

A STUDY ON EFFICACY OF ALVARADO SCORING IN EARLY DIAGNOSIS OF ACUTE APPENDICITIS

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ABSTRACT

INTRODUCTION

Acute appendicitis is the most common cause of acute surgical abdomen. The diagnosis may be easy but may also be very difficult. Diagnostic difficulties, in patients with atypical clinical findings have resulted in unnecessary appendicectomies which have been variably between 15%-30%. Diagnosis of acute appendicitis remains challenging despite improvement in history taking clinical examination, new computer aided decision support system, clinical diagnostic sourcing and new imaging techniques. Diagnostic scores are useful and easy methods which help in surgical decision to reach. These scores make use of clinical, analytical and radiological findings to produce a rationalized model of clinical decision making. Presently several such diagnostic scoring systems have been proposed to aid the diagnosis of acute appendicitis. The description of Alvarado scoring system introduced in 1986, has greatly improved the ability to diagnose.

AIMS AND OBJECTIVES

To Study the Efficacy of ALVARADO scoring in early clinical diagnosis of acute appendicitis and decrease in morbidity and mortality of patients admitted with abdominal pain subjected to appendicectomy in SVRRGGH Tirupati. To reduce the negative appendicectomy rates by establishing a prompt and correct diagnosis.

METHODOLOGY

A study of 120 patients presenting with pain abdomen and diagnosed provisionally as acute appendicitis was undertaken. Depending on individual presentation, a score was calculated for each case. Operative and conservative intervention was undertaken in patients with scores between 5 and 10 and <5 respectively. The results of scoring system, on table operative findings and HPE, were reviewed.

CONCLUSION

The Alvarado scoring system is a fast, simple, reliable, non-invasive, repeatable and safe diagnostic modality without extra expense and complications. It has greater sensitivity in males.

KEYWORDS

Acute appendicitis, Alvarado score, Sensitivity, Specificity.

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INTRODUCTION: The acute surgical abdomen is an important problem facing surgeons and radiologists alike. The wide range of cause and varied patient presentation pose a formidable diagnostic and therapeutic challenge. As with all new developments however, enthusiasm for the new and modern techniques has sometimes overwhelmed good clinical judgment.

Acute appendicitis is the most common cause of acute surgical abdomen. The overall lifetime occurrence is approximately 12% in men and 25% in women.¹ Classical clinical and laboratory findings usually allow for prompt diagnosis and treatment. However some patients have

atypical and frequently confusing presentation leading to misdiagnosis.

The diagnosis may be easy but may also be very difficult. Diagnostic difficulties, in patients with atypical clinical findings have resulted in unnecessary appendicectomies which have been variably between 15%-30%.² Equally distressing is the fact that perforation may occur up to 25% of cases.³ So traditionally surgeons have accepted higher rate of unnecessary appendicectomies in order to decrease the incidence of perforation. This approach has been increasingly questioned in today's era of cost effective health care. The goal of surgical treatment is removal of inflamed appendix before perforation with minimal number of negative appendicectomies.

Diagnosis of acute appendicitis remains challenging despite improvement in history taking clinical examination, new computer aided decision support system, clinical diagnostic sourcing and new imaging techniques.

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Plain abdominal films and barium studies considered to be of limited value. New technologies could lower the rate of delayed diagnosis. Graded compression ultrasonography in the diagnosis of acute appendicitis has greatly improved the ability to diagnose acute appendicitis with ultrasound.⁴ Ultrasonography is critically operator dependent and care must be taken to avoid over interpretation. Graded compression sonography plays an important role in reducing the number of negative surgical exploration for acute appendicitis. CT scan is complimentary to sonography. However CT scan is associated with greater cost, exposure to radiation and exposure to contrast agents.

Diagnostic scores are useful and easy methods which help in surgical decision to reach. These scores make use of clinical, analytical and radiological findings to produce a rationalized model of clinical decision making. Presently several such diagnostic scoring systems have been proposed to aid the diagnosis of acute appendicitis. The description of Alvarado scoring system introduced in 1986, has greatly improved the ability to diagnose.⁴

In our hospital acute appendicitis remains one of the most common acute abdominal emergencies warranting surgery. In patients with atypical presentation diagnosis becomes very difficult, so Alvarado scoring system and ultrasonography play a definitive role in the diagnosis of acute appendicitis.

AIMS AND OBJECTIVES:

1. To Study the Efficacy of ALVARADO scoring in early clinical diagnosis of acute appendicitis and decrease in morbidity and mortality of patients admitted with abdominal pain subjected to appendicectomy in SVRRGGH Tirupati.
2. To reduce the negative appendicectomy rates by establishing a prompt and correct diagnosis.

