

# Weigh Image Options in Diagnosing Appendicitis

*Decide between computed tomography and ultrasound based on the imaging tools' strengths and weaknesses.*

BY PATRICE WENDLING  
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CHICAGO — One way to avoid diagnostic pitfalls in pediatric appendicitis is by using imaging studies effectively, Dr. George Taylor said at the annual meeting of the Radiological Society of North America.

The decision to use diagnostic computed tomography (CT) versus ultrasound should be based on a thorough understanding of the institution's strengths and weaknesses. "As in politics, all imaging is local," said Dr. Taylor, chief of radiology at Children's Hospital Boston.



The trade-off with ultrasound is that it is radiation free, but the miss rate for ultrasound is highly dependant on the prevalence of appendicitis in the area. A local prevalence rate of 33% at Children's Hospital Boston meant that ultrasound imaging was missing 40% of appendicitis cases, Dr. Taylor said.

This finding is consistent with a recent

meta-analysis that shows CT had a significantly higher sensitivity than did ultrasound in diagnostic studies of children and adults (*Radiology* 2006;241:83-94).

Dr. Taylor recommends using ultrasound first, followed by CT if the ultrasound findings are negative. When CT is used, efforts should be made to minimize radiation exposure by reducing the area scanned and optimizing the dose according to the child's weight and age.

The classic study on radiation risk (*Am. J. Roentgenol.* 2001;176:289-96) was based on the assumption that pediatric abdominal CT images were acquired at 404 milliampereseconds (mAs) and scanned from the diaphragm to the symphysis pubis. However, Children's Hospital acquires CT images from the iliac crest to the symphysis pubis at 230 mAs. The scan results in a whole-body dose of 18-30 mCi.

At this dose, the increased risk of all cancers is 0.009%-0.15%. This is a small but significant increased risk that is acceptable

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COURTESY DR. GEORGE TAYLOR

**Although this CT was suggestive of appendicitis, the patient was eventually diagnosed with a normal appendix and a case of viral gastroenteritis.**

when viewed against the background lifetime risk of cancer at 16%-20%, and the risk involved in having a perforated appendix, Dr. Taylor said.

Another decision to be made is the type of contrast agent used for CT scans. Among 589 children seen at Children's Hospital for suspected appendicitis, the overall visualization of the appendix was 92% for all contrast agents, 93% for rectal contrast only, 94% for rectal plus IV, and 78% for oral plus IV.

Rectal agents would appear to be the best approach, and indeed, oral and IV contrast agents were initially reserved for

younger children, those with developmental delays, or those who couldn't tolerate rectal contrast. But a review of the records revealed that when only rectal contrast was used, there was so much diagnostic uncertainty that an additional CT scan was ordered in a stunning 46% of cases—a number that Dr. Taylor called unacceptable.

Because many of the additional scans required IV contrast, the hospital began using rectal and IV agents.

During the first 6 months, there was no change in the number of additional CT scans being ordered.

But after this transitional period, the percentage fell to about 3%, and after adopting an IV-only approach, there has not been a single repeat CT ordered in the last 3 years, he said.

Not only is the radiation exposure reduced, but so is the number of complaints voiced about the invasiveness of rectal contrast.

Other diagnostic challenges with CT include reduced visualization of the appendix because of a lack of mesenteric fat, especially in children younger than 6 years; a tendency to overdiagnose appendicitis; lower sensitivity for ovarian pathology; the risk of perforation with rectal contrast; and false-positive findings, most commonly associated with an appendix greater than 6 mm in size, Dr. Taylor said. ■

## Pediatric, General Surgeons Share Appendectomy Outcomes

BY BARBARA J. RUTLEDGE  
Contributing Writer

Clinical outcomes in pediatric appendectomies performed by pediatric surgeons and general surgeons do not differ significantly, reported Dr. Sherif Emil and Michael Taylor.

