Why Has Computed Tomography Won and Ultrasound Lost the Market Share of Imaging for Acute Pelvic Conditions in the Female Patient?

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In the late 1970s when I was a radiology resident, there was an ultrasound machine in the emergency radiology suite but no computed tomographic (CT) scanner. There was only 1 CT scanner in our hospital (Massachusetts General Hospital, 1977–1980), and all of the CT scans ordered by the emergency room were for head trauma. Nowadays, not only is there a CT scanner in the emergency room, but it is working around the clock and has become the first-line evaluation for many patients presenting with abdominal or pelvic conditions. Somehow over the years, ultrasound has inexplicably lost the market share for evaluating women with pelvic or lower abdominal pain.

This practice is evident daily in my ultrasound unit when patients are referred to me for pelvic ultrasound because of a finding on their recent CT scan that was equivocal or inconclusive. Don’t these ordering physicians remember that ultrasound is far better for evaluating the female pelvis than CT and ultrasound has no ionizing radiation? How have we evolved to ordering the most expensive imaging technique first for these patients, only to be followed frequently by a far less costly ultrasound examination to clarify the CT findings? Ultrasound is the established modality of choice to evaluate the female pelvis, so why do patients with pelvic masses or pain get a CT scan? In my opinion, doing a CT scan first for female patients with lower abdominal pain is dangerous and wasteful, a drain of much-needed health care dollars.

Several articles in the literature, mostly pictorial essays, describe the CT appearance of some of the common acute female pelvic conditions, such as ovarian cysts, hemorrhagic cysts, hydrosalpinx, pedunculated fibroids, and tubo-ovarian abscesses.\textsuperscript{1,2} While all of these articles claim that ultrasound is well known to be the imaging modality of choice for evaluation of the female pelvis, they show the appearance of these conditions on CT images because of the rampant use of CT in these patients who present to the emergency room.\textsuperscript{1,2} Rather than trying to teach the appearance of these gynecologic diseases on CT, why not simply order an ultrasound examination first and make the diagnosis more easily and without radiation or high costs?

The effect of exposure to low-dose radiation from the multitude of CT scans merits further discussion. A recent study in the \textit{New England Journal of Medicine} reported that among 952,420 adults aged 18 to 64 years seen between January 1, 2005, and December 31, 2007, 68.8% underwent at least 1 imaging procedure that involved radiation exposure.\textsuperscript{3} We must keep in mind that radiation exposure is cumulative, and each exposure
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adds incrementally to the long-term danger of cancer. These authors further showed that CT scanning and nuclear imaging accounted for 75.4% of the accumulated dose of radiation due to diagnostic tests, with 81.8% of these tests administered to outpatients.\(^3\) They showed that the 20 procedures with the largest contributions to the cumulative effect of radiation besides cardiac imaging included CT of the abdomen, pelvis, and chest, which accounted for almost 38% of the procedures. Plain-film radiography, on the other hand, made up 71.4% of the total number of procedures but only 10.6% of the cumulative radiation dose. Few people consider or even know that the dose of radiation from CT of the pelvis is much higher (6 mSv) than for a chest radiograph (0.02 mSv). Another recent study reported that CT scanning has increased 3-fold since 1993, and an estimated 29,000 future cancers could be related to CT done in the United States in 2007. The largest contribution to this projected risk of cancer (14,000 cancers) was attributed to CT of the pelvis and abdomen.\(^4\)

We must remember that ultrasound is safe and free of any radiation. After decades of widespread use, no harmful effects due to diagnostic ultrasound have emerged, even in the human fetus. So why has the medical community moved from ultrasound to CT for evaluation of the female pelvis with acute symptoms? Computed tomography does provide advantages over ultrasound in the detection of gastrointestinal conditions, such as appendicitis and diverticulitis. Ultrasound, however, has a respectable track record for appendicitis, and several studies have concluded that CT should be the secondary test if ultrasound does not provide the answer.\(^5,6\) I doubt that anyone will deny that most if not all cases of gynecologic abnormalities are better evaluated by ultrasound and will rarely need any further diagnostic imaging tests.

Some practitioners also believe that CT is easier to perform than ultrasound because it is less operator dependent and requires less personnel and time than ultrasound. Computed tomographic scans are rapid volume scans that can provide multiplanar reconstruction, whereas ultrasound has always been a 2-dimensional modality. This is changing. Ultrasound machines can now produce multiplanar reconstruction from 3D volume imaging much like CT or magnetic resonance imaging.\(^7\) It may be time for ultrasound to regain its rightful place in the evaluation of acute female pelvic and lower abdominal conditions and save the population from the dangerous radiation exposure and excessive cost of starting a workup with CT as a first-line imaging test.

References