

Comparative Analysis of Histopathological Specimen and Other Methods Of Acute Appendicitis Diagnosis, Aseer Region, Saudi Arabia

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ABSTRACT

Objective: We conduct this study in order to compare the results of different methods used in acute appendicitis diagnosis with histopathological findings.

Background: The diagnosis of acute appendicitis is mainly clinical and to confirm the diagnosis ultrasonography (USG) and Computerized Tomographic Scan (CT) are performed. Intraoperative findings are a certain indication of the actual diagnosis and for more confirmation histopathology is required.

Method: 136 patients were included in this cross-sectional based study, in Dr. Ghassan N. Pharaon hospital Abha, Saudi Arabia. We analyses the results of clinical diagnosis, CT scan, USG and intraoperative in compare to histopathological findings using SPSS software. We considered "p-values" <0.05 statistical significance.

Results: We included 136 patients, 72 (52.9%) were males and 64 (47.1%) were females, their mean years of age were 30.9 (11.83). Average hours of hospital stay were 34.29 (34.88). The mean of WBCs and neutrophils count in male patients was 10.8 (4.19) and 7.62 (4.11) respectively. There was no statistically significant difference between CT and intraoperative findings as well as clinical diagnosis when

compared with histopathological findings. On the other hand, significant difference was found between USG and histopathology.

Conclusion: We need further researches in the use of USG in diagnosis of acute appendicitis.

Keywords: Acute Appendicitis, Diagnosis, Histopathology, CT Scan, Ultrasonography.

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Article History:

Received: 07-09-2017, Revised: 02-10-2017, Accepted: 31-10-2017

Access this article online

Website: www.ijmrp.com	Quick Response code 
DOI: 10.21276/ijmrp.2017.3.6.004	

INTRODUCTION

The most popular emergent abdominal pain needing surgical interference is " acute appendicitis " with an incidence of 7 % of general population under the age of 40 years old with a female to male ratio 3 : 2.¹⁻³ Negative appendectomy rates are high and may reach up to 20% as reported in some literatures and Perforation rates may reach up to 35% when operation is delayed and this increase the risks of widespread, painful inflammation of the lining of the inner abdominal wall, blood sepsis and death.⁴⁻⁹

Diagnosis is still a different process although the high incidence rate due to absence of usual clinical manifestations and blood results in about 55% of presented cases with high percentage of missed diagnosis between 20:40 %.¹⁰⁻¹⁵ Abscess, perforation, sepsis and intra-abdominal adhesions are severe complications that may result, ligation and hospital stay may also be needed.

Flum et al¹⁵ said that patients with negative appendectomy complains usually from infections, post-operative complications

due to hospital stay. In last years, negative appendectomy rates were decreased with the appropriate use of computed tomography (CT) and ultrasonography (USG) to help the diagnosis of acute appendicitis.^{4,5} Accurate and early diagnosis of acute appendicitis is needed to avoid complications in non- operable cases and unnecessary surgical procedures.

In this study, our target is to analyses of the results of different methods used in one of Saudi hospitals to diagnose appendicitis. We include results of clinical, laboratory tests, radiological imaging and intraoperative findings in comparison to histopathology.

METHODS

Study Setting

In this cross-sectional study, 136 patients, who were admitted to the emergency unit of Dr. Ghassan N. Pharaon hospital in Abha, Saudi Arabia and clinically diagnosed with acute appendicitis.

Selection Criteria

All Patients with suspected acute appendicitis that visited the hospital during the period of the study were included with no restrictions to gender, race, color, religion or nationality. Exclusion criteria were: 1) hepatobiliary diseases, 2) hemolytic diseases, 3) alcoholic patients, 4) certain infectious diseases.

Data Collection and Laboratory Methods

We collected the data about lab results, diagnosis and general information from patients' medical records.

Statistical Analysis

We performed statistical analyses using SPSS 24 for Windows (SSPS Inc., Chicago, IL, USA). Chi square, and Fisher's exact test were applied. In order to compare the mean of age, gender, the test variables WBC and their application when predicting perforated appendicitis, receiver-operating characteristic (ROC) curves were created for each endpoint. When Two-sided "p-values" was <0.05 we considered it statistical significance.

Research Ethics

All patients gave their full informed consent after the explaining of the study's aim and assurance of confidentiality.

