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Modified Alavardo score in management of acute appendicitis

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Abstract:

Background and objectives: Acute appendicitis, the most common surgically correctable cause of abdominal pain, the diagnosis of which remains difficult in many instances and is essentially clinical. However a decision to operate based on clinical suspicion alone can lead to removal of normal appendix in 15 – 30 % cases. Several diagnosis scoring systems have been devised as an aid to the early diagnosis of acute appendicitis and to reduce the incidence of negative appendisectomy. One such scoring system was described by Alvarado and later modified by Kalan. The present study is attempted to evaluate the efficiency of modified Alvarado score in pre-operative diagnosis of acute appendicitis. Methods: A hundred consecutive patients suspected of acute appendicitis who are admitted, investigated and treated are taken for study. After detailed examination and investigations a modified Alvarado score was applied to these patients. They were assigned in three groups and were treated accordingly.Results: The results of the study showed that high score in male (7-9) had a sensitivity of 94.29 % where as in females it had sensitivity of 75.75 % respectively. The score (5-6) in male and female had a sensitivity of 90 % and 100 % respectively. Interpretation and conclusion: The high score in modified Alvardo score is dependable aid in the early diagnosis of acute appendicitis in male and but has limitations in young women. Ultrasonography of abdomen is a useful tool in avoiding negative appendisectomy rates.

Key words: Acute appendicitis; Appendisectomy; Fever; Leukocytosis ; Modified Alvarado score ;rebound tenderness

Introduction

Acute appendicitis is the most common surgically correctable cause of abdominal pain, the diagnosis of which remains difficult in many instances. Some of the signs and symptoms can be subtle to both the clinician and the patient and may not be present in all instances. Arriving at the correct diagnosis is essential; however, a delay may allow progression to perforation and significantly increased morbidity and mortality. Incorrectly diagnosing a patient with appendicitis although not catastrophic often subjects the patient to an unnecessary operation [1]. The diagnosis of acute appendicitis is essentially

clinical; however a decision to operate based on clinical suspicion alone can lead to removal of a normal appendix in 15–30 % cases. The premise that is better to remove normal appendix than to delay diagnosis doesn't stand up to close scrutiny, particularly in the elderly. A number of clinical and laboratory based scoring system have been devised to assist diagnosis. The most commonly used is the Alvarado score and equally its modification [2]. Modified Alvarado score: This consist of three symptoms, three signs and a laboratory findings as described by Alvarado et al [3], later modified by Kalan et al [4].

SYSTEM:

1 – 4 Appendicitis unlikely
5 – 6 Appendicitis possible
7 – 9 Appendicitis probable
9 – Appendicitis definitive

Table 1: Modified Alvarado score

Clinical feature		Score
Symptoms	Migratory RIF pain	1
	Anorexia	1
	Nausea / Vomiting	1
Signs	Tender RIF	2
	Rebound tenderness	1
	Elevated temperature	1
	Leucocytosis	2
	Total	9

Patient with score of 1–4 who are not considered likely to have acute appendicitis will be observed and not operated unless for compelling reasons to do so. Those with scores between 5–6 will be considered to have possible diagnosis of acute appendicitis, but not convincing enough to warrant immediate surgery and these patients will be monitored at 4 hourly intervals and if within 24 hours of observation their score becomes > 7 or their clinical features are convincing enough to warrant surgery, then irrespective of their scores, appendisectomy will be performed. All patients with scores 7 to 9 will be considered to have either probable or definite diagnosis of acute appendicitis and will be considered for appendisectomy in first instance.

Objectives

1) This study is to be conducted to evaluate the utility and reliability of the Alvarado scoring system for the diagnosis of acute appendicitis in our set-up.

2) Comparison of the Alvarado scores of patients with their operative findings and to ascertain the relative importance of individual parameters of the modified Alvarado Score in determining the diagnosis.

3) To evaluate the efficacy of Modified Alvarado score in acute Appendicitis, and to correlate it with different diagnostic modalities (USG) operative and histologic findings.

