EVALUATION OF ALVARADO SCORE IN DIAGNOSIS OF ACUTE APPENDICITIS

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ABSTRACT
Objectives: *To apply the Alvarado score as a criterion for admission and treatment plan for acute appendicitis to reduce the rate of negative appendicectomy and risk of perforation.*
Study Design: *Interventional study.*
Setting & Duration: *In the emergency Department of Surgery, Chandka Medical College/Teaching Hospital, Larkana from January 2008 to December 2008.*
Methodology: *This study based upon the data in which use of alvarado score system was assessed prospectively in a consecutive case series of 140 subjects >12 years of age with right iliac fossa pain with or without features of acute abdomen.*
Result: *Total number of 140 patients were included in this study 95(67.8%) were male and 45(32.1%) female. With male to female ratio was 1.5:1. Among 140 patients 28(20%) were observed with Alvarado score of 4 or below, discharged and advised to follow in the out patient clinic after 24 hours. 43(30.7%) were admitted for observation due to Alvarado score 5-6, 9 patients (20.9%) improved and 34 patients (79%) underwent appendicectomy due to their increased score up to 7 or above.*
Alvarado score of 7 or above were 69 patients (49.2%). All were admitted and underwent appendicectomy but we found perforated or gangrenous appendix in 22 patients (31.8%). Overall rate of negative appendicectomy was in 9 patients (8.5%), in which 3 were male and 6 female.
Conclusion: *In acute appendicitis, Alvarado score can be used as an objective criterion in selecting the patients for admission and conservative or operative treatment. In females adjunct ultrasound abdomen and pelvis should be done to exclude other pathology.*

KEY WORDS: *Appendicitis, Alvarado Score, Diagnosis*

INTRODUCTION

Acute appendicitis is the most common cause of acute abdomen in young adults.[1] Approximately 6% of population will suffer from acute appendicitis during their life time.[2] The diagnosis of acute appendicitis is obvious with history of abdominal pain which start in periumbilical area than shift to right iliac fossa. It is associated with nausea, vomiting, anorexia and some times with low grade fever. Abdominal examination shows tenderness and rebound tenderness at right iliac fossa. The diagnosis of acute appendicitis is difficult in females in their child bearing age[3], specially during pregnancy.[4] To make a definite diagnosis before surgery is impractical[5], but we can reduce the rate of negative appendicectomy by using simple clinical scoring system. There are several scoring systems for diagnosis of acute appendicitis in which Alvarado score is easy, simple and complimentary aid for diagnosis.[6] Alvarado score was first described in 1986[7], having three components as history, clinical examination and few lab tests i.e TLC count (Table I).

If the clinical presentation suggests the diagnosis of acute appendicitis and Alvarado score is 7 or higher surgical consultation is recommended.[8] It has been

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shown that the use of higher score >7, the sensitivity will be 98.3% and specificity will be 69.6%.[6] A negative appendicectomy rate 20-40% has been reported in literature and many would accept rate of 30% as inevitable.[9] The rate of negative appendicectomy is highest (26.5%) in patients with Alvarado score 5-6, similarly rate of negative appendicectomy is much higher in female as compared to male.[10] The purpose of different studies is to facilitate the surgeon's decision because the unnecessary surgical intervention carries the risk of morbidity and mortality.[11]

METHODOLOGY

This was a prospective consecutive case series study conducted in emergency as well as in general surgery department CMC Teaching Hospital Larkana, over a period of 1 year from January to December 2008. Total 140 patients were included with age more than 12 years irrespective of gender.

The data was collected in a proforma specially designed for and the decision of surgery was taken by consultant on call. Alvarado score was applied in all the patients presented with short history of pain in right iliac fossa with or without features of acute abdomen. Patients were categorized into 3 groups according to alvarado score.

Group-I score 4 or below
Group-II score 5-6
Group-III score 7 or above.

Time lapse between admission and surgery was different in different groups of patients. In group III (Alvarado score 7 or above) time duration between admission and surgery was 4-6 hours. In group II (Alvarado score 5-6) patients admitted for observation first and operated if their Alvarado score increased to 7. In this group time lapse was more and ranged between 12-36 hours. For every patient who was admitted CBC and blood chemistry was done. In patients who were 40 years of age or above, ECG and CXR were also advised for Anaesthetic protocol. In few selected patients where findings were equivocal especially in young females, additional ultra-sound abdomen and pelvis was also advised. Diagnosis was confirmed in two stages. First by the intra-operative findings and secondly by histopathology reports. All these patients were followed up in surgical OPD up to 3 months. Descriptive analysis was applied to Alvarado score. Reliability of Alvarado scoring system was asses-sed by calculating the negative appendicectomy rate and positive predictive value. Simple chi-square test was applied to find out the significant relation-ship among negative appendicectomy rate in subjects with different Alvarado score while double classifications test was applied to gender.