"There are no specialty-dependent differences in clinical outcomes for simple or complicated appendicitis," they said. However, simple appendicitis treated by pediatric surgeons was associated with lower hospital costs (*J. Am. Coll. Surg.* 2007;204:34-9).

To determine whether specialty-dependent differences exist, Dr. Emil and Mr. Taylor of the University of California, Irvine, evaluated clinical characteristics and surgical outcomes of children treated for appendicitis at Miller Children's Hospital in Long Beach, Calif.

The study was based on a review of the medical charts of 465 patients under age 18 who were treated between January 2002 and May 2004.

During the study period, the hospital staff included 26 general surgeons credentialed to perform open appendectomy in patients at least 6 years old.

Of these, 24 surgeons were also credentialed to perform laparoscopic appendectomy in that patient population. Only three general surgeons were credentialed to perform open appendectomy in patients younger than 6 years, and only one was credentialed to perform laparoscopic appendectomy in patients younger than 6 years old.

The pediatric surgical staff consisted of three fellowship-trained, board-certified pediatric surgeons credentialed to perform both open and laparoscopic appendectomy in patients up to age 21 years.

Two of the pediatric surgeons in the study were in academic practice. The third pediatric surgeon and all 26 of the general surgeons were in private practice.

Rates of misdiagnosis, postoperative readmission, wound infection, intra-abdominal infection, and duration of hospital stay were assessed as primary outcomes.

Hospital charges were assessed as a secondary outcome.

The pediatric surgeons treated two-thirds of the children (304), including all but 1 of the 75 children younger than 6 years.

These 304 cases were distributed equally among the three pediatric surgeons, each of whom performed 50-60 appendectomies annually during the 2-year study period.

Of the 26 general surgeons, only 1 performed more than 10 pediatric appendectomies per year during the study period, and only 4 performed more than 5 per year.

Among the general surgeons, the median number of pediatric appendectomies performed per year was 1 (range, 0-11).

Patients in both groups had similar demographic and clinical characteristics, with a few significant differences.

Pediatric surgeons treated children whose mean age was 8.3 years, vs. 13.2 years for those treated by general surgeons.

Pediatric surgeons also treated a significantly higher percentage of children transferred from other hospitals than did general surgeons (42% vs. 23%) and a higher percentage of patients with complicated appendicitis (54% vs. 33%).

Misdiagnosis rates were 4.3% in the pediatric surgeons' group and 5.6% in the general surgeons' group.

For treatment of simple appendicitis, mean hospital stay was 1.82 days in the pediatric surgeons' group, vs.

1.94 days in the general surgeons' group.

Readmission rates were higher in the general surgeons' group than in the pediatric surgeons' group, both for simple appendicitis (2% vs. 0%, respectively) and for complicated appendicitis (6% vs. 2%, respectively).

Complicated appendicitis was associated with higher wound infection and intra-abdominal infection rates in the general surgeons' group (2% and 4%, respectively) than in the pediatric surgeons' group (0.6% and 1%, respectively), but the differences did not reach statistical significance.

Mean hospital stays for complicated appendicitis were 5.21 days in the pediatric surgeons' group and 4.68 days in the general surgeons' group.

General surgeons used postoperative antibiotics in a significantly higher percentage of simple appendicitis cases than did pediatric surgeons (77% vs. 55%, respectively).

Similarly, general surgeons prescribed oral antibiotics on discharge to a higher percentage of

patients than did pediatric surgeons, following in-hospital treatment of simple appendicitis (15% vs. 4%, respectively) or complicated appendicitis (66% vs. 30%, respectively).

Median hospital charges for simple appendicitis were \$10,735 for the pediatric surgeons' group vs. \$11,613 for the general surgeons' group.

A subset analysis of patients aged 6 years and older showed a trend toward shorter hospital stays in the pediatric surgeons' group than in the general surgeons' group (1.75 days vs. 1.94 days, respectively).

Shorter hospital stays and lower use of antibiotics could account for the lower hospital costs for simple appendicitis treated by pediatric surgeons, the authors said. ■

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