

The Relationship Between Clinical and Laboratory Parameters and Structural Changes in the Kidneys in Various Morphological Forms of Chronic Glomerulonephritis

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Abstract: The results of 98 biopsies obtained from patients with various morphological forms of chronic glomerulonephritis were studied. A comprehensive clinical and laboratory examination was carried out on 74 patients. The proteinuric form of chronic glomerulonephritis was identified in 54 patients. The data from the correlation analysis of the studied morphometric parameters and the results of the analysis of laboratory studies made it possible to create a mathematical model that can be used to determine the morphological form of chronic glomerulonephritis. If it is impossible to perform a kidney biopsy to determine the morphological form of chronic glomerulonephritis, nephrologists are recommended to use the developed mathematical model.

Keywords: Chronic glomerulonephritis, mathematical model, biopsy.

Introduction. Chronic kidney diseases and renal failure are one of the main problems in theoretical and practical nephrology (1,2,3). Among chronic kidney diseases, chronic glomerulonephritis occupies a special place. All the achievements of modern immunology, genetics and practical aspects of pathomorphology are applied primarily to glomerulonephritis (3,4).

Purpose of the study: To study the correlations between clinical and laboratory parameters and structural changes in the kidneys for each nosological form of chronic glomerulonephritis.

Material and methods of research. The results of 98 biopsies of patients with chronic glomerulonephritis were studied. The diagnosis was established based on the results of clinical and morphological examination of patients. A comprehensive clinical and laboratory examination was carried out on 74 patients. Of these, 54 (72.9%) had proteinuric, 19 (25.7%) mixed and 1 (1.4%) hematuric forms of chronic glomerulonephritis. Patients under the age of 34 years (average age 23.4 ± 5.2 years) were observed. The number of men and women is approximately the same (52.6% and 48.4%, respectively). In patients with chronic glomerulonephritis, hypoproteinemia, dysproteinemia (hypoalbuminemia, hyperglobulinemia, hypergamma-2-globulinemia), hypergammalipidemia, hypercholesterolemia, urinary sediment (hematuria, lymphocyturia, cylindruria), proteinuria more than 3.5 g/day, hyperfibrinogenemia, and a decrease in the level of glomerular filtration were observed.

The results of the study and their discussion. We conducted a correlation analysis between the studied morphometric parameters and the results of laboratory analysis. It turns out that there is a direct and inverse correlation between these indicators. Also, each morphological form of chronic glomerulonephritis has different correlative characteristics. Thus, in mesangioproliferative glomerulonephritis, a direct correlation was revealed between the number of mesangial cells, blood creatinine concentration ($r=0.63$) and the level of proteinuria ($r=0.54$). The existence of a direct relationship between the volume of deposits and hematuria, as well as the density of deposits and proteinuria in mesangioproliferative glomerulonephritis is presented in the scientific works of Danielewicz, Wagrowska - Danielewicz (1997, 2001). In mesangioproliferative glomerulonephritis, inverse correlations are observed between the glomerular area and the level of total protein in the blood ($r=0.72$), proteinuria ($r=0.67$), between the number of convoluted tubule cells and the creatinine content in the blood ($r=0.71$), between the number of glomerular cells and creatinine level ($r=0.86$). Direct correlations were found between the cross-sectional area of glomerular capillaries and the glomerular filtration rate ($r=0.52$), between the number of glomerular cells and the number of hyaline

casts in the urine ($r=0.54$), between the cross-section of extraglomerular capillaries and the level of total protein in the blood ($r=0.61$).

In membranous glomerulonephritis, there is a direct correlation between the glomerular area and the level of total blood protein ($r=0.63$), and between the glomerular area and glomerular filtration rate ($r=0.50$), as well as the number of mesangial cells and proteinuria ($r=0.78$) an inverse correlation was observed. Also, a similar correlation was observed between the cross-sectional area of extraglomerular capillaries and the level of creatinine in the blood ($r=0.51$), between the cross-sectional area of extraglomerular capillaries and the level of proteinuria ($r=0.50$). The existence of a correlation between the area of the glomeruli with the level of blood proteins and glomerular filtration, proteinuria and the density of deposits in membranous glomerulonephritis was noted by other authors (Paraskeva et al., 2001, Danielewicz, Wagrowska - Danielewicz (1997, 2001).

In mesangiocapillary glomerulonephritis, between the cross-sectional area of glomerular capillaries and the level of total blood protein ($r=0.72$), the number of convoluted tubules of the kidneys and the level of total blood protein ($r=0.60$), the number of mesangial cells and the number of unchanged red blood cells in the urine ($r=0.54$), the area of convoluted tubule cells of the kidney and the level of total blood protein ($r=0.68$) a direct correlation was found. Between the cross-sectional area of the glomerular capillaries and the number of unchanged red blood cells in the urine ($r=0.55$), the area of the convoluted tubules and the level of proteinuria ($r=0.51$), the area of the cells of the convoluted tubules of the kidneys and the level of proteinuria ($r=0.54$), between cross-sectional area of glomerular capillaries and the level of total blood protein ($r=0.77$) inverse correlations were observed. The existence of a correlation between the level of blood creatinine and the number of cells containing the enzyme tryptase, as well as between the level of proteinuria and deposits located in the basement membrane in mesangiocapillary glomerulonephritis, is also presented in the scientific works of Danielewicz, Wagrowska - Danielewicz (1997, 2001).

In fibroplastic glomerulonephritis, between the area of the glomeruli and the level of glomerular filtration ($r=0.63$), the level of total blood protein ($r=0.49$), between the cross-sectional area of the glomerular capillaries and the number of leukocytes in the urine ($r=0.70$), cell area convoluted tubules and the number of hyaline casts in the urine ($r=0.75$) direct correlations were revealed. Between the number of convoluted tubule cells and the level of reabsorption ($r=0.94$), as well as the level of total blood protein ($r=0.49$), between the number of mesangial cells and glomerular filtration ($r=0.52$), the level of total blood protein ($r=0.61$), there was an inverse correlation between the area of convoluted tubule cells and the level of proteinuria ($p=0.52$).

In focal segmental glomerulonephritis, direct correlations were found between the area of the glomeruli and the number of red blood cells in the urine ($r=0.49$), the cross-sectional area of the glomerular capillaries and the number of leukocytes in the urine ($r=0.78$), as well as the number of unchanged red blood cells in the urine ($r=0.55$), between the cross-sectional area of convoluted tubules and the level of total protein in the blood ($r=0.57$), the cross-sectional area of extraglomerular capillaries and the level of proteinuria ($r=0.53$). Inverse correlations were found between the area of the glomeruli and the level of total protein in the blood ($r=0.79$), the area of epithelial cells of the convoluted tubules and the level of proteinuria ($r=0.50$), the cross-sectional area of extraglomerular capillaries and the level of total protein in the blood ($r=0.50$).

Conclusions. The data from the correlation analysis of the studied morphometric parameters and laboratory data made it possible to create a mathematical model with which the morphological form of chronic glomerulonephritis can be determined. If it is impossible to perform a kidney biopsy to determine the morphological form of chronic glomerulonephritis, nephrologists are recommended to use the developed mathematical model.

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