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Multidetector Computed Tomography and Holter Monitoring as Methods of Digital Technologies in the Diagnosis of Hernia of the Esophageal Opening of the Diaphragm and Reflux Esophagitis

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ABSTRACT
This publication discusses the issue of a possible practical correlation of the use of such digital technologies for the diagnosis of hiatal hernia and reflux esophagitis, such as multi-detector computed tomography and Holter monitoring. The efficiency and feasibility of the cumulative application of these digital technologies are evaluated from the point of view of the promptness and timeliness of diagnosing hiatal hernias and reflux esophagitis, its level and quality. The authors substantiate the idea that when examining a patient with hiatal hernias and reflux esophagitis using these digital technologies, it is advisable to use differential diagnostics, which makes it possible to distinguish between cardiological pathology and pathology of the gastrointestinal tract, taking into account the possible various manifestations of hiatal hernias diaphragm and reflux esophagitis, which are often combined.
Keywords: *digital technologies, diagnostics, hiatal hernia, reflux esophagitis, multidetector computed tomography, Holter monitoring*

1. INTRODUCTION

Hernia of the esophageal opening of the diaphragm, which is the most common disease of the gastrointestinal tract, often has a combined pathology with other diseases of the digestive system, among which reflux esophagitis, a disease of the upper gastrointestinal tract, has become the most frequent in recent years. The prevalence of gastroesophageal reflux disease in the world in 2014 was 18.1-27.8% in North America; 8.8-25.9% - in Europe; 2.5-7.8% - in East Asia; 8.7-33.1% - in the Middle East; 11.6% in Australia; 23% - in South America [1]. Reflux esophagitis is detected in 45-80% of patients with hiatal hernia [2]. A significant decrease in the quality of life of such patients is due to the high percentage of complications associated with this disease, such as reflux esophagitis, detected in 80-90% of patients with HH, 20% of them develop severe gastroesophageal reflux disease (GERD), which leads to the development of the esophagus Barrett (10-15%), ulceration (2-7%), stricture (4-20%), bleeding (2%) and esophageal adenocarcinoma (1%) [3; 4]. An increase in the number of patients with reflux esophagitis caused by axial hernia of the esophageal opening of the diaphragm was also expressed from the standpoint of their intensification, if possible, the number of patients with duodenal ulcers, pancreatitis, and chronic cholecystitis should compete [5; 6].

The diagnosis and optimal choice of tactics for surgical treatment of diseases of the esophagus and cardia, despite the increasingly common knowledge of these types of diseases and their combined pathology, remains an important and urgent task of modern surgery. The importance of solving this problem is also due to a number of reasons that complicate the examination of patients with these diseases and the choice of treatment tactics, including the anatomotopographic features of the location of organs, the complexity of physiological processes that ensure the activity of the esophagus, the variety, and dynamism of pathological conditions.

In recent decades, the rapid development of technical means used in medicine for the purpose of prevention, diagnosis, and treatment has led to the development of highly informative techniques, the use of which is included in the "normal circulation" of practical activity every day. This traces the prerequisites for the "digital" transformation of the healthcare sector. However, this does not mean that there is no practical tendency to use already "outdated" methods of diagnosis and treatment, which, of course, negatively affects various stages of medical care (for example, at the outpatient and polyclinic stage, at the stage of medical care). An "undesirable" result of using "outdated" diagnostic methods can be expressed in the lengthening of the procedure for establishing a diagnostic result, in an incorrect interpretation of the patient's diagnosis, in false positive or false negative results of the

study, which, in turn, affect the choice of further tactics of patient treatment.
Determination of the prospects for the use of specific therapeutic technologies is made dependent on the need to study multi-component pathological conditions [7].

2. RESEARCH METHODOLOGY

The research methods are comparative analysis, statistical analysis, system-structural analysis, synthesis.
The subject interest of the medical community in the optimization of methods for diagnosing hiatal hernia and reflux esophagitis, which are independent groups of nosological diseases and, at the same time, often have a combined nature of pathology, through the use of the digital format of methods for their diagnosis, is due to the large-scale paradigm of implementation in healthcare digital space.
Moreover, the incorporation of digital technologies in the diagnosis of reflux esophagitis, which has a fairly significant prevalence among the population, is also due to the medico-social aspect, expressed in the presence, on the one hand, of "typical" symptoms that significantly worsen the standard of living of patients, and, on the other hand, "Uncharacteristic", that is, atypical, clinical manifestations of an extraesophageal nature, one of which is gastrocardial syndrome.
The increase in recent years of interest in the study of functional relationships between the gastrointestinal tract, in particular, the esophagus, and the cardiovascular system has been reasonably noted [8].
In most cases, hiatal hernias are asymptomatic and are diagnosed incidentally, and are often associated with gastroesophageal reflux disease, as lower esophageal sphincter incompetence may be due to hiatal hernia. The doctrine expresses the position that the progression of paraesophageal hernias with clinical manifestations can cause unwanted additions, for example, reflux esophagitis, peptic gastric ulcer, perforation and stricture of the esophagus, restrained hernia. At the same time, the treatment of asymptomatic hernia is not provided, however, the dynamic indicators of its clinical manifestations require a diagnostic study, which also does not exclude the possibility of surgical intervention [9].
Timely diagnosis and detection of extraesophageal symptoms of reflux esophagitis of various nature (gastrocardial, otorhinolaryngological, bronchopulmonary), symptoms of hiatal hernia is impossible not only without the use of information and technical means of instrumental diagnostics, but also without the joint, "well-coordinated" work of doctors of various specialties.

