Case Report

A COMPREHENSIVE CASE REPORT ON CHRONIC KIDNEY DISEASE IN A GOLDEN RETRIEVER

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ABSTRACT

International Renal Interest Society (IRIS) grades canine chronic kidney disease based on proteinuria, blood pressure, serum creatinine, and SDMA (Symmetric Dimethylarginine). The inter-related structural and functional changes associated with canine chronic kidney disease can be used in diagnostic evaluation of kidney injury. Structural alterations can be studied readily with the non-invasive sonographic assessment of kidneys. Increased cortical echogenicity, loss of corticomedullary differentiation, reduced renal size, and irregular renal contour are observed during B-mode ultrasound imaging. The Doppler ultrasound studies supplement the ultrasonic B-mode assessment and enable the evaluation of renal perfusion based on hemodynamics. Doppler studies would allow clinicians to evaluate or define patient's response to the therapeutic management of chronic kidney disease.

Keywords: Chronic kidney disease, pulsatility index, resistive index, ultrasonography

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INTRODUCTION

Chronic kidney disease is a progressive irreversible disease process often associated with the aging process, due to long-term exposure to any unrecognized nephrotoxic agents or as a sequela to acute kidney injury. Such a renal insult will exceed the limit of renal compensation for more than a period of 90 days (Thanaboonnipat *et al.*, 2020).Renal fibrosis is usually associated concurrent with chronic kidney diseases and the renal biopsy is the gold standard procedure to confirm renal fibrosis which is mostly an impractical method in clinical setup. The use of Doppler ultrasonography has become an affordable technique for the evaluation of kidney health in animals. Important clinical insights into renal function may be obtained by precisely measuring changes in

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renal perfusion. Colour and Power Doppler sonography are mostly used as imaging procedures to assess kidney perfusion by measuring resistance and perfusion index (Dong *et al*., 2013). Doppler ultrasound is used to calculate a unitless resistive index (RI), which is a measure of renal vascular resistance (Nyland *et al., (*2014)). Urinalysis is an inexpensive diagnostic tool that can assist with the diagnosis of kidney injury. The physical, chemical, and microbial analysis of urine samples can help in monitor the kidney injury or its progression (Ettinger *et al.,* 2024).

MATERIALS AND METHODS

A five-year-old Golden Retriever of BCS (Body Condition Score) of 4/9 weighing 20kg (Fig 1.1) was presented with complaints of vomiting and lethargy for the past five days. The animal had a pale mucus membrane, a temperature of 102°F, moderately enlarged lymph nodes and a dehydration level of 5%. Abdominal palpation revealed no signs of organomegaly or pain. Auscultation revealed normal heart and lung sounds.. Hemogram showed mild marginal microcytic non-regenerative anemic changes (Table 1.1) and biochemistry (Table 1.2) revealed elevated azotemia suggestive of kidney injury.

Microscopic agglutination Test (MAT) was negative for Leptospira sero groups. PCR was negative for Babesia and Ehrlichia organisms.

Ultrasonographic evaluation revealed increased echogenicity of the right kidney compared to the adjacent caudal liver lobe (Fig. 2A). The sagittal view showed marked irregularity of the renal margins. The nephrosonogram demonstrated a contracted kidney with reduced overall size. The renal parenchyma exhibited poor corticomedullary distinction along with an apparent increase in cortical thickness.

The relative size was measured by comparing it with the aortic diameter;the K/Ao ratio measured 5.4 depicting the reduced renal size and volume.

Marked hypertension was noted, with a systolic blood pressure of 160 mmHg measured using a Doppler blood pressure device.Urine analysis revealed acidic isosthenuric urine along with proteinuria (Table 1.3) population. Microscopic examination of the urine sediment revealed granular casts, white blood cells, and clusters of tubular epithelial cells, along with a notable bacterial population.

Based on the hemato-biochemical, urinalysis, ultrasonographic, and Doppler findings the dog was diagnosed with chronic kidney disease of Stage IV.

Treatment was initiated by correcting dehydration resulting from vomiting and reduced water intake. For vomiting Antiemetic therapy was administered using ondansetron at 0.5 mg/kg body weight, along with pantoprazole at 1 mg/kg body weight as a gastroprotectant. Antihypertensive therapy was also started to address hypertension and concurrent proteinuria Tab Benazepril hydrochloride

@ 0.4 mg/Kg. A renal diet was initiated along with daily oral Probiotics to support gut dysbiosis and an oral phosphate binder containing Aluminium hydroxide @ 50mg/Kg along with food orally. Other supplements were added to address anemia along with omega 3,6 fatty acid.