Acute Appendicitis-Aetiology: There is no unifying hypothesis regarding the aetiology. The following factors are contributory.⁵

Age: Acute appendicitis is relatively rare in infants, and becomes increasingly, common in childhood and early adult life with Peak incidence in teens, early 20s. After middle age the risk of developing appendicitis is small

Sex: The incidence is equal in both sexes before puberty. Males are affected more commonly than females 3:2 at age 25, thereafter, the greater incidence in male declines.

Race: More in highly civilized European, American and Australian countries. Rare in Asiatic

Dietary Factors: More common in those who consume low fiber diet and increased consumption of refined carbohydrate.

Social Status: more common among the upper and middle classes than the labourers.

Familial Susceptibility: This is unusual, but generally well accepted fact, could be accounted for by, an inherited

malformations of organs, which predisposes to infection and similar diet consumption among the family members.

Obstruction of lumen of the appendix: The obstructing agent is usually a faecolith rarely foreign body or pinworm (*Oxyuris vermicularis*). Fibrotic stricture.

Carcinoma caecum is an occasional cause of acute appendicitis in middle aged and elderly patients.

Abuse of Purgatives: It is abundantly clear that the ingestion of purgatives particularly castor oil by patients with abdominal pain causes the violent peristaltic action which results, favours and often determines, perforation of an inflamed appendix.

Pathology: It is of great importance to recognize two types of acute appendicitis.

A. Non-obstructive [catarrhal] acute appendicitis:

The inflammation usually commences in the mucous membranes, less often in the lymph follicles and can terminate in one of the following ways.

- Resolution.
- Ulceration.
- Suppuration.
- Fibrosis.
- Gangrene.

B. Obstructive acute appendicitis: About two thirds of the cases belong to this group. The obstruction can be:

- In the lumen-faecolith, foreign body, parasites.
- In the wall-inflammatory, direct occlusion by the carcinoma caecum.
- Outside the wall-adhesions, and kinking.

In obstructive appendicitis the inflammatory products pent up so that inflammation proceeds more rapidly and more certainly to gangrene or perforation. [Usually 12 – 18 hrs]

Complications:

- Perforation of appendix leads to generalized peritonitis.
- Localized abscess formation.
- Abscess may perforate into rectum or vagina.
- Fistula between appendix and bladder or elsewhere in the gastrointestinal tract.
- In women the end result of perforation of appendix can be tubal adhesions and infertility.

Pathological types of appendicitis:

1. Catarrhal appendicitis.
2. Acute diffuse appendicitis.
3. Acute follicular appendicitis.
4. Gangrenous appendicitis.
5. Perforative appendicitis.

Non-Obstructive appendicitis: This is a less common and less serious variety. In this the mucopurulent products of inflammation have an opportunity of escaping along the

lumen into the caecum. Nevertheless all grades of inflammation occur and perforation may occur through one or more of the hiatuses where the blood vessels pierce the muscularis to reach the sub peritoneal plane where it spreads under tension and a purulent blister is liable to form leading to perforation. As a rule the inflammation progresses sufficiently slowly, so that protective adhesions develop and resulting peritonitis is localized. Because the tip suffers most, fibrosis usually occurs therein. Rarely proximal end is involved in ulceration, fibrosis and the stricture thus formed predisposes to future attacks of acute appendicular obstruction.

Appendicitis terminates in one of the following ways:

1. Resolution.
2. Ulceration.
3. Suppuration.
4. Fibrosis.
5. Gangrene.

Diagnosis of appendicitis: The diagnosis of appendicitis traditionally has been based on patient history and physical examination.⁶ An elevated white blood cell count has a low predictive value for appendicitis because it is present in a number of conditions.⁷ Total blood count and urine analysis should be done in all cases. The methods used currently for diagnosis are reviewed below. Clinical signs to be elicited in appendicitis:

Pointing sign⁸: Palpate superficially starting from left iliac fossa and move in anti-clock wise direction to right iliac fossa. We can detect maximum point of tenderness classically at Mc Burney's point (junction of medial 2/3rds and later 1/3 of spinoumbilical line) with localized muscle guarding.

Rovsing's sign⁹: Deep palpation of left iliac fossa may cause pain in the right iliac fossa.

Psoas sign: occasionally on inflamed appendix lies on the psoas muscle of the patient, often a young adult, lies with right hip flexed for pain relief. The patient is turned to the left and right hip joint is hyper extended which makes the muscle taut and initiates pain in retrocaecal appendicitis.

Obturator sign: Spasm of obturator internus is demonstrable when the hip is flexed and internally rotated. This will produce pain in the hypogastrium in pelvic appendicitis due to contact of inflamed appendix with obturator internus.

Baldwing's test: A hand is placed over the right flank and asked the patient to raise the right lower limb off the bed keeping the knee extended. The patient will immediately complain of pain in retrocaecal appendicitis due to contact with psoas major muscle.

Dunphy sign: increased pain in right lower quadrant with coughing.

