-16-13, 0800 Collection end 9-17-13, 0800 Volume 850 ml

#### EXAM: USAK - US KIDNEY (RENAL) LIMITED RETROPERITONEUM

#### COMPARISON: NONE

THE RIGHT KIDNEY MEASURES 9.2 x 3.0 CM\*. THERE IS THINNING OF THE RENAL CORTEX. THERE IS INCREASED RENAL ECHOGENICITY, WHICH MAY BE SEEN IN MEDICAL RENAL DISEASE. THERE IS NO EVIDENCE FOR HYDRONEPHROSIS, SHADOWING RENAL CALCULUS OR FOCAL ABNORMALITY. THE LEFT KIDNEY MEASURES 9.2 CM x 3.3 CM. THERE IS THINNING OF THE RENAL CORTEX. THERE IS AN INCREASE IN ECHOGENICITY, WHICH MAY BE SEEN IN MEDICAL RENAL DISEASE. A 2.8 X 2.8 X 2.1 ANECHOIC LESION WITH ENHANCED TRANSMISSION IS SEEN IN THE INTERPOLAR REGION OF THE LEFT KIDNEY, CONSISTENT WITH A SIMPLE CYST. THERE IS NO EVIDENCE FOR HYDRONEPHROSIS, SHADOWING RENAL CALCULUS OR FOCAL ABNORMALITY.

IMPRESSION: BILATERAL ECHOGENIC KIDNEYS WITH CORTICAL THINNING, WHICH MAY BE SEEN IN MEDICAL RENAL DISEASE.

\*\*\*normal kidney size on ultrasound: length 11-14cm, width 4-5cm

2. Why was a renal ultrasound ordered?

3. What is the estimated Glomerular Filtration Rate (GFR)? (use the Cockcroft-Gault equation). What is "normal GFR"? What is the "stage" of this patient's CKD?

4. What would be the estimated GFR if this patient were female?

5. What is the 24-hour urine protein excretion in this patient?

6. Is this 24-hour urine collection adequate?

7. What is the <u>measured</u> GFR in this patient?

8. What is the most likely etiology of this patient's kidney disease?

9. What are indications for dialysis? Should this patient be dialyzed?

10. What is the most likely cause of this patient's anemia? What is the approach to treatment?

#### **Additional Laboratory Data:**

Phosphorus 10.5 [2.6-6.4] mg/dl

INTACT PTH 895 pg/ml

REFERENCE VALUES FOR THE INTERPRETATION OF iPTH IN CONJUNCTION WITH THE TOTALSERUM CALCIUM CONCENTRATION IN ADULTS ARE AS FOLLOWS:

	INTERPRETATION	iPTH (PG/ML)	TOTAL CALCIUM (MG/DL)
NORM	MAL	10-65	8.5-10.5
PRIM	ARY		
HYP	ERPARATHYROIDISM	>60	>10.5
HYPE	ERCALCEMIA OF		
MAI	LIGNANCY	<20	>10.5
HYP	OPARATHYROIDISM	<10	<8.5

11. Explain the calcium, phosphorous and PTH values.

12. What is a "critical lab result"? (refer to Complete Metabolic Panel results) (this would be a good time for students to review "Introduction to Laboratory Medicine – Post Analytic Phase of Laboratory Testing Module").

13. What home medication should have been immediately stopped based on this critical lab result?

#### Case # 2

Cc: "I feel like an elephant is sitting on my chest for the past half hour"

A 61-year-old woman presents to the emergency department via ambulance with crushing left sided chest pain, 10/10 intensity, of 30 minutes duration, radiating to the left arm. She has no previous history of such pain. She had seen her primary care physician 2 days prior for a routine follow-up and felt well.

She was diagnosed with diabetes mellitus, type 2 five years ago.

She has been told she has an "elevated cholesterol" level which she is trying to lower with diet. Her medications are atenolol 25mg daily, glipizide 5mg BID, aspirin 81mg daily.

She has no known drug allergies.

On physical exam she is diaphoretic and pale. Blood pressure 136/82, pulse 107, respirations 22, temperature 98.9<sup>0</sup>F, pulse ox 95% on room air, weight 80 kg. Jugular venous pulse measures 3cm. Her lungs have bibasilar crackles. Heart exam reveals S1, S2, no S3 or S4 or murmurs. Abdominal exam is normal. Dorsalis pedis and radial pulses are 2+ bilaterally.

