

Acute Appendicitis - A Surgical Emergency: Study on the Histopathology And Scoring Systems on Diagnosis

Pradeep Kumar Nagaich¹, Atul Tandon^{2*}, Ramanand Thakur³

¹Assistant Professor, ³Professor & Head, Department of Pathology,

^{2*}Assistant Professor, Department of Surgery,

Varun Arjun Medical College Aand Rohilkhand Hospital, Shahjahanpur, Uttar Pradesh, India.

ABSTRACT

Acute appendicitis being a surgical emergency requires proper decision on the behalf of clinicians so as to prevent the complications. Though this is typical, sometimes the explanation of patient is quite challenging, different techniques such as various scoring systems (Alvarado and RIPASA) have been devised to aid the accurate diagnosis. Thus in this study we aimed to study the suspected cases of acute appendicitis and find out the reliability of the scoring systems in association with histopathological analysis of removed appendices with proper diagnosis of appendicitis.

We include 65 patients admitted for the suspected case of acute appendicitis. The patients were categorized on different groups based upon Alvarado and RIPASA scoring systems. All the patients underwent surgical removal of appendices which were than analyzed histopathologically. Based on histopathological analysis and scoring, We found the RIPASA scoring system (86.1%) is more reliable for accurate diagnosis of appendicitis in comparison to Alvarado score (76.9%).

INTRODUCTION

Life threatening surgical emergencies requires acute surgery for prompt and better results. One of such emergencies is acute appendicitis with the prevalence of 7-8%.¹ Acute appendicitis can be defined as the transmural inflammation or presence of pus in appendix lumen.² The dominant factor of acute appendicitis is obstruction of lumen and fecoliths being the usual cause. Other causes include lymphoid hyperplasia, tumors and intestinal worms.³

Pathologically, luminal obstruction is regarded as the most common cause of acute appendicitis as this leads to activation of inflammatory process.⁴ As obstruction occurs, the intraluminal pressure exceeds than that of appendiceal veins leading to obstruction of venous outflow. As a result there is development of ischemia that weakens epithelial integrity of appendix thereby increasing risk of bacterial infection.⁵

The history of surgical management of acute appendicitis is more than 100 years, however still there is necessity of prompt diagnosis to lower the morbidity and complications.⁶ The diagnosis of acute appendicitis is based on clinical history, examination and laboratory tests. The classical clinical presentation is vague abdominal pain at right iliac fossa with rebound tenderness. If not

Keywords: Appendicitis, Histopathology, Scoring Systems, Diagnosis, Complications.

*Correspondence to:

Dr. Atul Tandon,
Assistant Professor,
Department of Surgery,
Varun Arjun Medical College and Rohilkhand Hospital,
Shahjahanpur, Uttar Pradesh, India.

Article History:

Received: 25-12-2017, Revised: 21-01-2018, Accepted: 14-02-2018

Access this article online	
Website: www.ijmrp.com	Quick Response code 
DOI: 10.21276/ijmrp.2018.4.2.067	

treated in time, this can lead to complications such as sepsis, perforations and even deaths.^{7,8}

Studies have shown gradual rise in incidence of appendicitis from birth, with peaking at late 10 years of age. The frequency is high in the age group of 10-19 years.¹ However, recently higher incidences has also been demonstrated in the age group of 30-69 (about 6.3%).⁹ Though modern advances have been achieved in the sector of diagnostic medicine and therapies, the proper diagnosis of acute appendicitis still poses a clinical challenge as number of patients are shown to have normal appendix at the time of surgery. Inaccurate diagnosis leads to the accidental removal of normal appendices and the rate of such removal is as high as 8-30%.¹⁰ About 70% of patients show typical clinical presentation while rests 30% have uncertain preoperative diagnosis leading to negative laparotomy. The rates of such surgeries are even high in women of reproductive ages.¹¹

Different techniques such as ultrasonography, CT scan or diagnostic laparoscopy are used for diagnosis of appendicitis. However, USG is operate dependent and can miss the condition while CT scan is very costly and is not available at all health centers in a developing countries like India.¹² To resolve these

problems scoring systems with high sensitivity and appendicitis Alvarado scoring system and RIPASA (Raja Isteri Pengiran Anak Saleha Appendicitis) scoring system are such examples.

