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INFRARED SPECTROSCOPY OF BLOOD OF CHILDREN WITH MACROHEMATURIA SYNDROME

ANNOTATION

For experimental purposes, the blood of children with hematuria syndrome in acute and chronic glomerulonephritis and IgA nephropathy was studied by IR spectroscopy. The obtained results indicate the possibility of using IR spectroscopy as an additional diagnostic method for differentiating nephropathies.

Keywords: hematuria, IgA-nephropathy, chronic glomerulonephritis, acute glomerulonephritis, IR spectroscopy.

INTRODUCTION

One of the main causes of chronic renal failure is glomerulonephritis, the course and prognosis of which, according to modern concepts, depend on the inflammatory mechanisms of damage of renal tissue. The predominant sedimentation of immune complexes containing immunoglobulin A (IgA) in intraglomerular mesangial cells is known as IgA nephropathy, or Berger disease. This type of glomerulonephritis is the most common in the world: the incidence - 5 cases per 100,000 population [1].

In European, North American and Australian populations its share reaches 10-12% of all glomerulonephritis, and in Asian – up to 30%. IgA-nephropathy leads in terms of prevalence in Japan up to 50% of all cases of glomerulonephritis.

Currently in the Republic of Sakha (Yakutia) there is a tendency of the increasing of renal pathology among children. In the US, the spread of the disease varies from 2-10%, whereas in Asia to 50% (in Japan 18-40%) [3-5].

However, the causes of most hematuria and, in particular, of Berger's disease (IgA-nephropathy) have not been studied at the cellular and molecular levels. IgA-nephropathy is usually detected in children and adults under 30 years of age, most often observed in men.

Usually it is manifested by bouts of macrohematuria with pain in the lower back, growing on the background of pharyngitis. The reasons of the development of IgA-nephropathy can be etiological factors (hepatitis b viruses, herpes viruses, E. coli, fungi, cochlea, etc.), food factors (gluten, alpha-lactalbumin, beta-lactalbumin, casein, etc.) and endogenous antigens (in tumors of lymphoid tissue-lymphogranulomatosis, lymphoma).

There are also evidences of a genetic predisposition to develop Berger's disease [6]. It is known that in IgA-nephropathy there is an increase in the concentration of immune complexes containing IgA, both as a result of an increase in the production of antibodies, and as a result of a violation of their clearance.

The main hypothesis of pathogenesis, widespread at present, assumes abnormal glycosylation and polymerization of IgA with deposition of immune complexes containing abnormal IgA in glomeruli, with activation of leukocytes and inflammation cascade [8].

The main method of diagnosis of the disease is a kidney biopsy with morphological study of biopsy material. At a light microscopy of preparation increase in quantity of cells in a mesangium and a mezangialny extracellular matrix is found. At an immunohistochemical research conglomeration of IgA in a mesangium in the form of the separate granules merging among themselves is revealed [2]. The biopsy of a kidney is highly traumatic research technique giving no more than 90% of reliable results. Searching of new noninvasive and reliable methods of differential diagnosis of diseases of kidneys, in particular difficult diagnosed - IgA nephropathy, is relevant.

The purpose of the real research was assessment of features of blood of children with a macrohematuria syndrome by method of infrared spectroscopy.

Material and methods of a research

15 children aged from 8 up to 16 years with various forms of the nefropathy who had been undergoing inspection and treatment in nephrological office of the Center of protection of motherhood and childhood of Republican hospital No. 1 – National Centre of medicine (Yakutsk) are analyzed. The control group consists of 8 first-year students of MI SVFU and school students of Yakutsk without disease of kidneys.

Material of a research was venous blood which was evenly distributed on dry glass by the standard method. Researches were conducted by dint of an IR-spectrometer of Varian 7000 FT-IR (USA) (range of 4000 - 400 cm-1) by attenuated total reflectance technique (ATRT) in scientific and technological laboratory of «Technologies of Polymeric Nanocomposites» of the Center of collective use of the Arctic innovative center of the NEFU. It should be noted that the obtained data of spectroscopy can be estimated in 3-5 minutes that is an important factor for timely diagnosis.

Results of the research

The IR - spectroscopy of dabs of blood of children and teenagers with a macrohematuria syndrome was for the first time carried out at chronic glomerulonephritis (n=5), at acute glomerulonephritis (n=5) and the IgA - nephropathy (n=5).