Kocher's (Kosher's): From the history given, the appearance of pain in periumbilical region at the beginning of disease with a subsequent shift to the right iliac fossa.

Sitkovsky (Rosenstein's) sign: Increased pain in right iliac region as the patient lies on his/her left side.

Bloomberg's Sign: Also referred as rebound tenderness. Typical in retrocaecal appendicitis, deep palpation of viscera are the suspected inflamed appendix followed by sudden release of pressure will produce severe pain.

Ligat' sign: Hyperesthesia in Sherren's triangle [Formed by lines joining umbilicus right anterior superior iliac spine and pubic symphysis] is an occasional but inconstant accompaniment of gangrenous appendicitis.

Bartomier–Michelson's Sign: Increased pain on palpation at the right iliac fossa as the patient lies on her left side compared to when patient was on supine position.

Rectal examination: It is indicated primarily to exclude lesions such as ovarian cyst or tubal pathology in females and to elicit tenderness in cases of pelvic appendicitis. In about 1 in 3 patients with inflamed appendix, in or adjacent to the pelvis, the presence of mass or tenderness specifically localized to the right side may be elicited. In a few subjects whose inflamed appendix lies entirely within the pelvis, tenderness on rectal examination may be the only positive physical sign.

Diagnostic Scores¹⁰: Despite advances in other diagnostic modalities, appendicitis remains a diagnosis based primarily on the history and physical examination. A normal appendix is removed at 10- 20% of cases. A number of clinical and laboratory based scoring system have been devised to assist diagnosis. The most widely used is Alvarado score, which was based on a retrospective analysis of 305 patients with abdominal pain suspicious of appendicitis. Among many of these scoring systems Alvarado scoring system is simple, cheap and easily applicable. The authors believed that the adequate scoring system should fulfil the following criteria.

- A negative appendicectomy rate less than 15%.
- A perforated appendix rate less than 35%.
- A missed perforation rate less than 15%.
- A missed appendicitis rate less than 5%.

ALVARADO scoring system^{10,11}: Alvarado followed up patients admitted to surgical unit at the Nazareth hospital in Philadelphia with suspected acute appendicitis until surgery confirmed or refuted diagnosis. Alvarado found that eight criteria had high diagnostic accuracy for acute appendicitis. It is based on three symptoms, three signs and two laboratory findings.

Symptom	Score
Migratory RIF Pain	01
Anorexia	01
Nausea / vomiting	01
Signs	
Tenderness in RIF	02
Rebound tenderness	01
Elevated Temperature	01

Laboratory findings	
Leukocytosis	02
Shift to left (segmented neutrophils)	01
Total score	10

INTERPRETATION:

- Score of <5: appendicitis unlikely.
- Score of 5-6: appendicitis possible.
- Score of 7 -8: appendicitis likely.
- Score of 9-10: appendicitis highly likely.

From a total possible score of 10, one study recommended further investigation with CT scan for a score of 4-6, and consideration of appendectomy for scores of 7 and above.

IMAGING MODALITIES¹²:

- Plain Radiography.
- Barium meal follow through.
- Barium enema.
- Ultra sound.
- Radio isotope scanning.
- Color Doppler.
- CT Scanning.

Diagnostic Laparoscopy¹³:

Treatment: All suspected cases should be admitted to hospital. Appendectomy is the treatment of choice and is increasingly done as a laparoscopic procedure. The traditional treatment of acute appendicitis is appendectomy. Maybe performed by conventional open operation or by using laparoscopic techniques. Urgent operation is essential to prevent the morbidity and mortality of perforation and peritonitis. While there should be no delay, all patients particularly those at risk of serious morbidity benefit from a short period of intensive preoperative preparation which includes.

- Intravenous fluids.
- IV antibiotics.

Appendectomy:

- Conventional appendectomy.
- Laparoscopic Appendectomy.

Complications of appendectomy:**Immediate:**

- Wound infections occur in 5 to 10% of cases.
- Pelvic abscess is likely after removal of a perforated pelvic appendix.
- Paralytic ileus for a brief period is to be expected.
- Faecal fistula from the appendicular stump rarely occurs.
- Portal pyemia is a rare but very serious complication of gangrenous appendicitis.
- Venous thrombosis and embolism can occur in elderly and women taking oral contraceptive pill.

Delayed:

- Intestinal obstruction due to a local adhesive band.
- Right inguinal hernia due to injury to the ilio-inguinal nerve.

PATIENTS AND METHODS: This study was performed on 120 patients who attended the general surgery department of SVRRGG hospital, with the clinical diagnosis of acute appendicitis, during the period from December 2012 to September 2013.

Patients above 13 years and both genders presenting to the emergency department within the right lower quadrant of abdomen were included in the study. Patients with presentation of urological, gynecological surgical problems other than appendicitis and patients with mass in the right iliac fossa were excluded from the study.

