REPTILIAN URINARY SYSTEM: CLINICAL EVALUATION

Douglas Mader, MS, DVM, Dipl ABVP (Canine/Feline, Reptilian/Amphibian)

Marathon Veterinary Hospital, 5001 Overseas Hwy., Marathon, FL 33050 USA

ABSTRACT

The reptilian urinary system has many similarities to the mammalian system. There are also significant differences, some of which impart challenges to standard diagnostics normally utilized by dog and cat practitioners. The urinary tract shares a terminus with the genital tract, specifically, the urodeum. This anatomic structure does affect and influence urinary diagnostics since ingesta from the gastrointestinal tract passes first through the coprodeum, intermingles with the urinary/genital discharges in the urodeum, and ultimately exits the proctodeum. In addition, the cloacacolonic region acts as osmoregulatory site in several species of reptiles. The urinary system includes the kidneys, ureters, urethra and bladder if present. In some species extra-renal salt excreting glands exist (e.g., Green Iguana (Iguana iguana) and all sea turtles).

Diagnostic modalities used in evaluating these structures include history and physical examination, imaging such as radiography, CT, MRI, nuclear scans, laboratory analysis (blood, urine, microbial cultures), endoscopy, surgery and tissue analysis (biopsy, histology).

Introduction

The urinary system includes the kidneys, ureters and bladder and urethra if present. In some species extra-renal salt excreting glands exist (e.g., green iguana and all sea turtles). The anatomy and pathologic conditions of each have been covered by others in this conference. This presentation will concentrate on practical clinical diagnostics utilized to help determine the health status of the reptilian urinary tract. Knowledge of normal anatomy, and an understanding of potential pathology will help the practitioner target their diagnostics to maximize their chance of successful diagnostics and, ultimately, therapeutics. Due to the extensive subject matter involved, only urinary diagnostics will be covered in this manuscript. Therapeutics, as related to diagnostics, will be discussed, but extensive review of urinary tract therapeutics will be reserved for future presentations.

Disease of the urinary tract can involve the kidneys, bladder (if present), urethra and ureters, in that order. Several diseases, similar to those found in mammals, have been described in reptiles including neoplasia, calculi, infections (parasitic, bacterial, fungal) and metabolic. Degenerative conditions, such as glomerular or tubulonephrosis, are the most common. Dystrophic mineralization and crystal formation secondary to primary renal disease, inappropriate diet/husbandry and gout are not uncommon. High protein, inappropriate protein source diets and chronic dehydration are frequent co-factors in renal morbidity. Renal, ureteral, cystic and urethral calculi have also been reported.
History and Physical Examination

As with any patient a complete and thorough history is essential in proper diagnosis of urinary disease. Whether it is an individual pet reptile or a resident in a larger population, client observations and biodata are critical to discovery. In mammals polyuria/polydipsia (PU/PD) are common in renal disease. With herps, since many eliminate in water containers, it may not be possible for caretakers to note if PU is occurring. However, PD if noted, may be one sign that may have significance.

Husbandry is a common thread in reptilian disease, in general and specifically in regards to renal disease. Animals from tropical and temperate regions housed in confinement with heat lamps often suffer from chronic low humidity and dehydration. It is important to distinguish the difference and relationship between drinking water and exposure to a dry environment with subsequent loss of insensible water. Over time these conditions lead to hemoconcentration, hyperproteinemia and renal disease.

Nutrition, including diets as fed, and supplements like vitamins and minerals, are also implicated in both systemic and renal disease. As an example, excessive calcium and vitamin D supplementation can have direct negative effects on the kidneys. Diets high in protein or the wrong types of protein can affect metabolism/catabolism and may impact renal health.

A hands on physical examination is mandatory. In some cases sedation may be needed and the effects of chemical restraint will need to be weighed against the potential influence on laboratory analysis, disease and health status of the patient. Although not routinely performed, and certainly poorly documented, blood pressures (BP) should be attempted whenever possible and should be measured in non-sedated patients. BP measurements are critical to the evaluation of renal disease in mammals.

In animals that are large enough, direct, trans-colonic palpation of the kidneys is warranted. Large snakes can be palpated with large animal rectal sleeves and small animals can be palpated via bimanual or digital palpation. Familiarity with the normal kidney is necessary.

Laboratory Analysis

Whereas laboratory analysis is a critical part of any diagnostic work up in companion animal medicine, and it should also be in reptilian medicine, the significance in the latter leaves a lot to be desired. It would be wrong to tell you that the objective science is available to completely trust laboratory testing in its current state for reptile medicine. There are many, many variables that influence the published “normals.” Gender, age, size, season, reproductive status, laboratory, how the sample was collected, where the sample was collected, how the sample was analyzed, etc. can all affect results.

Cohort matched samples, serial patient samples and other control methods should be employed when interpreting laboratory data; even with that said, results should be evaluated with a skeptical eye. Do not interpret these comments to suggest that laboratory diagnostics are a waste
of time; that is not the case. However, it is what it is, and the values need to be scrutinized in light of the patient in front of you.

Similar results with mammals can be expected in reptiles with renal disease. For instance, non-regenerative anemia is a common finding in chronic renal disease as is seen in mammalian counterparts. Careful consideration is needed as dehydration in some patients may mask the anemia. The leukogram is less predictable as, even with mammals, patients with cystitis or nephritis may not always show a leukocytosis.

Routine clinical chemistries are generally not as useful as they are in mammals. BUN and creatinine are not produced in enough quantity in reptiles to make them indicators of renal disease. Creatine has been evaluated but limited data is available to support its usefulness. Calcium:Phosphorus ratios may have some value, but, some species, like sea turtles, normally have an inverted Ca:P ratio so any value in diagnosing renal disease is lost.

