Original Article

Diagnostic Accuracy of Appendicitis Taking Histopathology as Gold Standard

Usman Asif[1], Anam Zahira[1], Haris Nasrullah[2] and Suleman Asif[1]

ABSTRACT

Objective: To fix diagnostic accuracy Appendicitis score for diagnosis of acute appendicitis (AA) taking histopathology as gold standard.

Study Design: Interventional (clinical trial) study

Place and Duration of Study: This study was conducted at the Emergency Department of Ganga Ram Hospital, Lahore from 1st July 2016 to 31st December, 2016.

Materials and Methods: 315 patients fulfilling inclusion criteria. Their basic demographic information like name, sex, age and contact details was obtained after taking an informed consent from patients or attendants. Appendicitis score was calculated as per operational definition. The decision of appendicitis was taken by a single consultant to minimize bias. After operation / appendicectomy, the resected material /appendix was sent for final diagnosis to histopathology Lab of the hospital. Then diagnosis on appendicitis and histopathology was compared to calculate diagnostic accuracy of appendicitis.

Results: The mean age of patients was 34.42 ± 9.43 years with age range of 18-60 years. There were 179(56.8%) male and 136(43.2%) female patients in this study, the male to female ratio was 1.31:1. Sensitivity, specificity, Positive Predictive Value and Negative Predictive Value of appendicitis score keeping histopathology as gold standard was 96.68%, 90.91%, 98.5% and 81.63% respectively. The overall diagnostic accuracy of appendicitis score was 95.87%.

Conclusion: The sensitivity, specificity, Positive Predictive Value, Negative Predictive Value and overall diagnostic accuracy of appendicitis keeping histopathology as gold standard is high making it reliable and easier diagnostic tool.

Key Words: Appendix, surgery, histopathology, scoring system, Alvarado

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INTRODUCTION

Acute appendicitis (AA) is highly prevalent condition needing surgery in any emergency department.[1,2] According to a local study over all prevalence of AA was found 8% in patients with acute abdominal pain.[3] AA is commonly diagnosed on clinical presentation based on patient presenting history, laboratory testing and on physical examination.[4,5] A negative appendectomy rate is also high prevalent with rate of 15-34%.[6] Radiological diagnosis such as ultrasound technique has been widely used for the diagnosis of acute appendicitis[7] while CT has 100% sensitivity and specificity for diagnosis of acute appendicitis.[4] But both ultrasound and CT are operator dependent so results are influenced by the radiologists.[7] On the other hand simple soring systems are available such as Alvarado score that is the most widely used scoring system for early diagnosis of acute appendicitis.

[1.] Department of Surgery, Ganga Ram Hospital, Lahore.
[2.] Department of Surgery, Jinnah Hospital, Lahore.

Correspondence: Dr. Suleman Asif, Registrar/Medical Officer Surgical Unit II, Ganga Hospital, Lahore.
Contact No: 0334-4165029
Email: suleman_esif6@yahoo.com

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The scoring system can diagnose by giving one point each for migratory right iliac fossa pain, nausea, anorexia and vomiting, fever, rebound tenderness, shift to left(segmented neutrophils) and two points to each for, leukocytosis and right iliac fossa tenderness with a total score of 10 points.[6]

Like Alvarado another simple score is available i.e. The Appendicitis score is a novel diagnostic score that was developed for diagnosis of acute appendicitis.[2,8-10] Nanjundaiah N et al[5] in 2014 reported that Sensitivity = 96.2% Specificity = 90.5% at cut of value 7.5 for RIPASA score. Chong C et al[2] in 2010 published that sensitivity was 88.46% and specificity was 66.67% at same cut of value i.e. at 7.5.

The rationale of this study is to determine diagnostic accuracy of appendicitis for our local population. Although data is available but there are inconsistent statistics regarding specificity of appendicitis i.e. 66.67%[2]-90.5%[5]. If we get higher diagnostic accuracy of appendicitis then in future we can recommend appendicitis for diagnosis of AA. So that negative appendectomy can be minimized in future.

MATERIALS AND METHODS

This Interventional (clinical trial) study comprised 315 patients form Emergency Department of Ganga Ram

Hospital, Lahore from 1st July 2016 to 31st December, 2016- fulfilling inclusion criteria. Their basic demographic information like name, sex, age and contact details was obtained after taking an informed consent from patients or attendants. appendicitis score was calculated as per operational definition. The opinion of appendicitis was decided by a single consultant to minimize bias. After operation / appendicectomy, the resected material /appendix was sent for final diagnosis to histopathology Lab of the hospital. Then diagnosis on appendicitis and histopathology was compared to calculate diagnostic accuracy of appendicitis.

