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Study of Alvarado Score and Ultrasonography in Diagnosis of Appendicitis Evaluated with Operative and Histopathology Findings

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ABSTRACT

For people of all ages, acute appendicitis is a prevalent cause of abdominal discomfort. However, in the early stages of the disease, it might be a confusing diagnostic issue. Its clinical signs might be hazy and unclear in many cases, notably during the prodromal phase. Patients with right lower quadrant pain were scored using the Alvarado score, compression ultrasound scans were performed on the patients and the results were correlated with the histological and surgical findings. This research was an evaluation that was conducted prospectively. This study was carried out at the Ramakrishna Mission Seva Pratishthan Department of General Surgery in Kolkata between May 2003 and April 2005. This research had 51 patients in total. When all data (51 instances) are taken into account using the Alvarado Scoring and ultrasonography procedures, the distribution of cases in the categories TP, TN, FP and FN reaches a statistical significance of p = 0.0221. However, when looking at the data by sex the distribution of instances in the groups TP, TN, FP and FN in both Alvarado scoring and ultrasonography techniques did not approach a statistical significance. We may finish our discussion by saying that while a high Alvarado Score is a reliable tool for diagnosing acute appendicitis in males early on, it is not true for women.

INTRODUCTION

For people of all ages, acute appendicitis is a prevalent cause of abdominal discomfort. However, in the early stages of the disease, it might be a confusing diagnostic issue. Its clinical signs might be hazy and unclear in many cases, notably during the prodromal phase. The range of perforation rates is 4-45%, whereas the range of fatality rates is 0.17-7.5%. Up to 45% of unneeded laparotomies may be performed, especially on female patients. The range of the "negative appendectomy rate" is 14-75% overall.

Being able to lower the negative appendectomy rate without raising the risk of perforation is the main objective. Numerous strategies have been reported to improve diagnostic precision and lower the rate of unsuccessful appendices, especially in cases where the symptoms and signs are not encouraging. These strategies include the creation of predictive scoring systems, computer-aided diagnosis, close in-office monitoring, plain abdominal films, diagnostic laparoscopy and, more recently, Graded Compression Ultrasonography. The Alvarado score is the most practical of the scoring schemes. Developed by Alfredo Alvarado in the United States in 1986 the ten-point scoring system is based on two laboratory findings, three symptoms, and three indicators.

Score level:

1-4: Not likely to have appendicitis
5-6: Probable appendicitis
7-8: Possible appendicitis

Alvarado showed that a straight forward diagnostic score may be used to approach patients rationally, perhaps identifying which ones need to be watched over and which ones require surgery. The Alvarado scoring system is simple to use in an emergency and can be used as a criterion for admission. Out of all the imaging modalities, Ultrasonography has become the most important since it is less priced, readily available and radiation-hazard free. Compression ultrasound, which Puylaert defined as a rapid and accurate diagnostic technique for appendicitis, is used.

Normal appendix in a healthy individual is typically not seen on ultrasonography. The detection of a tubular, non-compressible, aperistaltic entity with a distal blind end and a diameter more than 6 mm provides the foundation for the sonographic diagnosis of acute appendicitis. Numerous writers have studied appendicitis using ultrasonography, with varying degrees of success and failure. Ultrasonography and the Alvarado scoring system both enhance or assist the surgeon's clinical diagnosis of appendicular diseases. It is common knowledge that there are many different reasons why right lower quadrant pain can occur in both teenagers and women in the 20-45 age range who are childbearing. Ultrasonography is very helpful in these patient categories. We have conducted a prospective, evaluative study of Alvarado score with Ultrasonography in Acute Appendicitis and it is correlated with preoperative findings and confirmed with Histopathology. USG helps to identify non-appendicular causes of pain, like terminal ileitis, Meckel's diverticulitis, Right lower ureteric calculi, and others.

MATERIALS AND METHODS

- The Department of General Surgery at Ramakrishna Mission Seva Pratishthan, Kolkata, is the site of this prospective evaluation study
- The investigation was conducted from May 2003 to April 2005
- Fifty one examples in total were chosen for the investigation. There were 34 female patients and 17 male patients among them
- The cases were chosen at random, using either outdoor or emergency criteria
- When the laboratory findings were available, cases were reassessed for a second scoring after six to eight hours, using the Alvarado scoring system that was used for the initial scoring. The ultimate scores were collected for assessment
- The choice regarding the patient's admittance and surgery was made without regard to the Alvarado scoring system. To see the appendix and/or other R.I.F. pathologies, all patients had lower abdominal ultrasonography examinations, with particular attention paid to the right iliac fossa.

RESULTS

From the data of ultrasonographic findings, per operative findings and Histopathological findings we deduce. From the above table, we find that the overall sensitivity of ultrasonography in diagnosis of Acute Appendicitis is 75%, which is of average value. Fisher's exact test was used to derive the statistical inference through an examination of sections based on the normal approximation to the binomial distribution.

