Introduction

The differential diagnosis of acute appendicitis is numerous and varies significantly.1 Despite technological advances, the diagnosis of appendicitis is still based primarily on the patient’s history and the physical examination.2 Diagnostic accuracy varies by sex, with a range of 78–92% in male and 58–85% in female patients. These differences reflect the fact that appendicitis may be extremely difficult to diagnose in women of reproductive age due to the symptoms of acute gynaecological conditions. Gynaecological diseases such as ectopic pregnancy, endometriosis, ovarian torsion, pelvic inflammatory disease, ruptured ovarian cyst (follicular, corpus luteum), tubo-ovarian abscess in women of reproductive age often imitate the clinical symptoms of acute appendicitis and vice versa as well.1,3,7

In approximately 20% of all cases however, the diagnosis is incorrect and patients undergo surgery without
having acute appendicitis at all.\textsuperscript{18-20} Approximately 7\% of the population will have appendicitis in their lifetime\textsuperscript{11} with the peak incidence occurring between the ages of 10 and 30 years.\textsuperscript{12} Prompt diagnosis and surgical referral may reduce the risk of perforation and prevent complications. The elevated rate of appendectomies without histological evidence of acute inflammation, especially in young women, and the high perforation rate in small children and elderly patients reflect poor diagnostic accuracy.\textsuperscript{14}

A surgeon often refers women of reproductive age with the clinical symptoms of acute abdomen to a gynaecological examination with the aim to diagnose the presence of acute gynaecological disease.

The search of the databases (Medline, Medscape, Dynamed) has shown no results for the studies which would deal with the diagnostic accuracy of the gynaecological examination itself in women of reproductive age who were originally referred to a surgeon, with suspected acute appendicitis.

The aim of this study was to examine the reliability of gynaecological examination in women of reproductive age who have shown clinical symptoms of acute abdomen.

**Patients and methods**

All patients underwent surgery at County Hospital in Po'ega. This hospital offers its services to some 80,000 people in the region of the eastern part of Croatia. Case histories of patients with acute appendicitis who were operated in the Surgical Department in the period from 1988 to 2003 were analysed retrospectively.

The surgeon’s referral of women patients of reproductive age to a gynaecological examination was analysed as well as intraoperative and histological findings. A female person, aged 15–45 was regarded as a woman of reproductive age. The women of reproductive age who were not examined by bimanual gynaecological examination itself in women of reproductive age who were originally referred to a surgeon, with suspected acute appendicitis.

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**Patients and methods**

All patients underwent surgery at County Hospital in Po'ega. This hospital offers its services to some 80,000 people in the region of the eastern part of Croatia. Case histories of patients with acute appendicitis who were operated on for suspected acute appendicitis. There were 946 males (55.6%) and 746 females (44.1%). The number of women of reproductive age was 547 (73.3%).

Pathohistological findings were not positive in 184 patients (10.9%) who underwent surgery for suspected acute appendicitis. Out of this number, there were 82 males (8.7%) and 102 females (13.7%). Appendicitis was not confirmed in 87 women of reproductive age (15.9%).

Out of 1508 patients with confirmed acute appendicitis, 289 patients (17.1\%) were found to have perforated appendix intraoperatively.

In 17 women a gynaecologist, apart from bimanual gynaecological examination, carried out other diagnostic tests as well ultrasound (US), computed tomography (CT) and these women were excluded from the study. There were 530 women of reproductive age who met the criteria and were included in the study.

For preoperative examination 159 women were referred to a gynaecologist and 371 were not. In 56 women gynaecological disease was diagnosed intraoperatively (10.6\%). Out of 159 women who were referred to a gynaecologist preoperatively, 34 (21.4\%) women were diagnosed with gynaecological disease even though the gynaecologist excluded it. Out of 371 women who were not referred to a gynaecologist for an examination, 22 (5.9\%) were diagnosed with gynaecological pathology (Table 1.).

A ruptured ovarian cyst (follicular, corpus luteum) was diagnosed in 34 patients, a tubo-ovarian abscess in 12, a pelvic inflammatory disease in 9 and an ovarian torsion in 1 woman (Table 2.).

During the same period, there were 114 women of reproductive age who underwent surgery for the acute abdomen.

<table>
<thead>
<tr>
<th>Gynaecological pathology – Ginekološka bolest</th>
<th>Ginekološki pregled</th>
<th>Total/Ukupno</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gynaecological examination</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes/Da</td>
<td>34</td>
<td>125</td>
</tr>
<tr>
<td>No/Ne</td>
<td>22</td>
<td>349</td>
</tr>
<tr>
<td>Total/Ukupno</td>
<td>56</td>
<td>474</td>
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<table>
<thead>
<tr>
<th>Intraoperatively established</th>
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<tr>
<td>Table 2. Gynaecological disease established intraoperatively</td>
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<tr>
<td>------------------------------------------------</td>
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<tr>
<td>Total/Ukupno</td>
</tr>
<tr>
<td>Ruptured ovarian cyst/Prsnuta cista jajnika</td>
</tr>
<tr>
<td>Tubo-ovarian abscess/Tuboovarijski apses</td>
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<tr>
<td>Pelvic inflammatory disease/Upalna zdjeljena bolest</td>
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<tr>
<td>Ovarian torsion/Torzija ovarija</td>
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<td>Total/Ukupno</td>
</tr>
</tbody>
</table>

| Total/Ukupno                                   | 114               |

Table 3. Incidence of the acute abdomen of the right lower quadrant with a suspected gynaecological disease in women of reproductive age operated at the Department of Gynaecology.
of the lower right quadrant with a suspected gynaecological disease at the Department of Gynaecology. Out of that number, 4 patients were diagnosed with acute appendicitis intraoperatively (Table 3).

