

ORIGINAL ARTICLE

Frequency of Negative Appendicectomy after Evaluation by JM Ramirez & J Deus Score

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ABSTRACT

Background: Acute Appendicitis (AA) is the commonest surgical emergency encountered by surgeon in public & private setup in Pakistan. When it comes to diagnosis, patient seldom presents with the typical bookish picture (symptoms / signs) of the condition. Diagnosis therefore remains an enigma many a times especially for house officers and residents during their emergency duty. Various scores had been developed to aid the diagnosis, Alvarado score although gained popularity and is practiced in our setup. This study was designed to evaluate one such score designed by JM Ramirez & J Deus, for its negative appendicectomy rate calculation with the view to adopt it to our routine practice if it turns out with lesser negative appendicectomy rate compared to other scores in practice.

Methods: This descriptive study was designed & carried out at the Surgical "B" Unit of Ayub Teaching Hospital Abbottabad from November 01, 2020 to June 30, 2021. A total of 190 patients with suspected AA were included, assessed by the score and accordingly placed in three groups based upon their initial score. Group-I patients were discharged with the advice to come back to same unit / hospital if pain persists or recurs. Group-II patients were kept in observation for 24 hours and finally re-categorized either as Group-I or Group-III based upon a drop or rise in their score. Group-III patients were operated after preparation. Data collected over a special proforma was finalized at the time of discharge of patient, earlier in case of group I patients or after getting histopathology report in case of Group-III patients that was later analyzed with the help of SPSS-version 26.

Results: Out of 190 patients included in study 129 were male while 61 were female patients. 49 patients presented with a score less than -15 (Group-I) & were discharged after evaluation. 53 patients had a score between -15 to 09 (Group-II), were therefore kept under observation till next 24-48 hour. Score of 30 dropped to Group-I range & were similarly discharged like Group-I patients. Score of 23 patients rose up to 10 or above (i.e. Group-III range) & were therefore operated like other 88 patients belonging to Group-III. 91 patients were having acutely inflamed, phlegmonous, gangrenous, perforated appendix or appendix with impacted faecolith / pus in the lumen, their appendicectomy specimen along with the specimen of 20 other difficult to diagnose cases on gross vision were sent for histopathology. H/P report confirmed 100 as positive & 11 as negative for appendicitis. 111 patients totally got operated, out of which 11 turned out negative appendicectomies. Frequency of negative appendicectomies overall was therefore 09.9%. It was 05.56% in male (i.e. 04/72) and 17.94 % (i.e. 07/39) in female patients.

Conclusion: Score developed by JM Ramirez and J Deus proved quite helpful in the diagnosis of acute appendicitis & reduction of the frequency of Negative appendicectomies. Being simple, non-invasive & cost-effective, requiring no special equipment or investigations for its application, it ensures an instant, structured & thorough assessment of patient. The score is therefore recommended for its routine adoption / application in our setup in the diagnosis of acute appendicitis to reduce the frequency of negative appendicectomies.

Keywords: Acute appendicitis, frequency of negative appendicectomy, scoring system, Ayub Teaching Hospital

INTRODUCTION

Acute Appendicitis (AA) despite being the commonest surgical pathology¹, is still continuing to pose diagnostic challenge in 21st century.² Several etiologies of AA have been suggested but exact cause has yet to be elucidated.³ Luminal blockage leading to stasis & pressure necrosis has been implicated as the main culprit. Blockage can be due to faecolith, foreign body, lymphoid hyperplasia or malignancy etc.⁴ Epidemiological data suggest that appendicitis may affect any age group but the population between 10-20 years of age is usually vulnerable. It has slight male preponderance with lifetime risk of 8.6% in males as compared to 6.7% in females⁵ but still the rate of appendicectomy is higher in females (23%) as compared to males (12%) due to diagnostic challenges in former.⁶ The annual rate of appendicectomies is reported to be 300,000 in US and 50,000 in UK but interestingly is on the decline.^{7,8}

