Role of Contrast Enhanced Abdominal Computed Tomography in the Diagnosis of Suspected Acute Appendicitis

Original Article

Karim K. Maurice[1], Ahmed Ali Mohamed Ali[1], Shady Nabil Mashhour[2], Amr Yehia El Shayeb[1]

[1]Department of General Surgery, [2]Department of Radiology, Faculty of Medicine, Cairo University, Egypt

ABSTRACT

Background: One of the most frequent reasons for acute abdomen that necessitates surgery is acute appendicitis. Even though appendicectomy is the standard treatment, there is a chance of complications following surgery. To assess individuals exhibiting equivocal symptoms, computed tomography (CT) scans have been introduced. Its application might reduce needless intervention by stratifying patients.

Objectives: To evaluate the diagnostic precision of contrast-enhanced computed tomography for suspected acute appendicitis.

Methods: Seventy-three individuals with probable acute appendicitis (Alvarado score range from 4 to 6) were included in this research. Prior to appendectomy, the patients had preoperative CT scans of their abdomen and pelvis with intravenous contrast. The final pathology was correlated with the CT results.

Results: The mean age of the study population 26.7 ± SD 11.9 years old. The incidence of positive appendicitis by intraoperative assessment was 70.5% while the incidence was 79.5 % by definitive pathological diagnosis. CT scan in the preoperative settings had a sensitivity, specificity and diagnostic accuracy of 75.3%, 100% and 80.3% respectively. There were 5 significant CT predictors for acute appendicitis: Distended appendix, thick enhancing wall, fat plane smudging, periappendicular fluid collection and appendicolith. A CT scoring system was created using the significant findings. A score of 2 or more had a 70.5% sensitivity, 100% specificty for diagnosing a pathologically proven acute appendicitis.

Conclusion: CT abdomen and pelvis with IV contrast is a useful tool with high accuracy in diagnosing or excluding acute appendicitis.

Key Words: Acute appendicitis, alvarado score 4-6, CT abdomen and pelvis.

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Corresponding Author: Karim K. Maurice, MD, Department of General Surgery, Faculty of Medicine, Cairo University, Egypt, **Tel.:** 01222760711, **E-mail:** drkkmaurice@yahoo.com

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INTRODUCTION

With a lifetime risk of 8.6% for men and 6.7% for women, acute appendicitis is one of the common causes of severe abdominal discomfort that necessitates surgical intervention[1]. Despite being a simple procedure, appendicectomy has a 2% to 23% risk of post-operative complications. Three percent of people who have had an appendix removed later experience the aftereffects of adhesive intestinal obstruction. Therefore, lowering negative appendicectomy rates is paramount[1]. The incidence of acute appendicitis is around 1 per 1000 annually[2].

Every patient experiencing acute abdominal discomfort should have appendicitis taken into account while making a differential diagnosis. The most consistent sign of acute appendicitis is the traditional pattern of migrating pain[3]. Clinical evaluation has an 80% diagnostic accuracy rate, according to the literature[4].

The most used imaging technique for assessing suspected adult appendicitis is a computed tomography (CT) scan[5].

AIM OF WORK

To evaluate the diagnostic precision of contrast-enhanced computed tomography for suspected acute appendicitis.

PATIENTS AND METHODS

Patients

Between November 2020 and March 2021, this prospective study was carried out at the emergency room of Cairo University's Kasr Al-Ainy Hospital. We reviewed patients who showed up at the emergency room with suspected acute appendicitis.

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Inclusion criteria

Individuals with probable acute appendicitis (Alvarado score 4-6).

Exclusion criteria

Patients with Alvarado score (<4, >6).

Pregnancy

Intellectual disability.

Methods

Patients who presented to the emergency unit of Kasr Al-Ainy university hospitals with suspected acute appendicitis were evaluated as follows:

All information pertaining to the Alvarado score was gathered from the patients. Age, sex, duration of hospitalization, anorexia, nausea/vomiting, right lower quadrant (RLQ) tenderness, rebound tenderness, and the presence or absence of migratory pain were among the variables examined in this study. At the time of admission, measurements were made of the differential count, white blood cell count (WBC), and body temperature.

Laboratory investigations: in the form of hemoglobin, TLC, platelets count, PC, INR, creatinine, urea, ALT, AST

Radiological studies: in the form of pelvi-abdominal ultrasound, erect chest x-ray

Only Patients with Alvarado score 4-6 were included in this study and were subjected to contrast enhanced abdominal and pelvic computed tomography after consultation.