Review of literature

Historical background: Claudius Amyand (1660–1740) a French surgeon working at St. George's and Westminster hospitals in London, performed the first successful appendectomy in an 11-year-old boy presented with an inflamed, perforated appendix in an inguinal hernia sac in 1735.Within the hernia sac, Amyand found the appendix. He successfully removed the appendix and repaired the hernia [5].

In 1824, Louyer- Villermay presented a paper before the Royal Academy of Medicine in Paris. He reported on two autopsy cases of appendicitis and emphasized the importance of the condition [6]. In 1827, Francois Melier, a French physician, expounded on Louyer- Villermay's work. He reported six autopsy cases and was the first to suggest the antemortem recognition of appendicitis. Reginald Fitz, a professor of pathologic anatomy at Harvard, is credited for coining the term "Appendicitis". His landmark paper definitively identified the appendix as the primary cause of right lower quadrant inflammation [7]. Fergus, in Canada performed the first elective appendisectomy in 1883. The greatest contributor to the advancement in the treatment of acute appendicitis is Charles Mc Burney. In 1889, he published his landmark paper in New York Medical Journal describing the indications for early laparotomy for the treatment of appendicitis. It is in this paper that he described McBurney's point as the point of maximum tenderness, when one examines with the fingertips is, in adults, one half to two inches inside the right anterior spinous process of the Ilium on a line draw to the umbilicus [8]. McBurneys subsequently published a paper describing the incision that bears his name in 1894. However, McBurney later credited McArthut with first describing this incision [9]. Semm is widely credited with performing the first successful laparoscopic appendisectomy in 1982 [10]. Bhattacharjeeet al in their study on 110 patients of acute appendicitis observed that high score (>5) was found to be a dependable aid both in the pre-operative diagnosis of acute appendicitis and in the

reduction of negative appendicectomy in men and children and the same was not true for women who had a high false positive rate for acute appendicitis [11]. Malik et al in their study on 106 patients concluded that the high score in men and children were found to be an easy and satisfactory aid in the early diagnosis of acute appendicitis, but a high false positive rate for acute appendicitis was found in women [12]. Kalan et al in their series of 49 consecutive patients observed that the presence of a high score was found to be easy and satisfactory aid to early diagnosis of appendicitis in children and men. However, the false positive rate for appendicitis in women was unacceptably high. [4]. Saidi et al studied 189 patients with acute appendicitis, the proportion of patients with Alvarado scores more than 7 was 40.7 % and in them negative appendisectomy rate was 19.7 % which was almost equal to overall negative appendisectomy rate of 18 % based on clinical suspicion alone. They concluded that the integration of this scoring system does not offer advantage over degree of clinical suspicion [13]. Lampareli et al assessed a total of 84 consecutive patients prospectively using the modified Alvarado Score. The rate of negative appendisectomy in the study group was 0 % compared to 18 % in the control group [14].

Materials and Methods

This study was conducted on patients presenting with pain in the right lower quadrant of abdomen, who after clinical examination were provisionally diagnosed to have acute appendicitis and appendisectomy done at Dhiraj hospital. The study will be a prospective one with comparative data being used extensively to formulate a conclusion. The data will be primarily gathered in the form of the performa for 100 patients. It will then be sorted out into various aspects of the study and then extrapolated to arrive at a conclusion. In the study period of 2011-2012, Modified Alvarado score was applied on all those patients.

Ethical Approval has been taken from IEC-SVJEC/ON/MEDI/BH-PWO/D11127.

Inclusion Criteria:

Patient with complaints of pain in abdomen with features suggestive of acute appendicitis.

Exclusion Criteria:

1) Patient with presentation suggestive of urological, testicular, gynecological, or surgical problems other than appendicitis.
2) Patient with mass/lump in right iliac fossa.
3) Patient with history of appendisectomy.
4) Patient of age less than or equal to 12 years.
5) Patients with generalized peritonitis due to appendicular perforation.

