Journal Reading
Acute Appendicitis

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ORIGINAL ARTICLE

J Comput Assist Tomogr • Volume 32, Number 3, May/June 2008

Receiver Operating Characteristic Analysis of the Diagnostic Performance of a Computed Tomographic Examination and the Alvarado Score for Diagnosing Acute Appendicitis: Emphasis on Age and Sex of the Patients

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Acute Appendicitis

- Common differential diagnosis of patients with lower abdominal pain at the ER.
- The lifetime prevalence: ~9% for males, ~7% for females.
- The negative appendectomy rate is 10% to 40% and is the highest in women of childbearing age.
- Appendectomy is performed to reduce the incidence of perforation; however, the general consensus of surgeons is that approximately 15% of appendectomies overall and 20% in women will be negative.

Diagnosis of AA

- High likelihood of appendicitis (early surgical intervention) vs observed safely or discharged
- Diagnosis based on history, PE and Lab results
- Clinical scoring systems are a good supporting tool: simple, noninvasive, and easy to use in clinical routine practice, requiring no special equipment

The Alvarado Score & CT

- The Alvarado score alone is inadequate as a single diagnostic test, showed poor result in assessment of women, children, and elderly patients
- Advocated as a tool to identify patients who should undergo imaging study or active observation
- Computed tomography (CT) plays a major role in improving the diagnostic accuracy of acute appendicitis.
- More beneficial in the elderly patients and premenopausal women, but less beneficial in young males.

Objective of this study

- To compare the diagnostic performance of CT and the Alvarado score for diagnosing acute appendicitis
- To evaluate the influence of age and gender

MATERIALS AND METHODS
Patients

- Retrospectively reviewed emergency medical data

500 pts
(>15 y/o)
AA as d/dx

→

128 excluded
85 pts transferred
27 pts X preop CT
12 pts incomplete chart & Alvarado score
4 pts appendiceal mucocele

→

372 patients
(157 men and 215 women; range of age, 15~84 years; mean age, 38 years) were included

Onset of pain → clinical evaluation 3 hours to 7 days (mean 2 days) → CT scans <24 hrs

- Classified by age and sex
- Final diagnoses by surgical pathology
- Clinical follow-up for at least 3 months

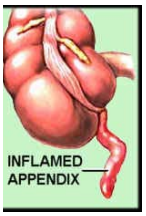
CT scans on a 5-point scale grade 1 (normal) to grade 5 (appendicitis)

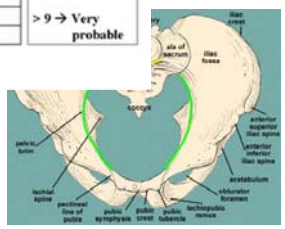
- **Grade 1**, thin appendiceal wall, appendiceal diameter smaller than 6 mm (no gas, no fluid) or 8 mm (gas or fluid-filled);
- **Grade 2**, thin appendiceal wall, appendiceal diameter 6 to 7.9 mm (no gas, no fluid) or 8 to 9.9 mm (gas or fluid-filled), or no demonstrable appendix without any secondary findings;
- **Grade 3, suspicious enhanced** appendiceal wall or periappendiceal strands and grade 2 appendix findings, or secondary findings (pericecal fluid, fatty stranding, cecal changes, or lymphadenopathy) without demonstrable appendix;
- **Grade 4**, **thickened appendiceal wall**, appendiceal diameter greater than 8 mm (no gas, no fluid) or 10 mm (gas or fluid-filled) without periappendiceal stranding, cecal (ileal) changes, or lymphadenopathy;
- **Grade 5**, features of grade 4 with **periappendiceal stranding**, cecal (ileal) changes, or lymphadenopathy.

