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ARAŞTIRMA MAKALESİ

SHOULD ULTRASONOGRAPHY BE A ROUTINE TEST IN PREOPERATIVE DIAGNOSIS OF ACUTE APPENDICITIS?

ULTRASONOGRAFİ AKUT APPENDİSİTİN PREOPERATİF TANISINDA RUTİN OLARAK İSTENMESİ GEREKEN BİR TETKİK MİDİR?

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ABSTRACT: Acute appendicitis is a common surgical problem. This study reviews if abdominal ultrasonography (US) is convenient for the clinicians in preoperative diagnosis of acute appendicitis.
67 patients who underwent an appendectomy in İdil State Hospital between January 01th 2011 and March 31th 2012 included to the study. Patient demographics, US results, white blood cell counts (WBC) and histopathological results documented retrospectively.

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35 (52.2%) of the 67 patients were male. Average age was 27.31, 32 (47.8%) patients underwent a preoperative US. US failed to show acute appendicitis in 10 patients (38.5%), and it was falsely positive in 4 patients (66.7%). We could not determine statistically significant difference between US and histopathological examination results.
Anamnesis and physical examination are still basic diagnostic for acute appendicitis diagnosis despite developing medical technology. US may be helpful in selected cases with diagnostic difficulty, rather than a routine method in the preoperative diagnosis of acute appendicitis.

Keywords: Acute appendicitis, ultrasonography, preoperative diagnosis

ÖZET: Akut apandisit en yaygın cerrahi hastalıklardan birisidir. Bu çalışmanın amacı batın ultrasonunun (US) akut apandisitin pre-operatif tanısında klinisyene ne kadar yardımcı olduğunu araştırmaktır.
Çalışmaya 1 Ocak 2011 ile 31 Mart 2012 tarihleri arasında İdil Devlet hastanesinde akut apandisit ön tanısı ile appendektomi uygulanan 67 hasta dahil edildi. Hastaların demografik verileri, US sonuçları, lökosit (WBC) değerleri ve histopatolojik inceleme sonuçları dosyaları retrospektif olarak kaydedildi.
67 hastanın 35'i (%52,2) erkek, yaş ortalamaları ise 27,31'di. Toplam 32 (%47,8) hastaya preoperatif US yapılmıştı. US 10 hastada (%38.5) akut appendisiti gostermekte basarisiz olurken, 4 hastada (%66.7) ise yalanci pozitifti. US bulguları ile histopatolojik veriler arasında istatistiksel olarak bir ilişki saptanmadı.
Gelisen tibbi teknolojiye ragmen akut apandisit tanısının temelini hala anamnez ve fizik muayene oluşturmaktadır. US ise preoperatif akut apandisit tanısında rutin kullanılan bir yöntem olmaktan ziyade, tanı güçlüğü yaşanan seçilmiş olgularda yararli olabilir.

Anahtar Kelimeler: Akut Appendisit, ultrason, preoperatif Tanı

INTRODUCTION

In fact, being the most common emergency surgery requiring abdominal pathology, appendicitis may be presented with various symptoms clinically (1,2). Therefore, it is likely to be misdiagnosed. Its main symptom is an abdominal pain that starts around the umbilicus and localizes towards the lower right abdomen, and a sense of nausea. Delay in the diagnosis and treatment causes perforation and increases morbidity and mortality. Detailed anamnesis and complete physical examination is essential in the diagnosis of acute appendicitis, and increased white blood cell count (WBC) is a laboratory finding that supports the diagnosis. Preoperative US is commonly performed for establishing the diagnosis of acute appendicitis in the recent years (3). US exam is requested for almost all patients with abdominal pain by physicians, and whether it should be included among the routine examinations in the diagnosis of acute appendicitis is controversial (4). The aim of this study is to evaluate the two commonly used methods and discuss if US is helpful in the preoperative diagnosis of acute appendicitis.

MATERIALS AND METHODS

67 patients underwent appendectomy between January 1th 2011 and March 31th 2012, patient charts reviewed retrospectively. Demographic data, US results (if applied), WBC, histopathological examination results and hospital stay lengths recorded. Preoperative gynecological examination performed for all female patients by gynecology and obstetrics specialist. Patients who underwent a surgical procedure for another pathology, and also performed appendectomy, excluded from the study. WBC above 10000 cells/µl was considered as leukocytosis. Appendix front-end diameter exceeding 6 mm in US, presence of peri-appendicular anechoic liquid, peri-appendicular hypo echoic inflammation, cecum and ileum walls thickening significantly more than the walls of other intestinal segments and being non-compressed and aperistaltic and appendicolith interpreted to indicate acute appen dicitis. Histopathological examination performed for all removed appen dices. In the histopathological exam ination, changes in the appendix observed from minimal focal inflammation to wide necrosis in the wall. Cases with no inflammatory change in their microscopy considered as normal appendix (negative appendectomy) while all other cases considered as appendicitis.

