

Laboratory biomarkers of renal function and renal damage in small animals

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INTRODUCTION

Renal biomarkers are of great importance in the diagnosis of kidney dysfunctions in small animal clinical practice. Currently, traditional biomarkers are still the most widely used parameters to determine the renal function and the presence of renal damage, but their present limitations have promoted the study of new biomarkers that could help the early identification of renal diseases.

OBJECTIVES

- ❖ Search on the most relevant endogenous biomarkers of renal function and renal damage in veterinary medicine, mainly in dogs and cats.
- ❖ Description of the most important new renal biomarkers under study in veterinary medicine.

RENAL FUNCTION

Glomerular filtration rate (GFR)

It is the most accurate approximation to renal function, and it can be measured indirectly by biomarkers like **creatinine**, **urea**, **SDMA**, and **cystatin C** in the blood.

RENAL DAMAGE

Urinalysis

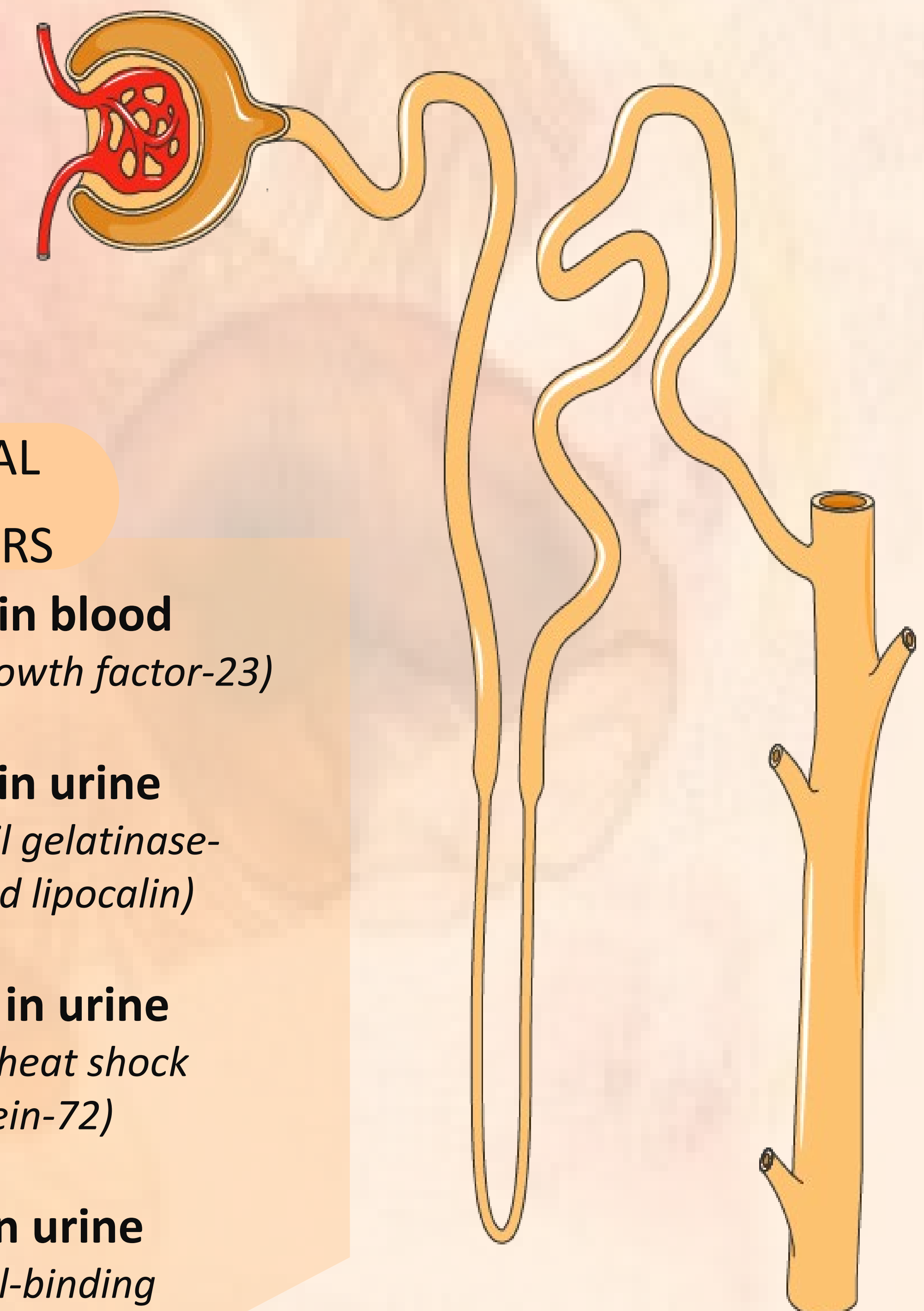
The presence of **proteins** (albumin) in urine indicate renal damage.

Proteinuria (quantitative)

Measured by **ratio proteins/creatinine** in urine.

Biomarker	Type	Sample	Reference Interval		Location of production
			Dog	Cat	
Creatinine	GFR	Serum or plasma	0,5-1,5 mg/dL	0,8-1,8 mg/dL	Muscle
Urea	GFR	Serum or plasma	9-26 mg/dL	17-35 mg/dL	Hepatocyte
SDMA	GFR	Serum or plasma	<14 µg/dL	<14 µg/dL	All nucleated cells
Cystatin C	GFR Tubular damage	Serum or plasma	<2,28 mg/dL	<1,95 mg/dL	All nucleated cells
Proteins	Glomerular /tubular damage	Urine	Ratio P/C <0,5	Ratio P/C <0,4	Hepatocyte

Table 1. Description of the most relevant biomarkers of renal function and damage in dogs and cats. Modified from Hokamp and Nability (2016). *Renal biomarkers in domestic species*.



NEW RENAL BIOMARKERS

FGF23 in blood
(Fibroblast growth factor-23)

NGAL in urine
(Neutrophil gelatinase-associated lipocalin)

HSP72 in urine
(Urinary heat shock protein-72)

RBP in urine
(Retinol-binding protein)

CONCLUSIONS

- ❖ The most used laboratory biomarkers are creatine, and urea measured in serum together, and protein measured in urine.
- ❖ SDMA and cystatin C are the newest studied biomarkers, so they are considered increasingly important in the evaluation of kidney diseases.
- ❖ Study of new renal biomarkers is mandatory to the early detection of renal diseases in small animals, in order to reach a diagnosis before the kidney has lost much of its functional mass.