The received analysis of these intensity of IR spectrums showed that essential distinctions (at figures 1-2 - averaged curves of comparison groups) are observed in the range of wave numbers from 3600 to 2700 cm-1 to which correspond stretching vibrations of primary amines (N-H) and amides (SN-) the monoreplaced acetylene and also, in the field of wave numbers from 1700 to 900, the main peaks of which show existence of stretching vibrations of - C=C-; stretching vibrations of C=N, stretching vibrations of C=N and C=C-communications.

Apparently from the presented averaged lines of the IR spectrums (fig. 1 a, b and c) forms of peaks are identical, i.e. show of the same chemical compounds. However, peaks of intensity of sick children are higher, than in control group. Essential distinctions of peaks of intensity in comparison with the control group are observed in children with the IgA-nephropathy. 3330 - 2800 cm-1, for example at the intensity maximum of 3286 cm-1 difference compared with the control

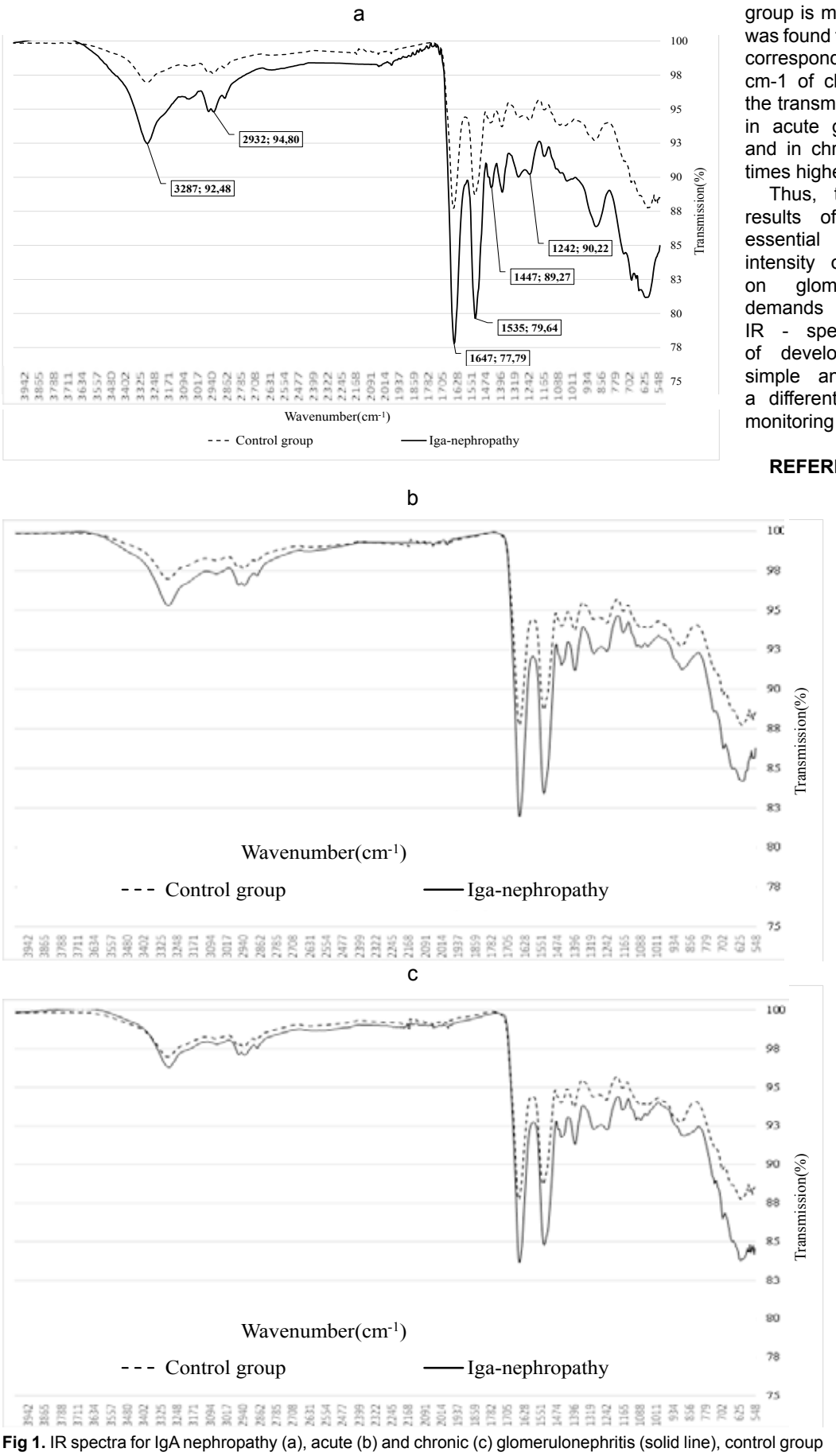

