

## Renal Case Studies

- J.H. is a 12-year-old boy diagnosed with glomerulonephritis thought to be secondary to a streptococcal throat infection. J.H. had been diagnosed with nephrotic syndrome several months prior to his most recent clinic visit. At his latest clinic visit, a decrease in urine output, increasing lethargy, hyperventilation, and generalized edema are noted. Trace amounts of protein are detected in J.H.'s urine. Blood is drawn for laboratory analysis, which reveals the following:

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- Case Discussion
  - pH = 7.36
  - PaCO<sub>2</sub> = 33 mm Hg
  - PaO<sub>2</sub> = 100 mm Hg
  - HCO<sub>3</sub><sup>-</sup> = 18 mEq/L
  - Hct = 30%
  - Na<sup>+</sup> = 130 mEq/L
  - K<sup>+</sup> = 5.4 mEq/L
  - BUN = 58 mg/dl
  - creatinine = 3.9 mg/dl
  - albumin = 2.0 g/dl

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- How does streptococcal infection lead to glomerulonephritis?
  - Poststreptococcal glomerulonephritis is the result of an immune complex reaction. The antibodies made against the bacteria bind to bacterial antigens and then precipitate out into capillary beds. The inflammation that follows injures the glomerular capillary and basement membrane
- Interpret J.H.'s laboratory values for likely cause and significance. Is J.H. still experiencing nephrosis or is his condition progressing to uremia?
  - J.H. looks to be developing uremia. The BUN and creatinine are significantly elevated, he has a compensated metabolic acidosis, his K<sup>+</sup> is elevated, and his hematocrit is low. These signs are all associated with renal failure. The low albumin and hyponatremia are indicative of nephrosis.

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- What additional physical or laboratory findings would be helpful in determining J.H.'s stage of renal impairment?
  - Creatinine clearance to estimate glomerular filtration rate would be the most helpful
  - Other findings would include edema, pruritis, urinalysis for protein, and serum calcium
- How will J.H.'s therapy change if his condition has progressed from nephrosis to uremia?
  - In nephrosis there is usually a high urine output and no fluid restriction. The patient is encouraged to consume a high-protein diet. In uremia a low-protein diet is recommended and precautions to avoid fluid volume overload are needed as urine output falls. Restrictions on salt and potassium intake may be instituted.

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- D.K. is being seen in the clinic for complaints of urinary frequency, urgency, and burning. She reports that her urine appears cloudy and smells abnormal. A urine culture is obtained, and D.K. is given a prescription for antibiotics.

- **Discussion**

- What is the most likely cause of D.K.'s signs and symptoms?
  - Urinary tract infection or cystitis

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- Was antibiotic therapy the appropriate treatment? What organism should the antibiotic be effective against since it is the most common cause of this disorder?
  - Yes, antibiotics are indicated for symptomatic urinary tract infection.
  - *Escherichia coli* causes 80% of urinary infections.

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- What factors predispose to development of this urinary tract disorder?
  - Sexually active women
  - Use of contraceptive diaphragm
  - Failure to void following intercourse
  - Incorrect hygiene (should be wiping from front to back)
  - Female anatomy
  - Low estrogen in postmenopausal women.
  - Catheters, tubes, or a foreign object placed in the urinary tract for long periods of time
  - Pregnancy
  - Diabetes mellitus

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- What strategies could be suggested to help D.K. avoid recurrence of this problem?
  - If sexually active, make sure to void directly following intercourse
  - Wipe perineal area from front to back
  - Wear cotton-crotch underwear and panty hose
  - Drink six to eight glasses of water daily
  - Avoid bubble baths and highly perfumed soaps
  - Avoid douches and feminine hygiene deodorants
  - Avoid harsh toilet paper
  - Avoid tight-fitting pants/underpants

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- P.W. was the victim of a hit-and-run auto-pedestrian accident and suffered multiple abrasions, a concussion, and a deep laceration of the left thigh. He was discovered approximately 2 hours after the incident and is now in the emergency department. P.W.'s vital signs and hematocrit suggest that he has had a major blood loss of about 2000 ml. A catheter is inserted to monitor urine output, and P.W. is fluid resuscitated while his wounds are cleaned and sutured. The urine output is quite low, with high urine osmolality and low urine sodium.

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- **Discussion**

- What type of renal failure is P.W. at risk for developing?
  - Prerenal acute renal failure because of blood loss, which may lead to poor renal perfusion.
- What is the best therapy to preventing renal failure?
  - Adequate extracellular volume replacement with blood or isotonic fluids to ensure adequate circulating blood volume.
  - Therapy as needed to maintain an adequate arterial blood pressure and perfusion pressure to the kidney.

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- In view of the low urine output, high osmolality, and low sodium, what stage is P.W. currently in?
  - He is in the stage of prerenal oliguria, which means the kidney is functioning as it should if blood volume and perfusion pressure are low. That is, the kidney will conserve fluid and sodium and produce a concentrated urine.
  - This stage is potentially reversible if perfusion pressure and flow to the kidney are quickly restored. If they are not, then the patient may progress to prerenal renal failure.

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- In addition to urine output, what laboratory data should be monitored to assess changes in P.W.'s renal function?
  - Serum BUN, creatinine, and potassium should be monitored. An increase indicates decreased renal function.
  - Creatinine clearance can be measured to assess glomerular filtration rate.
  - Serum sodium may be useful in determining the correct IV fluid composition to administer