

ALVARADO'S ACUTE APPENDICITIS SCORE FOR ALGORITHM, ADMISSION AND APPENDICECTOMY

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ABSTRACT: Appendicitis is a most common abdominal surgical emergency, clinically mimicked by other pathologies. Even with modern imaging, at times diagnosis is challenging. Several scorings are available to predict pre-operative diagnosis.

KEYWORDS: Appendicitis, Alvarado's score.

INTRODUCTION: Notwithstanding modern imaging, the diagnosis of Acute Appendicitis (AA) remains essentially clinical¹. AA is an enigma- simple disease despite best efforts commonly misdiagnosed.²

Imaging reduces the negative appendicectomy rate (NAR)³ to 20-46 %. Scorings devised by Lindberg,

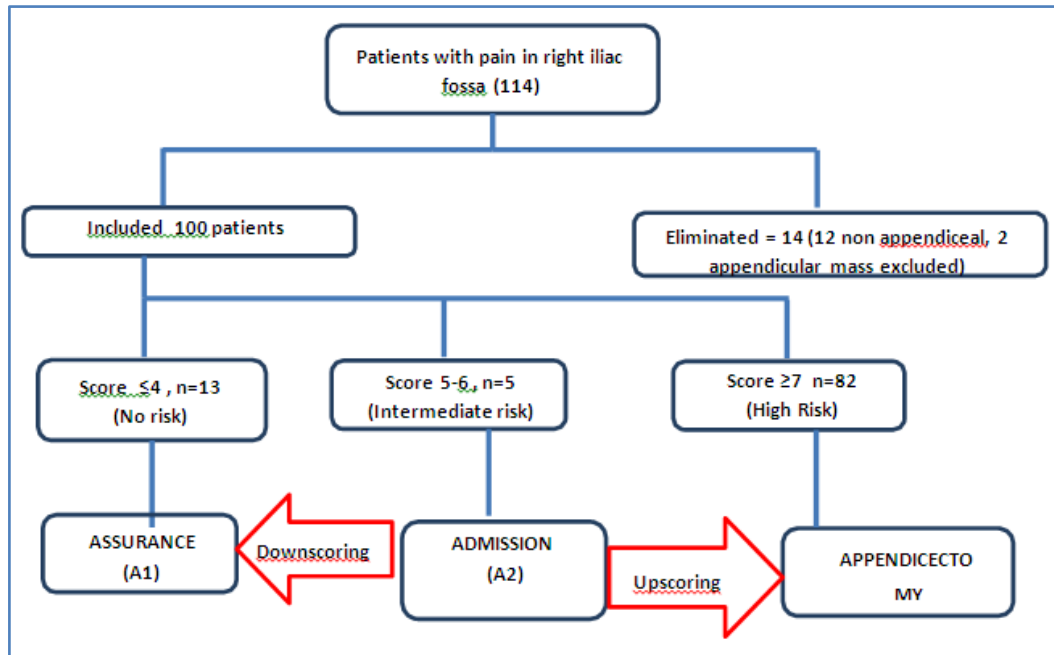
Fenya, Christian, are complex and difficult which were evaluated on their ability to fulfill these 4 criteria.⁴ viz: (a) An initial NAR of $\leq 15\%$ (b) A potential perforation rate of $\leq 35\%$ (c) An initial missed perforation rate of $\leq 15\%$ (d) A missed appendicitis rate of $\leq 5\%$. Alvarado score (AS) devised in 1986 is the simplest and practical⁴ including 8 variables viz: 3 symptoms, 3 signs and 2 laboratory findings called by acronym as MANTRELS Score (table-1). Score ≤ 4 is unlikely to be AA, Score 5 & 6 possible AA but not convincing enough to warrant urgent surgery. Score ≥ 7 , Appendicectomy has to be done. In 1992 T.D. Owen found AS can significantly decrease NAR.⁵ Since NAR was high in women of child bearing age and those scoring 5-6, aids like Ultrasonography (USG)/Laparoscopy (Lap) was suggested. Sudhir Kumar Mohanty combined AS and USG.⁶ In 1994 Kalan modified AS (MAS) by excluding shift to left. NAR in women higher than Owen (33% v/s 22%).