DISCUSSION AND RESULTS

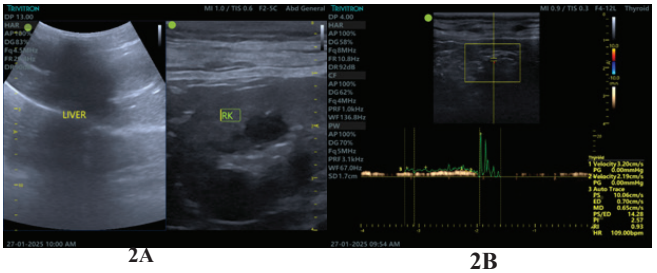
Both intrinsic and extrinsic factors that lead to decreased kidney perfusion can result in kidney injury. Following proper staging and substaging, an appropriate treatment regimen should be implemented to slow disease progression, stimulate hypertrophy and hyperfiltration of remaining nephrons and enhance the quality of life, which is often compromised in chronic kidney disease (Gunawan *et al.*, 2023). A key characteristic of anemia of chronic disease in a complete blood count (CBC) is its poorly regenerative nature, as indicated by reticulocyte count and red blood cell distribution width (RDW) (Lippi *et al*., 2021).

Renal cortical echogenicity is assessed by comparing it with other abdominal organs. Normally, it should appear slightly hypoechoic or isoechoic relative to the liver and hypoechoic compared to the spleen. Any alteration in this echogenic relationship may indicate an underlying pathological process. Increased echogenicity can suggest fibrosis, sclerosis, or infiltration. Colour Doppler imaging helps evaluate intrarenal arterial flow, which correlates with renal function. Pulsed wave Doppler ultrasound is particularly valuable for assessing conditions that impact renal parenchymal perfusion, as it allows for quantification through the Resistivity Index (RI) and Pulsatility Index (PI) (Bragato *et al.*, 2017).Measurements are taken from arteries near the corticomedullary junction (arcuate arteries) and renal hilum (segmental or interlobar arteries). RI is calculated by subtracting the end-diastolic frequency shift (or velocity) from the peak systolic frequency shift (or velocity) and dividing the result by the peak systolic frequency shift (or velocity). Increased vascular resistance raises RI by disproportionately reducing diastolic flow compared to systolic flow. In both cats and dogs, RI of less than 0.70 is considered normal.The kidney length-to-aorta diameter ratio typically ranges from 5.5 to 9.1. A ratio below 5.5 indicates small kidneys, while a value exceeding 9.1 suggests enlargement (Nyland *et al.*, 2014). Since the kidney was severely affected, even with conventional fluid therapy the health of dog deteriorated day after day.

CONCLUSION

Diagnosis of chronic kidney disease (CKD), along with proper staging and sub-staging, is essential in assessing a patient's life expectancy by enabling precise treatment planning and regular monitoring. Ultrasonographic evaluation and Doppler hemodynamic indices also can be used concurrently with other conventional renal tests to analyze kidney function.

Fig.1.1. The dog presented with complaints of vomiting and anorexia



2A 2B

Fig.2.A. showinghyperechogenic thickened cortex with irregular borders.
Fig.2.B. showing the increased resistive index (RI) of 0.93 and pulsatility index (PI) of 2.57 of interlobar artery.

Table 1.1. Hematological parameters of the dog

Parameter	Day 1	Day 14	Day 24
Hemoglobin (g/dL)	7.9	6.6	5.7
PCV (%)	24.0	21.7	29.9
RBC (m/cmm)	3.63	3.28	2.38
MCV (fL)	66.11	57.33	55.88
MCHC (%)	32.91	34.17	34.88
WBC (/cmm)	8400	12,433	11,640
Platelets (/cmm)	3,59,000	2,67,000	3,11,000

Table.1.2. biochemical parameters of the dog.

Parameter	Day 1	Day 14	Day 25
Glucose (md/dL)	52.0	76	78
Total Protein (g/dL)	6.3	5.2	4.9
Albumin (g/dL)	2.3	2.1	1.6
Urea (mg/dL)	111.83	122.2	134.33
Creatinine (mg/dL)	8.29	9.54	11.11
ALT (U/L)	35.0	102	133
ALP (U/L)	207.0	134	148
Sodium (mmol/L)	153.9	144	142
Chloride (mmol/L)	110.6	111	105
Potassium (mmol/L)	5.38	5.67	6.33
Calcium (mg/dL)	10.82	8.99	7.2
Phosphorous (mg/dL)	11.69	13.44	16.9
Total bilirubin (mg/dL)	0.82	0.88	0.75
Direct bilirubin (mg/dL)	0.69	0.65	0. 58

Table.1.3. showing the results of routine urinalysis

Parameter	Results
Colour	Yellow
Turbidity	Slightly (+)
Specific Gravity	1.007
pH	Acidic
Protein	Present (+++)
Blood	absent
Ketone bodies	absent
Bile pigments	negative

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