DIFFUSE LUNG DISEASE: A CASE REPORT

[1,2]Barabadze K., [1,2]Nishnianidze L., [3]Adamia N., [1,2]Todua M., [1,2]Shervashidze M.

[1]Tbilisi State University, Department of General Pediatrics;
[2]Ingorokva High Medical Technology University Clinic; [3]Tbilisi State Medical University Georgia

Diffuse lung disease (DLD) consists of a diverse group of acute and chronic disorders that involve pulmonary parenchyma. These disorders are classified together because they share common characteristics of clinical, radiographic, physiologic and pathologic manifestations [1]. A definitive diagnosis cannot be made based only on a chest X-ray. DLD is hard to differentiate from bacterial lung diseases, such as pneumonia and tuberculosis, which frequently result in incorrect treatment, disease progression and poor outcome. All of the above factors emphasize the importance of the issue of differential diagnosis [1,2].

Professionals especially pay attention to idiopathic forms of diffuse lung disease that are characterized by severe clinical course and poor prognosis due to progressive fibrous processes. Idiopathic interstitial lung disease presents with severe respiratory distress, progressive, chronic course, symptoms such as tachypnea, retractions, cough, failure to thrive, exercise intolerance, shortness of breath, gastroesophageal reflux and other nonspecific symptoms. Lots of other diseases possess similar clinical presentations, that make the differential diagnosis difficult. The right method of approach is to rule out more common conditions, such as infectious diseases of lungs, structural abnormalities of the respiratory airway, immunodeficiencies, congenital heart diseases, cystic fibrosis. Thus, DLD is a diagnostic challenge for pediatricians and pulmonologists [1,2],

Epidemiology: Diffuse lung disease is a rare condition. Low prevalence may also be due to undefined diagnostic algorithm. A study in Germany revealed 1.32 cases per million children ≤16 years of age (excluding patients with systemic diseases - autoimmune and immunodeficiency) [13]. A study in the UK and Ireland revealed 3.6 cases per million children (including only those patients diagnosed by lung biopsy, may not include mild cases) [12]. Other studies showed that the disease is more common among boys than girls under the age of two [2 9,11,12].

A prospective study in France revealed 205 new cases during three years, indicating that prevalence may be increased in targeted identification of new cases [7,10].

The term childhood interstitial lung disease (chILD) refers to a heterogeneous group of rare diseases that diffusely affect the lungs. ChILD specific to children younger than 2 years of age include diffuse developmental disorders, growth abnormalities, specific conditions of undefined etiology (neuroendocrine cell hyperplasia of infancy and pulmonary interstitial glycogenosis) and surfactant protein disorders. Clinical manifestations are highly variable, ranging from the absence of relevant symptoms to a severe onset [2].

There is no statistical data about children with diffuse lung diseases in Georgia.

The authors present a case report of a Georgian child with DLD. The purpose of the work was to demonstrate that an early-stage diagnosis of the interstitial lung disease would allow the establishment of the proper treatment course and as a result, increase life expectancy and quality in patients with this disorder.

Case report. The patient was admitted to the hospital on 03.07.2021, and discharged on 06.08.2021

A 4-month old male infant (5.5 kg) presented with subfebrile temperature, (37.9*), coryza, paroxysmal productive cough. Treated symptomatically at home with 0.9% sodium chloride inhalation, the condition has worsened, cough intensified, the patient was not able to effectively evacuate the sputum. The patient had difficulty breathing and an increased respiration rate.

At the time of admission patient's general condition was severe due to acute respiratory failure. T-36.8*C, HR-184, RR-78, SpO2-88%. Clinical severity was mainly due to intensive upper respiratory symptoms, productive paroxysmal cough, thick bronchial secretion, shallow breathing, tachypnea, tachycardia, expiratory-inspiratory dyspnea, labored breathing, retractions, nasal flaring, low oxygen saturation, required consistent oxygen therapy. The skin was pale, mild cyanosis was present, with mildly muffled heart sounds. Peripheral pulse was rhythmic, synchronized with the second wrist and heartbeat. Lungs auscultation revealed diffuse rhonchi, rales, and crepitation in the right middle lobe. The patient exhibited decreased appetite, flatulence, diarrhea, decreased diuresis due to exsiccosis. At admission the patient was conscious, adequately responded to stimuli, anterior fontanelle 1.5X1.5cm, non-pulsatile. Meningeal signs were absent.

