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Original Research Article

Augmentation of modified Alvarado score with abdominal ultrasound in diagnosis of acute appendicitis

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ABSTRACT

Background: Acute appendicitis is one of the commonest surgical emergencies. But confirming the diagnosis of acute appendicitis is still a subjective issue for clinicians. Modified Alvarado score is based on clinical and laboratory findings which is scored upto 9. Management of 5 to 7 modified Alvarado score came under equivocal. Either may be conservative or operative.
Methods: We augmented the modified Alvarado score with abdominal ultrasound in diagnosis of acute appendicitis.
Results: Outcomes were evaluated in terms of sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV) and negative appendicectomy rate, results of our study are sensitivity 95.7%, specificity is 76.92%, PPV 93.75% and NPV 33.34%.
Conclusions: Overall increased sensitivity, specificity, NPV and PPV of the augmented approach is useful for diagnosis of acute appendicitis which scored under 5-7 of modified Alvarado scoring system.

Keywords: Ultrasonography, Acute appendicitis, Modified Alvarado scoring system

INTRODUCTION

Acute appendicitis is one of the commonest conditions requiring surgery, 6 to 8% of the population is expected to have appendicitis in their life time. 8.6% for male and 6.7% for female. The diagnosis of acute appendicitis is mainly clinical and it is impossible to have a definite diagnosis by gold standard (histopathology).[1] If the clinical diagnosis is made, appendicectomy is done. A scoring system (Alvarado score) is described by alvarado 1886 in which have total 10 score system. Later modified and scored upto 9 in which above 7 score recommend confirm diagnosis of appendicitis and definite treatment is operative. Between 5 to 7 score come in equivocal, in which treatment options are either conservative or operative depending upon patient condition.[2] With alone this scoring system have more negative appendicectomy rate. Along with USG abdomen not only confirms the diagnosis but also offers increased sensitivity, specificity, PPV and NPV.

The sensitivity of modified Alvarado score was 93.18%, specificity of modified Alvarado score was 33.3%, positive predictive value of Modified Alvarado Score was 91.1% whereas negative predictive value of modified Alvarado score was 40%.[3] The sensitivity of modified Alvarado score was 95%, specificity of modified Alvarado score was 86%, positive predictive value of modified Alvarado score was 71%.[4] But in another study the sensitivity, specificity and positive predictive value of modified Alvarado score was 97.56%, 66.67% and 95.23% respectively whereas negative predictive value was 80%.[5]

In the present study the augmented approach of modified Alvarado score (5 to 7) with abdominal ultrasound, was used to evaluate the sensitivity, specificity, positive and

negative predictive value in diagnosing acute appendicitis.

METHODS

The present study was conducted in the Department of Surgery in Pt. Jawaharlal Medical college, Raipur. All patients presented with right lower quadrant pain were scored using the modified alvarado score. Written informed consent was obtained from all the patients before enrolling them into the study.

The decision to proceed with the surgery was done in patients having score between 5 to 7 and USG showing features of acute appendicitis after other causes of right lower quadrant pain were ruled out. In this prospective study, which was conducted from 2017 to 2018 ,60 patients are included. Patients having right lower quadrant pain with age group above 3 years of age and pregnant women and Modified Alvarado scoring system (MASS) below 5 and above 7 and other causes of right lower quadrant pain are excluded. Outcome of study was coined in terms of sensitivity, specificity and positive predictive value (PPV) and negative predictive value (NPV).

All the patients with MASS were subjected to abdominal ultrasound with suspicion of acute appendicitis and the findings were noted as positive or negative. Apendicectomy followed by histopathological examination was performed in all the patients and the confirmed diagnosis was made only on the basis of histopathological findings. The efficacy of modified Alvarado score, USG and the augmented approach (MASS and USG findings taken together) were evaluated by comparing with that of the histopathological findings.

The statistical tests were performed using the online statistical calculator at www.graphpad.com. Findings were noted in the form of positive or negative finding for all the evaluating systems. Results were evaluated in the form of sensitivity, specificity, positive predictive value and negative predictive value.

RESULTS

Clinical features

The most common symptom with which a patient of acute appendicitis presented to the emergency department was with anorexia (73.34%) followed by migratory pain in right iliac fossa (66.67%). On per abdominal examination tenderness in right illac fossa (at McBurney s point) was the commonest finding (100%) and rebound tenderness was found in 76.67% of patients, whereas elevated temperature was present in 41.67%, nausea and vomiting was recorded in 39 out of 60 patients (65%), leucocytosis was present in 25 out of 60 patients (41.67%) was the least common finding.

Table 1: Distribution of study subjects according to clinical parameters.