Alvarado score for appendicitis

Symptoms	Score
Migratory right iliac fossa pain	1
Nausea / Vomiting	1
Anorexia	1
Signs	
Tenderness in right iliac fossa	2
Rebound tenderness in right iliac fossa	1
Elevated temperature	1
Laboratory findings	
Leucocytosis	2
Shift to the left of neutrophils	1
Total	10

5-6 → Possible
7-8 → Probable
> 9 → Very probable





- <5 be discharged as non-AA
- 5 -6 be placed under observation as possible AA
- >=7 operated on as probable AA

Alvarado Score

- **1 point:** Migration of pain from the **center to the RLQ** abdomen, anorexia, nausea with vomiting, rebound pain, elevated body temperature >= 37.3C, and differential white count with a shift to the left (>75% neutrophils).
- **2 points**: RLQ tenderness and leukocytosis (>10,000 cells/mm3).

Statistical Analysis

- Receiver operating characteristic (ROC) analysis → compare CT and the Alvarado score for diagnosing acute appendicitis
- Compared the AUC of the CT examination and Alvarado score using the Hanley-McNeil method for paired data; $P<0.05$ was considered statistically significant

Statistical Analysis

- A test with an AUC value of 1 is perfectly accurate because the sensitivity is 1, when the false-positive rate is 0
- The practical lower limit for the AUC of a diagnostic test is 0.5
- Uninformative (AUC = 0.5), less accurate (0.5 < AUC =< 0.7), moderately accurate (0.7 < AUC =< 0.9), highly accurate (0.9 G AUC G 1), and perfect (AUC = 1)

To calculate sensitivity and specificity

- **CT**: **grade 3** was selected as the cutoff value to exclude the diagnosis of appendicitis in the ROC analysis (**grades 4,5: positive test results**)
- 2 cutoff values for the Alvarado score: one was derived from the ROC curve analysis, and the other was given in the original report on the Alvarado score (>=7: require surgery)

Results

TABLE 1. Incidence of Acute Appendicitis According to Age and Sex of the Patients

Age	Incidence (%)
15–30 yrs	
Male	37/62 (59.7)
Female	30/83 (36.1)
31–50 yrs	
Male	48/70 (68.6)
Female	42/80 (52.5)
>50 yrs	
Male	19/25 (76)
Female	37/52 (71.2)
All	
Male	104/157 (66.2)
Female	109/215 (50.7)

- Overall, 66.2% of male patients (104/157) and 50.7% of female patients (109/215) were confirmed to have acute appendicitis, showing significantly more frequent occurrence in male patients (P G 0.05).

Op findings

- 147 of 372 pts followed-up and acute appendicitis was excluded
- **225 operations** performed:
  - **27 cases (12.7%) of perforated appendicitis** (6 microperforations, 21 gross perforations, and 4 abscesses among 21 gross perforation cases)
  - **3 cases of abscesses** located in right lower quadrant abdomen, inferomedial aspect of cecum and another one at midlower abdomen, just distal to the perforated appendiceal tip.
- **Alternative diagnoses for 10** OP patients : 3 ovarian torsion, 2 diverticulitis of the ascending colon, 1 tuboovarian abscess, 1 cancer of the ascending colon, 1 ileal gastrointestinal stromal tumor, 1 intestinal obstruction, and 1 ileal perforation.
- No abnormalities were found in 2 cases.
- The overall **negative** appendectomy rate was **5.3% (12)**.

ROC Analysis

- The overall diagnostic accuracy of CT (AUC = 0.965) in diagnosing acute appendicitis was considerably superior to that of the Alvarado score (AUC = 0.732) (P < 0.05).

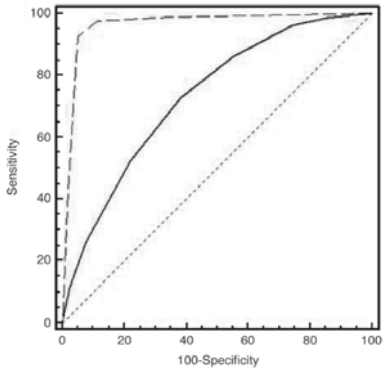


FIGURE 1. Receiver operating characteristic curve of CT and Alvarado score for diagnosing acute appendicitis, regardless of age and sex of patients. Long-dotted curved line represents ROC curve of CT (AUC = 0.965); solid curved line, ROC curve of Alvarado score (AUC = 0.732); short-dotted linear line, chance diagonal.