#### **Admission Laboratory Data**

	08/01/13	08/03/13 (ED)	Referen	nce Range		
Sodium	141	140	136-140	) mmol/Ľ		
Potassium	4.2	4.1	3.5-5.3 mmol/l			
Chloride	106	106	98-108	98-108 mmol/L		
Total CO <sub>2</sub>	24	24	ו 23-27 ו	mmol/L		
BUN	16	18	7-22 m	g/dl		
Creatinine	1.5	1.5	0.7-1.5 mg/dl			
Glucose	196	155	70 - 10	0 mg/dl		
<u>Myoglobin</u> Troponin I		214 1.8	[0 - 75] [ 0 – 0.04]	ng/ml ng/ml		

EKG – See separate sheet at end of session

The patient is emergently brought to the cardiac catheterization lab where the thrombosed coronary artery is stented (**students – what coronary artery would you suspect?**) The patient has no further episodes of pain.

A basic metabolic panel on hospital day #3 reveals the following:

#### Basic Metabolic Panel

6/13	
99	[70 - 100] mg/dl
32	[7 - 22] mg/dl
2.3	[0.7 - 1.4]mg/dl
3.7	[8.5 - 10.5] mg/dl
138	[136 - 146] mmol/L
5.2	[3.5 - 5.3] mmol/L
107	[98 - 108] mmol/L
19	[20 - 32] mmol/L
	6/13 99 32 2.3 3.7 138 5.2 107 19

# Learning Objectives:

1. On hospital day #3, what is the main clinical problem?

2. Develop a general differential diagnosis for the main clinical problem.

Additional Studies are obtained:

<u>UA w/Micro</u>		
Color	AMBER	[YELLOW]
pH	6.0	[4.5-8.0]
Spec Gravity	1.015	[1.003-1.035]
Protein	NEG	[NEG]
Blood	NEG	[NEG]
Glucose	NEG	[NEG]
Ketones	NEG	[NEG]
Bilirubin	NEG	[NEG]
Urobilinogen	0.2	[0.2-1.0] eu/dl
NITRATE	NEG	[NEG]
LEUKOCYTES	NEG	[NEG]
RBC	0-2	[0-2] /hpf
WBC	0-2	[0-5] /hpf
Epithelial casts	Moderate	
Course Granular casts	Few	

#### Sodium, Rnd Ur

Sodium mmol/l 50 mmol/l Volume RANDOM ml Date Of Collection 08/06/13

# Creat, Random Urine

Creatinine, mg/dl 20 mg/dl Total Volume RANDOM ml Date Of Collection 08/06/13 EXAM: USAK - US KIDNEY (RENAL) LIMITED RETROPERITONEUM COMPARISON: NONE THE RIGHT KIDNEY MEASURES 10.5 x 5.5 CM. ECHOGENICITY IS NORMAL. THERE IS NO EVIDENCE FOR HYDRONEPHROSIS, SHADOWING RENAL CALCULUS OR FOCAL ABNORMALITY. THE LEFT KIDNEY MEASURES 10.5 CM x 6.0 CM. ECHOGENICITY IS NORMAL. THERE IS NO EVIDENCE FOR HYDRONEPHROSIS, SHADOWING RENAL CALCULUS OR FOCAL ABNORMALITY.

IMPRESSION: NORMAL BILATERAL RENAL ULTRASOUND

3. Interpret the provided data in light of the clinical scenario. Calculate the fractional excretion of sodium. How do the results help in the determination of the etiology of this patient's problem?

4. Based on the all the clinical data that is available, what is your diagnosis? Be specifc ie why did this develop?

The patient's creatinine peaked at 2.7 mg/dl. Over the next two weeks, with supportive care, the creatinine improved to 1.7 mg/dl.