AA is usually diagnosed by clinical history and examination. Definitive diagnosis though becomes challenging at times, leading to delay in treatment. Delay may worsen the prognosis by causing complications like gangrene, perforation and abscess formation.⁹ Perforation rates have been reported to range between 16% and 40%.² It frequently occurs at extreme of ages affecting 40-60% of youngsters and 60-70% of aged population as well as women of child bearing age.² Complications increase morbidity and mortality. Like, mortality rate post simple appendicectomy ranges between 0.07 to 0.7% that may rise up to 2.4% to 5% after

appendicectomy in complicated cases.^{1,2,10} Similarly, post-operative morbidity rate of 10% in cases of simple appendicitis may jump up to 30% in complicated appendicitis.¹⁰ Prompt and accurate diagnosis therefore is mandatory to avoid delay in treatment and to reduce negative appendicectomy rate. CT scan is now considered a gold standard investigation for the diagnosis of AA as it has sensitivity and specificity of 99% and 95% respectively¹¹ but it poses radiation hazard especially in pregnant women and sometimes may not differentiate between complicated and simple appendicitis.¹² Besides availability issue, it is not cost-effective in developing countries like Pakistan.

Various scoring systems had been used as diagnostic aid like Alvarado & Modified Alvarado scores etc. JM Ramirez and J Deus had also designed a similar scoring system in 1994. This study is intended to evaluate their score for frequency of negative appendicectomy i.e. to know the sensitivity & specificity of this score as an aid in the diagnosis of AA in our population because the available data is limited & very few studies had been carried out earlier.

MATERIAL & METHODS

This study was carried out at Surgical "B" Unit of Ayub Teaching Hospital Abbottabad from 01.11.2020 to 30.06.2021. It is a descriptive non-interventional study. A total of 190 consecutive patients (male & female) presenting to Surgical "B" Unit, Ayub Teaching Hospital with the symptoms suggestive of acute

appendicitis were included in study after taking informed consent. They were assessed according to seven variables of JM Ramirez and J Deus score (Table. 01).

Table 1: JM Ramirez & J Deus Score for Diagnosis of Appendicitis

S. No	Variable		Score
01	Sex	Male	6
		Female	-5
02	Initial pain	Epigastric / Umbilical	5
		Other	-6
03	Diarrhoea	No	1
		Yes	-9
04	Rebound tenderness in right lower quadrant	Yes	5
		No	-21
05	Guarding RLQ	Yes	8
		No	-7
06	TLC (per mm ³)	≥ 10,500	6
		< 10,500	-14
07	DLC (per mm ³)	≥ 75	6
		< 75	-19

Acute appendicitis usually presents with one or more of the following symptoms:

- Pain right iliac fossa & / umbilical region
- Nausea
- Vomiting
- Anorexia

These symptoms were therefore taken as basic criteria for inclusion of the patients in the study. Patients presenting with other acute abdominal features like symptoms & signs of the following diseases were excluded:

- Generalized peritonitis
- Gynaecological diseases
- Urinary tract infection (UTI)
- Mass right iliac fossa

Similarly the following were also excluded:

- Children below 10 year age
- Mentally retarded and non-cooperative patients
- Patients unwilling for surgery / participation in study

All the patients included in study were admitted to Surgical "B" Unit initially & a thorough history was taken concentrating upon their complaints especially those related to the score parameters. History was followed by detailed clinical examination including GPE, systemic and local examination. Signs included in the scoring system were specifically elicited. Routine investigations were carried out with special emphasis on TLC and DLC. Patients aged ≥40 year & those with some co-morbidity (aged even < 40 year) were additionally investigated with tests like serum electrolytes, LFTs, CXR-PAV, ECG & echocardiography to rule out any underlying respiratory or cardiac issues.

