



# Clinical diagnosis of uncomplicated, acute appendicitis remains an imperfect science

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Appendicitis is one of the most common general surgery emergencies with an annual incidence worldwide of 96.5 to 100 cases per 100,000 adults (1,2). An accurate and expeditious diagnosis can typically be made by clinical exam when paired with basic laboratory testing. The more consistent the exam is with classical signs for appendicitis, the more straightforward the diagnosis.

Several scoring systems have been developed in an attempt to formalize a framework for history, physical and laboratory exam for consistency between clinicians. The Alvarado score (3) evaluate patients pain type, temperature, and leukocytosis. Points are scaled and assigned for each component. Other scoring systems such as the Appendicitis Inflammatory Response (AIR) (4,5), Adult Appendicitis Score (AAS) (6), and Raja Isteri Penegiran Anak Saleha (RIPASA) (7) score show improved specificity and sensitivity when compared to the Alvarado score depending on the country and population of study. The RIPASA score even considers whether the patient is a foreign national. Scoring systems perform well for patients who present with classical findings for appendicitis. All of these scoring systems start to breakdown with equivocal exams and atypical symptoms. For example, when the Alvarado scoring system predicts a high risk of appendicitis, it is approximately 87% correct. This quickly drops to 45% for moderate risk and 3.7% for low risk (3).

Multiple imaging studies are available to assist the clinician. This is especially important for the moderate to

low-risk scores, or female patients that carry the likelihood of an alternative diagnosis. Each imaging modality carries different advantages and disadvantages. The three most commonly used techniques are ultrasound (US), computed tomography (CT), and magnetic resonance imaging (MRI).

US is the cheapest available exam and provides minimal to no risk to the patient (7). Its primary advantage over other types of imaging is its safety. It does not use ionizing radiation allowing it be used for pediatric and pregnant patients. It is highly portable and can be plugged into a handheld smart phone or tablet. It does have limitations in that it is very user dependent with high rates of indeterminate examinations. For example, around 50% of normal appendices are not visualized, and it may not be helpful in patients with a moderate to large abdominal girth. The European Association for Endoscopic Surgery (EAES) recommends US as the first imaging modality for patients with suspected appendicitis (8,9). While it does remain a good rule in test, it is not as helpful as a rule out test and a negative study cannot exclude the differential of acute appendicitis.

CT is the most sensitive and specific of the three imaging modalities for acute appendicitis. Its advantages as an imaging modality include a high diagnostic accuracy and a low rate of indeterminate exams (7). Its use is associated with decreasing numbers of unnecessary surgical appendectomies. The primary drawback to CT imaging includes the exposure to ionizing radiation. This

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is especially concerning for younger patients with longer lifespans. To improve accuracy, contrast agents should be given intravenously, which also presents a risk to the patient.

MRI lands in between CT and US with regard to its utility for diagnosing appendicitis (3). Like US, it does not use ionizing radiation, it is highly accurate when the appendix is seen and can be used in pregnant patients (7). However, it is not widely available, is expensive, and is time consuming.

The selected scoring systems for the Bispebjerg Hospital's review of their institutional experience are Scandinavian in origin (4,6). With the similar ethnic background, their study is in line with previously published data. They displayed that imaging can be a useful adjunct for diagnosing uncomplicated, acute appendicitis when paired with the structure of a scoring system for the history, physical exam and basic laboratory. They also demonstrated that the current scoring systems are not as useful with female patients as they are more difficult to stratify between the high risk and low risk AAS scores. Still, use of a scoring system may lead to a decrease in the negative appendectomy rate.

Regardless of the scoring system, physician judgement remains a cornerstone of patient care. The local culture of the treating facility will influence what is an acceptable treatment for the individual patient. For example, a patient who lives near to a hospital with surgical capabilities is different than a patient with an unclear diagnosis who lives hours from medical care. Of particular concern to the clinician is the undifferentiated patient with signs of an infection concerning for appendicitis. While some groups may prefer imaging, or antibiotics, others may perform a diagnostic laparoscopy. Multiple factors should be taken into consideration for the treatment of the undifferentiated patient, including the patient's sex, symptoms, ethnic background, social factors, available surgical options, and ability to follow up. Diagnosis of acute appendicitis can be difficult in patients with equivocal exams. Patient factors not captured by this scoring systems should play a role in the successful treatment of the individual.

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