MCP-1 in urine as biomarker of renal lupus in absence of cytokines, interferon-γ and growth factors

Julia Barbado, Luisa Vega, Rocío González-Gallego, Antonio Jimeno, Raúl Ortiz De Lejarazu, and Jesús F. Bermejo-Martin

Unidad de Enfermedades Autoinmunes, Servicio de Medicina Interna, Hospital Clínico Universitario, Valladolid, Spain
Unidad de Investigación en Infección e Inmunidad, Servicio de Microbiología e Inmunología, Hospital Clínico Universitario, IECSCYL, Valladolid, Spain

* Corresponding author.
E-mail address: jbermejo@hcuv.sacyl.es (J.F. Bermejo-Martin).

A R T I C L E   I N F O

Article history:
Received July 15, 2009
Accepted September 29, 2009

Keywords:
Renal lupus
Urine
Immune mediators

A B S T R A C T

Objective: To characterize 17 immunological markers in the Urine of patients with SLE.
Introduction: Lupus nephritis is an inflammatory disease affecting the renal parenchyma. Cytokines and chemokines are key immune mediators that have been related with the pathogenesis of the disease. Obtaining non invasive prognosis markers is a highly desirable objective in order to improve the clinical management of these patients.

Patients and methods: In this study we profiled 17 immune mediators (Th1, Th2, Th17 cytokines, chemokines and growth factors) in the urine of 25 patients with systemic lupus erythematosus with active renal disease by using a Biorad 17-plex kit on a Luminex platform. A group of healthy volunteers of similar age and comparable sex distribution was recruited as control (n = 10).

Results: Results evidenced that the only detectable mediators in urine were IL-8, MCP-1 and MIP-1β. When levels of these mediators were compared between patients and controls, significantly higher levels of MCP-1 were observed in the urine of the patients. MCP-1 levels in urine correlated positively with the SLEDAI score in a significant way and negatively with plasma levels of complement C4.

Conclusions: Our results reinforce the role of MCP-1 in urine as biomarker of disease activity in renal lupus, excluding the detection of other soluble immune mediators such as Th1, Th2 ,Th17 cytokines and growth factors as suitable markers in this non invasive sample.

R E S U M E N

Objetivo: Perfilar 17 mediadores inmunológicos en la orina de pacientes con LES.
Introducción: La nefritis lúpica es una enfermedad inflamatoria que afecta al parénquima renal. Citoquinas y quimiocinas son los mediadores inmunes dominantes relacionados con la patogénesis de la enfermedad. La obtención de marcadores de pronóstico no invasivos es un objetivo sumamente deseable para mejorar el manejo clínico de estos pacientes.

Pacientes y métodos: En este estudio nosotros perfilamos 17 mediadores inmunológicos (citoquinas Th1, Th2, Th17, quimiocinas y factores de crecimiento) en la orina de 25 pacientes con lupus y enfermedad renal activa usando un kit Biorad 17-plex en plataforma Luminex. Como grupo control se seleccionaron (n = 10) voluntarios sanos con similar edad y sexo que los casos.

Resultados: Los resultados evidenciaron que los únicos mediadores perceptibles en orina eran IL-8, MCP-1 y MIP-1β. Cuando los niveles de estos mediadores fueron comparados entre los pacientes y los controles, MCP-1 en la orina de los casos fue el único que aumentó de forma significativa (p < 0,05) con respecto a los controles. Estos niveles de MCP-1 en orina se correlacionaron de forma positiva con la puntuación de SLEDAI y de forma negativa con los niveles en plasma de la proteína C4 del sistema de complemento.

Conclusions: Nuestros resultados refuerzan el papel de MCP-1 en orina como biomarcador no invasivo de actividad de enfermedad en el lupus renal, no evidenciando la detección de otros mediadores inmunológicos solubles, como son las citoquinas Th1, Th2, Th17 y factores de crecimiento.

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Introduction

Lupus nephritis is an inflammatory disease affecting the renal parenchyma. Cytokine and chemokines are the key immune mediators that have been related with the pathogenesis of the disease. Obtaining non-invasive prognostic markers is a key objective to improve the clinical management of these patients. The presence of chemokines in the urine of patients with lupus nephritis has been proved. The multiplex assays available today allow for the simultaneous detection of a great variety of mediators in a very small amount of urine. Monocyte chemoattractant protein-1 (MCP-1) is considered a renal inflammation marker, but it is not exclusive to lupus. It is present in high levels in the urine of patients with diabetes mellitus, IgA nephritis, and certain types of vasculitis, among other conditions.