IV contrast enhanced abdominopelvic CT technique: The abdomen and pelvis are imaged during the portal venous phase to assess for appendicitis following a dynamic bolus of 100 mL of nonionic contrast material ([iohexol] Omnipaque 300) administered IV by mechanical injector at a rate of 3 mL/sec. Using 5mm thick, adjacently reconstructed images, all contrast-enhanced scans were obtained helically from the top of the diaphragm to the lesser trochanters after a 60-second lag.

One radiologist reviewed every CT scan. In order to determine if the appendix could be seen, the following CT criteria were evaluated: distended ≥ 6 mm, wall thickening or enhancement, presence of inflammatory stranding in the right lower quadrant, presence of pelvic fluid collection in the right lower quadrant, and the ability to identify an appendicolith. The CT results were used to classify the case as negative if the appendix was normal or if there were no appendicitis findings.

All patients had an appendectomy, and the surgical and histological outcomes were recorded. When the final histology revealed acute appendicitis, the final diagnosis was established. Patients who had surgery with the clinical appearance of acute appendicitis but no histological signs of the condition were said to have had a negative appendicectomy.

The sensitivity, specificity, and diagnostic accuracy of CT were assessed by comparing its findings with the pathology results.

Primary outcome measures

Number of patients with positive appendicectomies by pathological examination.

Number of patients with positive CT findings.

Secondary outcome measures

Number of patients with positive ultrasound findings for acute appendicitis

Statistical analysis

SPSS 22nd edition was used for statistical analysis, and the Mann Whitney U and Kruskal Wallis tests were used to compare the continuous variables, which were provided as mean ± SD. To identify the cutoff signs in the diagnosis of acute appendicitis, ROC analysis was performed. A *p-value* of less than 0.05 was deemed significant.

RESULTS

This prospective study included a total of 73 patients, presented to emergency unit of Kasr Al-Ainy university hospitals with suspected acute appendicitis (Alvarado score 4-6).

Patient demographics

The mean age was 27.4 ± SD 12.3 years old. Male to female ratio was 1:1. 90.4% had no comorbidities, while 9.6% had Hypertension (HTN), epilepsy, cardiac disease or diabetes mellitus (DM). 24.7% had previous abdominal operations while 75.3% had a free past surgical history, as shown in (Table 1).

Incidence of Acute appendicitis

The incidence of positive appendicitis by operative assessment was 72.6%. The details of the operative findings are shown in (Table 1). Meanwhile, the incidence was 83.6 % by definitive pathological diagnosis as shown in (Table 1).

Alvarado score

Majority (60.3%) of cases had a score of 6, while 23.3% and 16.4% had a score of 5 and 4 respectively. Table demographics. Alvarado score of 6 was associated with a negative appendicitis in 58.3%. The score range from 4 to 6 was not a significant predictor to acute appendicitis by pathology (p= 0.678) (Table 2).

Total Leukocyte count and Neutrophils

The mean TLC for the included patients was 13.8 ± SD 5.6 (103/CC), and the mean percentage of neutrophil count was 74 ± SD 9.3%. as shown in (Table 1).

Ultrasound findings

There were positive ultrasound findings in 72.6% of the included patients, in the form of: Blind ended dilated non compressible structure in right iliac fossa, inflammatory process in right iliac fossa, right iliac fossa collection and/or tenderness on probing (Table 1).

78.7% of patients with pathologically proven acute appendicitis had positive sonographic findings. Ultrasound was a significant predictor to acute appendicitis ($p = 0.014$) (Table 2).

Ultrasound had a sensitivity, specificity and diagnostic accuracy of 78.6%, 58.3% and 75.3% respectively in detecting acute appendicitis.

CT diagnostic accuracy

CT and definitive pathological diagnosis

58.9% of patients had a positive CT finding(s) in the preoperative CT assessment (Table 1). None of those patients had a negative appendicitis (Table 3). CT scan had a sensitivity, specificity and diagnostic accuracy of 70.49%, 100% and 75.34% respectively. CT findings were significant predictors of pathological diagnosis with *p value* <0.0001.

CT findings

Incidence

Of all study cases, 59.8% had distended appendix, 35.6% had Appendicolith, 58.9% had Thick enhancing wall, 56.2% had Peri- appendiceal fluid collection, 15.1% had air loculi within the wall and 58.9% had Fat plane smudging (Table 1).