The collected data analyzed using SPSS version 20. Categorical data like gender and diagnosis of AA on appendicitis and histopathology (as per operational definition) was presented as frequency and percentages. Quantitative variables like age of patients, appendicitis score and duration of pain was presented in form of mean ± S.D. 2 x 2 table was generated for diagnosis of appendicitis and histopathology to calculate diagnostic accuracy (as per given below). Data was stratified for age, gender, duration of pain and obesity to address effect modifiers. 2x2 table was calculated to see significance of these effects modifiers.

RESULTS

The mean age of patients was 34.42±9.43 years with age range of 18-60 years. There were 179(56.8%) male and 136(43.2%) female patients in this study, the male to female ratio was 1.31:1.The mean duration of pain among the patients was 4.46±3.50 days with minimum and maximum duration of 1 and 7 days respectively. According to duration of pain there 80 (25.4%) cases who had 1-3 days of duration and rests of 235 (74.6%) of the cases had 4-7 days of pain. There were 81 (25.3%) obese and 234 (74.7%) non-obese patients in our study. The mean RIPASA score among the patients was 11.90±4.51 with minimum and maximum score of 1 and 17.50 days respectively. Among all, 266 (84.4%) patients had RIPASA score of >7.5 and 49 (15.6%) had score of ≤7.5. The histopathological findings showed positive result in 271 (86.0%) and negative in 44 (14.0%) patients (Table-1).

The sensitivity, specificity, positive predictive value and negative predictive value of appendicitis score keeping histopathology as gold standard was 96.68%, 90.91%, 98.5% and 81.63% respectively (Table 2).

The overall diagnostic accuracy of appendicitis score was 95.87% (Table 3). The sensitivity, specificity, PPV and NPV were almost same among young and older age group and both genders (Tables 4-6).

For lesser duration of pain (1-3 days) these measures were 100% while for duration of pain 4-7 days these measures were 95.57%, 87.5%, 97.98% and 75.68% respectively (Table-6). Similarly, the measures of diagnostic accuracy were greater for obese patients compared to non-obese patients.

Table No.1: Frequency of histopathological findings (n=315)

Histopathological findings	No.	%
Positive	271	86.0
Negative	44	14.0

Table No.2: Comparison of RIPASA score and histopathology findings

RIPASA	Histopathology		Total
	Positive	Negative	
> 7.5	262	4	266
≤ 7.5	9	40	49
Total	271	44	315
Sensitivity			96.68%
Specificity			90.91%
Positive predictive value			98.5%
Negative predictive value			81.63%
Diagnostic accuracy			95.87%

Table No.3: Comparison of RIPASA score and histopathology findings with age stratification

RIPASA score	Histopathology		Total
	Positive	Negative	
Age 18-39 years			
> 7.5	186	4	190
≤ 7.5	6	29	35
Age 40-50 years			
> 7.5	76	-	76
≤ 7.5	3	11	14

	Age (years)	
	18-39	40-69
Sensitivity	96.88%	96.2%
Specificity	87.88%	100%
Positive Predictive Value	97.89%	100%
Negative Predictive Value	82.86%	78.57%
Diagnostic Accuracy	95.56%	96.67%

Table No.4: Comparison of RIPASA score and histopathology findings with gender stratification

RIPASA score	Histopathology		Total
	Positive	Negative	
Male			
> 7.5	150	2	152
≤ 7.5	6	21	27
Female			
> 7.5	112	2	114
≤ 7.5	3	19	22

	Gender	
	Male	Female
Sensitivity	96.15%	97.39%
Specificity	91.3%	90.48%
Positive Predictive Value	98.68%	98.25%
Negative Predictive Value	77.78%	86.36%
Diagnostic Accuracy	95.53%	96.32%

Table No.5: Comparison of RIPASA score and histopathology findings with duration of pain as stratification

Duration of pain (days)			Histopathology		Total
			Positive	Negative	
1-3	RIPASA	> 7.5	68	0	68
		≤ 7.5	0	12	12
4-7	RIPASA	> 7.5	194	4	198
		≤ 7.5	9	28	37

	Duration of pain	
	1-3 days	4-7 days
Sensitivity	100%	95.57%
Specificity	100%	87.5%
Positive Predictive Value	100%	97.98%
Negative Predictive Value	100%	75.68%
Diagnostic Accuracy	100%	94.47%

