

## Emergency Evaluation of Patients Presenting with Acute Scrotum Using Bedside Ultrasonography

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**Abstract.** Acute scrotal pain is not a rare emergency department (ED) complaint. Traditional reliance on medical history and physical examination can be precarious as signs and symptoms can overlap in various etiologies of acute scrotal pain. **Objective:** To determine the accuracy with which emergency physicians (EPs) using bedside ultrasonography are able to evaluate patients presenting to the ED with acute scrotal pain. **Methods:** The study was performed at an urban community hospital ED with a residency program and an annual census of 70,000. A retrospective chart review identified 36 patients who presented with complaints of acute scrotal pain and were evaluated by EPs using bedside ultrasound. A 5.0- or 7.5-MHz linear-array transducer with color and power Doppler capability was used to scan the scrotum. Patients were seen between July 1998 and September 1999. Diagnoses were verified by radiology or surgery. Sensitivity and specificity with 95% confidence intervals were calculated. **Results:** The EP ultrasound examinations agreed with confirmatory studies for 35 of 36 patients, resulting in a sensitivity of 95% (95% CI = 0.78 to 0.99) and a specificity of 94% (95% CI = 0.72 to 0.99). Diagnoses included three testicular torsions, six cases of epididymitis, four cases of orchitis, one testicular fracture, three hernias, three hydroceles, and 15 normal examinations. One case of epididymitis was misdiagnosed as an epididymal mass. **Conclusions:** This study suggests that EPs using bedside ultrasonography are able to accurately diagnose patients presenting with acute scrotal pain. In addition, they appear able to differentiate between surgical emergencies, such as testicular torsion, and other etiologies. **Key words:** ultrasound; testicular ultrasonography; acute scrotal pain; emergency medicine. *ACADEMIC EMERGENCY MEDICINE* 2001; 8:90–93

Acute scrotal pain is not a rare presentation in the emergency department (ED). Differential diagnosis of the acute scrotum typically includes testicular torsion, testicular hemor-

rhage, epididymitis, orchitis, and hernia. Patients with acute scrotal pain seen in the ED often present a diagnostic dilemma. Physical examination alone is not enough to differentiate between several of these etiologies. However, a distinction between the underlying pathology is critical, as testicular torsion necessitates surgical intervention, while epididymitis is treated with medical management.

Approximately 0.5% of total ED visits are for acute scrotal pain. While earlier studies indicated that most of these patients present with testicular torsion, more recent literature based on ED patients disagrees; torsion represents no more than 25% of the cases of acute scro-

tal pain.<sup>1,2</sup> However, missed cases of testicular torsion are still a major concern for emergency physicians (EPs).

Emergency medicine textbooks sometimes imply that history and physical examination are highly reliable for differentiating the etiologies of acute testicular pain, such as torsion, epididymitis, orchitis, and trauma.<sup>3</sup> The urology and radiology literature, however, indicates that history and physical examination findings have significant overlap, especially in testicular torsion, epididymitis, and orchitis.<sup>4</sup> Even features such as time of onset, dysuria, urethral discharge, and fever do not always accurately differentiate the etiologies of torsion, epididymitis, and orchitis.

Previous episodes of testicular pain are not uniform in all cases of torsion. Testicular torsion pain can be gradual in onset in up to 25% of patients.<sup>5</sup> Furthermore, acute trauma to the testicle can lead to torsion and be a "red herring" for physicians who do not realize that trauma has led to torsion.<sup>6</sup> Epididymitis patients can present with an apparently acute onset of pain and in 50% of cases may lack associated urinary symptoms or urethral discharge.<sup>7</sup>

On physical examination the torsed testicle may have equivocal cremasteric reflex and the lie may be deceptively normal if obscured by swelling. Patients presenting early with torsion may have a painful epididymis only. Conversely, severe epididymitis has actually led to torsion.<sup>8</sup> The most common misdiagnosis for testicular torsion is epididymitis.

To determine EPs' ability to accurately diagnose the varying etiologies of acute scrotal pain, we retrospectively evaluated 36 testicular ultrasound exams performed by EPs from July 1998 to September 1999. All of the studies were performed for evaluation of acute scrotal pain.

### METHODS

**Study Design.** This was a descriptive retrospective study based on chart review. The institutional review board approved the research, with exemption from informed consent.

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### ***Study Setting and Population.***

The study was conducted in an urban teaching ED with an emergency medicine (EM) residency program. The ED has a census of approximately 70,000 visits per year. Adult as well as pediatric patients are seen at the facility, which has full specialty backup. All patients presenting to the ED with complaints of testicular pain between July 1998 and September 1999 were identified from a computerized hospital database as well as an ED ultrasound quality assurance (QA) database.