Findings after initial assessment were recorded on a special proforma designed according to seven variables of the score. Selected senior (4th year) residents on duty (already briefed about the study) initially filled the proforma at the time of admission. Such a proforma was later concluded at the time of operation & discharge of the patient in the presence of consultant.

Based upon their calculated score, patients were divided into three groups (Table 02). More than one proforma were issued to group-II patients for recording their re-assessment scores till next 24 hours after admission (on 4 hourly basis), until they were finally discharged or operated, depending upon a rise or drop in their aggregate score.

Table 2: Division of Patients into 03 Groups

Group I	Patients having aggregate score < -15
Group II	Patients having aggregate score -15 to 09
Group III	Patients having aggregate score ≥ 10

Group-I: (aggregate score < -15):

These patients were discharged with the advice to come back to the same unit / hospital if symptoms persist or recur.

Group-II: (aggregate score -15 to 09):

Patients in this group after initial assessment were kept in observation and re-assessed at 04-06 hourly intervals, to record a rise or drop in their score. Score if dropped to < -15, they were discharged. Score if rose up to ≥ 10, they were operated like other Group-III patients.

Group-III: (Aggregate score ≥ 10):

These patients were having acute appendicitis on the basis of score & were accordingly operated. Routine pre-operative preparation was carried out. Combination of two antibiotics amongst the following was used for a maximum of three doses in patients with un-complicated acute appendicitis i.e.

- Penicillin or First generation Cephalosporin
- Gentamycin
- Metronidazole

For patients with perforated or gangrenous appendicitis all the 03 group of antibiotics were continued in combination for 05-07 days. Post-operatively patients with uncomplicated acute appendicitis were kept NPO till recovery of bowel sounds, while complicated cases were kept NPO for 24-48 hours. Uncomplicated patients were discharged on 2nd post-op day while those with complications were kept under observation till stability. Appendicectomy specimen was sent for histopathology examination for confirmation of positive & negative cases.

Data collected through proformas was entered into the computer programme SPSS – version 26. Frequency of negative appendicectomies was calculated as percentage of negative cases (i.e. false positive to true positive cases). Other tests of statistical significance were applied wherever required and applicable.

RESULTS

Out of 190 patients included in study, 129 (67.89%) were male while 61 (32.11%) were female patients. Male to female ratio was 2.1:1. Age range was 10-47 years. Mean age was 22.7 years while median age was 24 years. Most patients presented between 16-30 years (n = 131). Mean hospital stay was 2.1 days (ranging from 01-06 days). Initial vs final placement of patients in various groups was as following (Table 03):

Table 3: Initial Vs Final Placement of Patients in 03 Groups

Group	P L A C E M E N T	
	Initial	Final
I	49	79
II	53	00 (30 patients shifted to group-I & 23 to group-III)
III	88	111

49 (25.79%) patients presented with a score below -15 (group-I), after evaluation they were discharged, with the advice to come back to the same unit / hospital if the symptoms persist or recur. This group included 36 (18.95%) male and 13 (06.84%) females (Table-04). None of them turned back to Surgical "B" Unit with either persistence or recurrence of symptoms.

Table 4: Gender-Wise Initial Vs Final Distribution of Patients in Various Groups

Group	Male		Female	
	Initial	Final	Initial	Final
I	36 (18.95%)	57 (30%)	13 (06.84%)	22 (11.58%)
II	36 (18.95%)	00	17 (08.95%)	00
III	56 (29.47%)	72 (37.89%)	32 (16.84%)	39 (20.53%)
Total	126 (66.32%)	126 (66.32%)	64 (33.68%)	64 (33.68%)

53 (27.89%) patients had a score between -15 to 09 (Group-II), were therefore kept under observation and assessed at 04-06 hourly interval till next 24-48 hours, to record a rise or drop in their initial score. This group included 36 (18.95%) male and 17 (08.95%) female patients (Table 04). Score of 30 (15.78%) patients including 21 males and 09 females dropped below -15 (i.e. to Group-I range), were therefore discharged (Table 03). Most of them were patients between 10-20 years, with suspected mesenteric lymphadenitis. Score of 23 (12.11%) patients including 15 males and 08 females rose up to 10 or above (i.e. Group III range), they were therefore operated. Of the operated 23 patients in this group, operative findings & histopathology report confirmed 19 (82.61%) patients with appendicitis while 04 (17.39%) including one child, one male & two female patients as having normal appendix on histopathology.

