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The efficacy of C-reactive protein, white blood cell count and neutrophil percentage in the diagnosis of acute appendicitis in Kirkuk city

Hassan Y. Hassan [(1)]*

Nada Y. Awwad [(2)]

Waleed A. Mares [(3)]

(1) Department of Physiology
College of Medicine
Tikrit University
Salahaldeen
Iraq

(2) Department of Public health
Azadi Teaching Hospital
Kirkuk Health Directorate
Kirkuk
Iraq

(3) Department of Infertility
Azadi Teaching Hospital
Kirkuk Health Directorate
Kirkuk
Iraq

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ABSTRACT

Background: One of the commonest emergencies in surgical practice (pediatric and general surgery) is acute appendicitis which is associated with acute phase reaction. Diagnosis of acute appendicitis is still a challenging issue for surgeons because lifetime risk of acute appendicitis is high (in some series reach 8%), rate of negative exploration is also high (in some series reach 35%) and complications of acute appendicitis (mainly perforation of appendix) are still high, especially in developing countries (in some series reach 62%). Several modalities have been used for diagnosis of acute appendicitis which include scoring systems (e.g. Alvarado scoring system), imaging techniques (ultrasound and computerized tomography), and laboratory investigations (white blood cell count, neutrophil percentage, C-reactive protein and some other serological markers) in order to improve diagnosis, reduce negative exploration rate and reduce complications rate. The aim of study is to evaluate efficacy of (CRP, WBC count and neutrophil percentage) in diagnosis of acute appendicitis. **Patients and methods:** The study was conducted at the beginning of January to the end of August 2018. Thirty male patients, whose age between 10-40 years and admitted to emergency department of Kirkuk general hospital and diagnosed clinically as acute appendicitis by same surgeon, were studied. In emergency department, white blood cell count (WBC) and neutrophil percentage (NP) are estimated by same automated analyzer in same laboratory (as part of complete blood count estimation). C- reactive protein (CRP) was estimated qualitatively by latex agglutination technique in same laboratory. Appendicectomy was done by same surgeon and decision was done regarding whether appendix was inflamed or not macroscopically (by same surgeon) and microscopically (by histopathological examination by same histopathologist). Chai-squared test was used to compare between means of variables. **Results:** There were significant relations between onset of symptoms and results of CRP results, onset of symptoms and end diagnosis, and WBC count and end diagnosis. All other relations were non-significant. **Conclusions**: Diagnosis of acute appendicitis remains a challenging issue in clinical practice. Frequent clinical examination remains the best method for accurate diagnosis of acute appendicitis. Laboratory investigations can be used as an adjuvant in diagnosis of acute appendicitis..

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**Corresponding author E mail :* kirkukhasan@tu.edu.iq

Introduction

One of the commonest emergencies in surgical practice (pediatric and general surgery) is acute appendicitis which is associated with acute phase reaction. (1-6) Incidence of acute appendicitis is more common between 10-40 years of age with males affected more than females. (7-10) Diagnosis of acute appendicitis is still a challenging issue for surgeons because lifetime risk of acute appendicitis is high (in some series reach 8%), rate of negative exploration is also high (in some series reach 35%) and complications of acute appendicitis (mainly perforation of appendix) are still high, especially in developing countries (in some series reach 62%). (1,2,4,5,7-10) Several modalities have been used for diagnosis of acute appendicitis which include scoring systems (e.g. Alvarado scoring system), imaging techniques (ultrasound and computerized tomography), and laboratory investigations (white blood cell count, neutrophil percentage, C-reactive protein and some other serological markers) in order to improve diagnosis, reduce negative exploration rate and reduce complications rate. (1,7-14)

White blood cell count, neutrophil percentage and C-reactive protein (CRP) level are elevated due to presence of acute inflammation and infection and all of them are available investigations in laboratories so they are used in diagnosis of acute appendicitis. (15-27) CRP is an acute phase non-specific inflammatory marker produced by liver in response to infection, inflammatory disorders, autoimmune processes, neoplasia, pregnancy and aging. Its production is controlled by interleukin-6 which can elevate its level by 10-1000 folds within few minutes. CRP has short half time which is about 4-7 hours. (4,10,11,15,17,23,27)

The aim of study is to evaluate efficacy of CRP, WBC count and neutrophil percentage in diagnosis of acute appendicitis.