He concluded that AS is effective in children and men but Lap is required in women.⁷ In 1997 Macklin recommended not to use MAS in children.⁸ In 2000 Charles Douglas concluded that USG is not better than clinical diagnosis alone.⁹ In 2000 Bhattacharjee showed that sensitivity with score > 7 in men was 94% and only 71.9% in women.¹⁰ In 2006 Lone Nazir Ahmed concluded that AS > 7 works well in men but not in women.¹¹ Our aim was to evaluate AS. Objectives were to rule out and rule in AA using AS and decrease NAR.

MATERIALS AND METHODS: In this prospective study (October 2010–October 2012) at Sri Siddhartha Medical College Hospital, patients with RLQ pain abdomen were included. Appendicular mass, pregnancy and patients on Steroids, Chemotherapy & Radiation were excluded. AS applied and correlated with USG, operative and histopathology (HP) findings. Ethical clearance and Informed consent obtained.

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RESULTS: Of the total 114 patients (65 males, 49 females) 12 cases with Different Diagnosis (DD) were screened out by USG and 2 women with appendicular mass were excluded. Of the 65 males, 61 were included and of the 49 females, 39 were included. AS applied to the included 100 cases and triaged into 3 treatment groups: A₁, A₂ and A₃. A₁ - Assurance Group (score ≤ 4) were symptomatically treated and advised to report if symptoms persisted or aggravated. A₂ - Admission Group (scores 5-6) were admitted for observation with frequent re-evaluation and rescoring. Those who scored ≥ 7 underwent appendicectomy and those who improved with score ≤ 4 were discharged with assurance as in A₁. A₃ - Appendicectomy Group (scores ≥ 7) underwent Appendicectomy.



In our study MANTRELS score variables were M=80%, A=75%, N=66%, T=100%, R=74%, E=69%, L=15% and S=1% of cases. Of the 18 cases (A₁+A₂), 4 were USG positive, but were managed conservatively and remained asymptomatic suggesting that AS is more sensitive and accurate. A positive USG is not pre-requisite for appendicectomy due to high NAR. USG was positive in 82 cases (A₃), were appendicectomised. AA was confirmed by operative and HP findings in 80 cases (sensitivity 98.76%) and not in 2 cases (false positive/negative appendicectomy). In A₃ 45 had toxic clinical features with leukocytosis in 15 and only 1 case had left shift. Of these 45 cases, 34 had perforated appendicitis (PA) with abscess. These protracted features correlate with PA warranting early surgery. PA had delayed presentation/referral, leading to morbidity (wound infection 8; wound dehiscence 2, bowel adhesions 1 case). All were advised follow-up after a week. A₁ and A₂ were relieved of symptoms and were advised to report if symptoms recurred. Mortality was nil. The cutoff point ≤ 4 is more useful to rule out, than score ≥ 7 which rule in AA. AS is well calibrated in men than women. As there were only 15 children, it is difficult to comment on the applicability in them. Many studies show the inconsistency of AS in children.

DISCUSSION: Patients were of 8-78 years age with majority between 21-30 years. Mean age was 25.5 years showing that AA is common in middle age. This is comparable with other studies.^{12, 13, 14, 15, 16}

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Men outnumbered women (M: F=1.5:1). Among the total 114 cases presenting with RLQ pain 14 were screened out by USG with majority (10) being women (8-DD, 2-appendicular mass). This suggests that women have a wide range of DD selectively requiring USG, CT, and Lap.¹⁷ Migratory pain was the commonest symptom as in other studies.⁴ Tenderness was elicited in all the cases, as in other studies⁴ justifying the idea of allotting 2 points. Leucocytosis encountered in 15 cases and 1 had shift to left. Literature states that only 20% will have leucocytosis in first 24 hours.⁷ Sensitivity of leucocytosis is 52-96% and left shift is 39-96%.² Hence Shera modified AS by reducing the score of leucocytosis to 1⁴ and Kallan eliminated left shift.⁷

