AMERIVET
VETERINARY PARTNERS

# Quick Guide Acute Kidney Injury

1. IRIS AKI Grading

| AKI Grade | Blood Creatinine | Subgrade |
|---|---|---|
| Grade I | <1.6 mg/dl | 1. Non-oliguric or oligoanuric<br>2. Requiring renal replacement therapy |
| Grade II | 1.7-2.5 mg/dl | |
| Grade III | 2.6-5.0 mg/dl | |
| Grade IV | 5.1-10 mg/dl | |
| Grade V | >10.0 mg/dl | |

2. AKIN AKI Staging System

| Stage | Criteria |
|---|---|
| 0 | Creatinine increase <150% from baseline |
| 1 | Creatinine increases 150-199% from baseline OR<br>Creatinine increases of 0.3 mg/dl from baseline |
| 2 | Creatinine increases 200-299% from baseline |
| 3 | Creatinine increase ≥300% from baseline OR<br>an absolute creatinine value >4.0 mg/dl |

3. Acute vs. Chronic

| Parameter | Acute | Chronic |
|---|---|---|
| History | Lethargy, vomiting | PU/PD<br>Weight loss |
| Red blood cell mass | Normal or if decreased= regenerative | Non-regenerative anemia |
| Degree of illness | Symptoms more severe for degree of azotemia | Symptoms less severe for degree of azotemia |
| Kidney size/shape | Normal to large<br>+/- painful | Small, irregular,<br>BKLK |
| Potassium | Normal to high | Low in cats<br>Mild hyperkalemia in dogs |

4. Categories of AKI
    a. Pre-renal, renal hypoperfusion

i. Hypovolemia- hemorrhage, GI losses, renal losses, third spacing, hypoadrenocorticism
ii. Decreased cardiac output- myocardial/valvular disease, pericardial effusion, pulmonary hypertension, anaphylaxis
iii. Systemic vasodilation- sepsis, drugs
iv. Renal vasoconstriction- drugs/anesthesia, sepsis, hypercalcemia, liver disease

b. Intrinsic renal
i. Toxins

| Cats | Dogs |
|---|---|
| Lilies | Grapes/Raisins |
| Ethylene Glycol | Ethylene Glycol |
| Vitamin D (cholecalciferol) | Vitamin D (cholecalciferol) |
| Medications (NSAIDS, aminoglycosides) | Medications |
| Myoglobin/ hemoglobin | Myoglobin/ hemoglobin |

ii. Medications
iii. Infections
1. Pylonephritis, Leptospirosis, FIP, Immune complex glomerulonephritis, Fungal
iv. Neoplasia
1. Lymphoma, Carcinoma, Hemangiosarcoma, Leiomyosarcoma, Nephroblastoma
v. Ischemia
vi. Glomerular disease

c. Post-renal, obstructive AKI
i. Ureteral – uroliths, stricture, blood clot, inflammatory debris, circumcaval ureters
ii. Urethral- uroliths, FLUTD
iii. Bladder neck- uroliths, neoplasia, perineal hernia

5. Diagnostic Workup
a. History
i. Medications, supplements, toxin exposure, previous illnesses, recent anesthesia, travel, vaccine history (leptospirosis particularly)
b. Laboratory
i. CBC/Biochemistry
ii. Urine
1. Urinalysis
2. Urine culture

3. +/- urine protein:creatinine ratio

iii. Blood pressure

iv. Resting Cortisol

v. Leptospirosis Testing

1. Zoonotic potential testing is imperative
2. Difficulties in diagnosing
    a. Incubation period is 1-7 days
    b. Vaccination and treatment can interfere with testing
3. PCR
    a. Blood PCR: 0-10 days post infection
    b. Urine PCR: 10 days post infection and after
    c. PCR sensitivity
        i. 0% in 1 study; other studies in first 5 days of illness 90% then 50%
        ii. Not useful after administration of antibiotics (doxycycline, penicillins, 3rd gen cephlosporins, azithromycin)
4. MAT Titer
    a. False negative in first 7 days of infection
    b. Single titer ≥1:800 has sensitivity of about 40%, specificity of 85%
    c. About 50% of cases are missed with only a single titer
    d. Gold Standard: Convalescent titers in 7-14 days after initial titer, with sensitivity of 94% and specificity of 85%
5. Lepto Snap
    a. ELISA titer
    b. 1:400 positive
    c. Vaccinal false positives
    d. Immediate results for protection of staff and owners particularly in unvaccinated patients
6. Ideal Recommendation
    a. Blood and Urine PCR
    b. Convalescent Titers

c. Imaging

i. Abdominal radiographs

ii. Abodminal US

iii. +/- pyelogram

iv. +/+ CT

6. Treatment

a. IV Fluids

i. If hypovolemic restore euvolemia

1. Isotonic crystalloid
2. Bolus, dog 20-40 ml/kg, felines 10-20 ml/kg
3. Reasses perfusion parameters

ii. Correct dehydration over 12 to 24 hours
iii. Goal improve renal perfusion to correct a pre-renal component
iv. ***After estabishment of euvolemia and hydration, increased fluid rates do not equate to increased GFR***

