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ORIGINAL ARTICLE

USING OF THE MODIFIED RIPAS SCORE IN DIAGNOSIS OF ACUTE APPENDICITIS TO DECREASE USE OF ABDOMINAL COMPUTED TOMOGRAPHY

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Abstract

Introduction: Acute appendicitis is one of the most common surgical emergencies. The RIPAS score has been developed to aid clinical diagnosis of acute appendicitis as high sensitive and specific score system. The aim of our study is to reduce use of CT abdomen in cases of acute appendicitis by using effective score system, thus reducing the risk of lifetime radiation induced fatal cancer.

Patients and Methods: Clinical data from 61 patients admitted to surgery department in Abdulrahman Al-Mishari Hospital (Riyadh- Kingdoms Saudi Arabia) who had undergone an emergency appendectomy was retrospectively collected following 15 RIPAS score system. The probability was calculated and a score of 0.5, 1.0 or 2.0 was allocated to each parameter. The receiver operating curve (ROC), sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) of the new scoring system were derived using the stats direct statistical software.

Results: The standard RIPAS score system for acute appendicitis had a sensitivity of 88% and a specificity of 67% with accuracy of 81%. In the modified RIPAS scoring system, CT finding were substituted for RIPAS scores in the ranges of 7 to 8, 7 to 9, 7 to 10, 7 to11 and 7 to 12. The modification resulted in the greatest accuracy 95% in diagnosis appendicitis in patients with score in the range of 7 to 12. This modification theoretically would have decreased the use of CT by about 30% in this group of retrospectively studied patients. Furthermore, in patients with RIPAS score of 2to 6, another diagnosis should be considered; in patients with score of 7 to 12, CT should be performed; and in patients with score 13 to 16, appendectomy should be performed promptly without further studies.

Conclusion: The modified RIPAS score is useful as an aid in diagnosis acute appendicitis in the adult populations. This scoring system eliminates unnecessary use of CT and the attendant potential cancer-inducing radiation.

Keywords: Appendicitis, RIPAS score, Computed tomography.

INTRODUCTION

One of the most common surgical emergencies is acute appendicitis, with prevalence rate in lifetime about one in seven.[1] The incidence is 1.5–1.9 per 1,000 in the male and female population, and is approximately 1.4 times greater in men than in women.[2]

The diagnosis of acute appendicitis is based purely on clinical history and examination combined with laboratory investigations such as elevated white cell count. Despite being a common problem, acute appendicitis remains a difficult diagnosis to establish, particularly among the young, the elderly and females of reproductive age, where a host of other genitourinary and gyne-cological inflammatory conditions can present with signs and symptoms that are similar to those of acute appendicitis.[3] A delay in performing an appendectomy in order to improve its diagnostic accuracy increases the risk of appendicular perforation and sepsis, which in turn increases morbidity and mortality.[4] The opposite is also true, where with reduced diagnostic accuracy, the negative or unnecessary appendectomy rate is increased, and this is generally reported to be approximately 20%–40%.[5]

Since the advent of computed tomography (CT) and its inception in the 1970, its use has increased exponentially. In addition, the technology has improved in a similar logarithmic fashion, allowing better visualization of the anatomy and identification of pathophysiological processes while reducing the exposure time in the scanner. Moreover, the greatest increase in the relative number of CT examinations performed in the past decade has occurred in the adult patients.[6,7]

Serious safety concerns have been raised as more data continue to be derived from atomic bomb survivor and there are many documents indicating prevalence of fatal malignant neoplasms among these individuals than in comparable populations even at low doses of ionizing radiation.[8,9]

Although the ultrasonography or computed tomography imaging had improved the accuracy of appendicitis diagnosis, but these modalities are still costly and may not be easily available when they required. This may lead to further delay in diagnosis and surgery. Many trials had been done to develop score system for diagnosis of appendicitis like Alvarado scores and its modification .These scores system showed sensitivity and specificity range from 53%-88% and 75%-80%,respectively.[10,11]