The patient was diagnosed with acute respiratory failure J96.0; Pneumonia, unspecified organism J18.9; Bronchospasm.

During the treatment course, patient's condition remained severe, acute respiratory failure persisted, the patient still required oxygenation, feeding via nasogastric tube.

Lab findings: CBC - normal, CRP-4.36g/L, SARS-CoV-2 Ag (-) negative, respiratory acidosis, high lactate level - 3.07mmol/L, Hypoproteinemia - 50g/L, Increased AST - 89 U/l, stool culture did not reveal GI infection.

Radiology findings: Chest-X-Ray revealed parahilar infiltrate in the right middle lobe.

12.07.21 Because of the prolonged respiratory failure and presence of a large amount of bronchial secretion CT scan without contrast was performed and revealed

tracheal stenosis and changes consistent with interstitial pneumonia. Due to the mild degree of tracheal stenosis, thoracic surgeons did not consider performing an invasive procedure.

20.07.2021 repeated lab findings revealed respiratory acidosis pH-7.279, pCO2-55.8 mmHg.

22.07.21 Because of the prolonged respiratory failure and increased amount of bronchial secretion despite the treatment repeated CT scan with contrast was performed. The results revealed central and peripheral parenchymal involvement, interlobar and intralobular septae, mosaic attenuation. Peribronchovasal mildly intensive infiltrative changes. Thickening of the right upper interlobar pleura, linear fibroatelectasis on the same side (Fig.).

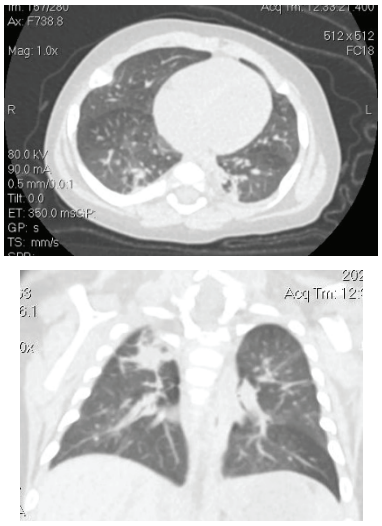

Fig. CT scan with contrast dated 22.07.21

Sputum culture revealed Acinetobacter Baumanii.

Genetic testing did not reveal cystic fibrosis. Lactose intolerance was revealed.

Echocardioscopy revealed the presence of a foramen ovale. ECG showed sinus tachycardia, non-specific ST-segment changes, a horizontal electrical axis of the heart.

Based on the clinical and laboratory studies (especially CT scan results which is the gold standard for this diagnosis), a diagnosis of diffuse lung disease was made. Treatment was carried out according to the existed evidence (Symptomatic treatment, oxygen therapy, antimicrobial therapy, glucocorticoids, nutritional support)

Patient history also supports the main diagnosis: patient was born to a mother G2P1 (Gravida 2, para 1; the first pregnancy ended with spontaneous abortion with unknown reason) by cesarean delivery, at the gestation age of 36 weeks, with asphyxia, birth weight: 2200g, length 47cm, head circumference 32 cm, thorax circumference 31 cm, Apgar score – 7/7.

Neonate had tachypnea after birth, RR-68, nasal flaring, retractions, desaturation, accessory muscles were participating in breathing, SpO2-79%. The newborn required respiratory support and was placed and treated in NICU for 20 days. The patient was on ventilatory support for 10 days.

Diagnosis:

P22.8 Other respiratory distress of newborn

P39.9 Infection specific to the perinatal period, unspecified

Concomitant medical conditions:

P52.0 Intraventricular (nontraumatic) hemorrhage, grade 1, of newborn

P92.2 Slow feeding of newborn

Q21.1. Atrial septal defect

P07.3 Preterm [premature] newborn [other]

P07.1 Other low birth weight newborn

At the age of 3 months, 10.06.21-21.06.21 the patient was again admitted to a hospital with acute bronchiolitis and severe respiratory distress and was transferred into PICU. 12 days after discharge from the hospital he was admitted to the pediatric intensive care unit of our hospital in relapsed severe condition with the same signs and symptoms. Family history: patient`s aunt had died in infancy with bronchopulmonary failure; the exact diagnosis was not known.

