

Diagnostic Procedures among Patients Undergoing Appendectomy: Findings from A Tertiary Hospital In Saudi Arabia

Mohammed AlQahtani¹, Mudassir Maqbool Wani¹, Omar Aldhasee², Abdulrahman Alqahtani³,
Yazeed Alharthi⁴, Suliman Alghnam⁵

1. College of Medicine, King Khalid University Abha, 2. Medical Student, College of Medicine, King Saud University, Riyadh, 3. Medical Student, College of Medicine, King Saud bin Abdulaziz University for Health Sciences, Riyadh. 4. College of Medicine, Royal College of Surgeons in Ireland, 5. King Abdullah International Medical Research Center, Riyadh

ABSTRACT

Objective: Acute appendicitis is a common surgical emergency. But often arriving at correct diagnosis is challenging. CT scan has reduced the rates of negative appendectomies but it has radiation risk. We compared CT with Alvarado score (AS) in acute appendicitis in terms of positive operative and histopathological findings with the aim to use CT evaluation appropriately.

Patients and methods: We collected retrospectively data of 358 patients admitted in a single hospital over a period of one year. All patients had Alvarado scoring done at the time of admission. CT was performed in 293 patients on consultant directions. CT and AS were compared in correlation with positive histopathological findings.

Results: The study included 224 males (62.56%) and 134 females (37.43%). CT was performed in 293 patients (81.84%) patients. 320 (89.38%) patients underwent surgery while 38 (10.615) patients were managed conservatively. Among the operated group, 268(83.75%) patients had uncomplicated appendicitis while 52 (16.25%) had complicated appendicitis. Histopathology was positive for appendicitis in 285 patients (89.06%).

Conclusions: An AS of 7 and above is as significant as CT scan so for these patients one can rely on AS score for deciding surgery. On the other hand if scores are less than 6 and there is strong suspicion of Appendicitis one should go ahead with CT.

Keywords: Appendectomy, CT, Alvarado score, Validity of CT, Appendectomy diagnosis.

INTRODUCTION

With a lifetime risk of 8.6% for males and 6.7% for females, acute appendicitis is one of the most common causes of acute abdominal pain requiring surgical intervention^{1,2}. Negative appendectomy rates in the range of 18- 20% were considered the norm. However, in present era this is no longer acceptable because even though complication rates in the setting of negative appendectomy are low, the complications such as incisional hernias, intestinal obstruction secondary to adhesions, and stump leakages is not a rare occurrence.

Although acute appendicitis being a clinical diagnosis, the computed tomography (CT) scan has emerged as the dominant imaging modality for evaluation of suspected appendicitis in adults helping us with decreased negative appendectomies³. The rate of negative appendectomy has gone to less than 10%⁴⁻⁶. But on the flip side the radiation exposure with CT is a matter of concern as in most patients with appendicitis are young, hence most susceptible to the adverse effects of radiation^{7,8}. Literature available has revealed that about 25 percent CT are not clinically warranted rather benefitting they do more harm⁹. As such it becomes

necessary to have guidelines to use CT properly in patients with acute appendicitis⁹. One of the alternative approaches is to use Alvarado scoring for the suspected cases of acute appendicitis. Studies have also shown how the Alvarado score (AS) can be used in guiding the usage of CT in appendicitis patients (Table 1)¹⁰.

Table 1. The Alvarado Scoring System

Mnemonic (MANTRELS) Symptom	Value
Migration	1
Anorexia-acetone	1
Nausea-vomiting	1
Signs	
Tenderness in right lower quadrant	2
Rebound pain	1
Elevation of temperature >37.3 C	1
Laboratory	
Leukocytosis	2
Shift to the left	1
Total score	10

However, in this study we compared the usage of Alvarado scoring and CT in correlation with positive histopathological findings.