A significant unreliability of bimanual gynaecological examination was found in diagnosing acute gynaecological pathology in patients referred to a consultation by a surgeon (p<0.05, $\chi^2 = 26.516$; odds ratio $= 4.31$, CI 95% $= 2.43–7.65$).

**Discussion**

Diagnosis of acute appendicitis, especially in certain high-risk groups within the population, still presents a considerable problem.

Women of reproductive age certainly belong to a high-risk group in the case of adequate diagnosis of acute appendicitis. Gynaecological diseases often imitate clinical symptoms of acute appendicitis and vice versa. This diagnostic problem has led to false-negative appendectomy rates as high as 30% in females of reproductive age. Flum et al. found the uniform/homogenous incidence of misdiagnoses in women of reproductive age (23.6%–26.6%).

At the County Hospital in Pozega, the false-negative appendectomy rate was noted in 87 women of reproductive age (15.9%), while 56 patients (10.6%) were diagnosed with a gynaecological disease intraoperatively. In a review of medical records of 4,950 patients who underwent emergency appendectomy at the U.S. Department of Defense Hospitals worldwide, the false-negative appendectomy rate was noted to be 9% in male patients and 19% in female patients.

For all these reasons patients with suspected acute appendicitis are often referred to a gynaecologist who will then confirm or remove any doubt for an acute gynaecological disease. This study has investigated whether the standard bimanual gynaecological examination was sufficiently reliable in making an adequate diagnosis. In all databases that we have searched no single study has been found which would deal with the reliability of gynaecological examination in women of reproductive age who were differentially diagnosed with suspected acute appendicitis or with an acute gynaecological disease.

We have analysed medical records in our hospital in the last 15 years and found out that the incidence of gynaecological pathology was 10.6% in women of reproductive age who underwent surgery for suspected acute appendicitis. In 159 women bimanual gynaecological examination was normal but 34 of them were diagnosed with gynaecological disease (23.6%). All the data (Table 1) obtained from the medical records have shown a significant unreliability of gynaecological examination (p<0.05, $\chi^2 = 26.516$, odds ratio $= 4.31$, CI 95% $= 2.43–7.65$).

Surgical removal of the appendix prior to perforation is the goal of treatment in patients with acute appendicitis. Of course, patients with clear clinical symptoms of acute appendicitis will not have to be sent to additional diagnostic tests, with the exception of patients with atypical symptoms, children, women of reproductive age and pregnant women. For all the above reasons, there could be an objection to this study that only women of reproductive age without clinical symptoms of acute appendicitis were referred to a gynaecological examination and were, therefore, more likely to be diagnosed with a gynaecological disease. However, a gynaecologist examining such a patient has to bear in mind that these unclear physical manifestations were the actual reason why the woman was referred to a gynaecological examination. In the prospective studies, it could be planned that all women of reproductive age with suspected appendicitis would also be referred to a gynaecologist.

**Computerized tomography (CT)** has been shown to determine very accurately the presence of acute appendicitis in patients with atypical clinical symptoms. Three prospective studies have demonstrated that CT reduces the negative appendectomy rate to about 5% without a corresponding increase in the rate of perforation. This improved diagnostic accuracy was seen in all age groups, but was most prominent in those patients in whom the disease can be most difficult to diagnose - women of reproductive age and small children. Balthazar et al. demonstrated that CT led to an overall false-negative appendectomy rate of 4%, with a rate of 8.3% in female patients of childbearing age. This was accomplished without incurring an increase in the perforation rate, which, at 22%, was similar to that in previously published reports. Rao et al. found that helical CT is an excellent imaging option for differentiating appendicitis from most acute gynaecological conditions.

In a review of 21 studies enrolling more than 100 patients each, the median sensitivity and specificity of ultrasound diagnostics (US) in detecting acute appendicitis was 86% and 96% respectively and the median positive and negative predictive value was 92% and 93% respectively.

Lim at all. found that graded compression sonography is a valuable procedure for detecting acute appendicitis in pregnant women despite technical difficulty in performing it during the third trimester of pregnancy.

Also studied was the role of laparoscopic exploration. Some authors have found a significant reduction in number of unnecessary laparotomies, and an overall improvement of diagnoses in such situations. Larsen et al. found that the use of laparoscopy in women of reproductive age detected only 7% of the patients who had their healthy appendix removed, compared with 34% in the open surgery group. They found among the women with a healthy appendix, that a gynaecological diagnosis was found in 73% after laparoscopy, compared with 17% after an open surgery. In another prospective study, laparoscopy was associated with a 5% negative appendectomy rate compared with 38% using physical examination and transvaginal US.
In contrast to these studies, Flum et al.\(^2\) argue that the total number of misdiagnoses in all patients who underwent laparoscopic appendectomy was significantly higher than in the open appendectomy patients (29.1%, vs. 24.8%; \(p=0.02\)).

Grönnroos et al.\(^{27}\) found that leukocyte and C-reactive protein count can help in differential diagnosis of appendicitis compared to acute gynaecological diseases. The results from a few studies indicate that magnetic resonance (MRI) is helpful in diagnosing acute appen-
Acute appendicitis in certain patient populations (e.g., children, pregnant women). Diagnosis of acute appendicitis in women of reproductive age still presents a difficulty, largely due to a possible gynaecological disease. The results of our study have shown that the gynaecological examination in such patients is unreliable in diagnosing an acute gynaecological disease. It is our opinion that in such cases it is essential to use other diagnostic methods (US and/or MR in children and pregnant women, CT and/or laparoscopy in others) in making an adequate diagnosis, and consequently an adequate therapy.

An algorithm of diagnostic and therapeutic procedures in patients with the symptoms of acute appendicitis could be suggested based on our experience and the works of other authors (Figure 1).

**Literature**


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