TABLE 5. Sensitivity, Specificity, PPV, and NPV of the Alvarado Score According to Age and Sex of the Patients (Cutoff Value = 6 [Positive When the Alvarado Score Is Equal to or More Than 6])

Age	Sensitivity	Specificity	PPV	NPV
15–30 yrs				
Male	81.1	52	71.5	65
Female	93.3	66	60.8	94.6
30–50 yrs				
Male	68.7	63.6	80.5	48.2
Female	59.5	65.8	65.8	59.5
>50 yrs				
Male	63.2	66.7	85.7	36.4
Female	73	46.7	77.2	41.2
All				
Male	72.1	58.5	77.3	51.7
Female	73.4	63.2	67.2	69.8

TABLE 4. Sensitivity, Specificity, PPV, and NPV of the Alvarado Score According to Age and Sex of the Patients (Cutoff Value = 7 [Positive When the Alvarado Score Is Equal to or More Than 7])

Age	Sensitivity	Specificity	PPV	NPV
15–30 yrs				
Male	56.8	72	75	52.9
Female	76.7	86.8	76.7	86.8
30–50 yrs				
Male	43.7	81.8	83.9	39.9
Female	47.6	78.9	71.4	57.7
>50 yrs				
Male	36.8	83.3	87.5	29.4
Female	54.1	46.7	71.5	29.2
All				
Male	47.1	77.4	80.3	42.8
Female	57.8	78.3	73.3	64.3

TABLE 3. Sensitivity, Specificity, PPV, and NPV of CT According to Age and Sex of the Patients

Age	Sensitivity	Specificity	PPV	NPV
15–30 yrs				
Male	89.2	100	100	86.2
Female	90	98.1	96.4	94.6
30–50 yrs				
Male	93.7	95.5	97.8	87.4
Female	92.9	86.8	88.6	91.7
>50 yrs				
Male	94.7	83.3	94.7	82.9
Female	94.6	100	100	88.2
All				
Male	92.3	96.2	97.9	86.5
Female	92.7	94.3	94.4	92.6

DISCUSSION

- AUC of CT was significantly higher in most groups. Moderately accurate (AUC = 0.846) in older men

Overall	CT	Alvarado score (>=7)
Sensitivity	92.5%	52.6%
Specificity	95%	78%
PPV	96.1%	78%
NPV	90.4%	55.1%
AUC	0.965 highly accurate	0.732 moderately accurate

TABLE 2. The AUC of CT and Alvarado Score for Diagnosing Acute Appendicitis According to Age and Sex of the Patients

Age	AUC: CT	AUC: Alvarado Score	Difference in AUC Value	P
15–30 yrs				
Male	0.989	0.742	0.247	0.000
Female	0.962	0.877	0.210	0.000
Male, female	0.983	0.823	0.160	0.000
31–50 yrs				
Male	0.984	0.719	0.266	0.000
Female	0.929	0.737	0.192	0.001
Male, female	0.954	0.728	0.226	0.000
>50 yrs				
Male	0.846	0.623	0.224	0.074
Female	0.983	0.586	0.397	0.000
Male, female	0.942	0.593	0.349	0.000
All				
Male	0.969	0.705	0.264	0.000
Female	0.962	0.752	0.210	0.000
Male, female	0.965	0.732	0.233	0.000

AUC for Alvarado Score

- AUC of the Alvarado score tended to decrease with increasing age of patient:
  - Young (0.823) and middle-aged pts (0.728) were within the range of moderate accuracy, less accurate in >50y/o (0.593)
- The AUC tended to be higher in **women** than in men in young (**0.877** vs 0.742) and middle-aged (**0.737** vs 0.719) patients (older women (0.586)< men (0.623)).
- Most useful for diagnosing acute appendicitis in **younger women**

Alvarado cut-off	Sensitivity	Specificity	PPV	NPV
>=6	72.8%	61.6%	71.7%	72.8%
>=7 (org)	52.6%	78%	76.2%	55.1%

- The overall sensitivity (52.6%) of the Alvarado score using the cutoff value >=7, for determining immediate surgical intervention was too low
- Cutoff value of the Alvarado score should be modified from 7 to 6, when considering immediate surgery vs active observation

16. Shrivastava UK, Gupta A, Sharma D. Evaluation of the Alvarado score in the diagnosis of acute appendicitis. *Trop Gastroenterol.* 2004;25:184–186.