Alvarado scoring system is based on parameters like migration of pain to RIF, anorexia, nausea and vomiting, tenderness, rebound tenderness, fever leucocytosis, shift of WBC count to left.¹³ Similarly RIPASA scoring system takes into account of age, gender, urine examination, guarding, rovsing's sign and asian origin in addition to parameters as included in Alvarado score.¹⁴ These scoring systems are easy, simple, cheap and effective means to categorize patients on the basis of risk of acute appendicitis. The confirmation of acute appendicitis is done by histopathological study. The minimum requirement for diagnosis is presence of neutrophils in lamina propria, sub-mucosa and mucosa.¹⁵ Thus in this study we aimed to compare both scoring systems and correlate them with histopathological outcomes.

MATERIALS AND METHODS

The study was conducted in the department of Surgery at Varun Arjun Medical College & Rohilkhand Hospital, Shahjahanpur from October 2017 to December 2017.

In total 65 patients who had clinical features of acute appendicitis were included in this study. These patients were analysed with scoring systems for correct diagnosis and were finally confirmed by histopathological analysis. Patients having complications such as appendicular perforations, peritonitis, lumps or abscess were excluded from study.

Before performing any analysis ethical clearance from the institution and written consent from the patients were taken.

We performed pre-operative analysis as follows:

- Analysis of detailed clinical history with physical examinations
- Investigations such as Hemoglobin, leucocyte count, shift of WBC to left, urine analysis
- Scoring based on Alvarado and RIPASA systems.
- Histopathological analysis under following headings
 - Normal appendix
 - Acute suppurative appendicitis
 - Acute appendicitis
 - Acute gangrenous appendicitis

To achieve early diagnosis Alvarado and RIPASA scoring systems were adopted in order to limit the negative appendectomy. The Alvarado score is based on 3 signs, 8 parameters that included, 3 symptoms and 2 laboratory investigations as shown in Table 1.

Table 1: Alvarado Score

		Score
3 Signs	Migrating Pain in RIF	1
	Nausea / Vomiting	1
	Anorexia	1
3 Symptoms	Tenderness	2
	Rebound tenderness	1
	Raised temperature/fever	1
2 Laboratory Investigations	Leucocytosis	2
	Shift to left (i.e. Increased neutrophills)	1
Total		10

Table 2: RIPASA Scoring

		Score
Gender	Male	1
	Female	0.5
Age	< 39.9 years	1
	> 40 years	0.5
Symptoms	Pain In RIF	0.5
	Migrating Pain in RIF	0.5
	Nausea/Vomiting	1
	Anorexia Duration	1
	Symptoms < 48 hours	
	Duration > 48 Hours	0.5
Parameters		
Signs	Tenderness in RIF	1
	Rebound tenderness	1
	Guarding	2
	Rovsing's Sign	2
	Raised temperature/fever	1
Laboratory	↑WBC Counts	1
Analysis	Negative urine analysis	1
Additional	Foreign NRIC	1
Total		17.5

RIPASA scoring systems was based on 18 parameters shown in Table 2. The score for Alvarado system ranged from 1-2 while it ranged from 0.5-2 in RIPASA system. A score of ≥ 7 And 7.5 for Alvarado system and RIPASA System were respectively considered to have high probability of acute appendicitis. Patients were continuously observed from the time of admission to the surgical intervention and discharge from the hospital. Histopathological analysis of appendix removed by surgery were recorded and correlated with both the scoring systems.

