THE ROLE OF ULTRASOUND DIAGNOSTICS IN ASSESSING THE THICKNESS OF THE COLON WALL IN PATIENTS WITH ULCERATIVE COLITIS AND CONCOMITANT ARTERIAL HYPERTENSION

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Summary

The aim. To evaluate the thickness of the large intestine wall in patients with ulcerative colitis and concomitant arterial hypertension using transabdominal ultrasound diagnostics.

Materials and methods. 96 patients were examined. Two groups were formed: the main group (group I) – patients with ulcerative colitis with concomitant arterial hypertension (n=49; age – 41.2±12.32 years, M±SD years) and control group (group II) – patients with ulcerative colitis without concomitant arterial hypertension (n=47; age – 40.2±10.85 years). The diagnosis of ulcerative colitis was confirmed by colonoscopy with biopsy and subsequent pathological examination. Endoscopic assessment of the severity of ulcerative colitis was performed according to the Mayo ulcerative colitis system. Anamnesis was taken in all patients, a general clinical examination, outpatient blood pressure measurement, colonoscopy, and transabdominal ultrasound diagnostics of the large intestine were performed.

Statistical processing of the data was performed using probability assessment criteria.

Results. The study found that in group I there was a more pronounced thickening of the colon wall involved in the inflammatory process than in group II (p<0.05), which was due to the systemic inflammatory process and the presence of concomitant hypertension.

Conclusions. The study proves that outpatient blood pressure measurement in patients with ulcerative colitis is a mandatory procedure. After all, untimely diagnosis of concomitant hypertension can affect the course and early relapse of ulcerative colitis. The advantages of transabdominal ultrasound diagnostics of the intestine are accessibility, relatively low price, good tolerability, lack of radiation exposure and, most importantly, non-invasiveness of the method for assessing disease activity.

Key words: ulcerative colitis, arterial hypertension, transabdominal ultrasound diagnostics of the intestine, intestinal wall thickness

INTRODUCTION

Ulcerative colitis (UC) and arterial hypertension (AH) are two different diseases that can interact with each other, thereby complicating the course of the primary disease. However, the cause-and-effect relationship between these diseases has not yet been sufficiently studied, so international research in this area continues.

At the turn of the 21st century, inflammatory bowel disease (IBD) became a global problem with an increase in the incidence in industrialised countries. The severity of the course and difficulties in the timely diagnosis of IBD necessitate a detailed study of this pathology among people of different ages and genders [1]. The most common IBDs include ulcerative colitis (UC), which is an inflammatory disease that affects the colon, characterised by episodes of disease activity and asymptomatic remission [2]. Most often, UC affects the rectum (proctitis), but it can spread to the sigmoid colon (proctosigmoiditis), beyond the sigmoid colon (distal ulcerative colitis), or cover the entire colon up to the cecum (total colitis) [3].

The annual incidence of UC is approximately 10 to 20 per 100,000 population [2]. The highest prevalence rates of UC were recorded in Europe, reaching 505 per...
100,000 people. Meanwhile, the prevalence of UC in the United States was 286 per 100,000 people. The prevalence of IBD exceeds 0.3 % in many European countries [1].

Chronic inflammation plays an important role in the initiation and progression of cardiovascular disease (CVD), and IBD may be one of the causes of a prolonged inflammatory process. CVD is the leading cause of mortality and morbidity worldwide. CVDs can lead to atherosclerosis and increase the risk of CVD, especially hypertension [4, 5, 6]. Globally, 1 billion people are diagnosed with hypertension, and in Ukraine, more than 12.3 million people suffer from hypertension [7].

Studies have shown that in patients with UC, hypertension occurred in 40 % [8], and high blood pressure (BP) can worsen the course of UC [9].

At present, reliable pathophysiological mechanisms that may link UC and hypertension are not yet fully understood, but there are theories about this [10]. Since UC is a chronic disease and is accompanied by emotional stress, the latter can cause activation of the sympathetic nervous system and increase the level of stress hormones such as catecholamines. This can lead to vasoconstriction and increased blood pressure. Emotional overload associated with sympathicotonus is more likely to lead to relapse in patients with UC [11, 12].

Due to persistent chronic inflammation, patients with UC experience damage to the vascular endothelium, and endothelial dysfunction is characterised by a decrease in the synthesis and release of nitric oxide (NO), which leads to vasoconstriction and increased blood pressure. In patients with UC, the intestinal barrier is depleted, which is manifested by a decrease in goblet cells containing mucin and a decrease in the production of mucin itself [13]. Goblet cells are more susceptible to stress due to their role in protecting the intestinal epithelium from microbes and harmful substances [14]. Stress leads to vasospasm, triggering the mechanism of the renin-angiotensin-aldosterone system, which increases blood pressure; on the other hand, stress leads to an increase in bacterial adhesion and a decrease in the number of lactobacilli in the intestinal lumen. As a consequence of all these changes in the intestinal lumen, antigens can gain access to the epithelium, causing and prolonging inflammation in UC. Intestinal permeability to large antigenic molecules leads to goblet cell activation, degranulation, reduction of mucin in the large intestine and inflammation [15].

