SEVEN publicações acadêmicas

CHAPTER 32

KIDNEY DISEASE IN FELINES

https://doi.org/10.56238/sevened2024.032-032

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ABSTRACT

The number of nephropathic feline patients in the small animal medical clinic is increasing, representing an important portion of the patients in the feline clinic. Kidney diseases can be primary or secondary diseases and invariably have a multifactorial etiology. This etiology is related to genetic and hereditary factors, such as nutritional, metabolic, infectious, and racial factors, among others. Understanding the etiology and pathogenesis of these conditions helps not only in establishing an adequate prognosis, but also in making therapeutic decisions and directing follow-up actions and prophylaxis of future events. Kidney diseases, in general, have a progressive and silent character, which can worsen according to the delay in diagnosis, so it is necessary to evaluate and connect the circumstances in which the alterations of the nephric system were installed for a quick resolution of the case or staging of it, since, divided into two categories, Acute Renal and Chronic Renal, The therapies employed for each type of kidney disease will differ, as well as the objectives behind each one. Thus, the need for an in-depth study aimed at understanding, recognizing and managing renal pathological processes is crucial, not only for the scientific community, but also for owners of nephropathic animals. This ensures an accurate diagnosis and treatment by the medical team, as well as management and continuity of treatment that promotes the improvement of the health of the kidney patient.

Keywords: Feline nephrology. Renal insufficiency. Nephropathy.

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INTRODUCTION

Feline Kidney Disease (DRF) is a definition for a state in which there is the presence of kidney damage in small animals, whether acute or chronic (NELSON; COUTO, 2001), and can affect felines of all ages and breeds, with a higher prevalence among older age groups. It has an aggressive, progressive character and can result in the death of the animal, if it does not receive the care and protocols appropriate to the type of insufficiency presented (XAVIER JUNIOR, 2019).

Its classification is given by the type and stage of progression of organ involvement, which can be evaluated by various laboratory and imaging methods, relying on blood and kidney markers to assist in a more accurate diagnosis, with Acute Renal Failure (AKI) and Chronic Kidney Disease (CKD) as the main guiding definitions in clinical management.

In this chapter, a narrative literature review is structured, in which indexed and internationally recognized scientific databases were surveyed and analyzed, as well as technical documents from the International Society of Renal Interest. The selection of the included studies was rigorously carried out by two researchers, simultaneously, in order to ensure the timeliness, accuracy, and comprehensiveness of the information collected. Topics covered include Acute Renal Failure (AKI), Chronic Renal Failure (CKD), the prevalence of these conditions and their risk factors in felines, clinical signs, diagnostic methods, as well as treatment strategies and management of these patients. This chapter aims to provide a detailed and practical view of kidney diseases in felines, helping veterinarians and researchers to understand and manage these conditions based on the most recent and relevant evidence available in the scientific literature.

ACUTE RENAL FAILURE (AKI)

The main characteristic of AKI is the sudden onset of decreased renal excretory function, which can be caused by several factors.

Precisely because of its sudden nature, the initial clinical signs are not noticeable, which can hinder the therapeutic approach and consequently the recovery of the renal patient, which contributes to its high morbidity and lethality (COBRIN et al., 2013).

AKI is classified according to the origin of the lesions and also by the degree of renal impairment caused by them. According to the origin, it can be defined as: pre-renal, renal and post-renal.

AKI of prerenal origin is characterized by renal integrity and originates in other organs, but which can influence its full functioning if any process occurs outside the physiological pattern. It usually occurs as a result of alterations that disturb the perfusion of

the organ, such as: dehydration, hyperthermia, congestive heart failure, gastrointestinal hemorrhages, liver diseases, excessive use of drugs such as ACE inhibitors and diuretics, among others. A common characteristic of insufficiencies of prerenal origin is that these can be reversed if the animal is quickly submitted to veterinary care. This can be verified with the reestablishment of the reference values of the laboratory parameters for renal evaluation, especially urea and creatinine (XAVIER JUNIOR, 2019).

Renal AKI has the particularity of originating in the organ in question, mainly due to a process of Acute Tubular Necrosis (ATN), in addition to changes at the cellular level that contribute to the process of necrosis and tissue dysfunction. Among the causes of ARI, congenital, infectious, toxic (endogenous and exogenous), immune-mediated, electrolyte imbalances (hypercalcemia and hypokalemia in the feline) and traumatic (AGOPIAN et al., 2016) stand out.