RESULTS

69.29% of patients involved were male and 30.77% were female with male to female ratio of 2.25:1. According to the age, 15.38%, 43.07%, 18.46% and 23.07% of patients were under age group of <20, 20-30, 30-40 and >40 respectively. We calculated Alvarado score and RIPASA score of each patient suspected for acute appendicitis. We found that 9.23% of patients had Alvarado score ≤ 4 , 12.3% had between 5-6 and 78.46% had ≥ 7 . Similarly, on the basis of RIPASA score 61.5 % patients had RIPASA score of ≤ 7 , 12.31%, and 81.53 % had 7-11 and ≥ 12 respectively. We also observed the symptoms shown by the patients, Pain in right iliac fossa (RIF) and tenderness. We observed in all cases (100%). 83.7 % of patients had rebound tenderness while 18.46 % and 21.53% patients showed guarding and Rovsing's sign respectively. Leucocytosis was seen in 27.69 % of cases and urine analysis was negative in 26.1% of cases.

We also performed histopathological analysis of surgically removed appendix. 10.7% of removed appendices were normal while 44.6%, 32.3%, and 12.3% cases were of acute appendicitis, acute suppurative appendicitis and acute gangrenous appendicitis respectively. 76.9% of patients had histopathologically confirmed case of acute appendicitis with Alvarado score of ≥ 7 while 4.6% patients showed negative cases. Similarly 12.3% of patients with Alvarado score < 7 had histopathologically confirmed cases of appendicitis and 6.1% showed negative results.

Table 3: Gender wise distribution of patients

Gender	No	(%)
Male	45	69.23%
Female	20	30.77%

Table 4: Age wise distribution of patients

Age	No	(%)
> 20	10	15.38%
20-30	28	43.07%
30-40	12	18.46%
> 40	15	23.07%

Table 5: Sign and symptoms shown by patients

Sign and Symptoms	No	(%)
Right Iliac Fossa Pain (RIF)	65	100%
Tenderness	63	100%
Rebound tenderness	54	83.07%
Guarding	12	18.46%
Rovsing's Sign	14	21.53%
↑WBC Counts	18	27.69%
Shift of WBC to left	13	20%
negative urine analysis	17	26.1%

Table 6: Distribution of patients according to Alvarado scoring system

Alvarado Score	No	(%)	Remark
≤ 4	6	9.23%	Appendicitis unlikely (Low risk)
5-6	8	12.3%	Appendicitis probable (Intermediate risk)
≥ 7	51	78.46%	Acute appendicitis (High risk)

Table 7: Distribution of patients according to RIPASA scoring system

RIPASA Score	No	(%)	Remark
< 7	4	6.15%	Appendicitis unlikely (Low risk)
7-11	8	12.3%	Appendicitis probable (Intermediate risk)
≥ 12	53	81.53%	Acute appendicitis (High risk)

Table 8: Histopathological Analysis

Histopathology	No	(%)
Normal	7	10.7%
Acute appendicitis	29	44.6%
Acute suppurative appendicitis	21	32.3%
Acute gangrenous appendicitis	8	12.3%

Table 9: Alvarado scoring system and histopathological analysis of cases of suspected appendicitis

Alvarado Score	Histopathological confirmed cases		Total
	Positive	Negative	
≥ 7 (A)	50	3	53
< 7 (B)	8	4	12
Total	58	7	65

Table 10: RIPASA scoring system and histopathologically confirmed cases of appendicitis

RIPASA Score	Histopathologically confirmed cases		Total
	Positive	Negative	
≥7 (C)	56	6	56
<7 (D)	2	1	9
Total	58	7	65

Table 11: Mean Alvarado score according to histopathological Study

Histopathological Analysis	No	Mean
Normal	7	5.26
Acute appendicitis	29	7.81
Acute suppurative appendicitis	21	7.95
Acute gangrenous appendicitis	8	8.99

Table 12: Mean RIPASA score according to histopathological Study

Histopathological Analysis	No	Mean
Normal	7	7.31
Acute appendicitis	29	8.59
Acute suppurative appendicitis	21	9.96
Acute gangrenous appendicitis	8	11.54

On comparing RIPASA score, it was observed that 86.1% of patients with RIPASA score of ≥ 7.5 had histopathologically confirmed positive cases of appendicitis. Likewise 3% of patients with the same score of <7.5 had histopathologically confirmed positive cases and 9.2 % had negative results. On further analysis of surgically removed appendices, we found that the mean value of Alvarado scores were 5.26, 7.81, 7.95 and 8.99 for normal, acute, acute suppurative and acute gangrenous appendices respectively while mean value of RIPASA score were 7.31, 8.59, 9.96 and 11.54 respectively.