All included patients were initially assessed and base line investigations were done. Then a specially proforma was filled in for each patient. These proforma had general information about the patient plus eight variables based on ALVARADO scoring system. Then the sum of all these scores were calculated for each patient and based on the results patients were divided into three groups.

1. Score 7-10(Emergency Surgery Group): These patients were prepared and all underwent emergency appendectomy.

2. Score 5 to 6 (Observation Group): These patients were admitted and kept under observation for 24 hours with frequent re evaluation of the clinical data and re application of the score, condition of some patients was improved shown by a decreasing score and there after they were discharged with instructions that they should come back if symptoms persist or increase in severity.

3. Score 1 to 4 (Discharge Home Group): These patients after giving initial symptomatic treatment were discharged and sent home with instructions to come back if symptoms persist or condition become worse.

The diagnosis of acute appendicitis was confirmed by operative findings and histopathological assessment of the appendectomy specimen.

Finally the reliability of ALVARADO scoring system was assessed by calculating negative appendectomy rate and positive predictive value.

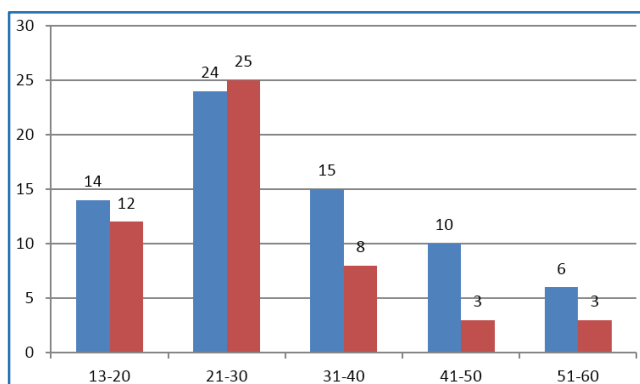
OBSERVATION AND RESULTS: In the study in 120 consecutive patients with clinical features suggestive of acute appendicitis, 69 were male and 51 were female. Most of the patients were younger age group.

In the present study, the minimum age was 13 years and the maximum age was 60 years. The numbers of patients were highest in the age group 21-30 (49%) years followed by 13-20(26%) years. The least was in the age group of 51 to 60(9%) years. Out of the 120 patients, 51 were female (42.5%) and 69 were male (57.5%). The male to female ratio was 1.3:1. Mean age was 34.8 years (with median age of 27 years). Most of the patients were of younger age group. This result shows that there is predominance in the

younger age group and the incidence peaks around 10 to 30 and decreased as age progressed.

Age	Male	Female	Total
13-20	14	12	26
21-30	24	25	49
31-40	15	8	23
41-50	10	3	13
51-60	6	3	9
Total	69	51	120

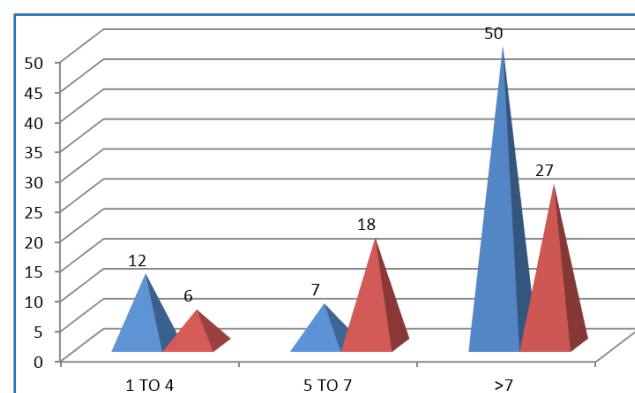
Table 1: Age and sex distribution



Graph 3: Frequency distribution of patients according to Alvarado

ALVARADO scores	Male	Female	Total	%
1 to 4	12	6	18	15%
5 to 7	7	18	25	20.83%
>7	50	27	77	64.17%
Total	69	51	120	100%

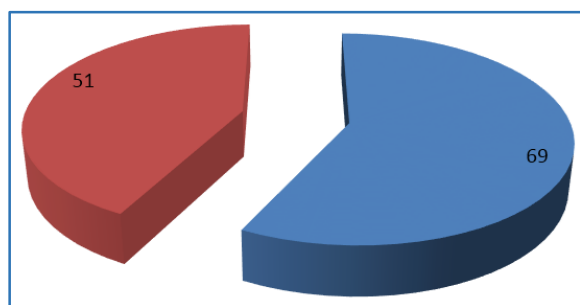
Table 4: Results of application of alvarado score



