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CONTENT

Doroshko V.A., Sokol V.V., Fedoriuk O.V., Fedoriak I.M.	
INFLUENCE DE HOMONES SEXUELLES SUR LA DISREGULATION POSTISCHEMIQUE DE L'HOMOSTOSTASE ANTIOXIDANE- PROOXIDANTE DANS DES STRUCTURES CEREBRALES DE RATS DE DIFFÉRENTS ÂGES.....	5
Olena Dulo, Larisa Lyachovets, Oleksandr Suran	
KINESIOTHERAPY OF POST – STROKE PATIENTS DURING THE STATIONARY PERIOD OF REHABILITATION	11
Hlazunov O.A., Hruzdeva A.O., Stepanova S.V.	
INTRODUCTION OF INNOVATIONS TO ENSURE THE QUALITY OF POSTGRADUATE MEDICAL EDUCATION	17
Olesia Hlukhanych	
POLYCULTURE PHENOMENON OF THE TRANSCARPATHIAN COMPOSERS' CREATIONS	23
Inna Horbatiuk? Iryna Horbatiuk	
DISTANCE LEARNING THROUGH THE EYES OF MEDICAL STUDENTS OF THE 6TH COURSE OF BUKOVINIAN STATE MEDICAL UNIVERSITY	30
Myroslava Hromovchuk	
EUTHANASIA AND BIOETHICS: THEORETICAL ASPECT	34
Kovpak A.V.	
CHANGE INDICATORS OF FIBRINOLYSIS AND PROTEOLYSIS IN SPONTANEOUS HYPERTENSIVE RATS IN TREATMENT WITH RAMIPRIL	41
Kovpak A.V.	
«INFLUENCE OF CANDESARTAN ON THE ACTIVITY OF FREE RADICAL LIPID PEROXIDATION IN RATS WITH CONGENITAL ARTERIAL HYPERTENSION»	46
Lyakh O.I, Tovt- Korshynska M.I., Derbak M.A.	
THE DISEASES OF THE DIGESTIVE SYSTEM AMONG COMCOMINANT PATHOLOGY OF THE PATIENTS WITH CHRONIC OBSTRUCTIVE PULMONARY DISEASE	53
Lysenko V. A., Syvolap V. V., Potapenko M. S.	
THE LEVEL OF KIM-1 IN URINE AND CHANGES IN STRUCTURAL-GEOMETRIC AND FUNCTIONAL PARAMETERS OF THE HEART IN PATIENTS WITH CHF OF ISCHEMIC ORIGIN.....	59
Matviykyiv Taras Igorovych, Rozhko Mykola Myhailovych, Gerelyuk Vitaliy Ivanovych	
THE PERIODONTAL STATUS AND ANALYSIS OF THE MEDICAL PROTOCOL TREATMENT OF THE COMPLICATED COURSE OF CORONAVIRUS DISEASE IN PERIODONTAL PATIENTS.....	67

Bohdan Pelekhan, Mykola Rozhko, Lyubomyr Pelekhan

IRRATIONAL PROSTHODONTIC TREATMENT AS AN ETIOLOGICAL FACTOR IN THE NEED FOR PRIMARY TREATMENT OF COMPLETE ABSENT DENTITION ON THE •LOWER JAW 72

Piddubna A.A., Makoviichuk K.Y.

PRINCIPLES OF RESPECT AND JUSTICE IN THE RELATIONSHIP BETWEEN MEDICAL STUDENTS AND THE PATIENT 78

Volodymyr (Ivanovych) Trishch, Andriy (Ivanovych) Mysak

EFFICIENCY OF TRANSURETHRAL RADIO FREQUENCY PROSTATE THERMOTHERAPY IN PATIENTS WITH CHRONIC NONBACTERIAL PROSTATITIS 83

Trishyna Viktoriia, Gulyaev Vitaliy Mikhailovich

EFFECT OF BIOLOGICALLY ACTIVE ADDITIVES AND CAROTENOIDS OF NATURAL ORIGIN IN THE DIET OF BROILER CHICKENS ON BLOOD BIOCHEMICAL PARAMETERS..... 89

Zeleniuk O.

DIFFERENTIAL DIAGNOSIS OF FUNCTIONAL AND ORGANIC DISORDERS IN PATIENTS WITH EXTRAHEPATIC CHOLESTASIS 93

Byelov Dmytro

LEGAL EDUCATION IN UKRAINE: ISSUES OF GAINING PRACTICAL EXPERIENCE BY STUDENTS 101

O.Ya. Bilynskyi, Ye.Ya. Kostenko

COMPARATIVE ANALYSIS OF THE DENTAL STATUS OF MONOZYGOTIC AND DIZYGOTIC TWINS..... 104

Konoplitskyi V.S. Shavliuk R.V. Shavliuk V.M. Kyrychenko O.P.

