

# Application of Alvarado scoring system in the diagnosis of acute appendicitis.

*\*Dr. Laith. Naif. Hindosh M B ChB ,CABS,, \*\*Dr. Zuhair Bashir Kamal-M B ChB ,CABS,\* , Dr. Mumtaz khider Alnasir- M B ChB ,CABS- Dr. Wisam Abdulateef Hussein -M B ChB ,FICM*

## ABSTRACT

**Background:** Acute appendicitis is the most common abdominal surgical emergency. The diagnosis of this condition is still essentially clinical and there is difficulty in the clinical diagnosis, especially among elderly, children and patients with a typical presentation, so early and accurate diagnosis of acute appendicitis is important to avoid its complications.

**Objectives:** To evaluate the degree of accuracy of Alvarado scoring system in the diagnosis of acute appendicitis.

**Method:** Two hundred patients were admitted to the Alkindy Teaching Hospital from January 2011 to april 2014-presented with symptoms and signs suggestive of acute appendicitis. After examination and investigations all patients were given a score according to Alvarado scoring 10 (8 variables) and they were classified accordingly to 6 groups of scores (score 5, score 6, score 7, score 8, score 9 and score 10). All the patients underwent appendectomy and the appendix specimens were sent for histopathological examination and the patients were divided into two groups:

1-patients  $\geq$ 7 score (164 patients)

2-patients  $<$ 7 score (36 patients)

-We calculate the percentage of appendix proved to be inflamed by histopathology in each group of these 6 scoring groups.

**Results:** The patients ages range from (7-64 years).

One hundred six patients were male, 94 patients were female with male: female ratio of 1.24:1.

Out of 200 patients, 168 patients had inflamed appendix proved by histopathological study, including 93 male and 75 female, while 32 patients have a normal appendix (13 male, 19 female).

The Alvarado sensitivity found to be 83%, specificity is 59%, diagnostic accuracy of 85%, positive predictive value of 92% and negative predictive value of 59%.

The diagnostic accuracy of the Alvarado score was found to be increased with the increase in the Alvarado score as it was 81% with Alvarado score 7 it was 100% in Alvarado score 10.

**Conclusion :** Alvarado scoring system is a useful tool in diagnosis of acute appendicitis because it is simple, with high diagnostic accuracy rate and this accuracy increase proportionally to the increase in the degree of the score.

Alvarado scoring system is a useful tool in diagnosis of acute appendicitis because it is simple, with high diagnostic accuracy rate and this accuracy increase proportionally to the increase in the degree of the score.

**Al-Kindy College Medical Journal 2015:Vol11 No.2**

**Page:39-42**

**Key words:** Alvarado scoring system, acute appendicitis, Diagnosis.

*\*Assistant Prof.; Al-Kindy College of Medicine .Surgery Department .*

*\*\*Prof.; Al-Kindy College of Medicine .Surgery Department*

*Received at 14<sup>th</sup> April 2014 accepted in final 25<sup>th</sup> June 2015.*

*Corresponding author to Dr : Laith. Naif. Hindosh*

**A**cute appendicitis is the most common abdominal emergency in both developed and developing countries <sup>(1,2)</sup>.The life time of appendectomy is 12% for men and 25% for women with approximately 7% of all people undergoing appendectomy during their lifetime <sup>(3)</sup>.

The diagnosis of acute appendicitis is essentially clinical, however a decision to operate based on clinical suspicion alone can lead to removing the normal appendix in 15\_30% of cases <sup>(4)</sup>.

Diagnosis of acute appendicitis is difficult and its complications more in young children and the elderly <sup>(5)</sup>.

Acute appendicitis is a clinical diagnosis and no laboratory or radiological tests are 100% accurate <sup>(6)</sup>.

Delay in diagnosis and management may increase the morbidity. A number of scoring systems have been used for aiding in early diagnosis of acute appendicitis and its prompt management. Scoring systems are a valuable and valid instrument of discrimination between acute appendicitis and nonspecific abdominal pain <sup>(7)</sup>.

One of the scoring systems is the Alvarado scoring system which is purely based on history, clinical, few laboratory tests, and it is very easy to apply <sup>(8)</sup>.