Parameters	Yes		No	
	Number	(%)	Number	(%)
Migratory RIF pain (M)	40	66.7	20	33.3
Anorexia (A)	44	73.3	16	26.7
Nausea and vomiting (N)	39	65	21	35
Tenderness over RIF (T)	60	100	00	00
Rebound tenderness RIF ®	46	76.7	14	23.3
Elevated temperature	37	61.7	23	38.3
Leucocytosis	25	41.7	35	58.3

Predictors of modified Alvarado scoring (5-7)

In our study the sensitivity of modified Alvarado score was 85.1%, specificity of modified Alvarado score was 46.15%, positive predictive value of modified Alvarado score was 85.1% whereas negative predictive value of modified Alvarado score was 46.15%.

Table 2: Predictors of MASS.

MAS result	HPE positive	HPE negative	Total	%
MAS positive	40	7	47	PPV-85.1
MAS negative	7	6	13	NPV-46.15
Total	47	13	60	
	85.1% sensitivity	46.15% specificity		

Predictors of USG

In our study the sensitivity of USG was 89.3%, specificity of USG was 53.84%, positive predictive value of USG was 87.5% whereas negative predictive value of USG was 58.33%.

Table 3: Predictors of USG.

USG result	HPE positive	HPE negative	Total	%
USG positive	42	6	48	PPV-87.5
USG negative	5	7	12	NPV-58.33
Total	47	13	60	
	89.3% sensitivity	53.84% specificity		

Predictors of augmented approach

In our study on augmentation of modified Alvarado score with USG it was found that all the parameters of statistical accuracy improved, sensitivity for our study was 95.7%, specificity was 76.92%. positive predictive value was 93.75% whereas negative predictive value was 83.34%.

Table 4: Predictors of augmented approach.

Augmented test result	HPE positive	HPE negative	Total	%
Augmented test +	45	3	48	PPV 93.75
Augmented test -	2	10	12	NPV 83.34
	47	13	60	
	95.7% sensitivity	76.92% specificity		

Overall predictors of outcome

We conclude that augmented approach improved all the statistical predictors of outcome when compared with individual USG or modified Alvarado scoring system (5-7).

Table 5: Over all predictors of outcome.

Factors	Modified Alvarado score (5-7) (%)	USG (%)	Augmented approach (%)
Sensitivity	85.1	89.3	95.7
Specificity	46.15	53.84	76.92
PPV	85.1	87.5	93.75
NPV	46.15	58.33	83.34

DISCUSSION

Acute appendicitis is a common surgical emergency encountered in medical practice. Prompt and accurate diagnosis of acute appendicitis reduces the rate of negative appendicectomy and reduces the morbidity and mortality. According to modified Alvarado scoring system, a score of 7 and above is considered positive and a score below 5 is negative where as a score between 5 to 7 is equivocal. In the equivocal group patients may be managed conservatively or surgically. But due to delayed confirmation of diagnosis of the equivocal group, the definitive management of the case of appendicitis in the same group is postponed which adds to the associated morbidities and mortalities. And hence this study was designed to study the augmented approach of modified Alvarado scoring with ultrasound to diagnosis of acute appendicitis. The accuracy was measured in terms of sensitivity, specificity, positive and negative predictive value and also in terms of negative appendicectomy rate.

In our study we found that 71.7% patients were male, rest 28.3% were females. The male and female ratio was 2.5:1, male is more affected then female.

In our study the sensitivity of MAS (5-7) was 85.1%, specificity of MAS (5-7) was 46.15%, positive predictive value of MAS (5-7) was 85.1% whereas negative predictive value of MAS (5-7) was 46.15% . The sensitivity of USG was 89.3%, specificity of USG was 53.84%, positive predictive value of USG was 87.5% whereas negative predictive value of USG was 58.33%. The findings were comparable with that of the previous studies.[3-5]

On comparing the statistical outcomes of augmented approach it was found in the study conducted by Money et al.[4] That sensitivity was 86%, specificity was 100% where as positive predictive value was 100% and In our study on augmentation of MAS with USG it was found that all the parameters of statistical accuracy improved, sensitivity for our study was 95.7%, specificity was 76.92%. positive predictive value was 93.75% whereas negative predictive value was 83.34%.

CONCLUSION

The results of the current study showed that augmented approach in diagnosing a suspected case of acute appendicitis is better than the commonly used modified Alvarado score or USG of abdomen. This modified approach is not only beneficial in early diagnosis of acute appendicitis but also in reducing negative appendicectomy rate and coexist morbidity.

Future studies may be conducted as multicenter trials with larger number of subjects to further establish the superiority of modified alvarado scoring system augmented with abdominal ultrasonography for the diagnosing acute appendicitis.

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