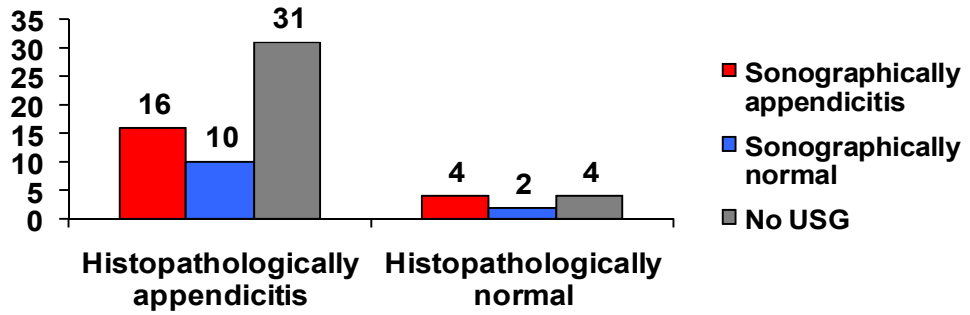
Statistical analysis of the data done with SPSS 15.0 for Windows packaged software with 95% confidence. Chi-Square used for the comparison of non-parametric data, independent sample t test for the inter-group comparison of parametric data, Kappa and ROC analyses for the compatibility of US and histopathologi cal examination results, and ROC analysis for the compatibility of WBC counts and histopathological results. P value <0,05 considered as statistically significant.

RESULTS

35 (52.2%) of the 67 patients were male, and 32 (47.8%) were female while their average age was 27.31. According to the preoperative hemo gram results, number of patients with WBC 10000 cells/µl and above determined to be 46 (68.6%) and the median WBC was 11850 cells/µl. Histopathological examination results revealed as acute appendicitis in 57 patients (85.1%), and normal appendix in 10 patients (14.9%). 32 (47.8%) patients underwent a preoperative US. Histopathological examination reports did not prove acute appendicitis in 6 (18.7%) of them (Figure 1). Median length of hospital stay was 2 days (min: 1, max: 6).

26 (81.3%) of 32 patients with US, and 31 (88.6%) of 35 patients without US diagnosed as appendicitis in histopathological examination. There was no statistically significant difference between histopathological diagnosis and preoperative US results. Histopathological examination results revealed as normal appendix for 10 (38.5%) of the 26 patients who were sonographically diagnosed as acute appendicitis preoperatively (false negative). US examination showed acute appendicitis (false positive) in 4 (66.7%) of the 6 patients who had a normal appendix in final histo pathological examination result. There was no statistically significant compatibility in the Kappa analysis between US and histopathological results (Kappa value:-0,037 p= 0,815).

Figure 1: Distribution of cases according to their histopathological diagnoses



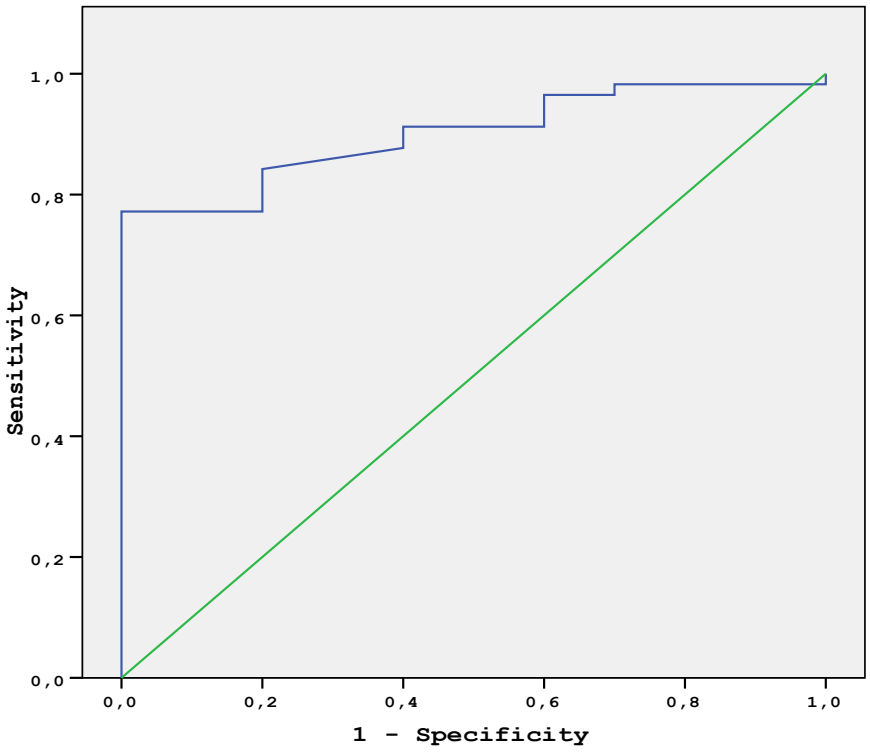


Figure 2: The ROC curve for the WCC and histopathology

	Histopathology				Total		Kappa Value	P
	Appendicitis		Normal Appendix					
	n	%	n	%	n	%		
USG compatible with appendicitis	16	61.5	4	66.7	20	62.5	-0.037	0.815
USG not compatible with appendicitis	10	38.5	2	33.3	12	37.5		
Total	26	81.3	6	18.8	32	100.0		

Table 1: Distribution of USG and histopathological results according to the diagnosis of appendicitis

In the ROC analysis made for the compatibility of US and histopatho logical results, the area under the curve found to be 0.474 (positive predictive value 47.4%). Sensitivity and specificity for US was 61.5% and 33.3% respectively. There was no statistically significant compatibility between US and histopathological results (Table 1). (AUC:0.474 "95% CI:0.217-0.732" p=0.847). In the ROC curve that drawn for the compatibility of histopathological results with WBC, the area remaining below the curve calculated to be 0.900 (AUC 95% CI:0.824-0.976 p:0.001) and it found to be statistically significant in the diagnosis (Figure 2) ($p<0.05$).

