

Which one in the diagnosis of acute appendicitis: Physical examination, laboratory or imaging? A retrospective analysis in the light of pathological results

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ABSTRACT

Background: Acute appendicitis is the most frequently performed emergent operation. Although the clinical signs, symptoms and physical examination are the mainstay of diagnosis, imaging and biochemical tests also help. We analyzed the reliability of our operation decision and the contribution of biochemical tests and imaging to diagnosis in the light of pathological results.

Material and Methods: The files of 361 patients (199male and 162 female) who underwent appendectomy were analyzed retrospectively in terms of age, sex, physical examination, blood tests, imaging and pathological results.

Results: The mean age of the patients was found 31 ± 13.5 . Pathology revealed normal appendix in 20.1% of the cases. The patients with a leukocytosis or more were found an increased possibility of acute appendicitis. Physical examination was still the mainstay in diagnosis and ultrasound had a low sensitivity.

Conclusion: Physical examination is still mainstay in acute appendicitis diagnosis. Leukocytosis of $11 \times 10^3/\text{ml}$ or more increases the possibility of acute appendicitis.

Keywords: physical examination, appendectomy, leukocytosis

INTRODUCTION

Acute appendicitis (AA) is the most frequent disease which a general surgeon meets in emergency unit. Along with its classical features, AA might show variety of clinical signs and symptoms which might cause delay in diagnosis (1).

Delay in diagnosis increases possibility of perforation, thus, risk of morbidity and mortality. A normal appendix may be found in 14 to 25% of the cases which are operated on the prediagnosis of acute appendicitis (2-4). Its incidence was reported 89/100000 per year (5).

In spite of all the experience, negative appendectomy rates cannot still be decreased (6). Moreover, complicated appendicitis rates are still 13.4 to 29.3% (7-9).

A good clinical observation and repeated physical exams may prevent surgery but false negative clinical evaluation results in increased perforation rates (10,11). A good evaluation provides proper time for surgery, which results in decrease both in perforation risk and negative appendectomy rate.

We aimed to analyze relevance of decision of surgeons, imaging and laboratory results in 361 cases that underwent appendectomies, retrospectively in the light of pathological findings.

MATERIAL AND METHODS

Three hundred sixty-one patients (162 female, 199 male) who applied emergency department with abdominal pain and underwent appendectomy because of pre-diagnosis of AA between April 2012 and August 2017 were included. The

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Table 1: Relation of Pathology and Radiological Findings

Radiology-based		Pathology-based			P
		AA (-)	AA (+)	Total	
		n (%)	n (%)	n (%)	
	AA (-)	32 (17,4)	105 (57,1)	137 (74,5)	0,001**
	AA (+)	5 (2,7)	42 (22,8)	47 (25,5)	
	Total	37 (20,1)	147 (79,9)	184 (100)	

McNemar Test ****p<0,01**

Table 2: Results for Diagnostic Scan Tests for WBC and ROC (Receiver Operating Characteristic) Curve

	DiagnosticScan				ROC Curve		p	
	Cut-off	Sensitivity	Specificity	Positive Predictive Value	Negative Predictive Value	Area		95% Confidence Interval
WBC	$\geq 11 \times 10^3 / \text{mm}^3$	83,68	65,75	90,60	50,53	0,739	0,662-0,815	0,001**

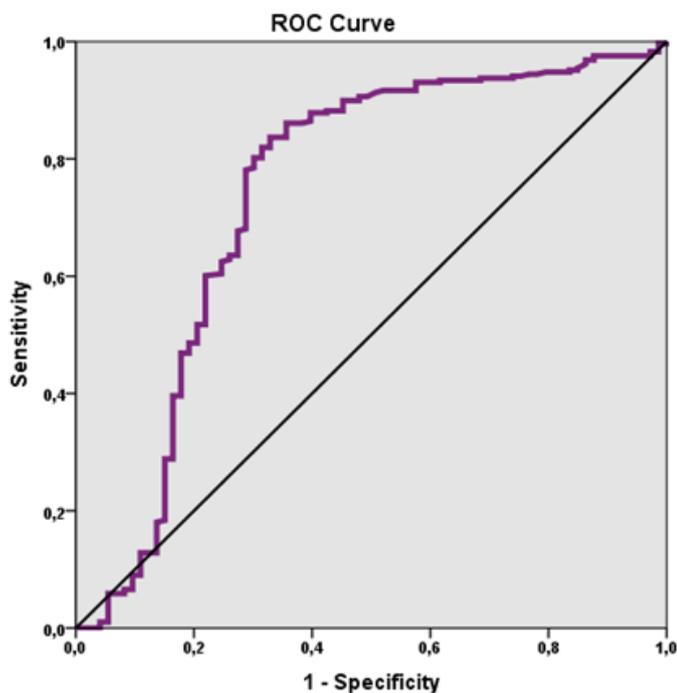


Figure 1: WBC ROC curve related to the presence of AA

gender, age, WBC level, ultrasound and histopathological results were analyzed retrospectively. All the patients were pre-operatively consulted for urological and, in female, gynecological pathologies.