2.1. Multidetector computed tomography, abbreviated as "MDCT" as a digital verification method

Multidetector computed tomography is a non-invasive research method by visualizing in three-dimensional images changes in the coronary arteries and peripheral arteries, previously used to diagnose metastases in patients with malignant lesions of this zone.
In recent years, the area of application of MDCT has been increasing more and more, spreading its possible use in the diagnosis of diseases of the chest and abdominal organs. It is substantiated that the reflection of layer-by-layer visualization in the results of MDCT studies contributes to the possibility of a more accurate determination of the pathology zone with an assessment of its severity and distribution boundaries. At the same time, the use of additional capabilities of the MDCT examination software, in particular, multiplanar and 3D reconstructions, significantly contributes to the quality of visualization, visual demonstration of the pathological zone in a volumetric format, and timely determination of the choice of the plan and tactics of surgical intervention [10]. In the positive dynamics of the practical application of MDCT examination, it was also noted that its results allow obtaining three-dimensional images with submillimeter scanning, which actually broadens the scope of this digital research method, which can be used to study the anatomy of the heart and coronary vessels [11].
A study using MDCT, which is carried out in several phases (stages), is carried out on multi-detector computed tomographs, which represent special technical means that allow using digital software to scan a certain area with suspected pathological changes, and subsequently illustrate the results obtained in a volumetric format.
The preliminary stage of preparation and use of MDCT implies the need, among other things, to determine the scanning zone of a certain area, within which pathological changes are possible. If there are suspicions of the presence of such changes in the area of the cardioesophageal junction, the scan area can be determined by the "non-standard" shape, including the abdominal region, the lower half of the chest. The "non-standard" scan area will, accordingly, provide more "informative" information about the presence of pathological changes, including their volume, details, due to the study of several areas (areas of the cardia, subcardia, esophagus), with the help of the total "informative" data of which obtaining the clinical picture as a whole existing in the patient seems more likely. Getting more "meaningful" information depends on a careful assessment of each phase of the study and its results as a whole.
MDCT examination is possible in several versions, including with intravenous contrast and with contrast enhancement in the hydro-CT version, but the latter is the most effective in terms of studying pathological changes in the cardioesophageal junction zone. Results of MDCT examination with contrast enhancement in the variant of hydro-CT (with subsequent multiplanar reforms), in

comparison with MDCT examination with intravenous contrast enhancement, which does not provide the opportunity to thoroughly visualize the investigated areas (stomach wall, subcardia, cardia) in the form of volumetric images, make it possible to visualize cancer in a hiatal hernia, cancer growing (generating) into the hernia. Moreover, such results contribute to the correct determination of the length of the malignant lesion, thereby contributing to the formation of a "proper" assessment of the studied cardioesophageal zone, guiding the choice of the optimal tactics of surgical intervention.

It should be noted that the results of the MDCT examination contribute to the identification and diagnosis of hiatal hernia, at the same time providing an opportunity to establish its pathological complications. At the same time, the correct interpretation of the results obtained in the form of a volumetric image, taking into account the fact that in the area of the abdominal segment of the esophagus, cardia, fornix and the upper third of the stomach, the course of branches a is of no small importance. Gastrica, branches of the vagus nerve and veins of the stomach coincide.

2.2. The digital paradigm for Holter monitoring

Holter monitoring is a non-invasive diagnostic procedure performed to analyze cardiac functions such as automatism, conduction, refractoriness.

The growing number of facts of the use of such digital technology confirms its quality and effectiveness, providing the researcher with the most "voluminous" and reliable information about the frequency of arrhythmias, making it possible to establish appropriate control over the effectiveness of the treatment.

The study is carried out on the basis of the use of a Holter monitor, which is a digital electronic technical device: a portable cardiograph, the sensors of which are "attached" to the surface of the patient's body, connected to the device using special technical wires.

