Neuropsychological and psychometric parameters in the patients with duodenal ulcer depending on Helicobacter pylori presence


Abstract. Background. The purpose was to study the effect of Helicobacter pylori (H.pylori) in duodenal ulcer on the neuropsychological and psychometric scores. Materials and methods. We conducted a comprehensive clinical, neurological, neuropsychological, and psychometric examination of 60 patients with duodenal ulcer aged 25–60 (the mean of 39.80 ± 1.29) years. All of them were divided into two groups considering whether H.pylori infection was detected (group 1) or not (group 2). The control group included 30 apparently healthy individuals with no somatic abnormalities. To study psychometric and neuropsychological characteristics, the patients were comprehensively tested, in particular using the Beck Depression Inventory for evaluating the severity of depression, the State-Trait Anxiety Inventory for assessing separate dimensions of state and trait anxiety, the Well-being, Activity, Mood (WAM) questionnaire, the Mini-Mental Health Examination for screening cognitive function, the Schulte tables for evaluating the refocusing speeds and performance distribution. Results. The level of depression in H.pylori-positive duodenal ulcer was significantly higher than with H.pylori-negative duodenal ulcer (p < 0.05). The patients from the group 1 had higher scores of state and trait anxiety and the lower ones of the functional state. The concentration of attention detected by means of the Schulte tables was lower in these patients. A direct correlation was found between the degree of depressive disorders and the number of complaints associated with psycho-emotional disorders in the patients with duodenal ulcer (r = 0.61). We found an inverse correlation (p < 0.05) between the anxiety level and the WAM indices, on the one hand, and between depressive disorders and the WAM indices, on the other hand, in the patients with duodenal ulcer. Depression and anxiety were comorbid in 73.3 % of cases in the group 1 and in 30 % of cases in the group 2. Conclusions. The complaints associated with psycho-emotional disorders occurred in the patients with both H.pylori-positive and H.pylori-negative duodenal ulcer; however, they were more frequent in the group 1. The clinical presentations of depression were observed in both groups, but the depression level was significantly higher in the patients with H.pylori-positive duodenal ulcer (p < 0.05). An increase in anxiety was also found in both groups; however, the rates of state and trait anxiety were higher in the group 1. At duodenal ulcer exacerbation, no matter if H.pylori infection was present or not, the patients had unsatisfactory well-being, low activity, and poor mood. The decreased indices of the functional state self-assessment were detected in the group with H.pylori-positive duodenal ulcer. Using the Schulte tables, we found that a decrease in attention concentration was more evident in the group 1 that in the patients with H.pylori-negative duodenal ulcer. Thus, having conducted the neuropsychological and psychometric testing, we conclude that H.pylori infection has not been the main cause of psycho-emotional disorders in duodenal ulcer, but if the patients were infected, the dysfunction was more severe. It was subject to the increased frequency of psycho-emotional complaints, the deterioration in the patients’ sense of well-being, the increased levels of anxiety and depressive disorders.

Keywords: duodenal ulcer; depression; anxiety; Helicobacter pylori
Introduction

The nervous system disorders with internal diseases are challenging medical and social issues, considering their prevalence and impact on patients’ life quality and working ability [7, 8]. Currently, there is a significant increase in psychosomatic illnesses, and the phenomenon of affecting more younger people by them. Given that the digestive system functioning is closely associated with the nervous system regulatory mechanisms, many gastrointestinal diseases are psychosomatic. Psychosomatic relationships in duodenal ulcer remain among the current issues of modern gastroenterology [7, 8].

Peptic ulcer disease has been high on the list in the overall structure of the digestive diseases, it affects from 6.0 to 10.0 % of the population in developed countries, and the mortality ranges from 6 to 9.7 cases per 100,000 population [7, 8, 14]. From a modern viewpoint, it is considered to be a polyetiologically, genetically and pathogenetically heterogeneous disease, which is based on the systemic response of the whole human body to the influence of etiological factors, including Helicobacter pylori (H.pylori), overwhelmingly gastric and duodenal mucosal lesions, against the background of the adaptive hierarchy irregularity [2, 7, 14].