RESULTS

We included 136 patients, 72 (52.9%) were males and 64 (47.1%) were females, their mean years of age were 30.9 (11.83). Average hours of hospital stay were 34.29 (34.88). The mean of WBCs and neutrophils count in male patients was 10.8 (4.19) and 7.62 (4.11) respectively (table 1).

There were 17 patients diagnosed without performing histopathological procedures.

Table 1: Participants' characteristics

Variables	Value
Total	136
Gender (Males/females)	72 (52.9%)/64 (47.1%)
Age: mean (SD)	30.9 (11.83)
Hospital stay in hours: mean (SD)	34.29 (34.88)
WBCs count: mean (SD)	10.8 (4.19)
Neutrophils count: mean (SD)	7.62 (4.11)

Table 2: Diagnosis by a specialist and histopathology

DIAGNOSIS BY A SPECIALIST					
	Acute abdomen	Acute appendicitis	Appendicular Mass	acute appendicitis with Right renal colic	AGE with acute appendicitis
HISTOPATHOLOGY					
▪ Early acute appendicitis with intraluminal and mucosal inflammation.	26	39	7	1	0
▪ Acute suppurative appendicitis.	7	11	1	0	0
▪ Gangrenous appendicitis.	3	7	0	0	0
▪ Perforated appendicitis.	1	10	0	0	0
▪ Not performed	5	11	0	0	1
▪ p-value	0.351				

Table 3: USG findings and histopathology

USG FINDINGS					
	Normal/negative	Appendicitis	Other diagnosis	Advised other investigations	Not performed
HISTOPATHOLOGY					
▪ Normal appendix without any gross pathologic changed.	1	0	0	0	0
▪ Early acute appendicitis with intraluminal and mucosal inflammation.	10	55	3	7	2
▪ Acute suppurative appendicitis.	2	7	5	1	4
▪ Gangrenous appendicitis.	1	8	0	0	1
▪ Perforated appendicitis.	2	4	2	1	3
▪ Not performed	0	7	3	3	4
p-value	0.003**				

Table 4: CT findings and histopathology

CT FINDINGS				
	Normal/negative	Appendicitis	Other diagnosis	Not performed
HISTOPATHOLOGY				
▪ Normal appendix without any gross pathologic changed.	0	0	0	1
▪ Early acute appendicitis with intraluminal and mucosal inflammation.	3	42	3	29
▪ Acute suppurative appendicitis.	0	7	3	9
▪ Gangrenous appendicitis.	1	5	1	3
▪ Perforated appendicitis.	1	5	2	3
▪ Not performed	1	6	4	6
p-value 0.213				

Table 5: Intraoperative findings and histopathology

INTRAOPERATIVE FINDINGS				
	Appendicitis	Complicated appendicitis	Appendicitis with other finding	Notes not available
HISTOPATHOLOGY				
▪ Normal appendix without any gross pathologic changed.	1	0	0	0
▪ Early acute appendicitis with intraluminal and mucosal inflammation.	28	21	17	8
▪ Acute Suppurative appendicitis.	9		5	1
▪ Gangrenous appendicitis.	8	2	0	0
▪ Perforated appendicitis.	7	2	3	0
▪ Not performed	13	2	0	1
p-value 0.131				

Table 6: Intraoperative findings and histopathology

INTRAOPERATIVE FINDINGS				
	Appendicitis	Complicated appendicitis	Appendicitis with other finding	Notes not available
CT FINDINGS				
Normal/negative	3	1	1	1
Appendicitis	33	11	15	4
Other diagnosis	8	3	0	1
Not performed	21	15	9	4
p-value 0.46				

In table 2, we compare the results of histopathology and diagnosis by specialist, which shows a significant difference between those 2 methods of appendicitis diagnosis. There were 39 histopathologically diagnosed with early acute appendicitis with intraluminal and mucosal inflammation as well as acute appendicitis when diagnosed by specialist. In table 3, there was a significant difference between both histopathology diagnosis and USG findings. 55 patients were diagnosed with Early acute appendicitis with intraluminal and mucosal inflammation according to histopathology specimen and acute appendicitis when diagnosed

by specialist and while in table 4,5 no significant differences between CT finding and intraoperative and histopathology. However, there were some differences in the diagnosis between the 2 methods and the histopathological analysis of specimen and those differences when we perform chi-square test has no statistical influence. We also compare CT and intraoperative findings and no significant differences were detected (table 6). Although, there were patients diagnosed normally with CT and when the surgery was done, surgeons found with different types of appendix diseases.

