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Multispiral Computed Tomography in the Diagnostics of Atypical and Rare Forms of Acute Appendicitis

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Abstract The article discusses the issues of improving the diagnostics of such a common pathology as acute appendicitis. It is noted that in recent decades it has become possible to diagnose many pathological conditions of the appendix using a non-invasive diagnostic method, such as computed tomography. The advantage and information content of multispiral computed tomography (MSCT) have been considered in patients with acute appendicitis according to the world literature. The indications and the order of use of MSCT in combination with the Alvarado diagnostic scale of acute appendicitis and ultrasound data of the appendix in identifying various forms of acute appendicitis have been determined. MSCT should be performed in patients with intermediate risk (5-8 points according to Alvarado scale) after unsatisfactory ultrasound results of the second stage. Compared with ultrasound, MSCT shows a high percentage (80-100%) of visualization of the non-inflamed appendix, which allows to confidently exclude the diagnosis of acute appendicitis. The probability of acute appendicitis after a negative CT result makes up 0.04%.

Keywords Acute appendicitis, Atypical and rare forms of acute appendicitis, Multispiral computed tomography, Diagnostics

1. Introduction

The issues of verification and therapeutic tactics at acute appendicitis (AA) are quite solvable in typical cases. However, it is difficult to diagnose atypical and rare forms of AA timely and accurate. This is due to the fact that none of the known symptoms is pathognomonic for AA and is detected in many other acute diseases of the abdominal cavity [1]. According to A.K. Soroka, among 1729 patients admitted to the hospital with clinical manifestations of AA, the diagnosis was confirmed only in 933 (54%) cases [2]. The same opinion is shared by other authors, noting the presence of the main symptoms of AA only in 50% of cases. In other patients, the authors note a variety of symptoms and their disguise as other diseases. In such cases errors in the diagnostics of AA are inevitable. Hyperdiagnosis of AA leads to an increase in negative appendectomy (17-28%), and underdiagnosis leads to complications of acute appendicitis (32.6-43%) and an increase in mortality which can reach 4.3-6.8% [3-6]. Errors in the diagnostics of AA are most often caused by incorrect interpretation of clinical data, untimely and incomplete use of special non-invasive examination methods which help to detect inflammatory changes in the appendix [7].

In this regard, an urgent need to include non-invasive imaging methods in the differential diagnostic search for AA, one of which is computed tomography (CT) is remained.

The main goal of using non-invasive diagnostic methods is to diagnose acute appendicitis quickly, with high accuracy, using the non-invasive nature of the study and to provide a differential diagnosis at the stage before surgery [8]. The use of CT for the diagnosis of AA began in 1986. The advantage of CT is the high accuracy of the examination, non-invasiveness and comparability of the study with laparoscopy in terms of cost [9]. It allows to identify appendix with any type of location (atypical and rare forms of AA) and the form of inflammation, to obtain high-quality images and allows to retrospectively reproduce the data of multi-planar reconstruction [10].

At the initial stage of the study and application of CT, the frequency of the appendix detection made up 51-79% [11]. Further study of tomographic signs of the disease, the appearance of spiral CT (SCT), and then multispiral CT (MSCT) significantly improved the accuracy of the method and put it in the leading position [12]. Thus, in the USA, the use of CT at AA had increased to 93.2% by 2007 in compare with 1998 (18.7%). As a result, the number of "negative" appendectomies in women aged 45 and younger decreased from 42.9% in 1998 to 7.1% in 2007 [9]. In the Russian Federation, the frequency of using CT for suspected acute appendicitis has increased from 25 to 68% over the past 5 years [13].

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According to a retrospective study by P.J. Pickhardt et al., sensitivity, specificity and accuracy of the method were 98.5; 98 and 98.1% respectively [14]. Similar data are presented by other authors: the sensitivity of CT in the diagnosis of AA was 90-100%, specificity 91%-99%, accuracy 94-98% [15]. Compared with ultrasound, CT showed a high percentage (80-100%) of visualization of non-inflammatory appendix, which allows to confidently exclude the diagnosis of AA, and the probability of having AA after a negative result of CT made up 0.04% [16].

The most promising method for the differential diagnostics of inflammatory changes in the right iliac region is MSCT. Its high sensitivity in the diagnostics of the right iliac region diseases has been shown - 95.1% [12]. MSCT is the method of choice in emergency diagnostics and differential diagnostics of tumor and inflammatory diseases of the right iliac region. Moreover, non-contrast MSCT has an advantage over contrast: the risks associated with allergic reactions to the administration of contrast are completely eliminated, the study can be used in patients with kidney pathology, and the cost of the study is also significantly reduced. Besides, the results of both MSCT methods are comparable [17].