Regarding postrenal AKI, it is mainly characterized by mechanical obstructive processes of the urinary tract (XAVIER JUNIOR, 2019), causing an accumulation of metabolic substances that should have been excreted through the urine, decreased Glomerular Filtration Rate (GFR) and characteristic clinical signs of increased levels of some components, such as urea and creatinine, which are normally excreted in the urine, inducing a state of azotemia, which can quickly evolve to the death of the animal (WORWAG & LANGSTON, 2008).

AKI is also classified according to the progression of kidney lesions, created by the International Society of Renal Interest (IRIS), with grades ranging from level I to IV, and these are visualized mainly through serum creatinine, SDMA, urine density, urine formation and volume, and can characterize from the mildest grades to those in which there is a need for renal replacement therapy. This classification facilitates decision-making and planning of the therapeutic protocol used for the rapid stabilization of the animal (IRIS, 2016).

Serum creatinine levels can vary between values below 1.6mg/dL and higher than 10mg/dL, defining the severity of the injury and possible reversibility for Grade I and II patients. Patients of higher grades should be hospitalized, but depending on the situation of renal integrity, they may require Renal Replacement Therapy (RRT) in addition to the high risk of death, even with intensive hospital support. However, these levels are not fixed values, and may decrease or increase depending on the patient's evolution, and are not always proportional to the degree of organ involvement (IRIS, 2016).

CHRONIC KIDNEY DISEASE (CKD)

Chronic Kidney Disease (CKD), like AKI, has a progressive character, but it is not reversible and has other etiopathogenesis, in addition to the protocol used being different, since CKD does not have a state of stagnation or prospects for reestablishing kidney function (XAVIER JUNIOR, 2019), resulting in the gradual and irreversible loss of nephrons, which generates an impairment of excretory, endocrine and metabolic functions (KOGIKA, 2015).

Polzin (2011) highlights the high prevalence of the condition in elderly animals, and O'Neill et al (2014) found that the prevalence of CKD in felines is approximately 4% in the feline population, affecting about 40% of cats over 10 years of age.

CKD has a persistence that can vary from months to years, all depending on the therapeutic follow-up that the animal receives, age and whether there are pre-existing diseases. However, in order to define that the patient is developing a chronic process like this, it is necessary that the condition persists for a minimum period of three months, together with other clinical signs such as loss of glomerular filtration rate in more than half of its standard capacity, in addition to anatomical alterations and morphofunctional losses unilaterally or bilaterally (POLZIN et al., 2005; POLZIN, 2008).

The classification of CKD, as well as AKI, was also developed by the International Society of Renal Interest (IRIS), with the aim of differentiating the levels of disease progression to improve the quality of clinical support for renal patients. This classification also occurs in four stages, according to serum creatinine levels that must be evaluated at various times throughout the same week, to verify fluctuations in levels during clinical investigation.

In stage I, the patient does not present azotemia, but kidney injury is present and possible to manifest itself through the results of laboratory tests such as urinalysis and also imaging tests such as ultrasound, showing proteinuria and changes in renal mass, respectively (WAKI, 2010).

In patients with stage II, there is a slight azotemia in the various serum creatinine assessments, which are higher than in stage I. In both stages I and II, there is no very noticeable evidence of the presence of CKD in the patient.

In the following stages, III and IV, there is an increase in azotemia and a greater clinical manifestation, and renal function may be completely compromised, further reducing the patient's life expectancy because renal functions were not preserved in the early stages of the disease, increasing the speed of its progression (POLZIN et al., 1995).

PREVALENCE

The occurrence of diseases related to the renal system does not have a predilection for races, sex or age of patients, whether feline or other species, however, there are factors that contribute to the occurrence of DRF.

Among the two types of kidney disease, CKD is more prevalent in felines and the most recurrent, with a higher sample size, especially in older animals over 7 years of age, and gradually increasing its possibility according to advancing age, and in these animals mortality is high (WAKI, 2010).

Unlike CKD, AKI is linked to several causes associated with multiple organ dysfunction, and in veterinary medicine its main cause is connected to urinary obstruction, which has a high occurrence mainly in male cats and cats of different age groups, but this is not yet well defined in veterinary medicine, since the lack of noticeable clinical symptoms linked to the rapid evolution of the patient to death makes it difficult to elucidate studies about ANGER (XAVIER JUNIOR, 2019).

