

REHABILITATION OF CHILDREN WITH NEPHROLITHIASIS ASSESSMENT OF THE RESPIRATORY FUNCTION IN CHILDREN WITH AMBILATERAL UROLITHIASIS IN COMBINATION WITH CHRONIC KIDNEY FAILURE

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RELEVANCE

The development of a chronic inflammatory process in the kidneys is a serious medical and social problem since it may lead to disability of the affected children. The inflammation caused by pyelonephritis seems to be limited to one single organ: the kidney. The results of our research prove that every disease, even at an early stage, does damage to various body functions such as the respiratory function. An early discovery of these disorders is of great importance for the choice of a specific treatment and the prognosis of the course of the disease [1,3,4]. Chronic renal failure that develops as a result of nephrolithiasis and can be detected in a complex set of clinical manifestations that are caused by changes of the organs in the human body [5]. Damage of the respiratory system of patients with nephrolithiasis is not sufficiently discussed in literature. Therefore, a detailed study of respiratory function and blood circuit of these patients is required for making a correct diagnosis, choice of appropriate analgetics, prevention of various intra- and postoperative complications and, in first place, detection of existing functional resources and the development and prescription of appropriate medication [1,2,4].

A significant part of the contemporary anesthetic practice is the applied physiology of respiration. Therefore the effect of the most common inhalational anesthetics depends on its absorption and elimination in the lungs. The main side effects of these anesthetics are associated with the process of breathing. Muscle relaxants, the unfamiliar position on the operating table and some special factors have a profound influence on the patient's breathing process [1,2,3,4].

Purpose of the study. Determine the most significant sources of irritation of the breathing process of children with ambilateral nephrolithiasis in combination with chronic kidney failure.

MATERIAL AND METHODS

Analyzed were the results of the examination and treatment of 187 children suffering from nephrolithiasis at the age of six months to 18 years. There were 38 (20%) patients at the age of six months to six years, 4-7 years – 54 (28%), 8-11 years – 57 (31%) and 12-18 years – 40 (20%). 128 (68.5%) of them were male and the rest, 59 (31.5%) were females. In 116 (62.2%) cases one side of the kidney was affected, both sides in 47 (24.8%) cases and 24 (13%) of the children had numerous kidneystones.

Single stones were found in 126 (67.4%) children and accumulations in 51 (32.6%). Each patient suffered from chronic calculous pyelonephritis (CP) and 35 (18.8%) of them were at an advanced stage. 44 (23.5%) patients had CP in stage I, 80 (42.8%) in stage II and 63 (33.7%) in stage III. In addition to this hydronephrosis was observed in 64 (32.4%) cases and 78 (41.7%) children out of 187 suffered from chronic kidney failure (CKF). 26 (33.3%) of these patients were in stage I, 35 (44.91%) in stage II and 17 (21.79%) in stage III. The respiratory function of 63 patients was analyzed.

To evaluate the respiratory function (RF), spirometry — (“Metatest-2”, “Cosmed”) was employed, the blood gases determined by oximetry, pulmonary shunt – capnography and the oxygen method, hypocoagulation and the detoxificational function of the lungs (biochemical analysis of the blood flowing to and out of the lungs), central and pulmonary hemodynamics (through impedance and doppler pneumography).

The results of the study were evaluated in accordance with the modern standards of evidence-based medicine. The obtained data was worked on with the method of varying statistics with calculation of the mean (M), error ($\pm m$) and evaluation of the reliability of the data ($P \geq$). The data was collected and processed with MS Excel (Ver.5.0.).