Significant findings

The following CT findings were significant predictors of acute appendicitis: Distended appendix, thick enhancing wall, appendicolith, peri-appendiceal fluid collection and fat plane smudging (p<0.001) (Table 3, Figures 1,2,3).

Number of findings in each patient

The majority (24.6%) of patients had positive 5 findings followed by 4 findings then 6 findings and 3 findings.as shown in (Table 2).

CT score for Acute Appendicitis

In the current study we used the ROC curve to create a score based on the following significant CT signs:

1. Distended appendix
2. Thick enhancing wall
3. Fat plane smudging
4. Periappendiceal fluid collection
5. Appendicolith

ROC analysis showed that 2 or more positive findings in the CT scan had 70.5% sensitivity, 100% specificty were significant predictors for diagnosing a pathologically proven acute appendicitis (Tables 3,4).

Table 1: Demographic data

			Count	%
Sex		M	39	53.4%
	F	34	46.6%	
Medical history		HTN	2	2.7%
	HCV	1	1.4%	
	G6PD deficiency	1	1.4%	
	epilepsy	1	1.4%	
	DM	1	1.4%	
	cardiac	1	1.4%	
	free	66	90.4%	
Ultrasound		positive	53	72.6%
	negative	20	27.4%	
blind ended dilated non compressible structure in rt iliac fossa		positive	29	39.7%
	negative	44	60.3%	
inflammatory process in rt iliac fossa		positive	38	52.1%
	negative	35	47.9%	
collection		positive	41	56.2%

			Count	%
	negative	32	43.8%	
tenderness on probing		positive	39	53.4%
	negative	34	46.6%	
CT		positive	43	58.9%
	negative	30	41.1%	
pneumoperitoneum		positive	2	2.7%
	negative	71	97.3%	
distended appendix		positive	43	58.9%
	negative	30	41.1%	
appendicolith		positive	26	35.6%
	negative	47	64.4%	
thick enhancing wall		positive	43	58.9%
	negative	30	41.1%	
periappendiceal fluid collection		positive	41	56.2%
	negative	32	43.8%	
air loculi within the wall		positive	11	15.1%
	negative	62	84.9%	
fat plane smudging		positive	43	58.9%
	negative	30	41.1%	
Number of positive CT findings	0		30	41.1%
	3		2	2.7%
	4		14	19.2%
	5		15	20.5%
	6		12	16.4%
Operative findings		positive	53	72.6%
	negative	20	27.4%	
Perforated/not perforated		perforated	24	32.9%
	not perforated	49	67.1%	
Base		healthy	68	93.2%
	not healthy	5	6.8%	
Suppurative/Catarrhal		suppurative with gangrenous tip	1	1.4%
	suppurative	44	60.3%	
	catarrhal	28	38.4%	
Purulent collection		positive	35	47.9%
	negative	38	52.1%	
pathology		appendicitis	61	83.6%
	not appendicitis	12	16.4%	

	Mean	Standard Deviation	Median	Minimum	Maximum
Age	27.47	12.32	23.00	13.00	58.00
TLC	13.80	5.66	13.00	4.80	31.00
neutrophils	74.38	9.37	75.00	51.00	90.00
Alvarado score	5.44	0.76	6.00	4.00	6.00
Number of positive ct findings	2.86	2.50	4.00	0.00	6.00