Several studies have reported very low sensitivity and specificity when these scores are applied to population with a completely different ethnic origin and diet from those of western countries.[12,13] In 2010 the Department of Surgery , Raja Isteri Pengiran Anak Saleha (RIPAS) Hospital developed a new score for acute appendicitis, depending on 15 parameters and the scores generated were age (less than 40years is 1 point; greater than 40 years is 0.5 point), gender (male is 1 point ; female is 0.5 point), right iliac fossa (RIF) pain (0.5 point), migration of pain to RIF (0.5 point),nausea and vomiting (1 point), anorexia (1 point), duration of symptoms (less than 48 hours is 1 point; more than 48 hours is 0.5 point), RIF tenderness (1 point), guarding (2 point), rebound tenderness (1 point) Rovsing sign (2 point), fever (1 point), raised white cell count (1 point), negative urinalysis (1 point) and foreign national registrations identity card (1point).[14]

This study was performed in surgery department of ARMH led to modification of standard RIPAS score with selective use of CT. By substituting CT result for observation in patients with indeterminate score of 7 to 12 we were able to demonstrate an increased diagnostic accuracy while potentially decreasing the total number of CT scans 30%. This modification increased the accuracy of the standard RIPAS score from 81% to 90% for modified RIPAS score thereby achieving an accuracy that is greater than previously attainable by CT or by standard RIPAS score alone. Although the selective use of CT as a diagnostic study may improve accuracy in diagnosis, its use is not without risks.[7,15]

During the past few years, there is 200% increase in CT scans as a diagnostic tool and has become virtually standard in the evaluation of an acute abdomen, including its routine use in the diagnosis of acute appendicitis.[16]

Increasing number of publication suggest more widespread use of CT as the primary imaging technique in multiple clinical scenarios, especially in young adults and children with suspected acute appendicitis, this lead to an increase in radiation exposure which increase lifetime cancer risk of children and young adults.[8,17,18]

Moreover, it has been shown that the rate of appendectomies with negative finding has not decreased with the liberal use of CT[19] but, in fact, may lead to increased hospital costs, delayed in diagnosis, and increased unnecessary radiation exposure.[19,20]

The standard RIPAS score has been validated by several studies in the adult population.[14] We believed that, by implementing the modified RIPAS scoring system (Fig. 1), the use and risk of radiation can be minimized in pediatric and young adult population.