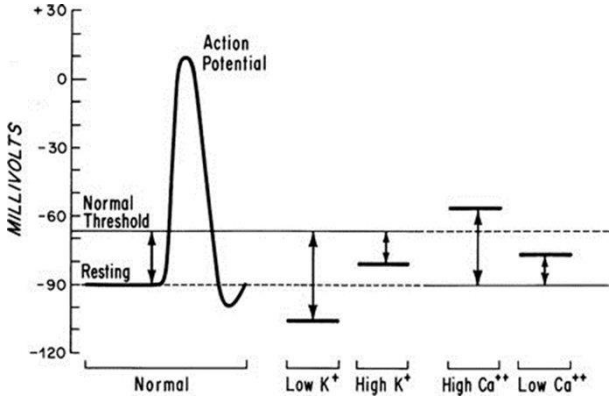
1. Careful assessment of ins and outs
2. Overhydration leads to renal interstitial edema making GFR worse
3. Weigh frequently!

b. Broad spectrum antibiotics
   i. Treat the treatable – pyelonephritis, Leptospirosis
   ii. Ampicillin and a fluroquinolone
c. Hypertension
   i. Amlodipine first line
d. Anti-emetics
   i. Cerenia, Dolasetron, Ondansetron
e. Acid reducers
   i. Proton pump inhibitors > H2 blockers
f. +/- Analgesia
g. Enteral Nutrition
   i. Phosphate binder

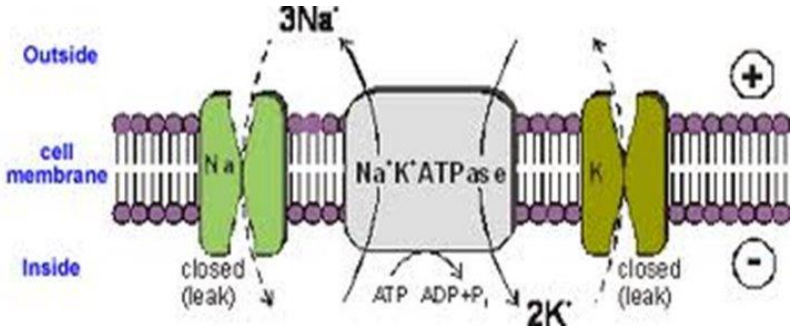
7. Monitoring
   a. Weights q4-6h
   b. Renal values q12-24h
   c. Electrolytes – variable depending on changes, minimally q24h
   d. +/- Central venous pressure
   e. Monitor for volume overload
      i. Excessive weight gain, chemosis, edema/ascites, serous nasal discharge, respiratory watch
      ii. If signs of fluid overload discontinue IV fluids
8. Urinary Catheterization
   a. Pros
      i. Monitoring ins and outs
      ii. Contain potentially infectious urine in closed system
   b. Cons
      i. Risk of infection- 50% of dogs with u. caths develop UTI, each day increases risk by 27%
      ii. Risk sedation to place
      iii. Cost
9. Oliguria/Anuria

a. Oliguria < 2ml/kg/hr
b. Anuria < 0.5 ml/kg/hr
c. Treatment
    i. Furosemide: bolus if response start CRI
    ii. Fenoldopam
    iii. Mannitol: bolus if response start CRI
        1. Do utilize if fluid overoaded
    iv. Dialysis

10. Hyperkalemia Treatment
    i. Calcium gluconate or Calcium Chloride Raises threshold potential




    ii. 50 to 100 mg/kg
b. Insulin + Dextrose
    i. Stimulate Na/K-ATPase pump moving K intracellular




    ii. Regular insulin 0.25 to 0.5 U/kg
    iii. Dextrose 1 to 2 gram/U
c. Sodium Bicarbonate
    i. H+ exchanges for K+ to titrate HCO3-
d. B2 agonist
e. Dialysis

11. Dialysis
    a. Indications
        i. Symptomatic uremia
        ii. Hyperkalemia

iii. Refractory Hypervolemia
iv. Oligoanuria

b. Goal
    i. Does not treat etiology (outside of certain toxins) or help repair kidneys, supports the body to give time for kidneys to heal

12. Prognosis
    a. Short Term
        i. About 50% survival for dogs and cats
    b. Long Term
        i. About 25% of the 50% that survived full renal recovery
        ii. Dogs 19% of creatinine that returned to normal in 2 weeks to 2 months 55% of those went on to develop CKD
        iii. Cats 25% discharged with normal creatinine