Graph 4: Results of application of alvarado score

Male	Female
69	51

Table 2: Sex distribution



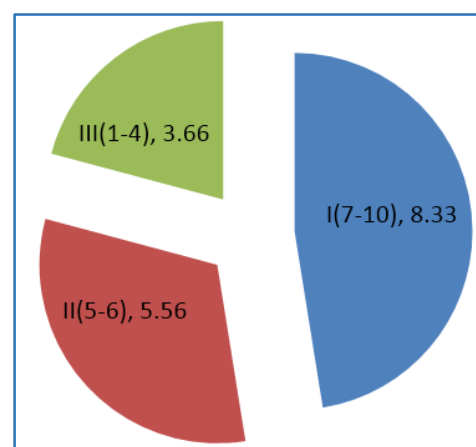
Graph 2: Sex distribution

ALVARADO score	% of patients
1	0
2	0
3	6
4	12
5	11
6	14
7	13
8	36
9	17
10	11

Table 3: Frequency distribution of patients according to Alvarado score

Group score	Mean
I(7-10)	8.33
II(5-6)	5.56
III(1-4)	3.66

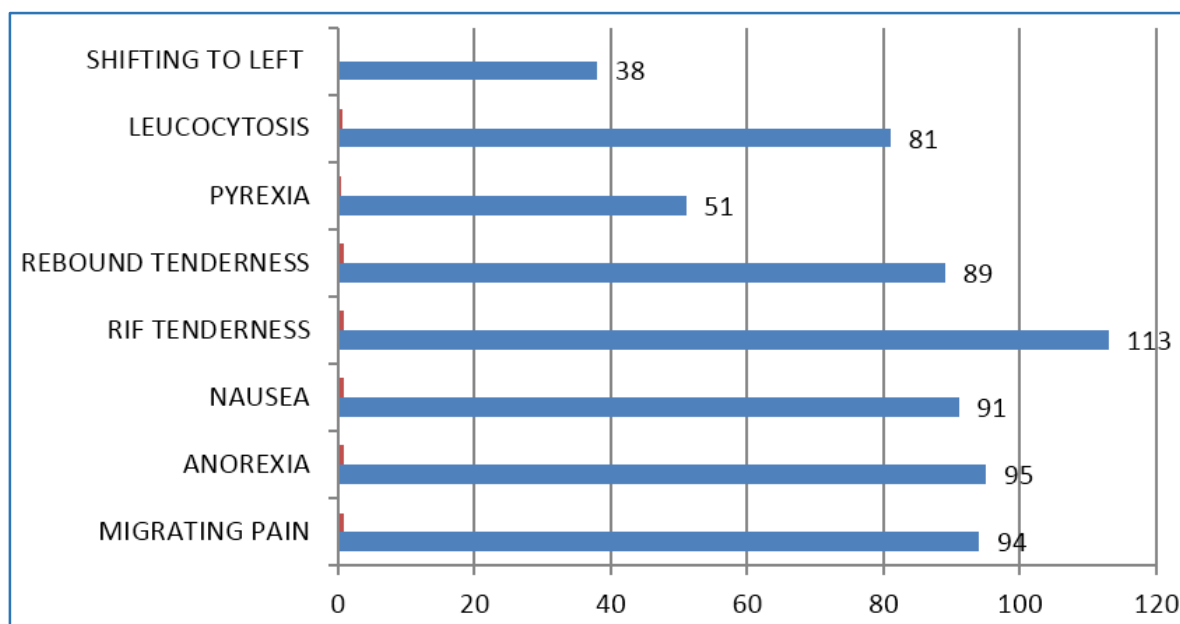
Table 5: Mean scores of different groups



Graph 5: Mean scores of different groups

ALVARADO components	No. of cases	%
Migrating pain	94	78.30%
Anorexia	95	79%
Nausea	91	75.8%
Rif tenderness	113	94%
Rebound tenderness	89	74.20%
Pyrexia	51	42.5%
Leucocytosis	81	67.50%
Shifting to left	38	31.60%

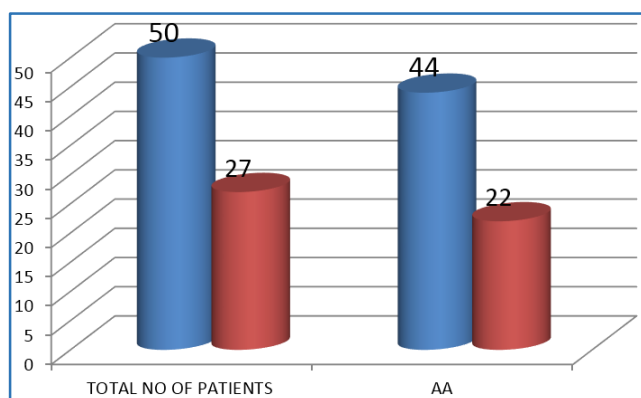
Table 6: Individual features of the Alvarado score



Graph 6: Individual features of the alvarado score

Sex	Total no. of patients	AA
Male	50	44
Female	27	22
Total	77	66

Table 7: Results of group I (score 7–10)

