

CHRONIC RENAL FAILURE

Chronic Renal Failure Learning Objectives

At the completion of this module the student should be able to:

- Recognize the clinical and laboratory presentation of a patient with chronic renal failure.
- Distinguish between glomerular and interstitial disease.
- Describe the acid-base abnormalities of chronic renal failure.
- Describe the effect of chronic renal failure on water balance.
- Describe the effect of chronic renal failure on potassium balance.
- Describe the effect of chronic renal failure on sodium and volume regulation.
- Describe the effect of chronic renal failure on calcium and phosphate balance and the role of PTH and Vitamin D in mineral metabolism.
- Describe the hematological consequences of chronic renal failure.
- Describe the management of a patient with chronic renal failure with regards to both the prevention of the complications of chronic renal failure and the progression of renal failure.
- Differentiate between essential hypertension and secondary hypertension resulting from renal disease.
- Recognize the role of uncontrolled hypertension in progressive renal failure.
- Recognize the clinical and laboratory information that can be used to distinguish acute from chronic renal failure.
- Calculate creatinine clearance.
- Describe the role of muscle mass in determining serum creatinine.
- Describe the relationship of serum creatinine to creatinine clearance and GFR.
- List the signs and symptoms of uremia.
- List the indications for renal replacement therapy.
- Recognize uremic pericarditis and pericardial tamponade.
- Describe the utility of a plot of $1/\text{plasma creatinine}$ in monitoring a patient with progressive renal disease.
- Recognize the normal progression of chronic renal disease.
- Describe the adaptive response of vascular tone of the afferent and efferent arterioles in maintaining GFR in chronic renal failure.
- Describe how these adaptive responses can contribute to progressive renal disease.
- Define hyperfiltration.
- Describe the effects of angiotensin converting enzyme inhibition and prostaglandin inhibition on glomerular hemodynamics.

Case 1:

The patient is a 48 year old woman who is admitted for evaluation of increased fatigue and shortness of breath. In her Doctor's office, she was noted to be hypertensive. Five years prior to admission, she was admitted for evaluation of headaches, which she had suffered from for many years. She has required multiple analgesic preparations for relief, including aspirin, phenacetin and codeine. A complete neurological evaluation was normal, but her BUN was noted to be 28 and creatinine 2.4 mg/dl. Her urine showed 8-10 white cells and a culture was sterile. Over the following 5 years, her headaches persisted and analgesics were used indiscriminately. Her past history is significant for gastritis and duodenal ulcer approximately 10 years prior to current admission. The patient denies hematuria, dysuria, urinary tract infection. There is no family history of kidney disease. She is now admitted with a 2 week history of fatigue, shortness of breath on exertion, general malaise, poor appetite.

Physical examination: The patient is a thin white female in no distress. Blood pressure 180/110. HEENT - no hemorrhages, no exudates, discs flat. Lungs-bibasilar rales. Heart - no S3, no rub. Abdomen - no organomegaly. Extremities - 1+ edema.

Laboratory: Sodium 133, potassium 4.5 chloride 104, CO₂ (bicarb) 14, Bun 65, creatinine 6.2, calcium 5.2, phosphorus 8.6.

ABG: pH 7.32 PCO₂ 28; PO₂ 90, HCO₃ 14.

Hemoglobin 8, hematocrit 24.

Urine specific gravity 1.010, pH 6.0, 2+ protein, 10-12 WBC's, 1-2 renal tubular cells, occasional granular casts.

Urine sodium 90 mEq/L; 24 hour urine: protein 1200 mg, creatinine 1240 mg.

Ultrasound demonstrated bilateral small kidneys with no obstruction.

1. What is the significance of the urine sediment?
 - a. WBC's
 - b. Renal tubular cells
 - c. Granular casts

2. Is the etiology of the renal disease glomerular or interstitial?
 - a. Does the degree of proteinuria help determine the diagnosis?