AUC for CT

- AUC for CT in older patients was 0.942 (highly accurate test)
- Older women with an atypical presentation of acute appendicitis are expected to receive the most benefit from CT

Limitations

- Retrospective study: review of patients' medical records and pathological reports
- Study was limited to one institution of cohort

Summary

- Overall diagnostic performance of CT in diagnosing AA was superior to the Alvarado score
- The high diagnostic performance of CT was not changed according to age and sex of the patient
- Alvarado score: less accurate (AUC = 0.586, older F) to moderately accurate (AUC = 0.877, young F)
- Even if the cutoff value of the Alvarado score was modified (ie, 6 points), the overall sensitivity (72.8%) and specificity (61.6%) of the Alvarado score were low

Conclusion

- Alvarado score + CT examination for accurate diagnosis of acute appendicitis in all suspected acute appendicitis
- Low sensitivity and specificity of the Alvarado score, especially in older woman

ORIGINAL ARTICLE

Pediatric Emergency Care • Volume 27, Number 3, March 2011

Prospective Validation of Two Systems of Classification for the Diagnosis of Acute Appendicitis

Alexandre Escribá, MD, Anna María Gamell, MD, Yolanda Fernández, MD, Jose María Quintillá, MD, and Carlos Luaces Cubells, MD

Acute appendicitis (AA) for pediatrics

- One of the most common surgical pathologies in childhood, and it is the most important cause of acute abdomen in pediatrics
- In most cases: clinical data and PE sufficient for diagnosis
- When to operate? Doubts among pediatricians, surgeons → can lead to delays in the diagnosis and an increase in the percentage of **appendicular perforations** (a complication that is present in 30%-66% of pts diagnosed with AA)
- Inappropriate appendectomies: 10%-30%

Scoring system and U/S

- To reduce the time needed for diagnosis and the number of inappropriate appendectomies, classification and scoring have been created to aid in the decision making process
- Alvarado score: 1986, adult population
- Pediatric Appendicitis Score (PAS): 2002, pediatric population
- Imaging: abdominal ultrasound is most often used to improve the preoperative diagnostic accuracy

- Alv. <5 be discharged as non-AA
- 5 -6 be placed under observation as possible AA
- >=7 operated on as probable AA
- PAS =<5 no AA
- >=6 operated under suspicion of AA

TABLE 1. Alvarado Score

Alvarado Score	
Migration of pain	1
Anorexia	1
Nausea/vomiting	1
Right lower quadrant tenderness	2
Rebound pain	1
Elevation in temperature (≥37.3°C)	1
Leukocytes ≥10,000/μL	2
Polymorphonuclear neutrophilia ≥75%	1
Total	10

TABLE 2. Pediatric Appendicitis Score

Pediatric Appendicitis Score	
Migration of pain	1
Anorexia	1
Nausea/vomiting	1
Right lower quadrant tenderness	2
Cough/hopping/percussion tenderness in the right lower quadrant	2
Elevation in temperature (≥38°C)	1
Leukocytes ≥10.000/μL	1
Polymorphonuclear neutrophilia ≥75%	1
Total	10

Study Ojectives

- Main objective: Validation of Alvarado score and PAS
- Second objective: Evaluate whether abdominal ultrasound, when carried out can increase the reliability of the diagnosis

Methods

- ER of a third-level urban maternity and childhood hospital, referral center for an area of some 1,300,000 inhabitants, average of 290 patients daily in 2008.
- The study is **prospective**, from **October 1, 2008, to January 1, 2009**
- Patients **4-18 y/o** with **abdominal pain**, after history taking and PE compatible with AA, were subjected to blood tests
- Excluded: pts with abdominal pain but not subjected to blood analysis, in the belief that they were not having AA, and those referred with a prior diagnosis of AA

Methods

- Once order blood analysis because of suspicion of AA → completed a data sheet that included pt's age, sex, evolution of symptoms, Alvarado and PAS items
- PAS: Did not define exactly the percentages for polymorphonuclear neutrophilia and fever
- This study defined the percentage of PMN as >=75% and fever >=38-C under the arm