Table 2: Correlation between variables and final pathology

		pathology				*P value*
		appendicitis		not appendicitis		
		Count	%	Count	%	
Sex	Male	34	55.7%	5	41.7%	0.372
	Female	27	44.3%	7	58.3%	
Medical history	HTN	2	3.3%	0	0.0%	0.006
	HCV	0	0.0%	1	8.3%	
	G6PD deficiency	0	0.0%	1	8.3%	
	epilepsy	0	0.0%	1	8.3%	
	DM	1	1.6%	0	0.0%	
	cardiac	0	0.0%	1	8.3%	
	free	58	95.1%	8	66.7%	
Alvarado score	4	9	14.8%	3	25.0%	0.678
	5	15	24.6%	2	16.7%	
	6	37	60.7%	7	58.3%	
Ultrasound	positive	48	78.7%	5	41.7%	0.014
	negative	13	21.3%	7	58.3%	
blind ended dilated non compressible structure in rt iliac fossa	positive	28	45.9%	1	8.3%	0.022
	negative	33	54.1%	11	91.7%	
inflammatory process in rt iliac fossa	positive	36	59.0%	2	16.7%	0.007
	negative	25	41.0%	10	83.3%	
collection	positive	38	62.3%	3	25.0%	0.017
	negative	23	37.7%	9	75.0%	
tenderness on probing	positive	38	62.3%	1	8.3%	< 0.001
	negative	23	37.7%	11	91.7%	
CT	positive	43	70.5%	0	0.0%	< 0.001
	negative	18	29.5%	12	100.0%	
Pneumoperitoneum	positive	2	3.3%	0	0.0%	1
	negative	59	96.7%	12	100.0%	
Distended appendix	positive	43	70.5%	0	0.0%	< 0.001
	negative	18	29.5%	12	100.0%	
Appendicolith	positive	26	42.6%	0	0.0%	0.006
	negative	35	57.4%	12	100.0%	
Thick enhancing wall	positive	43	70.5%	0	0.0%	< 0.001
		18	29.5%	12	100.0%	
Periappendiceal fluid collection	positive	41	67.2%	0	0.0%	< 0.001
	negative	20	32.8%	12	100.0%	
Air loculi within the wall	positive	11	18.0%	0	0.0%	0.192
	negative	50	82.0%	12	100.0%	
Fat plane smudging	positive	43	70.5%	0	0.0%	< 0.001
	negative	18	29.5%	12	100.0%	
Operative findings	positive	53	86.9%	0	0.0%	< 0.001
	negative	8	13.1%	12	100.0%	
Perforated/not perforated (Operative findings)	perforated	24	39.3%	0	0.0%	0.006
	not perforated	37	60.7%	12	100.0%	
base (Operative findings)	healthy	56	91.8%	12	100.0%	0.583
	not healthy	5	8.2%	0	0.0%	

		pathology				*P value*
		appendicitis		not appendicitis		
		Count	%	Count	%	
Suppurative/Catarrhal (Operative findings)	suppurative with gangrenous tip	1	1.6%	0	0.0%	< 0.001
	suppurative	44	72.1%	0	0.0%	
	catarrhal	16	26.2%	12	100.0%	
Purulent collection (Operative findings)	positive	35	57.4%	0	0.0%	< 0.001
	negative	26	42.6%	12	100.0%	
Number of positive CT findings	0	18	29.5%	12	100.0%	< 0.001
	3	2	3.3%	0	0.0%	
	4	14	23.0%	0	0.0%	
	5	15	24.6%	0	0.0%	
	6	12	19.7%	0	0.0%	

Table 3: Logistic regression to detect independent predictors of appendicitis

			Regression coefficient	Item score
Appendicitis	Distended appendix		20.797	1
	Appendicolith		20.132	1
	Thick enhancing wall		20.797	1
	Periappendiceal fluid collection		20.692	1
	Fat plane smudging		20.797	1
	Area under curve	*P value*	95% Confidence Interval	
			Lower Bound	Upper Bound
score	0.852	< 0.001	0.767	0.938

Table 4: Cutoff values for predicting acute appendicitis using the CT score

CT score	sensitivity	specificity
>1	70.5%	100%
>3	67.2%	100%
>4	42.6%	100%

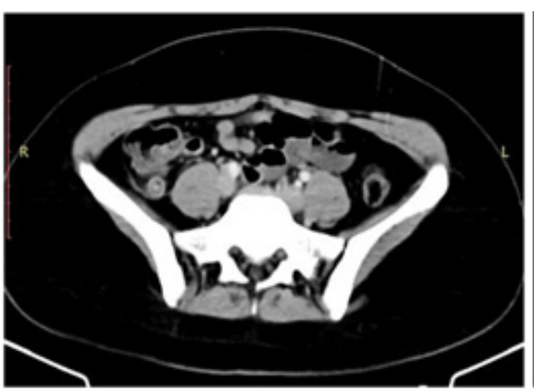

Fig. 1: thick enhancing appendiceal wall with Appendicolith.