Taking into account the pathophysiological links between the diseases under study, it can be concluded that late detection and lack of correction of high blood pressure in patients with UC will contribute to recurrence of the latter. That is why a multidisciplinary approach to the assessment of the patient’s general condition and the use of minimally invasive examination methods will allow a comprehensive approach to the diagnosis and treatment of these two conditions.

THE AIM OF THE STUDY

The aim of this study was to determine blood pressure in patients with UC. Using transabdominal ultrasound diagnostics (TAUSD), to assess the thickness of the colon wall at the site of inflammation in patients with UC with and without concomitant arterial hypertension.

MATERIALS AND METHODS

According to the study design, 96 patients were examined in whom UC was confirmed by colonoscopy with pathological examination. The patients were diagnosed with concomitant hypertension using outpatient blood pressure measurement. Thus, 96 patients were divided into two groups: the main group (group I) – patients with UC with concomitant hypertension (n=49; age: 41.2±12.32 years, M±SD years) and the control group (group II) – patients with UC without concomitant hypertension (n=47; age: 40.2±10.85 years).

The inclusion criteria for the study were: the age of the examined patients was from 18 to 60 years; the presence of diarrhoea (loose or liquid stools three or more times a day) with or without mucus, with or without blood impurities; the presence of UC confirmed by colonoscopy and pathology; the presence or absence of high blood pressure; signing of the patient’s informed consent to participate in the study.

Non-inclusion criteria: patients’ unwillingness to participate in the study; gastrointestinal complaints in the form of constipation; patients with a confirmed diagnosis of celiac disease, colorectal cancer, Crohn’s disease, pseudomembranous colitis, antibiotic-associated diarrhoea, and parasitic intestinal infection.

The intestinal examination was performed according to the recommendations and guidelines of the European Federation of Ultrasound in Medicine and Biology [16, 17]. Guided by the recommendations, intestinal TAUSD was performed on an empty stomach after abdominal ultrasound without special preparation. We recommended excluding foods that increase flatulence from the diet the day before the study. The intestinal wall thickness was measured perpendicular to the wall from the border between the serosa and the intrinsic muscles to the border between the mucosa and the lumen [17].

TAUSD of intestin was performed on the Toshiba Aplio MX (Toshiba Medical Systems Corporation, Japan) with broadband convection 1.5-6 MHz and linear 5-12 MHz transducers.

The clinical trial was approved at the ethics meeting of the Shupyk National Healthcare Institution of Ukraine

ДОСЛІДЖЕННЯ
(Protocol No. 6, dated 03.10.2022). This study complies with international regulations and laws of Ukraine: «Fundamentals of the Legislation of Ukraine on Health Care» (1993), «On Medicines» (1996), «On Personal Data Protection» (2010). The study was conducted in compliance with the principles of bioethics and legal norms and requirements: The Helsinki Declaration (2000), all patients signed informed consent to participate in the clinical trial.

**Statistical analysis.**

Statistical processing of the obtained data was performed using licensed statistical packages «Statistica 10» using the criteria for assessing the reliability of the study results (parametric Student’s t-test and nonparametric Mann-Whitney U-test). To describe the distribution of demographic and clinical parameters, the arithmetic mean of the sample (M), standard deviation (SD), and the level of statistical significance (p) were used. The results were analysed in accordance with generally accepted recommendations. The difference between the study groups was assessed as statistically significant at p<0.05.

**RESULTS AND DISCUSSION**

In the course of the study, 96 patients were examined. The analysis revealed no significant difference in the age of patients in both groups (p=0.7 by the Mann-Whitney test), thus the study groups were similar in age. The diagnosis of UC was confirmed by colonoscopy with biopsy and subsequent pathological examination, and endoscopic severity was assessed according to the Mayo ulcerative colitis system. All patients underwent anamnesis, general clinical examination, outpatient blood pressure measurement, transabdominal ultrasound examination of the large intestine with measurement of intestinal wall thickness (Table 1). The average systolic blood pressure (SBP) in group I was 153.02±5.22 mm Hg, in group II – 126.49±10.17 mm Hg. The average diastolic blood pressure (DBP) in group I was 96.02±3.06 mm Hg, in group II – 80.98±6.59 mm Hg.

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Group I (M±SD) (n=49)</th>
<th>Group II (M±SD) (n=47)</th>
</tr>
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<tbody>
<tr>
<td>Average age of patients (in years)</td>
<td>41,2±12,32</td>
<td>40,2±10,85</td>
</tr>
<tr>
<td>Average SBP (mm Hg.)</td>
<td>153,02±5,22</td>
<td>126,49±10,17</td>
</tr>
<tr>
<td>Average DBP (mm Hg.)</td>
<td>96,02±3,06</td>
<td>80,98±6,59</td>
</tr>
<tr>
<td>Average value of wall thickness (mm)</td>
<td>7,49±1,36</td>
<td>6,30±1,12</td>
</tr>
<tr>
<td>Average duration of UC disease (years)</td>
<td>5,5±4,77</td>
<td>3,3±2,58</td>
</tr>
</tbody>
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Note: n – number of patients.