Collection of Data:

A total of 100 consecutive cases of suspected acute appendicitis that were admitted investigated and treated were taken for study. After detailed examination and investigations a modified Alvarado score was applied to each case. Following decisions were taken: Cases with score of 1-4 were observed and not operated and were followed up. After for six months for development of acute appendicitis, cases with score 5-6 were observed for next 24 hours for revision of scoring. If score became > 7 or their clinical condition was highly suspicious of acute appendicitis as decided by treating surgeon they were subjected for appendisectomy. All patients who were considered for appendisectomy underwent ultrasonography of abdomen primarily to rule out other conditions mimicking acute appendicitis. Patients with score of 7-9 who were considered candidates for appendisectomy were assessed again after ultrasonography. If any other condition mimicking acute appendicitis was found in them, they were not operated and were considered as false positive cases. All the specimens were sent for histopathological examination. Final correlation between the scoring system and final diagnosis was made.

Eighty three patients who constituted present study group were divided in to three groups

Group 1: Patient who were between score 1-4.
Group 2: Patient who were between score 5-6.
Group 3: Patient who were between score 7-9.

Results

Out of 100 patient 62(62 %) were male and 38(38 %) were female. Clinically males were more susceptible than female, with a male: female ratio is 1.63:1.

Table 2: Distribution of patient as per sex group (n=100)

	Modified Alvarado score group			Total
	1 – 4	5 – 6	7 – 9	
F	0 0 % 0 %	5 13.2 % 33.3 %	33 86.8 % 48.5 %	38 100 .0 % 38.0 %
M	17 27.4 % 100.0 %	10 16.1 % 66.7 %	35 56.5 % 51.5 %	62 100.0 % 62.0 %
Total	17 17 % 100.0 %	15 15.0 % 100.0 %	68 68.0 % 100.0 %	100 100.0% 100.0 %

Group 1: Seventeen patients were in first group (1-4) who were not considered likely to have appendicitis. They were observed and were treated conservatively. Discharged after 2 – 3 days and were followed monthly for six months and none of them required surgery.

Group 2: Fifteen patients were in second group (5-6), 15 were operated upon clinical suspicion of high probability of acute appendicitis. Of the 15 patients, whose score was 5-6 who were operated, 10 were male and 5 were females, 9 out of 10 males and 5 out of 5 females had acute appendicitis. The overall negative appendisectomy rate of patients with score less than 6 is 6.7%.

Group 3: Out of 68 patients in third group (7-9), 68 patients underwent appendisectomy. Distribution of cases according to modified Alvarado score (7-9); out of 68 patients 7 female patients on subjecting for ultrasonography of abdomen had pathology mimicking acute appendicitis and they undergo appendisectomy. Six patients had pelvic inflammatory disease, and one patient had normal appendix. 59 patients out of 68 cases had appendicitis. Sensitivity of modified Alvarado score of > 7 was 86.8% (proportion of true positive). The sensitivity was highest among males i.e. 94.29 %, while in female it was 75.75%. Negative appendisectomy rate was highest among female (24.25%), where as in case of male it was 5.71 %. 1 male patient with normal appendix had Meckel's diverticulitis.

Discussion

Acute appendicitis is a condition which is diagnosed clinically however imagine modalities and laboratory tests are a useful adjunct to such diagnosis. Diagnostic scoring system aim at simplifying variables and making the criteria easy and reproducible at the same time, thereby serving the purpose of diagnosis [15]. Utilizing a scoring system should aid in the early preoperative diagnosis of this condition. Depending upon the range of score into which a particular patient fits into other ancillary investigations can be added in order to increase the diagnostic efficacy. This is particularly pertinent to the female population, wherein the spectrum of differential diagnosis is extensive. The modified Alvarado score is an easy and comprehensive system of scoring, since it takes into consideration symptoms, signs and laboratory reports. The gamut of symptoms and signs included in the scoring system are ones that constitute the traditional Murphy's triad. It also includes laboratory investigations. It was the WBC count which was studied instead. The system is reproducible and can even be assessed by the junior surgical residents. It is helpful for preparing patients for early surgery thereby preventing a delay in surgical intervention, which increases the complication rate in appendicitis. Despite all attempts to make an accurate preoperative diagnosis a negative appendisectomy rate continues to prevail. The negative appendisectomy rates in most studies are in the range of 22-33% [16]. Laproscopy is perhaps an answer to the problem of high negative appendisectomy rates in females. In the present study laproscopic appendisectomy was performed only in those patients who underwent surgery during office hours. For those who underwent surgery after office hours or at night, the open method of appendisectomy was performed. This perhaps could be an attributable cause for a high negative appendisectomy rate in females.

