

# Validation of a Classification System for Predicting Renal Function Recovery in Cats with Hydronephrosis

Morgana de Lima Marcolino<sup>1</sup>, Cíntia Ribas Martorelli<sup>1,2</sup>, Luciano Henrique Giovaninni<sup>1,2</sup>

<sup>1</sup>UNICPET, Veterinary Center for Nephrology and Urology, São Paulo, Brazil

<sup>2</sup>National Association of Small Animal Veterinary Clinicians (ANCLIVEPA-SP), São Paulo, Brazil

Corresponding Author: lhgiovaninni@yahoo.com.br

## INTRODUCTION

Hydronephrosis is a common condition with high morbidity and mortality in cats. Diagnosis relies on ultrasound findings, mainly renal pelvis dilation, but it does not assess functional impairment or recovery potential after surgical treatment. This study aims to validate a classification system that could potentially predict renal function recovery following renal parenchyma decompression.

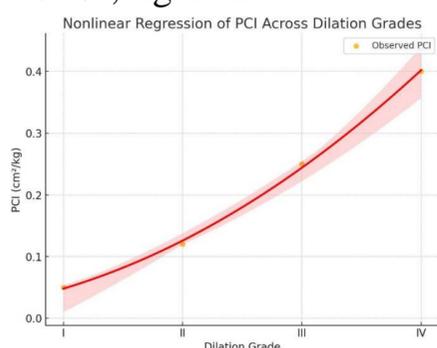
## METHODOLOGY

A retrospective analysis was conducted on 202 ultrasonographic records from 93 cats (404 kidneys). Data collected included linear and volumetric measurements of the renal pelvis, renal length, and body weight. Renal pelvis width were classified into five grades of dilation (Normal, Grades I to IV). Additionally, Pelvic Compression Index (PCI) was calculated by considering renal pelvis volume, renal length, and body weight.

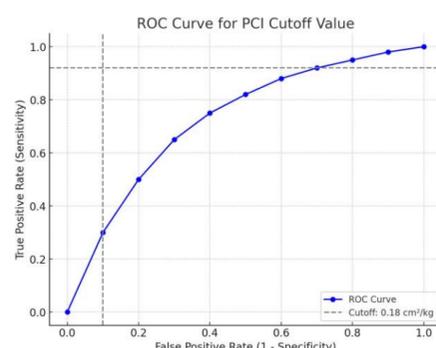
$$PCI = \frac{\text{Renal pelvis volume (cm}^3\text{)}}{\text{Renal length (mm) x Patient weight(kg)}}$$

## RESULTS

It was observed a significant correlation between PCI and the grades of dilation ( $r=0.87$ ). Nonlinear regression highlighted an exponential increase in PCI at advanced dilation grades (III and IV), figure 1. ROC analysis identified 0.18 cm<sup>2</sup>/kg as the PCI cutoff value, with a sensitivity of 92% and specificity of 90%, figure 2.



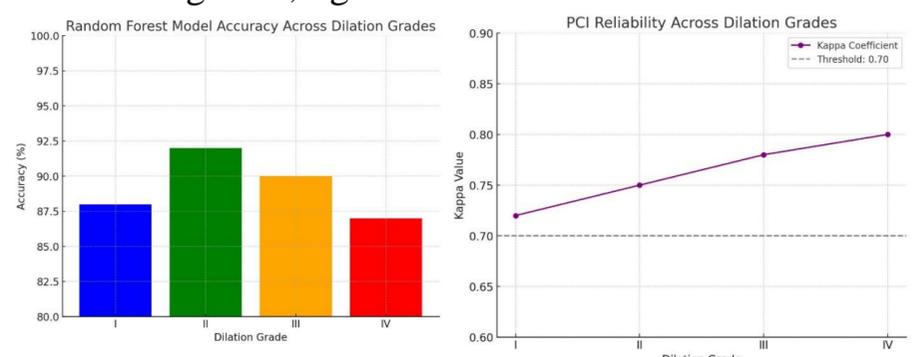
**Figure 1.** Nonlinear regression showing an exponential increase in PCI at advanced dilation grades (III and IV), indicating a strong correlation with renal impairment ( $r = 0.87$ )



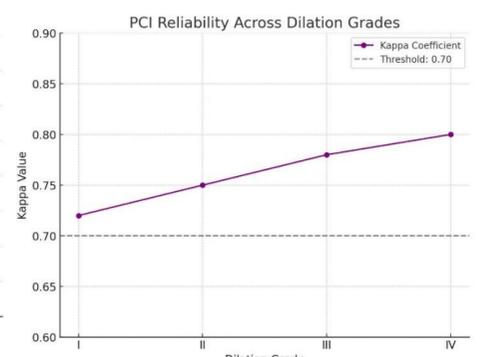
**Figure 2.** ROC curve identifying PCI cutoff at 0.18cm<sup>2</sup>/Kg, with 92% sensitivity and 90% specificity for predicting renal function impairment.

The Random Forest model achieved 88% accuracy, reinforcing the PCI's effectiveness as a diagnostic predictor, figure 3.

Moreover, the PCI demonstrated high reliability, with a kappa coefficient above 0.70 across all dilation grades, figure 4.



**Figure 3.** Random Forest machine learning model achieved 88% accuracy in predicting renal impairment based on PCI classification, supporting its use as a diagnostic tool.



**Figure 4.** PCI reliability assessment across all dilation grades, showing a Kappa coefficient above 0.70, indicating high reproducibility and diagnostic consistency

These findings suggest that the PCI is strongly correlated with varying degrees of renal pelvis dilation and holds promise as both a diagnostic and prognostic tool. Future studies should include renal function assessments, enabling more accurate and objective diagnoses.

## CONCLUSION

The implementation of this index and the proposed classification system could significantly improve the clinical management of hydronephrosis in cats, as well as contribute to the standardization of ultrasonographic criteria for evaluating renal pelvis dilation.

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