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APPENDICITIS;

AN EVALUATION OF APPENDICITIS INFLAMMATORY RESPONSE AND ALVARADO SCORING SYSTEM IN PATIENTS WITH SUSPECTED APPENDICITIS FOR DIAGNOSTIC ACCURACY.

Gulshan Ali Memon[1], Syed Kashif Ali Shah[2], Habib-ur-Rehman Khan Toor[3]

1. MBBS, MS, FRCS
Professor & Dean
Department of Surgery
Peoples University of Medical & Health Sciences Nawabshah.
2. MBBS, MS
Assistant Professor
Department of Surgery
Peoples University of Medical & Health Sciences Nawabshah.
3. MBBS, FCPS
Associate Professor
Department of Surgery
Peoples University of Medical & Health Sciences Nawabshah.

Correspondence Address:
Dr. Habib-ur-Rehman Khan Toor
Department of Surgery
Peoples University of Medical & Health Sciences Nawabshah.
dr_habibtoor@yahoo.com

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ABSTRACT… Background: Acute appendicitis continues to be the most common surgical problem till date and its diagnosis in this era of advance innovation still remains to be on lock horns, resulting in the high rates of negative appendectomy. In this perplexed dilemma the designed scoring systems have been forwarded to aid the clinical accuracy in patients for suspicious appendicitis. The appendicitis Inflammatory Response (AIR) score has outperformed the more widespread Alvarado scoring (ALS) in many documented studies. So, the aim of this study was to evaluate and compare the AIR score with ALS system for diagnostic accuracy in patients with suspicious appendicitis. **Study Design:** Prospective comparative study to evaluate the AIR and ALS at score of (5 – 8) in 150 patients with suspected appendicitis. **Setting:** Tertiary care hospital. **Period:** March 2016 to January 2018. **Methods:** The score were measured and compared for diagnostic accuracy through statistical analysis. **Results:** This prospective study has drawn an inference that AIR scoring system for suspicious appendicitis has slightly higher percentage (91.07%) of sensitivity compared to ALS system (86.36%). This study enunciates the positive, negative predictive values for profound accuracy of diagnosis with 91.07%, 73.68% and 86.67% by AIRs and 86.36%, 62.50% and 80% by ALS systems (ALs) respectively. Among 150 patients, 30 (20%) were with negative appendectomies. **Conclusion:** The data of present study appreciate that: AIRs system having variable of CRP and WBC has high diagnostic accuracy in comparison to ALS system of patients with suspected appendicitis. AIRs can safely protect the health care resource by avoiding un-necessary hospitalization, Investigations and interventions.

Key words: Acute Appendicitis, Inflammatory Response AIR, Alvarado Scoring (ALS).

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INTRODUCTION

The historical background of acute appendicitis is as old as mankind itself. Claudius Amyand, a French surgeon, while performing Herniotomy, removed perforated appendix from hernial sac of an 11-year old boy on December 6, 1735 at St. George's Hospital in London.[1] Mr. Abraham Goves had performed first ever appendectomy in august 1883.[2] Reginald Fitz noted the appendectomy as an effective treatment of acute appendicitis.[3] Most of the surgeon believed that every subject of acute appendicitis invariably ends on perforation and this fact kept all appendicitis with appendectomy as a standard option of treatment.[4]

Acute appendicitis continues to be the most common surgical problem till date and its diagnosis in this era of advance innovations like laparoscopy, still there exist few cases of negative appendectomies.[5] This is so because the management of acute appendicitis hangs more at surgeon's clinical acumen, some advocating early intervention to prevent complications, while other propose active observation in patients with uncertain diagnosis of acute appendicitis.[6]

In this perplexed dilemma the designed scoring systems have been forwarded to aid the clinical accuracy in patients for acute appendicitis. The ALS is the most well-known and best performing in documented studies. However, it has some drawbacks toward definitive indication of surgery.[7-9] There is yet no perfect diagnostic evaluating tool existing to detect appendicitis in

patients having ambiguous symptoms. While in vague symptoms diagnostic process takes even longer time and thus delaying decisions with increased rate of complications; On the other hand, hasty operation without accurate diagnosis will lead to negative appendectomy, increasing the morbidity and cost of treatment.[10,11]

The Diagnostic approaches through symptomatology and physical examinations augmented with laboratory findings and imaging modalities like ultrasonography and computerized tomography (CT) of abdomen are very much advanced, even then, the misdiagnosis of appendicitis still exists.[12]

Among laboratory inflammatory markers C-Reactive Protein has been shown to have acceptable reliability in diagnosis of infectively. The most common and widely used ALS best performed for appendicitis have been observed with few drawbacks.[13]

Hence, the AIR score was introduced in 2008 in Sweden to overcome the drawbacks of ALS system for negative appendectomies.[14] This score incorporated the CRP value in its design and was developed and validated on a prospective cohort of patients with suspicion of acute appendicitis.[15]

Risk stratification using clinical appendicitis scores has the potential to optimize the use of resources and to improve diagnosis and management. Among various scoring systems for the diagnosis of acute appendicitis, only a few scores have been validated.[16-18] The AIR score has outperformed the more widespread ALS in woldwide studies.[19,20] So, the aim of this study was to evaluate and compare the AIR score with ALS system for diagnostic accuracy in patients with suspicious appendicitis.