Laproscopy can help to decrease the negative appendisectomy rate as the appendix can be visualized properly to confirm the morphological features of acute appendicitis before removing it.

In addition, it also helps to rule out any adnexal pathology, which closely mimics appendicitis in females. In male patient the scoring system is fairly acceptable, with an significant failure rates as was seen in the present study [17,18]. This could be due to a narrow spectrum of differential diagnosis in males as compared to females. Combining modified Alvarado score with radiological methods like USG or probably CT scanning can lead to accurate preoperative diagnosis of the condition. However, the cost factor with imaging needs to be given a serious thought, especially in the developing world where financial constraints significantly guide the investigative approach to a patient. Hence, in such a scenario modified Alvarado scoring is of great diagnostic significance [17].

Sex distribution:

In present study out of 100 patient 62(62%) were male and 38(38%) were females. Clinically males were more susceptible than females with a male: female ratio of 1.63:1.

Table 3: Comparison of male: female ratio in different studies

Author	Male	Female	Ratio
Petrosyan [19]	925	702	1.32
Rezak [20]	43	16	2.68
Shreef [21]	228	122	1.86
Shrivastava [22]	45	30	1.50
Tade [23]	68	33	2.06
Present study	62	38	1.63

In present study, 83(83 %) out of 100 patient with suspected appendicitis underwent appendisectomy from Modified Alvarado score group 5-6 & 7-9. Of these 38 patients were female and 45 patients were male and 17 patients were in first modified Alvarado score group (1-4) who were not considered likely to have appendicitis. They were observed and were treated conservatively, discharged after 2-3 days and were followed up every month for six months, none of them required surgery. Out of 100 patients, were 15 in Modified Alvarado score group 2 (5-6) and 68 in group 3 (7-9). Modified rate of negative appendisectomy varied from 8% in Malik [12], 29% in Borges study [24], Alvarado-18% [3], Memon -9 % [25] and the present study has 12.04 % negative appendisectomy rate.

Table 4: Comparison of negative appendisectomy rate by other authors and present study

Author	Negative appendisectomy rate
Alvarado [3]	18 %
Borges [24]	29%
Malik [12]	8%
Memon [25]	9%
Present study	12.04%

In Modified Alvarado scoring system, present study showed that most common symptom is pain in right iliac fossa in 99 % cases.

Anorexia was present in 71 % of the patient in present study, as compared to Kalan et al- 85% [4], Schwartz -100 [6]. In group 1 (1-4) out of 17 patient 10 patient had anorexia. In group 3(7-9) out of 68 patients 55 had anorexia.

Nausea and vomiting was present in 57(57%) of case in present study, as compared to Schwartz 75 % [6], Own Td et al 78% [16]. The symptom is very common among 7-9 group out of 68 patient 50(73.5%) cases had nausea and vomiting. Right iliac fossa tenderness was present in 90 %, as compared to Bhattacharjee et al- 92% [11], Kallan et al -95% [4]. In present study 73 % cases had rebound tenderness as compared with other study, Own Td et al -96 % [16]. This is noted that Modified Alvarado score is increasing sensitivity of the sign is also increasing, so specificity of this sign higher for appendicitis. Fever was present in 32 % of cases in present study as compared with Kallan et al -40% [4]. WBC count more than 10000 cells/cu mm was found in 79% of cases. Among 17 patient in group 1 only 3 patient had increased WBC count whereas in group 2 out of 15 patients 9 had raised WBC count and in group 3 out of 68 patients 57 (84.8%) patient had increased WBC count. Total 69 patients had increased WBC count. The result of present study shows a high score (> 7) in man was a satisfactory aid in the early diagnosis of acute appendicitis, the overall sensitivity in men with modified Alvarado score >7 was 94.29%, with a negative appendisectomy rate of 5.7%. But in females negative appendisectomy rate was quite high in Modified Alvarado Score group (7-9).The negative appendisectomy rate in group (5-6) and (7-9) being 6.6 % and 5.71 % respectively. Sensitivity of acute appendicitis was 94.29% for male in the present study with Modified Alvarado Score group (7-9) correlate well with the figures of studies by Kallan-

