Radiol Oncol 1995; 29: 190–3.

Value of ultrasound in the diagnosis of acute appendicitis

Ivan Drinković, Boris Brkljačić, Drago Odak, Andrija Hebrang

University hospital "Merkur" Center for ultrasound diagnostics, Department of Radiology, Zagreb, Croatia

Acute appendicitis is the most common surgical disease. Incidence of appendectomies performed for suspected acute appendicitis is rather high, although some other diseases may mimick appendicitis. 10–30 % of appendectomies are performed unnecessarily. Using ultrasound diagnostics the number of unnecessary operations was reduced to 2.85 %, the number of nonrecognized cases of appendicitis to 7 %, while in 24.9 % of patients prepared for surgery due to the picture of acute appendicitis, another disease was found, and operation avoided. Ultrasound specificity was 94 %, sensitivity was 89 % and accuracy 90 %. Based on the results of our investigation, ultrasound examination of the appendix has proved to be highly recommendable as a routine method in the preoperative treatment for appendectomy.

Key words: Appendicitis ultrasonography

Introduction

Acute appendicitis presents the most common, though diagnosticaly very delicate indication for surgical operation. In spite of all clinical indications, as much as 30 % of patients with a suspected appendicitis are operated on without real need because some other disease was misinterpreted as appendicitis.[1,2]

Ultrasound diagnostics using high resolute transducers, suprapubic and transvaginal examination methods, the appendix compression technique, as well as the diagnostic criterion calling for appendix visualization, wall thickness greater than 4.0 mm and transudate formation all enable the high accuracy of the diagnosis of appendicitis and its attendant complications.[3–10]

Correspondence to: Ass. prof. Ivan Drinković Ph.D. M.D. University Hospital "Merkur", Zajčeva 19, Zagreb, Croatia

UDC: 616.346.2-002-073:534-8

The aim of this study was to evaluate transabdominal and intravaginal ultrasonography in the diagnosis of acute appendicitis, that is, to evaluate its role in preventing an operative procedure indicated by the incorrect diagnosis.

Materials and methods

During a 10-year period, in collaboration with the Emergency Surgical Service of the Department of Surgery, the "Merkur" University Hospital, 570 patients suspected of having appendicitis on the basis of clinical and laboratory findings, were ultrasonographically examined. After a complete examination, transabdominal ultrasonography together with an additional intravaginal ultrasonography in women, were performed using high resolute transducers.

Of 570 patients, 385 were submitted to operation, and 185 remained under frequent clinical follow-up in order to confirm or rule out appendicitis.

Ultrasonographic examinations were performed by three well-trained sonographers. No time limits for the examination were imposed, and the diagnostic criterion of appdenicitis called for the following parameters:

1. appendix visualization
2. dosed transducer compression and pain
3. wall thickness $>4{,}0$ mm
4. perityphlitic abscess visualization

The following equipment was used for examination : the Radius CF GI, RT 4000, RT 3600, RT 2800, all provided with 7,5 MHz transducers and the first two also with additional 7,5 MHz intravaginal transducers.

Results

During a 10-year study 570 patients with clinical symptoms of appendicitis, accompanied with increased temperature and leukocytosis, were examined. Using ultrasonography, acute appendicitis was suspected in 385 patients by the above mentioned criteria, while in 185 patients the diagnosis of appendicitis was ruled out or was uncertain.

Open or laparoscopic surgery was performed in 385 patients. In 11 patients ultrasound diagnosis was not accurate, the picture of appendicitis having been simulated by inflammatory bowel diseases, adentis, or inflammatory alterations in the small pelvis.

A hundred and eighty-five patients ultrasonographically diagnosed without the signs of appendicitis or with suspected appendicitis were followed-up intensively in the course of 5 days, and in 42 patients a clinical picture of appendicitis eventually developed, in some of them subsequently recognized at sonography. These 42 patients were submitted to surgery.

Sensitivity of the examination was 89 %, specificity was 94 % and accuracy 90 %.

Discussion

Despite the apparently manifested symptoms of appendicitis in most of the patients, the diagnosis of acute appendicitis can be difficult in a smaller group of patients including especially children, pregnant women and elderly people. Certain gastrointestinal diseases, genitourinary system diseases and obstretric and gynaecological diseases present particular problems in differential diagnosis.

Even with all laboratory and clinical examinations available 10–30 % of the patients diagnosed with appendicitis are operated on without a real reason as actually suffering from a disease other than appendicitis, eg. disease of some of the systems mentioned above.

Using ultrasonography the number of unnecessary operations on our patients was reduced to only 2.85 (11 %) of patients.

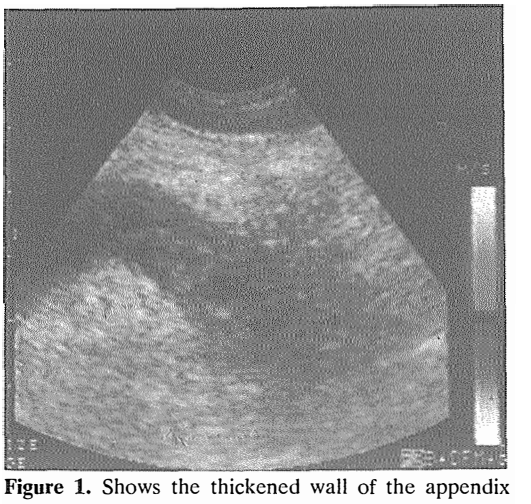

Figure 1. Shows the thickened wall of the appendix $>4{,}00$ mm.