H.pylori is a helical-shaped gram-negative bacterium, the descendant of ancient bacteria that colonized mammalian stomach, and it can infect the human stomach and duodenum. Although it is unclear precisely, the suggestion is that H.pylori has been colonizing the human stomach since the Paleolithic Age [6, 9]. Most of the recent papers focus on studying its pathogenic properties and their impact on the development of chronic gastritis, duodenal ulcer, and stomach cancer. The clinical trials indicate that eradication of H.pylori significantly reduces duodenal ulcer incidence and its complications [6, 10]. Nevertheless, the world’s leading gastroenterologists’ opinion that H.pylori has been the major cause of duodenal ulcer remains ambiguous. Some experts consider H.pylori to be the main factor [3, 6, 10], the others think about it as a trigger for the disease progression given genetic predisposition and other factors [2, 4, 13].

The recent trials of H.pylori virulence and pathogenicity have enabled us to analyze the possible manifestations of infection both in various gastrointestinal diseases and other pathologies. A number of authors assume that H.pylori infection is likely to be a risk factor for the development of extragastric disease [1, 5, 6].

Concurrently, there are studies suggesting potentially beneficial effects of H.pylori infection on the human body [2, 11, 12]. The prevalence of H.pylori among the population and its mainly asymptomatic existence is taken as indicating it to be a representative of the microbiome and a non-pathogenic microorganism [4, 11, 12]. The presence of H.pylori in the human body is asymptomatic in approximately 85 % of cases, symptomatic duodenal ulcer affects 15 % of people, and gastric cancer less than 1% [2, 6, 10].

The represented data testify to the effect that the problem of H.pylori infection contamination is very ambiguous and it requires further investigations, a long-term follow-up and the systematic data analysis of both its impact on health, and the rationale and indications for eradication therapy [2, 4, 11].

Nevertheless, most authors, who consider H.pylori an important contributor to the occurrence and progression of duodenal ulcer, are noted to emphasize the importance of psycho-emotional disorders and the participation of the nervous system in the pathogenic mechanism [2, 6, 11].

In the light of the mentioned above, studying the role of H.pylori in the disease mechanisms, in particular in the patients with duodenal ulcer, remains relevant. In this regard, we studied neuropsychological and psychometric characteristics in the patients with duodenal ulcer, according to whether H.pylori was present in them or not. The studied clinical characteristics may serve to specify the role of H.pylori infections in somatic neurological relationships in the patients with duodenal ulcer and to improve diagnostic approaches, taking into account the possible impact of H.pylori, if it is present, on neuropsychological and psychometric parameters.

The purpose was to study the effect of H.pylori in duodenal ulcer on the neuropsychological and psychometric scores.

Materials and methods

We conducted a comprehensive examination of 60 patients with duodenal ulcer. They underwent examination and treatment at the Gastroenterology Unit and the Center for Gastrointestinal Bleeding of Kyiv City Clinical Hospital 12, which is the clinical site for the Department of Neurology of the Shupyk National Healthcare University of Ukraine. The examinees were 25–60 years old, with the mean age of 39.80 ± 1.29 years. There were 43 (71.7 %) men and 17 (28.3 %) women. They were divided into two groups considering the fact whether H.pylori infection was detected (group 1) or not (group 2). The control group was made up of 30 apparently healthy individuals with no somatic abnormalities. All participants with duodenal ulcer underwent esophagogastroduodenoscopy along with a rapid H.pylori detection test in the endoscopy room (a rapid urease test).

Also, all the examinees underwent a detailed questioning through a purposely designed questionnaire (the chief complaints related to psycho–emotional disorders were analyzed), and were comprehensively tested, including assessing the severity of depression, separate dimensions of state and trait anxiety, the well-being, activity, mood, screening cognitive function, evaluating the refocusing speeds and performance distribution.

