

Comparative Study between Alvarado Score and Appendicitis Inflammatory Response Score in Diagnosis of Acute Appendicitis

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ABSTRACT

Background: The appendix is a worm like extension of caecum and for this reason has been called "vermiform appendix". Appendicitis may occur due to several reasons, such as an infection of the appendix, but the most important is the obstruction of appendiceal lumen. Acute appendicitis has remained the most common acute surgical condition of the abdomen in all ages and of course, a common disease in surgical practice. The usual picture of appendicitis is often not classical, leaving in many cases a diagnostic problem. In patients with questionable findings, the aggressive surgical approach has been "when in doubt, take it out," and the price paid is the frequent removal of normal appendix. **Aim of the Work:** The aim of the work is to evaluate the appendicitis inflammatory response (AIR) score and compare its performance in predicting the risk of appendicitis to the Alvarado score.

Patients and Methods: In this randomized prospective study, 100 patients with acute pain in right lower quadrant of abdomen were admitted to the surgical department of Al-Hussain University Hospital in the period from June 2017 to October 2017. All the patients had indications for appendectomy. The present study was carried out among patients suffering from acute pain in right lower quadrant of abdomen. **Results:** This randomized prospective study comprised 100 patients, of whom 52 were females (52%) and 48 were males (48%). Their ages ranged from 16 to 42 years old with a mean age of 21 years. These 100 patients were presented with acute pain in right lower quadrant of abdomen. All female cases proved to be pregnant were excluded from the study. Recurrent sub-acute appendicitis were also excluded from the study. Patients with known abdominal malignancies or previous abdominal surgery were also excluded from the study. **Conclusion:** This prospective study comprised 100 patients with acute right iliac fossa pain for evaluation and comparing between Alvarado score and AIR score in diagnosis of acute appendicitis. The present study showed that the AIR score has a good statistical discrimination for patients with acute appendicitis and outperforms the Alvarado score.

Keywords: Alvarado Score, Appendicitis Inflammatory Response Score, Acute Appendicitis.

INTRODUCTION

The appendix is a worm like extension of caecum and for this reason has been called "vermiform appendix". Appendicitis may occur due to several reasons, such as an infection of the appendix, but the most important is the obstruction of appendiceal lumen^[1].

Acute appendicitis has remained the most common acute surgical condition of the abdomen in all ages and of course, a common disease in surgical practice^[2]. The usual picture of appendicitis is often not classical, leaving in many cases a diagnostic problem. In patients with questionable findings, the aggressive surgical approach has been "when in doubt, take it out," and the price paid is the frequent removal of normal appendix^[3].

Acute appendicitis is perhaps the commonest cause of acute abdomen that is responsible for over 40,000 hospital admissions per year in England, and more than 200,000 operations per year in the United States^[4].

The lifetime risk of having appendicitis is 8.6% for males and 6.7% for females, while the lifetime risk of appendectomy is 12 % for males and 23.1 % for females^[5].

Despite this, the majority of patients who present with acute right iliac fossa (RIF) pain do not

have appendicitis and the scenario continues to pose a diagnostic challenge^[6].

The Alvarado score is the best known clinical predicting rule for estimating risk of appendicitis. It is based on a combination of symptoms, signs and basic laboratory results and has been the subject of many validation studies^[7].

Its use in routine clinical practice is varied and limitations included overestimating the risk of appendicitis in women and children have been noted^[8]. The appendicitis inflammatory response score (AIR) is based along the same principles of the Alvarado score, assigning patients to low, medium or high probability of acute appendicitis. It incorporates CRP as a variable in the score, a widely available laboratory test that has not shown sufficient sensitivity or specificity to be used as a stand-alone test to predict the risk of appendicitis^[9].

AIM OF THE WORK

The aim of the work is to evaluate the AIR score and compare its performance in predicting the risk of appendicitis to the Alvarado score.

The study was approved by the Ethics Board of Al-Azhar University.

PATIENTS AND METHOD

In this randomized prospective study, 100 patients with acute pain in right lower quadrant of abdomen were admitted to the surgical department of Al-Hussain University Hospital in the period from June 2017 to October 2017.

All the patients had indications for Appendectomy.

Inclusion criteria:

Patients with acute right iliac fossa pain, right iliac fossa tenderness and rebound tenderness.

Exclusion criteria:

- Pregnant females.
- Patients below age of 16y old.
- Patients with known abdominal malignancies.
- Patients with previous abdominal surgery for short time.
- Patients refuse to do surgical intervention.
- Patients with recurrent sub acute appendicitis.
- Patients with history of complicated appendicitis managed conservatively.