There is a statistically significant difference between the two groups in the assessment of the duration of UC disease p=0.008 and the value of wall thickness p<0.05 (Figure 1).
International studies have shown that intestinal wall thickness correlates well with the clinical activity of UC, non-invasive inflammatory markers, and endoscopy findings [16, 18, 19, 20]. Loss of the layered structure (stratification) of the intestinal wall (hypoechoic pattern) correlated with moderate (55% of cases) and severe (100% of cases), while normal layered structure of the intestinal wall was present in 87% of mild UC cases. Increased vascularisation of the intestinal wall has also been associated with clinical and endoscopic indicators of UC activity [16]. Thus, our study shows that an essential stage in the management of patients with UC is the early detection of hypertension, which significantly affects the condition of the colon wall.

**CONCLUSIONS**

The presence of comorbidities such as hypertension undoubtedly complicates the course of UC. The complex interaction between these two conditions can lead to increased symptoms, complicate treatment strategies, and affect the psychoemotional state. A comprehensive approach to diagnosis and treatment is important to improve the quality of life of patients. A multisystem approach should include not only optimal medical treatment, but also psychological support and patient education. We will also conduct further research to better understand the links between UC and AH to optimise diagnostic and treatment protocols.

**Prospects for further research.** In the course of further research, a larger sample of patients with UC and concomitant arterial hypertension will be examined. The study will compare changes in inflammatory biomarkers with colonoscopy and intestinal ultrasound findings and develop a treatment regimen for patients with UC and concomitant hypertension. After treatment andremission, the intestines will be reassessed using minimally invasive methods.

**FUNDING AND CONFLICT OF INTEREST**

The authors report no conflict of interest. The study was funded by the state budget. The presented research is a fragment of the PhD thesis of the Department of Therapy and Geriatrics of the Shupyk National University of Health of Ukraine on the topic: «Minimally invasive methods of diagnosis and evaluation of the effectiveness of treatment of patients with ulcerative colitis and concomitant hypertension».

**REFERENCES**


Резюме

РОЛЬ УЛЬТРАЗВУКОВОЇ ДІАГНОСТИКИ В ОЦІНЦІ ТОВЩІІ СТІНКИ ТОВСТОГО КИШЕЧНИКА У ПАЦІЄНТІВ З НЕСПЕЦИФІЧНИМ ВИРАЗКОВИМ КОЛІТОМ ТА СУПУТНЬОЮ АРТЕРІАЛЬНОЮ ГІПЕРТЕНЗІЄЮ

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Мета дослідження. За допомогою трансабдомінальної ультразвукової діагностики оцінити товщину стінки товстого кишечника у пацієнтів з неспецифічним виразковим колітом та супутньою артеріальнюю гіпертензією.

Матеріали та методи. Обстежено 96 пацієнтів. З них сформовано дві групи: основна (група І) – пацієнти з неспецифічним виразковим колітом із супутньою артеріальною гіпертензією (n=49; вік – 41,2±12,32 року, M±SD років) та контрольна (група ІІ) – пацієнти з неспецифічним виразковим колітом без супутньої артеріальної гіпертензії (n=47; вік – 40,2±10,85 років). Діагноз неспецифічного виразкового коліту був підтверджений за допомогою колоноскопії з біопсією та подальшим патогістологічним дослідженням. Ендоскопічна оцінка тяжкості неспецифічного виразкового коліту проводилася за Mayo ulcerative colitis system. В усіх пацієнтів був зібраний анамнез, проводився загальноклінічний огляд, амбулаторне вимірювання артеріального тиску, колоноскопія, трансабдомінальна ультразвукова діагностика товсто-го кишечника. Статистична обробка отриманих даних проводилась з використанням критеріїв оцінки вірогідності.

Результати. В ході дослідження встановлено, що в І групі відзначалося більш виражене потовщення залученої у запальний процес стінки товстої кишки ніж в ІІ групі (p<0,05), що обумовлено системним запальним процесом та наявністю супутньої АГ.

Висновки. Проведене дослідження доводить, що амбулаторне вимірювання артеріального тиску у пацієнтів з неспецифічним виразковим колітом є обов’язковою процедурою. Адже несвоєчасна діагностика супутньої артеріальної гіпертензії може впливати на перебіг та ранній рецидив неспецифічного виразкового коліту. Перевагами трансабдомінальної ультразвукової діагностики кишечника є доступність, порівняно невелика ціна, добра переносимість, відсутність радіаційного впливу та, головне, неінвазивність методу для оцінки активності захворювання.

Ключові слова: неспецифічний виразковий коліт, артеріальна гіпертензія, трансабдомінальна ультразвукова діагностика кишечника, товщина стінки кишечника