NCSS (Number Cruncher Statistical System) 2007 (Kaysville, Utah, USA) program was used for statistical analysis. McNemar, Cochran's Q tests and diagnostic-screening test were used along with identifying statistical methods (Mean, standard deviation, median, frequency, ratio, minimum and maximum). Pearson chi-square test was used for non-countable parameters. P<0.05 level was significant.

RESULTS

Ultrasound (US) imaging was performed in 184 of the patients of whom 25.5% were diagnosed with acute appendicitis on US. US examination was performed by radiologists during working hours but could not be performed during night shifts.

The mean age was 31±13.5 years. Pathological examination of specimens of 361 patients revealed AA was not present in 20.1% of them. Pathological findings proved AA in forty-two out of 47 of the patients in whom AA diagnosed on US imaging. Histopathological examination also revealed that only 32 patients had no AA out of 137 patients who were said not to have AA on US (**Table 1**).

The cut-off point for leukocyte (WBC) level was found $11 \times 10^3 / \text{mm}^3$ and higher for the presence of AA in the light of pathological results. Specificity was 93.68% and sensitivity was 65.75% for the leukocyte level of $11 \times 10^3 / \text{mm}^3$ (**Table 2**).

The area below ROC curve was 73.9% and standard error was 3.9% (**Figure 1**).

Table 3: The relationship between pathologically proven AA and WBC level (Cut-off value: $11 \times 10^3/\text{mm}^3$)

		WBC(mm^3)				p
		< $11 \times 10^3/\text{mm}^3$		≥ $11 \times 10^3/\text{mm}^3$		
		n	%	n	%	
Histopathologically proven AA	(-)	48	65,8	25	34,2	0,001**
	(+)	47	16,3	241	83,7	

Pearson chi-square test

** $p < 0.01$ **Table 4:** Histopathological presence and absence of AA in male and female patients

Gender		Pathologically Proven		p
		AA (-)	AA (+)	
		n (%)	n (%)	
Male		37 (18,6)	162 (81,4)	0,393
	Female	36 (22,2)	126 (77,8)	

Pearson chi-square test

Statistically, there was a significant relationship between the presence of AA and the leukocyte cut off level of $11 \times 10^3/\text{mm}^3$ ($p=0,001$; $p < 0,01$). If leukocyte (WBC) level was over $11 \times 10^3/\text{mm}^3$ in AA suspected cases, possibility of AA increased 9.845 fold (Table 3).

Histopathological analysis revealed the presence of perforation in 12.84% of the 288 patients in whom AA was found. Also, endometriosis focus in one and enterobiosis vermicularis in one patient were detected.

In patients in whom AA was not found, three had ovarian cyst rupture; omentum torsion in two and Meckel diverticula in one were found.

Gender didn't show any difference statistically for the presence of AA as a result of histopathological analysis (Table 4).

DISCUSSION

Though AA is a frequently seen clinical condition in emergency units and, sometimes, diagnosis is not so easy. Patient's history, physical examination and laboratory parameters should be interpreted together to make the diagnosis. None of the tests are neither completely specific nor sensitive as negative appendectomies shown (12). The most important reason for negative appendectomy is fear of perforation risk.

AA is generally seen under 40 years of age (13,14). Our results that the cases below 40 years of age was 75.3% also correlated these reports.

Although some reports saying that US examination in AA has got high specificity and sensitivity, there are others proposing that it is of low specificity and sensitivity, which might cause delay in diagnosis, resulting in increase in complications (15-17). We found that US had a low sensitivity (28.57%).

We also saw that the decision for operation was mainly based on physical examination and our negative appendectomy rate correlated literature (2-4).

High level of WBC is very suggestive for AA along with the findings on physical examination. Our results with the cut-off point of 11000 for WBC level in histopathologically proven AA also correlated literature (18,19). We found 83.7% of the 288 patients, in whom AA was proven histopathologically, had a WBC level higher than $11 \times 10^3/\text{mm}^3$.

Preoperative gynecological examination is a valuable precaution which might help decreasing in negative appendectomy. It was reported that intra abdominal pathologies other than AA might have been seen more frequently in female patients, compared to male (13,20). But, we didn't find any difference statistically between genders. We thought this result was because that all female patients were evaluated for gynecologic pathology preoperatively. The indifference between male and female gender in negative appendectomy showed the importance of preoperative gynecological examination.

Radiological imaging, laboratory tests and physical examination are the parameters which are helpful in the cases considered as AA. In spite of the cases in which all these parameters support the diagnosis, in some, don't. In such doubtful cases, to prevent delay in treatment, decision for operation might be taken by surgeon on physical examination findings. A careful evaluation and consulting other disciplines are needed to exclude the pathologies other than AA.

As a result, in spite of more advanced imaging modalities, increased level of WBC and physical examination are still the most important parameters for surgeons to diagnose AA and to make decision for operation to prevent delay in proper procedure.

In the light of these results, if the AA is highly suspected based on physical examination, WBC count and excluding gynecologic and urologic pathologies, appendectomy should be offered without hesitation. This approach can shorten both the waiting period of patient for treatment and occupation of emergency department services.

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