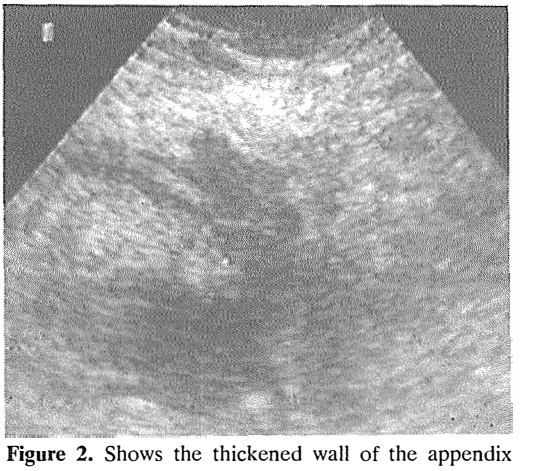

Figure 2. Shows the thickened wall of the appendix up to 4,0 mm with formed perityphlitic abscess.

It shoud be mentioned that ultrasonography prevented 185 patients (32.4%) from being operated on due to failure to recognize or establish a certain diagnosis of appendicitis, and that intensive follow-up of patients enabled a still timely operation in 42 of them (7%). thus avoiding possible complications.

The use of ultrasonography prevented an unnecessary operation in 142 (24.9%) patients.

When assessing acute appendicitis all clinical and laboratory parameters, as well as ultrasonographic parameters of inflammation including the wall thickness greater than 4.0 mm and liquid, ie. perityphlitic abscess formation should be observed. (Figure 1,2)

It is very important to use the dosed compression technique with appendix visualization, as well as pain registration, which additionaly improve examination accuracy.

Intravaginal ultrasonography was of great importance in diagnosing obstetric and gynaecological disorders in patients in whom it was not possible to diagnose appendicitis or the diagnosis was not certain at transabdominal ultrasonography. Uncertain ultrasonographic diagnoses of appendicitis despite well-founded clinical suspicion, indicate on the basis of our results, the necessity of intensive follow-up of patients in the subsequent several days because of the inability of ultrasound to approach the retrocoecal location and atipical site of the appendix, and the possibility of paretic and thickened bowel loops to simulate appendicitis.

According to our investigation, we recommend the ultrasonographic examination of acute appendicitis as a complementary diagnostic method which by its advantageous possibility of using the additional intravaginal examination technique in doubtful cases, provides a significant reduction of unnecessary surgical procedures.

In our study the use of intravaginal ultrasonography has significantly reduced the number of positive diagnosis of appendicitis in women which suggests that this examination method should be used in this population of patients paralel to suprapubic examination.[11]

Conclusion

Ultrasonographic examination of the appendix has become a complementary diagnostic method in the recognition of acute appendicitis.

It is of a particular importance in children, pregnant women, elderly people, and in all patients with atipical clinical presentation. The use of intravaginal transducer and the 7.5 MHz transducer in suprapubic examination improves the accuracy of the diagnostic procedure. This examination method reduced the number of unnecessary operations to only 2.5% of patients and was inefficient in the detection of appendicitis in only 7% of patients. Satisfactory specificity and sensitivity accompanied with sufficient accuracy argue for the desirability of the introducing ultrasonography in the routine examination procedure of acute appendicitis.

References

1. Wilson JL, JJ MC Donald. Abdominalna kirurgija – Kirurgija apendiksa. Med. knjiga Zagreb, 1969; 385–91.
2. Štulhofer M. Kirurgija probavnog sustava – Kirurgija apendiksa; 893–914.
3. Athey PA, Hacken JB, Estrada R. Sonographic appearence of mucocele of the appendix. *J Clin Ultrasound* 1984; **12:** 333.
4. Beyer D, Richer O, Kaiser C, Horsch S. Realtime-Sonographie bei akuten Appendizitis. Untersuchungstechnik – Sonomorphologie, Ergebnisse ciner prostektiven Studie, *Ultraschall Klin Prax* 1989; **4:** 124.
5. Drinkovič I, Brkljačić B, Boko H, Odak D, Vidjak V, Anić P. The treatment od appendiceal abscess by ultrasonically guided drainage. *Radiol Oncol* 1992; **26:** 96–8.
6. Hapke MR, Bigelow B. Mucocele of the appendix secondary to obstruction by endometriosis *Hum Pathol* 1977; **8:** 585–9.
7. Horgan JG, Chow PP, Richter JO, Rosenfield HT, Taylor KOW CT and sonography in the recognition of the mucocele of the mucocele of the appendix. *AJR* 1984; **143:** 959–62.
8. Hulek M, Vagner Z. Grose Mukozele der Appendix imitiert eine Ovarialzyste. *Zantralbl Gynahol* 1978; **100:** 186–186.
9. Rieber A. und Brambs H-J. Die Mukocele der Appendix in Ultrachall und CT. *Ultrachall Klin Prax* 1989; **4:** 26–7.

10 Richer OH, Beyer D, und Horsch S. Mukozele der Appendix abs Differentialdiagnose der akuten Appendizitis Sonographie und kliniche Bedeutung. *Ultraschall Klin Prax* 1991; **6:** 33–6.

11. Worrell JA, Leo F, Drolshagen, Thomas C. Kelly, David W. Hunton, Gudrn R. Durmon, Arthur C. Fleischer. Graded Compression Ultrasound in the Diagnosis of Appendicitis Ultrasound Med 1990; **9:** 145–50.