Egyptian Journal of Veterinary Sciences

https://ejvs.journals.ekb.eg/

Chronic Kidney Disease in Cats

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Abstract

CHRONIC kidney disease (CKD) is a serious and widespread health concern for our feline companions, often dubbed a "silent killer." This label reflects the disease's insidious nature; in its early stages, CKD typically shows no obvious symptoms, making early detection incredibly challenging. This lack of awareness contributes significantly to the high rates of illness and mortality among cats. Understanding the risk factors for CKD is crucial for proactive pet ownership. Conditions such as advanced age, certain breeds, gender differences, systemic hypertension, cardiovascular issues, and urinary tract infections (UTIs) all play a role in the development of this serious disease. A thorough diagnosis is essential and involves a detailed medical history, comprehensive physical examination including, body condition assessment and blood pressure evaluation, hematology, serum biochemistry, urinalysis, and advanced imaging techniques. One noteworthy advancement in diagnosing CKD is the use of serum symmetric dimethylarginine (SDMA). This sensitive biomarker allows for earlier detection of kidney dysfunction compared to the traditional serum creatinine test, which can be misleading due to variations in muscle mass. When it comes to managing CKD in cats, a personalized approach is vital. The focus should be on two primary goals: slowing disease progression while preserving remaining kidney function, and improving the cat's quality of life by managing clinical symptoms. It's important to remember that the prognosis for a cat with CKD greatly depends on the stage at which it is diagnosed ; cats in stages I and II generally have a favorable outlook, while those in stages III and IV face a more guarded prognosis.

Key words: chronic kidney disease (CKD), serum symmetric dimethylarginine (SDMA), cats.

Introduction

The kidneys are the powerhouse of the urinary system, performing critical functions like blood filtration, maintaining electrolyte balance, and regulating water levels[1].These vital organs are essential for removing waste through a sophisticated process that includes blood filtration, tubular reabsorption, and secretion.The two kidneys are situated dorsally in the abdominal cavity and have a bean-like form[2]. Renal disorders are a common reason for veterinary visits in cats [3-6]. Unfortunately, the absence of initial symptoms can make these kidney diseases difficult to diagnose and treat[6]. Kidney diseases can be broadly divided into two categories[7]. Each of these categories has its own distinguishing features and classification criteria[8]. Chronic kidney disease is characterized by a gradual onset, a progressive decline over time, and is irreversible. In contrast, acute kidney injury develops rapidly and allows for the possibility of kidney repair. AKI is also believed to play a significant role in the progression of late-stage renal disease and chronic kidney disease [9]. By understanding the various diseases that affect the kidneys, veterinarians can provide more effective treatment for afflicted cats.

Epidemiology and risk factors:

Age, sex, and breed are significant risk factors for the diagnosis of chronic kidney disease (CKD) in cats. The incidence of CKD is higher in older and purebred cats[10-12]. Research indicates that age is a crucial factor, with older and senior cats exhibiting a higher prevalence of CKD[13-17].Additionally, cats older than nine years had a higher mortality risk from CKD

[17].As Siamese, Abyssinian, Persian, Maine Coon, and Burmese cats are said to be more susceptible to the progression of CKD[10,18] . While data on breed-specific risks is somewhat limited, the

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(Received 19 March 2025, accepted 20 April 2025)
DOI: 10.21608/ejvs.2025.366943.2688

trends suggest that specific genetic factors may contribute to this susceptibility[17]. It's important to note that gender is not a major determinant of CKD progression[10, 18] Nonetheless, male cats between the ages of nine and eleven are more prevalentwith CKD[17, 19]. Neutered males, in particular, are at a heightened risk of developing CKD compared to their spayed female counterparts, primarily because of a greater likelihood of urethral blockages [20].Phosphate-restricted diet (PRD) in cats is linked to the advancement of CKD[21].

Hypertension as well as cardiovascular disease and urinary tract infections is a common disease in older cats with CKD. These different conditions could also contribute in the progression of renal disease[17, 22]. In cats with chronic kidney disease (CKD), cardiovascular disorders that are either caused by or separate from systemic hypertension have been documented [17, 23, 24].