RESULTS AND DISCUSSION

In order to assess the disfunction of the lungs of patients suffering from ambilateral nephrolithiasis worsened by chronic renal failure we observed the respiratory function (RF) of 67 out of 187 patients at the age of six to 18 years. According to the obtained data, 56 out of 67 patients suffered from inadequate alveolar ventilation (IAV). IAV stage I was detected in 16 (28.59%) cases, stage II in 29 (51.81%) and stage III in 11 (19.6%) cases out of 56. The IAV was handicapping for 12 (21.43%) patients, limiting for 27 (48.21%) and with both impacts on the patient in 17 (30.36%) cases. Especially often IAV was found in patients with numerous stones on both sides of the kidney, ambilateral CP and CKF. IAV was detected concurrently with CP stage I and II. 11 (16.42%) of the patients suffered from an acute handicapping course of the disease. Every patient suffering from IAV was also diagnosed with stage II or III of hydronephrotical kidney transformations and signs of chronic intoxication (lag in physical development, anemia, fatigue, loss of appetite).

The stage I of IAV caused the tidal volume (TV), lung capacity (LC), respiratory minute volume (RMV), maximum voluntary ventilation (MV), indicators of pneumotachometry (IP) and the forced expiratory volume (FEV) to decrease to 70–80% of the standard values.

The effectiveness of the pulmonary ventilation as well as the accordance of the values of ventilation and volume of the pulmonary blood flow (ventilation-perfusion ratio) is assessed by the changes in the oxygen utilization (uO_2). The decline of the uO_2 rate indicates the dominance of the ventilation over the blood flow and its increase may be a sign of a lack of alveolar ventilation in relation to the pulmonary circulation. The decrease of uO_2 was observed in 21 (31.35%) cases, which shows the dominance of alveolar ventilation in relation to the pulmonary circulation. The decline of uO_2 was observed in 38 patients with CKF, which is associated with spasms or the contamination of the pulmonary capillaries with toxic metabolites of the organism. 24 (35.82%) patients suffering from CP in stage II and III had an increase in the uO_2 rate indicating a lack of alveolar ventilation in relation to the pulmonary circulation. These patients were also having latent bronchospasm which is associated with the contamination of the alveolar walls and the bronchioles through the toxic substances in the lungs.

31 (46.27%) out of 67 patients had a decreased oxygen intake (iO_2). These changes (decrease of the value $23 \pm 1.3\%$ in comparison to the standard) were detected in children with stage II or III of IAV and characterize respiratory failure with decreased respiratory resources.

Berotec and pneumotachometry were prescribed to patients with CKF and ambilateral CP to detect latent bronchospasm, which 25 (37.32%) patients were suffering from.

Normally, the lung volume and capacity values vary up to $\pm 20\%$.

Thus, 56.6% of the patients with ambilateral nephrolithiasis worsened by chronic kidney failure were

Table 1. Respiratory failure due to lack of ventilation of children suffering from ambilateral nephrolithiasis worsened by chronic renal failure.

Type of kidney disease, stage CP, CKF	Respiratory insufficiency								
	Handicapping type			Restrictive type			Mixed type		
	stage			stage			stage		
	I	II	III	I	II	III	I	II	III
CP I stage		2			2	1	1		1
CP II stage		1		1				2	
CP III stage	1		1	3		3		3	
CKF I stage		1			3	2	2		2
CKF II stage		3			4	2		2	
CKF III stage		1	2		6			1	3

Stage II of IAV decreased the previously mentioned parameters to 60–70% and stage III to less than 60%.

proved to have varying degrees of respiratory failure that depend on the stage of CP and CKF. It should be

noted that these children did not show clinical manifestations of respiratory disorders.

Therefore, analyzing the respiratory function of patients with ambilateral nephrolithiasis worsened by chronic kidney failure plays an essential role in the preoperative preparation, choice of the method of pain relief and prevention of intra- and postoperative complications.

CONCLUSIONS

1. Monitoring and appropriately assessing respiratory dysfunctions of children with chronic kidney failure supports a sufficiently early mending of the dysfunctions and leads to a decrease of complications in the intra- and postoperative period.
2. Complex examinations of patients with CKF allows to detect clinical manifestations of latent bronchospasm and, based on the identified transformations, conduct preoperative preparations.

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