88 (46.32%) patients initially fell in Group-III range with a score of 10 or above & were accordingly operated. 59 (31.05%) were males and 29 (15.26%) were females. Histopathology findings confirmed 81 (92.05%) patients as positive while excluded 07 (07.95%) as negative for appendicitis. 02 were male & 05 were female patients.

A total of 141 (74.21%) patients were admitted after excluding (discharging) the 49 (25.79%) Group-I patients. Score of 30 (15.79%) patients amongst 141, dropped to Group-I range (i.e. < -15) & were discharged. 111 (58.42%) patients got operated, out of which 11 turned out negative appendicectomies. So the frequency of negative appendicectomies was 11 out of 111 (i.e. 09.91%). The frequency was 05.56% in males (i.e. 04/72) & 17.94% in females (i.e. 07/39) Table 04.

Post operative complication rate (including wound infection, pelvic abscess, chest & urinary tract infection) was 20.72% (i.e. 23/111) table-05. Morbidity was 23 cases including ones with gangrenous and perforated appendicitis that over stayed for 05-07 days. Mortality was none.

Table 5: Post Operative Complications

S.No.	Complications	Count
01	Wound infection	13
02	Chest infection	05
03	UTI	03
04	Pelvic abscess	02

Statistics: After putting the data in SPSS, the 2 x 2 table was applied for comparison of the observed (score confirmed) Vs actual (gross vision / biopsy proven) cases of acute appendicitis. The actual cases were kept along x-axis while the observed (i.e. score confirmed) cases were kept along y-axis. The following facts and figures were obtained.

Score Confirmed	Histopathology confirmed	
	True Positive 100	False Positive 11
	False Negative 00	True Negative 79

True positive patients were 100, 79 patients were true negative, 11 were false positive and none were false negative. So the sensitivity of the scoring system turned out to be 100 % (100/100) in my study. The sensitivity in males was 100 % (i.e. 36 / 36) and in females also it was 100 % (i.e. 16/16). Specificity was 87.5% (i.e. 42/48). Positive predictive value of the score was 90.09% while the negative predictive value was 100 %. The overall accuracy of the scoring system was 94.21%.

DISCUSSION

Acute Appendicitis, despite being a common surgical entity, poses diagnostic challenges at times especially during pregnancy and extreme of ages. Although a clinical diagnosis usually but requires sophisticated diagnostic aids in atypical cases. Such investigations are neither cost-effective nor consistently available particularly in third world countries. Investigations like CT scan do have radiation hazards especially in pregnant patients.

Timely diagnosis is imperative as delay in surgical management might lead to complications like perforation and peritonitis that may increase morbidity and mortality. It is also important to keep negative laparotomy rate due to "over-diagnosis", at a minimum. The diagnosis therefore requires sound clinical judgment and utilization of available resources with mindfulness.

In 1986, Alfredo Alvarado published the result of a scoring system that he applied as an aid in clinical diagnosis of acute appendicitis. It was based on symptoms, signs & laboratory findings of a retrospective study of 305 patients with suspected appendicitis. Eight criteria were chosen and weightage was given to each according to its diagnostic yield. His scoring system is cost effective and popular even today with a slight modification. Shuaib et al¹³ concluded sensitivity and specificity of this system to be 82.8% and 56% respectively, while study by Nanjundaiah et al¹⁴ has shown it's sensitivity and specificity to be 77% and 100% respectively. There is huge variation and inconsistency in results and vary widely amongst different institutions and practices.¹⁵

In 1994, Ramirez et al¹⁶ devised a scoring system from local database. They initially collected data from 360 patients retrospectively and analyzed it. They identified seven criteria that distinguished patients who were false positive from true positive. Weightage was given to each criterion using Bayesian method & a scoring system was devised. It was later on applied prospectively to 166 patients suggesting surgery in 113 and observation in-hospital in 38 cases. It showed sensitivity and specificity of 80% and 81% respectively.