Abbreviations
- AIR - Appendicitis Inflammatory Response
- ALS - Alvarado Score

MATERIALS AND METHODS

Study Design
Cross-sectional prospective study

Setting
The data was collected from the surgical unit-I of Peoples University Medical Hospital, Nawabshah.

Duration of Study
From March 2016 to January 2018.

Target Population
Suspected appendicitis (patients with non-traumatic acute –onset of pain for one week or less, in right lower quadrant of abdomen).

Sampling Techniques
Non- probability consecutive

Sample Size
150 patients

Inclusion Criteria
- Both genders
- Age from 10 – 70 years.
- Patients having clinically suspicious acute appendicitis
- Patients having score (5 – 8) on AIRs &ALS system
- Patients having completed required investigations according to AIR &ALS system.
- Patients given signed information consent
- Patients completed follow-up for 30 days
- Patients under went for appendectomy.

Exclusion Criteria
- not fill fulfilled inclusion criteria
- patients having Co-morbidities
- H/O abdominal pain lasting more than 07 days.
- Pregnancy

MANAGEMENT MEASURES
- The patients with score of 1-4 (low risk group)were observed for development of acute appendicitis at OPD (out patients department) and some were re-admitted for having increased score and no improvement in symptoms within 07 days.
- The target population with suspicious acute appendicitis was further analyzed by senior consultant on clinical examination and ultrasonography to rule out conditions other

than appendicitis. While CT –Scan abdomen was also performed in selected cases on discretion of the surgeon.

- Patients irrespective of scores having enough clinical features to warrant surgery were under gone for appendectomy on the direction of senior consultant in surgery.
- Every resected appendix specimen was submitted to Histopathological scrutiny for confirmation of diagnosis and type of appendicitis.
- The Histopathological criteria for (a) phlegmonous and (b) advanced appendicitis were transmural infiltration of neutrophils and transmural gangrene respectively. The appendix having peri-appendicular abscess or perforation were marked as variant of advanced appendicitis identified by surgeon during surgery.
- The high risk patients having (9 – 12) points on AIR and ALS system were instantly subjected to appendectomy.
- All procedures were followed in accordance with the Ethical Standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2008.

Data Collection Tools

- Predesigned proforma was used to collect data as per need of study.

Data Collection Procedure

- Informed and signed consent was obtained from all subjects of this study.
- All variables / indices of Alvarado and AIR scoring system tabulated below were recorded, evaluated and compared in all subjects to draw diagnostic accuracy of appendicitis.

- Follow up period was 30 days after discharge

Characteristics of Appendicitis Inflammatory Response (AIR) Score and ALS.

Diagnosis	ALS	AIR score
Migratory RLQ pain	1	
Anorexia	1	
Nausea and vomiting	1	1
Tenderness	2	
Muscle Guarding	1	
Light		1
Medium		2
Strong		3
Raised temperature	1	1
Leukocytosis shift (%)	1	0
70 – 80		1
>85		2
WBC count		
>10.0 x10^9 /1	2	
>10.0-14.9x10^9 / 1		1
>15 x 10^9 / 1		2
C-Reactive protein conc		1
10-49 g/l		2
>50 gl		

RESULTS

Under strict inclusion and exclusion criteria this prospective study enrolled 150 subjects with suspected appendicitis. Their ages ranged from 10 – 70 years. There were 90 (60%) males and 60 (40%) females with preponderance of male patients. The mean, median and SD +/ - of ages in males were 30.6, 40 and +/- 12.13 respectively. In females means, median and SD +/- of age were 29.4, 40 and 9.18 respectively. While in total 150 patients, the mean, median and SD +/- were 30.13, 40 21.31 +/- respectively. The greater (42%) subjects of study were in age group of 16 – 25 as shown in Table-I.

Age in Years	Male (%)	Female (%)	Total (%)
16 – 25	38 (25.34)	25 (16.66)	63 (42%)
26 – 35	24 (16)	20 (13.34)	44 (29.34)
36 – 45	16 (10.66)	10 (6.67)	26 (17.33)
46 – 55	08 (5.34)	04 (2.66)	12 (8)
55 – 70	04 (2.66)	01 (0.66)	05 (3.33)
Total	**90 (60%)**	**60 (40 %)**	**150 (100%)**
Mean	30.6	29.4	30.13
S.D ±	12.13	9.18	

Table-I. Age, Sex, Mean, SD±

According to design of study, each subject having at least starting score of 05 according to

either AIR or ALS system, the symptom of pain in RLQ was the (100%). While after anorexia (93.33%) a second common the so on and so forth were vomiting (60%), rebound tenderness (76.66%), guarding (48%), WBC (65.33%) and CRP (86.66%) as shown in Table-II.

