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MANAGING FLUID, AND ELECTROLYTE PROBLEMS IN PATIENTS WITH KIDNEY DISEASE

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Key Concepts

1. Renal patients are predisposed to both dehydration and overhydration. A principal factor influencing this is the patient's urine production rate. Urine output should be determined early in the course of disease.

2. Dehydration (or volume contraction) must be corrected rapidly in azotemic patients to minimize risk of renal hypoperfusion and additional ischemic renal injury. Failure to rapidly rehydrate renal patients delays their response to therapy (both clinical and laboratory responses).

3. Urine output should be determined after an initial fluid challenge. Fluid therapy must be adjusted according to urine output to avoid overhydration or persisting dehydration.

4. Maintenance therapy must be more carefully regulated in renal patients due to reduced ability of the kidneys to accommodate errors in therapy. Electrolyte balance and acid-base status

Significance of fluid balance in renal disease. The kidneys are the primary organs responsible for maintaining body fluid balance, conserving or excreting water and electrolytes as necessary to maintain an *internal milieu* appropriate for sustaining life. It is commonly accepted that fluid therapy in patients with normally functioning kidneys is relatively simple because the kidneys accommodate for errors in prescribing fluid therapy (i.e "The dumbest kidneys are smarter than the smartest clinician."). The great risks of fluid therapy in patients with renal disease are: 1) failure to adequately rehydrate a dehydrated patient, thus sustaining prerenal azotemia and promoting ischemic renal injury, and 2) over-hydrating a patient with limited urine production.

Fluid balance in patients with polyuric renal disease is maintained by compensatory polydipsia. If water consumption is insufficient to compensate for polyuria, dehydration is the result. This may occur as a consequence of lack of intake or lack of access to fresh, clean, unadulterated water. Cats and some dogs with CRF fail to consume sufficient water to prevent chronic or recurrent dehydration. In addition, acute gastrointestinal fluid losses resulting from renal or non-renal causes may lead to extracellular fluid volume depletion.

Dehydration and volume depletion promote renal hypoperfusion and prerenal azotemia that may exacerbate the clinical and laboratory abnormalities of chronic renal insufficiency/failure. In addition to prerenal azotemia, dehydration may be associated with electrolyte disturbances such as hyperphosphatemia, hyperkalemia, and metabolic acidosis. Clinical signs characteristic of dehydration include decreased appetite, lethargy, and constipation. In some patients, prerenal azotemia may precipitate uremic crisis. Further, if dehydration and decreased renal blood flow are allowed to persist, additional ischemic renal damage may occur.

Indications for Fluid Therapy. Principal indications for fluid therapy in renal patients are correction of reduced effective circulating volume and management of acute uremic crises or abrupt decline in renal function. Oncotic support may be required for patients with the nephrotic syndrome. Renal function is highly influenced by renal perfusion, so any condition reducing renal perfusion may further impair renal function. It is important to correct such deficits early in the process to limit additional irreversible loss of functioning nephrons. In addition, many of the clinical signs of uremia are caused or exacerbated by dehydration. Symptomatic relief can be provided by appropriate fluid therapy.

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Initial Stabilization of renal Function. Before beginning fluid therapy, an accurate body weight, pulse, respiratory rate, arterial blood pressure, PCV, total solids, serum creatinine and BUN, serum electrolytes, acid-base status and other appropriate tests should be determined. These tests should be repeated at this time if they have not been performed in the past 12 hours earlier). These tests should be serially monitored as indicated; body weight should be repeated at least every 8 to 12 hours using the same scale.

Patients presenting for uremic crisis or abrupt decline in renal function require intravenous fluid therapy for optimum response. Treatment of azotemic patients should be via intravenous administration; however, when the owner rejects IV therapy (due to cost, hospitalization, etc.), subcutaneous therapy will occasionally be successful (nonetheless, it should generally be discouraged due to likelihood of failure). Fluids of choice include normal saline (with appropriate supplements) or a balanced electrolyte solution. Markedly abnormal electrolyte or acid-base disturbances may dictate a different fluid, but this is uncommon

As in other patients with fluid disorders, a fluid plan can be developed considering replacement, maintenance and ongoing losses. A major ongoing loss to consider in renal patients is polyuria. In contrast, in patients with oliguria/anuria, maintenance therapy assumes normal urine production which is absent for these patients. When urine output is unknown, urine output should be measured to assure appropriate therapy. Elimination of fluid excess is very difficult in oliguric patients and may require dialysis. However, if hydration is not corrected, continuing hypoperfusion of the kidneys may cause a continued physiologic oliguria. It is often difficult to assess urine output accurately until the patient has been adequately rehydrated.

Renal patients that are azotemic should receive fluids more aggressively during the first 6 to 12 hours. Failure to rapidly restore renal perfusion during this initial period may cause continued renal ischemia and further renal injury. In addition, the response to fluid therapy may be delayed or less pronounced which may be misinterpreted as lack of response to fluid therapy. Depending on the overall assessment of the patients needs and concurrent problems, at least 50% of the maintenance fluid volume should be administered in the first 6 to 8 hours. During this period of more aggressive fluid administration, the patient should be carefully monitored for signs of overhydration.

Maintenance therapy typically involves approximately 1/3 saline (Or balanced electrolyte solution) to replace urinary losses and 2/3 dextrose 5% in water to replace respiratory and other insensible losses. Fluids similar to this combination are commercially available as maintenance fluids. It is quite common for veterinarians to continue to administer replacement fluids as maintenance fluids, often with no adverse effects. However, this approach may be unsatisfactory for patients with renal disease leading to electrolyte disturbances. Increased urinary losses in polyuric patients should be replaced by saline or a balanced electrolyte solution.

Once hydration has been corrected, the principal goal of therapy is to maintain hydration by providing maintenance fluids and replacing ongoing losses in order to prevent exacerbating azotemia and renal hypoperfusion. When the patient has improved sufficiently so that fluid therapy can be withdrawn, fluid therapy should be gradually withdrawn over several days. Initially, intravenous administration may be reduced, then the patient may be switched to subcutaneous fluid therapy.