Material and methods

In this study, we profiled 17 molecules present in urine, from the first morning urination, of 25 patients with systemic lupus erythematosus (SLE) with active renal disease by using a BioPlex® 17-plex kit on a Luminex® platform. The selected mediators included Th1 cytokines (IL-2; IL-12p70); Th2 cytokines (IL-4; IL-5; IL-10; IL-13); Th17 cytokines (IL-6; IL-17); growth factors (GM-CSF; GCSF); chemokines (IL-8; MCP-1; MIP-1); and also IL-7. Patients with SLE were selected from the Autoimmune Disease Unit at our hospital. A group of 10 healthy people who work at the University of Valladolid (Spain) of similar age and comparable gender distribution to that of the group of patients was selected as control group. The definition of patients with SLE was that of the American College of Rheumatology. All patients with SLE were receiving immunomodulator treatment at the time of sample collection, either with non-steroidal anti-inflammatory drugs, steroids, chloroquine, or immunosuppressive medication. Disease activity in each patient was assessed at the moment of sample collection using the SLE Disease Activity Index 2000. Renal disease was defined as the presence of proteinuria (>0.5 g/24 h), which is the predominant characteristic in lupus nephritis, of pyuria (>6 leukocytes/field), the presence of urinary casts detected by microscopic examination of urine sediment, haematuria (>5 red blood cells/field), creatinine levels in blood serum above 1.1 mg/dL for women and 1.3 mg/dL for men, and the clearance of creatinine below 87 mL/min in women or 97 mL/min in men. The best method to evaluate renal function is estimating the glomerular filtration rate (GFR) using the Cockroft-Gault or MDRD formulae. The results of the estimated GFR are expressed as median [interquartile range]: patients (124.7 [138.6] pg/mL) and controls (56.8 [75.7] pg/mL) (P < 0.05). No difference was found between patients and controls for IL-8 and MIP-1Î±. The positive correlation between the MCP-1 levels in urine and the score of the SLE Disease Activity Index 2000 with statistical significance (expressed as Spearman’s correlation coefficient; P = 0.569; 0.004) and the negative correlation with plasma levels of C4 protein of the complement system (−0.389; 0.05) were an interesting discovery. Just as interesting is the discovery of a positive association between the urine levels of MCP-1 and IL-8 (0.436; 0.029) and between MCP-1 and MIP-1Î± (0.478; 0.016), which somehow suggests coordinated secretion of these chemokines in this disease.

No relation was found between MCP-1 and the GFR ratio with the MDRD formula of patients, with the mean being 89.57 mL/min/1.73 m².

We simultaneously examined 17 immune mediators in the urine of patients with renal disease in the context of SLE for the first time.

Discussion

Chemokines, such as MCP-1 and IL-8, are powerful chemotactic factors of monocytes in the glomerulus when there is renal damage. Furthermore, MCP-1 stimulates the increase of intracellular calcium, which induces the freeing of superoxide anions and lysozymic enzymes and stimulates the production of adherence molecules and cytokines. Many cytokines and pro-inflammatory mediators could cause the production of MCP-1 in the mesangial cells of the glomerulus, the endothelial cells of tubules, and the monocytes. It has been proven that increases of tubular MCP-1 expression were strongly associated to infiltration of monocytes and fibrosis in the interstice of patients with lupus nephritis. This suggests that MCP-1 takes part in the pathogenesis of tubular-interstitial damage, as it recruits monocytes and the fibrosis of the interstice takes place.

One method to detect the expression of MCP-1 in glomerular disease is to measure the levels of MCP-1 in urine, which is high in patients with glomerulopathies, and more acutely so in patients who present inflammatory glomerulopathies. Our results reinforce the role of MCP-1 in urine as a biomarker of disease activity in lupus nephritis; the production of MCP-1 is minimal or undetectable in the renal tissue of subjects without renal affection, excluding the detection of other soluble immune mediators such as Th1, Th2, and Th17 cytokines and growth factors as non-invasive markers.

Financing

This study was made possible thanks to a grant from “Caja de Burgos” “Premios de Investigación Biomédica” (Biomedical Research Award). Jesús F. Bermejo-Martín, R. Almansa and L. Rico were supported by the “Fondo de Investigaciones Sanitarias” (Health Research Fund), the Ministry of Science and Innovation, Spain, EMER07/050 and the “Programa para favorecer la incorporación de grupos de investigación en las instituciones del Sistema Nacional de Salud, EMER07/050” (Programme for the promotion of research group integration into institutions of the National Health System, EMER07/050).

Conflict of interest

The authors declare no conflict of interests.

Acknowledgements

We wish to thank the nursing staff of the Internal Medicine Service at our hospital, who kindly collected the samples.
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