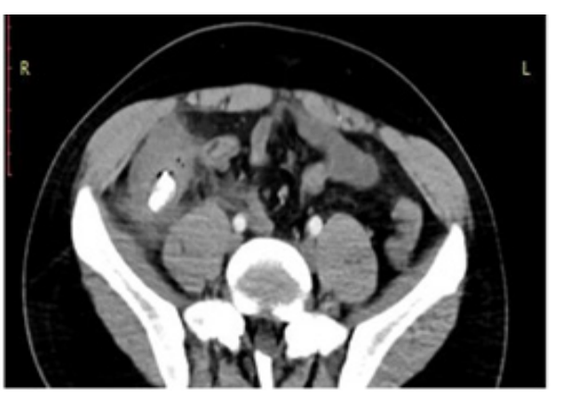

Fig. 2: CT with IV contrast showing Appendicolith, smudging and Peri-appendiceal collection.

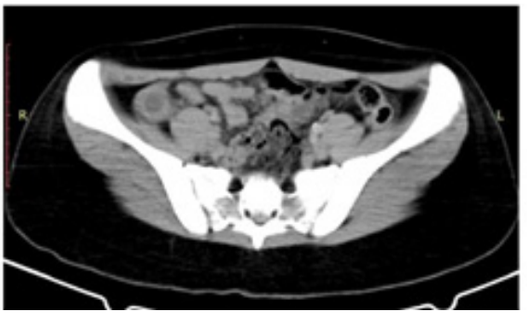

Fig. 3: distended appendix with thick enhancing wall

DISCUSSION

Acute appendicitis is one of the most common causes of acute abdominal pain requiring surgical intervention, with a lifetime risk of 8.6% for males and 6.7% for females[1]. The diagnosis of acute appendicitis should be made carefully to optimize true positive patients' identification while minimizing unnecessary surgical interventions (negative appendectomies)[6]. Laparoscopic appendectomy has become increasingly prevalent due to its advantages in reduced hospital stay and morbidity[7]. The combination of clinical and laboratory assessment especially the history of migratory pain, tenderness and rebound tenderness has a high diagnostic accuracy[8]. Contrast-enhanced CT protocols using intravenous contrast demonstrate excellent diagnostic performance while decreasing any delay in diagnosis[9].

With a lifetime risk of 8.6% for men and 6.7% for women, acute appendicitis is one of the most frequent causes of severe abdominal pain that necessitates surgical intervention[1]. The combination of laboratory and clinical evaluation, particularly the history of rebound tenderness, migratory pain, and tenderness, has a good diagnostic accuracy[8].

These individuals have been evaluated using computed tomography (CT) scans[5]. In an effort to reduce the negative appendectomy rate to less than 10%, computed tomography (CT) has been promoted as a diagnostic tool for acute appendicitis. It's a useful technique for examining suspected appendicitis because of its 80% to 100% sensitivity and specificity[10].

73 patients who visited the Kasr Al-Ainy emergency room between November 2020 and March 2021 with a suspected case of acute appendicitis were included in this prospective research. The mean age of the included patients was 27.4 ± SD 12.3. The ratio of males to females was 1:1.

Patients having Alvarado scores between 4 and 6 were included in the current research. The score did not significantly predict pathology-proven acute appendicitis in this range (p=0.67).

According to this study, ultrasonography was able to identify acute appendicitis with a sensitivity, specificity, and diagnostic accuracy of 78.6%, 58.3%, and 75.3%, respectively (p 0.014).

The following were examples of positive ultrasound findings: right iliac fossa collection, inflammatory process, blind ending dilated noncompressible structure, and/or pain on probing. Notably, 5 patients (41.7%) with a pathology-negative appendectomy had positive ultrasound results, indicating that the test had a lower specificity than a CT scan.

The ultrasound Sensitivity, Specificity, Positive Predictive Value (PPV), and Negative Predictive Value (NPV) are 74.3%, 53.0%, 95.9%, and 12.2%, respectively, for diagnosing acute appendicitis, according to Atwood R *et al*.[11].

58.9% of the participants in the current research showed positive preoperative CT findings. None of those patients had negative appendicitis. The diagnostic accuracy, sensitivity, and specificity of a CT scan were 75.34%, 70.49%, and 100%, respectively.

In line with our findings, Ali M *et al*. found that the CT scan's sensitivity, specificity, positive and negative predictive values, and accuracy in detecting appendicitis were 71.4%, 90.7%, 62.5%, 93.6%, and 87.3%, respectively[12].

Additionally, a research by Chalazonitis AN *et al*., showed that CT had a 100% sensitivity, 95% specificity, 97% positive predictive value, 100% negative predictive value, and 98% accuracy when used routinely[13].