DISCUSSION

Acute appendicitis is a common surgical emergency with the prevalence rate of 1 in 7,¹⁶ and particularly occurring in the age group of < 30 years.¹⁷ The diagnosis is particularly based upon history and clinical findings, the accuracy of which is estimated to be between 76-92%.¹⁸ It shows that the diagnosis of acute appendicitis is difficult yet, diagnosis is further exacerbated in young and elderly patients or in females of fertile ages due to any

prevalent genitourinary or gynecological inflammatory conditions which increases the risk of morbidity and mortality.¹⁹ Accurate Diagnosis is needed to reduce the rate of negative appendectomy which ranges between 15-30%.¹⁸ However, several authors have considered the acceptability of negative appendectomy in order to reduce the incidence of appendix perforation.²⁰ Diagnostic accuracy can also be improved via ultrasonography or CT imaging. Various scoring systems such as Alvarado scoring systems and RIPASA scoring system have been developed to aid the accurate diagnosis of acute appendicitis, both of which have good sensitivity and specificity.

In our study 69.23 % cases were male and 30.77 % cases were female with male to female ratio of 2.25:1. In study of Midha K et al 73.1 % were male and 26.9 % were females.²¹ In study of Batra P et al too, majority of cases were male (59%) while 1683 et al showed higher preponderance of females.¹² Acute appendicitis is more frequent in age group of 20-30 years (43.07%), which was in accordance with that of Batra Pet al who showed highest incidence of acute appendicitis in the age group of 21-30 years.¹² We observed pain in right iliac fossa and tenderness in all the patients, while rebound tenderness, guarding, rovsing's sign were reported in 83.07 %, 18.46% and 21.53 % of cases. Leucocytosis was seen in 27.69 % of cases and 25.66 % cases showed negative urine analysis. Study of Midha K et al demonstrated of RIF pain in 100% of cases with tenderness, rebound tenderness, guarding, Rovsing's sign in 100 %, 73.9%, 23.2% and 16.4% (Out of 73) respectively.²¹ Alvarado scoring system that consists of 10 parameters is simple, easy to use and valuable in diagnosis of acute appendicitis. When we applied this scoring system in the patients we found that 9.23 % of patients had the score ≤ 4 , 12.3% had between 5-6 and 78.46% had ≥ 7 . Alvarado score of ≤ 4 indicated unlikely cases of appendicitis while 5-6 indicated probable case but not and score of ≥ 7 indicated the case of acute appendicitis that required immediate surgery.

Like Alvarado score, another new scoring method has also been developed namely RIPASA scoring system that is extensive but very simple and is based on 17 parameters with additional parameters NRIC unique to Asian individuals. When RIPASA score was applied we found that 6.15%, 12.3% and 81.53% of patients had score of respectively < 7 , 7-11 and ≥ 12 . RIPASA score of ≤ 7 indicated unlikely appendicitis, 7-11 indicated probable appendicitis and ≥ 12 indicated acute appendicitis.

In studies conducted in past, 88.5% of patients had Alvarado score ≥ 7 while 11.5% cases had < 7 . Similarly 96.2% of patients had RIPASA score ≥ 7.5 indicating appendicitis group while 3.8% of patients showed the score of < 7.5 indicating no appendicitis group.²¹ All the patients suspected for acute appendicitis underwent surgical removal of appendix. We conducted histopathological analysis of removed appendices. 10.7% of appendices were normal, 44.6% were the cases of acute appendicitis while 32.3% and 12.3% were cases of acute suppurative and acute gangrenous appendicitis respectively. Midha K et al showed 42.3%, 41%, 10.3% and 5.1 % cases of acute appendicitis acute suppurative, acute gangrenous and normal appendices respectively.²¹ Similarly Subedi N et al 1.4% cases were of normal appendix²² while the study of Nabipour et al²³ and Khan et al²⁴ showed the rate of normal appendectomy to be 34.2% and 11.5% respectively.