UTIs are regarded as a risk factor for the onset of chronic kidney disease (CKD)[17]. Conversely, UTIs in cats with CKD may result from altered urine composition and weakened local and systemic defense mechanism [25]. UTIs in cats with chronic renal disease have not been linked to noticeably higher serum creatinine levels or other urine parameters[26, 27].

Chronic kidney disease (CKD) in felines:

Chronic kidney disease is a serious ailment in cats [28-30]. It is described as a metabolic disorder that primarily affects elderly domesticated cats[31, 32].When permanent and worsening kidney structural or functional abnormalities persist for longer than three months, it is referred to as CKD[33-35].The disease has been identified as a significant problem that contributes to both mortality and morbidity, particularly in older cats (>10 years old)[30, 36]. The severity of chronic kidney disease (CKD) in cats can be effectively classified according to the established guidelines set by the International Renal Interest Society (IRIS). As the disease advances, it often brings about a host of serious complications, including hyperphosphatemia, secondary renal hyperparathyroidism, hypokalemia, anemia, proteinuria, systemic hypertension, metabolic acidosis, and uremia. Understanding these potential issues is crucial for proactive management and treatment, ensuring our feline companions receive the care they need to maintain a better quality of life[31, 37].

Staging of chronic kidney disease :

To ascertain the type of therapy, possible response to treatment, and long-term prognosis, CKD staging is extremely important[38].Cats with CKD were divided into four stages (Stages I–IV) by the International Renal Interest Society [39](Table 1). Staging by the International Renal Interest Society (IRIS) is initially based on serum creatinine levels,Symmetrical dimethyl arginine (SDMA) followed by purification to sub-stages predicated on

systemic blood pressure (Table 2) and the presence of protein in urine. The choice of intervening therapy can be tough in case of lack of information about the nature and severity of renal parenchymadamage[40, 41].

Clinical signs of CKD:

In the initial stages of CKD, clinical indications are not visible[5, 42], as the illness worsens, the cat may exhibit symptoms such as appetite loss, polyuria, polydipsia, bloody vomiting, emaciation, lethargy, halitosis, oral ulcerative lesions, and melena. A physical examination may reveal emaciation, varying degrees of dehydration, anemia, hypertension, and acute blindness (as a result of hypertension)[5, 28, 43, 44].

Dehydration is a recurring side effect of CKD that frequently causes acute uremia and declines in renal function[42, 45]. And Small, irregular kidneys that are not painful were found during the physical examination of cats with chronic renal disease[42]. IRIS demonstrated four stages of CKD: (Table 1); Cats with stage I CKD do not exhibit any clinical symptoms. Clinical symptoms in cats with stage II CKD are either nonexistent or very mild. Clinical indications in stage III can be moderate, but toward the end of the stage, there will be a lot of systemic signs. The end- stage of CKD, stage IV, is associated with serious clinical symptoms and a substantial risk of uremic crisis[44, 46].

Diagnosis of CKD in felines:

To ensure the highest level of care for our feline friends, it is essential to accurately diagnose any potential diseases. This process encompasses several critical steps: gathering a comprehensive medical history, conducting a detailed physical examination that evaluates the body condition score, measuring blood pressure, performing a thorough hematological examination, analyzing serum biochemistry, conducting a urinalysis, and employing advanced imaging techniques like computed tomography and ultrasound for renal biopsies. By following this thorough approach, we can effectively identify health issues and provide our cats with the best possible treatment and care[5]. It is advantageous to diagnose CKD early to decide when renoprotective therapy should begin that could halt its progression[47].

To ensure the best health outcomes for our beloved pets, it's crucial to meticulously evaluate pet owners' case histories. By paying close attention to these details, we can avoid misunderstandings and prevent incorrect diagnoses of interrelated illnesses. Consider the vital information that must be documented: initial symptoms, prior medical conditions, the duration of any current issues,

vaccination history, deworming practices, and overall body condition. We must also track the frequency of troubling symptoms such as vomiting, diarrhea, excessive thirst (polydipsia), increased urination (polyuria), loss of appetite, bad breath (halitosis), and signs of weakness. In the clinical examination, we should focus on critical indicators, such as weight loss, the condition and color of mucous membranes, and oral evaluations to uncover any ulcerative lesions or persistent halitosis. Capillary refill time serves as a reliable indicator of anemia, while skin tenting time provides valuable insights into dehydration. Furthermore, comprehensive assessments through serum biochemistry, urinalysis, and routine hematology require careful collection of blood and urine samples. By prioritizing these thorough evaluations, we can pave the way for accurate diagnoses and effective treatments, ensuring our pets receive the excellent care they deserve[5].