DISCUSSION

We included 136 patients, 72 males and 64 females in a cross-sectional based study, their mean years of age was 30.9 (11.83). Average hours of hospital stay were 34.29 (34.88).

White Blood Cells (WBCs) and Neutrophils Count:

One of the most common methods of investigations of acute appendicitis is the white cell count, and it has been studied well before. Increase of number due to response to any inflammation and that means it is used within limits in differential diagnosis of appendicitis.¹⁶

Shogilev et al¹⁷ has studied the ratio of sensitivity, specificity, likelihood and overall accuracy of WBCs in diagnosis of acute appendicitis. The studies used varied WBC cut-off value with unclear conclusions on what cut-off point is best in the appendicitis context. A WBC cut off value of higher than 10,000: 12,000 cell/mm³ yielded sensitivity values in a range of 65% and specificity values of 32% and 82%. Neutrophilic count may be an indication for the differential diagnosis of appendicitis.¹⁸

In table 1, it is clear that WBCs and neutrophils is elevated than normal but a recent review has reported that WBCs count is not adequate to predict appendicitis alone, so we should not depend on it for further management or diagnostic workup on its own.¹⁹⁻²³

Clinical Diagnosis and Intra-Operative Findings

In table 2, there were no statistically significant differences between histopathological finding and intraoperative findings in table 4. The diagnosis of appendicitis is clinically but some lab tests and radiological imaging to confirm the diagnosis²⁴ and our results confirming that.

Radiological Imaging

The most accurate diagnostic test of appendicitis is "CT" with sensitivity and specificity range of 83%: 98% so we could decrease negative appendectomy rates to less than 10%. Literatures say that ultrasound scanning (USS) is a popular imaging method and most accurate for confirming the appendicitis diagnosis.²⁵

Both methods have common problems as operator dependent variability, and visibility difficulties of the appendix due to body mass index, overlying body gases and variation in anatomy. CT problems are high exposure to ionizing radiation, contrast related complications and relative high costs. We made efforts to limit CT high levels of radiation with low CT imaging.²⁶

Kim et al²⁶ examined the use of abdominal CT with low dose to evaluate suspected appendicitis. They performed a single center study on 891 of adolescents and young adults, their results were that low dose CT and standard CT had an equal negative appendectomy rates and no major differences in perforation rates. Other studies have similar results.

By evidence, USG is preferred in children as well as pregnant and breast-feeding women. Specific USG criteria and repeated CT scans have been adopted to increase the sensitivity of diagnosis and to avoid radiation. That has improved USG diagnostic accuracy to reaches 100%²⁷⁻³³ but our results showed significant differences between both USG and histopathological findings and this may be due to our small sample size.

Some recommended the use of (USG-Ct pathway) in cases with appendicitis to perform the surgery without CT need. CT scans are employed in equivocal cases.³⁴

Also, Poortman et al³⁵ that analysed 151 cases of suspected appendicitis. of 79 cases with positive USG, 71 patients had confirmed appendicitis. Cases with inconclusive or a negative

USS got a CT scanning with 21 were positive appendicitis. So, USS is useful in diagnosis of suspected cases and CT scanning for unequivocal cases can reliably pick up cases with negative USS. Another study with (620 children, USG equivocal) some got a follow-up CT while others were under observation, with no missed diagnosis.^{36,37}

CONCLUSION

Our purpose of this article was to present the evidence considering methods of diagnosis that are currently used in KSA when compared with histopathological finding. So, we include discussions of blood testing, radiological imaging as well as intra-operative findings.

In conclusion, diagnosis in adults depends on raised laboratory markers (WBCs and neutrophils) used in suspicious of appendicitis. They cannot be used alone, so no surgical interference will be made in this case.

When used together they show great benefit. We also think that many novel markers will be adopted successfully in near future, so future research will determine their effectiveness. And the best radiological method in diagnosis of appendicitis is still CT with major concern to long term cancer risks and radiation exposure. We could increase accuracy and reach the sensitivity to 100% by using USG-CT.

We suggest widespread consideration of using low-radiation CT that has proven repeatedly to equal sensitivity of normal CT or repeated USG. The accurate sequence for imaging pathways are yet not determined. We recommend having further researches on the use of USG in appendicitis and its accuracy.