To evaluate the severity of depression, we used the Beck Depression Inventory; the questionnaire makes it possible to identify a set of the most relevant and significant depressive symptoms and the most common complaints. Severity of 21 depressive symptoms was gradually estimated by cognitive-affective and somatic-vegetative subscales. To interpret the results, we classified the scores as follows: 0 to 9 points — no depression; 10 to 15 — mild depression; 16 to 19 — moderate depression; 20 to 29 — moderately severe depression; 30 to 63 points — severe depression.
We applied the State-Trait Anxiety Inventory to assess separate dimensions of state and trait anxiety. The technique is informative for current anxiety (state anxiety, or anxiety about an event) and trait anxiety (anxiety level as a personal characteristic) self-assessment. To interpret the results, we used the following targeted scores: 0 to 30 points — mild anxiety, 31 to 45 — moderate anxiety, more than 45 points — severe anxiety.

The WAM questionnaire served to measure wellbeing, activity, and mood in the patients. It contained 30 pairs of opposite characteristics, by which the participants were asked to assess their state. Each pair was a scale wherein the patient marked down the severity of the state characteristic. The average score was equal to 4. The scores exceeding 4 points indicated the good state, the ones up to 4 points denoted the bad state. The reference ranges were 5.0—5.5 points.

The Mini-Mental State Examination (MMSE) was used to detect cognitive impairments in the examined patients. The scale is a method reliable enough for the primary screening of cognitive disorders, including dementia. The maximum score is 30, which corresponds to the highest cognitive abilities. The lower the test result is, the more pronounced the cognitive deficiency is. The scores are as follows: 29–30 points are classed as normal, no cognitive impairment; 27–28 points are considered to be mild cognitive impairment; 24–26 points denote moderate cognitive impairment; 20–23 points are indicative of early dementia, less than 20 points are classed as severe dementia.

The Schulte tables were used to test attention stability and the work efficiency. We evaluated the refocusing speeds and performance distribution in each patient group. Based on the results on each table, we constructed a fatigue curve that represented the follow-up attention stability and work efficiency.

We calculated the data by applying a personal computer and a software package Statistica 6.0 for processing and analyzing statistical information. The correlation analysis was performed with the Spearman’s rank correlation test. Depending on the magnitude, the correlation was considered to be weak at \( r = 0.3–0.5 \), moderate at \( r = 0.5–0.7 \), and strong at \( r > 0.7 \). The detected relationship indicated a positive (direct) or negative (indirect) value of the correlation coefficient. The differences were considered significant at \( p < 0.05 \).

Results and discussion

From the detailed survey with a specially designed questionnaire, we analyzed the main complaints related to psycho-emotional disorders and found complaint of anxiety to be most frequent: in 28 (93.3 %) patients with \( H. pylori \)-positive duodenal ulcer, in 14 (46.6 %) with \( H. pylori \)-negative duodenal ulcer and in 5 (16 %) control patients. The second most frequent complaint was sleep disorder, which was noted by 26 (86.6 %) patients of the group 1, 9 (30 %) of the group 2 and 3 (10 %) control patients. The complaints of memory decline were also frequent: 24 (80 %) cases in the group 1, 7 (23.3 %) in the group 2, and 1 (3.3 %) in controls. Eighteen (60 %) patients of the group 1, 8 (26.6 %) of the group 2 and 2 (6.6 %) controls had complaints of decreased attention span (Fig. 1).

Having analyzed the survey data, we found the complaints related to psycho-emotional disorders to occur in the patients with both \( H. pylori \)-positive and \( H. pylori \)-negative duodenal ulcer. All complaints were more common in the patients of the first group. The mentioned indices differed significantly from those in the controls (\( p < 0.05 \)).

The findings of Beck Depression Inventory are presented in Table 1. Depressive disorders were found to occur in most patients with \( H. pylori \)-positive duodenal ulcer (83.3 %). The mean score in those patients was equal to 19.1 ± 2.6 points, which was indicative of moderate depression. No depression was observed in 5 (16.7 %) patients, mild depression in 10 (33.3 %), moderate in 8 (26.7 %), moderately severe in 3 (10 %) and severe depression in 4 (13.3 %) patients. Depressive disorders were detected in 14 (46.7 %) patients with \( H. pylori \)-negative duodenal ulcer. The mean score in them was 11.2 ± 1.4 points, which indicated mild depression. In this group, no depression was found in 16 (53.3 %) patients, mild depression