WIDERSPRUCH ZUM PROBLEM DER ANGEBORENEN UND ERWORBENEN ÄTIOLOGIE DER PILONIDALE KRANKHEIT BEI KINDERN..... 110

Konoplitskyi Viktor, Korobko Yuri

IMPROVING THE EFFICIENCY OF DIAGNOSIS OF ACUTE APPENDICITIS IN FEMALE CHILDREN THROUGH THE USE OF ANAL MANOMETRY AND TOTAL INDEX OF ENDOGENOUS INTOXICATION 119

Konoplitskyi Viktor, Pasichnyk Oleh

SUTURING OF POSTOPERATIVE WOUNDS IN CHILDREN WITH DIFFERENT THICKNESS OF SUBCUTANEOUS FAT AS ONE OF THE MOMENTS OF IMPROVING THE QUALITY OF SURGERICAL TREATMENT 125

Kostenko Yevhen, Kostenko Svitlana, Stetsyk Mariia Pirchak Ilya

THE EFFECT OF LONG-TERM IONIZING RADIATION ON ORGANS AND SYSTEMS OF THE HUMAN BODY 131

Myronyuk Ivan, Bilak-Lukianchuk Viktoria, Slabkyi Gennadiy

ON THE ISSUE OF METHODOLOGICAL AND PEDAGOGICAL BASIS OF TEACHING PUBLIC HEALTH MASTERS THE SUBJECT "ORGANIZATION AND PRESENTATION OF SCIENTIFIC RESEARCH" 137

IMPROVING THE EFFICIENCY OF DIAGNOSIS OF ACUTE APPENDICITIS IN FEMALE CHILDREN THROUGH THE USE OF ANAL MANOMETRY AND TOTAL INDEX OF ENDOGENOUS INTOXICATION

Konoplitskyi Viktor,

head of the Department of children surgery National Pirogov Memorial Medical University, Vinnytsia, Ukraine; doctor of Medical Science, Full professor; orcid.org/0000-0001-9525-1547; lundqist747@gmail.com.

Korobko Yurii,

assistant lecturer of the of the department of children surgery National Pirogov Memorial Medical University, Vinnytsia, Ukraine; orcid.org/0000-0002-3299-878X; lundqist747@gmail.com.

Summary. The aim of the study was to increase the efficiency of the diagnostic process in children with abdominal pain by using anal manometry and the total index of endogenous intoxication.

Research methods. 400 female patients with abdominal pain aged 3 to 17 years, on the basis of Vinnytsia Children's Regional Clinical Hospital (Ukraine), were involved in the analysis of endogenous intoxication and anal pressure.

Results. The study showed a clear proportional increase in the values of anal pressure and total index of endogenous intoxication in accordance with the extent of the inflammatory process in the abdominal cavity due to acute appendicitis.

Conclusions. Having conducted a clinical study, which involved measuring the anal pressure of the sphincters in various pathologies of the abdominal cavity and pelvic organs, we can say about the feasibility of using this technique in the clinical practice of surgeons. The above method demonstrates a fairly high informativeness. Therefore, it can be used as an additional element of diagnosis in complex clinical cases, especially in girls with overweight, cases with atypical location of the appendix, and atypical course of the disease. This method clearly demonstrates the dependence of the tone of the rectal sphincters with the degree of spread of the inflammatory process in the abdominal cavity and pelvic cavity. An new approach to the interpretation of endogenous intoxication according to general blood analysis based on the value of the total index of endogenous intoxication allows to assess the severity of endotoxiosis, based on which it is possible to predict the form of pathology and timely choose the necessary treatment tactics. Exceeding the value of the proposed total index of endogenous intoxication of the body more than twice indicates the child has the level of endotoxiosis characteristic of destructive forms of acute appendicitis, exceeding the index more than 2.5 times indicates a possible complicated pathology in the form of peritonitis. The introduction of the

developed total index of endogenous intoxication in the algorithm of acute appendicitis will improve the results of early diagnosis and predict the form of pathology and its nature in children.

Key words: children, acute appendicitis, diagnosis.

Topicality. Acute appendicitis is one of the most common acute surgical diseases of the abdominal cavity in children. About 65–75% of surgical interventions in children account for acute appendicitis, which is due to the peculiarities of functional and morphological processes of the child's body, the rapid development of destructive processes [2,3,5,6].

The problem of early diagnosis of acute appendicitis in children of different ages remains one of the most pressing in the provision of emergency surgery. At the diagnostic stage in determining the main clinical symptoms of acute appendicitis, differential diagnostic signs of concomitant pathology, features of the clinical course, similarity of symptoms, there are usually significant difficulties in diagnosing the inflammatory process of the appendix, which requires auxiliary laboratory and instrumental tests – ultrasound method, computed tomography of the abdominal organs, indicators of which are necessary for pediatric surgeons [1,5,7]. However, even the use of high-tech tools and clinical experience does not always help in the timely recognition of an acute surgical problem.