The biggest area remaining below the ROC curve found to be 0.886 when the WBC count cut-off value taken as 10.500 (positive predictive value 88.6%) (Table 2). On the other hand, there was no statistically significant difference for average WBC of the male and female cases ($p>0.05$).

Length of hospital stay for the patients histopathologically diagnosed as acute appendicitis found to be 2.25±1.02 days and those considered having normal appendix 1.7±0.68 days. However, the difference between two groups was not statistically significant (p=0.110 $p>0.05$).

DISCUSSION

Sensitivity varies 65 to 90%, specificity varies 90 to 100%, positive predictive value varies 80 to 89%, and negative predictive value varies 76 to 92% for US examination in the preoperative diagnosis of acute appen dicitis (2,5-7). US examination is commonly preferred by physicians in the diagnosis of acute appendicitis, because it is simple to perform and does not involve radiation. US has higher sensitivity and equal specificity comparing with computerized tomo graphy (CT). MRI has higher sensitivity and negative predictive value compared to US, but there is no statistically significant difference for specificity and positive predictive value. MRI may be a good alternative diagnostic tool for the diagnosis of acute appendicitis in children and

pregnant women who has a non-diagnostic US examination (7).

Memisoglu et al. reported a negative appendectomy rate of 17.3% in their study. They also suggested that this rate may decrease to 7.6% with increased WBC and positive US examination. WBC and US exam ination results were both negative in the 46% of negative appendectomies (3). Reported negative appendec tomy rates vary 10 to 30% in the literature. On the other hand, negati ve appendectomies may be accep table when we consider 30% possibility of perforation related to delayed appendectomy (8). However, negative appendectomy rates rise up to 40% in the presence of gyne cological situations such as dys menorrhea or ovarian cyst (9). Some studies show that routine imaging decreases negative appendectomy rates in patients with pre operatively suspected acute appendicitis (10,11) while others suggest that there is not a difference, or even an increase (7,12,13). Ma et al. reported that preoperative US exam ination facilitates the diagnosis of acute appendicitis only in women of reproductive age (4).

Reported negative appendectomy rate was 14% in the study of Kum et al. while it was 16% for patients with perforated appendicitis (14). Same study claimes that the most prom inent reason for perforated appen dicitis is the delay in appendectomy. Increased bilirubin levels may also detected in patients with acute appendicitis, and this laboratory finding indicates perforated appen dicitis frequently (15,16). In this study negative appendectomy rate determined as 14.9%. This rate is comparable with the literature altho ugh preoperative US examination was performed in 52.2% of the patients. A study, which included 3540 patients, showed that negative appendectomy rate was 9.8% for patients without preoperative US exam while it was 8.6% for patients examined with US preoperatively, and it was 4.5% for patients who undergone a CT scan. In another study, the compatibility between imaging methods and histopathological results was 82.4% for US, and 92.3% for CT. Imaging procedures related with statistically significant decrease in negative appendectomy rates (12).

Fox et al. found 65% sensitivity, 90% specificity, 84% positive predictive value and 76% negative predictive value for US in a prospective study. However, they suggested that US could be used only in selected cases in spite of these high rates (6). Gokce et al reported 69% sensitivity, 60% specificity, 89% positive predictive value and 30% negative predictive value for US in a prospective study on reliability of US (8). In this study, the sensitivity and specificity of US found to be 61.5% and 33.3%, respectively, and not comparable with the values reported in the literature. No statistically significant difference found in terms of positive predictive value and negative predictive value between two groups for US. In the study of Demircan et al. sensitivity and specificity found as 61% and 75% consecutively for US like our study (17). In the same study, WBC (>10000/mm^3) sensitivity found to be 98.8%, specificity 75% and the area below ROC 0.869. Similarly, we found WBC sensitivity to be 77.2%, specificity 100% and the area below ROC 0.886 when the cut-off value taken as 10.500; and this shows us that the positive predictive value is 88.6% for WBC.

A wide range of sensitivity and specificity rates reported for US in the literature. However, these rates are quite low in our study. Reason for this may be high patient volume in the radiology department, or the radio logists may be avoiding to take responsibility. Also, there may be a lack of experience. On the other hand, many low volume hospitals do not have a staff radiologist in the emergency department.

As a conclusion, anamnesis and physical examination are still basic diagnostic tools for the preoperative diagnosis of acute appendicitis. Laboratory tests (WBC) may facilitate establishing this diagnosis. US may be

useful for either too old or too young, or female patients in whom there is diagnostic difficulty.

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