Table I. Alvarado Score

Features	Score
Migration of pain RIF	1
Anorexia	1
Nausea / Vomiting	1
Tenderness in RIF	1
Temp. > 37.5C	1
Rebound tenderness in RIF	2
Leukocytosis > 11,000	2
Shift to the left of neutrophills	1
Total	10

RESULTS

Alvarado score was applied on total 140 patients as a criterion for admission, observation and operative treatment. Out of 140 patients, males were predominant 95 (67.8%). Age ranged from 12 to 49 years and mean age was 29 years. The prominent age group was 21-30 years in 52 patients (37.1%), Table II. Over all mean of the Alvarado score was 6.22.

First Group:
(Alvarado score below 4) contained 28 patients (20%). All of these patients were seen in the emergency and discharged to follow up in general surgery out patient clinic after 24 hours. Only 20 patients came in outpatient department out of which 16(80%) were completely resolved and 4 were (20%) admitted for observation. In 2(07%) patients who complained of increased pain and tenderness in right iliac fossa having their Alvarado score increased upto 7. Both underwent for appendicectomy and found inflamed appendix, later on confirmed on histopathology report.

Table II. Demographic data (n=140)

Age Groups	Gender	
	Male (No. %)	Female (No. %)
12-20 Years	29 (20.7)	13 (9.2)
21-30 Years	35 (25)	17 (12.1)
31-40 Years	19 (13.5)	10 (7.1)
> 40 Years	12 (8.5)	5 (3.5)
Total	95 (67.8)	45 (32.1)

Groups	Score	(No. %)
Group I	1	
	2	6 (4.2)
	3	10 (7.1)
Group II	4	12 (8.5)
	5	14 (10)
	6	29 (20.7)
Group III	7	30 (21.4)
	8	25 (17.8)
	9	11 (7.8)
	10	3 (2.1)

Table III. Frequency distribution of subjects with Alvarado Score (n=140)

Second Group:
(Alvarado score 5-6) contained 43(30.7%) patients out of 140 were admitted in surgical ward for observation. After admission, 9(20.9%) patients improved clinically and discharged. In 34 patients (79%) Alvarado score raised 7 and above were operated. In these patients appendix were found normal in 6(17.6%) patients, in which 3 were female (two were having ruptured ovarian cyst and in one patient having ectopic pregnancy). Appendix was also removed in these patients to avoid any confusion or diagnostic difficulty in future due to incision given.

Third Group:
(Alvarado score 7-10) contained 69(49.2%) patients, all were admitted and underwent surgery. During surgery only 3(2.9%) patients were found having normal appendix and 44(63.7%) were acutely inflamed appendix, while in 22(31.2%) patients were found having complicated (gangrenous, perforated and appendicular abscess). Later On histopathological examination proved the above described data. In 25 patients where the diagnosis was difficult ultrasound abdomen and pelvis was done. It was done in 7 males and 18 females and, was normal 2 males and 8 females. Features of acute appendicitis were found in 3 males and 11 females on ultrasonography. Free fluid was found in right lower abdomen in 3 males and 7 females. In 4 females right ovarian cyst was found and 1 patient had ectopic pregnancy. One patient with ectoic pregnancy and 2 patients with ovarian cyst were referred to gynae/ Obs unit, while other 2 patients having ovarian cyst were operated in our unit, because still in these patients, suspicious of acute appendicitis was high. Both were found having inflammed appendix as well. Out of total 1o5 patients operated, the rate of negative appendicectomy was in 9 (8.5%) patients in whom 3 were male and 6 female (Table III and IV). As a whole positive predictive value of Alvarado score was 90.2 while in male (95.3%) and female (81.5%) (Table V). There was significant difference among the negative appendicectomy rate of subjects of group-III and those with group-II and I who got surgery due to their raised Alvarado score.