Methods

- The clinical records, discharge reports, lab data of the pts included in the study were reviewed
- For those operated on, the confirmed diagnosis of AA was determined by pathological anatomy
- Those patients who were not admitted and who did not return to our center were contacted by telephone after 10 days to confirm the final diagnosis

Methods

- Clinical and analytical variables of the AA and non-AA groups were compared
- In the comparison of categorical variables, the X^2 test was used, and for the quantitative variables, the Student t test or the Mann- Whitney U test was used depending on the normality or the nonnormality of the distribution of each variable
- A receiver operating characteristic (ROC) curve was constructed for both the Alvarado score and the PAS, and for each value of the score, we calculated sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and 95% confidence intervals (CIs).

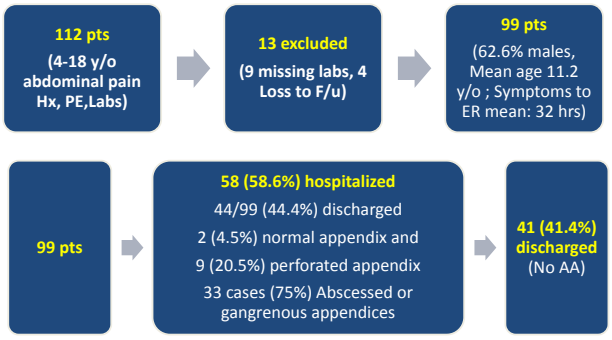
Methods

- The optimal cutoff point to discriminate between AA and non-AA patients was determined.
- In the same manner, we calculated sensitivity, specificity, and predictive values for the ultrasound.
- Finally, to uncover a possible increase in diagnostic reliability, we designed a retrospective protocol of action based on the combined application of either Alvarado score or PAS along with abdominal ultrasound (Alvarado score - ultrasound protocol and PAS - ultrasound protocol).

Methods

- Defined non-AA those values of the score below the best cutoff point in sensitivity, and as AA, those values above the best cutoff point in specificity.
- For the intermediate values, the action taken would be conditioned by the results of the ultrasound. Also studied in relation to this action protocol were sensitivity, specificity, and predictive values.

Results



Result

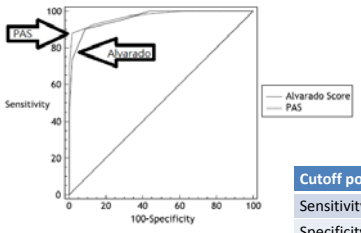
- Group AA (histological confirmation of AA): 42 pts
- Group non-AA: 57 pts

TABLE 3. Characteristics of the 2 Groups Along With the Most Relevant Comparative Results

	Group AA (n = 42)	Group Non-AA (n = 57)	*P*
Age, mean (95% CI), yr	10.61 (9.28–11.93)	11.75 (10.89–12.60)	ns
Sex (males)	69%	57.9%	ns
Evolution of symptoms, mean (95% CI), hr	34.23 (23.79–44.66)	29.30 (20.74–37.87)	ns
Alvarado score, mean (95% CI)	8.14 (7.76–8.53)	4.23 (3.77–4.69)	<0.001
PAS, mean (95% CI)	7.98 (7.55–8.40)	3.81 (3.40–4.21)	<0.001
Leukocytes, mean (95% CI), /μL	16,488 (14,958–18,017)	12,056 (10,635–133,477)	<0.001
Polymorphonuclear neutrophilia, mean (95% CI), /μL	14,195 (13,050–15,339)	8612 (7338–9986)	<0.001
% polymorphonuclear neutrophilia, mean (95% CI)	83.98 (82.33–85.63)	68.11 (64.21–72)	<0.001

Results

- The Alvarado score and PAS were calculated for each of the 99 patients from the data collected.
- No patient with an Alvarado score less than 5 or PAS less than 4 had AA.
- All patients with an Alvarado score higher than 8 and PAS higher than 7 had AA.