One of the most common complications in felines with CKD is hypertension. All cats with a diagnosis should have their blood pressure checked because chronic hypertension can seriously harm multiple organs[44]. In cats, systolic blood pressure is determined using oscillometric or Doppler techniques. Cats' blood pressure is frequently measured using the ultrasonic Doppler flow detector method, which measures changes in blood flow caused by external compression via an inflatable cuff to determine arterial pressure (brachial, dorsal pedal, and saphenous arteries[5].

Diagnostic biomarkers

In both humans and cats, renal biomarkers are essential for the initial detection of renal disorders and for enabling prompt treatment intervention[48]. Serum creatinine, blood urea nitrogen (BUN), and SDMA are examples of renal biomarkers. In the early phases of impaired kidney function, the sCr and BUN have low diagnostic sensitivity[49, 50]. However, SDMA enhances the precision of renal disease diagnosis at an earlier stage, enabling early treatment and lowering mortality[49-51]. SDMA is a relatively emerging kidney biomarker. Renal excretion is the primary method of SDMA elimination. It is therefore an endogenous GFR marker. It has the advantage of not being affected by muscle mass, unlike creatinine. Consequently, SDMA has been effectively utilized to diagnose CKD in felines[52]. The kidneys are primarily responsible for filtering out SDMA[53]. In CKD, it is a very specific and sensitive renal biomarker. The rise in serum creatinine levels is months after the rise in SDMA levels. In contrast to serum creatinine levels, which rise only after 75% of nephrons are destroyed, SDMA levels begin to rise as early as a 40% drop in GFR. Furthermore, patient's muscle mass has no bearing on SDMA levels[17, 54].

Four phases of CKD were established by IRIS: Cats identified with normal SDMA (less than 14 µg/dl) are diagnosed with stage I CKD. SDMA is mildly elevated in cats with stage II CKD (18–25 µg/dl). SDMA indicates stage III (26–36 µg/dl). With a high likelihood of crisis of urea and SDMA (>38µg/dl), stage IV is the end stage of chronic kidney disease [44].

A valuable and affordable diagnostic procedure that can reveal chronic kidney disease is routine urinalysis [55]. In both males and females, urine samples were obtained by manually compressing the bladder or by using appropriatly-sized urinary catheters. The samples were then physically and chemically analyzed using a dipstick or analyzers[5, 6, 55].Cats typically have relatively low levels of protein in their urine, although proteinuria can develop as a result of chronic kidney disease. Proteinuria is linked to both a lower survival time and the disease's progression[56, 57]. In felines with CKD, proteinuria is a sign of renal failure caused by either tubular damage that reduces the nephron's capacity to filter the even minute quantity of albumin in the glomerular filtrate or glomerular damage that permits increased albumin leakage[6, 42, 58].

Ultrasonographic examination of kidneys

Over the past 15 years, diagnostic ultrasonography has seen a sharp increase in use in the veterinary field. It is a crucial technique for identifying kidney diseases, which are regarded as health issues in cats.Ultrasonography makes it simple to check the urinary tract [59, 60].It is regarded as the standard modality for examining the feline kidney, offering superior images for renal size, shape, and internal architecture, and is more accurate than radiography in detecting kidney diseases. Additionally, because it is more affordable, easier to obtain, doesn't require general anesthesia, and enables real-time operations, it is the preferred imaging test for renal evaluation [60, 61].When imaging the kidneys of cats, B-mode ultrasonography is frequently the preferred method[60, 62].Both kidneys are caudally situated, mobile, and pendulous in cats. The left kidney of a cat is situated between the L2 and L5 vertebrae, while the right kidney is situated between the L1 and L4 vertebrae [2].Each kidney has about a million nephrons[63].