- When male and female patients are treated as independent groups, there is no statistically significant difference seen for any of the three screening test parameters accuracy, specificity, or sensitivity
- Sensitivity and accuracy between the two screening tests are statistically homogeneous when all patients (51), regardless of sex, are taken into account
- In contrast to the alvarado score, the ultrasonography technique produced a statistically significant greater proportion or percentage of specificity when all patients were taken into account

- Using Alvarado Scoring and ultrasonography the distribution of cases in the categories TP, TN, FP and FN, when all data are taken into account collectively (i.e., 51 cases), acquired a statistical significance of p = 0.0221
- However, when analysing the data based on gender the distribution of instances in the TP, TN, FP, and FN groups did not approach a statistical significance in either the Alvarado scoring or ultrasonography method

DISCUSSIONS

One of the most common causes of abdominal emergencies in almost all age groups is acute appendicitis, which is also renowned for its ability to mimic other illnesses. The surgical department at Ramakrishna Mission Seva Pratishthan Kolkata regularly performs emergency and interval appendicectomies. Fifty one patients were chosen at random from Ramakrishna Mission Seva Pratishthan's Emergency or Surgery OPD between May 2003 and April 2005. The 51 cases were split into two groups Group B (with 17 male cases) and Group A (with 34 female cases).

The cases that met the above-mentioned criteria for selection were those that initially appeared with pain and/or tenderness in the right lower quadrant of the abdomen. The consultant made the choice to perform the surgery based on the overall clinical diagnosis rather than the Alvarado score or the results of the ultrasonography. Of the 51 cases in the research, only 41 patients had surgery. The remaining ones weren't used.

The kind and degree of appendix inflammation, as well as any concomitant findings, were meticulously documented in the preoperative findings. Last but not least, a link was made between the histological reports of the operated cases and the results of Alvarado scoring and ultrasonography. A similar correlation was made between the nonoperated instances and USG.

We talk about the results in two groups of 51 cases. 34 women make up Group A, and 17 men make up Group B. Only 23 of the 51 patients in the research who had pain in the right iliac fossa and were thought to have acute appendicitis had an inflamed appendix that could be seen on ultrasonography. A blind-ending, non-compressible, aperistaltic structure with an anechoic lumen."Most of the American and European studies give high resolution ultrasonography high sensitivity (80-89%) and specificity (94-100%) in diagnosing acute appendicitis," according to Pearson in 1988[1].

We have determined that ultrasonography had an overall sensitivity of 75% and an overall specificity of 89.47% in identifying acute appendicitis in our study. Puylaert[2] who examined 60 people in a row who appeared to have severe appendicitis. Our group experienced 54.90% of his patients' 47% cases of acute appendicitis.

In 1987, Julien Puylaert *et al*.[2] Ultrasonography revealed a sensitivity of 75% and specificity of 100% in another prospective research with 111 patients who were suspected of having appendicitis. In our study, the percentage values for sensitivity and specificity in Males were greater than those in Females (71.46% and 84.62%, respectively) at 81.81% and 100%, respectively.

Not only are there new high resolution transducers on the market but graded compression can now be applied without causing excruciating pain, which makes it easier to visualize the inflamed appendix and eliminate intestinal gas. A sensitivity of 100% was achieved in our study when the appendix was visible in all five male patients with either gangrenous or perforated appendicitis, whereas a sensitivity of 85.71% was achieved in six out of seven female cases with either gangrenous or perforated appendicitis.

This is corroborated by aresearch by Wolf Schwerk *et al*.[3] which found that ultrasound was able to identify the inflamed appendix, periappendiceal abscess, or both in 89% of patients with a ruptured appendix. According to Ooms *et al*.[4] in, this is most likely because of the severe peritonitis that is associated with it, which prevents appropriate compression due to reflex rigidity. Given the substantial risk of misdiagnosis, a comparably high level of diagnostic ultrasonography accuracy may be reached in the group of ovulating women aged 20-40. There are fifteen females in the childbearing age bracket in our study.

In a different analysis of women of childbearing age, Wolf Schwerk *et al*.[3] in found that the sensitivity, specificity, and accuracy of ultrasonography were, respectively, 82.6%, 100% and 96.7%. In, Emmie[5]. Fa and colleagues discovered that ultrasound was 100% sensitive, 84.6% specific and 86.4% accurate when diagnosing appendicitis in women who were fertile. Thus, for young women with pelvic or abdominal pain, ultrasonography is likely to be useful in narrowing down the range of potential diagnosis.