	AUC	95% CI
Alvarado Score	0,963	0,904 - 0,990
PAS	0,972	0,917 - 0,994
Significance level	P = 0,488 (ns)	

AUC: Area under the curve
CI: confidence interval

FIGURE 1. Area under the ROC curve for Alvarado score and PAS.

Cutoff point at 6	Alvarado	PAS
Sensitivity	90.48%	88.10%
Specificity	91.23%	98.25%
PPV	88%	97%
NPV	93%	92%

- No significant differences were found between the 2 scores.
- The optimal cutoff point was 6 for both Alvarado score and PAS.

Results

- Abdominal ultrasound was done in 31 pts (31.3%)
- Sensitivity of 84.62%, specificity of 94.44%, a PPV of 91.7%, and an NPV of 89.4%
- To increase the diagnostic reliability, a retrospective Alvarado score-ultrasound and PAS-ultrasound protocol was designed (Fig. 2).

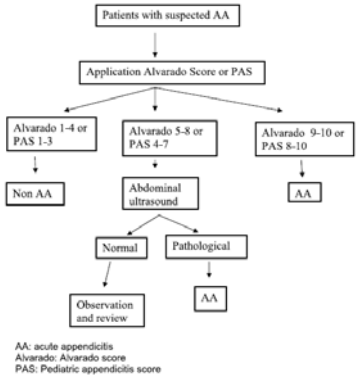


FIGURE 2. Algorithm for using the Alvarado score–ultrasound or PAS–ultrasound protocol.

Discussion

- PAS was designed by Samuel in 2002 in a prospective sample of 1170 patients from 4-15 y/o chosen during a period of 5 years

This study…	PAS
Sensitivity	100%
Specificity	92%
PPV	96%
NPV	99%

19. Schneider C, Kharbanda A, Bachur R. Evaluating appendicitis scoring system using prospective pediatric cohort. *Ann Emerg Med*. 2007;49:778–784.
20. Goldman RD, Cartes S, Stephens D, et al. Prospective validation of the pediatric appendicitis score. *J Pediatric*. 2008;153:278–282.
21. Bhatt M, Joseph L, Ducharme F, et al. Prospective validation of the pediatric appendicitis score in a Canadian pediatric emergency department. *Acad Emerg Med*. 2009;16(7):591–596.

Alvarado score

- Useful for the diagnosis of AA when obtained a score > 8
- Valid for ruling out AA when obtained a score <5

TABLE 4. Alvarado Score and Each Cut Point for All Possible Scores

Alvarado Score for Diagnostic Appendicitis				
Criterion Values and Coordinates of the ROC Curve				
Criterion	**Sensitivity**	**95% CI**	**Specificity**	**95% CI**
≥1	100.00	91.5–100.0	0.00	0.0–6.3
>1	100.00	91.5–100.0	5.26	1.2–14.6
>2	100.00	91.5–100.0	19.30	10.1–31.9
>3	100.00	91.5–100.0	35.09	22.9–48.9
>4	100.00	91.5–100.0	56.14	42.4–69.3
>5	95.24	83.8–99.3	71.93	58.5–83.0
>6*	**90.48**	**77.4–97.3**	**91.23**	**80.7–97.1**
>7	73.81	58.0–86.1	98.25	90.6–99.7
>8	45.24	29.9–61.3	100.00	93.7–100.0
>9	9.52	2.7–22.6	100.00	93.7–100.0
>10	0.00	0.0–8.5	100.00	93.7–100.0

*Score for 6 was previously the discriminating cut point for diagnostic appendicitis.

PAS

- >7 strong suspicion of AA
- <4 valid for ruling out AA

TABLE 5. Pediatric Appendicitis Score and Each Cut Point for All Possible Scores

PAS for Diagnostic Appendicitis				
Criterion Values and Coordinates of the ROC Curve				
Criterion	**Sensitivity**	**95% CI**	**Specificity**	**95% CI**
≥1	100.00	91.5–100.0	0.00	0.0–6.3
>1	100.00	91.5–100.0	10.53	4.0–21.5
>2	100.00	91.5–100.0	19.30	10.1–31.9
>3	100.00	91.5–100.0	38.60	26.0–52.4
>4	97.62	87.4–99.6	66.67	52.9–78.6
>5	92.86	80.5–98.4	85.96	74.2–93.7
>6*	**88.10**	**74.4–96.0**	**98.25**	**90.6–99.7**
>7	69.05	52.9–82.4	100.00	93.7–100.0
>8	42.86	27.7–59.0	100.00	93.7–100.0
>9	7.14	1.6–19.5	100.00	93.7–100.0
>10	0.00	0.0–8.5	100.00	93.7–100.0

*Score for 6 was previously the discriminating cut point for diagnostic appendicitis.

