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Comparison of Corticomedullary Ratio and Medullary Rim Sign in Feline Lower Urinary Tract Disease Recurrence in Persian Breed

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Abstract

The Persian cat breed has grown rapidly in the last decade. This increase is not balanced with adequate maintenance, especially related to feed management and this causes problems, one of which is the emergence of feline lower urinary tract disease (FLUTD). Several complications often occur in cases of FLUTD recurrence, one of which is the kidneys. This study aimed to determine the differences in the corticomedullary ratio (CMR) and medullary rim sign (MRS) using an ultrasonography (USG) in Persian cats with FLUTD recurrences. Kidney examination was carried out using a linear USG probe with a frequency of 10MHz, with a dorsal view of the kidney. The parameters were analyzed using the independent t-test. Based on the calculation results, it was found that there were no significant differences in CM and MRS values in cats with FLUTD and FLUTD recurrences. These results indicated that cats with FLUTD recurrences have slightly disorders in kidney tissue but it still did not affect the macro anatomy of the kidney, and might cause chronic kidney disease.

Keywords: corticomedullary ratio, feline lower urinary tract disease, medullary rim sign, Persian cats

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INTRODUCTION

There are many types of cat breeds in the world, but in Indonesia, the breed of cat that is kept still dominates the Persian breed. Genetically, Persian cats are a type of cat breed that has a high level of sensitivity to the urogenital system, meaning that Persian cats easily experience disorders of the urogenital system (Tavinia *et al*., 2023).

The most common urogenital case in Persian cats is feline lower urinary tract disease (FLUTD). Post-treatment of FLUTD cases also takes a long period and highly costs. This condition contributes cat owners pay less attention to post-treatment management of FLUTD cases. This has an impact on cases of FLUTD recurrences in cats. Recurrences cases that often occur in cats can harm several organs that are directly related to the urogenital system, one of which is the kidneys (Baroroh *et al*., 2023).

Corticomedullary ratio (CMR) is a comparison value between the thickness of the cortex and medulla in the kidney (Holland and Hudson, 2020). In recent decades, many studies have evaluated the function of renal cortical thickness using USG as an indicator of renal impairment in humans diagnosed with acute kidney disease. Renal cortex thickness measured in the transverse plane using USG is a better variable than kidney length, medler thickness, and CMR for evaluating and monitoring the progression in cats, showing excellent diagnostic performance and excellent intra- and interobserver reproducibility (Yan *et al*., 2020).

This study aimed to determine the difference in CMR and medullary rim sign (MRS) using an USG in normal Persian cats and cats with FLUTD recurrences. On USG examination, the MRS was a visible hyperechoic line in the renal medulla, parallel to the junction between the cortex and medulla. MRS is commonly found in healthy cats, but also a sign that can be found in cats with renal disorders such as pyogranulomatous vasculitis relevant to peritonitis and chronic interstitial nephritis.

MATERIALS AND METHODS

Study Period and Location

This study was conducted in June–July 2022 in Veterinary Teaching Hospital, Brawijaya University.

Case Design

In this study, a total of 8 cats with FLUTD were investigated for renal function, including blood urea nitrogen and creatinine. In addition, those samples were also observed which were indicated by FLUTD recurrences. Several cats that has been diagnosed with FLUTD recurrences were acclimatized. The process of ultrasonography (USG) examination in cats were initiated by shaving around the abdomen close to the position of the kidneys. Shaving was done to reduce the resistance of sound waves that will be emitted from the probe in contact with the skin. After shaving, the next step was positioned the animal ventrodorsally to facilitate the process of capturing USG images. The animal was positioned as comfortably as possible so as not to experience excessive stress and to reduce the cat's movement which will hinder the USG process. After all preparations were complete, the probe or transducer and the area to be examined for USG were applied using gel. Gel application functions to reduce friction between the skin and the transducer and helps transmit sound waves emitted by the transducer. Position the transducer in the kidney area. The right kidney was closer to the last rib of the animal, while the left kidney was more caudal.

Data Analysis

The observation data obtained was then analyzed quantitatively using the independent sample t-test.

RESULTS AND DISCUSSION

This study reported the differences in kidney images in cats with FLUTD and cats that have experienced FLUTD recurrences based on renal corticomedullary texture, CMR, and MRS images which can represent a picture of kidney function. The benefits of this activity can be generated in the form of supporting data on the kidney condition of cats that have been repeatedly exposed to FLUTD cases based on the CMR and MRS, thus the onset of chronic kidney disease can be identified and prevented by providing appropriate therapy.

In this study, 8 cats with FLUTD conditions and no previous history of FLUTD were used, and 8 male cats with a history of FLUTD recurrences but whose physical condition looked healthy. From the results obtained and after analysis using the t-test on CMR values, there was no significance in the results of CMR values between FLUTD cats and cats that experienced FLUTD recurrence (Table 1).

In this study, kidney observation focused on the CMR and MRS. The CMR was a ratio of the area between the renal cortex and the renal medulla based on USG images. The MRS was a visible hyperechoic line in the renal medulla, parallel to the junction between the cortex and medulla.

