ORIGINAL ARTICLE

REVISITING ALVARADO SCORE FOR NEGATIVE APPENDICECTOMY RATE AT AYUB TEACHING HOSPITAL ABBOTTABAD

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Background: Surgeons specifically junior ones in our setup of third world country face the issue of diagnosing Acute Appendicitis (AA) as presentation usually is not typical. Cases presenting at odd hours may put residents & house officers in trouble, when sophisticated investigations are either un-available or expansive. Need for a structured diagnostic criterion is thus always there. Various scores have been designed to help out surgeon e.g. Alvarado score which got more popular & is practiced randomly. Aim of this study was to revisit Alvarado score for its efficacy in current era at Ayub Teaching Hospital (ATH) Abbottabad, i.e., by calculating negative appendicectomy rate. **Methods:** This descriptive study was conducted at Surgical "B" Unit (ATH) from 1st September 2021 to 31st May 2022. 160 patients with pain RIF were included & evaluated by Alvarado score & consequently placed in 03 groups. Those having score 1–4 (Group-1) at presentation were discharged while the ones with score 5-6 (Group-2) were observed, re-evaluated at interval for re-grouping as Group-1 or 3 based on their final score. Patients with score 7–10 (Group-3), having score confirmed Acute Appendicitis were operated. Findings were recorded on a proforma. SPSS-version 26 was utilized for statistical analysis. **Results:** Total patients were 160, males were 118 & female patients were 42. Discharged (Group–1) patients were 22. Group-2 patients (41 in number), were observed for 24–48 hour when score of 16 declined to ≤4 level & were discharged. 25 patients whose score increased to ≥7 levels were operated like other 97 patients of Group-3. Histopathology confirmed 109 of 122 patients as acute appendicitis while 13 turned out negative appendicectomies. Negative appendicectomy rate was therefore 10.65%, i.e., 13 out of 122, it was 06.17% in males (i.e., 05 of 81) & 19.51% (i.e., 08 of 41) in females. **Conclusion:** Alvarado score again proved helpful even today in reducing the negative appendicectomy rate at surgery department of ATH, it should therefore be routinely adopted in diagnosis of suspected appendicitis cases in the third world countries (e.g. Pakistan) setup (facing scarcity of sophisticated resources).

Keywords: Acute appendicitis; Alvarado score; Negative appendicectomy rate; Ayub Teaching Hospital Abbottabad

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INTRODUCTION

Acute Appendicitis though the most common surgical emergency[1] is still providing difficulty in diagnosis in today's modern era.[2] Exact aetiology of AA is still unknown & several factors therefore are suspected being etiological.[3] In both the obstructive & non-obstructive appendicitis luminal blockage either by lymphoid tissue, foreign body, tumour / malignancy, worms or faecolith[4] is the initial stage, leading to stasis of secretions, growth of microorganisms & spread of infection to the appendicular wall leading to establishment of clinically evident acute appendicitis. Age 10–20 years is more vulnerable as evidenced by the available epidemiological data, but no age is immune. Prevalence in males of 8.6% is higher than females having a prevalence of 6.7%[5], although appendicectomy rate of 23% in females is greater than 12% in males because of diagnostic issues being met in females[6]. Documented appendicectomy rate in US & UK is 300,000 & 50,000 respectively but it is decreasing with the passing time.[7,8]

Acute Appendicitis diagnosis is mostly established with history & clinical examination which may be difficult sometimes causing an undue delay in timely commencement of management. Prognosis can be further worsened by any such undue delay in diagnosis paving way for perforation, gangrene or abscess formation.[9] Perforation rate in the range of 16–40% has been reported,[2] occurring

mostly at extremes of ages. It affects youngsters in 40–60% while elderly population in 60–70% cases including child bearing age women.[2] Rate of morbidity & mortality rises proportionately with complications. For example, post simple appendicectomy mortality rate ranges from 0.07–0.7% but may rise in complicated appendicectomies up to 2.4–5%.[1,2,10] Similar is the fate of morbidity which changes from 10% in simple appendicitis to 30% in case of complicated appendcitis.[10] Accurate & timely diagnosis is therefore obligatory to skip the risk of delay in management and control the rate of negative appendicectomy. Computed Tomography scan with reported sensitivity of 99% & specificity of 95% is the gold standard investigation these days[11] but carries the risk of radiation exposure especially in pregnant patients & may fail at times to isolate complicated from simple appendicitis cases[12]. In underdeveloped countries like Pakistan, it also has the issue of availability besides expansiveness.