Patients and methods

The study was conducted at the beginning of January to the end of August 2018. Thirty male patients, whose age between 10-40 years and admitted to emergency department of Kirkuk general hospital and diagnosed clinically as acute appendicitis by same surgeon, were studied. In emergency department, white blood cell count (WBC) and neutrophil percentage (NP) are estimated by same automated analyzer in same laboratory (as part of complete blood count estimation). C-reactive protein (CRP) was estimated qualitatively by latex agglutination technique in same laboratory. Appendicectomy was done by same

surgeon and decision was done regarding whether appendix was inflamed or not macroscopically (by same surgeon) and microscopically (by histopathological examination by same histopathologist).

Chai-squared test was used to compare between means of variables.

Results

In this study,30 male patients whose age between 10-40 years were studied. These patients were admitted to emergency department of Kirkuk general hospital with features of acute appendicitis. In emergency department, investigations (CRP, WBC count and neutrophil count) were done and diagnosis of acute appendicitis and appendiectomy done by same surgeon. The final decision whether appendix was inflamed or not was done grossly by surgeon during operation and histopathologically by histopathologist in laboratory of hospital. Among these patients,26 of them had appendicitis (23 acute appendicitis and 3 complicated appendicitis) and 4 of them had normal appendix.

Regarding relationship between onset of symptoms and results of CRP reaction, there was a highly significant relationship (P value <0.005) and this relationship became more significant and obvious when duration of symptoms was more than one hour (Table 1).

Regarding relationship between onset of symptoms and results WBC count, there was non-significant relationship (P value >0.05) and 24 of patients had WBC count <11000 cell/mm3(Table 2).

Regarding relationship between onset of symptoms and neutrophil percentage, there was non-significant relationship (P value >0.05) and 24 of patients had neutrophil percentage <68% (Table 3).

Regarding relationship between onset of symptoms and end diagnosis, there was a significant relationship (P value <0.05) and 26 of studied patients in this study had either acute appendicitis or complicated appendicitis (23 of them had symptoms for more than 6 hours and 3 of them had symptoms for more than 1 hour). Duration of symptoms in those patients who did not have appendicitis was less than 6 hours (Table 4).

In this study, there was no significant relationship between results of CRP reaction and end diagnosis of patients (p value >0.05) (Table 5).

According to this study, relationship between WBC count and end diagnosis of patients was significant (p value <0.05) and 24 of studied patients had WBC count more than 4000 cell /mm3(23 of them had

appendicitis and only 1 of them did not have appendicitis) (Table 6).

Our results showed that there was no significant relationship between neutrophil percentage and end diagnosis of studied patients (p value >0.05) (Table 7).

Table 1 The relationship between onset of symptoms and results of CRP

CRP (Results of reaction) / Onset Of symptoms (Hours)	Negative	Weakly positive	Strongly positive	Total
<1hourr	3	0	0	3
>1hour - <6hours	8	7	2	17
>6hours- <24 hours	0	2	7	9
>24 hours	0	0	1	1
Total	11	9	10	30

(*p* value <0.005)

Table 2 The relationship between onset of symptoms and results of WBC count

WBC count (cells/mm^3) / Onset of symptoms (Hours)	<4000	≥4000-<11000	≥11000	Total
<1hour	0	3	0	**3**
>1hour - <6hours	4	10	3	**17**
>6hours- <24 hours	2	5	2	**9**
>24 hours	0	0	1	**1**
Total	**6**	**18**	**6**	**30**

(*p* value <0.005)

Table 3 The relationship between onset of symptoms and neutrophil percentage

Neutrophil Percentage (%) / Onset of symptoms (Hours)	<50%	≥50%-<68%	≥68%	Total
<1hourr	0	3	0	**3**
>1hour - <6hours	6	8	3	**17**
>6hours- <24 hours	2	5	2	**9**
>24 hours	0	0	1	**1**
Total	**8**	**16**	**6**	**30**

