A Relationship between Clinical Diagnosis, Modified Alvarado Score and Histopathological Findings in Acute Appendicitis

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ABSTRACT

INTRODUCTION: Acute appendicitis is a common surgical condition; yet its diagnosis can be elusive at times and missed diagnosis can lead to attendant complications of perforation and its sequelae. Decision-making in patients with acute appendicitis poses a diagnostic challenge worldwide. The Modified Alvarado Scoring System (MASS) has been reported to be a cheap and quick diagnostic tool in patients with acute appendicitis. The aim of this study was to investigate the accuracy of clinical diagnosis and Modified Alvarado score in acute appendicitis.

METHODS: A prospective observational study was carried out from July 2012 to December 2013 in the surgery department of Bir Hospital and a total of 100 cases of acute appendicitis were enrolled. MA score, were computed for each patient; the suggested cutoff values by the authors of this score were used to find out the accuracy These patients underwent surgery and specimen was sent for histopathological examination. The clinical finding and histopathological report was correlated finally. Data was processed by SPSS software and Microsoft excel.

RESULT: Total of 100 of AA, 69% were male and 31% were female. The age group presenting maximum number of cases (49%) was in age group of 15 to 24 years. Acute appendicitis was confirmed in 90% of these patients. MAS between 7 to 9 had confirmed AA in 96% where as 5 to 6 had AA in 82.4% MAS between 0 to 4 had acute appendicitis in 20%. The Sensitivity and specificity for MAS were 86.2% and 72.72% respectively with PPV 96.15% and NPV 40%. The PPV for clinical diagnosis was 88.77%.

CONCLUSION: In the diagnosis of acute appendicitis, the modified Alvarado score is a fast, simple, reliable, noninvasive, and safe diagnostic modality without extra cost and complications. The application of this scoring system improves diagnostic accuracy and consequently reduces negative appendicectomy and thus reduces complication rates.

KEY WORDS: Acute Appendicitis(AA), Modified Alvarado Score(MAS),

INTRODUCTION

Acute appendicitis is one of the most common causes of abdominal surgical emergencies with a lifetime prevalence of approximately 1 in 7 worldwide. It is associated with high morbidity and occasionally morbidity related to failure of making an early diagnosis. It has been estimated that approximately 6% of the population will suffer from acute appendicitis during their lifetime; therefore, much effort has been directed toward early diagnosis and intervention

Acute appendicitis refers to acute inflammation of the vermiform appendix which is a blind ended tubular structure arising from the caecum at the convergence of taenia coli. Appendicitis accounts for over 3% of the diseases that involve the digestive system and appendectomy is the fifth most common surgical procedure performed on the gastrointestinal tract

There have been numerous advances in the diagnosis and treatment of appendicitis. Nonetheless, acute
Appendicitis continues to challenge surgeons to this day. The cornerstone of the diagnosis of acute appendicitis has traditionally been the combination of history and physical examination. Although the decision to explore a patient with suspected AA is based mainly on disease history and physical findings, the clinical presentation is seldom typical.

Diagnostic errors are common, resulting in a median incidence of perforation of 20% and a negative laparotomy rate ranging from 2% to 30%. Prompt diagnosis of AA is rewarded by a marked decrease in morbidity and mortality. As the consequences of missed diagnosis are dire, the common surgical practice has been to operate on doubtful cases rather than to wait and see until the diagnosis is certain. This resulted in negative appendicectomy rate of 20 to 30% and has been considered acceptable.

However, this concept is being challenged at present day of quality assurance. Many scoring systems for the diagnosis of acute appendicitis have been tried, but most of these are complex and not feasible in emergency setting. The modified Alvarado scoring system (MASS) has been shown by recent studies to be easy, simple and cheap diagnostic tool for supporting the diagnosis of acute appendicitis especially for junior surgeons.

Classic Alvarado score included shift to left of neutrophil maturation (score 1) yielding a total score of 10. However, Kalan et al. omitted this parameter which was not routinely available in many laboratories and produced a Modified Alvarado score with an aggregate score of 9.

Several authors have studied the utility of CT scan in improving diagnosis of acute appendicitis. Some authors found that the use of CT scan was associated with an overall lower negative appendectomy rate for females, especially in the < 5 years and > 45 years age categories and concluded that use of CT was associated with lower rate of negative appendectomy, depending on patient age and sex. However others found that neither CT nor USG improved the diagnostic accuracy or the negative appendectomy rate; in fact, they may delay surgical consultation and appendectomy.