The kidney can be sectioned to expose a black, highly vascular cortex on the outside, surrounded by cortical labyrinth and collections of capillary tufts that give the kidney a lighter texture. Medullary rays are smooth striations that seem to be extending toward the cortex's edge from the medulla. The renal pyramids that make up the renal medulla unite to produce the renal crest, a central ridge[2].The High-frequency (7.5 MHz) transduceris crucial for kidney imaging in felines, and kidneys can be checked from both a lateral and ventral approach with the animal in

lateral or dorsal recumbency[60].Cat kidney measures can be as much as 5.3 cm, but they have been found to fall between 3.0 and 4.3 cm. The lengths of the two kidneys should be comparable [64]. The normal renal cortex is consistently echogenic and usually relatively hypoechoic in comparison to the liver parenchyma and the spleen parenchyma[65]. The renal medulla, which encircles the renal pelvis, is extremely hypoechoic—almost anechoic. These veins may exhibit acoustic shadowing as they travel from the sinus to the cortex via the medulla Calculi shouldn't be used to misdiagnose this[66,60]. Even though the renal pelvis is typically invisible, it can occasionally be seen as a tiny, anechoic fissure in the middle of the sinus that is 1-2 mm broad. The renal pelvis is most seen on pictures taken in the cross-sectional plane[60, 64].

Numerous causes of end-stage kidney disease, chronic inflammatory illnesses, and juvenile nephropathy in cats have been linked to decreased corticomedullary definition and increased renal echogenicity[67]. The kidneys in end-stage renal disease are usually tiny, irregular because of fibrosis and scarring, and diffusely echogenic, making it difficult to see the internal renal architecture and corticomedullary junction.Reduced cortical echogenicity, multifocal hypoechoic patches, hypoechoic nodules, or hypoechoic masses are possible symptoms of cat kidney lymphosarcoma[68 - 73].

Computed tomographic examination of kidneys

Abdominal problems are increasingly being diagnosed using computed tomography (CT), a common imaging model. The development of more sophisticated CT technology over the past few decades has made veterinary diagnostic imaging more accurate[74]. CT provides better tissue contrast than traditional radiography, with a range of greyscale tones, and volume data[75]. CT has been used to scan a variety of organs in domestic cats to identify illnesses, including kidney[76 - 81].With CT, the typical kidneys of cats appear as uniform structures inside the fat-enclosed dorsal belly[78]. Due to its correlation with renal function, renal volume is a crucial measure in evaluation of the kidney[82, 83].Additionally, volume is frequently used to distinguish between different phases of renal failure, with small kidneys indicating chronic failure[84].Renal volume and feline renal length are strongly correlated, and in cases of CKD, the renal volume decreased as the kidney shrank[81].

Renal biopsy

A kidney biopsy is an invasive diagnostic procedure

It involves obtaining kidney tissue samples for cytological or histological analysis.Animals suspected of renal malignancies or chronic renal insufficiency should get kidney biopsies.The species of the animal, its size, the operator's background, the equipment available, and the clinical state of the cats referred for biopsy all influence the kidney biopsy technique selection[85]. The most popular method for kidney biopsy in cats is ultrasound-guided biopsy. It involves taking a kidney sample for an ultrasonography examination[86]. In cats under anesthesia, the lateral position is the preferred kidney biopsy location[87, 88].

The following medical conditions present significant risks that contraindicate the use of kidney biopsy: end-stage kidney disease, perirenal abscesses, pyonephrosis, hydronephrosis, polycystic kidney disease, severe kidney insufficiency, uncontrolled hypertension, extensive pyelonephritis, severe respiratory or circulatory insufficiency, and the absence of one kidney. Given the serious nature of these disorders, careful consideration is essential to prioritize the patient's health and safety[89].

Management strategies and treatment of CKD:

Cats suffering from chronic kidney disease (CKD) deserve tailored care that meets their unique needs. The ultimate goal is not only to slow the progression of CKD while safeguarding renal function, but also to significantly enhance their quality of life by effectively managing their symptoms. In the early stages (I and II), signs of the disease may be subtle, making it crucial to focus on interventions that can delay its advance. However, as we progress to stage III and beyond, the urgency to initiate treatment intensifies. By prioritizing the well-being and comfort of our beloved feline friends, we can ensure they enjoy a better quality of life, even as they navigate the challenges of CKD. Let's commit to providing them with the best possible care during their journey[44].

