African Journal of Emergency Medicine (2016) 6, 138–143

African Federation for Emergency Medicine

African Journal of Emergency Medicine

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## ORIGINAL RESEARCH ARTICLES

# Added value of graded compression ultrasound to the Alvarado score in cases of right iliac fossa pain

## *Valeur Ajoutée De L'échographie De Compression Calibrée Au Score d'Alvarado En Cas De Douleurs Dans La Fosse Iliaque Droite*

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Received 11 November 2015; revised 6 February 2016; accepted 16 February 2016; available online 7 April 2016

**Introduction:** Acute appendicitis is one of the most common emergencies treated by the general surgeon. Simple appendicitis can progress to perforation, which is associated with a much higher morbidity and mortality, and surgeons have therefore been inclined to operate when the diagnosis is probable rather than wait until it is certain. The aim of this study was to evaluate the sensitivity and specificity of the Alvarado score combined with ultrasounds of the abdomen and pelvis in cases of right iliac fossa pain with suspected acute appendicitis.
**Methods:** 100 patients admitted to the Department of Surgery at Alexandria Main University Hospital in 2013 complaining of right iliac fossa pain with suspected acute appendicitis were studied prospectively. The demographic information, histopathology, physical examination, laboratory data, Alvarado score, sonography report and histopathological reports of these patients were gathered. The treating surgeon made decisions for surgery or conservative management without any intervention from the research team.
**Results:** A combination of methods showed that Alvarado alone was 100% sensitive in excluding appendicitis at scores below five and was highly specific at scores above eight (91.9%) with no added value when combining it with ultrasound in those scores. On the other hand, ultrasound was beneficial only in patients with Alvarado scores between five and eight for detecting appendicitis and not excluding it (increasing specificity to 100% and not affecting sensitivity).
**Conclusion:** Ultrasound is a good adjuvant examination in cases with Alvarado scores between five and eight in order to diagnose appendicitis. Negative ultrasound results do not exclude appendicitis and further assessment by other modalities should be performed.

**Introduction:** L'appendicite aigüe est l'une des urgences les plus courantes traitées par un chirurgien généraliste. L'appendicite simple peut évoluer en perforation, liée à une morbidité et une mortalité bien plus élevées, et les chirurgiens ont donc eu tendance à opérer lorsque le diagnostic était probable plutôt que d'attendre qu'il soit certain. Le but de cette étude était d'évaluer la sensibilité et la spécificité du score d'Alvarado associé à des échographies de l'abdomen et du bassin en cas de douleurs dans la fosse iliaque droite avec suspicion d'appendicite aigüe.
**Méthodes:** 100 patients admis au Service de chirurgie de l'Hôpital universitaire principal d'Alexandrie en 2013 se plaignant de douleurs dans la fosse iliaque droite avec suspicion d'appendicite aigüe ont été étudiés de façon prospective. Les informations démographiques, l'histopathologie, les examens physiques, des données de laboratoire, les scores d'Alvarado, les rapports d'échographie et les rapports histopathologiques de ces patients ont été rassemblés. Le chirurgien traitant a pris la décision d'une intervention chirurgicale ou d'une prise en charge prudente sans aucune intervention de l'équipe de recherche.
**Résultats:** Une combinaison des deux méthodes a montré qu'Alvarado seul était sensible à 100 % en termes d'exclusion de l'appendicite pour des scores inférieurs à cinq ans et était très spécifique pour des scores supérieurs à huit (91,89 %) sans valeur ajoutée constatée lors de sa combinaison avec une échographie pour ces scores. D'autre part, l'échographie n'a été bénéfique que chez les patients ayant des scores d'Alvarado situés entre cinq et huit pour détecter l'appendicite et non l'exclure (en augmentant la spécificité jusqu'à 100 % et sans incidence sur la sensibilité).
**Conclusion:** L'échographie est un bon examen complémentaire pour diagnostiquer l'appendicite dans les cas où les scores d'Alvarado se situent entre cinq et huit. Le résultats de l'échographie négatifs n'excluent pas l'appendicite et une évaluation plus poussée par d'autres modalités doit être effectuée.

### African relevance

- Unnecessary appendectomies should be avoided.
- Ultrasound provides a quick examination, is easy to do and is low cost.
- Combining Alvarado scores and ultrasound may reduce unnecessary exams for some cases of suspected appendicitis.

### Introduction

Appendicitis is one of the most common and most difficult surgical emergency conditions that can be diagnosed, and it may progress to peritonitis, which is associated with high mortality and morbidity. Decisions based on a bedside examination only result in the removal of normal appendices (i.e., useless operations) in 15–30% of cases.[1,2]

To avoid this situation, various investigative tools can be employed, including laparoscopy, clinical scoring systems,

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Peer review under responsibility of African Federation for Emergency Medicine.

http://dx.doi.org/10.1016/j.afjem.2016.02.004

and different radiological modalities, such as ultrasonography, computed tomography (CT) scans and magnetic resonance imaging (MRI).