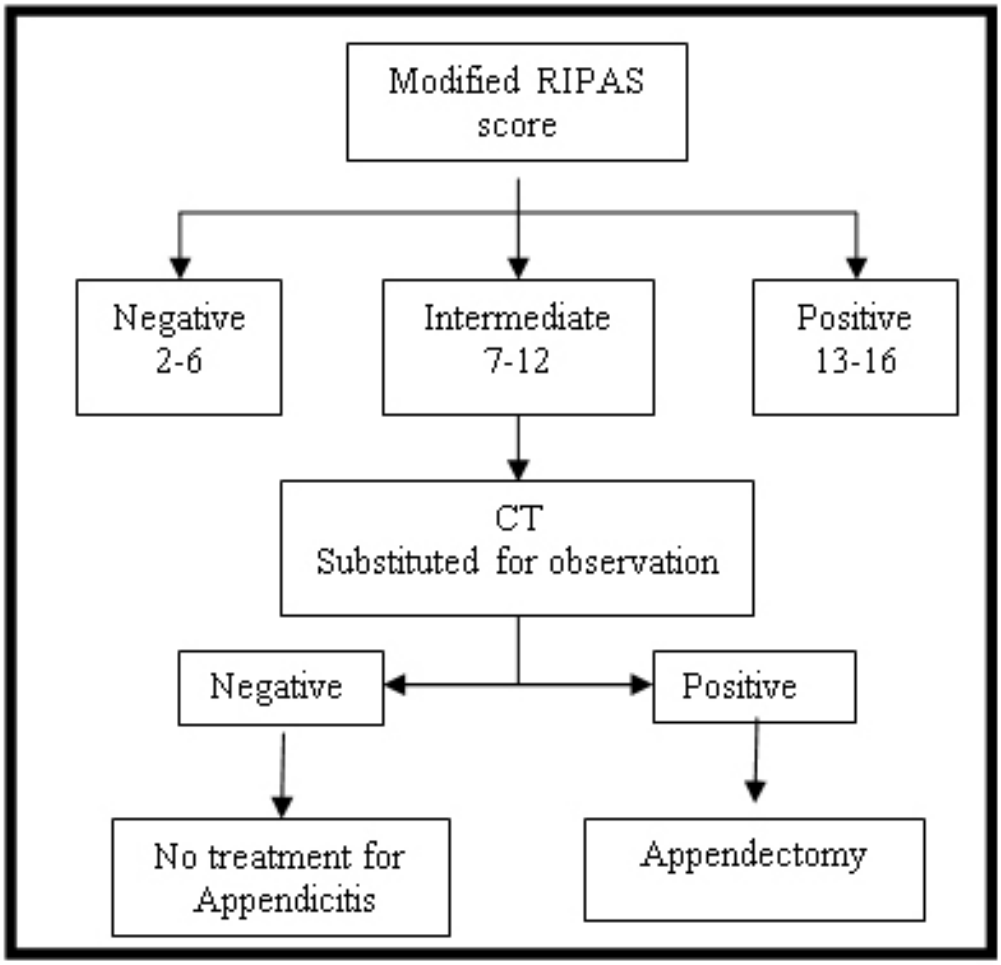

Fig 1. Modified RIPAS score algorithm derived by substituting computed tomography (CT) for observation in the original RIPAS score algorithm.

PATIENTS AND METHODS

After approval by ARMH review board, medical record were reviewed retrospectively for 61consecutive patients with mean age of the group 25.0±12.5 years who were admitted to our hospital as cases of appendicitis and underwent abdominal CT. Additional data derived from these patients from December 2010 to December 2012 were reviewed and are listed in the Table. RIPAS scores were calculated for each patient and correlated with final pathology reports and CT results. Two patients were excluded from the study owing to incomplete records and the inability to calculate the RIPAS score. We used 2x2 contingency tables correlate standard and modified RIPAS scores with the outcomes. Appendectomy or discharge home was considered the end of this study. A Fisher exact test analysis was performed on the data, and P• .05 was considered significant.

Table. Demographic characteristics of patients in the study.

Characteristic	No. of patients	Percentage
Exclusions	2	3%
Male patients	43	73%
Female patients	16	27%
CT scan	42	71%
Total appendectomies	34	58%
(-ve) appendectomy	2	3%