The high cost, radiation exposure (which is especially undesirable for children and pregnant women), possible complications with the introduction of a contrast agent, difficulties in interpreting the results in some patients with poorly expressed mesenteric fiber or obese patients (BMI over 30) are the main disadvantages of the method.

Reliable CT signs of acute appendicitis in accordance with the gradations of N. Nitta et al. the diameter of the appendix is considered to be more than 6 mm, the presence of fluid in the lumen of the appendix, the thickening of the wall of the appendix is more than 2 mm, the presence of fluid in the periappendicular zone, signs of purulent inflammation in the right iliac fossa, the presence of free gas outside the appendix [18]. Approximate data were obtained by Willekens et al (2014) by standardizing CT features of unchanged appendix in 186 patients without clinical manifestations of AA. At the same time, the average maximum diameter was 8.19±1.6 mm, length 81.11±28.44 mm, wall thickness 2.2±0.56 mm, respectively [19].

There is controversy in the literature regarding indications for CT at AA. Many clinicians believe that CT is indicated at the following conditions: at unclear clinical situations to detect acute appendicitis in the phase of catarrhal inflammation, at suspicion of atypical and rare forms of the disease, to characterize periappendicular inflammatory formations (phlegmon, abscess) and tumors, as well as for the diagnostics of other acute abdominal conditions not associated with AA, which can cause pain in the right iliac region (intestinal ischemia, dissected abdominal aortic aneurysm) [20-21,16].

Meanwhile, bearing in mind that the value of individual clinical parameters for determining the probability of AA at atypical and rare forms is low, many world-class specialists, depending on the probability of the disease, recommend an individual step-by-step approach to the diagnosis of AA, which are determined by the AA diagnostic scales. Only clinical assessments, for example, Alvarado's assessment of the presence of AA, are sensitive enough to rule out acute appendicitis, accurately identifying low-risk patients and reducing the need for non-invasive imaging, reducing the incidence of negative appendectomy. In patients with intermediate risk (5-8 by Alvarado score – "gray zone") is recommended to include in the diagnostic search additional methods of non-invasive (ultrasound, MSCT, MRI) and invasive diagnostics [22-23].

A comparative review of the literature to evaluate the efficiency of abdominal ultrasound and CT in the diagnosis of AA in adults and children showed that in the USA, the sensitivity, specificity, positive prognostic value and negative prognostic value of ultrasound made up 86%, 94%, 100% and 92%, respectively. The values of sensitivity, specificity, positive prognostic value and negative prognostic value for CT were 95%, 94%, 95% and 99%, respectively. These results suggest that ultrasound is an effective first-line diagnostic tool for AA diagnosis and that CT should be performed in patients with inconclusive ultrasound results [24].

The conditional strategy, in which CT is performed after negative ultrasound results, is preferable because it reduces the number of CT scans by 50% and allows the correct identification of as many AA patients as the immediate CT strategy. Meanwhile, the combined use of CT and ultrasound in the verification of AA allows to increase the accuracy of diagnosis up to 98% [25].

Thus, despite the wide range of diagnostic measures carried out, the efficiency of diagnosis and choice of therapeutic tactics at AA in 35-40% of cases may be difficult, which is most often associated with atypical and rare forms of AA [26]. In these cases, the key to successful diagnosis and treatment of AA is the timely and widespread introduction of MSCT in the diagnostic and treatment algorithm for atypical and rare forms of AA [22]. It is impossible not to agree that the key to correct diagnosis is a detailed history of the disease and a skillful examination of the patient, and if differential diagnostic difficulties arise, radiation examination methods should be used. However, clinical and laboratory, ultrasound research methods are not informative enough in the diagnostics of atypical and rare forms of AA. Wait-and-see diagnostic tactics lead to an increase in the number of diagnostic and tactical errors, as a result of which the number of complications and deaths increase. Despite the high cost and radiation loads for patients at using MSCT, it is absolutely legitimate to perform it for patients whose clinical verification of the diagnosis was difficult, and ultrasound examination (ultrasound) did not help. In this regard, there is an urgent need for timely diagnostics and treatment of atypical and rare forms of AA through the broad integration of MSCT in the therapeutic and diagnostic process due to its excellent diagnostic capabilities of the method in establishing or excluding inflammation in the appendix [22]. It is obvious that a

thorough assessment of the totality of anamnesis data, physical examination, laboratory data, the results of prognostic scales of AA and several instrumental studies, often performed in dynamics allow to establish the correct diagnosis and when their diagnostic capabilities are exhausted, MSCT is the method of choosing timely diagnosis and subsequent surgical treatment of atypical and rare forms of acute appendicitis, surpassing all expectations [27].

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