The most widely used is the Alvarado score. A score of 7 or more is strongly predictive of acute appendicitis. In patients with an equivocal score (5-6) ultrasound or contrast enhanced C-T examination further reduces the rate of negative appendectomy <sup>(4)</sup>.

The aim of this study is to evaluate the degree of accuracy of Alvarado scoring system in its application for diagnosis of acute appendicitis.

**Methods.** A prospective case control study is performed on 200 patients were admitted to the surgical unit of the Alkindy Teaching Hospital from the emergency department presented with clinical suspicion of acute appendicitis during the period from January 2011 to April 2014.

Patients $\geq 7$ score with histopathology +ve 151 patients = True + ve
Patients $\geq 7$ score with histopathology - ve 13 Patients = False + ve
Patients $< 7$ score with histopathology + ve 17 Patients = False - ve
Patients $< 7$ score with histopathology - ve 19 Patients = True - ve

Patients presented with right lower abdominal pain are included in this study.

The following patients are excluded from this study:

- Patients presented with right iliac Fossa mass.
- Patients with immune suppression, chemotherapy and diabetes mellitus.
- Pregnant women.

The investigations which were performed include:-

I- Laboratory tests:-

- White blood cells count.
- Blood film.
- General urine analysis.
- Pregnancy test.

II- Imaging study:-

- Chest.X-ray.
- Plain abdominal x-ray.
- Abdominal and pelvic ultrasonography.

A format containing general information about the patients and 8 variables based on Al-varado scoring system are documented and the patients are classified into 6 groups according to their scores, including scoring 5,6,7,8,9 and 10 score.(Table I)

After investigations the patients were re-assessed and if there was no improvement occurred and they were undergone appendectomy and the appendix was sent for histopathological examination.

Statistical analysis was calculated:

-Patients with score  $\geq 7$  with histopathological diagnosis of acute appendicitis are True Positive (TP).

-Patients with score  $\geq 7$  with histopathological diagnosis of non inflamed appendix are False Positive (FP).

-Patients with score  $< 7$  with histopathological diagnosis of acute appendicitis are False Negative (FN).

-Patients with score  $< 7$  with histopathological diagnosis of non inflamed are True Negative (TN).

Statistical analyses were done by measurement of:

1-Sensitivity =  $TP/TP+FN$

2-Specificity =  $(TN) / (TN) + (FP)$

3-Positive predictive value =  $TP/ TP+FP$

4-Negative predictive value =  $TN/ TN+FN$

5-Accuracy =  $TP+TN/TP+TN+FP+FN$

**Table. I**

Shows the variables of Alvarado scoring system

Symptoms	Score
Migrating right iliac fossa pain	1
Nausea and vomiting	1
Anorexia	1
<b>Signs</b>	1
Tenderness in right iliac fossa.	2
Rebound tenderness	1
Elevated temperature	1
<b>Laboratory findings</b>	
Leukocytosis	2
Shift to the left (segmented neutrophils)	1
<b>Total</b>	10

#### Results.:

In this study the positive predictive value was the lowest in Alvarado score 5 and it increases steadily with the increase in the score of the patient as in table II.

**Table. II** Shows the number of patients in each score, the results of the histopathological examination and the Positive predictive value for each score.

Alvarado score	Number of patients	Histopathological Results of the appendix	Positive predictive value
5	16	6 cases inflamed 10 cases normal	37%
6	20	11 cases inflamed 9 cases normal	55%
7	43	35 cases inflamed 8 cases normal	81%
8	36	33 cases inflamed 3 cases normal	91%
9	47	45 cases inflamed 2 cases normal	96%
10	38	38 cases inflamed	100%

Out of 200 patients, there were 168 patients with inflamed appendix and 32 patients with non-inflamed appendix proved by histopathological study.

**Table III:** shows that positive and negative appendicectomies were compared in both genders.

Sex	Number of Patients	%	Positive appendicectomy	%	Negative Appendicectomy	%
Male	106	(53%)	93	(46.5%)	13	(6.5%)
Female	94	(47%)	75	(37.5%)	19	(9.5%)
Total	200	(100%)	168	(84%)	32	(16%)

Rupture ovarian cyst was the most common intraoperative finding as shown in table IV.