We categorized patients into two groups based on both Alvarado score and RIPASA score. On basis of Alvarado score, the patients were grouped as A (those with score of ≥ 7) and B (those with score of < 7). These score were correlated with histopathologically confirmed positive and negative cases of appendicitis. We found that 76.9% of patients with score of ≥ 7 had appendicitis while 4.6% patients did not have. Similarly 12.3% of patients with score of < 7 had appendicitis and 6.1% showed negative result. Our findings were in accordance with that of Kothari et al.²⁵

Likewise on the basis of RIPASA score too, the patients were categorized into two groups namely C (those with score of ≥ 7) and D (those with score of < 7). Those score were correlated with histopathologically confirmed cases of acute appendicitis. 86.1% of patients with score of ≥ 7 had acute appendicitis. Similarly 3% of cases with score of < 7 were positive and 9.2% cases were negative for acute appendicitis, which was supported by the previous studies.²⁵

We compared both Alvarado and RIPASA scoring system and we found RIPASA scoring system to be more sensitive compared to Alvarado system. Via RIPASA scoring 86.1% of patients were correctly diagnosed to have appendicitis in comparison to Alvarado system (76.9%). Our results were comparable with that of Chong et al¹⁴ and Nanjundaiah N et al.²⁶ There was also increase in mean value of Alvarado score and RIPASA score depending upon the severity of appendicitis which was in accordance with the previous studies.²¹

CONCLUSION

Acute appendicitis being a surgical emergency need a prompt decision on the behalf of surgeon, which is based on physical examination and clinical features of patients. Their decisions are further aided by various formulated scoring systems such as Alvarado and RIPASA scoring systems.

However, there can be various cases of appendicitis depending upon complications and severity. Therefore histopathological analysis should be also conducted in order to determine the negative appendectomy rate.

REFERENCES

- Stephens PL, Mazzucco JJ. Comparison of ultrasound and the Alvarado score for the diagnosis of acute appendicitis. *Conn Med.*, 1999;63:137-40.
- Beasley SW. Can we improve diagnosis of acute appendicitis? *BMJ* 2000;321:907-10.
- Duzgan AP, Moram M, Uzun S. Unusual findings in appendectomy specimens: Evaluation of 2458 cases and review of the literature *Indian J Surg.*, 2004;66:221-6.
- Akbuluts, Tas M, Sogutu N, Arianoglu Z, Basbug M, Ulka A. Unusual Histopathological findings in appendectomy specimens : a retrospective analysis and literature review. *World J Gastroenterol*, 2011; 17 (15):b1961-1970
- Chandrasegaram MD, Rothwell LA, An FI, Miller RJ. Pathologies of the appendix :10 years review of 4670 appendectomy specimens. *ANZ J Surg.*, 2012; 82(11):844-7.
- Horzic M, Salamon A, Kopljak M, Skupnjak M, Cupurdija K, Vanjak D. Analysis of Scores in Diagnosis of Acute Appendicitis in Women. *Coll Antropol.*, 2005; 29:133-8.