Need to develop a score was therefore felt which is handy, easy to apply, less expansive, does not need any expansive investigations & reproducible, lead to the development of various scores. Alfredo Alvarado[13], by applying his score retrospectively to 305 patients (based on the available symptoms, signs and lab findings of those suspected appendicitis cases) published his results in 1986. Indeed, he chose 08 criteria & points according to its diagnostic yield were awarded to each. His scoring system with slight alteration is cost-effective / popular even today & was recently endorsed as the most clinically useful by two independent consensus statements.[14,15]

This study was planned to revisit the Alvarado score for its negative appendicectomy rate after application to suspected appendicitis patients at Ayub Teaching Hospital Abbottabad, as limited data is available here & only few studies locally have been carried out earlier.

Aim is to adopt it routinely in our setup of 3rd world country hospitals' setup if still proves effective in current era, for helping out house officers & residents in difficult to diagnose / odd cases of suspected appendicitis.

MATERIAL AND METHODS

This descriptive non-interventional study comprising 160 consecutive patients (both male & females) with suspected appendicitis was conducted at Surgical "B" (Unit ATH). Study duration was 09 months, i.e., from 01.09.2021 to 31.05.2022. Patients included in study with their informed consent were assessed with Alvarado score (Table-1).

Interpretation:

1-4 : Appendicitis unlikely
5-6: Compatible with appendicitis
7-8: Probable appendicitis
9-10: Very probable appendicitis

Inclusion criteria were:

- History of right iliac fossa / umbilical region pain
- Anorexia
- Nausea
- Vomiting

Exclusion criteria were:

- Children with age < 10 year
- Patients who were not willing to join study or undergo surgery
- Patients presenting with symptoms / signs of Gynaecological diseases
- Those having Mass right iliac fossa
- Patients with history of urinary tract infection

All the patients initially were admitted, history was taken & examination was carried out with emphasis over the symptoms / signs outlined by Alvarado score. Routine investigations were advised including TLC & shift to the left. Investigations like CXR, ECG, Echocardiography, LFTs & serum electrolytes were additionally advised wherever needed for patients having age ≥40 year or those with co-morbid conditions.

Patient findings were recorded over a proforma based on the 08 variables of Alvarado score, duty of filling such proforma was assigned to selected 4th year residents of FCP-II training. They initially filled it on patient arrival at ward & later added / concluded it at the time of re-assessment, surgery or discharge of the patient. Patient in line with their assessed score were placed into 03 groups (Table. 02). Multiple proformas were used to group-2 patients (retained in observation for 24–48 hours) to know their ultimate fate.

Group-1 (score 1- 4):
These patients after evaluation were discharged with the advice to come back to the same unit & hospital if the symptoms persist or recur.

Group-2 (score 5-6):
Patients in this group after initial assessment were kept under observation & re-assessed at 04-06 hourly intervals, to record a rise or drop in score. Score if dropped to 1-4 (group-1 range), they were discharged with the same advice to come back if symptoms persist or recur. Score if rose up to 7-10 (group-3 range), they were operated like Group-3 patients.

Group-3 (score 7-10):
Group-3 patients according to score evaluation were having appendicitis, they were therefore prepared & operated. Antibiotics like first generation Cephalosporin, Aminoglycosides in combination with Metronidazole were advised for 03 doses in non-

complicated while for 5–7 days in complicated appendicitis cases. Uncomplicated cases were kept NPO till return of bowel sounds while complicated ones for 24–48 hours. Patients mostly were discharged on their 2nd postoperative day while complicated cases were discharged at full recovery. Specimens were submitted to histopathology.

Computer programme SPSS-26 was utilized for processing the data to get negative appendicectomy rate (as percentage of negative appendicectomies to total operated ones) & for application of other relevant tests of statistical significance.