The age and breed of felines can significantly influence the development of chronic kidney disease (CKD). Studies show that CKD is more common in elderly felines, over the age of 7 years, and that up to 49% of cats over the age of 15 are affected (AGOPIAN et al., 2016). In addition, some breeds have a greater genetic predisposition to chronic kidney disease, which may be related to specific hereditary factors. It is essential to closely monitor older cats and more susceptible breeds, implementing preventive measures and appropriate management strategies to detect early and treat chronic kidney disease in these animals (LITTMAN, 2017).

The diet and lifestyle of felines play a crucial role in the development of kidney disease. An inadequate diet, rich in protein, phosphorus and sodium, can overload the kidneys and contribute to the development or progression of kidney disease in cats. In addition, environmental factors such as lack of access to fresh water, stress, obesity, and sedentary lifestyle can also negatively impact feline kidney health. Therefore, it is essential to offer a balanced diet, with restriction of harmful nutrients, and to promote a healthy lifestyle, with encouragement of physical activity and adequate hydration, to prevent and control kidney disease in cats (ASSIS; TAFARREL, 2018).

CLINICAL SIGNS AND DIAGNOSIS

The clinical signs present in kidney diseases mainly include azotemia, which is characterized by increased serum creatinine levels in the body, which is used as the main marker in the investigation of kidney diseases, whether acute or chronic (IRIS, 2019).

In Chronic Kidney Disease (CKD), the main symptoms can be highlighted as polyuria and polydipsia, but these are not the most observed in felines, and the signs of lethargy, anorexia and progressive weight loss are the most noticed. Other signs can be observed such as frequent vomiting, diarrhea, food selectivity, inappetence, uremic breath, weakness, opaque coat, pale mucous membranes, among others (POLZIN, 2017).

Regarding Acute Renal Failure (AKI), the clinical signs presented will depend on the concomitant pathology, since it can be triggered by several situations. However, even with their diverse causality, it is possible to observe some patterns, such as: integrity or discrete unilateral hypertrophy of the kidneys during palpation, lethargy, inappetence, anuria, vomiting. In addition, depending on the concomitant cause, it is possible that the patient presents hypothermia, pale mucous membranes, bradycardia, tachypnea that can progress to cardiorespiratory arrest, in addition to pain during abdominal palpation (XAVIER JUNIOR, 2019).

For the diagnosis of kidney disease, whether acute or chronic, some laboratory or imaging tests are necessary, done recurrently during routine exams that can help in the early detection of kidney injury and possible stagnation or reversal of the condition. The use of hematological and biochemical tests to analyze creatinine and urea levels, ultrasound, and an anamnesis in conjunction with the animal's clinical history are the main means of diagnosis currently used (XAVIER JUNIOR, 2019).

Regarding the particularities of detection of each kidney disease, CKD presents a variation in diagnosis, with regard to the detection of increases in serum creatinine, being performed at least three times during a period of one week to verify the fluctuation of these levels and monitor their persistence in the body (IRIS, 2019; WAKI, 2010).

As the clinical signs during the physical examination of the animal in the early stages of CKD are practically unobservable, the tests requested by the veterinarian can help a lot in the agility of stagnation of the chronic renal condition. According to the degree of injury, the findings of hematological and biochemical tests are different in the four stages presented by the International Society of Renal Interest (IRIS). In Grade I patients, it is possible to obtain serum creatinine measurement at normal levels, defining the patient as non-azotemic, but the accusation of a possible CKD is evidenced by ultrasound or biopsy diagnosis, with renal changes in size and shape and also at the cellular level. In addition, in urinalysis tests, the absence of urinary concentration is noticeable, indicating a possible decrease in the glomerular filtration rate, in addition to proteinuria that should be observed from the first stage if CKD is detected, to reduce its levels and help the stagnation of the disease (WAKI, 2010).

From Grade II to IV, it is already possible to notice the presence of azotemia in the laboratory findings, in addition to showing more clinical signs such as polyuria and polydipsia, and it is common to observe a slight loss of appetite and weight in feline patients. However, these signs can be easily confused with other diseases that also have the same signs such as diabetes and parasitic diseases that influence the animal's appetite. The values that define the patient as azotemic exceed the levels of 1.4mg/dL to 10mg/dL, in grade II and IV respectively, and from grade III onwards the patient begins to show evident signs of renal failure, which are aggravated in stage IV. as gastrointestinal, neuromuscular and cardiovascular manifestations, increasing their probability of death (WAKI, 2010).