In our setup also the accurate diagnosis of acute appendicitis continues to be perplexing. This is more so as the diagnosis of acute appendicitis is more often delegated to the most junior member of the surgical team. Usually the clinical impression of the operating surgeon is the decisive factor in opting for surgical exploration. Scoring systems have only been used as adjuncts and to reinforce the clinical impression. Moreover advanced imaging systems are not easily accessible and add to the costs significantly.

This study is done with a view that the combination of clinical diagnosis and Modified Alvarado score is a better option for the diagnosis of acute appendicitis.

**METHODS**

All the data were collected using a structured Proforma covering the relevant details. All the personnel involved in the study were given proper orientation on criteria for patient selection and data collecting methodology. Patients fulfilling the inclusion criteria were explained about the nature of the study and informed written consent was obtained from those willing to get enrolled.

Patients admitted through SOPD/ ER with the clinical diagnosis of acute appendicitis were included in the study; those who were managed conservatively were excluded. Routine investigations including WBC counts and urine analysis were performed for each. These patients underwent ultrasonography of abdomen and pelvis.

Modified Alvarado score was computed for each of the admitted patients. The decision to operate was made on the basis of physical examinations, laboratory reports and Modified Alvarado scores.

All operated specimens were sent for histopathological examination, the results were taken as the final diagnosis. The results of Modified Alvarado score were appraised by comparing the results of clinical diagnosis, operative findings and histopathology reports.

Datas were tabulated and interim analysis was performed and any discrepancies will be sorted out after consultation with the thesis guide. SPSS program will be used for data analysis. Results will be presented in tables, graphs and diagrams. Appropriate statistical tests will be performed and the statistical significance of the results will be assessed. For the purpose of this study a 95% confidence interval will be accepted and a p value <0.05 will be taken as significant.
RESULTS

Figure 1:
In our study 99% of patients presented with RIF pain, 88% had nausea and vomiting, 74% had migratory RIF pain, 55% had anorexia and 38% had fever. The most common presenting symptom was right iliac fossa pain and least common symptom was fever.

Figure 2:
All patients enrolled in the study had RIF tenderness, 97% had RIF Rebound tenderness, 65% had RIF guarding, 56% had Rovsing’s sign, 27% had psoas sign and 10% had obturator sign. The most common observed sign was right iliac fossa tenderness and least common observed sign was obturator sign.

Figure 3:
In this study 100% of the patients had neutrophilia, 87% had normal urine RME, 77% had leukocytosis and 75% had positive USG findings.

Table 1. Modified Alvarado Score
<table>
<thead>
<tr>
<th>Modified Alvarado Score</th>
<th>No of patients</th>
<th>Acute appendicitis</th>
<th>Normal appendix</th>
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<tr>
<td>7-9</td>
<td>78</td>
<td>75</td>
<td>96.2</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>3</td>
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<td>5-6</td>
<td>17</td>
<td>14</td>
<td>82.4</td>
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<td></td>
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<td></td>
<td>3</td>
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<tr>
<td>0-4</td>
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</table>

78 patients had MAS was between 7 to 9, out of them 75 patients (96%) had acute appendicitis 3 patients (3.8%) had normal appendix. 17 Patients had MAS 5 to 6, among them 14 patients (82.4%) had acute appendicitis, 3 patients (17.6%) had normal appendix. 5 patients had MAS between 0 to 4, and among them 1 patient (20%) had acute appendicitis and 4 patients (80%) had normal appendix.

Table 2. Operative diagnosis
<table>
<thead>
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<th>Modified Alvarado Score</th>
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<th>Normal appendix</th>
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<td>10.0</td>
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</table>

In this study 10% of patients were found to have either normal appendix or other pathology. Among them 2 patients had ovarian cyst, 1 had perforated Meckel’s diverticulum, 1 had mesenteric lymphadenitis, 1 had caecal mass and in 5 patients no pathology was found.
90% of the patients actually had acute appendicitis and 10% was not found to have appendicitis.

In MAS 78% was diagnosed for acute appendicitis and 22% had normal appendix. 90% of patients operated for appendicitis had actually AA and 10% had normal appendix. 87% was confirmed for AA by HPE and HPE showed normal appendix in 11% of patients.