Uric acid (UA), at this point, seems to be the best single parameter used to evaluate renal disease. That stated, in reptiles it takes approximately 66-75% of renal function loss before uric acid levels rise. So, elevations, if real, are suggestive of severe to terminal renal disease. Spikes in UA may occur post-prandially following a high purine meal in some of the carnivores, so interpretation of elevated values should be done with care.

Recently renal function testing has been evaluated using iohexol (GE Healthcare, Princeton, NJ) elimination in the Green Iguana as the indicator. Iohexol, a low osmolarity, non-ionic radiographic contrast medium, is excreted solely by glomerular filtration. The plasma clearance of Iohexol can be determined over time after a single IV administration. The rate of clearance is compared to “normals” and an estimate of renal function can be made.

Based on studies done in mammals, the reptilian patient is administered 75 mg/kg Iohexol, IV and blood samples are collected at 4, 8 and 24 hr post. Normal values are reported to be 16.56±3.9 ml/kg/hr, with a 95% confidence interval of 14.78 – 18.34 ml/kg/hr.

**Urinalysis**

Urinalysis, as with blood analysis, is mandatory for renal diagnostics in dog/cat medicine. Although still in its infancy in reptile medicine, urinalysis is gaining value.

Most, but not all, reptiles have a urinary bladder. In those species that do, it functions mostly for fluid storage. Several factors complicate the quantitative evaluation of urine in reptiles – the fact that the bladder functions in fluid/electrolyte exchange, urine passes through the urodeum and therefore is not sterile, and reptiles cannot concentrate urine so the specific gravity is useless in evaluating renal function.

Nonetheless, urine cytology can have some value. Evidence of erythrocytes, leukocytes and certain pathogens (fungal elements, parasites, foreign bodies) can have significance.
As with dogs and cats, voided samples are the least diagnostically useful. Whether free catch or from the floor, the contamination that occurs while admixing with the contents of the urodeum make any interpretation challenging. It is possible to catheterize the urethra for a direct sample. However, the BEST urine sampling is directly from a ureter – a clinically challenging – but not impossible – task. Cystocentesis is possible in all species with a bladder. Assistance with an ultrasound make this fairly simple.

Standard urinalysis techniques can be applied. Ideally the sample should be analyzed immediately after collection to avoid artifacts such as changes in pH, crystal formation/degradation and overgrowth of resident bacterial flora. S.G., cytology and chemical analysis should be performed. A standard urine dipstick used in mammalian diagnostics can be used, with some limitations.

**Diagnostic Imaging**

Radiography is the most often utilized imaging modality. Because of the widely differing body morphologies in herps, standard plain film radiography may not always be useful. In certain situations, where the “normal” kidney may NOT be visible on a survey radiograph, it MAY be apparent when diseased. Renal, ureteral, cystic and urethral calculi are often readily visualized on standard Dorsoventral/Lateral projections in most species.

Intravenous urography has been utilized and reported in several species. 800-100 mg/kg aqueous iodine can be given either via the tail vein or cranial peripheral access. Results may vary pending location of administration, but, in general, excellent visualization of the kidneys and surrounding vascular supply is readily apparent.

Ultrasound evaluation is possible in some species. Patient with thickly keratinized scales, osteoderms and some chelonians may be challenging. Crystallization, neoplasia, abscesses and mineralization are generally obvious. In addition, renal biopsy is aided with the assistance of ultrasound guidance.

Advance imaging such as computed tomography (CT), magnetic resonance imaging (MRI), and nuclear scintigraphy are all available to most practitioners. CT with contrast and MRI provide excellent images of the kidneys, with the latter being preferable. Limited work has been done with scintigraphy but as more is learned it will no doubt be a valuable tool in assessing renal disease in the future.

**Direct Visualization and Biopsy**

Without a doubt, with all the diagnostic limitations that filter out useful information in reptilian patients, the BEST method for renal analysis is direct visualization and renal biopsy.

While endoscopy is the gold standard, equipment limitations should not prevent the practitioner from performing exploratory coeliotomies to evaluate the kidneys (and liver, pancreas, spleen, etc.). The kidneys in most reptile species are readily accessible with routine laparotomy
incisions. Two common species, the Green Iguana and the bearded dragon (*Pogona vitticeps*), have intrapelvic kidneys, making visual inspection of the entire organs impossible. Patient with obvious renomegaly are easily evaluated.

A simple cutaneous cut-down biopsy technique has been described where the caudal pole of the kidneys is accessed through a keyhole incision in the cranial tail base. That portion of the kidney is readily visualized and assessed, and biopsies are readily collected. This is a quick procedure that can be done with sedation and a local analgesic. The main disadvantage is the limited access to the entire organ.

Endoscopic evaluation of the reptilian coelomic cavity has been described extensively and is well documented. In patients with abdominal kidneys, bilateral visual interrogation of both structures is simple, often with a single access incision. In patients such as the iguana and bearded dragon, access is limited to the cranial poles. Regardless, the use of endoscopy is invaluable for the assessment of renal, and other diseases, in the reptilian patient.

**Summary**

Of all the diagnostic modalities available to practitioners, the back-to-basics history and physical examination are by far the most important. Although renal disease, in general, seems to be increasing in prevalence in captive herps, it may in fact be that our ability to recognize and diagnose the pathology has become more sophisticated in recent years. Even practitioners that do not have multi-thousand dollar ultrasounds, endoscopes and the like can still make accurate diagnoses by using a basic, systematic approach to their problem solving. The indiscriminate use of antibiotics is no longer acceptable and therapeutics should be initiated based on quantitative assessment.

**LITERATURE CITED**

Multiple references support this document. Two reviews that are readily accessible with excellent reference lists include: