

Evaluation of a Combination of Qualitative and Quantitative Features in Chronic Glomerulonephritis in Children with Atopic Dermatitis

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Abstract:

In recent decades, there has been a steady increase in nephropathies among the child population. Among many kidney diseases, glomerulonephritis (GN) has a special place due to the severity of its course, the complexity of treatment, the ambiguity of the prognosis and the steady progression towards chronic renal failure (CKD), which leads to disability of patients. CKD in children as a cause of disability occurs with a frequency of 5:100,000 in the pediatric population. According to foreign studies, the risk of developing end-stage CKD by the age of 20 in children with chronic glomerulonephritis (CGN) is 68.0%.

Introduction

In this regard, serious attention is paid to GBV in children suffering from allergic diseases, such as atopic dermatitis, bronchial asthma, hay fever, etc. [1,2,3,4,5,8,9,10]. Currently, it is known that there is a group of patients in whom the development of nephrotic syndrome occurs due to the presence of atopic reactions to antigens, the cause of which depends on the mutation of genes that determine the state of gap membrane proteins. And in some cases, it is the features of the alleles of these genes that can determine the predisposition to the development of nephrotic syndrome [11,12,13,14,15].

The incidence of atopy has increased in the last 30 years, yet genetic components remain the greatest risk factor.

To study the combination of qualitative and quantitative traits in children with CGN and CGN+BP, we used the mathematical modeling method (ANN) [6,7]. The principle of this method is a sequential analysis of the comparison of the probabilities of the distribution of symptoms of two conditions and the determination of the diagnostic informativeness of the signs.

Quantitative and qualitative characteristics were compared using a number of criteria: frequency characteristics of nominal features, which determine intra-class similarity and inter-class difference; the value of the synoptic weights of the NS for the selection of an informative set of features.

The aim of the study was to study a combination of qualitative and quantitative signs in chronic glomerulonephritis in children with atopic dermatitis

Materials and Methods

We conducted clinical and immunological studies during 2015-2018 in 145 children aged 7 to 11 years. Of these, the control group consisted of 25 children of the same age. 120 examined children were divided into 3 groups depending on their nosology: Group 1 consisted of 40 children with nephrotic syndrome; Group 2 - 40 children with nephrotic syndrome due to AD; Group 3 - 40 children with AD. Clinical diagnosis is made on the basis of clinical and anamnestic data, results of laboratory, immunological and functional research methods, SCORAD index [2].

The material for the study was venous blood taken in the morning on an empty stomach. The numerical data were processed by the method of variational statistics with the calculation of the reliability of numerical differences according to Student.

In the processing of clinical, laboratory, and immunological parameters, the **method of "artificial neural networks"** (ANN) was also used [6,7]. The main principle of the "Neural Networks" method of sequential analysis is to compare the probabilities of the distribution of symptoms of two conditions, to determine the diagnostic informativeness of the signs.

Results and Discussion

As a result of the study of the combination of qualitative and quantitative signs in children with AD, CGN and CGN + BP, we assessed the weight of nominal qualitative signs of each symptom in the process of diagnosing a particular disease and proved the high informative value of the identified signs.

In order to determine the degree of comparison of qualitative indicators by the NS method, we analyzed the clinical symptoms of patients before treatment, dividing them into two groups: Igr. - who should receive traditional treatment, II - trad. Treatment + mycophenolate-mofetil. Signs with very low informative weight indicate that in all groups these signs, i.e. clinical symptoms were detected almost in the same way, and signs with a high informative weight indicated a large difference between the groups.

In the analysis, the calculation of the informative weight took into account the frequency and degree of expression of each feature (Table 1). 1.).

Table 1. Informative Comparative Qualitative Indicators detey pri AD, HGN, HGN+AD

Quality Indicators	Weight of nominal signs (before treatment)		
	AД, n=40	CGN, n=40	CGN+BP, n=40
Clinical symptoms of CGN			
"chalky" pallor	0,0117	0,7542	0,0329
lethargy	0,2123	0,5340	0,7642
decreased appetite	0,3476	0,4673	0,6789
Swelling	0,1669	0,8933	1,000
A/D increase	0,3124	0,5917	0,7670
tachycardia	0,2177	0,6913	0,8552
nausea	0,2518	0,5338	0,6538
vomit	0,1432	0,4981	0,5168
Hepatomegaly	0,1222	0,3456	0,7871
Oliguria	0,0112	1,000	1,000
anuria	0,0100	0,2612	0,3421
headache	0,5643	0,7752	0,9657
Blood pressure markers			
Onset of the disease <i>At an early age</i>	0,4600	0,0111	0,7200
Presence of allergic diseases <i>parents or relatives of the patient</i>	0,4764	0,1281	0,4751
Presence of pruritus <i>Skin</i>	1,000	0,2431	0,8967
<i>dry skin,</i>	0,9769	0,1110	1,000
<i>Hyperemia of the skin</i>	0,6869	0,0443	0,7924
Typical location of skin eruptions <i>on the face, extensor surfaces of the extremities</i>	0,5000	0,1000	0,8659
Flow <i>chronic relapsing</i>	0,7894	0,8862	0,9764
IgE <i>high serum levels</i>	1,000	0,2658	1,000

Note: The numbers obtained are indications of the degree of difference between the pre-treatment values.

The analysis of 12 clinical symptoms of CGN and 6 BP markers observed in CGN and CGN + BP made it possible to identify the most informative of them. The following signs characteristic of CGN and BP had a pronounced degree of significance, i.e. high informative value: in case of blood pressure, decreased appetite (0.3476), headache (0.5643); in CGN – increased A/D (0.5917), decreased appetite (0.5917), tachycardia

(0.6913), chalky pallor (0.7542), headache (0.7752), edema (0.8933), oliguria (1.000); in case of CGN + BP – decreased appetite (0.6789), lethargy (0.7642), increased A/D (0.7670), hepatomegaly (0.7871), headache (0.9657), edema (1.000), oliguria (1.000).

Analysis of BP markers showed high informative value of the following signs: in BP – onset at an early age (0.7200), skin hyperemia (0.6869), chronic relapsing course (0.7894), dry skin (0.9769), itching (1.000), high IgE (1.000); CGN – chronic relapsing course (0.8862); in case of CGN + BP – onset of the disease at an early age (0.7200); skin flushing (0.7924), chronic (0.9764), dry skin (1.000), pruritus (0.8967), high IgE (1.000).

In our opinion, the high informative value of signs such as: oliguria, edema, headache, dry skin, itching, high IgE, which can be diagnostic criteria for diagnosis, is interesting.

**Table 2. Informative Comparative Quantitative Indicators
detey pri AD, HGN, HGN+AD**

Quantities	Weight of nominal signs (before treatment)		
	AD, n=40	CGN, n=40	CGN+BP, n=40
Hemoglobin, g/l	0,5385	0,5689	0,7452
Erythrocytes, 1012 /l	0,4962	0,7845	0,8965
Leukocytes, 109 /l	0,5329	0,4871	0,5693
Lymphocytes, %	0,3216	0,4983	0,6732
Eosinophils%	1,000	0,1326	0,9912
ESR, mm/h	0,3987	0,2967	0,3452
Urea, mmol/l	0,1121	0,8591	0,8879
Creatinine, mmoll/l	0,0120	0,2019	0,4259
Total protein, g/l	0,3675	1,000	1,000
Albumins, %	0,2310	0,5767	0,6363
Gamma-globulin, %	0,1256	0,5499	0,6365
Calcium_in_blood mmol/L	0,6142	0,5492	0,6767
Total cholesterol mmol/L	0,4073	0,3689	0,3948
fibrinogen g/l	0,4796	0,9037	0,9865
proteinuria	0,0115	1,000	1,000
erythrocyturia	0,0113	0,5875	0,6782
Leukocyturia	0,0231	0,7691	0,8872

Note: The numbers obtained are indications of the degree of difference between the pre-treatment values.

As a result of the mathematical analysis of laboratory parameters, (Table 1). 2.) characteristic of CGN and BP having a high informative weight, the following should be distinguished: in AD - erythrocytes (0.4962), hemoglobin (0.5385), calcium in the blood (0.6142), leukocyturia (0.4564), fibrinogen (0.3215), urea (0.2194),

eosinophilia (1.000); in CGN - leukocytes (0.5329), hemoglobin (0.5689), albumin (0.5767), leukocyturia (0.7691), erythrocytes (0.7845), urea (0.8591), fibrinogen (0.9037), proteinuria (1.000), total protein (1.000); in CGN + BP - leukocytes (0.5693), albumin (0.6363), lymphocytes (0.6732), erythrocyturia (0.6782), hemoglobin (0.7452), leukocyturia (0.8872), urea (0.8879), erythrocytes (0.8965), fibrinogen (0.9865), proteinuria (1.000), total protein (1.000).

Thus, the clinical symptoms of AD, CGN, CGN+BP are characterized by: polymorphism of symptoms of glomerulonephritis and atopic dermatitis, manifestation, recurrence and duration of the pathological process. The data of an objective study of patients also confirmed a more severe course and significant manifestations of symptoms of nephrotic syndrome in glomerulonephritis and blood pressure markers in CGN.

The mathematical method of modeling "Neural Networks" used by us allowed us to identify the degree of specificity and significance of individual signs of CGN and BP. It is also noted that each variant of CGN in this cohort of patients has its own peculiarity, which, according to clinical and laboratory signs, can be subjected to qualitative, quantitative analysis and assessment.

On the basis of the obtained values for the assessment of informative weights, the qualitative and quantitative signs of the most reliable and significant for CGN and BP, which play an important role in making the diagnosis, and the early detection and prevention of CKD are revealed.

Findings

1. The mathematical method of modeling neural networks made it possible to assess the combinations of qualitative and quantitative features of nephrotic forms of chronic glomerulonephritis and atopic dermatitis.
2. Combinations of qualitative and quantitative traits in CGN and BP had their own characteristics.
3. In children with nephrotic syndrome with atopic dermatitis, the following positive qualitative and quantitative signs were highly informative in UA: oliguria, proteinuria, T3DM; In case of HC+BP: edema, total protein, ASL to renal tissue, CIC; by markers AD-itching of the skin, IgE.

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