Scoring system devised by Ramirez et al¹⁶ is easily applicable and assists in diagnosis of acute appendicitis. No costly or difficult to manage investigations are required. Structured history & examination sheet makes it usage feasible for junior & less-experienced staff.

In our study, total number of patients were 190, including 129 male and 61 female patients which is comparable to similar studies conducted by Soomro et al¹⁷ (227 patients), Khan et al¹⁸ (150 patients) & Xingye et al¹⁹ (179 patients). Mean age was 22.7 years (median age was 24 years) which is comparable to the mean age findings of 26 years by Chong et al²⁰ and 27 years by Jawaid et al²¹. The age range of 10-47 years is comparable with the age range findings of 10-62 years by Soomro et al¹⁷, 13-87 years by Xingye et al¹⁹ & 15-75 years by Jawaid et al²¹. Total number of operations performed in our study were 111, 100 were having acute appendicitis on gross vision & histopathology, while 11 (9.91%) turned out negative appendicectomies, having no element of inflammation on histopathology. Mean hospital stay of 2.1 days in our study is comparable with 3.5 days by Soomro et al¹⁷ and 4.6 days by Chong et al²⁰. Overall post operative complication rate of 20.72 % in our study is comparable with complication rate of 16.5% recorded by Khan et al¹⁸ & 22% by Chong et al.²⁰

Frequency of negative appendicectomies was 09.91%, slightly greater than the study findings of 3.78% by Soomro et al¹⁷ but lesser than the findings of 16.6% by Khan et al¹⁸, 16.3 % by Chong et al²⁰, 13 % by Jawaid et al²¹ & 12% by Jade et al²². In males the frequency of negative appendicectomies was 05.56% (04/72) while in females it was 17.94% (07/39) which can be compared to published results of 25%, 21%, 17.5% by Ijaz et al²³, Ohmann et al²⁴ and Fenyo et al²⁵ respectively.

Sensitivity of this score was recorded 100% while specificity was 87.5 %. Positive predictive value was 90.09% and negative predictive value was 100%. Khan et al¹⁸ observed sensitivity of 77%, specificity of 92% & positive predictive value of 93% while

evaluating same score. Similarly Ijaz et al²³ recorded sensitivity of 96%, specificity of 85% & positive predictive value of 85% while evaluating JM Ramirez and J Deus developed score. Memon et al²⁶ observed the sensitivity of 93.5%, specificity of 80.6%, positive predictive value of 92.3% & negative predictive value of 83.3%. Our recorded statistical values are thus closely comparable with their values. The diagnostic accuracy of 83% recorded by Khan et al¹⁸, 84% by Ijaz et al²³ and 89.8% by Memon et al²⁶ also matches our study's recorded value of 94%.

CONCLUSION

Our study findings thus proved the score developed by JM Ramirez and J Deus quite helpful in diagnosis of acute appendicitis / reduction of the frequency of Negative appendicectomies.

Score is simple, non-invasive & cost-effective, takes less than 5 minutes in its application. No special equipment, setup, expertise or investigations other than routine are required. As it is dynamic so the score of the patient can shift either way up or down depending upon his / her latest clinical condition.

In units where multiple surgeons with varying clinical acumen look after patients, score by Ramirez et al surely enables a structured & thorough assessment with consistent outcome. It is especially helpful for junior surgeons whom usually face difficulty in the diagnosis of acute appendicitis.

The score is therefore recommended for routine adoption to our setup in getting help in the diagnosis of acute appendicitis to reduce the frequency of negative appendicectomies.

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