

# EFFECT OF GFR IMPAIRMENT ON DIAGNOSTIC PERFORMANCE OF NGAL AND BNP AS MARKERS OF ACUTE CARDIAC AND RENAL FAILURE IN CHRONIC KIDNEY DISEASE PATIENTS

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## OBJECTIVES

Cardio-renal syndromes are characterized by the impairment of cardiac and renal functions. Plasma and urinary Neutrophil Gelatinase-Associated Lipocalin (NGAL), and plasma B-type natriuretic peptide (BNP) are markers of acute kidney injury (AKI) and heart failure (HF), respectively.

The aim of this study was to assess the effect of the reduction of GFR on plasma BNP and on plasma and urinary NGAL concentrations in stable chronic kidney disease (CKD) patients at different functional stages.

## PATIENTS and METHODS

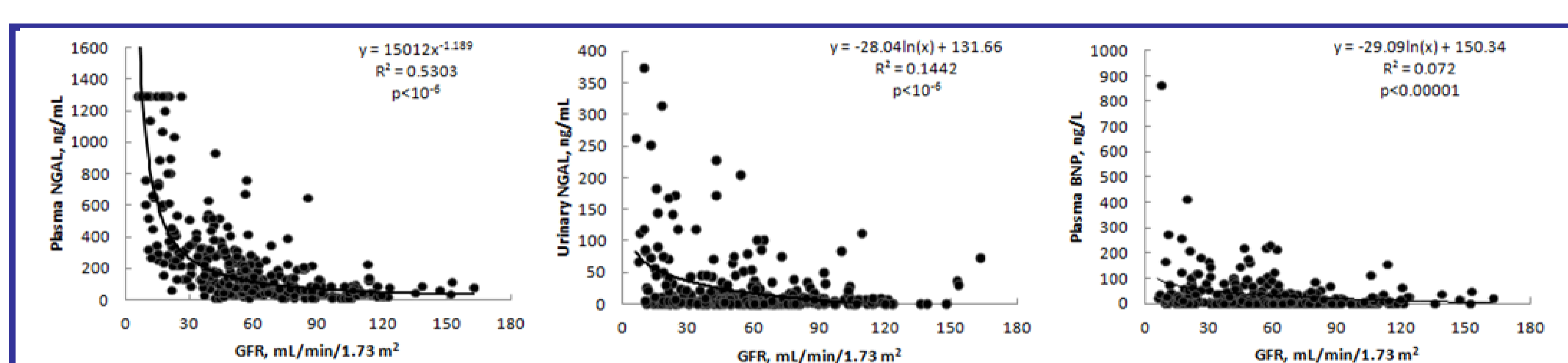
- GFR (99mTc-DTPA)
- plasma BNP
- plasma and urinary concentrations of NGAL

were measured in 310 clinically stable CKD patients, at functional stages from 1 to 5.

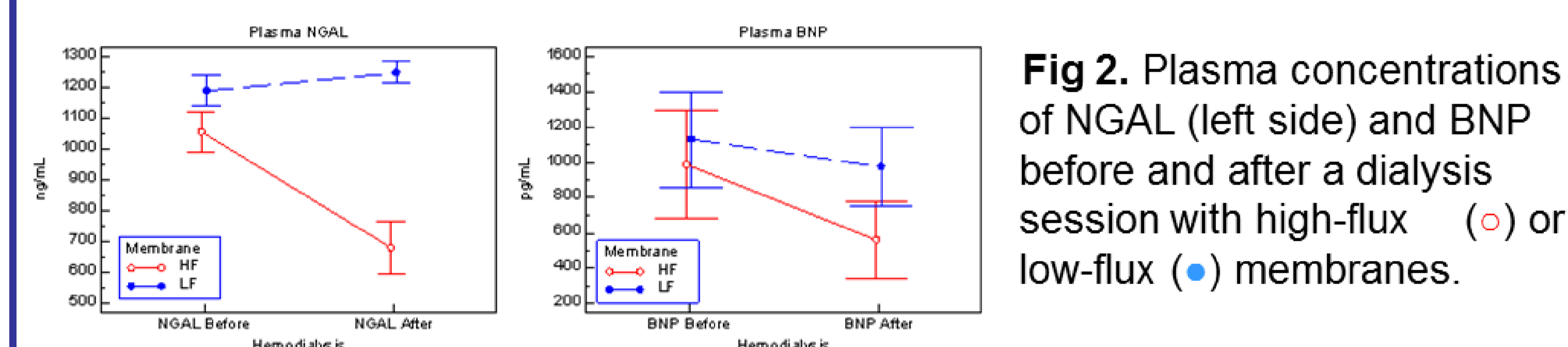
- Serum and urinary low-molecular-weight proteins cystatin C and  $\beta$ 2-microglobulin, and
- urinary tubular enzymes

were measured for comparison.

Plasma BNP, NGAL, cystatin C and  $\beta$ 2-microglobulin were measured also in 31 maintenance hemodialysis patients.



**Fig 1.** Correlations with GFR of plasma and urinary NGAL and plasma BNP.



**Fig 2.** Plasma concentrations of NGAL (left side) and BNP before and after a dialysis session with high-flux (○) or low-flux (●) membranes.

**Table.** Percentage of patients with values of the markers above the upper limit of the reference ranges in the different functional stages of CKD.

CKD Stage	PlasmaNGAL >153 ng/mL n/N	Percentage	UrineNGAL >131.7ng/mL n/N	Percentage	PlasmaBNP >100 g/mL n/N	Percentage
Stage 1	1/48	2	2/48	4	2/48	4
Stage 2	18/85	21	1/85	1	2/85	2
Stage 3a	31/64	48	3/64	5	7/64	11
Stage 3b	36/50	72	3/50	6	4/50	8
Stage 4	39/43	91	5/43	12	9/43	21
Stage 5	20/20	100	8/20	40	3/20	15
Overall	145/310	47	22/310	7	27/310	9

## RESULTS

Plasma NGAL increased with the reduction of GFR in CKD patients from stage 2.

In the different CKD stages modest differences were found for BNP values.

Urinary NGAL increased slightly but significantly in patients at CKD stages 4&5, similarly to urinary cystatin C and  $\beta$ 2-microglobulin.

In maintenance hemodialysis patients, plasma NGAL and BNP were markedly increased, and high-flux hemodialysis significantly decreased their plasma concentrations.

## CONCLUSIONS

Plasma NGAL increases markedly with the reduction in GFR, generating a very high number of false positive diagnoses of AKI in stable CKD patients.

The grade of GFR impairment and the cause of kidney disease have a lower effect on urinary NGAL and on plasma BNP.

In any case, specific reference values of NGAL and BNP should be used in chronic kidney disease patients, according to their functional stage, when assessing acute kidney injury, heart failure, and cardio-renal syndromes in patients with impaired GFR.