3. What would be expected to be found in a renal biopsy?
 - a. Is a biopsy indicated?

4. What are the causes of interstitial nephritis and what is most likely in this case?

5. What is the acid-base abnormality?
6. What is the cause of the patient's hyponatremia and how would you treat it?
7. What is the cause of the patient's shortness of breath and how would you treat it?
8. What is the cause of the patient's hypocalcemia and how would you treat it?
9. What is the cause of the patient's anemia and how would you treat it?
 - a. Should an erythropoietin level be measured?
10. What dietary restrictions should be suggested?
11. Calculate the patient's creatinine clearance.

Case 2:

The patient is a 28 year old white male who was noted to be hypertensive on a routine insurance physician examination and was referred for evaluation. The patient's hypertension has been asymptomatic. He has no past history of medical problems, but one year previously was not allowed to donate blood because of anemia. He received no medical follow up for this problem. There is no history of diabetes, renal disease, hypertension or heart disease. No dysuria, no hematuria, no frequency, no urinary tract infections, no kidney stones, no hearing loss. Family history is negative. The patient's only complaint is fatigue and some recent increase of pruritus but without dermatitis.

Physical examination: The patient is a thin male in no acute distress. Blood pressure 210/140, pulse 88 and regular. Skin-multiple excoriated areas over the trunk and extremities. HEENT-arteriolar narrowing with multiple flame shaped hemorrhages. Disc margins were sharp. Lungs-bilateral rales. Heart- PMI in the anterior axillary line. Left ventricular heave was present, no rub. Abdomen-no organomegaly. Extremities- 2+ pedal edema. Neurological mild asterixis and lower extremity sensory neuropathy.

Laboratory: Hemoglobin 8.2, hematocrit 26, BUN 95, creatinine 9, Na 137, K-5.3, Cl-101; bicarb 18. Total protein 6.7, albumin 3.7, calcium 5.2, phosphorus 9.4, glucose 125, uric acid 11, iron 40 mcg (low), iron binding capacity 200 mcg (low) alkaline phosphatase 250 (high). pH 7.36, PCO₂ 33, PO₂ 94, HCO₃ = 18, parathyroid hormone 600 (15-65). 24 hr urine: protein 3 gm, creatinine 1800 mg. Chest x-ray: cardiomegaly and mild pulmonary congestion, Ultrasound: small kidneys, no obstruction.

Urine-clear, specific gravity 1.010, pH 5, 2+ protein, rare cells, no cellular casts. Several broad casts.

1. What is the likely cause of the hypertension?
2. What are the mechanisms of the renal component of the hypertension?
3. How could the hypertension contribute to the kidney dysfunction?
4. Is the kidney disease acute or chronic?
 - a. What clues in the history and findings help you determine duration of renal disease?
5. How does the acid base abnormality compare with patient I?
6. Compare this patient's creatinine clearance with patient I. Why do they have similar creatinine clearances while having different plasma creatinine levels?
7. Is there an indication to initiate this patient on dialysis?
8. What would you expect to happen to the patient if he refuses dialysis?

Case 4:

A 30 year old male with a 15 year history of Type I diabetes mellitus and a 10 year history of hypertension was noted to have proteinuria in Jan. 1990. His creatinine at that time was 1.0 mg/dl. He was started on an ACE inhibitor and a diuretic. In Jan. 1991 his creatinine was 1.2 mg/dl. In Jan.1992 his creatinine was 1.5 mg/dl. In Jan 1993 his creatinine was 2.0 mg/dl. In Jan1994 his creatinine was 3.0 mg/dl. In Feb 1994 he developed gout and began taking Advil on a daily basis. After 2 weeks he began feeling weak and developed nausea. He saw his physician who sent the patient for some blood work. His Creatinine was now 15 mg/dl.

1. Plot this patient's $1/\text{plasma creatinine}$.
2. Is this patient's recent renal deterioration part of the normal progression of diabetic nephropathy?
3. What is the pathophysiology behind this patient's recent loss of renal function?
4. What should this patient be told concerning the need for dialysis?