Answer Key to Nephrology Jumble Bumble: Respiratory Alkalosis

1. **Hypocalcemia**

Alkalemia increases binding of calcium to albumin, thereby lowering the ionized calcium without affecting the total calcium. The ionized calcium falls by 0.6 mg/dL for each 0.1 unit rise in pH in acute respiratory alkalosis.

2. **Quetiapine**

Quetiapine is a dopamine, serotonin, and adrenergic antagonist, and is metabolized by the cytrochrome P450 enzyme. Hyperventilation and respiratory alkalosis have been reported with quetiapine use, especially with co-administation of medications that inhibit the cytochrome P450 enzyme. Clinical trials of quetiapine reported hyperventilation as a rare adverse effect (1/1000 patients), although causality was not established. The proposed mechanisms for drug-induced hyperventilation are a direct action on the respiratory center in the brain stem, stimulation of either peripheral or central chemoreceptors, and modulation of central neurotransmitters such as serotonin.

3. **Progesterone**

Progesterone is metabolized in the liver, and is elevated in patients with cirrhosis. Progesterone stimulates ventilation by activating receptors in the central nervous system. Massive ascites limiting respiratory excursion and hypoxemia due to hepato-pulmonary syndrome are also factors in cirrhosis that cause hypocapnia.

4. **Kussmaul Breathing**

Identified and termed by Adolph Kussmaul, this type of respiration is characterized by slow, deep, and labored breathing. It is most often seen as a compensatory respiratory mechanism in patients with metabolic acidosis.

5. **Hypothyroidism**

Basal metabolic rate is significantly reduced in patients with severe hypothyroidism, and decreased carbon dioxide production can cause respiratory alkalosis. However, a drop in $PaCO_2$ can also decrease the ventilation through inhibition of the respiratory center.

Bonus Answer:

Acetate Dialysis

In the early days of dialysis, the dominant form of dialysate buffer was acetate. During acetate dialysis, CO_2 diffuses from the blood to dialysate leading to a respiratory alkalosis. As a result of respiratory alkalosis, the pH of the blood exiting the dialysis filter does not fall. Most healthy patients did relatively well with acetate-based dialysate, but those with liver failure, sepsis, or other severe illnesses would often feel extremely ill about an hour or so into the treatment session. These patients are unable to convert acetate to bicarbonate. In addition, since the acetate dialysate lacks bicarbonate, there is diffusion of bicarbonate from the blood to the dialysate leading to worsening metabolic acidosis.