Sonography alone cannot confidently rule out acute appendicitis, even if it can show the inflammatory appendix in a large proportion of patients and may lead to a different diagnosis in a noteworthy number of instances. In 51 examinations overall, false-negative cases with an ultrasonographic diagnosis of acute appendicitis were noted at a rate of 15.68%. The use of ultrasonography in cases of acute appendicitis has been the subject of numerous research conducted worldwide, some of which have shown very favorable findings. However, there haven't been many studies that compare the Alvarado Scoring system with ultrasonography. In 2000, Douglas *et al*.[6], conducted an ultrasonography randomized controlled

Table 1: Classifying 51 cases as per alvarado scoring WE deduce

Score level	No. of the male cases	No. of the female cases
1-4	01	06
5-6	04	05
7-8	06	18
9-10	06	05
Total	17	34

Table 2: Compression ultrasonography of 51 cases, suspected to have acute appendicitis

Analysed result	Male	Female	Overall
Sensitivity	97%	88.8%	89.28%
Specificity	57.14%	50%	52.17%
Predictive value of a positive test	75%	66.66%	69.44%
Predictive value of a negative test	80%	89%	84%

Table 3: Ultrasonography

Analysed result	Males	Females	Overall
Sensitivity	81.81%	78.43%	79%
Specificity	100%	83.62%	86.47%
Predictive value of a positive test	100%	84.24%	92.30%
Predictive value of a negative test	75%	64.70%	78%

Table 4: Classification of cases (both male and female) as per alvarado score <6 and >6 with visualisation of appendix in ultrasonography

Visualisation of appendix in ultrasonography	No. of cases with Alvarado Score < 6	No. of cases with Alvarado Score > 6
Appendix visualised in USG	0	23
Appendix not visualised in USG	13	15

Table 5: Classification of male cases as per Alvarado Scoring with visualisation of appendix in ultrasonography

Alvarado score	No. of cases in which appendix was visualised in ultrasonography	No. of cases in which appendix was not visualised in ultrasonography
1-4	0	01
5-6	0	04
7-8	02	04
9-10	06	0

study to diagnose acute appendicitis and calculate the Alvarado Score. They discovered a decrease in the meantime to operation for patients undergoing surgery and validated the accuracy of ultrasonography. They came to the conclusion that there is no evidence that using graded compression ultrasonography to diagnose acute appendicitis leads to a better result than using clinical diagnosis alone.

When the Alvarado Score and Ultrasonography findings were statistically analyzed in our study, we discovered that there was no statistically significant difference between the two screening methods (i.e., Alvarado Score and Ultrasonography), either for overall sensitivity or overall accuracy. However, the ultrasonography approach produced a statistically significant greater proportion or % (percentage) for overall specificity compared to the Alvarado score.

Thus, ultrasonography had a statistically higher specificity for appendicitis diagnosis than the Alvarado Score. ($p<0.05$).

In a comparable prospective study, Kuniyasu Soda *et al*.[7] came to the conclusion in 2001 that ultrasonography's efficacy, as measured by the basic criteria, was greater than the surgeon's clinical judgment ($p<.001$). It is noteworthy, therefore, that Davies *et al*.[8] did not conclude that ultrasonography was a better diagnostic tool for appendicitis than the surgeon's initial clinical judgment.

It is common knowledge that an operator affects an ultrasound's accuracy. If the exams had been performed by general radiologists or radiology residents, it's probable that the outcomes would not have been as striking as they were by skilled ultrasonographists. Numerous prior research studies have demonstrated the utility of USG examination in confirming or ruling out appendicitis, however, a few of clinical trials have not demonstrated this advantage. The identification of an aperistaltic, non-compressible appendix was the sole criterion for acute appendicitis in early studies on ultrasonography diagnosis, a criterion we also took into account in our investigation. Since the advent of sophisticated USG equipment that made it possible to show a normal appendix, numerous criteria have been developed for the diagnosis of acute appendicitis. To sum up our conversation, it can be said that while a high Alvarado Score is a reliable tool for diagnosing acute appendicitis in men early on, it is not true for women.

CONCLUSION

We conclude that, the Alvarado scoring system and ultrasound calculations were analysed statistically using "fisher's Exact Test." When comparing the sensitivity or overall accuracy of the two screening tests ultrasonography and the Alvarado scoring system there is no discernible statistical difference. The Alvarado scoring system and right lower quadrant ultrasonography have both been demonstrated to be reliable methods for diagnosing appendicitis; nevertheless, they are not meant to take the place of a clinician's judgment. It serves simply as an addition to the most effective diagnostic method, which is still a thorough history and physical examination. A straightforward diagnostic score known as the

Alvarado scoring system indicates which patients need immediate surgery and which ones should be monitored. Aside from being a helpful supplementary tool for clinical decision-making in the diagnosis of acute appendicitis, ultrasound imaging of the lower abdomen and pelvis may also be used to rule out appendicitis in cases when it is not present by revealing other pathologic disorders that may mimic the illness. It is therefore a helpful diagnostic tool.

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