In patients with acute appendicitis, especially in complicated cases, the presence of endogenous intoxication in the body is of great importance. Determination of integrated indicators of endotoxemia allows to assess the patient's condition without using special research methods, according to the general clinical blood test [4]. The development of a reliable and accessible algorithm for the diagnosis of acute appendicitis, including taking into account the integrated indicators of the hemogram, which would allow in a short time to decide on the feasibility of appendectomy, remains an unsolved problem of pediatric surgery.

The aim of the study was to increase the efficiency of the diagnostic process in children with abdominal pain by using anal manometry and the total index of endogenous intoxication.

Materials and discussion of the study. The study on the measurement of anal pressure included 60 female children who were hospitalized in the surgical departments of the Vinnytsia Regional Children's Clinical Hospital (Ukraine). We examined children of the older age group. The age range of the examined girls was in the range of 3 – 17 years. The main reason for referring medical help were abdominal pain, mainly in the lower abdomen. For anal manometry, patients were divided into three equal groups – 20 children each. The first group consisted of girls who were hospitalized with abdominal pain with suspected acute appendicitis, but during the dynamic observation of acute surgical pathology was excluded. The second group included girls who underwent surgery for acute appendicitis. Girls in this group had no complications in the form of peritonitis. The third group consisted of girls who underwent surgery for acute appendicitis and had peritonitis of varying severity. All patients and their parents had prior informed consent prior to anal manometry after being introduced to the method of anal manometry. Anal manometry was performed immediately after rectal examination, which is mandatory in children with suspected acute appendicitis according to clinical protocols in Ukraine. Anal manometry was performed in the treatment room in the position of the child on his back. The device we developed for anal manometry consisted

of a standardized manometer, to which was attached a cuff made of an intubation tube (tube diameter without cuff 4.5 mm) and a manual supercharger with a clamp to create a constant pressure in the sensitive cuff. All modules of the device were connected by rubber tubes (Fig. 1).



Fig. 1. Device for measuring the tone of the rectal sphincters. The components of the device are: 1- manometer (mm Hg); 2 - sensitive cuff, which is inserted into the rectum; 3 - clamp; 4 - pressure blower.

At the beginning of the procedure, up to 20 mm Hg air was pumped into the circuit of the device by means of a manual supercharger and the lumen of the tube was closed at the level of the clamp to maintain the appropriate constant pressure in the circuit and give the cuff sensitivity by fully straightening. The cuff and anus were then lubricated with a solution of Vaseline to reduce soft tissue resistance and reduce discomfort during the procedure. The procedure was performed without general and local anesthesia, because in the straightened state the diameter of the cuff does not exceed the diameter of an adult's finger and does not cause significant pain. The sensitive cuff was inserted into the rectum to a depth of 3 cm in order to establish it in the lumen of the anal sphincter. Immediately after the introduction of the cuff, the value of the manometer in

millimeters of mercury was recorded. This indicator, the so-called reactive pressure, is an indicator that includes passive sphincter tone, as well as active conscious contraction of the sphincters in response to the cuff. To obtain the second, more important indicator (basal pressure), which takes into account only the passive tension of the sphincter muscles, it is necessary to hold the cuff in the lumen of the sphincter for 60 seconds. It is during this time that the sphincter pressure gets used to the cuff and significantly reduces the element of active tension of the striated muscles of the closing apparatus.

The diagnostic procedure was completed by determining the basal pressure. Measurement of basal pressure is a more important indicator than reactive pressure, because it more objectively reflects the constant tension of the sphincter muscles at rest. It is the basal pressure that reflects the nonspecific reaction of the sphincter apparatus to pain, and hence the inflammatory reaction, in the abdominal cavity and pelvic cavity by the mechanism of the visceromotor reflex arc. After the procedure, the device was cleaned and sanitized by disinfection in an antiseptic solution. After measuring the anal pressure, it was necessary to subtract from each value the value of the pressure that was created to straighten the cuff. That is, from the value that was set during the pressure measurement it was necessary to subtract 20 mm Hg. Statistical processing was performed using the computer program MS Statistica 5.0.

Research results. In the course of our research, the following indicators were identified. In children of the first group, the average value of reactive anal pressure was 59.65 ± 2.11 mm Hg, the average basal pressure was observed at 50.35 ± 2.53 mm Hg. In patients of the second group, the data of sphincterometry were as follows. The average value of the reactive pressure was at the level of 89.1 ± 3.27 mm Hg, after holding the cuff in the lumen of the sphincter, the pressure decreased to its basal level, the average value of which was 70.7 ± 1.94 mm Hg. The highest value of mean anal pressure, compared to the previous two groups, was observed in the third group. The average value of anal pressure had the following indicators: reactive pressure – 106.4 ± 4.3 mm Hg, basal pressure – 77.85 ± 2.81 mm Hg. The overall mean value for patients with acute appendicitis was 97.75 ± 3 mm Hg – reactive pressure and 74.28 ± 1.78 mm Hg – basal pressure.