Table No.6: Comparison of RIPASA score and histopathology findings with obesity stratification

Obesity			Histopathology		Total
			Positive	Negative	
Obese	RIPASA	**> 7.5**	68	1	69
		≤ 7.5	1	11	12
Non-obese	RIPASA	**> 7.5**	194	3	197
		≤ 7.5	8	29	37

	BMI	
	Obese	Non-obese
Sensitivity	98.55%	96.04%
Specificity	91.67%	90.63%
Positive Predictive Value	98.55%	98.48%
Negative Predictive Value	91.67%	78.38%
Diagnostic Accuracy	97.53%	95.3%

DISCUSSION

Acute appendicitis is a common surgical emergencies, with a prevalence rate of about one in seven as described by Stephens P.[14] The prevalence of this problem has been reported to be around 13-77%. Egyptian mummy of the Byzantine era displays sticking in right lower quadrant indicative of old appendicitis as reported by Shrivastava at al.[16] Patients typically experience the typical relocation of pain to the right lower quadrant of the abdomen. Later, a worsening pain along with vomiting, nausea, and anorexia are labeled by the patient.[17]

It is difficult diagnosis mainly amongst the early, the ageing and females of reproductive age, where a host of other genitourinary and gynecological inflammatory conditions can exist (Gilmore).[18]

The appendicitis score has shown greater diagnostic accuracy than that reported for the Alvarado or Modified Alvarado scores.[17]

The mean age of patients in our study was 34.42 ± 9.43 years with age range of 18-60 years. There were 179 (56.8%) male and 136 (43.2%) female with male to female ratio of 1.31:1. The mean duration of pain among the patients was 4.46±3.50 days with minimum and maximum duration of 1 and 7 days respectively. There were 81 (25.3%) obese and 234 (74.7%) non-obese patients in our study. In study by Khadda S. et. al., maximum number of patients were males (83) while maximum patients were in age group <30 (n=93). Mean age in females was 30.49±15.68 while mean age in males was 28.65±11.73.[17]

Khadda et al., reported that among patients assessed for appendicitis score 55.3% were males and 44.7% were females. Out of total 150 patients 50 patients scored 5-7 appendicitis score, 71 patients scored 7.5-11.5 appendicitis score while 29 patients scored >11.5 appendicitis score. In our study, mean appendicitis score among the patients was 11.90±4.51 with minimum and maximum score of 1 and 17.50 days respectively. Among all, 266 (84.4%) patients had appendicitis score of >7.5 and 49 (15.6%) had score of ≤7.5. The histopathological findings showed positive result in 271 (86.0%) and negative in 44 (14.0%) patients. The diagnosis of appendicitis score keeping histopathology as gold standard was 96.68%, 90.91%, 98.5% and 81.63% respectively. The overall diagnostic accuracy of appendicitis score was 95.87%. The mean age of the patients (92 male, 100 female) was 25.1 ± 12.7 years, which is moderately lesser than observed in our study. At the optimum cut-off edge score of 7.5 derived from the ROC, diagnostic accuracy of the RIPASA score were 98.0 percent, 81.3 percent, 85.3 percent, 97.4 percent and 91.8 percent.[13]

The study conducted by Erdem et. al., of the 113 patients (62 males, 51 females), the mean age was 30.2 ± 10.1 (range 18 to 67) years. The diagnostic accuracy of appendicitis was 100% and 28%, and negative appendectomy rate was 25%. When a cut-off value for the RIPASA system was set at 10.25, its sensitivity was 83.1%.[19] Nanjundaiah et al reported diagnostic accuracy of appendicitis was 96.2% and 90.5% respectively.[19]

A Pakistani study with similar objectives. true positive were 147, false positive 8, false negative 5, and true negative 107.Sensitivity of appendicitis score was 96.7%, specificity 93.0%, [12] Conclusively, the diagnosis of acute appendicitis remains to be multifactorial.

CONCLUSION

The sensitivity, specificity, Positive Predictive Value, Negative Predictive Value and overall diagnostic accuracy of appendicitis keeping histopathology as gold standard is high making it reliable and easier diagnostic tool.

Author's Contribution:

Concept & Design of Study:	Usman Asif
Drafting:	Anam Zahira
Data Analysis:	Haris Nasrullah, Suleman Asif
Revisiting Critically:	Usman Asif, Anam Zahira
Final Approval of version:	Usman Asif

Conflict of Interest: The study has no conflict of interest to declare by any author.

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