Table-1: Alvarado Score (Mantrels)

Symptoms	Migratory pain	1
	Anorexia	1
	Nausea & vomiting	1
Signs	Tenderness RIF	2
	Rebound pain	1
	Elevated temperature	1
Laboratory	Leucocytosis	2
	Shift to left	1
Total score		**10**

Table-2: Patient Division into 03 Groups

Group 1	Patients with score **1 – 4**
Group 2	Patients with score **5 – 6**
Group 3	Patients with score **7 – 10**

Table-3: Placement (i.e., Initial & Final) of Patients in 03 Groups

Group	Placement	
	Initial	**Final**
1	22	38
2	41	00 (16 shifted to group-1 & 25 to group-3)
3	97	122

Table-4: Gender-based distribution (i.e., Initial & Final) of patients in various groups

Group	**Male**		**Female**	
	Initial	**Final**	**Initial**	**Final**
1	**13** (8.13%)	**24** (15%)	**09** (5.62%)	**14** (8.75%)
2	**26** (16.25%)	**00**	**15** (9.37%)	**00**
3	**66** (41.25%)	**81** (50.62%)	**31** (19.37%)	**41** (25.62%)
Total	**105** (65.62%)	**105** (65.62%)	**55** (34.38%)	**55** (34.38%)

Table-5: Post operative complications

Complications	**Count**
Wound infection	09
Chest infection	04
UTI	02
Pelvic collection	01

RESULTS

Collectively 160 patients were included in study with number of male & female patients as 118 (73.75%) & 42 (26.25%) respectively. Ratio of male to female patient was 2.8:1. 11-53 year was the recorded age range. 21.3 year was the mean while 23 year was median age. Most of the patients included were 13–30-year-old (n=103). Mean hospital stays of 2.3 days (ranging from 1–6 days) was recorded in our study. Following was the patients' placement in different groups based upon their initial & ultimate Alvarado score (Table-3):

Twenty-two (13.75%) patients presenting with score 1–4 (group-1) were discharged after evaluation. 13 (8.12%) males & 09 (5.62%) female patients were included in this group (Table-4). Neither of them consulted back the concerned Surgical "B" unit with continuation or reversion of their symptoms.

Patients initially placed in group-2 (score 5–6) were 41 (25.62%), they were observed at interval of 4–6 hour for next 24–48 hours. Out of these 41, 26 (16.25%) were male & 15 (9.37%) were female patients (Table-4). Ultimately score of 16 (10%) patients comprising 11 (6.87%) male & 05 (3.12%) female patients decreased to group-1 range (i.e., ≤4) patients & they were discharged accordingly (Table-3). Most of them were teenagers, with sonographic evidence of mesenteric lymphadenitis. Score of 25 (15.62%) patients including 15 (9.37%) males & 10 (6.25%) females rose up to Group-3 range (i.e., ≥07), they were operated like other group-3 range patients. Ninty-seven (60.62%) patients initially fell in Group-3 range (score ≥ 07) were operated. Males were 60 (37.5%) while female patients were 37 (23.12%).

Of the total 160 patients included in study, 138 (86.25%) patients were admitted longer while 22 (13.75%) of group-1 were sent home after evaluation. Later on, additional 16 (10%) patients, whose score fell down to Group-1 range (i.e., ≤ 4) were also sent home. Out if 122 (76.25%) surgeries, 109 were confirmed positive while 13 were confirmed as negative appendicectomies by histopathology. Collective rate of negative appendicectomy was 10.65% (i.e., 13 out of 122 patients), same in males was 6.17% (i.e., 05 out of 81 surgeries) while recorded value for female was 19.51% (i.e., 08 out of 41 appendectomies).

Complication rate was 13.11% (i.e., 16 out of 122 surgeries) which included cases of wound infection, pelvic collection, urinary tract & chest infection (Table-5). These 16 (13.11%) patients staying hospital for longer duration (i.e., 06–08 days), were therefore counted as morbidity. Mortality was none. Data was put in SPSS, observed cases (i.e. confirmed by score) were compared with actual cases (confirmed by biopsy) by applying the 2x2 table. Actual cases were plotted along the x-axis while the

observed cases were plotted along the y-axis. The facts & figures received were as following:

Score Confirmed	Histopathology confirm d	
	True Positive 109	False Positive 13
	False Negative 00	True Negative 38

Study revealed true positive cases were 109, true negative were 38, false positive were 13 while false negative cases in our study were zero. Recorded sensitivity of the score was 100% (109/109) in our study. Sensitivity in both male & female was 100% (i.e., 76/76 & 33/33 respectively). Specificity was 74.51% (i.e., 38/51). Likewise, 89.34% was the recorded positive predictive value, 100% was the observed negative predictive value & 91.88% was the overall accuracy rate of the score.