Based on the results of the study, the dynamics was characterized by an increase in both reactive and basal pressures, which is directly proportional to the degree of inflammation in the abdominal cavity (Table 1).

Table 1.

The average value of anal pressure in children hospitalized with abdominal pain.

Type of anal pressure	I group (mm Hg)	II group (mm Hg)	III group (mm Hg)	p
Reactive	$59,65 \pm 2,11$	$89,1 \pm 3,27$	$106,4 \pm 4,3$	$p_1 < 0.01$ $p_2 < 0.01$
Basal	$50,35 \pm 2,53$	$70,7 \pm 1,94$	$77,85 \pm 2,81$	$p_1 < 0.05$ $p_2 < 0.01$

* Footnote: p_1 – reliability of comparison of results between I and II groups;

p_2 – reliability of comparison of results between I and III groups.

However, given the above indicators, it should be noted a significant difference

between the indicators in patients with acute appendicitis and patients in whom acute surgical pathology was excluded. It is this difference in pressure that helps in resolving the issue of surgical tactics for the patient. Indicators between groups II and III had less significant differences. The difference between mean basal pressures in patients of the last two groups was less than 10 mm. rt. Art. The difference between the indicators of groups II and III is not so clinically important, because patients from these groups were diagnosed with acute appendicitis, and therefore they underwent emergency surgery in any case.

Also during the study was an analysis of endogenous intoxication. 400 female patients aged 3 to 17 years were involved on the basis of Vinnytsia Children's Regional Clinical Hospital (Ukraine), which was divided into 4 groups (100 children per group): group I - actually healthy children; group II - patients with abdominal pain in whom after further research surgical pathology was excluded; group III - patients operated with destructive forms of acute appendicitis, without peritonitis; group IV - patients operated with destructive forms of acute appendicitis with peritonitis. Children with catarrhal forms of acute appendicitis were not included in the study. The mean age of patients was 12.6 ± 1.2 years.

Taking into account the data and information reports of other researchers, we proposed a total index of endogenous intoxication (TIEI), which took into account all components of the general blood analysis, and which was calculated by the formula

$$\text{TIEI} = \left(\frac{L \times \text{ESR}}{100} + \frac{(e + \text{bas} + \text{ban} + s + j + \text{myel})}{(\text{mon} + \text{lym})} \right) / 2,$$

L - the number of leukocytes; ESR - erythrocyte sedimentation rate; e - eosinophils; bas - basophils; ban - band neutrophils; s - segmented neutrophils; j - juvenile neutrophils; myel - myelocytes; mon - monocytes; lym - lymphocytes. TIEI normally averages is 1.42 ± 0.06 c. u.

The study of the value of TIEI in various forms of pathology has determined the presence of positive dynamics. The total index of endogenous intoxication was 1.42 ± 0.06 ($p < 0.05$) in patients of the first group. In group II, the index level was 2.31 ± 0.32 ($p < 0.05$). The value of the total index of endogenous intoxication was 3.52 ± 0.45 ($p < 0.05$) in patients of group III. In children of group IV, the total index of endogenous intoxication was 3.80 ± 0.31 ($p < 0.05$).

The presence of such a positive dynamics of the total index of endogenous intoxication indicates the presence and increase in the value of endogenous intoxication with the growth of tissue destruction, which is regarded as a direct sign of intoxication.

Conclusions. Therefore, after conducting a clinical study, which involved measuring the anal pressure of the sphincters in various pathologies of the abdominal cavity and pelvic organs, we can say about the feasibility of using this technique in the clinical practice of surgeons. The above method demonstrates a fairly high informativeness. Therefore, it can be used as an additional element of diagnosis in complex clinical cases, especially in girls with overweight, cases with atypical location of the appendix, and atypical course of the disease. This method clearly demonstrates the dependence of the tone of the rectal sphincters with the degree of spread of the inflammatory process in the abdominal cavity and pelvic cavity.

An new approach to the interpretation of endogenous intoxication according to general blood analysis based on the value of the total index of endogenous intoxication

allows to assess the severity of endotoxycosis, based on which it is possible to predict the form of pathology and timely choose the necessary treatment tactics. Exceeding the value of the proposed total index of endogenous intoxication of the body more than twice indicates the child has the level of endotoxycosis characteristic of destructive forms of acute appendicitis, exceeding the index more than 2.5 times indicates a possible complicated pathology in the form of peritonitis. The introduction of the developed total index of endogenous intoxication in the algorithm of acute appendicitis will improve the results of early diagnosis and predict the form of pathology and its nature in children.

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