Fig 1. IR spectra for IgA nephropathy (a), acute (b) and chronic (c) glomerulonephritis (solid line), control group (dashed line)

group is more than 2 times (Figure 2). It was found that at an absorbance intensity corresponding to a wave number of 1645 cm-1 of children with IgA-nephropathy, the transmission intensity was 1.8 times, in acute glomerulonephritis. 1.2 times and in chronic glomerulonephritis. 1.15 times higher than with a control group.

Thus, the analysis of preliminary results of a research confirms an essential divergence of peaks of intensity of IR spectrums depending on glomerulonephritis forms that demands more detailed studying of IR - spectroscopy for the purpose of development of less expensive, simple and noninvasive method for a differentiation of the diagnosis and monitoring at this pathology.

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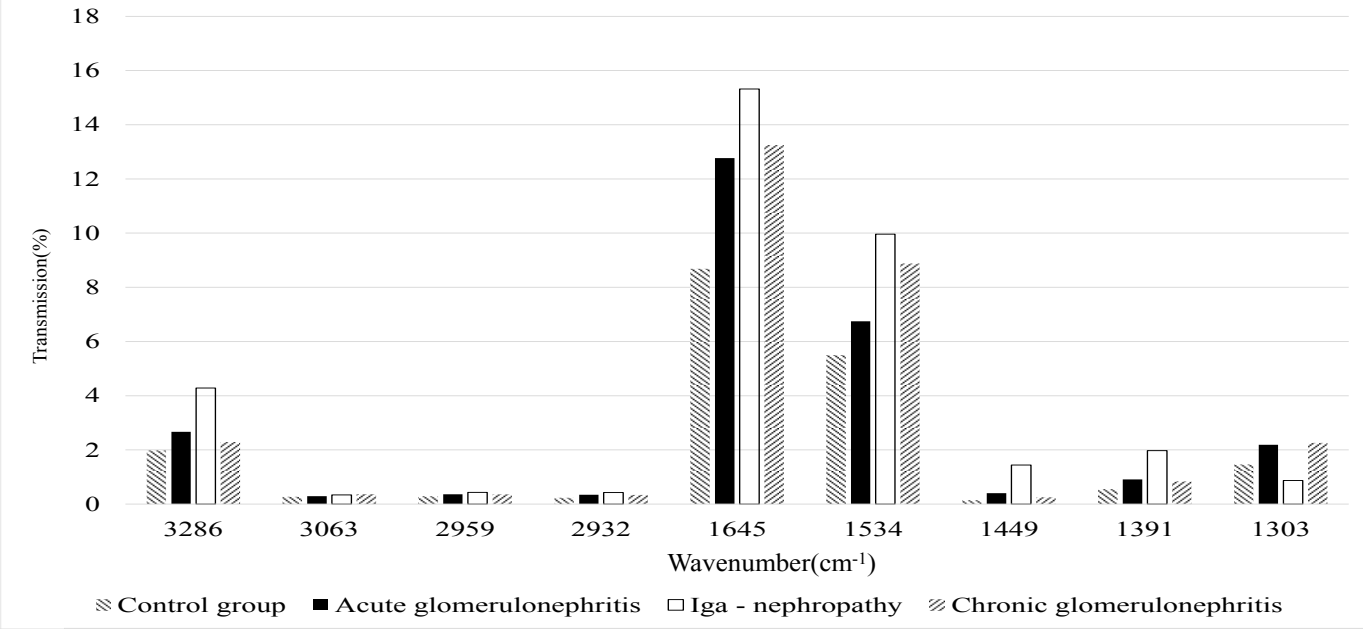

Fig.4. Histogram of comparison of peaks of intensity of spectra for various types of nephropathies with hematuria syndrome with control group

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