Dehydration can be a serious issue for cats with CKD, as their ability to concentrate urine is compromised and gradually deteriorates. The cat must always have access to potable water. Adjusting for fluids should be accomplished by I/V or S/C delivery of isotonic replacement fluid (such as Ringer lactate) in cases of acute dehydration brought on by illness or in the later stages of the disease. To stay hydrated, cats with stage III or IV CKD may require fluid injections[3, 90,91].

Providing fluids to dehydrated cats is crucial. Correction and prevention of dehydration and its clinical consequences are the goals. Intravenous or subcutaneous delivery is used for acute fluid correction, based on what the patient requests and the degree of dehydration[45].

Antacids, antiemetics, and cytoprotectant medications can be used to manage common gastrointestinalsymptoms such as nausea, emesis,

and loss of appetite are common. Proton pump inhibitors (as., omeprazole,pantoprazole) and H2 blockers (as., ranitidine, famotidine) are among the most commonly used antacids.To stop the emesis, antiemetic medications such as maropitant citrate, ondansetron hydrochloride or dolasetronmesylate, and metoclopramide can be administered. When uremia causes gastrointestinal ulcers and hemorrhages, a cryoprotectant medication like sucralfate helps to smooth the GI mucosa[92].

The standard treatment for uremia's GI side effects involves giving an H2 blocker, frequently in conjunction with an antiemetic and a stomach mucosal protector like sucralfate[93].

The gastrointestinal consequences of uremia can be effectively managed with proton pump inhibitors (such as omeprazole 0.2 mg/kg Po Q 24 h) and anti-emetics (0.4 mg/kg Po / 8 h)[42].

The body excretes phosphorus mostly through the kidneys. Any decrease in the GFR has the potential to cause the body to accumulate phosphorus. Excess phosphorus retention encourages mineralization of tissues, renal secondary hyperparathyroidism, and the advancement of CKD. Limiting the amount of phosphorus (Ph) in food is the first step in lowering serum Ph levels. In CKD Stage III, commercial renal meals that are prepared with minimal protein and phosphorus content frequently succeed in reaching serum phosphorus objectives. Phosphate binders should be added to commercial diets if they are ineffective at keeping serum phosphorus levels within acceptable ranges [5].Phosphate retention happens when renal function declines because plasma phosphorus contents are inversely correlated with GFR. Therefore, intestinal binding of phosphates drugs make phosphorus in the diet less absorbable by promoting the development of non-absorbable phosphorus salts in th gastrointestinal tract lumen. Aluminum hydroxide (60 mg/kg/day), oxide, or carbonate (100 mg/kg/day), calcium salts (30 mg/kg/day) and calcium carbonate (150 mg/kg/day), and lanthanum carbonate (30 mg/kg/day) are the most often utilized intestinal binding of phosphates agents in cats. Typically, therapy starts at the lower end of the suggested dose range and is increased as necessary every 4-6 weeks until the desired therapeutic outcome is achieved[37,42, 94 -96]. In cats with CKD, alkalinization therapy is recommended when the bicarbonate concentration and blood pH drop below normal. Because a renal diet is pH-neutral, it may help with acidosis. When nutrition alone isn't enough, alkalinizing salts like potassium citrate (60 mg/kg every 8–12 hours) or sodium bicarbonate (12 mg/kg po, every 8–12 hours) might be used[5, 42, 97].

Potassium citrate has the benefit of treating acidosis and hypokalemia with a single medication. Analysis ofblood gas should be performed weekly after starting alkalinization therapy to evaluate response, and dosage should be changed until normal[5].