#### Case #3

Cc: I am getting more and more swollen for the past several weeks

The patient is a 54 year-old man with a history of coronary artery disease who is admitted to the hospital for increasing lower extremity edema, abdominal swelling and shortness of breath. The patient had noted about a 20 pound weight gain over the past month. During the past week he has had three pillow orthopnea (usually he sleeps on one pillow). He denied chest pain. The patient's medications include aspirin 325mg daily, lisinopril 40mg daily, metoprolol XL 50mg daily, and atorvastatin 80mg daily. He ran out of his furosemide tablets about 1 month ago. He had been taking 40mg twice daily.

On physical exam the patient is a well-developed, well nourished male in moderate respiratory distress. Blood pressure 140/80, pulse 95, respirations 28 and labored. Body weight 101 kg, height 5' 10''. Oxygen saturation on room air 88%. Jugular venous pulse was at the angle of the jaw. On cardiac auscultation there was S1, S2 and S3 without S4 or murmur. PMI was displaced laterally. Pulmonary exam was remarkable for bilateral rales 2/3rd up both lung fields. There was bilateral dullness to percussion involving the basilar 1/3 lung fields. Abdomen was enlarged with a positive fluid wave. Lower extremities were remarkable for 3+ pitting edema.

<u>Laboratory Data</u> 07/01/13		
		<b>Reference Range</b>
Sodium	133	136-140 mmol/L
Potassium	5.7	3.5-5.3 mmol/l
Chloride	90	98-108 mmol/L
Total CO <sub>2</sub>	20	23-27 mmol/L
BUN	87	7-22 mg/dl
Creatinine	3.0	0.7-1.4 mg/dl
UA w/Micro		
Color	AMBER	[YELLOW]
pН	6.0	[4.5-8.0]
Spec Gravity	1.030	[1.003-1.035]
Protein	NEG	[NEG]
Blood	NEG	[NEG]
Glucose	NEG	[NEG]
Ketones	NEG	[NEG]
Bilirubin	NEG	[NEG]
Urobilinogen	0.2	[0.2-1.0] eu/dl
NITRATE	NEG	[NEG]
LEUKOCYTES	NEG	[NEG]
RBC	0-2	[0-2] /hpf
WBC	0-2	[0-5] /hpf
Hyaline Casts	Few	

#### Sodium, Rnd Ur

Sodium mmol/l 10 mmol/l Volume RANDOM ml Date Of Collection 07/01/13

#### Creat, Random Urine

Creatinine, mg/dl 130 mg/dl Total Volume RANDOM ml Date Of Collection 07/01/13

EXAM: USAK - US KIDNEY (RENAL) LIMITED RETROPERITONEUM COMPARISON: NONE THE RIGHT KIDNEY MEASURES 10.5 x 5.5 CM. ECHOGENICITY IS NORMAL. THERE IS NO EVIDENCE FOR HYDRONEPHROSIS, SHADOWING RENAL CALCULUS OR FOCAL ABNORMALITY. THE LEFT KIDNEY MEASURES 10.5 CM x 6.0 CM. ECHOGENICITY IS NORMAL. THERE IS NO EVIDENCE FOR HYDRONEPHROSIS, SHADOWING RENAL CALCULUS OR FOCAL ABNORMALITY.

#### IMPRESSION: NORMAL BILATERAL RENAL ULTRASOUND

- 1. Develop a problem list.
- 2. Calculate this patient's fractional excretion of sodium.

3 Develop a differential diagnosis for the etiology of the patient's renal failure. What is the likely etiology in this case?

- 4. Comment on the following treatments for this patient.
  - i. Intravenous sodium chloride
  - ii. Intravenous pressure support
  - iii Continued afterload reduction with an ACE inhibitor
  - IV. Afterload reduction with hydralazine and a nitrate.

The patient clinically improved over the next week with treatment. He was discharged home on July 9.

	07/04/13	07/06/13	07/09/13	<b>Reference Range</b>
Sodium	134	133	135	136-140 mmol/L
Potassium	5.8	5.4	5.2	3.5-5.3 mmol/l
Chloride	91	94	96	98-108 mmol/L
Total CO <sub>2</sub>	17	19	23	23-27 mmol/L
BUN	101	87	64	7-22 mg/dl
Creatinine	3.7	3.3	2.8	0.7-1.5 mg/dl

5. What do hyaline casts represent and what is their significance?

# Case 4 - Unknown

Students will not have case data until the session meets.

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