<table>
<thead>
<tr>
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<th>HPE</th>
<th>MAS</th>
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<tbody>
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<td>Acute Appendixitis</td>
<td>Acute Appendixitis</td>
<td>Acute Appendixitis</td>
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<tr>
<td>Normal Appendix</td>
<td>Normal Appendix</td>
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<tr>
<td>Total</td>
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* Fisher’s Exact test

Table 3: MAS compared to HPE

DISCUSSION

Acute appendicitis is one of the most common surgical emergencies. Patients with acute appendicitis may present with different signs and symptoms varying from non-specific vague abdominal pain to typical findings of right lower quadrant pain, tenderness and rebound tenderness. This variability has been attributed to a series of possible causes, including patient age, inflammation severity and perforation, or a combination of these factors. Its clinical findings may be quite different among cases and therefore, a number of clinical scores have been developed attempting to improve accuracy of diagnosis of appendicitis. Alvarado described a clinical scoring system to differentiate patients in need of surgical intervention. In this study, we evaluated combination of clinical diagnosis and Modified Alvarado for the diagnosis of acute appendicitis with histopathological examination of specimen proves the final diagnosis.

In the present study out of 100 patients with presumptive diagnosis of acute appendicitis 69% were male and 31% were female with male to female ratio of 2.2:1 which was concurrent with the study by O’Connell PR et al where male: female with a ratio was 2:1 and the study by Omran et al where 58% of the patients were male. The female: male age-adjusted rate ratio was 1:1.4

In our study 49% of the patients were in 15-24 years age group, 32% were in 25-34 age group, 15% were in 35-44 years age group, 2% were in age groups 45-54 and >55 years respectively. Mean age was 26.82, Median age was 25. Similarly study by Omran et al where the incidence was highest in those aged 10–19 years.

In the present study 99% of patients presented with RIF pain, 88% had nausea and vomiting, 74% had migratory RIF pain, 55% had anorexia and 38% had fever which was concurrent with the study by In >95% of patients with acute appendicitis abdominal pain, anorexia, which is followed, in turn, by vomiting (if vomiting occurs). All patients enrolled in our study had RIF tenderness, 97% had RIF Rebound tenderness, 65% had RIF guarding, 56% had Rovsing sign, 27% had psoas sign, and 10% had obturator sign. A meta-analysis by Anderson RE also showed that percussion tenderness, guarding, and rebound tenderness are the most
reliable clinical findings indicating a diagnosis of acute appendicitis

In our study 100% of the patients had neutrophilia, 87% had normal urine RME, 77% had leukocytosis, 75% had positive USG findings. A study conducted by Sheikh Muzamil Shafi et al10 on 110 patients who were operated for acute appendicitis to determine the role and predictive value of the total leucocyte count (TLC) and percentage of neutrophil count in the diagnosis of acute appendicitis. The TLC was found to be significantly high in 90 patients of acute appendicitis and neutrophil percentage was raised in 91 patients. Another study by Haider Kamran et al also concluded that TLC is helpful investigation in decision making11.

Similarly in the prospective study by W. Y. Lau et al12, more patients with appendicitis had either raised TLC or raised neutrophil percentage compared with patients with normal appendices (p < 0.001. The sensitivity and specificity of raised total leucocyte count in diagnosing appendicitis for patients who underwent appendicectomy were 81.4% and 77.3%, respectively.

In a prospective study carried out by MSG Ballal et al13, significant presence of pus cells (>5 pus cells/HPF) and/or red blood corpuscles in urine (2 or more RBC/HPF) were recorded there was no significant association between significant microscopic pyuria or haematuria and the severity of the inflammation and/or position of the appendix. and concluded that the presence of significant pus cells and or red blood cells does not exclude the diagnosis of acute appendicitis nor predicts position or severity of inflammation but calls for more evaluation of the urinary tract.

With advances in technology, high negative appendectomy rates are no longer acceptable. In this conjunction ultrasonography is being used increasingly especially where CT scans are not available. Ultrasonography is simple, easily available, noninvasive, convenient and cost effective14.

Puylaert reported the sensitivity of 89% and specificity of 100% of ultrasound in the diagnosis of acute appendicitis. In another study done by Mohammad Akbar Ali Mardan et al the sensitivity of diagnostic protocol in one group was 93% but dropped to 81% in second group when ultrasound was routinely incorporated in diagnostic process15. In our study USG was found to have 83.90% sensitivity and 81.81% specificity with PPV 97.33% and NPV 39.13% which is similar to sensitivity and specificity values found in the different literature.

A delay in performing an appendicectomy in order to improve its diagnostic accuracy increases the risk of appendicular perforation and sepsis, which in turn increases morbidity and mortality16. Another study states that ‘after the first 36 hours from the onset of symptoms the average rate of perforation is between 16% and 36%, and the risk of perforation is increased by 5% for every subsequent 12 hour period17. So a reasonable degree of promptness is definitely desirable. The increased mortality and morbidity associated with perforation has been used as justification for high rates of negative appendicectomy, quoted as between 20% and 25%18.