Diffuse lung disease consists of a group of disorders that damage the lung parenchyma and interfere with normal gas exchange [2]. In children and infants it presents with severe respiratory abnormalities, progressive, chronic clinical course; symptoms: tachypnea, hypoxemia, retractions, cough, developmental disorder, failure to thrive, dyspnea, gastroesophageal reflux and other non-specific symptoms [1,2]. These signs and symptoms were presented in our patient as well. The spectrum of differential diagnosis of this disorder in pediatric patients is very vast. Initially, with the presence of these symptoms, numerous common diseases must be ruled out: infectious diseases, immune deficiencies, respiratory tract structural anomalies, congenital heart abnormalities, and cystic fibrosis. In the presented case we have ruled out these diseases. Only mild degree tracheal stenosis was revealed, which, by consultation with thoracic surgeons, was not considered an indication for invasive therapy. This degree of tracheal stenosis did not induce the severity of the disease in our patient. After excluding the common diseases, based on the symptoms and existence of diffuse lung infiltrates, a preliminary diagnosis of interstitial lung disease was made. It requires performing additional tests to determine the cause [5,6].

Making the exact diagnosis is important for predicting the outcome, genetic consultation of the parents, and in some cases for changing the treatment course [1,2,6,10].

However, treatment for many forms of ILD is limited and includes the medication, the effectiveness of which is not entirely proven and some may have significant side effects [9,12].

Interstitial lung disease must be considered in every neonate who presents with unexplained respiratory distress or neonates/children who have consistent tachypnea, crackles, hypoxemia, chronic cough, or clubbing of the fingers. [6,7,9]. Most of these symptoms were presented in our patient. ILD is also suspected in premature infants

born with chronic lung disease, which is inconsistent with prematurity and is not associated with other concomitant abnormalities. In our case, the patient was born prematurely at the gestational age of 36 weeks with the diagnosis: P22.8 Other respiratory distress of newborn; P07.3 Preterm [premature] newborn [other].

Another common presentation of this disease is the tachypneic child in the first months of life who is hospitalized with acute viral respiratory illness and the disease clinical course is more severe than expected (respiratory distress, hypercapnia, resistant hypoxemia), poor feeding, poor weight gain, gastroesophageal reflux, etc…Our patient's extensive history raised suspicions for ILD, and consequent work-up has proved the diagnosis.

Many of these children also have unexplained lung infiltrates on imaging. Older children present with exercise intolerance and clubbing of the fingers [2,4,11]. Most of these symptoms were present in our patient.

According to some definitions, the persistence of the symptoms may last for about 3 months, as was in the case with our patient.

An approach, similar to one taken by us in the presented cases would allow excluding more common diseases with similar symptoms but fails to reveal some forms of the disease in neonates who are in need of immediate intervention. For older children, if symptoms are persistent, severe and unexplained, it is not necessary to wait for 3 months to establish this diagnosis [2,8,11].

Diagnostic approach: diagnostic tests are used to determine the existence of the underlying disease, determining the disease spreading and severity and assessment of primary diffuse pulmonary disease, when possible. The most important diagnostic approach is collecting the patient's history, and physical examination, which is followed by noninvasive tests and invasive tests if necessary. Genetic testing may eliminate the need for invasive tests such as lung biopsy and therefore have to be considered if the clinical presentation is consistent with this diagnosis. It is not always possible to identify the specific disorder even after a thorough clinical evaluation [1-4,6,8].

Patient history must consider symptoms of possible restrictive lung disease and its duration. Symptoms include tachypnea, dyspnea, retractions, exercise intolerance, and/or dry cough. These symptoms, although, are neither specific nor sensitive for ILD.

Studies by a specific group of European Respiratory Society Task Force (ERSTF) revealed the three most common symptoms of ILD: cough (78% in all age groups, 73% under 2 years of age), tachypnea/dyspnea (76% in all age groups, 84% under 2 years of age), difficulty to gain weight (37% in all age groups, 62% under 2 years of age) and fever (20% in all age groups, 29% under 2 years of age). More than 25% of children with ILD have pulmonary hypertension at the beginning of the disease. 10% of siblings also present with ILD [9,11,12].

Extrapulmonary manifestations may help narrow the differential diagnosis, especially in older children. Those include specific findings of skin, eyes and fingers, anemia, pancytopenia, lymphadenopathy, arthritis, hepatosplenomegaly. For example, congenital dyskeratosis may be associated with pulmonary fibrosis which is sometimes present in late childhood or early adolescence [2,3].

Congenital dyskeratosis is characterized by a bone marrow hypoplasia or failure, reticular skin pigmentation, fingernail dystrophy, mucous leukoplakia. [2,3].