USG was positive in all the A₃ patients of A₁ & A₂ though USG positive in 4, they responded to conservative management alone. A positive USG is not a prerequisite for operation as there is high NAR. USG can only complement clinical score because in some appendix is invisible due to bowel gas or missed due to subjective variation and observer dependency.³ The cutoff point of ≤ 4 rules out AA its sensitivity was 100% in overall, men and women. Specificity was 76.47% in overall, 70% in men, 85.7% in women. Cut off point of ≥ 7 rules in and its sensitivity was 98.76% overall, men 100%, women 96.77%. Specificity was 97.56%, men 90.90%, women 87.50%. PPV was 89.47% overall, men 98.03%, women 96.77%. NPV was 94.44% overall, men 100%, women 87.50%. Robert Ohle et al¹⁸ cut of point 5 to rule out showed sensitivity 99% overall, 96% men, 99% women. Cut off point 7 will rule in with specificity overall 81%, men 57%, women 73%. Subhajeet Dey et al¹⁶ showed, in males the sensitivity 89%, specificity 62.8%, PPV 81.6%, PNV 62.8%. Females had PPV 93%, sensitivity 89%; NPV and specificity were 30.9%. The overall PPV 86.9%, NPV 69.8%, sensitivity 94.2% and specificity 70%. NAR was 10.52% overall, 9.09% men, 22.22%, women. In Subhajeet et al¹⁶ study it was 13%, 18.3% and 6.9% respectively and in Hemanth Nautiyal³ it was 8.11%, 7.14%, 11.11% respectively. These results comparable with our study. NAR in other studies results are 6.84%⁴, 16.21%¹², 14.3%¹⁹, 15.6%²⁰, 16%²¹, 16.1%²² and 17.5%²³

CONCLUSIONS: Alvarado's Acute Appendicitis score can be used frame an Algorithm and triage the patients into three management groups i.e., Assurance, Admission and Appendectomy groups. It should be introduced in Emergency departments, Rural hospitals as this simple score helps in early referral for intervention and prevent complications. It is cheap and non-invasive which is well calibrated in men, over predicts the probability in women and inconsistent in children. The score very well rules out Appendicitis and reduces NAR avoiding significant morbidity, loss of precious staff hours and financial resources. Alvarado score is easy, simple, cheap, non-invasive, safe, fast, reliable, repeatable and modifiable for pre-operative prediction of Acute Appendicitis.

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		Score variables	Score
SYMPTOMS	M	Migratory pain	1
	A	Anorexia	1
	N	Nausea/vomiting	1
SIGNS	T	Tenderness in RLQ abdomen	2
	R	Rebound tenderness	1
	E	Elevated temperature	1
LABORATORY	L	Leucocytosis	2
	S	Shift to left	1
TOTAL SCORE			10

Diagnosis	Total	Males	Females
Ureteric calculi	2	1	1
Mesenteric Adenitis	3	1	2
Tubo-ovarian mass	1	0	1
Terminal ileitis	1	0	1
Psoas Abscess	1	1	0
Intussusception	1	1	0
Abdominal Tuberculosis	1	0	1
Cholecystitis	1	0	1
Total	12	4	8

Score	Diseased	Non Diseased	Total
5-6 (A2)	1 [M=0, F=1]	4 [M=3, F=1]	
>7 (A3)	82 [M=51, F=31]	0	87
1-4 (A1)	0	13	13
Total	83 [M=51, F=32]	17 [M=10, F=7]	100

Table 3: Cut off Points: Cut off point of ≤ 4 was used to rule out AA (A₁)

(M=male, F=female)

Score (test)	Diseased	Non Diseased	Total
≥ 7 (positive)	80 (true positive) [M=50, F=30]	2 (false positive) [M=1, F=1]	82 (A ₃)
≤ 6 (negative)	1 (false negative) [M=0, F=1]	17 (true negative) [M=10, F=7]	18 (A ₁ +A ₂)
Total	81 (total diseased) [M=50, F=31]	19 (total non-diseased) [M=11, F=8]	100 (total sample size)

Table 4: Cut off point of ≥ 7 rule in AA requiring Appendicectomy-A₃

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Validity tests	Men	Women	Overall
Sensitivity	100 %	96.77 %	98.76 %
Specificity	90.90 %	87.50 %	97.56 %
Predictive Value of Positive Test (PPV)	98.03 %	96.77 %	89.47 %
Predictive Value of Negative Test (NPV)	100%	87.50 %	97.44 %
False Positive (NAR)	9.09 %	22.22 %	10.52%

Table 5: Validity of the score to rule in AA

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