REFERENCES

- Gwynn, L. (2001). The diagnosis of acute appendicitis: clinical assessment versus computed tomography evaluation. *The Journal of Emergency Medicine*, 21(2), pp.119-123.
- Ferri, F. (2009). *Ferri's clinical advisor 2009*. St. Louis, Mo.: Mosby Elsevier.
- Gerhard Mostbeck, E. Jane Adam, Michael Bachmann Nielsen, Michel Claudon, Dirk Clevert, Carlos Nicolau, Christiane Nyhsen, and Catherine M. Owens, *How to diagnose acute appendicitis: ultrasound first*, *Insights Imaging*. 2016 Apr; 7(2): 255–263.
- Bongard F, Landers DV, Lewis F (1985) Differential diagnosis of appendicitis and pelvic inflammatory disease. A prospective analysis. *Am J Surg* 150:90–96
- Lau WY, Fan ST, Yiu TF, Chu KW, Wong SH (1984) Negative findings at appendectomy. *Am J Surg* 148:375–378
- Binnebösel M, Otto J, Stumpf M et al (2009) Acute appendicitis. *Modern diagnostics—surgical ultrasound*. *Chirurg* 80:579–587
- Lally KP, Cox CS Jr, Andrassy RJ (2004) Appendix. In: Townsend CM Jr, Mattox KL, Evers BM et al (eds) *Sabiston textbook of surgery*, 17th edn. Saunders, New York, pp 1381–1395
- Hobler K, (1998). *Acute and Suppurative Appendicitis: Disease Duration and its Implications for Quality Improvement*. *The Permanente Journal* /Spring. Vol. 2 No. 2
- Ansari, P. *Appendicitis*. Merck Manual. Whitehouse Station, NJ. U.S.A. 2014.
- Hong JJ, Cohn SM, Ekeh AP, et al. A prospective randomized study of clinical assessment versus computed tomography for the