Laboratory studies include hematologic tests, evaluation of infectious etiologies and immune function tests; serological testing to reveal autoimmune disorders and evaluation for hypersensitive pneumonitis. Blood CBC and biochemistry tests must be conducted in every infant [2,3,5]. A quantitative study of immunoglobulins should be considered in most cases except neonates. Rheumatologic evaluation is usually necessary for older children or children who present with pulmonary hemorrhage.

Genetic testing may avoid the need for more invasive tests such as lung biopsy. Genetic testing is suggested in infants with unexplained acute respiratory distress and in older children with chronic clinical course or family history of ILD, especially if radiologic studies indicate ILD [1,2,5]. Assessment of severity: in cases of DLD assessment of severity is performed with pulmonary function tests and pulse oximetry. In our patient pulse oximetry results were SpO2-88%. ABG may be determined. In our case lab findings revealed respiratory acidosis pH-7.279, pCO2-55.8mmHg.

To evaluate pulmonary hypertension echocardiography and cardiac catheterization are needed. The degree of hypoxemia and pulmonary hypertension determines the severity of the disease.

Nutritional status and growth chart also play a significant role in determining disease severity, especially in infants and young children [2,9,11,12]. In our case, the diagnosis at birth was P07.1 Other low birth weight newborn.

Radiologic diagnostics: chest X-ray is important for diagnosis. It is usually abnormal but rarely specific. Infiltrates are usually interstitial, although maybe alveolar or mixed. The exception is NEHI (neuroendocrine hyperplasia) where a chest X-ray is often normal or shows hyperinflation or peribronchial cuffing. During previous diseases our patient was investigated by chest X-ray, but ILD-specific changes were not seen [1- 3].

High-resolution computed tomography determines disease distribution and severity better than X-ray. Chest CT findings are specific in some forms of DLD and may exclude the necessity for lung biopsy. If a biopsy is needed radiologic findings are useful to determine the surgical sites of biopsy.

Specific CT findings for different forms of DLD include septal thickening, ground-glass opacification, geographic hyperlucency or mosaic attenuation, lung cysts or nodules, and consolidation [1-5].

A high-resolution CT scan was performed in our clinic. The results revealed central and peripheral parenchymal involvement, interlobar and intralobular septae, mosaic

attenuation, peribronchovasal mildly intensive infiltrative changes. Thickening of the right upper interlobar pleura, linear fibroatelectasis on the ILD side.

Treatment is mostly based on the evidence from single cases. In most forms of DLD controlled studies have not been conducted.

Supportive therapy: bronchodilators in case of reversible obstruction, nutritional support, minimal exposure to cigarette smoke and other inhalation irritants, oxygen therapy in hypoxemia, supervised exercise in older children, aggressive treatment of infections, annual influenza vaccinations, RSV prophylaxis [1,2].

Specific treatment exists for some forms of DLD. E.g. antimicrobial treatment for infections, management of dysphagia or reflux in chronic aspiration patients, avoiding the specific causative agent in hypersensitive pneumonitis, whole lung lavage in older children with pulmonary alveolar proteinosis. Granulocyte-macrophage colony-stimulating factor, which is necessary for normal homeostasis of surfactant and may be alternatively used in pulmonary alveolar proteinosis [1-3].

Glucocorticoids are used in some forms of DLD treatment – in cases when inflammation and improper proliferation of cells occur. Glucocorticoids are effective in some cases (maybe <50%) and the outcome depends on the type of DLD.

Glucocorticoids are used because of their anti-inflammatory and antiproliferative features.

If the decision is made to treat the condition with glucocorticoids, monitoring Is recommended for a minimum of 3 months, and a maximum of 6 months which depends on the disease process, a balance between benefits and side effects during the first months of treatment. There are no studies in children with DLD that suggest the dosing or duration of the treatment. Pulse-therapy with I.V. methylprednisolone, 10-30mg/kg/day – max. 1000mg is administered for 1 hour for 3 consecutive days every month or every week. This treatment is chosen over daily oral treatment because of the lesser side effects. For therapy with oral medications, the treatment starts with prednisone (1-2mg/kg/day) or with equivalent glucocorticoid [2,11].

Patients with connective tissue disorder or capillaritis require daily oral treatment with glucocorticoids until the disease is controlled with other immunomodulatory agents and rheumatologic consultation is recommended for the patient.