In cats with advanced chronic kidney disease (CKD), anemia is a common issue. This occurs due to decreased production of erythropoietin, a hormone that stimulates red blood cell formation. Anemia can be worsened by factors such as iron deficiency, poor nutrition, both iatrogenic (treatment-related) and spontaneous blood loss, and the shorter lifespan of red blood cells. One treatment option for anemia related to CKD is hormone replacement therapy. Among these treatments, erythropoietin therapy is often the most effective. The success of this therapy depends on the severity of the disease and its underlying causes. The two most commonly used erythropoietin preparations in cats are darbepoetin alpha (DPO) and recombinant human erythropoietin (EPO, also known as Epogen). When administered, EPO leads to a dose-dependent increase in packed cell volume (PCV%), which can help treat anemia and its associated clinical symptoms within about two to eight weeks. Although EPO is usually effective in managing anemia due to CKD, it may initially trigger the production of antibodies[5, 91, 98].

In contrast to EPO, darbepoetin alfa is a long-acting erythropoiesis-stimulating drug that is less prone to produce anti-erythropoietin antibodies. The dosage must be modified depend on the patient's reaction to therapyand the regular assessment of PCV values [5].

First treatment 1 µg/kg SC once a week till PCV% reaches 25%.and 1 µg/kg SC every two to three weeks for maintenance therapy; or Weekly lower dose (e.g., 0.5 µg/kg) PCV numbers should be periodically evaluated and modified according on how well a patient responds to treatment[91].

Cats with CKD frequently express arterial hypertension, which has been connected to cardiac, neurological, ophthalmic, and renal problems. Blood pressure measurement must be the foundation for the diagnosis of arterial hypertension. The recommended antihypertension medications for cats with CKD are calcium channel blockers (like amlodipine) and antihypertensive medications (such enalapril and benazepril), as they may have renoprotective effects[5, 99].

Enalapril or benazepril dosage (0.25–1 mg/kg Po / 12 h)[42, 91, 100]. When cats are fed a therapeutic renal diet, Chronic enalapril therapy has been shown to change glomerular hemodynamics, proteinuria, blood pressure, and the morphological progression of renal injury in CKD[101]. Amlodipine dosage (0.0625–0.25 mg/kg/24 hours)

[91].

The most prevalent electrolyte imbalance in CKD is hypokalemia. Potassium supplements should be used to treat hypokalemia in cats. The safest and most recommended method of potassium administration is oral replacement. Injection therapy is often saved for cats that cannot tolerate oral therapy or who require an immediate reversal of hypokalemia. For oral supplementation, potassium citrates or gluconate work well. Initially, 40–60 mg/kg/day of potassium citrate is administered in two or three doses. After starting injectable or oral potassium supplementation, hypokalemic myopathy often goes away in 1–5 days. The potassium dosage should then be modified in accordance with the patient's clinical response and serum potassium levels[102, 103].

Prognosis and survival rates

The severity of the disease, which may be ascertained based on the cat's IRIS stage, determines the prognosis at the time of diagnosis[91].Other clinical factors that are linked to a noticeably worse prognosis include the degree of proteinuria, hyperphosphatemia, and FGF-23 concentration. A reduced PCV and the evidence of CKD progression

[5, 18, 91, 104, 105]. In its more advanced phases, CKD appears to be progressive. In cats, the illness progresses more slowly. Cats in stages III and IV of CKD must be assessed each three to four months. Until renal function stabilizes, cats in stages I and II of CKD frequently need fewer assessments, every four to six months[5]. The most frequent histological finding with fibrotic alterations that indicates a poor prognosis in cats with CKD is tubulointerstitial inflammation[106, 107].

The median survival times for each IRIS stage reveal significant variation, underscoring the importance of accurate understanding and prognosis. According to the findings of Syme *et al*., [104], patients in IRIS stage II have a median survival of 504 days, while those in stage III can expect only 154 days, and stage IV is even more critical, with just 57 days. In stark contrast, Boyd *et al*., [18] present a more optimistic outlook for stage II, reporting an astonishing median survival of 4110 days. However, this drops dramatically for stage III at 263 days and plummets to a mere 20 days for stage IV. Further support comes from Geddes *et al*., [108], who offer another perspective: stage II survival reaches 490 days, stage III shows a more extended survival of 778 days, but again, stage IV is concerning, with only 103 days. These varying statistics highlight the necessity for healthcare professionals to consider multiple sources when discussing prognosis, as the differences can dramatically influence treatment decisions and patient expectations. Understanding these survival times can empower both patients and providers to make informed choices in their care journey.

