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Ultrasonography guidelines for imaging acute appendicitis

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ABSTRACT

Introduction: acute appendicitis is often the diagnosis in patients who are suffering from acute abdominal pain. Quite often, it is complicated to detect this ailment based only on the patient's medical history, physical examination and laboratory findings. The use of imaging modalities is essential to confirm the diagnosis. Ultrasonography (US) is usually the first-line imaging examination which is performed when acute appendicitis is suspected. The main advantage of US is the absence of ionizing radiation, which is important in the young adult and pediatric populations, among which appendicitis usually occurs and who are very vulnerable to the radiation.
Aim: to review scientific literature and determine guidelines for imaging acute appendicitis using ultrasonography.
Materials and methods: literature analysis. A research of articles in English language on the "PubMed" 2011 to 2017 database. Keywords used in the search: "Acute appendicitis", "Ultrasonography", "Guidelines".
Results: the clinical diagnosis of acute appendicitis remains difficult, both in the pediatric and adult population, as the presentation is often atypical. Symptoms are frequently non-specific and overlap with various other diseases. The reported sensitivity for US varies in the literature (67–100%) and is lower than computed tomography (CT). Despite the variety in the sensitivity, the reported specificity of US is 95–98%, which is almost equal to the specificity of CT
Conclusions: the use of US as an initial imaging technique can help reduce the rate of negative appendectomies and minimize radiation hazards by limiting the use of CT, especially in pediatric patients. CT is recommended only in patients with negative or inconclusive US findings.
Key words: appendicitis, ultrasonography, guidelines.

List of abbreviations

AA - acute appendicitis

NA – negative appendectomy

US - ultrasonography

CT – computed tomography

RLQ – right lower quadrant

Introduction

Acute appendicitis is often the diagnosis in patients who are suffering from acute abdominal pain. Quite often, it is complicated to detect this ailment based only on the patient's medical history, physical examination and laboratory findings. The use of imaging modalities is essential to confirm the diagnosis. Ultrasonography (US) is usually the first-line imaging examination which is performed when acute appendicitis is suspected. The main advantage of US is the absence of ionizing radiation, which is important in the young adult and pediatric populations, among which appendicitis usually occurs and who are very vulnerable to the radiation. [1] On the other hand, it is a simple, non-invasive and brief procedure which is available at most hospitals; also it may be performed at the bedside. [2] Despite all these advantages, US is an operator dependent imaging modality. In order to improve the diagnostic accuracy of the US, the role of guidelines is very important. [1, 3]

Materials and methods

Literature analysis. A research of articles in English language on the "PubMed" 2011 to 2017 database. Keywords used in the search: "Acute appendicitis", "Ultrasonography", "Guidelines".

Results

The diagnosis of AA is complicated both in the pediatric and adult populations, as the presentation is often atypical. Symptoms are usually non-specific and may be mistaken for various other diseases. [4] The reported rate of negative appendectomies varies from 15% to 20%. [5, 6] However, a review of studies has shown that with the help of imaging modalities, the rate of NA can be significantly reduced. [7] US examination should be the first imaging test performed, especially among the previously mentioned populations and also in pregnant patients, who represent the main targets for appendicitis. [8, 9] When visualizing AA, a high-resolution linear array transducer allows optimal definition of the structures at the RLQ. In obese patients, a convex array lower frequency transducer may be needed for better penetration. Applying compression with the transducer helps differentiate between normal displaceable loops and the fixed inflamed appendix. In the case of a deeper situated appendix, the use of posterior manual compression is recommended. The sonographer's left hand is forced to the patient's right lower back above the ileum in order to reduce the distance and to allow better identification of deeper appendices. Visualization of the whole appendix is needed to evaluate if the inflammation is localized only at the end or if it is consistent throughout. [1] A normal appendix is compressible and less than 6 mm in diameter, while an inflamed appendix is usually painful when applying pressure, enlarged and non-compressible with a thickened wall (Figure A). [10] The findings of imaging AA also include: distension and obstruction of the appendiceal lumen, such as an appendicolith, hyperemia and high echogenicity surrounding the appendix. What is more, pericecal and perivesical free fluid, thickened bowel loops with deceased peristalsis and phlegmon with pericecal inflammatory fat changes are clear indications for the diagnosis of AA. [2, 3, 11-14] The use of Doppler increases the sensitivity and accuracy of US. Doppler imaging is effective in detecting hyperemia, inflammation and edema, all of which are present during the first stage of acute appendicitis (Figure B). On the other hand, the diagnostic accuracy of Doppler is reduced by conditions that impair blood flow, such as necrotic

and gangrenous appendicitis. [15] Gender differences in US for appendicitis have been reported, with lower sensitivity for girls, because US in girls is primarily used to exclude gynecologic diseases. [3] Also, it is important to differentiate right-sided diverticula from AA. Right-sided diverticula occur more often in younger patients than left-sided diverticula and because patients are young and present with right lower quadrant pain, they are often thought to suffer from AA. [16] What is more, mesenteric lymphadenitis is a common finding in the context of RLQ pain and also needs to be differentiated from AA. There is usually no echogenic mesenteric fat in this condition as unlike AA. The inflammation is contained within the nodes. [10] The inability of US to properly scan a gas distended bowel or an obese patient, and lack of demonstration of a normal appendix, especially when retrocecal or deeply situated in the pelvis, may lead to indeterminate or false negative exams. A negative or indeterminate US exam in a non-pregnant adult with a high clinical suspicion of appendicitis must be followed by CT. [1]

Discussion

The main advantages of US as a first imaging modality over CT are the lack of radiation (this is especially true for children and pregnant women), the relative cost and the ease of access (bedside US). The reported specificity US varies from 95% to 98%, which is almost equal to CT. However, the reported sensitivity for US varies in the literature (67–100%), is lower than computed tomography (CT) and also highly dependant on the skill of the operator. [2] This is the main disadvantage of US, and also the main reason why CT is commonly used as a first imaging modality in adults who present with RLQ pain. Another advantage of CT is the diagnosis of AA when the presentation of the appendix is atypical [18]. Therefore we suggest that US should be used as a first imaging modality, and CT be used only in patients with negative or inconclusive US findings.

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