Imaging

- Intermediate scores (Alvarado score 5-8 and PAS 4-7), advisable to use an imaging test (abdominal U/S or CT) to increase the reliability of the diagnosis
- Abdominal radiography, ultrasound, abd. CT
- limitations of ultrasound is that it may be affected by patient obesity and by the presence of great pain in the pt
- CT is reserved for cases that are doubtful clinically, in which ultrasound has not proven definitive

Ultrasound

- For the pts on whom it was performed, proved to be highly specific and sensitive
- Only in 2 cases did it show normal results and turned out to be AA, and then there was another case in which the results were pathological, but the patient showed clinical improvement and appendectomy was unnecessary
- No patient in our study was given an abdominal CT scan. **Ultrasound is the imaging procedure of choice** and abdominal CT is reserved for very select cases.

Opinion of an expert surgeon

- Can never be replaced by a scoring system, final decision as to whether to operate or not must rest on surgeon criteria.
- But the first contact with most cases of AA is made by the **clinician who may not be familiar with the appendicular pathology**. This is where clinical scoring system may be useful in ruling out or detecting AA as early as possible.

Limitations

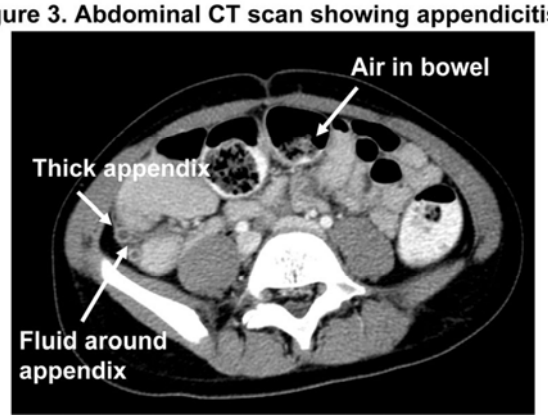
- The size of the selected sample, which is small.
- High prevalence in our study of patients with AA (the indication for requesting blood analysis is restrictive; it is only undertaken when there is a medical history and compatible physical exploration after evaluation).

Conclusion

- **Alvarado** score and **PAS** were useful in the evaluation of suspected AA because of their heightened sensitivity and specificity. No statistical differences were found between them.
- At their extreme point values, they yield results that justify their use in emergency services, although they **should not be used as the only means** of clinically determining the need for surgery
- The design of **diagnostic algorithms** that include scoring systems and imaging tests in cases of intermediate point values could improve diagnostic reliability.

- Thank you for your attention!

Figure 3. Abdominal CT scan showing appendicitis.



ORIGINAL ARTICLE

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Receiver Operating Characteristic Analysis of the Diagnostic Performance of a Computed Tomographic Examination and the Alvarado Score for Diagnosing Acute Appendicitis: Emphasis on Age and Sex of the Patients