Suggested Management	Score	Results	Mean Core
Surgery	Group III		
	69+34+2	105(75%)	7.9
Observation	Group II		
	43-34	9(6.4%)	5.6
Discharge	Group I		
	28-2	26(18.5%)	2.8

Table IV. Suggested management after application of Alvarado Score (n=140)

DISCUSSION

Acute appendicitis is the most common acute surgical condition of the abdomen over past 100 years with morbidity and mortality rates related to this condition have markedly decreased. This is because of recognition of deleterious effects of appendiceal perforation, and aggressive surgical treatments strategy involving early operations with acceptance of high negative appendicectomy rate of 15-30% is universal.[12] Alvarado score is an objective assessments of right lower quadrant pain.

Table V. Positive predictive value (n=105)

Gender	Operated No. (%)	Patients	Negative Appendicectomy No. (%)	Positive Predictive Value No. (%)
Male	95	66	3 (4.6)	3 (4.6)
Female	45	39	6 (15.3)	6 (15.3)
Total	140	105	9 (8.5)	9 (8.5)

The score of more than 7 indicates high probability of acute appendicitis. Thus Alvarado score is a practical, reliable and easy to score. With the application of Alvarado scoring system we can decrease the post-operative morbidity and mortality.[13] It can be helpful for safe and accurate decision making in patients with acute appendicitis and it can also categorize the patients for observation. Acute appendicitis is a progressive disease and Alvarado score can easily be repeated to assess the progress of disease after admission on patients who are kept under observation. In equivocal patients, U/S abdomen and pelvis and diagnostic laparoscopy are also the excellent diagnostic tools to be considered.[14] In our study, out of total 140 patients, 95(67.8 %) were male while female were 45(32.1 %) with male to female ratio 1.5: 1. This ratio can be compared with the studies of Arfa[15], Saleem MI[16], and Chan[17], i.e. 0.7: 1, 1.5: 1, 2.85:1, respectively. Our study highlighted the rate of overall negative appendicectomy (9.7 %) but the studies of Chan 2001 and 2003 it was 21%[17], and 13%[17], respectively. The studies of Saleem MI (27.3%)[16], Arfa (15-20%)[15], and Khan (15.6%)[6], had shown greater tendency than ours negative appendicectomy rate, the negative appendicectomy rate in female (18.4%) in our study was almost four times greater than that of male (4.6%). Same trend was seen in other studies e.g. rates of negative appendicectomy in female and male patients were 21 % and 6.3% respectively as reported by Rajan[18], and 17.9% and 12% by Khan.[6] Likewise positive predictive value of our study (90.2%) is greater than that of Khan (84.3%)[6], and this value in males (95.3%) is higher while in females (81.5%) lower than Khan's study i.e. (88%) and (82.1 %), respectively. Rare causes of acute appendicitis were cancer caecum and parasitic infections like Enterobious Vermicularis and Entamoeba histolytica.

Alvarado score has a high diagnostic value in below 4 and above 7. Only 2 patients (having Alvarado score up to 4) out of 28 (7.1%) returned with increasing pain in right iliac fossa having Alvarado score of 7 to whom appendicectomy was performed and found inflammed, unlike the studies of Tade AO from Nigeria[19], where they reported no patient returned with increasing pain in right iliac fossa with Alvarado score less than 5. The current study provided further evidence that the rate of negative appendicectomy with Alvarado score 7-10 was only 4.3% with Alvarado score 7, but the rate of perforated or gangrenous appendicitis increased to 13.5%, mostly with Alvarado score 9. Zero percent negative appendicectomy with Alvarado score 9 was reported by chan.[20] All patients with Alvarado score 5-6 were admitted but 9 patients (20.9%) discharged after observation on improvement and 34(79%) operated because of increase in Alvarado score. Rate of negative appendicitis was highest (17.6%) in this group similarly rate of negative appendicectomy was much higher in female as compared to males. Delay in performing appendicectomy for acute appendicitis had adverse effects in terms of post operative complications but in selective cases delaying appendicectomy for few hours after presentation did not significantly increase the rate of perforation, operative time or length of stay.[21]

Alvarado score described in 1986 had its own limitations. It does not consider age and sex of the patient, and duration of symptoms. In extremes of age, early surgery should be done even if the score is less. There should be separate Alvarado score for males and females because of greater chances of misdiagnosis of acute appendicitis in females.

CONCLUSION

Alvarado scoring system has high diagnostic value 90%. This scoring system is dynamic one, its application improve diagnostic accuracy and sequently reduce the rate of negative appendicectomy.

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