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Bedside Ultrasonography Done in Emergency Department Expedites Diagnosis of Abdominal Aortic Aneurysms: Three Case Studies

Ruptured abdominal aneurysms have a high rate of misdiagnosis and mortality. We report three cases of ruptured abdominal aneurysm diagnosed by an emergency department physician using bedside ultrasonography as part of routine abdominal examination.

Combined with clinical findings in one case, ultrasonographic detection of aneurysm and free intraperitoneal fluid obviated the need for computed tomography (CT) evaluation. In another case, the diagnosis of ruptured aortic aneurysm might have been missed had bedside ultrasonography not been done. In all three cases, bedside ultrasonography facilitated expeditious diagnosis and management of the condition.

Introduction

Abdominal aneurysm is defined as focal dilation of the aorta to a diameter ≥50% of normal or to a diameter >3 cm. When the correct diagnosis is established initially, the mortality rate for ruptured abdominal aortic aneurysms is 35%. However, mortality rate is increased to 75% when ruptured abdominal aortic aneurysm is not recognized initially.[1] Unfortunately, rupture is frequently the first manifestation of aortic aneurysm, and as many as two thirds of abdominal aortic aneurysms are not recognized before rupture.[2] Moreover, although abdominal pain is noted in more than 80% of patients with ruptured abdominal aneurysm, only half of patients with this condition show the classic triad—abdominal pain, hypotension, and a pulsatile mass.

In the Emergency Department at the Kaiser Permanente (KP) Medical Center in Bellflower, California, bedside ultrasonography has, for the past year, been part of the standard physical examination done for all patients evaluated for flank and abdominal pain. This aspect of the examination is brief and diagnosis-specific.

We present three cases where a quick ultrasonographic examination done at the bedside expedited the diagnosis of ruptured abdominal aortic aneurysm. In one case, the ruptured aneurysm might have been missed had bedside ultrasonography not been part of the routine evaluation. In another case, bedside ultrasonography obviated the need for computed tomography (CT) scan and expedited definitive care.

Case Reports

Case 1

A 78-year-old man was transferred to our Emergency Department from a non-KP emergency department with a diagnosis of nephrolithiasis made on the basis of left flank pain and microscopically detected hematuria. Hematocrit and results of abdominal x-ray series were normal. Vital signs at arrival in our Emergency Department were normal. Results of abdominal examination led to suspicion an aneurysm. Bedside ultrasonography showed a 9-cm abdominal aortic aneurysm (Figure 1). Rupture was confirmed by CT scan, and the patient was immediately taken to have surgery for definitive repair of the aneurysm. The patient did well postoperatively and was discharged home without adverse sequelae.

Case 2

A 91-year-old man was transferred by paramedics to our Emergency Department because of acute back and abdominal pain. Vital signs measured at arrival included blood pressure of 90 mmHg systolic and 60 mmHg diastolic, pulse rate of 110 beats per minute, 18 respirations per minute, and temperature of 36.4°C. Results of physical examination showed a slightly tender abdomen, suggesting presence of an aneurysm. Immediate bedside ultrasonography showed an 8.9-cm aortic aneurysm (Figure 2). Aneurysmal rupture into the peritoneum was increasingly suspected after fluid was noted in Morrison's pouch (Figure 3). On

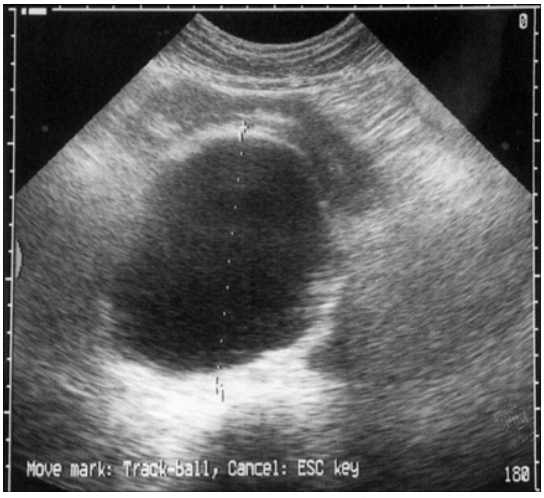

Figure 1. Ultrasonogram shows 9-cm abdominal aortic aneurysm in 78-year-old man.

"We present three cases where a quick ultrasonographic examination done at the bedside expedited the diagnosis of ruptured abdominal aortic aneurysm."