- diagnosis of acute appendicitis. *Surg Infect (Larchmt)* 2003;4:231e239.
11. Jones K, Pena AA, Dunn EL, et al. Are negative appendectomies still acceptable? *Am J Surg* 2004;188:748e754.
 12. Naoum JJ, Mileski WJ, Daller JA, et al. The use of abdominal computed tomography scan decreases the frequency of misdiagnosis in cases of suspected acute appendicitis. *Am J Surg.* 2002;184:587-589.
 13. Bergeron E. Clinical judgment remains of great value in the diagnosis of acute appendicitis. *Can J Surg.* 2006;;49(2):96--100.
 14. Flum DR, Morris A, Koepsell T, et al. Has misdiagnosis of appendicitis decreased over time? A population--based analysis. *JAMA.* 2001;;286(14):1748--1753.
 15. Flum DR, Koepsell T. The clinical and economic correlates of misdiagnosed appendicitis: nationwide analysis. *Arch Surg* 2002;137:799-804.
 16. Calder JD, Gajraj H. Recent advances in the diagnosis and treatment of acute appendicitis. *Br J HospMed.* 1995;54(4):129-33.
 17. Daniel J Shogilev, Nicolaj Duus, Stephen R. Odom, Nathan I. Shapiro. Diagnosing Appendicitis: Evidence-Based Review of the Diagnostic Approach in 2014. *Western Journal of Emergency Medicine* 15(7): Nov. 2014: 859-871.
 18. Ishizuka, M., Shimizu, T. and Kubota, K. (2012). Neutrophil-to-Lymphocyte Ratio Has a Close Association With Gangrenous Appendicitis in Patients Undergoing Appendectomy. *International Surgery*, 97(4), pp.299-304.
 19. Andersson RE. Meta-analysis of the clinical and laboratory diagnosis of appendicitis. *Br J Surg.* 2004;91(1):28-37.
 20. Wu HP, Chen CY, Kuo IT, et al. Diagnostic values of a single serum biomarker at different time points compared with Alvarado score and imaging examinations in pediatric appendicitis. *J Surg Res.* 2012; 174(2):272-277.
 21. Agrawal CS, Adhikari S, Kumar M. Role of serum C-reactive protein and leukocyte count in the diagnosis of acute appendicitis in Nepalese population. *NMCJ.* 2008; 10(1):11-15.
 22. Yu CW, Juan LI, Wu MH, Shen CJ, Wu JY, Lee CC. Systematic review and meta-analysis of the diagnostic accuracy of procalcitonin, C-reactive protein and white blood cell count for suspected acute appendicitis. *Br J Surg* 2013; 100: 322-329 [PMID: 23203918 DOI: 10.1002/bjs.9008]
 23. Kabir, S., Kabir, S., Sun, R., Jafferbhoy, S. and Karim, A. (2017). How to diagnose an acutely inflamed appendix; a systematic review of the latest evidence. *International Journal of Surgery*, 40, pp.155-162.
 24. Flum, D. (2015). Acute Appendicitis — Appendectomy or the “Antibiotics First” Strategy. *New England Journal of Medicine*, 372(20), pp.1937-1943.
 25. Hernanz-Schulman M. CT and US in the diagnosis of appendicitis: an argument for CT. *Radiology.* 2010; 255: 3-7 [PMID: 20308436 DOI: 10.1148/radiol.09091211]
 26. Kim K, Kim YH, Kim SY, et al. Low-dose abdominal CT for evaluating suspected appendicitis. *N Engl J Med.* 2012 366(17):1596-1605.
 27. Keyzer C, Tack D, de Maertelaer V, et al. Acute appendicitis: comparison of low-dose and standard dose unenhanced multi-detector row CT. *Radiology.* 2004 232(1):164-172.
 28. Seo H, Lee K H, Kim HJ, et al. Diagnosis of acute appendicitis with sliding slab ray-sum interpretation of low-dose unenhanced CT and standard-dose i.v. contrast-enhanced CT scans. *AJR Am J. Roentgenol.* 2009 193(1): 96-105.
 29. Gamanagatti S, Vashisht S, Kapoor A, Chumber S, Bal S. Comparison of graded compression ultrasonography and unenhanced spiral computed tomography in the diagnosis of acute appendicitis. *Singapore Med J* 2007; 48:80-7.
 30. Wilson EB, Cole JC, Nipper ML, Cooney DR, Smith RW. Computed tomography and ultrasonography in the diagnosis of appendicitis: when are they indicated? *Arch Surg* 2001;136:670-5.
 31. Rao PM, Boland GW. Imaging of acute right lower abdominal quadrant pain. *ClinRadiol* 1998;53:639-49.
 32. Pickhardt PJ, Lawrence EM, Pooler BD, et al. Diagnostic performance of multidetector computed tomography for suspected acute appendicitis. *Ann Intern Med.* 2011;154(12):789-796,W-291.
 33. Doria AS, Moineddin R, Kellenberger CJ, et al. US or CT for Diagnosis of Appendicitis in Children and Adults? A Meta-Analysis. *Radiology.* 2006;241(1):83-94.
 34. A, Wesson D, Munden M, Hicks J, Brandt M, Minifee P, Nuchtern J. The impact of ultrasound examinations on the management of children with suspected appendicitis: a 3-year analysis. *J Pediatr Surg* 2001; 36: 303-308 [PMID: 11172421 DOI: 10.1053/jpsu.2001.20702]
 35. Krishnamoorthi R, Ramarajan N, Wang NE, Newman B, Rubesova E, Mueller CM, Barth RA. Effectiveness of a staged US and CT protocol for the diagnosis of pediatric appendicitis: reducing radiation exposure in the age of ALARA. *Radiology* 2011; 259: 231-239 [PMID: 21324843]
 36. Poortman P, Oostvogel HJ, Bosma E, et al. Improving diagnosis of acute appendicitis: results of a diagnostic pathway with standard use of ultrasonography followed by selective use of CT. *J Am Coll Surg.* 2009;208(3):434-441.
 37. Ramarajan N, Krishnamoorthi R, Gharahbaghian L, et al. Clinical correlation needed: what do emergency physicians do after an equivocal ultrasound for pediatric acute appendicitis? *J Clin Ultrasound.* 2014;42(7):385-94.

Source of Support: Nil. **Conflict of Interest:** None Declared.

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Cite this article as: Claim Haif AlQahtani, Saeed Abdullah AL-Shahrani, Faisal Abdullah Al malwi, Mastour Muflih Al-Mannaa, Jubran Safar Alshahrani, Yara Mofarih Assiri, Saad Shaker Saad, AbdulKhaliq Yahya Alahmari, Mudassir M. Wani, Jasper C. Pilongo, Ali M. Alahmary. Comparative Analysis of Histopathological Specimen and Other Methods Of Acute Appendicitis Diagnosis, Aseer Region, Saudi Arabia. *Int J Med Res Prof.* 2017 Nov; 3(6):17-21. DOI:10.21276/ijmrp.2017.3.6.004