PATIENTS AND METHODS

The study was conducted retrospectively in King Abdulaziz Medical City, Saudi Arabia, from 09 July to 22 August 2017. We collected retrospectively data of 358 patients admitted in a single hospital over a period of one year. All patients had Alvarado scoring done at the time of admission. CT was performed in 293 patients. The study was done after approval of the ethical board of King Abdulaziz University and an informed written consent was taken from each participant in the study.

The AS of each patient was scored by the attending surgeon at the point of admission, before the decision was made for CT evaluation, and it was recorded in the clinical chart.

For each patient, computed tomography findings, surgical findings, and histologic results were recorded. Patients with a final histology showing

acute appendicitis were considered as Appendicitis. On the other hand, when a patient had undergone surgery with the clinical impression of acute appendicitis but had no features of appendicitis in histology was considered to be a negative appendectomy.

Patients who did not undergo surgery were considered not to have appendicitis if they did not re-present within 2 weeks from initial discharge with acute appendicitis. Patients discharged without surgery were treated with antibiotics only if they were diagnosed with conditions that warranted therapy. Empirical treatment with antibiotics was not practiced.

Sensitivity, specificity, positive and negative predictive values, and likelihood ratios were estimated for each of the cut off AS scores ranging from 2 to 10, using histology results as the gold standard. Scores of zero and 1 were omitted because there were no patients with such scores. The same diagnostic performance measures were calculated for CT scan using the same gold standard.

Table 2.

Alvarado score	No of patients	Mean Age of patients	Number Of patients who underwent CT	Number of patients who had CT findings of Appendicitis	Patients managed conservatively	Number of patients operated	uncomplicated appendicitis (avg)	complicated	Number of patients with positive Histopathology
3 M	12	31.67	12	9	3	9	8	1	9
3 F	6	36.6	4	3	2	4	4	0	4
4 M	14	25.5	14	10	3	11	11	0	11
4 F	15	29.7	14	11	4	11	9	2	11
5 M	27	28.4	27	19	8	19	17	2	19
5 F	12	25	9	9	0	12	10	2	12
6 M	26	32.6	26	22	1	25	23	2	23
6 F	18	31.0	13	11	2	16	15	1	13
7 M	37	25.89	37	22	8	29	25	4	28
7 F	24	29.4	22	20	2	22	18	4	20
8 M	60	27.95	41	39	1	59	53	6	56
8 F	34	28.9	26	21	1	33	21	12	18
9 M	39	26.28	26	22	1	38	36	2	31
9 F	19	28.01	16	14	1	18	11	7	16
10 M	9	27.06	0	0	1	8	3	5	8
10 F	6	40.1	6	6	0	6	4	2	6
	358	47.40	293	238	38	320	268	52	285

RESULTS AND ANALYSIS

The study included 224 males (62.56%) and 134 females (37.43%). CT was performed in 293 patients (81.84%) patients. 320 (89.38%) patients underwent surgery while 38 (10.615) patients were managed conservatively. Among the operated group, 268(83.75%) patients had uncomplicated appendicitis while 52 (16.25%) had complicated appendicitis. Histopathology was positive for appendicitis in 285 patients (89.06%).

Our study revealed that for Alvarado scores of 5 or less than 5, CT was more useful as histopathological findings are in consistence with the CT findings. So for such patients if there is a strong

clinical suspicion but Alvarado score is less, one should opt for CT scan.

For patients with score in the range of 6-8, we noticed that both the Alvarado score as well as CT have similar correlation with histopathology. So for such patients , it is the attending doctors discretion to decide whether to rely on CT or Alvarado score.

For patients with score above 8, we find that both are equally diagnostic, but due to CT scan issues like cost and radiation, we recommend Alvarado score for the diagnosis of acute appendicitis.