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the basis of ultrasonographic findings and initial clinical appearance, the patient was taken to the operating suite for resection of the ruptured aneurysm and for placement of a tube graft; surgery was begun within 30 minutes after the patient arrived in the Emergency Department. Presence of blood in the peritoneum was noted intraoperatively; at that time, the patient received transfusion of 12 units of whole blood. On the third postoperative day, the patient became comatose and hypotensive. At the request of his family, he was not resuscitated. The patient died.

Case 3

Paramedics transferred an 85-year-old man to our Emergency Department because of acute weakness, dizziness, and abdominal pain. Vital signs measured at arrival in the Emergency Department included blood pressure of 120 mmHg systolic and 72 mmHg diastolic, pulse rate of 67 beats per minute, 18 respirations per minute, and temperature of 36.4°C.

Physical examination showed mild abdominal pain that completely resolved after the patient had a bowel movement. Bowel sounds were normal, and no mass was palpated. Laboratory examination showed guaiac-negative stool.

As part of the initial evaluation, preliminary bedside ultrasonography was done by the Emergency Department physician and showed a 3.3-cm abdominal aneurysm and intraluminal clot (Figure 4). Baseline laboratory results were normal and included a white blood cell count of 11.0×10^9/L, and hematocrit of .40. The patient requested immediate discharge but was persuaded to have formal ultrasonography done in the Radiology Department; results of this examination corroborated the preliminary diagnosis of aneurysm. Contrast-CT scan confirmed that the aneurysm measured 3.8 cm. In addition, a small leak was noted in the posterior wall of the aorta. Ectasia of both common iliac arteries and an intraluminal clot were also seen. The patient was taken to the operating suite for resection of the leaking abdominal aortic aneurysm and for placement of a tube graft. He also received bilateral femoral thromboembolectomy. Postoperative complications included acute renal failure, ischemia of the spinal cord at T10-T12, areflexia of the knees and ankles, and minimal use of hip flexor and leg extensor muscles. The patient's renal function gradually became normal, and he was discharged to a rehabilitation facility for physical therapy after two weeks of inpatient care at our medical center.

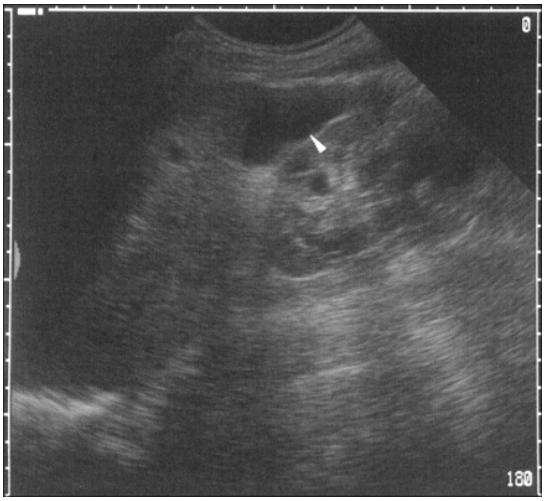

Figure 3. Ultrasonogram shows intraperitoneal fluid in Morrison's pouch.

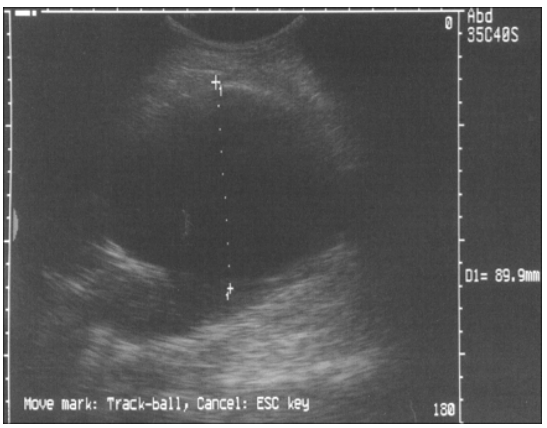

Figure 2. Ultrasonogram shows 8.9-cm aortic aneurysm in 91-year-old man .

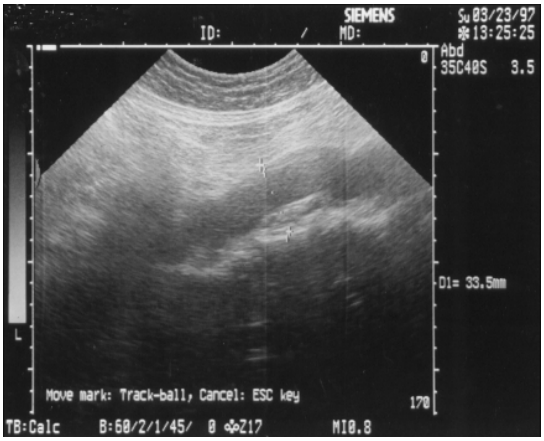

Figure 4. Ultrasonogram shows 3.3-cm abdominal aneurysm and intraluminal clot in 85-year-old man.