Negative appendectomy rates have not significantly come down even in parts of the world where sophisticated imaging are used more frequently. Flum DR et al state that the frequency of misdiagnosis leading to unnecessary appendectomy has not changed with the introduction of computed tomography, ultrasonography, and laparoscopy, nor has the frequency of perforation decreased. However negative appendectomy is associated with certain morbidity and costs; moreover people are becoming increasingly aware and high negative appendectomy rates of yesteryears should no longer be acceptable.

In our study out of 100 cases of acute appendicitis 77% found to have non-complicated inflamed appendix, 13% had perforated appendix, 6% had gangrenous appendix, 3% had appendicular abscess and 1% had appendicular lump. And we found that 90% of these patients actually had acute appendicitis and 10% was not found to have appendicitis. Overall negative appendectomy rate in our series was 10%. There are studies which report higher overall negative appendectomy rates as well as those with lower rates19.

The main aim of clinical decision making is to reach the diagnosis. Good history and proper clinical examination helps much to reach the diagnosis in most of the cases. Purpose of the different studies is to facilitate the surgeon’s decision because unnecessary
surgical intervention carries the risk of morbidity and mortality. Diagnostic accuracy regarding appendicitis also depends on the experience of surgeon yet the need for supportive measures is always there.

At present, many scoring systems are also in use but Alvarado scoring system which is based on history, physical examination and few laboratory investigations is easy to apply in comparison to other systems. There are studies showing that Alvarado scoring system can be used to diagnose acute appendicitis in the emergency department. It is easy and quick to apply.

The diagnosis of acute appendicitis still remains a challenging task for surgeons. In a prospective study of 215 adults and children, use of the Alvarado score decreased an unusually high false positive appendicectomy rate of 44% to 14%. In a study conducted by Talukder DB1, Siddiq patients with score of 8-10, 5-7 and 1-4 had 95%, 78% and 0% sensitivity respectively. Another study conducted by Kanumba et al. The sensitivity and specificity of MASS was 94.1% (males 95.8% and females 88.3%) and 90.4% (males 92.9% and females 89.7%) respectively and they concluded that the MASS provides high degree of sensitivity, specificity, PPV, NPV and accuracy in the diagnosis of acute appendicitis and has found to be more helpful in male patients by showing lower negative appendicectomy rate.

In this study 78 patients had MAS was between 7 to 9, out of them 75 patients (96%) had acute appendicitis 3 patients (3.8%) had normal appendix. 17 Patients had MAS 5 to 6, among them 14 patients (82.4%) had acute appendicitis, 3 patients (17.6%) had normal appendix. 5 patients had MAS between 0 to 4, and among them 1 patient (20%) had acute appendicitis and 4 patients (80%) had normal appendix. These results are similar to those which values in the literature.

In our study sensitivity and specificity for MAS were 86.2% and 72.72% respectively with PPV 96.15% and NPV 40% which is comparable with studies favoring use of MAS.

In the study done by SubhajeetDey et alHistopathological examination of the specimens confirmed acute appendicitis in 60 patients. There were 4 perforated appendix in the group and 6 had gangrenous appendicitis. 3 males had negative appendicectomy, no pathology was detected in one and two had Meckel’s diverticulitis. Operative note findings and histology reports confirmed appendicitis in 80 out of 92 patients undergoing appendicectomy (86.9%). And they also conclude that the application of Alvarado scoring system definitely improves diagnostic accuracy and possibly reduces the complication rates.

In this series, among 78 patients diagnosed for acute appendicitis by MAS 75 patients confirmed AA by HPE and 3 patients samples were reported as normal appendix. Among 20 patients who were suggestive of equivocal or not AA by MAS 12 patients samples were found to have AA and 8 samples reported normal appendix by HPE with a p value < 0.001. Sensitivity is 86.20%, specificity is 72.72%, PPV is 96.15% and NPV is 40.00%. These values showed statistically significant and that MASS has high accuracy in diagnosing AA.

CONCLUSION

In the diagnosis of acute appendicitis, the modified Alvarado score is a fast, simple, reliable, noninvasive and safe diagnostic modality without extra expense and complications. The application of this scoring system improves diagnostic accuracy and consequently reduces negative appendicectomy and thus reduces complication rates. Hence MAS is a useful adjunct to clinical judgment in the diagnosis of acute appendicitis.

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