**Table IV** Shows the pathological causes in cases of negative appendicectomy which are mainly related to the female genital tract pathologies

Pathology	Number
Rupture of right Ovarian cyst	8
Mesenteric Lymphadenitis	5
Gastro enteritis	4
Torsion of right Ovarian cyst	3
Urinary tract infection	3
Right tubal Pregnancy	2
Pelvic inflammatory Disease	2
Endometriosis	1
Tumour of caecum	1
No pathological Finding	3
<b>Total</b>	<b>32</b>

In this study Alvarado score shows a sensitivity of 83%, specificity of 59%, accuracy = 85%, positive predictive value = 92%, negative predictive value in 59% of cases, positive appendicectomy rate = 84% and negative appendicectomy rate of 16%.

**Discussion:** The diagnosis of acute appendicitis is mainly clinical. Early and accurate diagnosis of a cute appendicitis is essential to decrease the morbidity and mortality associated with delayed diagnosis. Also negative appendicectomy is not without risks. Different diagnostic aids have appeared like laparoscopy and ultrasonography with good results but they have limitations.

Initial assessment can be improved by using a clinical scoring system which was used in this study (Alvarado score). Two hundreds patients underwent appendicectomy. The appendicectomy specimens were histopathologically evaluated. The negative appendicectomy rate was 16% and it is comparable with the results of other studies which reported a negative appendicectomy rate of 14.3%<sup>(9)</sup>, 15.6%<sup>(10)</sup>, 16%<sup>(11)</sup>, 16.1%<sup>(12)</sup> and 17.5%<sup>(7)</sup>.

It has been found that patient with Alvarado score 5 have a positive appendicectomy of 37.5% and 55% in patient who have Alvarado score <6 and 92.07% in patients with Alvarado score 7 and above which indicate that the positive appendicectomies increases as the score increase this goes with the study of Jang SO et al who report a positive appendicectomy rate of 90.9% in patient with Alvarado score 7 and above<sup>(13)</sup>.

The sensitivity rate was found to be 83% which was comparable with other studies 87.4%<sup>(14)</sup> and lower than other studies who report sensitivity rate 92%<sup>(15)</sup>, 99%<sup>(16)</sup> and higher than 68.4%<sup>(17)</sup>.

The specificity rate was found to be 59% which was comparable with the study 60%<sup>(18)</sup> and lower than the study 74.39%<sup>(15)</sup>, 81%<sup>(17)</sup> and 87.09%<sup>(18)</sup>, as we measure the specificity for all cases included in the study regardless the score while these studies they measure the specificity for patient who have a score  $\geq 7$ .

-Positive predictive value in our study was 92% and it is higher than the literature which reported positive predictive value of 82.7%<sup>(18)</sup>, 83.5%<sup>(10)</sup>, 85.3%<sup>(19)</sup>, 87.4%<sup>(20)</sup> and 75%<sup>(21)</sup>.

The negative predictive value was found to be 59% which was lower than the result of Chong CF et al 71.4%<sup>(17)</sup> and comparable with the result of shrivastava UK et al 52%<sup>(15)</sup>.

The diagnostic accuracy in our study is 85% and it is comparable with other studies 82%<sup>(16)</sup> and 88.2%<sup>(22)</sup> and higher than the value of 68.5%<sup>(17)</sup>.

Our study shows that application of Alvarado scoring system with high degree of accuracy in the diagnosis of acute appendicitis.

#### Conclusion :-

This study showed that Alvarado score can be used routinely in diagnosis of acute appendicitis because it is of high diagnostic value, reliable, simple, cheap, non invasive, easy and quick method to apply in emergency unit.

#### Recommendations :-

To get early and accurate diagnosis of acute appendicitis, it is important to take good history and perform precise clinical examination and investigations.

Patients with Alvarado score between 1- 4 could be discharged home.

Patients with Alvarado score 5 - 6 should be admitted and scored frequently.

Patients with Alvarado score 7 - 10 especially in male virtually confirmed and they should undergo appendicectomy.

Diagnostic laparoscopy is advised to minimize the unacceptable high false negative rate in women.

