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 to 11 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 2 to 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. 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.

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 gynecological inflammatory conditions can present with signs and symptoms that are similar to those of acute appendicitis. 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. 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%.

Since the advent of computed tomography (CT) and its inception in the 1970s, 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.

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. 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.

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

The standard RIPAS score has been validated by several studies in the adult population. 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.
PATIENTS AND METHODS

After approval by ARMH review board, medical record were reviewed retrospectively for 61 consecutive 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.

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>No. of patients</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exclusions</td>
<td>2</td>
<td>3%</td>
</tr>
<tr>
<td>Male patients</td>
<td>43</td>
<td>73%</td>
</tr>
<tr>
<td>Female patients</td>
<td>16</td>
<td>27%</td>
</tr>
<tr>
<td>CT scan</td>
<td>42</td>
<td>71%</td>
</tr>
<tr>
<td>Total appendectomies</td>
<td>34</td>
<td>58%</td>
</tr>
<tr>
<td>(-ve) appendectomy</td>
<td>2</td>
<td>3%</td>
</tr>
</tbody>
</table>
**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 to 12, 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 7 to 12 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 scans 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. 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 2 to 6 should be discharged home or that another diagnosis should be considered. For patients with score 7 to 12, 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 health risks. 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.

REFERENCES