Approximately 300 bedside ultrasound studies are performed in our ED each month. The ED is staffed by board-certified EM attending physicians as well as EM residents. Both residents and attending physicians perform bedside ultrasound examinations. An intra-departmental certification exists that rates residents and attending physicians into different user levels. An active ultrasound education program exists within the department as well as a one-year ultrasound fellowship.

In our ED a 7.5-MHz probe is available on an ultrasound machine capable of color Doppler imaging. The machine and probe were initially used for a lower-extremity deep venous thrombosis (DVT) study. Several EPs in the ED perform testicular ultrasound examinations. During evening and night hours, ordering a testicular ultrasound exam can be difficult logistically because the radiologists on duty must call a technologist in from home. When a test is ordered the typical turnaround time is two to three hours. These factors have encouraged EPs at our institution to learn and begin performing their own testicular ultrasound examinations for evaluation of acute testicular pain. The study physicians all had more than 150 ultrasound scan experience. None of them had previously had training in performing testicular ultrasound studies.

Patients presenting to the ED were eligible for study enrollment if they complained of acute-onset testicular pain. Acute onset of pain was defined to be within 24 hours of presentation. It is the ultrasound policy that bedside testing should not interfere with patient care and no ul-

trasound examinations can be performed that would delay formal testing or surgical intervention.

Only patients who received a testicular bedside ultrasound exam, and then a confirming study such as radiology ultrasound testing, scintigraphy, or surgical exploration, were enrolled into the study.

***Study Protocol.*** Patients who received bedside ultrasound examinations for evaluation of scrotal pain were identified from an ED QA database. Patients were scanned to evaluate for painful etiologies, including testicular torsion, testicular fracture, epididymitis, orchitis, hernia, hemorrhage, and testicular mass. Patients scanned for teaching purposes, for chronic pain, or unrelated injury, such as gunshot wound, were not included in the study. All examinations were recorded on a standardized ultrasound log and were taped on VHS tape for review by the department ultrasound QA committee.

***Measures.*** Clinical data were obtained from a computerized patient database and from an ED ultrasound QA database. Residents and attending physicians saw all patients. Bedside ultrasonography was performed immediately after initial physical examination. Radiological testing or surgical consultation was not delayed for bedside scanning. Initial complaint, bedside ultrasound results, criterion standard study results, and diagnosis upon leaving the ED were recorded.

Standard definitions of ultrasound pathology were used. Testicular torsion was defined as absent or markedly decreased blood flow in the affected testicle in comparison with the contralateral testis. Epididymitis was defined as increased blood flow to the epididymis in comparison with the contralateral side. Epididymal enlargement was also sought. Orchitis was defined as increased blood flow on color Doppler throughout the affected testicle when compared with the contralateral side. Testicular hemorrhage was defined as any abnormalities seen within the testis that could be considered evidence of testicular rupture, especially in the face of scrotal trauma. Ultrasound findings

that suggest testicular rupture and hemorrhage include focal areas of inhomogeneous testicular echogenicity.

Confirmatory radiology testing consisted of color Doppler ultrasonography; no scintigraphy was performed. The radiologists performing the tests were all board-certified in radiology. During the daytime an ultrasound fellowship-trained radiologist with more than 20 years' experience provided the diagnosis. Overnight tests were initially read by board-certified attending radiologists and were then reread the next day by an ultrasound fellowship-trained radiologist. Surgical consultation was obtained from the urology service and was provided by urology residents with attending supervision.

***Data Analysis.*** All patient information was entered into a Microsoft Excel 5.0 spreadsheet (Microsoft Corporation, Redmond, WA). Data were analyzed using descriptive statistics from a commercially available software package (Analyse-it 1.44, Analyse-it Inc., Leeds, Great Britain). Sensitivity and specificity with 95% confidence intervals were calculated.

## RESULTS

One hundred ninety-four patients with a complaint of scrotal pain were evaluated in the ED during the study period. Thirty-six patients received bedside ultrasound evaluation for acute testicular pain between July 1998 and September 1999. Median age was 45 years (range 10–62). The EP ultrasound examinations agreed with confirmatory studies for 35 of 36 patients, resulting in a sensitivity of 95% (95% CI = 0.78 to 0.99) and a specificity of 94% (95% CI = 0.72 to 0.99). The range of pathology identified is listed in Table 1. Scrotal pathology identified included testicular torsion, epididymitis, orchitis, and hernia.