![Figure 1. Frequency of neuropsychological complaints (%)](http://inj.zaslavsky.com.ua)
in 9 (30 %), moderate in 3 (10 %), severe depression in 2 (6.7 %) cases. The mean score of depression in the control group was equal to 6.1 ± 0.8 points, which indicative of no depressive disorders. With that, no depression was observed in 28 (93.3 %) patients, mild depression in 2 (6.7 %) people. According to the Beck Depression Inventory, the different severity of depressive disorders was found in both study groups. The level of depression was significantly higher in the patients with \textit{H.pylori}-positive duodenal ulcer than that in participants with \textit{H.pylori}-negative duodenal ulcer (p < 0.05). The indices were found to differ significantly from those in the control group (p < 0.05). There was a correlation between the level of depressive disorders and the number of complaints associated with psycho-emotional disorders in the patients with duodenal ulcer (r = 0.61).

Having analyzed the state and trait anxiety levels through the State-Trait Anxiety Inventory, we found them to be 70.00 ± 3.10 and 71.9 ± 2.2 points, respectively, among those with \textit{H.pylori}-positive duodenal ulcer; the scores were indicative of severe anxiety. In that group, 75.4 % of the patients had severe trait anxiety, 22.2 % — moderate trait anxiety, 2.4 % — mild trait anxiety. State anxiety was severe, moderate, and mild in 73.1, 24.6 and 2.3 % of cases, respectively. In the patients with \textit{H.pylori}-negative duodenal ulcer, the levels of trait and state anxiety were 55.3 ± 4.8 and 52.40 ± 2.83 points, respectively; the scores were indicative of severe anxiety as with \textit{H.pylori}-positive duodenal ulcer. In this group, 42.2 % of the patients have severe trait anxiety, 53.26 % — moderate trait anxiety, and 4.54 % — mild trait anxiety. Severe, moderate, and mild state anxiety was detected in 40.1, 55.41 and 4.49 % of cases, respectively. In the control group, the average trait anxiety rate was equal to 25.4 ± 1.2 points, and the average state anxiety was 23.9 ± 1.4 points that corresponded to mild anxiety.

The average levels of trait and state anxiety were higher in the patients with \textit{H.pylori}-positive and \textit{H.pylori}-negative duodenal ulcer compared to those in the control group (p < 0.05). However, they were higher with \textit{H.pylori}-positive duodenal ulcer than with \textit{H.pylori}-negative duodenal ulcer (Fig. 2).

Thus, according to the findings of the State-Trait Anxiety Inventory, an increase in both trait and state anxiety was typical for patients with duodenal ulcer, regardless of whether \textit{H.pylori} was positive or negative.

The comorbidity of depression and anxiety was found in 22 (73.3 %) patients of the group 1 and in 9 (30 %) of the group 2.
The findings of well-being, activity, and mood in the patients with duodenal ulcer according to WAM questionnaire are presented in Table 2. In acute *H. pylori*-positive duodenal ulcer, the average scores were as follows: well-being — 2.6 ± 1.2 points, activity — 2.9 ± 1.4 points, mood index — 3.0 ± 2.1 points. The indices of the functional state assessment were decreased in the group with acute *H. pylori*-negative duodenal ulcer. The average well-being index was 3.5 ± 1.8, the average activity index was 3.30 ± 2.51, and the average mood index was 3.6 ± 2.2. The indices of the functional state assessment were decreased in the group with acute *H. pylori*-positive duodenal ulcer (p < 0.05). There was an inverse correlation between the WAM score and the indices of anxiety and depressive disorders in all the patients with duodenal ulcer (p < 0.05). Thus, we confirmed the presence of correlation between the decreased level of the patients’ well-being, activity and mood and an increase in anxiety (both trait and state), on the one hand, and between the decreased level of the patients’ well-being, activity and mood and the increased level of the depressive disorders, on the other hand.