Pain in RLQ	150	100%
Anorexia	140	93.33%
Vomiting	90	60%
Rebound Tenderness	115	76.66%
Guarding	72	48%
WBC	98	65.33%
CRP	130	86.66%

Table-II. Frequencies of symptoms, signs & increased WBC, CRP

In total of 150 patients, 120 (80%) were proven for appendicitis with 65 (43.33%) phlegmonous 55 (36.66%) advanced appendicitis under gold standard histopathological security. While remaining 30 (20%) patients were negative histopathologically for appendicitis. In total 150 patients of study, 102 and 95 were detected as true positive appendicitis by AIR and ALS system. There were only two patients of relapsing appendicitis within 05 days from conservatively managed target population under observation. All the subjects of study were in strict follow-up after discharge for 30 days post-operatively and no remarkable complications were noted. However, inarguably a few patients with negative appendicitis were in complaint of pain in abdomen post operatively for other pathologies like (PID, UTI, right Renal Cyst, mesenteric-lymphadenitis, Gastroenteritis, Crohn's disease). The area under the ROC curve of AIR was 0.84 and was little better than the curve of ALS of 0.78. The AIR in comparison to ALS translate the better prediction in analysis of more difficult women and elderly patients.

Diagnosis	AIR	ALS
Phlegmonous appendicitis	47	44
Advanced appendicitis	28	55
Negative appendicectomy	28	55

Diagnostic comparison (5 – 8) score

As the intermediate score (5 – 8) from both scoring system place the doubtful and suspicious impression in clinical assessment for making decision. So in this drawback of scoring system, this prospective study has drawn an inference that AIR scoring system for appendicitis has slightly higher percentage (91.07%) of sensitivity compared to ALS system (86.36%). Further AIR scoring system has also high specificity (73.68%) against Alvarado (62.50%) in ruling out the possibility of appendicitis. This study enunciates the positive, negative predictive values for profound accuracy of diagnosis with 91.07%, 73.68% and 86.67% by AIRs and 86.36%, 62.50% and 80% by ALS systems respectively as shown in table no: 03. Among 150 patients, 30 (20%) were with negative appendectomies.

DISCUSSION

The increased number of unscheduled admission in emergency surgical care for non-suspicious abdominal pain and suspicious appendicitis remain to be the most common exhausting entities health care resources.[21,22] Further, the management of suspected appendicitis still measures the high rates of negative exploration.[23] So, in this regards, the exponent surgical wisdom has moved ahead with creation of risk stratification through potential scoring strategies to have big successes.

Diagnostic Value Score (5 – 8)	AIR Score %	95% CL	ALS %	95% CL
Sensitivity	91.07	84.19 to 95.64	86.36%	78.51 to 92.61
Specificity	73.68	56.90 to 86.60	62.50%	45.80 to 77.27
Positive likelihood ratio	3.46	2.03 to 5.91	2.30%	1.53 to 3.46
Negative likelihood ratio	0.12	0.07 to 0.23	0.22%	0.13 to 0.37
Positive predictive value	91.07	85.66 to 94.57	86.36%	80.83 to 90.49
Negative predictive value	73.68	60.07 to 83.90	62.50%	49.57 to 73.86
Accuracy	86.67	80.16 to 91.16	80.00%	72.70 to 86.08

Table-III. An evaluation and comparison of air score with Alvarado for diagnostic accuracy in 150 patients of suspected appendicitis.

The present study has observed 86.7% and 80.00% accuracies in score from (5 – 8) of AIR and ALs system in diagnosis of suspected appendicitis respectively, which are in line to Anderson M et al and Scott AJ, et al.[20,24] Further, this study inferences that the AIR score has more better predictive property compared to ALS for women and elderly difficult patients with suspected appendicitis and same is validated in other studies.[25-28] We are of opinion that AIRs system is best available option to be used to avoid negative appendectomies as the same is also opined by Macco et all.[19]

Our study correlated the comparative studies of AIR and ALS at (5 – 8) score, as under.[29,30]

Accuracy	Present Study %		Patil et al %		Castro et al %	
	AIR	ALS	AIR	ALS	AIR	ALS
Sensitivity	91.078	86.36	89.9	7.86	93	90
Specificity	73.68	62.50%	63.6	54.5	85	55

In this study among 120 patients positive for acute appendicitis on histopathology 110 patients were having increased WBC count and CPR level, which depicts about 91.66%. (120/110 x 100), and same was noticed in meta-analysis of the clinical and laboratory analysis of appendicitis by Anderson RE in his study in 2004[16], and we think that it was the actually triggering stimulus to turn on AIRs in 2008 in Sweden.

However, the standard management strategy for suspected acute appendicitis is still blurred and challenging.

CONCLUSION

The data of present study appreciate that:

- AIRs system having variable of CRP and WBC has high diagnostic accuracy in comparison to ALS system of patients with suspected appendicitis in intermediate risk group (5-8) score.
- AIRs can safely protect the health care resource by avoiding un-necessary hospitalization, Investigations and interventions.

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AUTHORSHIP AND CONTRIBUTION DECLARATION

Sr. #	Author-s Full Name	Contribution to the paper	Author=s Signature
1	Gulshan Ali Memon	Data collection, data analysis & discussion.	
2	Syed Kashif Ali Shah	Introduction & result writing.	
3	Habib-ur-Rehman K. Toor	Reference work.	