In case with our patient the treatment was performed according to the existed evidence (symptomatic treatment, oxygen therapy, antimicrobial therapy, glucocorticoids, nutritional support).

Monitoring: patient should carefully be reevaluated and treatment must continue if there is evidence of benefit, which is indicated by relief of symptoms, improved oxygenation, increased exercise tolerance, improved pulmonary function tests, improvement in radiological studies (revealed later). If glucocorticoid therapy continues, a minimal effective dose should be chosen. Glucocorticoid therapy in infants must be considered with caution because of the side effects on neuromotor and cognitive development. Monitoring the side effects is essential which includes assessing growth, nutritional status, bone density, hypertension, etc… [7,8,12].

As a result of one month-long symptomatic and glucocorticoid treatment at our clinic, the patient was stabilized and discharged home with the abovementioned treatment and regular follow-up monitoring.

Other medications: if glucocorticoids are ineffective or severe side effects are revealed, other immunosuppressive agents may be considered, although their effectiveness are not proven. In these cases additional medication is started and the dose of glucocorticoids is lowered.

Hydroxychloroquine (6-10 mg/kg/day) is used most often as empiric or steroid-free therapy.

Some physicians use cyclophosphamide, mycophenolate mofetil and azathioprine instead of hydroxychloroquine. Methotrexate, cyclosporine and high-dose intravenous immunoglobulin are also used. These therapies are used in case of DLD associated with connective tissue disorder, capillaritis or other severe and progressive disorders that are characterized by severe inflammatory processes [1-3].

Lung transplantation is considered in children who are refractive to treatment. Timely surgical intervention may improve outcome. Survival rate in these patients is the same as in the population with lung transplants due to any other cause – about 50% 5-year survival. DLD recurrence after lung transplantation has not been reported [2,9,10].

Prognosis depends on the causative/underlying disease. At the initial assessment, symptoms duration, weight below 5th percentile, crackles, clubbing of the fingers, and family history of DLD are not associated with decreased survival rate. On the contrary, hypoxemia and pulmonary hypertension (an indicator of severity) is tightly associated with decreased survival rate [5,10,12].

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SUMMARY

DIFFUSE LUNG DISEASE: A CASE REPORT

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[1]Tbilisi State University, Department of General Pediatrics; [2]Ingorokva High Medical Technology University Clinic; [3]Tbilisi State Medical University Georgia

The purpose of the work was to demonstrate that an early stage diagnosis of the interstitial lung disease would allow establishing the proper treatment course and as a result, increase life expectancy and quality in patients with this disorder.

More than 200 acute and chronic conditions with inflammatory and fibroproliperative changes comprise the group of diffuse lung diseases. Definitive diagnosis cannot be made based on chest X-ray only. Diffuse lung disease (DLD) is difficult to differentiate from bacterial lung diseases, such as pneumonia and tuberculosis, which frequently results in incorrect treatment, disease progression and poor outcome. All of the these factors emphasize the importance of the issue of differential diagnosis. Professionals especially pay attention to idiopathic forms of diffuse lung disease, which is characterized with severe clinical course and poor prognosis due to progressive fibrous processes. The right method of approach is to rule out more common conditions, such as infectious diseases of lungs, structural abnormalities of the respiratory airway, immune deficiencies, congenital heart diseases, cystic fibrosis. Thus, DLD is a diagnostic challenge for pediatricians and pulmonologists.

Article presents the case report of 4-month old infant with DLD that was analyzed according to the diagnostic and management approach. It includes anamnesis, clinical and diagnostic criteria of the disease, established by multiple studies, different methods of treatment, outcome and recommendations.

Keywords: diffuse lung disease, infants.

РЕЗЮМЕ

ДИФФУЗНОЕ ЗАБОЛЕВАНИЕ ЛЕГКИХ (СЛУЧАЙ ИЗ ПРАКТИКИ)

[1,2]Барабадзе К.А., [1,2]Нишнианидзе Л.М., [3]Адамия Н.А., [1,2]Тодуа М.В., [1,2]Шервашидзе М.Р.

[1]Тбилисский государственный университет, кафедра общей педиатрии; [2]Клиника Ингороква высоких медицинских технологий; [3]Тбилисский государственный медицинский университет, Грузия

Представлен клинический случай диффузного заболевания легких, который проанализирован в соответствии с диагностическим и лечебным подходом. Он включает анамнез, клинико-диагностические критерии заболевания, установленные многочисленными исследованиями, различные методы лечения.