Conclusion

This review delivers essential insights into chronic kidney disease (CKD) in cats, highlighting the critical diagnostic methods used to identify this serious condition. By exploring hematological and biochemical results, diagnostic biomarkers, urine analysis, ultrasonography, CT scans, and renal biopsy data, it equips cat owners and veterinarians with the knowledge needed for accurate diagnosis. Furthermore, it addresses the prognosis and survival rates while outlining effective management and therapy options for CKD, empowering caregivers to take proactive steps in ensuring their feline companions receive the best possible care.

Acknowledgments

We would like to thank Department ofAnimal medicine, Faculty of veterinary medicine, Zagazig University, Zagazig, Egypt for their valuable support.

*Funding statement*Funding support was not provided for this study.

Declaration of Conflict of Interest

There is no conflict of interest, according to the authors.

Authors' contributions

Each author made an equal contribution to this study.

TABLE 1. Stages of CKD based on creatinine concentration (mg/dL) and SDMA µg/dl in cats (IRIS, 2019).

Stage of CKD	Serum creatinine concentration (mg/dL)	SDMA(µg/dl)	Comment
Stage I	<1.6	<18	Not azotemic
Stage II	1.6–2.8	18–25	Mild to moderate renal azotemia often presents with few to no noticeable clinical symptoms
Stage III	2.9–5.0	26-38	Moderate renal azotemia, accompanied by significant systemic signs
Stage IV	>5.0	>38	Severe renal azotemia, systemic signs grew

TABLE 2. Sub stages of CKD in cats based on Systolic blood pressure (mmHg) (IRIS, 2019).

Classification	Systolic blood pressure (mmHg)	Risk of future target organ damage
Normotensive	<140	Minimal
Borderline hypertensive	140–159	Low
Hypertensive	160–179	Moderate
Severe hypertensive	≥180	High

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أمراض الكلى المزمنه فى القطط

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الملخص

يعتبر مرض الكلى المزمن واحد من أكثر المشاكل التى تواجه القطط ، فهو يعتبر قاتل صامت في القطط. فبسبب غياب أعراض المرض فى المراحل الاولى منه وبسبب قله الدلالات الحيويه للمرض أصبح التشخيص المبكر للمرض تحديا كبيرا مما أدى الى زياده معدلات الوفاه والنفوق بين القطط ، ان السن والسلاله و الجنس وامراض القلب والضغط وايضا امراض الجهاز البولى تعد من اكثر العوامل التى تساهم فى حدوث هذا المرض فى القطط .ان التشخيص الدقيق لمرض الكلى المزمن فى القطط يشمل معرفه التاريخ المرضى للحاله وكذلك أيضا الفحص الأكلينيكى للحاله والذى يتضمن قياس وزن الحاله بالأضافه إلى قياس الضغط وأيضا عمل صوره دم كامله والتحليل الكيميائى للدم وتحليل البول للحاله واخيرا استخدام الوسائل التصويريه فى تشخيص الحاله. يعتبرSDMA من الدلالات الحيويه الكلويه الجديده والتى تعبر عن معدلات الترشيح فى الكليه والذى يستخدم فى التشخيص المبكر لأمراض الكلى المزمنه فى القطط بدلا من الكرياتينين والذى لا يعتبر دقيقا لأنه يتأثر بالكتله العضليه فى الجسم. يجب إدارة وعلاج مرض الكلى المزمن فى القطط لكل حاله منفرده حيث يشمل العلاج خطوتين: الخطوه الاولى تتمثل فى إبطاء تطور المرض والمحافظه على بقيه الكلى صحيه أما الخطوه الثانيه والتى تتمثل فى الحفاظ على جوده حياه الحيوان المصاب بالإضافة إلى التعامل مع الأعراض الأكلينيكيه التى تظهر على الحيوان . إن التنبؤ بمصير المرض يعتمد على شده المرض وقت التشخيص حيث تعتبر القطط فى المرحله الاولى والثانية للمرض لها مصير افض من القطط فى المرحله الثالثة و الرابعة.

الكلمات الدالة:مرض الكلى المزمن ، SDMA، القطط.