A 2019 systematic review of 71 research found that CT was a valid diagnostic test that might assist medical professionals in diagnosing and treating patients who could have appendicitis. Estimates of specificity varied from 50 to 100 percent, while those of sensitivity ranged from 72 to 100 percent. According to these data, there is a minimal likelihood that a physician wrongly diagnosing acute appendicitis (8% of patients whose CT scans indicated they have appendicitis). The chances of missing a diagnosis of appendicitis is also low (4% among those whose CT scans indicate they do not have appendicitis[14].

Also, a research by Mun S *et al*. found that IV-contrast-enhanced helical CT without oral contrast material has a 100% sensitivity and 97% specificity for acute appendicitis diagnosis[15]. This prevents the diagnosis and treatment from being delayed.

Notably, the most pathognomonic CT findings in a research by Choi D *et al*. were appendiceal wall enhancement, peri-appendiceal fat stranding, thickness of the appendiceal wall, and enlarged appendix[16].

Acute appendicitis was shown to be statistically significantly associated with a swollen appendix, appendicolith, peri-appendiceal fluid accumulation, fat plane smudging, appendiceal wall augmentation, and air loculi inside the wall (p *value* <0.0001). Two positive CT

scan results had sensitivity and specificity of 70.5% and 100%, respectively (p <0.0001) in predicting pathology-proven acute appendicitis, according to ROC analysis.

The highest diagnostic accuracy was found in distended appendix, fat plane smudging, thick enhancing wall (75.34% for each), followed by peri appendiceal fluid collection (72.6%) and presence of appendicolith (52.05%).

Scoring system

When diagnosing acute appendicitis, a number of clinical grading systems have been employed as adjuncts, either to assist clinical therapy or to assess if additional radiologic investigations are necessary[17,18]. Inconclusive results require more investigation or a longer observation period[19].

Alvarado score: (Figure 4)

Based on the overall score, the Alvarado score is utilized to stratify the risk of appendicitis and provide targeted therapeutic suggestions. A score of 5 or 6 is compatible with acute appendicitis but serial assessments are advised to confirm. An appendicitis score of 7 or 8 indicates suspected appendicitis, whereas a score of 9 or 10 indicates extremely probable appendicitis and suggests surgery[20]. Sensitivity and specificity are 81% and 74%, respectively, according to the original Alvarado research[20]. A score of Five indicates likely appendicitis with a sensitivity of 99% and specificity of 43%, while seven indicates probable appendicitis with a sensitivity of 82% and specificity of 81%, according to a meta-analysis of 29 studies. This suggests that while a cutoff point of seven or above cannot produce an appropriate ruling in score, a cutoff point of five or less can provide a solid ruling out score[21]. However, it should not be utilized alone in future management planning since it cannot accurately predict appendicitis without more research[22].

The Appendicitis Inflammatory Response score (AIR): (Figure 4)

Based on adding CRP to the majority of other points of the Alvarado score[23], this score assigns patients to low, medium, or high probability of acute appendicitis. It is accurate in ruling out appendicitis, and its higher specificity makes it more useful in determining which patients should have surgery[24]. The AIR score also performed well when analyzing the pediatric population, where the variables that need to be recorded were compared to the Alvarado score[25].

Alvarado score	Variable	Value
Symptoms	Migration	1
	Anorexia	1
	Nausea-vomiting	1
Signs	Tenderness in right lower quadrant	2
	Rebound of pain	1
	Elevation of temperature (>37.3C)	1
Laboratory	Leukocytosis (White blood cell count >=10,000/uL)	2
	Shift to the left (>75% neutrophils)	1
Total score		10

Appendicitis Inflammatory Response Score		
Vomiting		1
Pain in right inferior fossa		1
Rebound tenderness or muscular defense	Light Medium Strong	1 2 3
Body temperature > 38.5°C (101.3°F)		1
Polymorphonuclear leukocytes	70%-84% ≥ 85%	1 2
WBC count	10.0-14.9 ≥ 15.0	1 2
CRP concentration	1-4.9 mg/L ≥ 5 mg/L	1 2
Sum		I0-12I

AIR: sum 0-4=low probability; sum 5-8=mild probability; sum 9-12=high probability (*Andersson M et al.,2008*).