However a comparative statistical analysis comparing Alvarado and CT scan revealed an insignificant p value for all scores together. Figure 3

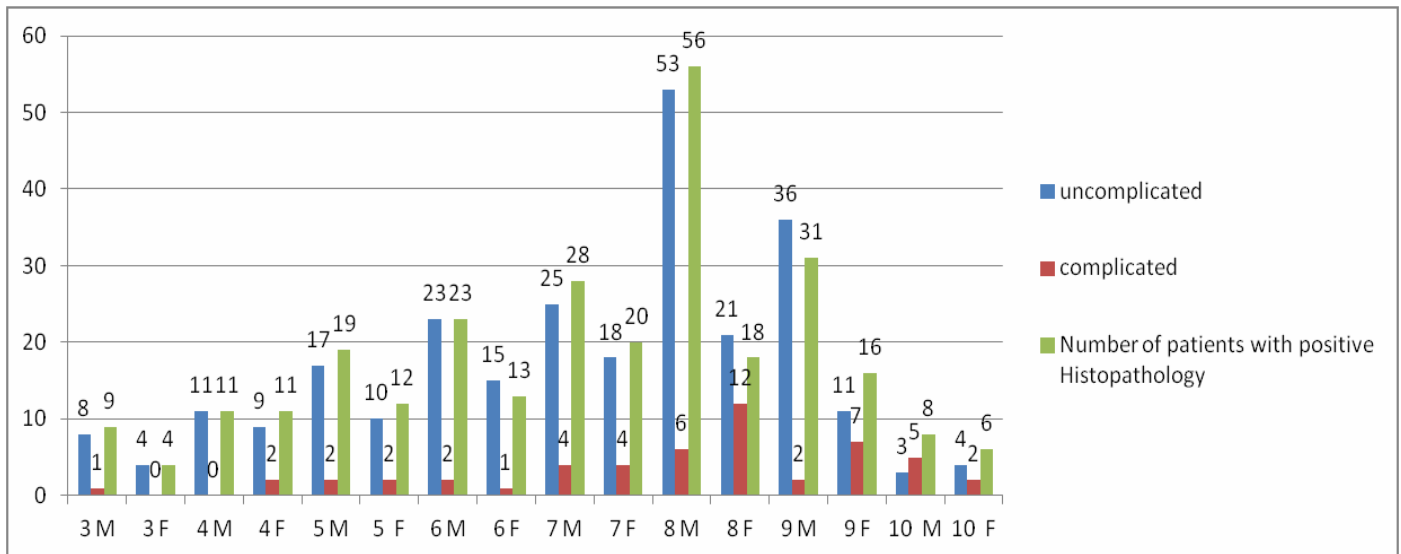


Figure 3: comparative statistical analysis comparing Alvarado and CT scan

DISCUSSION

In the diagnosis of suspected acute appendicitis in adults, computed tomography scan has emerged as the main imaging modality³. But the issue of cost, potential delay and above all radiation exposure makes it modality to be used only for clinically equivocal cases¹¹⁻¹⁵. The radiation exposure with a single CT abdomen pelvis is about 14 mSv of ionizing radiation, that amounts to risk of up to 0.2%¹⁶⁻¹⁷ for an individual of 30 years of age.

Our data indicated that CT evaluation had value mainly in patients with AS of 5 and below. Patients with AS of 7 and are unlikely to benefit from CT evaluation because AS correlates well with positive histopathology. With the advent of diagnostic laparoscopy many surgeons prefer AS scores without further imaging evaluation. The criteria for

surgery without further imaging evaluation have

become more stringent in females than in males because the AS is known to over-predict the probability of acute appendicitis in females¹⁸. These findings are congruent with sentiments from practicing surgeons, who are usually more willing to offer surgery without further imaging evaluation in males with suspected appendicitis because there are no gynecologic conditions to mimic their presenting signs and symptoms¹⁹. To the best of our knowledge, there have only been few previous studies evaluating the use of the AS as a stratification tool for CT evaluation in suspected appendicitis^{10,20}. Our study is also being retrospective but is the first to cover many indicators at the same time including operative findings, CT findings and a large patient sample.

There are several limitations of our study. First of all it is a retrospective study. Second we could not define the role of diagnostic laparoscopy in this setting. Lastly, the attending consultants who decided about the patients were more than two.