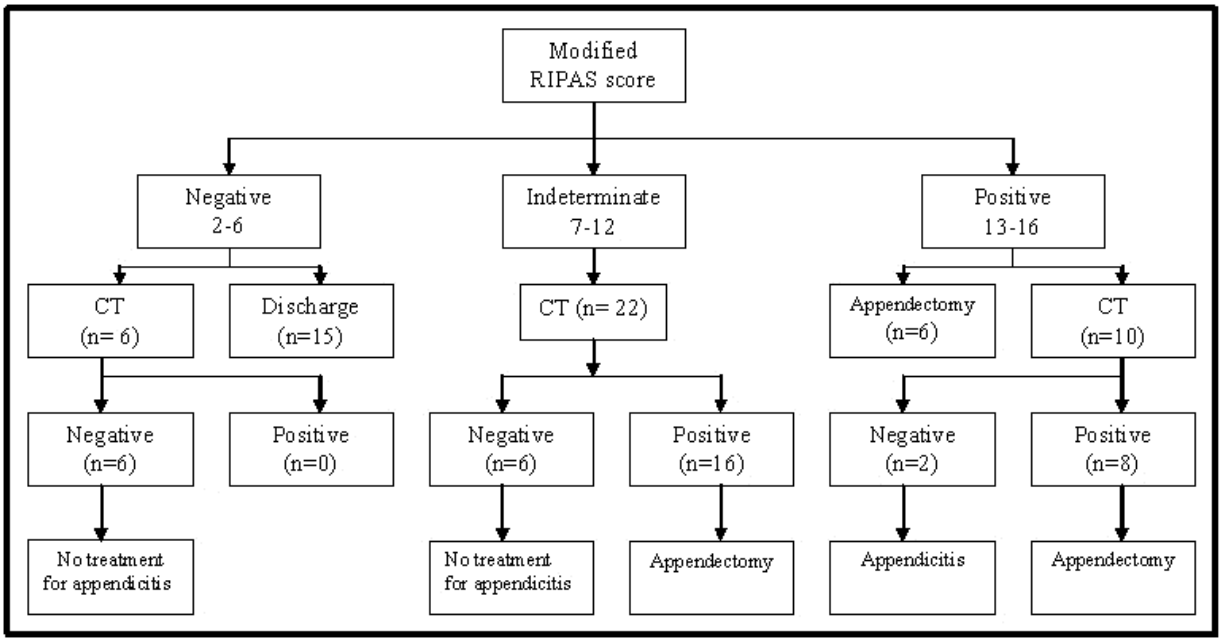

Fig 2. Modification of the RIPAS score and results.

RESULTS

When it applied to the 59 patients in this study, the standard RIPAS score for appendicitis had a sensitivity of 88%, a specificity of 67%, and an accuracy of 81%.

Twenty- two patients (37%) had indeterminate RIPAS score of (7 to12), and all 22 patients underwent CT (Fig. 2).

Computed tomography alone had sensitivity 93%, a specificity of 97%, and an accuracy of 95%. Use of the modified RIPAS score and substitution of CT results for scores of (7to12) resulted in a sensitivity of 92%, a specificity of 90%, and an accuracy of 95%. If this modification had been used in this group of patients, the number of unnecessary CT scan could have been reduced 30%.

When the RIPAS score was modified for scores of (7 to 12), there was sensitivity 100%, a specificity of 97%, and an accuracy of 98%. The number of CT scans could have been reduced by 27% in this patient group if this modification had been used. When the RIPAS score was modified for scores of 7 to 13, there was a sensitivity of 93%, a specificity of 97%, and an accuracy of 95%. This would have resulted in only a 1% reduction in the number of CT scans used.

Thus, the modification resulting in the greatest accuracy was with modified RIPAS score of 7 to 12. Overall, the rate of appendectomies with negative findings was 3%.

Of the 34 patients (58%) who were taken to the operating room for appendectomy, 2 patients were excluded from the study owing to incomplete medical records.

DISCUSSION

In last decades there was annual increase in performed CT for cases of appendicitis up to 10 % as it accounts for about 10% of the radiological investigations and contributes about 45% of total radiation dose to the population.[21,22] Thus, it is imperative that every effort be made to decrease the number of CT scans performed unnecessarily.

In our study we try to demonstrate a modification by which the RIPAS scoring system can be applied to population to reduce the number of CT scans performed while maintaining a timely and accurate diagnosis and treatment of acute appendicitis (Fig. 2). We believe that patients with RIPAS score 2to 6 should be discharged home or that anther diagnosis should be considered. For patients with score 7to12, CT should be performed. If the finding is negative, then another diagnosis should be considered; if the finding is positive, then the patient should be undergoing appendectomy. Patients with score 13 to 16 do not need further imaging; these patients should undergo laparoscopy or laparotomy for appendectomy.

Performing CT in this group of patients will only delay the diagnosis and may even lead to an error in

diagnosis. According to this study, only 2 of 16 patients with score of 13 to 16 had a negative CT finding with pathological finding positive for appendicitis. Because of strong clinical suspicion for acute appendicitis, one of these patients was taken to the operating room for appendectomy, which proved to be positive for appendicitis on histological examination of the specimen.

The other patient was observed and eventually underwent ultrasonography, the results of which supported the clinical findings. This patient also had acute inflammatory changes on pathological examination of the appendix. This study showed that time spent waiting for and performing CT in a patient with a high RIPAS score (13 to 16) only delays the diagnosis and definitive treatment of the patient. At the same time, patients are exposed to the unnecessary use of CT and its attendant high levels of radiation, which has been shown to increase the lifetime incidence of fatal malignant neoplasms in this sensitive and vulnerable group. This study is limited by its small size, and we advocate for a larger randomized prospective study to validate our findings using the modified RIPAS score in the evaluation of the acute abdomen and especially in the diagnosis of acute appendicitis.

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