93% [4], Bhattacharjee et al -94.1% [11]. Sensitivity for appendicitis is 76.31% in present study with Modified Alvarado Score group (7-9) and correlates well with the figure of study by Kallan et al -67% [4], Bhattacharjee et al -71.9% [11]. The overall sensitivity of acute appendicitis being 85.29%, in the present study with Modified Alvarado Score group (7-9) correlate well with the figure of studies by Kallan et al -83.7% [4], Bhattacharjee et al -82.7% [11].

Conclusion:

In present study out of 100 patients, 62(62%), were male and 38 (38%), were female. Clinically males were more susceptible than female with a male-female ratio of 1.68:1. In present study it may be concluded that cases with Modified Alvarado score group (1-4) were observed and were managed conservatively, their percentage in present study is 17% and in 2nd Modified Alvarado score Group of patients whose score is between 5-6 are highly suspicious of acute appendicitis were evaluated clinically along with the use of Modified Alvarado scoring system for the confirmation of acute appendicitis and the percentage of patient failing in this Modified Alvarado score group in present study is 15%, the overall negative appendisectomy rate of patients with modified Alvarado score <6 is 6.67%.

The third Modified Alvarado score group of patients having score 7-9 are definitive case of acute appendicitis and their management is appendisectomy and their percentage in the present study is 68%. Sensitivity of Modified Alvarado score of more than 7 is 85.29% in present study. In patients falling in Modified Alvarado score group 5-6 and 7-9 are a dependable aid in early diagnosis and treatment of acute appendicitis in men but the same is not true as far as females are concerned because of other conditions mimicking appendicitis like PID or ruptured ectopic. USG abdomen is useful tool in avoiding negative appendisectomy rate is particularly in female is 24.25%. From the present study it may be concluded that high score (7-9) in Modified Alvarado score is dependable aid in early diagnosis of acute appendicitis in men but the same is not true as far as women are concerned, because of other conditions mimicking appendicitis like pelvic inflammatory disease, ruptured ectopic pregnancy. To check the association between Appendicitis and modified Alvarado score group, Pearson's Chi-square test is applied and its p-value is obtained. As p-value is less than 0.01, it can be conclude that there is strong association between Appendicitis and Modified Alvarado score group. There is no difference in proportion of patients with migration of pain in three groups of Modified Alvarado score group (p-value>0.05) There is significant difference in proportion of patients with anorexia in three groups of Modified Alvarado group (p-value < 0.01) so it conclude that Anorexia is a significant symptom in acute appendicitis. There is significant difference in proportion of patients with nausea and or vomiting in three groups of Modified Alvarado score (p-value < 0.01), so it concluded that nausea and or vomiting are significant symptoms in acute appendicitis. There is significant difference in proportion of patients with right iliac fossa tenderness in three groups of Modified Alvarado score (p-value < 0.01), so it conclude that right iliac fossa tenderness is a significant sign in acute appendicitis. There is significant difference in proportion of patients with rebound tenderness in three groups of Modified Alvarado score (p-value < 0.01), so it conclude that rebound tenderness is a significant sign in acute appendicitis. There is significant difference in proportion of patient with fever in three groups of Modified Alvarado score (p-value < 0.01), so it concluded that fever is a significant sign in acute appendicitis. There is significant difference in proportion of patients with raised WBC count in three groups of Modified Alvarado score (p-value < 0.001), so it conclude that raised WBC count is a significant laboratory findings in acute appendicitis. Ultrasonography of abdomen is a useful tool in avoiding negative appendisectomy rates particularly in females.

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