CONCLUSION

An AS of 7 and above is as significant as CT scan so for these patients one can rely on AS Score for deciding surgery. On the other hand if scores are less than 6 and there is strong suspicion of Appendicitis one should go ahead with CT.

REFERENCES

1. **Birnbaum BA, Wilson SR (2000):** Appendicitis at the millennium. *Radiology*, 215:337-48.
2. **Rothrock SG, Pagane J (2000):** Acute appendicitis in children: emergency department diagnosis and management. *Ann Emerg Med.*, 36:39-51.
3. **Yildirim E, Karagulle E, Kirbas I et al. (2008):** Alvarado scores and pain onset in relation to multislice CT findings in acute appendicitis. *Diagn Interv Radiol.*, 14:14-18.
4. **Hong JJ, Cohn SM, Ekeh AP et al. (2003):** A prospective randomized study of clinical assessment versus computed tomography for the diagnosis of acute appendicitis. *Surg Infect (Larchmt).*, 4:231-39.
5. **Jones K, Pena AA, Dunn EL et al. (2004):** Are negative appendectomies still acceptable? *Am J Surg.*, 188:748-54.
6. **Smink DS, Finkelstein JA, Garcia Pena BM et al. (2004):** Diagnosis of acute appendicitis in children using a clinical practice guide-line. *J Pediatr Surg.*, 39:458-63.
7. **Berrington de Gonzalez A, Darby S (2004):** Risk of cancer from diagnostic X-rays: estimates for the UK and 14 other countries. *Lancet*, 363:345-51.
8. **Brenner DJ, Hall EJ (2007):** Computed tomography: an increasing source of radiation exposure. *N Engl J Med.*, 357: 2277-84.
9. **Brenner DJ (2012):** Minimising medically unwarranted computed tomography scans. *Ann ICRP.*, 41:161-69.
10. **Tan WJ, Pek W, Kabir T et al. (2013):** Alvarado score: a guide to computed tomography utilization in appendicitis. *ANZ J Surg.*, 83:748-52.
11. **Balthazar EJ, Rofsky NM, Zucker R (1998):** Appendicitis: the impact of computed tomography imaging on negative appendectomy and perforation rates. *Am J Gastroenterol.*, 93:768-71.
12. **Lee SL, Walsh AJ, Ho HS (2001):** Computed tomography and ultra-sonography do not improve and may delay the diagnosis and treatment of acute appendicitis. *Arch Surg.*, 136:556-62.
13. **Paulson EK, Kalady MF, Pappas TN (2003):** Clinical practice. Suspected appendicitis. *N Engl J Med.*, 348:236-42.
14. **Rao PM, Rhea JT, Novelline RA et al. (1998):** Effect of computed tomography of the appendix on treatment of patients and use of hospital resources. *N Engl J Med.*, 338:141-46.
15. **Stroman DL, Bayouth CV, Kuhn JA et al. (1999):** The role of computed tomography in the diagnosis of acute appendicitis. *Am J Surg.*, 178:485-89.
16. **Mettler FA Jr, Huda W, Yoshizumi TT, Mahesh M (2008):** Effective doses in radiology and diagnostic nuclear medicine: a catalog. *Radiology*, 248:254-63.
17. **National Research Council(2006):** Health Risks from Exposure to Low Levels of Ionizing Radiation. BEIR VII Phase 2. Washington, DC: National Academies Press.
18. **Ohle R, O'Reilly F, O'Brien KK et al. (2011):** The Alvarado score for predicting acute appendicitis: a systematic review. *BMC Med.*, 9:139.
19. **Borgstein PJ, Gordijn RV, Eijsbouts QA, Cuesta MA (1997):** Acute appendicitis: a clear-cut case in men, a guessing game in young women. A prospective study on the role of laparoscopy. *Surg Endosc.*, 11:923-27.
20. **McKay R, Shepherd J (2007):** The use of the clinical scoring system by Alvarado in the decision to perform computed tomography for acute appendicitis in the ED. *Am J Emerg Med.*, 25: 489-93.