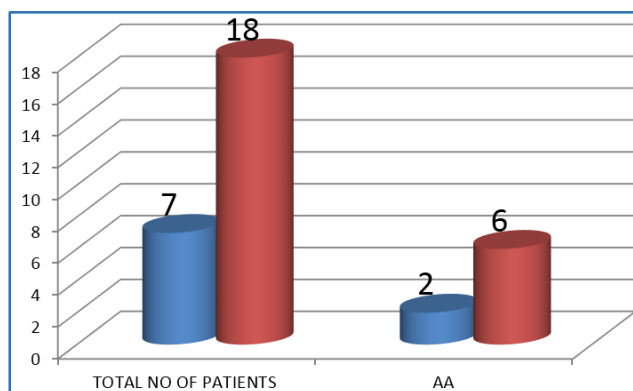


Graph 7: Results of group I (score 7–10)

In 77 patients (64.1%) the score was found to be 7 or more. All were admitted and underwent appendectomy. Among them 50 were male (65%) and 27 females (35%). Operative findings and histopathological reports showed that 66 patients had inflamed appendix and 11 had normal appendix.

Sex	Total no. of patients	AA
Male	7	2
Female	18	6
Total	25	8

Table 8: Results of group II (score 5–6)



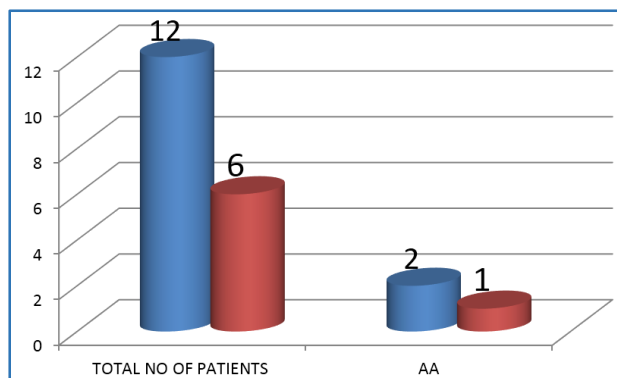
Graph 8: Results of group II (score 5–6)

25 patients (20.8%) had a score of 5-6; all were admitted for observation and regular re-evaluation. This group comprised of 18 female (72%) and 7 male (28%) patients. 16 patients ended up in a score of 6 or less after 24 hours and therefore they were discharged. Only 9 patients had increased severity of symptoms with score 7 and more on re-evaluation with in the first 24 hours.

These 9 patients underwent appendectomy. Operative findings and histopathological reports showed that 8 patients had inflamed appendix and the remaining 1 patient had normal appendix.

Sex	Total no. of patients	AA
Male	12	2
Female	6	1
Total	18	3

Table 9: Results of group III (score 1–4)



Graph 9: Results of group III (Score 1 – 4)

There were 18 patients (15%) with ALVARADO score of 1-4. Among them 6 were female (33.3%) and 12 were male (66.6%). All of them were discharged after initial assessment and symptomatic treatment. 3 of them came back with increased severity of symptoms and score of 7 or more within 48 hours. They were admitted and all of them underwent appendectomy. Operative findings and histopathological report showed that all the 3 patients had inflamed appendix.

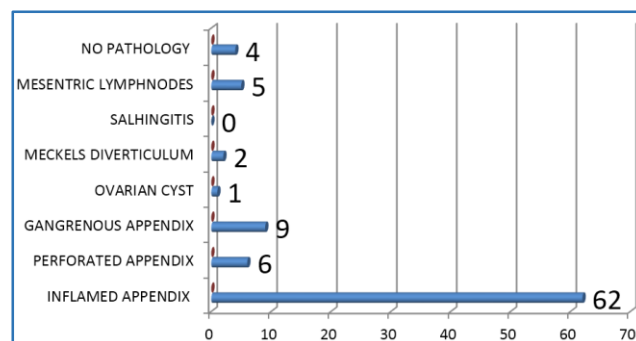
Total number of surgeries performed in this study was 89 (74.1%). Among these patients 35 were female and 54 were male. Operative findings and histopathological reports showed that 77 patients (88.8%) had inflamed appendix including 29 female patients and 48 male patients. Among all surgeries performed 6 patients (6.7%) had perforated appendices, 9 patients (10%) had gangrenous appendices and none of them were missed by Alvarado score and all were operated. The negative appendectomy rate in our study was 13.48%. The negative appendectomy rates for males and females were 11.11% and 17.14% respectively. The sensitivity of Alvarado scoring system was 96% and the specificity was around 72%. The positive predictive value of the scoring system was 86%.