A. Patients

The present study was carried out among patients suffering from acute pain in right lower quadrant of abdomen.

Patient's ages ranged from 16-45 years old, they all underwent CBC with differential leucocytic count and CRP. Subsequently, all the patients underwent Appendectomy based on the preoperative and intraoperative findings, all resected specimens were sent for histopathology for definitive diagnosis.

I- History taking and clinical examination

(A) History

1. Personal history
2. Complaint
3. Present history

4. Past history
5. Family history

(B) General examination

- A- Facies and body built
- B- Vital signs
- C- Head
- D- Neck
- E- Upper limbs
- F - Lower limb
- G - Chest and heart
- H -The abdomen
- I- The back and skeleton

(C) Local examination of the abdomen

- Inspection
- Palpation
- Percussion
- Auscultation

II- Investigations

- 1- CBC with differential leucocytic count.
- 2- CRP

III. Preoperative assessment

- A- Full clinical assessment
- B- Routine laboratory studies:

- CBC with diferential leucocytic count.
- CRP.

Statistical analysis

Data were coded and entered using the statistical package SPSS (Statistical Package for the Social Sciences) version 24. Data were summarized using mean, standard deviation, median, minimum and maximum in quantitative data and using frequency (count) and relative frequency (percentage) for categorical data. Comparisons between quantitative variables were done using unpaired t test.

RESULTS

Table (1): Variation of patients according to sex, occupation, marital status and smoking:

		Count	%
Sex	Male	48	48.0%
	Female	52	52.0%
Occupation	Worker	15	15.0%
	Student	75	75.0%
	House wife	9	9.0%
	Driver	1	1.0%
Marital Status	Single	86	86.0%
	Married	14	14.0%
Smoking	Yes	24	24.0%
	No	76	76.0%

Among 100 patients regarding presentation, all the patients were presented with acute pain in right lower quadrant of abdomen (100%).

Table (2): Ratio of RIF tenderness and rebound tenderness in acute appendicitis

		Count	%
Right Iliac Fossa Tenderness	Yes	100	100.0%
	Yes(light)	6	6.0%
RIF Rebound Tenderness	Yes(medium)	23	23.0%
	Yes(strong)	71	71.0%

Among 100 patients all of them by local examination showed RIF tenderness (100%) and all of them has rebound tenderness. 6 of them had light rebound tenderness (6%), 23 patients had medium rebound tenderness (23%) and 71 patients had strong rebound tenderness (71%).

Table (3): Ratio of TLC, Neutrophils and CRP in acute appendicitis

		Count	%
TLC	High	62	62.0%
	Normal	38	38.0%
Neutrophils	Low	11	11.0%
	High	50	50.0%
	Normal	39	39.0%
CRP	High	100	100.0%

Among 100 patients all of them presented with high CRP (100%) with mean value (64.8), standard deviation (31.36), median value (48), minimum value (24) and maximum value (96).

Table (4): Ratio of different histopathological diagnosis

		Count	%
Operation	Open appendectomy	100	100.0%
Histopathology	Normal appendix	10	10.0%
	Acute catarrhal appendicitis	34	34.0%
	Acute Suppurative appendicitis	49	49.0%
	Acute Suppurative appendicitis with periappendicitis	1	1.0%
	Acute gangrenous appendicitis	6	6.0%

In comparison between the two scores Alvarado score and AIR score in normal and abnormal appendix the results were as following: According to histopathology; in normal appendix Alvarado score showed mean value (5.20), standard deviation (.63), median value (5.00), minimum value (4.00) and maximum value (6.00). AIR score showed mean value (4.90), standard deviation (.99), median value (5.00), minimum value (3.00) and maximum value (6.00).

Table (5): P Value for both Alvarado score and AIR score in normal and abnormal appendix

	Histopathology										P value
	Normal appendix					Abnormal appendix					
	Mean	SD	Median	Minimum	Maximum	Mean	SD	Median	Minimum	Maximum	
Alvarado Score	5.20	.63	5.00	4.00	6.00	7.77	1.62	8.00	4.00	10.00	<0.001
AIR Score	4.90	.99	5.00	3.00	6.00	8.24	2.29	9.00	4.00	12.00	<0.001

P value for both Alvarado score and AIR score was <0.001 which is statistically significant.

In comparison between two scores, Alvarado score and AIR score in complicated and non-complicated appendicitis the results were as following: in complicated appendicitis; Alvarado score showed mean value (8.66), standard deviation (1.16), median value (9.00), minimum value (6.00), and maximum value (10.00). AIR score showed mean value (9.75), standard deviation (1.22), median value (10.00), minimum value (6.00) and maximum value (12.00).