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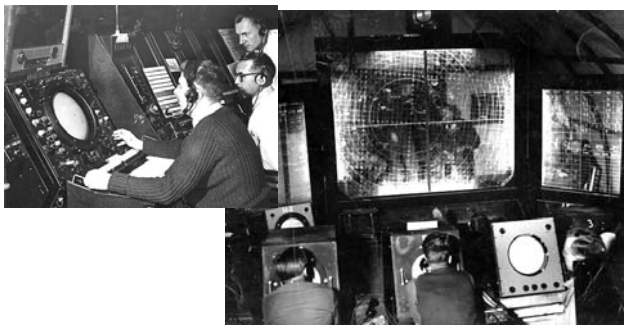
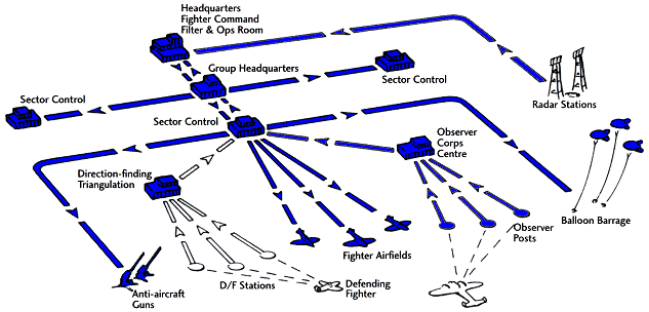
Receiver Operating Characteristic

Receiver Operating Characteristic





Imaging Method

- Routine CT protocol for abdominal pain, precontrast and postcontrast CT of the entire abdomen and pelvis
- 47 patients were scanned using a single-channel CT scanner (Hispeed Advantage; GE Medical Systems, Milwaukee, Wis)
- 325 patients were examined using a 16-channel multidetector row CT scanner (Somatom Sensation 16; Siemens, Issaquah, Wash).

Image Interpretation

- CT scans were interpreted retrospectively, based on the consensus of 2 board-certified abdominal radiologists (J.K.K. with 7-year experience, S.J.S. with 3-year experience.)
- Only information of a possible diagnosis of acute appendicitis, were blinded to the original CT reports, surgical findings, final clinical diagnoses, and pathological results

AUC for CT

- AUC for CT in older … rate test)
- Older wom… appendicit… from CT
- This result differed … Alvarado score was unsa… tory for diagnosing acute appendicitis in women
- The frequency (16.9% for all younger women) of an alternative gynecologic diagnosis mimicking acute appendicitis in younger women in our study was similar to that shown in previous studies (9%-12%).

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TABLE 4. Alvarado Score and Each Cut Point for All Possible Scores

Alvarado Score for Diagnostic Appendicitis				
Criterion Values and Coordinates of the ROC Curve				
Criterion	**Sensitivity**	**95% CI**	**Specificity**	**95% CI**
≥1	100.00	91.5–100.0	0.00	0.0–6.3
>1	100.00	91.5–100.0	5.26	1.2–14.6
>2	100.00	91.5–100.0	19.30	10.1–31.9
>3	100.00	91.5–100.0	35.09	22.9–48.9
>4	100.00	91.5–100.0	56.14	42.4–69.3
>5	95.24	83.8–99.3	71.93	58.5–83.0
>6*	**90.48**	**77.4–97.3**	**91.23**	**80.7–97.1**
>7	73.81	58.0–86.1	98.25	90.6–99.7
>8	45.24	29.9–61.3	100.00	93.7–100.0
>9	9.52	2.7–22.6	100.00	93.7–100.0
>10	0.00	0.0–8.5	100.00	93.7–100.0

*Score for 6 was previously the discriminating cut point for diagnostic appendicitis.

TABLE 5. Pediatric Appendicitis Score and Each Cut Point for All Possible Scores

PAS for Diagnostic Appendicitis				
Criterion Values and Coordinates of the ROC Curve				
Criterion	**Sensitivity**	**95% CI**	**Specificity**	**95% CI**
≥1	100.00	91.5–100.0	0.00	0.0–6.3
>1	100.00	91.5–100.0	10.53	4.0–21.5
>2	100.00	91.5–100.0	19.30	10.1–31.9
>3	100.00	91.5–100.0	38.60	26.0–52.4
>4	97.62	87.4–99.6	66.67	52.9–78.6
>5	92.86	80.5–98.4	85.96	74.2–93.7
>6*	**88.10**	**74.4–96.0**	**98.25**	**90.6–99.7**
>7	69.05	52.9–82.4	100.00	93.7–100.0
>8	42.86	27.7–59.0	100.00	93.7–100.0
>9	7.14	1.6–19.5	100.00	93.7–100.0
>10	0.00	0.0–8.5	100.00	93.7–100.0

*Score for 6 was previously the discriminating cut point for diagnostic appendicitis.