Discussion

Ruptured abdominal aortic aneurysm accounts for at least 15,000 deaths per year in the United States and is the tenth leading cause of death among men older than 55 years.[3] Recent research suggest that abdominal aortic aneurysm in men older than 60 years may be more than twice as common as the traditionally reported value, 2%.[4]

In a review of 152 patients with ruptured abdominal aortic aneurysm, Marston et al[5] noted a 30% rate of misdiagnosis, defined as six hours' delay between initial and final diagnosis. Half of the patients in that series[5] were misdiagnosed as having renal colic. Another third were misdiagnosed as having diverticulitis or gastrointestinal bleeding. In a review of referrals for radiologic evaluation for possible aortic aneurysm in Olmsted County, Minnesota, Beede and Ballard[6] reported that during a two-year period, clinical suspicion had a positive predictive value of only 14.7% (ie, clinical suspicion was confirmed for 17 of 116 patients).

Risk of aneurysmal rupture and subsequent long-term survival for patients who do not have surgery is directly related to size of the aneurysm. The 5-year rate of rupture of aneurysm exceeds 75% for patients with an aneurysm measuring ≥7.0 cm. For patients with an aneurysm measuring 6 cm, the 5-year rate of rupture is about 35%; and for patients with an aneurysm 5.0-5.9 cm, the rate of rupture is about 25%. About 10% of all aneurysms smaller than 4 cm rupture and cause death.[5,6,7] Currently, elective surgery is recommended for all patients with an aneurysm >6 cm, and a selective approach is used for patients with an aneurysm measuring 5-6 cm.

Because of the high mortality rate associated with a ruptured aortic aneurysm, this diagnosis should be considered for elderly patients who are seen for abdominal or back pain and transitory hypotension. Clinical studies confirm that ultrasonography done in the Radiology Department is effective for diagnosing presence or absence of aneurysms in 94%-98% of patients.[8] However, concealment of the aorta by intestinal gas or severe obesity can occasionally make radiologic evaluation difficult.

Ultrasonography is not routinely used to diagnose a ruptured aneurysm. In one of our patients, however, ultrasonography showed peritoneal fluid in Morrison's pouch. In conjunction with presence of a large abdominal aneurysm, this finding obviated the need for a CT scan. Indeed, the patient was taken immediately to the operating suite on the basis of these two bedside ultrasonographic findings.

The sensitivity of ultrasound for detecting peritoneal bleeding is somewhat controversial. After nondiagnostic peritoneal lavage was done in patients who had blunt abdominal trauma, Branney et al[9] infused fluid into the peritoneum while Emergency Department physicians, radiologists, and surgeons continuously scanned Morrison's pouch. Only 10% of these surgeons detected peritoneal fluid volumes measuring <400 ml. After a liter of fluid was infused, sensitivity of detection increased to 97%.[9] In contrast, Goldberg[10] noted that 100 ml of intraperitoneal fluid injected into cadavers placed in various positions could be detected by ultrasonography.

For hemodynamically stable patients, contrast CT should be done. In most cases, high-resolution CT correctly identifies the proximal and distal extent of aortic as well as iliac aneurysms. CT is 77% sensitive and 100% specific for detecting retroperitoneal blood.[11] Magnetic resonance imaging (MRI) is an excellent tool for preoperative evaluation of aortic aneurysms, but cost and availability favor use of CT for most patients seen in the Emergency Department.

Our three cases illustrate how bedside ultrasonography done by the Emergency Department physician expedited and improved the management of ruptured aortic aneurysm: In one case, bedside ultrasonography assisted our Emergency Department physician in correctly diagnosing a ruptured aneurysm after it was misdiagnosed elsewhere as a kidney stone; in another case, although the diagnosis was clinically apparent, results of bedside ultrasonography obviated the need for a CT scan and thus further expedited definitive care; in a third case, resolution of symptoms rendered the diagnosis of ruptured aortic aneurysm unlikely.

Conclusion

A compelling argument exists for any tool that expedites evaluation of patients by the Emergency Department physician. Given that bedside ultrasonographic screening for abdominal aortic aneurysm adds only minimal time to the physical examination and given the high rates of misdiagnosis and mortality associated with ruptured aneurysm, incorporating bedside ultrasonography into routine examination of patients—especially elderly patients—who come to the Emergency Department with abdominal or flank pain improves the clinician's skill in diagnosing and expeditiously managing ruptured aortic abdominal aneurysm. ❖

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