Table (6): Ratio of complicated, non-complicated and normal appendix in both males and females

		Complicated		Non-complicated		Normal	
		Count	column %	Count	column %	Count	column %
Sex	Male	34	60.71%	12	35.29%	2	20.00%
	Female	22	39.29%	22	64.71%	8	80.00%

Complicated appendicitis is more in males than females while Normal appendix after appendectomy is more in females than males.

DISCUSSION

This prospective study comprised 100 patients with acute right iliac fossa pain for evaluation and comparing between Alvarado score and AIR score in diagnosis of acute appendicitis.

Most claims involved misdiagnosis or delayed diagnosis and common pitfalls were including poor documentation. The most commonly known scoring system is the Alvarado score^[10]. The Alvarado score was first reported in 1986 and was based on the weight of several significant variables found in patients with acute appendicitis^[11].

Other variations on the Alvarado score had been developed but did not differ much, these scoring systems never enjoyed wide application because of their suboptimal discriminatory properties. The AIR score was first reported in 2008. It was based on data collected prospectively from 545 patients admitted for suspected appendicitis at four hospitals. Then the score was developed on 316 randomly selected patients and evaluated on the remaining 229 patients. It was based on similar values to the Alvarado score, but it also included C-reactive protein as a new variable. A recent meta-analysis showed that when both an elevated WBC count and elevated C-reactive protein level are present, there is a fivefold increase in the positive likelihood ratio for acute appendicitis^[12].

Routine use of an Alvarado-like scoring system was evaluated in a large German study comparing 870 patients who did not receive routine scoring with 614 patients who were evaluated with an Alvarado-like scoring system^[13].

The scoring system consisted of eight variables developed in another study and validated on a Dutch population. The scoring system also did not include C-reactive protein, and it found no difference in the rates of perforated appendix, negative appendectomy, or complications between groups^[14].

A conditional strategy with CT only after negative or inconclusive US yielded a sensitivity of 94% in a recent study of patients

with acute abdominal pain, 372 patients (40%) would fall in the intermediate group. Hypothetically, if they all underwent imaging with this strategy, there would be 22 patients (2%) with a negative appendectomy^[15].

Thus, the negative appendectomy rate could potentially decline from 10% to 2% with the AIR scoring system. The AIR score probably works better in the pediatric population than the Alvarado score because the variables scored are easy to apply to children^[16]. However, pediatric patients were excluded from this study.

The Alvarado score requires children to identify nausea, anorexia, and migration of pain. This was probably the reason why the Alvarado score compared best to the AIR score in the adolescent age group, because this group closely mimics the initial cohort on which the Alvarado score was designed.

The results showed that Alvarado score was more sensitive than AIR score in prediction of appendicitis but both scores were equal in specificity regarding the prediction of acute appendicitis.

AIR score was more sensitive and specific in prediction of complicated appendicitis than Alvarado score.

Complicated appendicitis was more common in males than females mainly due to high pain threshold leading to late presentation.

Smoking might be a cause due to vascular disease associated with smoking "something that need further study".

Normal appendix, according to histopathology after appendectomy, was common in females than males most probably due to low pain threshold in females and due to presence of other gynecological causes of lower abdominal pain like pelvic inflammatory disease or tubo-ovarian causes.

Both Alvarado score and AIR score were accurate in diagnosis of acute appendicitis in both males and females.

The management of patients with suspected acute appendicitis was still challenging and the optimal management strategy was still unknown, even after the introduction of US, CT and diagnostic laparoscopy. This study externally validated that

the AIR score has a high discriminating power and outperforms the Alvarado score.

This score could aid in selecting patients who require timely surgery or those who require further evaluation. Finally, the score could safely avoid hospitalization and unneeded investigations in patients in whom the diagnosis is unlikely.

Such a scoring system is important for future research to better compare results. First, a proper prospective randomized controlled trial evaluating the effect of introducing such a score in a relevant patient population has to be performed.

CONCLUSION

This prospective study comprised 100 patients with acute right iliac fossa pain for evaluation and comparing between Alvarado score and AIR score in diagnosis of acute appendicitis. The present study showed that the AIR score had a good statistical discrimination for patients with acute appendicitis and outperformed the Alvarado score. The discriminatory property of the AIR score remained high in the more difficult to diagnose patients (e.g., women, children, and the elderly). The results showed that Alvarado score was more sensitive than AIR score in prediction of appendicitis but both scores were equal in specificity regarding prediction of acute appendicitis. AIR score was more sensitive and specific in prediction of complicated appendicitis than Alvarado score.

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