Findings	No. of patients	Percentage
Inflamed appendix	62	69.6%
Perforated appendix	6	6.74%
Gangrenous appendix	9	10%
Ovarian cyst	1	1.12%
Meckels diverticulum	2	2.24%
Salhngitis	0	0
Mesentric lymphnodes	5	5.61%
No pathology	4	4.49%
Total operated	89	

Table 10: Statistical results of the study

Sensitivity	96%
Specificity	72%
Positive Predictive Value	86%

Table 11: Final diagnosis (operative findings + histopathology)



Graph 10: Final diagnosis (operative findings + histopathology)

DISCUSSION: Acute Appendicitis is the most common acute surgical condition of the abdomen. Over past 100 years, the morbidity and mortality rates related to this condition have markedly decreased. This is because of the recognition of deleterious effects of appendicular perforation. Thus an aggressive surgical treatment strategy involving early operation with acceptance of a high negative appendectomy rate of 15% to 30% is universal. Although the negative appendectomy has negligible mortality, it has associated morbidity rate of 10%. The diagnostic accuracy of clinical assessment of acute appendicitis varies from 50%-80%. The series from US Naval Hospital, San Diego, California, revealed an accuracy of 87%. The clinical diagnosis is especially difficult in the very young, the elderly and in the women of reproductive age group.

Appendicitis still poses a diagnostic challenge and many methods have been investigated to try to reduce the removal of a normal appendix without increasing the perforation rate. Radiological methods such as ultrasonography and computed tomography, as well as laparoscopy are all methods that have been investigated previously. Many diagnostic scores have been advocated but most are complex and difficult to implement in a clinical situation. The Alvarado score, first described in 1988, is a simple scoring system. Good clinical acumen remains the mainstay of correct diagnosis of appendicitis. It is a scoring system that can be instituted easily in the outpatient setting and a cheap and quick tool to apply in the emergency room Alvarado Score is an objective assessment of right lower quadrant pain. The score indicated ≥ 7 indicates high probability of acute appendicitis. Practically speaking, it is equivalent to one's degree of clinical suspicion. Therefore this scoring system was used to reach the clinical diagnosis. It was considered that use of the scoring system to make the clinical diagnosis would allow uniformity as more than one senior surgical resident were involved in making the decision.

In this study, the youngest patient was 13 years and the oldest being 60 years. Men accounted for 58% and women 42% of the study group. The maximal incidence of acute appendicitis was found between the ages 21-30 years which is comparable with the literature. In the study by Ohmann

et al¹³ the negative appendectomy rate was 14.3%. In this study the negative appendectomy rate was 13.5% with the rate being higher in females (17.14%) than males (11.11%). Removal of some normal appendices is bound to lower the rate of perforation and consequent mortality. Literature shows that if negative appendectomy rate is less than 10-15%, then the surgeon is operating on too few patients thus increasing the risk of complications. Some centers have even reduced negative appendectomy rates to less than 10% by having regular audit of appendicectomies.

In the present study the perforation rate was 6.74 % and all the 6 cases of perforative appendicitis had scores 7 or more and were subjected to surgery thereby giving a 0% missed perforation rate. Ohmann C et al¹³ in their study on diagnostic scores for acute appendicitis measured the main outcome of Alvarado score and showed an initial negative appendectomy rate less than 15%, perforation rate less than 35% and a missed perforation rate less than 5%. The results of our study are comparable to that of Ohmann C et al¹³. The missed appendicitis rate in our study was 5.5%. The 3 cases which were missed initially came back with increased severity of symptoms and had a higher Alvarado score on re-evaluation and were operated. The probable reason for the 3 false negatives in our study may be the very early stage of acute appendicitis they might have presented initially, thereby hindering the clinical diagnosis.

In this study the sensitivity, specificity and positive predictive value were 96%, 72% and 86% respectively. The positive predictive value was 86.95% in males as compared to 81.57% in females, resulting in higher diagnostic accuracy in males. This study also shows that application of Alvarado scoring system in the diagnosis of acute appendicitis can provide a high degree of positive predictive value and thus diagnostic accuracy. Positive predictive value shown by this study is comparable with the studies done by M Kalan¹⁴ reported 87.5%.

This study also revealed that Alvarado scoring system is more helpful in male patients by showing lower negative appendectomy rate and high positive predictive value for male patients as compared to females. In females, additional investigations and even a diagnostic laparoscopy may be helpful to confirm the diagnosis of acute appendicitis as supported by the study conducted by Lampreali et al¹⁵ as a prospective evaluation of the combined use of the modified Alvarado score with selective laparoscopy in adult females. The negative appendectomy rate in females came down to 0% with the use of laparoscopy in their study. Other studies also support this observation.

Operated Cases	Total	Male	Female
Biopsy positive	77	48	29
Biopsy negative	12	6	6
Total	89	54	35

Table 12: Correlation of Alvarado score with histopathology reports

CONCLUSION: In the present study we had 120 cases out of which 69 were males and 51 were females. In this study 89 were operated and acute appendicitis was found in 77 patients including 29 female patients and 48 male patients. So to conclude

- Alvarado Scoring System has a high sensitivity and Positive predictive value.
- This scoring system is a dynamic one, allowing observation and critical re-evaluation of the evolution of the clinical picture.
- Its value in decision making is high both in males and females. However in females because infection is multifactorial in origin, diagnostic laparoscopy.
- If possible should be done before scheduling for surgery to minimize the high negative appendectomy rate.
- Its application improves diagnostic accuracy and consequently reduces negative exploration and complication rates.
- This scoring system is quick and cost effective and it can be useful in any district hospitals or day care centre as an adjunct to clinical diagnosis.