The data of the results of Holter monitoring, which carries out an electrocardiogram continuously for a 24-48 hour interval, makes it possible in the longer term to carry out cardiac monitoring, to measure the heart rate during the day, at the same time providing the opportunity to detect painless attacks of ischemia. Kholetrovskoe monitoring makes it possible to assess the causal relationship between the occurrence of cardiac arrhythmias and other clinical symptoms, to record their occurrence, duration and dynamics, and to identify the causes of cardiac arrhythmias. Reasonably noted is the extremely wide spread in everyday medical practice of establishing the facts of cardiac arrhythmias, cardiac arrhythmias in the etiological, clinical, diagnostic and prognostic terms [12].

The practical significance of the application of this digital research method is seen in the more informative content of its results in comparison with other research methods that do not use direct surgical interventions in the cardiovascular system. Moreover, this significance is also seen in the possibility, through its application, of identifying and analyzing all possible types of cardiac arrhythmias, as well as painful and painless attacks of myocardial ischemia [13]. From the results of pain and painless myocardial ischemia indices obtained as a result of daily Holter monitoring of the electrocardiogram, there were significant data on the maximum ST segment displacement, the duration of myocardial ischemia during the day and the number of their episodes, the total area of the ST segment, and the total number of episodes [14].

The study of the state of the cardiovascular system in pathology of the upper gastrointestinal tract showed that there is an improvement in conductivity indicators against the background of normalization of indicators of daily monitoring of intraesophageal pH and electrocardiogram, Holter monitoring, the frequency of cardiac arrhythmias decreases, and vegetative influences are harmonized [15].

It is true that the final resolution of the issue of determining the appropriate treatment tactics is possible only after the simultaneous conduct of studies using daily monitoring of intraesophageal pH and Holter monitoring, since the combined nature of their results makes it possible to establish typical and atypical forms of coronary heart disease, the latter of which is reflux esophagitis, often provoking the onset and development of heart ischemia [16].

3. RESEARCH RESULT

An MDCT examination, which is a non-invasive research method, with the use of additional contrast enhancement in the hydro-CT version (with subsequent multiplanar reformation), provides an opportunity to "carefully" visualize in a three-dimensional image the scanned area under study, in which pathological changes are presumably possible, including the walls stomach, the area of the cardia and subcardia, and, ultimately, formulate an assessment of the cardiac phageal zone.

MDCT examination is reasonably recognized as a highly informative digital method used in the diagnosis of hiatal hernias, since it helps to detect the movement of a large part of the stomach into the chest cavity, intussusception of the esophagus into the stomach, determine the presence or absence of cardia insufficiency, identify signs of inflammation of the esophageal-gastric junction, stomach, in different phases of research in axial projection and with the help of multiplanar reforms; contributes to the possibility of formulating a conclusion about the attribution of a pathological process in a particular patient to a certain variant of hernia of the esophageal opening of the diaphragm.

The simultaneous use of digital diagnostic methods in the examination of patients with hiatal hernias, reflux esophagitis: MDCT examination and Holter monitoring, which makes it possible in the longer term to carry out continuous daily cardiac monitoring, is not only not excluded, but is welcomed, confirming this by the positive

dynamics of the results of their combined use. At the same time, the presence of the information content of each of the indicated digital research methods is not questioned, however, the results obtained with their possible "scattered" application may be insufficient to establish and determine pathological changes, their causes and dynamics of development, from the timeliness and correctness of which, in principle, the determination of the patient's treatment tactics depends. The results obtained with the "combined" combination and use of these digital technologies will actually be more "informative", meaningful, with the highest degree of reliability.
The application of the principle of combined use of digital capabilities in diagnostics does not diminish the need for a comprehensive, "total" assessment of the results obtained using several independent methodological technologies, which is due to the variability of the clinical picture of hiatal hernia and reflux esophagitis.

4. DISCUSSION OF THE RESULTS

Differential diagnosis in patients with hiatal hernias and reflux esophagitis through the integrated use of digital technologies for MDCT examination and Holtra monitoring helps doctors of different specialties in the diagnosis and correct diagnosis of the patient, morphological clinical changes and appropriate, optimal treatment tactics.

5. CONCLUSION

The conducted research confirms the increasing prevalence of digital orientation of the use of digital and technical means and medical devices, methods of diagnosis and treatment of hiatal hernia and reflux esophagitis. The practical effectiveness of the use of digitalization resources is undeniable due to the receipt of more significant, "significant" and significant results of the diagnosis of pathological processes and deviations, their volume and dynamics, the timely detection of which affects the appropriate optimal and, which is important, timely, choice of treatment tactics, after all, situations often "dictate" the need for the promptness of its adoption.

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