**References:**

- 1- Okobia MN, Osime U, Aligbe JU. Acute appendicitis: review of the rate of negative appendectomy in Benin City. *Nig J Surg* 1999; 6:1-5.
- 2- Ogbonna BC, Obekpa PO, Momoh JL etal. Another look at acute appendicitis in tropical Africa : the value of laparoscopy in diagnosis. *Tropical Doctor* 1993; 23:82-4.
- 3- Bernard.M.Jaffe and David H.Berger. The Appendix, F.charles Bruni Cardi Dana K.Andersen. Timothy R.Billiar, David L,Dunn.John G.Hunter,Jeffrey B.Matthews and Raphael E.Pollock.Schwartzs PRINCIPLES of SURGERY,Ninth edition. New York .2010.MC Graw Hill, page 1075.
- 4- Robert E,Condon,The vermiform appendix.Norman s.Williams,Christopher J.K Bulstrode,P.Ronan o connell.Bailey and Loves SHORT PRACTICE of SURGERY.25th Edition.Saffron House.London.2008,page 1211.
- 5- Kozar RA, Roslyn JJ. The Appendix. In : Schwartz SI,Shires GT, Spencer FC. Principles of Surgery. McGraw. Hill, 7th ed. 1999 .pp.1383-93.
- 6- Field S, Marrison L. Acute Abdomen. In: Sutton D. Textbook of Radiology and Imaging. Churchill Livingstone, 7th edn.2003.pp. 685.
- 7- Fenyo G, Lindberg G, Blind P, Enochsson L. Oberg A.Diagnostic decision support in suspected acute appendicitis: validation of a simplified scoring system. *Eur J Surg* 1997;163;831-8.
- 8- Alvarado A. A practical score for the early diagnosis of acute appendicitis. *Ann Emerg Med* 1986; 15:557-65.
- 9- Ohmann C, Yang Q, Franke C: the abdominal pain study group. Diagnostic scores for acute appendicitis. *Eur J Surg* 1995; 161:273-81.
- 10- Khan I, Rehman AU. Application of Alvarado scoring system in diagnosis of acute appendicitis. *J Ayub Med Coll Abbottabad* 2005; 17: 3
- 11- Osime OC. Incidence of negative appendectomy: Experience from a company hospital in Nigeria. *California J Emerg Med* 2005; 6: 69-73.
- 12- Arian GM, Sohu KM, Ahmad E, etal SA. Role of Alvarado score in diagnosis of acute appendicitis. *Pak J Surg* 2001;17:41-6.
- 13- Jang SO ,Kin BS,Moon DJ. Application of Alvarado score in patients with suspected appendicitis ..Korean J Gastroenterol 2008 Jul;52 (1):27-31.
- 14- Limpawattanasiri ,Alvarado scores for the acute appendicitis in a provincial hospital.J Med Assoc Thai.2011 Apr, 94(4):441-9.
- 15- Shrivastava UK et al. Evaluation of Alvarado score in the diagnosis of acute appendicitis. *Trop Gastroenterology* 2004 Oct-Dec ,25(4):184-6.
- 16- Ohle R,Oreilly F,Obrien KK et al . The Alvarado score for predicting acute appendicitis a systematic review . BMC med 2011 Dec 28.9..139 doi :10.1186/1741-1015-9-139.
- 17- Chong CF ,Thien A, Mackie AJ et al .Comparison of RIPSASA and Alvarado score for the diagnosis of acute appendicitis..Singapore Med J 2011May,52(5)340-5.
- 18- Crnogorac S,Lovrenski J .Validation of Alvarado score in the diagnosis of acute appendicitis. *Med pregl.*2001 Nov-Dec 54(11-12):557-61.
- 19- Malik KA, Khan A, Waheed I. Evaluation of the Alvarado score in diagnosis of acute appendicitis. *J Coll Physicians Sur Pak* 2000; 10:392-4.
- 20- Owen TD, Williams H, Stiff G, Jenkison LR, Rees BI. Evaluation of the Alvarado score in acute appendicitis. *J R Soc Med* 1992; 85:87-8.
- 21- Kallan M, Talbot D, Cunliffe WJ, etal. Evaluation of the modified Alvarado score in the diagnosis of acute appendicitis: a prospective study. *Ann R Coll Surg.*1994; 76:418-9.
- 22- N. Baidya, G. Rodrigues, A. Rao, etal: Evaluation Of Alvarado Score In Acute Appendicitis: A Prospective Study. *International Journal of Surgery* , 2007; 9, 1, 125.