SUMMARY: 120 cases with a clinical diagnosis of acute appendicitis were studied for evaluation of the Alvarado scoring system from November 2012 to July 2013.

1. In this study, 69 patients (57.5%) were male and 51 patients (42.5%) were female.
2. In this study, maximum patients were from age group 21-30 years who accounted for (49 %) followed by 10-20 years age group (26%) and least number of patients in the 51-60 years age group (9%)
3. There were 18 patients with Alvarado score 1-4 with 6 females (33.3%) and 12 males (66.6%).
4. Among the patients with the score 1-4 who underwent appendicectomy, histopathological report of inflamed appendix was seen in 2 male (66.6%) and 1 female (33.3%).
5. There were 25 patients (20.8%) with Alvarado score 5-6 with 18 females (72%) and 7 males (28%).
6. In 9 Patients with a score of 5-6 who underwent appendicectomy, histopathological report of inflamed appendix was seen in 6 patients with 2 males and 6 females, and normal appendix in 1 patients.
7. In 77 patients (64.1%) the score was 7-10 with 27 females (35%) and 50 males (65%).
8. 77 patients (100%) underwent appendicectomy. the histopathology showed inflamed appendix in 66 patients with 44 males and 22 females, and normal appendix in 11 patients.
9. 89 patient underwent appendicectomy with histopathological confirmation of inflamed appendix in 77 patients including 29 females and 48 males.
10. 6 patients (6.7%) had perforated appendices and 9 patients (10%) had gangrenous appendices.
11. Of the patients with normal appendix; 1 patients (1.12%) had Ruptured Ovarian cyst, 2 patients (2.24%) had Meckels diverticulum, mesenteric lymphadenitis in 5 cases (5.61%) and no pathology was found in 4 patients (4.49%).
12. The negative appendectomy rate in this study was 13.48% (male 11.11 %, female 17.14%).
13. The sensitivity and specificity of the Alvarado scoring system was 96% and 72% respectively.

14. The positive predictive value of the scoring system was 86% in this study and was higher in males than in females.

REFERENCES:

- Hordin DM. Acute appendicitis: Review and update. *Am Fam physician* 1999;60:2027-34.
- Hoffmann J, Rasmussen OO. Aids in the diagnosis of acute appendicitis. *Br S Surg* 1989;76:774-9.
- Bernard M Jaffe, David H Berger. The appendix in Schwartz's. principles of surgery, McGraw Hill. 2010;9th edition:1119-1137.
- Puylaaert JB. Acute appendicitis: ultrasound sonography evaluation using graded compression. *Radiology* 1986;158:35-60.
- Prystosky JB, Pugh CM, Nagle AP. Current problems in surgery appendicitis. *Curr Probl Surg* 2005;42:688-742.
- Gladman MA, Knowles CH, Glandman LJ, et al. Intra operative culture in appendicitis: traditional practice challenged. *Ann R Coll Surg Engl* 2004;86:196-201.
- Flum DR, Koepsell T. The clinical and economic correlates of misdiagnosed appendicitis. *Nationwide analysis Arch Surg* 2002;137:799-804.
- Birnbaum BA, Wilson SR. Appendicitis at the millennium. *Radiology* 2000;215:337-48.
- Lumley JS. Hamilton Bailey's demonstration of physical signs in clinical surgery. Oxford: Hodder ARNOLD publication, 1997;18th ed.
- Benjamin IS, Patel AG. Managing acute appendicitis. *BMJ* 2002;7363:505-6.
- Alvarado A. A practical score for the early diagnosis of acute appendicitis. *Ann Emerg Med* 1986;15:557-564.
- Khan I, Rehman A. Application of alvarado scoring system in diagnosis of acute appendicitis. *J Ayub Med Coll Abbottabad* 2005;17(3).
- Ohmann C, Yang Q, Pranke C. Diagnostic scores for acute appendicitis: abdominal pain study group. *Eur J Surg* 1995;161:273-81.
- Kalan M, Rich AJ, Talbot D, et al. Evaluation of the modified alvarado score in the diagnosis of acute appendicitis: a prospective study. *Ann R Coll Surg Engl* 1994;76:418-419.
- Lamparelli M. A prospective evaluation of the combined use of the modified alvarado score with selective laparoscopy in adult females in the management of suspected appendicitis. *Ann R Coll Surg Engl* 2000;82(3):192-95.