When examining the patients using the MMSE, we found no significant differences between two groups of the patients with duodenal ulcer (Table 3). Most of them had no cognitive impairments, no matter if *H. pylori* infection was present or not. Neither moderate nor severe dementia was detected. The average score for the young patients of the group 1 was 27.31 ± 0.83 points, for the middle-aged ones, it was 27.55 ± 1.06, for the young patients of the group 2 was 26.91 ± 1.31, for the middle-aged ones, it was 26.51 ± 1.91, for the young patients of the group 3 was 29.41 ± 0.94, and for the middle-aged ones, it was 29.29 ± 1.23.

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**Table 2. Functional status of the patients according to the WAM questionnaire (M ± m, points)**

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Clinical trial population</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><em>H. pylori</em>-positive (n = 30)</td>
</tr>
<tr>
<td>Well-being</td>
<td>2.6 ± 1.2</td>
</tr>
<tr>
<td>Activity</td>
<td>2.9 ± 1.4</td>
</tr>
<tr>
<td>Mood</td>
<td>3.0 ± 2.1</td>
</tr>
</tbody>
</table>

**Table 3. Assessment of cognitive impairments according to the MMSE scale (average score, M ± m)**

<table>
<thead>
<tr>
<th>H. pylori-positive (n = 30)</th>
<th>H. pylori-negative (n = 30)</th>
<th>Control group (n = 30)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Young patients (n = 18)</td>
<td>Middle-aged patients (n = 12)</td>
<td>Young patients (n = 14)</td>
</tr>
<tr>
<td>27.31 ± 0.83</td>
<td>26.91 ± 1.31</td>
<td>27.55 ± 1.06</td>
</tr>
</tbody>
</table>

Figure 3. Time for reading the Schulte tables (sec)
was 26.91 ± 1.31 points. The average score for the young patients of the group 2 was 27.55 ± 1.06 points, for the middle-aged ones, it was 26.51 ± 1.91 points. The mentioned indices were found to differ significantly from those in the control group, wherein the average score for the young patients was equal to 29.41 ± 0.94 points and for the middle-aged ones, it was 29.29 ± 1.23. At the same time, the controls had no cognitive impairments.

According to the MMSE, there was an average correlation between the degree of depression and the detected cognitive impairments (r = 0.51), as well as between the anxiety level and the detected cognitive impairments (r = 0.58).

The Schulte tables were used to test the follow-up attention stability and the work efficiency. The concentration of attention was detected to be lower in the group 1, where the mean time for performing the Schulte tables was 60.80 ± 0.89 seconds. The mean time for reading the Schulte tables was 50.00 ± 1.24 seconds in the group 2. The scores were indicative of somewhat reduced concentration of attention and were better in the group 2 than in the group 1 (p < 0.05). The indices were found to differ significantly from those in the control group (p < 0.05), wherein the mean time for reading the Schulte tables was 40.94 ± 2.01 seconds. We constructed a fatigue curve to represent the follow-up attention stability and work efficiency (Fig. 3). To plot the curve, we used the index of the time spent by the patients on performing each individual Schulte table. The time for reading varied insignificantly in all the examined groups, but there was a clear increase in the interval for performing the 2nd and 5th tables in the patients with duodenal ulcer, both H.pylori-negative and -positive, that was indicative of somewhat reduced concentration of attention and were better in the group 2 than in the group 1 (p < 0.05). The indices were found to differ significantly from those in the control group (p < 0.05), wherein the mean time for reading the Schulte tables was 40.94 ± 2.01 seconds. We constructed a fatigue curve to represent the follow-up attention stability and work efficiency (Fig. 3).

Thus, having conducted the neuropsychological and psychometric testing, we conclude that H.pylori infection has not been the main cause of psycho-emotional disorders with duodenal ulcer, but if the patients were infected, the dysfunction was more severe. It was subject to the increased frequency of psycho-emotional complaints, the deterioration in the patients’ sense of well-being, the increased level of anxiety and depressive disorders.

Conclusions

The complaints associated with psycho-emotional disorders occurred in the patients with H.pylori-positive and H.pylori-negative duodenal ulcer; however, they were more frequent in the group 1. The clinical presentations of depression were observed in both groups, but the depression level was significantly higher in the patients with H.pylori-positive duodenal ulcer (p < 0.05).

An increase in anxiety was found in both groups; however, the rates of state and trait anxiety were higher in the patients with H.pylori-positive duodenal ulcer.