DISCUSSION

Appendicitis a frequently encountered emergency is still producing issue in diagnosis for surgeon. Such issues they mostly come across in pregnant patients or those presenting at extreme of ages. Presentation is seldom typical in our cases & need to be supported with investigations to reach a diagnosis. CT scan currently is considered the gold standard investigation to diagnose AA but isn't widely available in our part of the world, especially at district & tehsil level. It also possesses the risk of exposure to radiation & can't be utilized in pregnant patient. Delay in the diagnosis may lead to the development of complications with increased risk of morbidity & mortality. Minimize the rate of negative appendicectomy & avoid complications should be the goal of surgeon.

Alfredo Alvardo[13] in 1986 developed a clinical score, applied it to patients & published his results. His scoring system was based on retrospective study of symptoms, signs & lab investigation findings of 305 patients with suspected appendicitis. He ultimately shortlisted eight criterions & allotted them each weightage in accordance with their diagnostic yield. His score with minute alteration is still cost effective & popular. Alvarado score being easier to utilize requires no special investigations besides routine ones for its application.

Number of patients included in our study was 160 that may be compared to the total number of 227 patients shared by Soomro *et al*[16], 150 shared by Khan *et al*[17] & 179 shared by Xingye *et al*[18] while conducting similar studies. Chong *et al*[19] observed the mean age of 26 year & Jawaid *et al*[20] observed it as 27 years, the same in our study was 21.3 year. 2.1 days was the mean hospital stay finding in our study whereas Soomro *et al*[16] reported it 3.5 days & Chong *et al*[19] reported it 4.6 days. 13.11% was the post-operative complication rate in our study which may be compared with recorded complication rate of 16.5% reported by Khan *et al*[17] & 22% by Chong *et al*.[19]

10.65% was the observed negative appendicectomy rate in our study while the same recorded by Soomro *et al*[16], Khan *et al*[17], Jawaid *et al*[20] & Jade *et al*[21] was 3.78%, 16.6%, 16.3% & 13% respectively in their studies on same / similar scores. Our observed negative appendicectomy rate was 06.17% in males &19.51% in females, whereas Ijaz *et al*[22] published it 25%, Ohmann *et al*[23] 21% & Fenyo *et al*[24] 17.5% in their studies.

Observed sensitivity of the score was 100% while specificity was 74.51% in this study. Positive predictive value of 89.34% & negative predictive value of 100% was recorded. 77% sensitivity, 92% specificity & 93% positive predictive value were observed by Khan *et al*[17] while evaluating the same score. Likewise, 96%, 85% & 85% were the observed sensitivity, specificity & positive predictive value respectively reported by Ijaz *et al*[22] while evaluating a similar other score. During their evaluation of Alvarado score Memon *et al*[25] confirmed the figures of 93.5% for sensitivity, 80.6% for specificity, 92.3% for positive predictive value & 83.3% for negative predictive value.

CONCLUSION

Alvarado score thus proved helpful once again in reducing the negative appendicectomy rate at Department of Surgery ATH, it should therefore be routinely adopted in the diagnosis of suspected appendicitis cases in the third world countries setup. By providing an effective alternative platform to replace the difficult to arrange / afford investigations like CT scan especially during odd hours & stations with scarcity of resources, it helps surgeon remarkably in controlling the negative appendicectomy rate.

AUTHORS' CONTRIBUTION

HK: Conceptualization of study design, Data collection, write-up. IA: Data collection, Data Analysis, proof reading. AF: Data collection, Data interpretation. ZA: Literature search, Data analysis, proof reading. ZA: Literature search, Data collection SA: Data interpretation, proof reading. FDK: Data collection, Literature search. TH: Data collection, Literature search

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