Fig. 4: Alvarado or MANTRELS scoring system[20], AIR score[8]

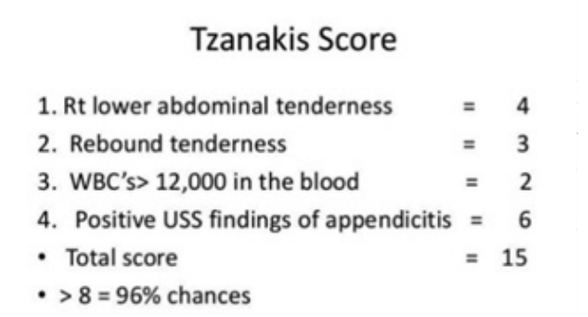

Fig. 5: Tzanakis score[26]

The present study proposed a diagnostic CT score using the six statistically significant CT predictors for acute appendicitis. The total score is of 5 points as follows: (Mnemonic: PADFAT score) (Figure 6).

PADFAT score	
Periappendcular fluid collection	1
Appendicolith	1
Distended appendix	1
Fat plane smudging	1
Thick enhancing wall	1
Total score	5
Score of 2 or more has a sensitivity and specificity of 75% and 100% respectively for diagnosing a pathologically proven acute appendicitis	

Fig. 6: CT score for acute appendicitis

Using ROC curve, it was found that a score of 2 or more in the CT scan was a significant predictor for diagnosing a pathologically proven acute appendicitis with a sensitivity and specificity of 75% and 100% respectively.

Our study had some limitation as it described results of single-center study with a small number of studied population (a larger sample would better evaluate the efficacy and the accuracy of CT in diagnosis of suspected cases of acute appendicitis).

CONCLUSION

The current study concludes. that CT abdomen and pelvis with Iv contrast is a useful diagnostic imaging modality for patients suspected of having acute appendicitis with equivocal clinical findings and/or physical examinations (Alvarado score 4-6). CT signs

of acute appendicitis include distended appendix, thick enhancing wall, fat plane smudging, Appendicolith, per appendicular fluid collection. PADFAT score of 2 or more has a 75% sensitivity and 100% specificity in diagnosis of pathology proven acute appendicitis. Further studies are needed to validate the score.

ETHICAL APPROVAL

The research was approved by the Ethical committee of Cairo University Faculty of Medicine.

CONFLICT OF INTERESTS

There are no conflicts of interest.