Table 4 The relationship between onset of symptoms and end diagnosis

The end diagnosis / Onset of symptoms (Hours)	No appendicitis	Acute appendicitis	Complicated appendicitis	Total
<1hour	0	3	0	**3**
>1hour - <6hours	4	13	0	**17**
>6hours- <24 hours	0	7	2	**9**
>24 hours	0	0	1	**1**
Total	**4**	**23**	**3**	**30**

(*p* value <0.005)

Table 5 The relationship between results of CRP and end diagnosis

The end diagnosis / CPR (Results of reaction	No appendicitis	Acute appendicitis	Complicated appendicitis	Total
Negative	2	9	0	**11**
Weakly positive	2	6	1	**9**
Strongly positive	0	8	2	**10**
Total	**4**	**23**	**3**	**30**

(*p* value <0.005)

Table 6 The relationship between WBC count and end diagnosis

The end diagnosis / WBC count (cells/mm^3)	No appendicitis	Acute appendicitis	Complicated appendicitis	Total
<4000	3	3	0	**6**
≥4000- <11000	0	16	2	**18**
≥11000	1	4	1	**6**
Total	**4**	**23**	**3**	**30**

(*p* value <0.005)

Table 7 The relationship between neutrophil percentage and end diagnosis

The end diagnosis / Neutrophil Percentage (%)	No appendicitis	Acute appendicitis	Complicated appendicitis	Total
<50%	3	4	0	**7**
≥50%-<68%	1	14	2	**17**
≥68%	0	5	1	**6**
Total	**4**	**23**	**3**	**30**

(*p* value <0.005)

Discussion

Acute appendicitis is one of common conditions encountered in emergency departments and its diagnosis remains a challenging issue because any misdiagnosis or any delay in diagnosis will result in disastrous results, especially in extremes of age. (1,2,28-32)

In current study, it had been seen that onset of symptoms was significantly related to CRP results and non-significantly related to WBC count and neutrophil percent. This was probably due to CRP level elevation was more rapid than elevation of WBC count and neutrophil percentage.

Present study showed that significant relation between onset of symptoms and end diagnosis. In our study, 20 of patients with acute appendicitis and all of patients with complicated appendicitis had duration of symptoms more than 1 hour. This could be explained by fact that initial features of appendicitis are non-specific, clinical diagnosis of the condition is difficult and features become more specific after few hours.

Our study showed significant relation between end diagnosis and WBC count and non-significant relation with CRP results and neutrophil percentage. This could be explained by increased number of white blood cells in response to inflammation and presence of any other medical condition caused elevated WBC count. Also, elevation of CRP level is not always same in all patients but it depends on strength of inflammatory stimulus.

Venkadesan V.,et al., Alvarado A. and Snyder M., et al. mentioned that detailed history, clinical examination and investigations will aid diagnosis of acute appendicitis as in other disease.(19,33,34)

Stanković N., et al.recommend use of neutrophil to leukocyte count ratio in pediatric patients.(1 (

Soldo I., et al. concluded that acute appendicitis could be diagnosed in emergency department by combination of clinical features, elevated WBC count and negative urinalysis with no rule for CRP in diagnosis.(35)

Park J., et al. concluded that CRP, WBC count and neutrophil percentage were significantly different between appendicitis and non- appendicitis patients. (6)

Sushruth S., et al. found that radiological, hematological and biochemical investigations could used as adjunicts to physical examination in diagnosis of patients with acute appendicitis. (14)

Kumari B., et al. recommended that CRP should be added as a routine investigation in diagnosis of acute appendicitis and sensitivity and specificity of CRP was higher than that of WBC count in patients with acute appendicitis. (9)

Rudiman R., et al. said that CRP and neutrophil to lymphocyte ratio were highly diagnostic in patients with appendicitis, especially perforated appendicitis. (15)

Ulukent S., et al. concluded that WBC count, neutrophil percentage and neutrophil to lymphocyte ratio were highly significant in patients with acute appendicitis. (20(

Conclusions

It had been seen that diagnosis of acute appendicitis remains a challenging issue in clinical practice. It had been concluded that frequent clinical examination remains the best method for accurate diagnosis of acute appendicitis and laboratory investigations (white blood cell count, neutrophil percentage and C-reactive protein) can be used as an adjuvant in diagnosis of acute appendicitis .

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