At duodenal ulcer exacerbation, no matter if H.pylori infection was present or not, the patients had unsatisfactory well-being, low activity, and poor mood. The decreased indices of the functional state assessment were detected in the group with H.pylori-positive duodenal ulcer.

Using the Schulte tables, we found that a decrease in attention concentration was more evident in the patients with H.pylori-positive duodenal ulcer than in those with H.pylori-negative duodenal ulcer.

References

Оригінальні дослідження / Original Researches

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Нейропсихологічні й психометричні показники при виразковій хворобі дванадцятипалої кишки залежно від наявності в пацієнтів Helicobacter pylori

Резюме. Мета: дослідження впливу Helicobacter pylori (H.pylori) при виразковій хворобі дванадцятипалої кишки (ВХ ДПК) на нейропсихологічні та психометричні показники.

Матеріали та методи. Проведено комплексне клініко-неврологічне, нейропсихологічне й психометричне обстеження 60 пацієнтів із ВХ ДПК. Вік обстежених осіб коливався від 25 до 60 (у середньому 39,80 ± 1,29) років. Усі пацієнти були поділені на дві групи за ознакою наявності інфекції H.pylori (група 1) чи її відсутності (група 2). Контрольну групу становили 30 практично здорових осіб без соматичної патології. Для дослідження нейропсихологічних і психометричних характеристик проведенено комплексне тестування, яке включало визначення рівнів депресії за шкалою Бека, конституційної та реактивної тривожності за шкалою Спілбергера — Ханіна, оцінку самооцінки, активності та настрою за опитувальним WAM, когнітивних порушень за шкалою MMSE, швидкості переключення уваги та динаміки працездатності за допомогою таблиць Шульте.

Результати. У пацієнтів із H.pylori-позитивною ВХ ДПК рівень депресії був вірогідно вищим, ніж при H.pylori-негативній ВХ ДПК (p < 0,05). У групі 1 виявлені більш високі показники особистісної та реактивної тривожності та низькі показники функціонального стану. Також у них пацієнтів за допомогою таблиць Шульте встановлено зниження концентрації уваги. Зафіксовано прямий кореляційний зв'язок між ступенем депресивних розладів та кількістю скарг, пов’язаних з психоемоційними розладами, у пацієнтів із ВХ ДПК (r = 0,61). Зворотний кореляційний зв’язок виявленний (p < 0,05) між рівнем тривожності та функціонального стану пацієнтів із ВХ ДПК.

Висновки. Скарги, пов’язані з психоемоційними розладами, зустрічалися в пацієнтів як з H.pylori-позитивною, так і з H.pylori-негативною ВХ ДПК, однак частіше в групі 1. Зростання тривожності також відмічено в обох групах, утім, показники особистісної та реактивної тривожності були вищими в групі 1. При загостренні ВХ ДПК незалежно від наявності інфекції H.pylori спостерігалося значне зниження активності, погіршення самооцінки та настрою пацієнтів. У групі із H.pylori-позитивною ВХ ДПК, (p < 0,05). Загострення тривожності також відмічено в обох групах, утім, показники особистісної та реактивної тривожності були вищими в групі 1. При загостренні ВХ ДПК незалежно від наявності інфекції H.pylori спостерігалося значне зниження активності, погіршення самооцінки та настрою пацієнтів. У групі із H.pylori-позитивною ВХ ДПК зазначено низькі показники самооцінки функціонального стану. За допомогою таблиць Шульте виявили більш зниження концентрації уваги в групі 1, ніж у пацієнтів із H.pylori-негативною ВХ ДПК. Таким чином, за даними нейропсихологічного та психометричного тестування виявлено, що інфікованість H.pylori не є основною причиною психоемоційних розладів у пацієнтів із ВХ ДПК, але за її наявністю можуть відбуватись більш виражені показники психоемоційних спрямувань, погіршення оцінки рівня самооцінки, підвищення рівня тривожності та зменшення активності.

Ключові слова: виразкова хвороба дванадцятипалої кишки; депресія; тривога; інфекція Helicobacter pylori