Table 1. Evaluation of CMR and MRS in all cases

Sample No	Cats with FLUTD		Cats with FLUTD recurrences	
	CMR (cm)	MRS (cm)	CMR (cm)	MRS (cm)
1	0.90	Unidentified	0.80	Unidentified
2	0.88	Unidentified	0.88	Unidentified
3	0.93	Unidentified	0.78	Unidentified
4	1.00	Unidentified	0.89	Unidentified
5	0.79	Unidentified	0.77	Unidentified
6	1.00	Unidentified	0.80	Unidentified
7	0.91	Unidentified	0.80	Unidentified
8	0.88	Unidentified	0.76	0.10
Mean ± SD	0.90 ± 0.076		0.82 ± 0.056	

(A) (B)

Figure 1. USG image in (A) cats with FLUTD, (B) cats with FLUTD recurrences.

MRS is commonly found in healthy cats but is also a sign that can be found in cats with renal disorders such as pyogranulomatous vasculitis relevant to peritonitis and chronic interstitial nephritis. This kidney problem is more likely to occur in Persian breed cats compared to other breeds of cats (Cordella *et al*., 2020).

The results reported several possibilities that the samples used in the group with FLUTD recurrence only experienced an average of 2–3 recurrences, which also affect the results of the USG image where the area expands. The cortex and medulla have a 1:1 ratio and the results are still within normal CMR limits. In the results of USG, no MRS form was observed (Figure 1). The MRS is a shape found at the medullary cortico-junction, squeaking with a hyperechoic line shape (Szabo and Lewin, 2013). Based on these results, we revealed the possibility of kidney disorders that is still at the cellular and micro stage, damage that is still small will not have a significant impact on the macro shape of the kidney even though the kidney has improved (Khasana *et al*., 2023).

The absence of macro changes in the kidneys will also have an impact on the USG results, that the organ appeared normal. Thus, it can be emphasized that there was no significant difference in CMR values in the cats with FLUTD and cats with FLUTD recurrences group, and the MRS shape was also not observed in the both of groups, possibly because the pathological changes were still minor and did not affect the macro shape of the kidney (Plumeriastuti *et al*., 2023).

CONCLUSION

There was no significant difference in CMR values in cats with FLUTD and cats with FLUTD recurrences group, and the formation of MRS was also not observed in both groups. This was caused the pathological changes were still minor thus they did not affect the macro formation in kidney.

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AUTHORS' CONTRIBUTIONS

AWW: Conceptualization and drafted the manuscript. AWW, PJ, and GWS: Treated the animal. AWW: Validation, supervision, and formal analysis. AWW and GWS: Performed the statistical analysis and the preparation of table and figures. All authors have read, reviewed, and approved the final manuscript.

COMPETING INTERESTS

The authors declare that they have no competing interests.

REFERENCES

Baroroh, D. N., Tyasningsih, W., Praja, R. N., Rahmahani, J., & Yunita, M. N. (2023).

Retrospective Study of Feline Panleukopenia Risk Factors in Pet Cats in Madiun. *Jurnal Medik Veteriner*, 6(1), 114–119.

Cordella, A., Pey, P., Dondi, F., Dunn, M., Caramazza, C., Cipone, M., & Diana, A. (2020). The ultrasonographic medullary "rim sign" versus medullary "band sign" in cats and their association with renal disease. *Journal of Veterinary Internal Medicine*, 34(5), 1932–1939.

Holland, M., & Hudson, J. A. (2020). Feline diagnostic imaging. John Wiley & Sons. pp: 142.

Khasana, U., Meles, D. K., Praja, R. N., Tyasningsih, W., & Wibawati, P. A. (2023). Risk Factors for Feline Otitis in Madiun: A Prospective Study. *Jurnal Medik Veteriner*, 6(1), 29–34.

Plumeriastuti, H., Novitasari, S. P., Yunita, M. N., Hamid, I. S., & Wibawati, P. A. (2023). Risk Factors and Incidence of Feline Lower Urinary Tract Disease (FLUTD) in Sahabat Satwa Genteng Animal Clinic. *Jurnal Medik Veteriner*, 6(1), 15–20.

Szabo, T. L., & Lewin, P. A. (2013). Ultrasound transducer selection in clinical imaging practice. *Journal of Ultrasound in Medicine*, 32(4), 573–582.

Tavinia, T., Fikri, F., Purnomo, A., Chhetri, S., Maslamama, S. T., & Purnama, M. T. E. (2023). Risk Factors of Feline Lower Urinary Tract Disease in Banten, Indonesia. *Indian Veterinary Journal*, 100(6), 24–28.

Yan, G., Chen, K., Wang, H., Ma, T., & Chen, K. (2020). Relationship between ultrasonographically determined renal dimensions and International Renal Interest Society stages in cats with chronic kidney disease. *Journal of Veterinary Internal Medicine*, 34(4), 1464–1475.

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