

# Lab tests and ultrasounds identify children who need surgical treatment for appendicitis

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Data from two standard diagnostic tests commonly obtained in children evaluated for abdominal pain—when combined—can improve the ability of emergency department physicians and pediatric surgeons to identify those patients who should be sent to the operating room for prompt removal of an inflamed appendix; those who may be admitted for observation; and those who may safely be discharged home, according to a new study published online as an "article in press" in the *Journal of the American College of Surgeons (JACS)*. The study will appear in a print edition of the Journal this spring.

The researchers from Boston Children's Hospital retrospectively examined major categories of ultrasound findings in children with suspected [appendicitis](#) in conjunction with blood tests that signal [bacterial infection](#) in 845 children seen in the [emergency department](#) between 2010 and 2012. It is believed to be the one of the first studies to show that the addition of the white blood count (WBC) and polymorphonuclear leukocyte differential (PMN%) data can significantly improve the clinical value of ultrasound in diagnosing appendicitis in children, according to the study authors.

"Ninety percent of all hospitals perform laboratory studies and ultrasound when there is a reasonable suspicion of appendicitis in children. Hospitals tend to look at the results of these studies independently, however, and the improved diagnostic value of using these in a complimentary fashion has not yet been reported. The diagnostic evaluation approach in this study can be used by other institutions as a diagnostic tool to help emergency department physicians and surgeons provide better care by avoiding treatment delay in very high-risk patients and unnecessary admissions for very low risk patients," according to

lead study author and pediatric surgeon Shawn J. Rangel, MD, MSCE, FACS, at Boston Children's Hospital.

Emergency physicians and surgeons typically order ultrasound scans to obtain images of the appendix and the surrounding tissues in children with acute abdominal pain to look for evidence of appendicitis. Sonographic scans often do not lead to a definitive conclusion about the presence or absence of appendicitis, however. In the Boston Children's Hospital study, a radiologist could not identify a normal appendix or any evidence of appendicitis on sonogram in more than half of all patients with suspected appendicitis. This relatively high rate of equivocal studies is not uncommon in children, however, and has been reported at other hospitals that also routinely evaluate children with abdominal pain.

An elevated WBC and a shift in the PMN% differential tend to be sensitive indicators of appendicitis. However, these changes are not always present in children with appendicitis, and such changes may be abnormal even in children who do not have the disease. Of the 845 children in this study, 393 (46.5 percent) had appendicitis. An elevated WBC count was found in 348 (62.1 percent) of these patients, and a PMN% shift was found in 340 (58.5 percent). In children who did not have appendicitis, the WBC was elevated in 212 (37.9 percent), and the PMN% shift occurred in 241 (41.5 percent).

The ability to identify children with and without appendicitis was significantly improved when sonographic and laboratory findings were paired. The risk of appendicitis rose from 79.1 percent to 91.3 percent when laboratory studies indicated a bacterial infection and sonography showed primary signs of appendicitis, such as increased blood flow

or a thickening in the wall of the appendix. The risk of appendicitis rose from 89.1 percent to 96.8 percent when laboratory results were abnormal and the sonogram showed secondary signs of appendicitis, e.g., fat near the appendix.

The ability to single out children who did not have appendicitis also was substantially improved, the researchers noted. In children where the ultrasound showed neither a normal appendix nor evidence of appendicitis (the largest single category of ultrasound findings), the percentage of [children](#) who did not have appendicitis rose from 46.0 percent to 98.2 percent when laboratory studies were within normal ranges.

The approach outlined in this study differs from other methods of assessing the risk that a child may have appendicitis. The Pediatric Appendicitis and Alvarado Scores typically combine a child's clinical presentation and laboratory data to determine whether a child has a high-, medium-, or low-risk of appendicitis. The scores have not been proven to be reliable in a clinical setting in a number of prospective studies, however, and do not take into account the important diagnostic information provided by ultrasound.

The approach followed in the Boston Children's Hospital study can be adapted to individual settings. "Any institution can read our study and readily reproduce what we did," Dr. Rangel said. "We are not advocating that other hospitals adopt our sonographic categories or laboratory value cut-offs for WBC and PMN values, but rather to work collaboratively with their radiologists and emergency room physicians to develop their own approach for categorizing sonographic findings in their patients with suspected appendicitis, and then develop risk profiles that are tailor-made for their patients after incorporation of their institution's laboratory data. Institutions can use the risk profiles as educational vehicles and clinical guidelines decision tools to help emergency department physicians and surgeons avoid unnecessary computed tomography (CT) scans and admissions for observation for very low-risk patients, and avoid treatment delays in very high-risk patients," he concluded.

**More information:** Use of White Blood Cell Count and Polymorphonuclear Leukocyte Differential to Improve the Predictive Value of Ultrasound for Suspected Appendicitis in Children. *Journal of the American College of Surgeons*.

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