The classifications of the stages of progression of CKD allow the veterinarian's decision-making to be correct and contribute to a better quality of life and expectancy of the patient, in addition to assisting in therapeutic measures. In addition, the need for outpatient and clinical monitoring of chronic kidney patients is essential for the correction of changes caused by the progression of the disease (WAKI, 2010; ELLIOT AND WATSON, 2009).

For AKI, blood count tests are not very useful, showing levels within the normal range. On the other hand, those with serum biochemistry may present different results according to the cause concomitant with AKI, but it has moderate azotemia as a standard. In patients with AKI caused by urethral obstruction, hypercalcemia and hyperphosphatemia may be noted, but these changes are not pathognomonic signs of AKI. The biomarkers most used for laboratory diagnosis help to detect the levels of the lesion and renal function, in addition to allowing the visualization of the therapeutic response of the patient's body. The ones that are most used in the detection of AKI and CKD are: GGT (Gamma Glutamiltransferase), NAG (N-acetyl-beta-d-glucosaminidase), SDMA (Symmetric Dimethylarginine). These markers can indicate certain evolutions of the disease because each one is present in a part of the urinary system and has a relationship with each type of lesion. Regarding SDMA, its elimination in the urine occurs before serum creatinine, allowing an earlier detection of acute kidney diseases when there is still 60% or more of kidney function preserved, allowing the detection of kidney diseases still in early stages, allowing agility in treatment and consequent favorable prognosis (XAVIER JUNIOR, 2019).

The urinalysis test is widely used in the diagnosis of kidney diseases, as it can indicate isosthenuria, which is the inability to concentrate urine. In addition, urinalysis findings may correspond to the cause of AKI, and may present casts, pyuria, crystalluria, hematuria, etc.

Imaging tests are also necessary in the evaluation and detection of the causes of AKI, such as the presence of uroliths, crystals, neoplasms, etc. (XAVIER JUNIOR, 2019).

TREATMENT AND MANAGEMENT

The treatment of kidney disease in felines is a medical challenge that involves a multifaceted approach. The choice of the most appropriate therapy depends on the stage of the disease, the age and breed of the animal, as well as the individual response to treatment. (EVANGELISTA, 2023).

In general, the objective of the treatment of chronic kidney disease helps to improve the quality of life of felines, focusing on stages III and IV, these being the stages of kidney disease that most present clinical manifestations such as the correction of uremia, water and electrolyte balance, adequate nutrition and meeting the daily needs of protein, calories and minerals that influence the progression of chronic kidney disease (SPARKES et al., 2016).

The administration of intravenous or subcutaneous fluids plays a crucial role in helping to maintain hydration and kidney function in felines with CKD. Thus, this fluid therapy helps maintain fluid and electrolyte balance, which is essential for patients with impaired kidney function. (NHANHARELI, 2019). In general, the main benefits of fluid therapy include improved appetite, activity, and control of constipation (POLZIN, 2011).

Regarding the drugs that can be used in the treatment of kidney disease in felines, these also play a crucial role. This includes medications that help control blood pressure, heart function, and kidney function, such as diuretics, antihypertensives, and medications that regulate the balance of salts and water in the body (NHANHARELI, 2019).

Diet modification is also of great importance in the approach to the treatment of CKD in cats. This includes introducing a kidney diet that is low in protein and low in salts, which helps reduce the workload of the kidneys and prevent protein loss (LIMA; SCARELLI, 2022).

Therefore, during the treatment of kidney disease in felines, the patient's environmental management plays a crucial role in improving and controlling the clinical picture. Concomitantly with the specific therapeutic measures previously mentioned, such as the administration of medications and nephroprotective therapies, the environment in which the cat lives plays a significant role in its well-being. The offer of an enriched environment with water sources, in order to encourage the patient's hydration, interactive toys, shelves, burrows and scratching posts can stimulate the feline's physical and mental activity, promoting a better quality of life. In addition, maintaining a clean and adequate litter box, along with positive interactions with owners and other animals, contributes to reducing stress and promoting the cat's comfort during kidney disease treatment. These environmental management practices, when integrated into clinical treatment, can optimize

the therapeutic outcomes and quality of life of felines affected by kidney disease. (NORSWORTHY et al., 2011; ASSISI; TAFARREL, 2018).

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