REFERENCES

1. Addiss DG, Shaffer N, Fowler BS, Tauxe RV. The epidemiology of appendicitis and appendectomy in the United States. American journal of epidemiology. 1990 Nov 1;132(5):910-25.
2. Pieper R, Kager L. The incidence of acute appendicitis and appendectomy. An epidemiological study of 971 cases. Acta Chir Scand. 1982;148(1):45-9. PMID: 7136411.
3. Lee SL, Ho HS. Acute appendicitis: is there a difference between children and adults?. The American Surgeon. 2006 May 1;72(5):409-13.
4. Old JL, Dusing RW, Yap W, Dirks J. Imaging for suspected appendicitis. American family physician. 2005 Jan 1;71(1):71-8.
5. Yildirim E, Karagülle E, Kirbas I, Türk E, Hasdogan B, Teksam M, Coskun M. Alvarado scores and pain onset in relation to multislice CT findings in acute appendicitis. Diagnostic and Interventional Radiology. 2008 Mar 1;14(1):14.
6. Di Saverio S, Podda M, De Simone B, HYPERLINK "https://pubmed.ncbi.nlm.nih.gov/?term=Ceresoli+M&cauthor_id=32295644" Ceresoli M, HYPERLINK "https://pubmed.ncbi.nlm.nih.gov/?term=Augustin+G&cauthor_id=32295644" Augustin G, HYPERLINK "https://pubmed.ncbi.nlm.nih.gov/?term=Gori+A&cauthor_id=32295644" Gori A, et al. Diagnosis and treatment of acute appendicitis: 2020 update of the WSES Jerusalem guidelines. World J Emerg Surg. 2020;15(1):27. Published 2020 Apr 15.
7. Konstantinidis KM, Anastasakou KA, Vorias MN, Sambalis GH, Georgiou MK, Xiarchos AG. A decade of laparoscopic appendectomy: presentation of 1,026 patients with suspected appendicitis treated in a single surgical department. J. Laparoendosc. Adv. Surg. Tech. A 2008; 18: 248–258.
8. Andersson RE. Meta-analysis of the clinical and laboratory diagnosis of appendicitis. British journal of surgery. 2004 Jan 1;91(1):28-37.
9. Old JL, Dusing RW, Yap W, Dirks J. Imaging for suspected appendicitis. American family physician. 2005 Jan 1;71(1):71-8.
10. Jones K, Peña AA, Dunn EL, Nadalo L, Mangram AJ. Are negative appendectomies still acceptable?. The American journal of surgery. 2004 Dec 1;188(6):748-54.
11. Atwood R, Blair S, Fisk M, Bradley M, Coleman C, Rodriguez C. NSQIP Based Predictors of False Negative and Indeterminate Ultrasounds in Adults With Appendicitis. Journal of Surgical Research. 2021 May 1;261:326-33.
12. Ali M, Iqbal J, Sayani R. Accuracy of computed tomography in differentiating perforated from nonperforated appendicitis, taking histopathology as the gold standard. Cureus. 2018 Dec;10(12).
13. Chalazonitis AN, Tzovara I, Sammouti E, Ptohis N, Sotiropoulou E, Protoppapa E, Nikolaou V, Ghiatas AA. CT in appendicitis. Diagnostic and Interventional Radiology. 2008 Mar 1;14(1):19.
14. Rud B, Vejborg TS, Rappeport ED, Reitsma JB, Wille-Jørgensen P. Computed tomography for diagnosis of acute appendicitis in adults. Cochrane Database of Systematic Reviews. 2019(11).
15. Mun S, Ernst RD, Chen K, Oto A, Shah S, Mileski WJ. Rapid CT diagnosis of acute appendicitis with IV contrast material. Emergency radiology. 2006 Mar;12(3):99-102.
16. Choi D, Park H, Lee YR, Kook SH, Kim SK, Kwag HJ, Chung EC. The most useful findings for diagnosing acute appendicitis on contrast-enhanced helical CT. Acta radiologica. 2003 Jan 1;44(6):574-82.
17. Rezak A, Abbas HM, Ajemian MS, Dudrick SJ, Kwasnik EM. Decreased use of computed tomography with a modified clinical scoring system in diagnosis of pediatric acute appendicitis. Arch Surg. 2011;146:64–67.
18. Farahnak M, Talaei-Khoei M, Gorouhi F, Jalali A. The Alvarado score and antibiotics therapy as a corporate protocol versus conventional clinical management: randomized controlled pilot study of approach to acute appendicitis. Am J Emerg Med. 2007;25:850–852
19. Pouget-Baudry Y, Mucci S, Eyssartier E, Guesdon-Portes A, Lada P, Casa C, Arnaud JP, Hamy A. The use of the Alvarado score in the management of right lower quadrant abdominal pain in the adult. Journal of Visceral Surgery. 2010 Apr 1;147(2):e40-4.
20. Alvarado A. A practical score for the early diagnosis of acute appendicitis. Annals of emergency medicine. 1986 May 1;15(5):557-64.

21. Ohle R, O'Reilly F, O'Brien KK, Fahey T, Dimitrov BD. The Alvarado score for predicting acute appendicitis: a systematic review. BMC medicine. 2011 Dec;9(1):1- 3.

22. Kabir SA, Kabir SI, Sun R, Jafferbhoy S, Karim A. How to diagnose an acutely inflamed appendix; a systematic review of the latest evidence. International Journal of Surgery. 2017 Apr 1;40:155-62.

23. Andersson M, Andersson RE. The appendicitis inflammatory response score: a tool for the diagnosis of acute appendicitis that outperforms the Alvarado score. World journal of surgery. 2008 Aug; 32(8):1843-9.

24. Kollár D, McCartan DP, Bourke M, Cross KS, Dowdall J. Predicting acute appendicitis? A comparison of the Alvarado score, the Appendicitis Inflammatory Response Score and clinical assessment. World journal of surgery. 2015 Jan;39(1):104-9.

25. Sekhar AP, Sudhir S. Evaluation of appendicitis inflammatory response score as a novel diagnostic tool for diagnosis of acute appendicitis and its comparison with Alvarado score. IJSS Journal of Surgery. 2017 Jan 30;3(1):21-6.

26. Tzanakis NE, Efstathiou SP, Danulidis K, Rallis GE, Tsioulos DI, Chatzivasiliou A, Peros G, Nikiteas NI. A new approach to accurate diagnosis of acute appendicitis. World journal of surgery. 2005 Sep;29(9):1151-6.