Целью исследования явилась диагностика интерстициального заболевания легких на ранней стадии, постановка правильного диагноза и выбор адекватной тактики лечения и как следствие, увеличение продолжительности и качества жизни пациентов.

По данным литературы, более 200 острых и хронических состояний с воспалительными и фиброзирующими изменениями в легких составляют группу диффузных заболеваний легких (ДЗЛ). Особое внимание уделяется идиопатическим формам диффузного заболевания легких, которые ввиду прогрессирования

процессов характеризуются тяжелым течением и неблагоприятным исходом. ДЗЛ является диагностической проблемой для профессиональных педиатров и пульмонологов. В каждом отдельном случае, с целью выбора правильной тактики лечения необходимо тщательное проведение дифференциальной диагностики с применением многосторонних методов обследования, исключение наиболее частых патологий, таких как инфекционные заболевания легких (пневмония, туберкулез), структурные аномалии дыхательных путей, иммунодефицитные состояния, врожденные аномалии сердца, муковицидоз.

რეზიუმე

ფილტვის ინტერსტიციული დაავადება - კლინიკური შემთხვევის დემონსტრირება

[1,2]ქ. ბარაბაძე, [1,2]ლ. ნიშნიანიძე, [1,2]ნ. ადამია, [3]მ. თოდუა, [1,2]მ. შერვაშიძე

[1]თბილისის სახელმწიფო უნივერსიტეტის ზოგადი პედიატრიის კათედრა;
[2]ინგოროყვას მაღალი სამედიცინო ტექნოლოგიების საუნივერსიტეტო კლინიკა;
[3]თბილისის სახელმწიფო სამედიცინო უნივერსიტეტი, საქართველო

შრომის მიზანს წარმოადგენდა ბავშვთა ასაკში ფილტვის ინტერსტიციული დაავადების ადრეულ სტადიაში გამოვლენა, მათი სწორი დიაგნოსტირება, მკურნალობის ტაქტიკის ჩამოყალიბება და შედეგად სიცოცხლის ხანგრძლივობის, ხარისხის გაუმჯობესება.

ფილტვის ინტერსტიციულ დაავადებათა ჯგუფში ერთიანდება 200-ზე მეტი მწვავე და ქრონიკული დაავადება ანთებითი და ფიბროპროლიფერაციული ცვლილებებით. მათი დიაგნოსტირება რთულია და ვერ ხერხდება რენტგენოლოგიური მონაცემების საფუძველზე. რთულია მათი გარჩევა ფილტვის ბაქტერიული დაავადებებისგან, განსაკუთრებით პნევმონიებისა და ტუბერკულოზისგან, რაც ხშირად განაპირობებს არასწორ მკურნალობას, დაავადების პროგრესირებას და სავალალო გამოსავალს.

სტატიაში წარმოდგენილია კლინიკური შემთხვევა, რომლის ანალიზი მოხდა ლიტერატურაში არსებული დიაგნოსტიკური და დაავადების მართვის კრიტერიუმების საფუძველზე. სტატიაში დეტალურად განხილულია სხვადასხვა კლინიკური კვლევების შედეგების საფუძველზე ჩამოყალიბებული დაავადების ძირითადი დამახასიათებელი ანამნეზური, კლინიკური და დიაგნოსტიკური კრიტერიუმები. წარმოდგენილია დაავადების მკურნალობის სხვადასხვა სქემა.

PRESENCE OF PRENATAL MATERNAL STRESS INCREASES THE RISK OF THE DEVELOPMENT OF ADHD SYMPTOMS IN YOUNG CHILDREN

[1]Kacharava T., [1]Nemsadze K., [2]Inasaridze K.

[1]David Tvildiani Medical University; [2]Laboratory of Behavior and Cognitive Functions, Iv. Beritashvili Center of Experimental Biomedicine, Tbilisi, Georgia

Attention deficit hyperactivity disorder (ADHD) is a common neurodevelopmental disorder, with a prevalence of around 7.2% in children [1]. ADHD is characterized by symptoms of inattention, hyperactivity and impulsivity, and is associated with psychosocial impairment, poor academic functioning and psychiatric problems in children and adolescents [2]. Twin studies have shown that ADHD is highly heritable, but 10-40% of the variance in liability is explained by environmental influences [3]. In addition, the heritability estimate may include unknown amounts of environmental influences due to gene-environment interaction, and it is important to identify environmental risk