The Alvarado score is a representative clinico-laboratory scoring system that was chosen for this study due to its ease and speed of application in emergency centres in addition to the fact that it is a well-tested and widely available scoring system.[3] However, some surgeons are afraid of its low accuracy or its inapplicability to their communities.[4]

Radiological judgement has been a topic of debate in terms of the selection of the modality that should primarily be used, that is, ultrasound, CT or MRI, as well as the stratification of patients according to their needs for these techniques.

Ultrasound has the advantages of being quick, inexpensive, highly available, requiring no preparation by the patient, being potentially transportable, not requiring ionising emission or any contrast, and being potentially valuable in the diagnosis of other causes of abdominal pain and excluding different gynaecological pathologies.[5–7]

Despite the established superiority of CT over ultrasound in the diagnosis of appendicitis, recent studies have advocated for a first-line ultrasound approach for adult patients presenting with possible appendicitis.[8–11] This strategy has been found to be highly accurate when CT is reserved for patients with clinically suspicious negative or equivocal ultrasound results.[9,10,12] This diagnostic pathway has been demonstrated to be cost effective and to adhere to the principle of ALARA (as low as reasonably achievable) as well as the goal of the Image Gently campaign.[11,13]

## Methods

This study included 100 consecutive patients with complaints of right lower abdominal quadrant pain with suspected acute inflammation of the appendix who were admitted to the surgical emergency centre of Alexandria Main University Hospital in 2013.

This research was approved by the ethics committee of Alexandria University, and informed consent was acquired from each of the patients while they were still in the emergency centre.

The exclusion criteria were the following: age below 12 years or above 65 years; mental retardation, and pregnant females.

The data collection team worked independently of the surgeons, radiologists and pathologists and did not interfere with the decisions made by the emergency surgery team or the radiologists.

The Alvarado scores were determined by the data collection team based on the patient's admission into the emergency centre before they were either examined by the surgeons on duty or underwent ultrasound examination. Next, all patients were examined by the radiologists and doctors immediately after being examined by the surgical team, regardless of their decision (the radiologists were blinded to the clinical findings) and the ultrasound results were classified as positive for appendicitis, negative for appendicitis, or equivocal.

'Negative for appendicitis' criterion was as follows: the appendix was not observed normally or pathologically identified. The equivocal criterion was: the appendix was observed but a non-considerable amount of free fluid with thickened, dilated, or non-peristaltic structure was observed in the right inferior quadrant of the abdomen. And the 'positive for appendicitis' criteria were as follows:

- Non-compressible, non-peristaltic blind tubular structure with an outer diameter of $\geqslant 6$ mms,
- Hyperechogenicity of the surrounding fat,
- The presence of an appendicolith (i.e., an intra-luminal echogenic focus with posterior shadowing),
- Peri-appendicular collection denoting perforation or abscess formation, and
- Hypervascularisation of the appendix as observed on colour Doppler.

All patients received intravenous fluids and parenteral antibiotics in the emergency centre. The patients that did not undergo surgery were followed-up in the hospital for 48 h (with coverage with intravenous fluids and parenteral antibiotics) and then discharged on a home medical treatment of antibiotic + antispasmodic for ten days, and the follow-up was continued for one month in the outpatient clinic.

Outcomes were investigated, and pathological reports for the patients who underwent operations were recorded. The collected data were sent to the Biostatistics Department for analysis, and the results were sent to the data collection team at the end of the research.

## Results

This study included 100 patients, including 57 females (57%) and 43 males. The ages ranged from 14 to 48 years with a mean of 25.9 ± 8.2 years. Most (52%) of the patients were in the third decade of life, 26% in their second decade of life, and 22% were older than 30 years of age.

All patients presented with complaints of right iliac fossa pain, but only 53 patients reported a history of periumbilical pain shifting to right iliac fossa (migratory right iliac fossa pain). Seventy-four patients (74%) complained of anorexia, 85 patients (85%) complained of nausea, 53 patients (53%) had histories of vomiting, and 5 patients (5%) had histories of diarrhoea. Seventeen patients (17%) complained of constipation, and 12 patients (12%) had urinary complains related to dysuria or urinary frequency.

Forty-five patients (45%) were febrile with temperatures ranging from 37.4 to 38.6 degrees Celsius with a mean of 37.9 ± 0.4 degrees.

Total white blood cell (WBC) counts ranged from 800 to 24,000/μl with a mean of 11,900 ± 4900 cells. Taking 10,000 WBC/μl as the cut-off for leucocytosis, 66 patients (66%) had leucocytosis. Regarding the differential count, 62 patients (62%) had neutrophilia.

Ultrasounds were found to be positive in 46 patients, and all were found to be pathologically positive for appendicitis. Among the negative ultrasound cases ($n = 41$), 31 patients were definitively without appendicitis, and 10 patients had appendicitis (Table 1). Regarding the equivocal cases ($n = 13$), seven patients had appendicitis, and six were negative for appendicitis.

The studied patients had Alvarado scores ranging from four to ten with a mean of 7.3 ± 2.0. The Alvarado score