7. Christian F, Christian GP. A simple scoring system to reduce the negative appendectomy rate. *Ann R Coll Surg Engl.*,1992;74:281-5.
8. Bhopal FG, Khan JS, Iqbal M. Surgical audit of acute appendicitis. *J Coll Physicians Surg Pak.*,1999; 9:223-6.
9. Buckius MT, McGrath B, Monk J, Grim R, Bell T, Ahuja V. Changing epidemiology of acute appendicitis in the United States: Study period 1993-2008. *J Surg Res.*, 2012;175:185-90.
10. Lane MJ, Liu DM, Huynh MD, Jeffrey RB, Mindelzun RE, Katz DS. Suspected acute appendicitis: nonenhanced helical CT in 300 consecutive patients. *Radiology*, 1999; 213(2):341-6.
11. Abu-Yousef MM, Bleicher JJ, Maher JW, Urdaneta LF, Franken. EA Jr, Metcalf AM. High-resolution sonography of acute appendicitis. *AJR*,1987; 149:53-8.
12. Batra P, Kurhade S, Rana KVS, Singh A, Zaveri A, Pathak J. Evaluation of Clinical Algorithm in Acute Appendicitis with the Aim to Reduce the Negative Appendectomy Rate. *IOSR Journal of Dental and Medical Sciences*, 2016; 15(6):1-6.
13. Alvarado A. A practical score for the early diagnosis of acute appendicitis. *Ann Emerg Med.*, 1986;15:557-64.
14. Chong CF, Adi MI, Thien A, Suyoi A, Mackie AJ, Tin AS et al. Development of the RIPASA score: a new appendicitis scoring system for the diagnosis of acute appendicitis. *Singapore Med J.*, 2010;51:220-5.
15. Andreou P, Blain S, Du Boulay CE. A histopathological study of the appendix at autopsy and after surgical resection. *Histopathology*, 1990;17:427-31.
16. Stephens PL, Mazzucco JJ. Comparison of ultrasound and the Alvarado score for the diagnosis of acute appendicitis. *Conn Med.*, 1999;63:137-40.
17. Addiss DG, Shaffer N, Fowler BS, Tauxe RV. The epidemiology of appendicitis and appendectomy in the United States. *Am J Epidemiol.*, 1990; 132:910-25.
18. Choy Ng K, Shih WL. Clinical analysis of the related factors in acute appendicitis. *Yale J bio med.*, 2002;75:41-5.
19. Kalan M, Talbot D, Cunliffe WJ, Rich AJ. Evaluation of the modified Alvarado score in the diagnosis of acute appendicitis: a prospective study. *Ann R Coll Surg Engl.*,1994;76:418-9.
20. Antel J, Rivera L, Landenberg B, Halm G, Fatava MA. Clinical diagnostic pathway for acute Appendicitis: prospective validation. *JAM Coll Surg.*, 2006;203(6):849-56.
21. Midha K, Zahoor Y, Bali RS. Diagnosing Acute Appendicitis: ALVARADO vs. RIPASA Scoring Systems. *J Med Res Prac.*,2017, 6(4):128-32.
22. Subedi N, Dangol US, Adhikary MB, Pudasaini S, Baral R. Acute appendicitis: a 2- year review of clinical presentation and histopathology. *Journal of Pathology of Nepal*, 2011; 1:104-7.
23. Nabipour F. Histopathological feature of acute appendicitis in Kerman Iran from 1997 to 2003. *Am J Environ Sci.*, 2005;1:130-2.
24. Khan G, Grillo IA, Abu-Eshy SA, Khan AR, Mubarak J, Jastaniah S. Pathology of the appendix. *J Natl Med Assoc.*, 2000;92:533-5.
25. Kothari D, Kothari A, Kalantri A, Bhambani P. Modified Alvarado scoring system as a diagnostic tool for acute appendicitis at a tertiary care teaching hospital, Central India: a cross sectional study. *Int Surg J.*, 2017;4(8):2439-44.
26. Nanjundaiah N, Mohammed A, Shanbhag V, Ashfaque K, Priya SA. A Comparative Study of RIPASA Score and ALVARADO Score in the Diagnosis of Acute Appendicitis. *Journal of Clinical and Diagnostic Research*, 2014; 8(11): NC03-NC05.

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

Copyright: © the author(s) and publisher. IJMRP is an official publication of Ibn Sina Academy of Medieval Medicine & Sciences, registered in 2001 under Indian Trusts Act, 1882.

This is an open access article distributed under the terms of the Creative Commons Attribution Non-commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

Cite this article as: Pradeep Kumar Nagaich, Atul Tandon, Ramanand Thakur. Acute Appendicitis - A Surgical Emergency: Study on the Histopathology And Scoring Systems on Diagnosis. *Int J Med Res Prof.* 2018 Mar; 4(2):293-97. DOI:10.21276/ijmrp.2018.4.2.067