Three testicular torsions were diagnosed. Two of the torsions were confirmed by radiology color Doppler ultrasound, and these patients were taken to the operating room (OR). Both of these patients were found to have torsed spermatic cords in the

TABLE 1. The Pathology Identified by Emergency Physicians on ED Ultrasound Examination

ED Ultrasound Finding	Number of Patients
Testicular torsion	3
Epididymitis	6
Orchitis	4
Hernia	3
Hydrocele	3
Testicular fracture	1
Testicular mass	1
No pathology	15

OR. One patient had complete salvage of the testicle. The second patient had 50% function in the affected testicle after operative intervention. The third patient with torsion was taken directly to the OR after the urologist reviewed our ultrasound findings. Torsion was confirmed in the OR, the testicle was successfully salvaged, and full function was restored. Two of the torsion patients were previously reported in a case report.<sup>9</sup>

The patient diagnosed as having herniation of abdominal content as the cause of his acute testicular pain was taken to the OR the same day due to worsening pain. The EP performing the bedside ultrasound examination believed that the herniated content was most likely to be omental fat. Surgical exploration confirmed this suspicion. The patient recovered from surgery uneventfully; no testicular involvement was shown.

The patient with testicular hemorrhage from trauma was operated on by the urology service without complication and recovered uneventfully. The patients diagnosed as having epididymitis or orchitis were treated with antibiotics and anti-inflammatory medications as indicated based on their age and urine results. No long-term follow-up of patients was performed. No patient returned to our facility for related complaints within 30 days; we did not determine whether these patients were evaluated later at other hospitals.

## DISCUSSION

Acute scrotal pain can be seen in patients of a wide age range. Although

previously thought to be the leading cause of acute scrotal pain, torsion represents no more than 25% of these ED visits.<sup>2</sup> Etiologies such as epididymitis, orchitis, and testicular hemorrhage can overlap with torsion in both signs and symptoms, thus leading to misdiagnosis.

Scrotal pathology has been investigated with ultrasonography since the late 1970s.<sup>10</sup> Color Doppler allowed sonographers to examine the testicle for blood flow. As a result, scintigraphy has been left largely by the wayside in many centers. Ultrasound is now the tool of choice for evaluation of testicular blood flow detection of inflammation and masses.

Emergency physicians have embraced ultrasound as a diagnostic aid in life-threatening illnesses such as trauma, abdominal aortic aneurysms, and cardiac tamponade, and some in the field are now exploring less traditional applications for emergency ultrasonography. Testicular ultrasound in the ED is becoming possible as more departments are acquiring high-resolution ultrasound machines, some with color Doppler capability. These have been used in evaluation for lower-extremity DVT, superficial foreign bodies, and joint arthrocentesis.<sup>11-13</sup> We have previously reported two of these torsion patients as case reports; we found no other references about EP evaluation of testicular pain with bedside ultrasonography.<sup>9</sup>

Although some cases of acute scrotal pain clearly call for surgical exploration, physical examination and history are not as accurate as previously thought. A patient who presents with what appears to be a relatively benign cause of testicular pain such as epididymitis may actually be torsed. Conversely, a patient who presents with an exquisitely painful and swollen testicle, which may upon exam indicate a torsed spermatic cord, may actually be suffering from orchitis. Physical examination has been shown to be only 50% accurate for diagnosis of acute testicular pain in one series.<sup>14</sup> It is often difficult to differentiate testicular torsion from other inflammatory conditions that can affect the scrotum. A recent study evaluated 77 cases of suspected testicular torsion by physical examination and

history.<sup>15</sup> Only nine of the 77 patients had torsion; 63 patients had findings that were normal or consistent with epididymitis or orchitis. Five patients had other diagnoses such as mass or testicular fracture that necessitated surgical exploration at a later time.<sup>15</sup>

In another study of 90 patients with acute scrotal pain, it was concluded that clinical diagnosis of epididymitis was not accurate enough to rule out testicular torsion, and the authors recommended exploration for all cases of acute scrotal pain.<sup>16</sup> Although this recommendation is unusually conservative, their results underscore the difficulty in reaching the correct diagnosis in acute scrotal pain without using an imaging study.

Scintigraphy, the traditional method of evaluating blood flow to the testis, is not readily available, is time-consuming, and does not visualize scrotal anatomy, thus making it difficult to diagnose hematoma, testicular fracture, and neoplasm.<sup>17</sup> Further, it may misdiagnose epididymitis in some cases of torsion. Increased blood flow to the scrotum may be seen in torsion and it may be hard to discern testicular from scrotal structures on scintigraphy, thus misdiagnosing the torsed testicle as orchitis.<sup>18</sup>

Color Doppler has lent itself as a highly accurate test for blood flow in the testicle and allows excellent visualization of the anatomy. Color Doppler ultrasound is now heavily relied upon throughout the United States to evaluate acute scrotal pain.<sup>14</sup> While ultrasound technology is more accessible than scintigraphy, it may still be difficult to obtain studies at night, leaving EPs at the mercy of a busy radiology department. In addition, ordering color Doppler ultrasound studies through radiology in every case of acute scrotum is not realistic in many institutions as hours may be added to a patient's ED workup. Funding cutbacks and a shortage of ultrasound technologists have made it difficult for some institutions to provide 24-hour-per-day coverage. In some cases, studies may be available, but the technologist must be called in from home, again adding extra time to the workup. Such situations create an ideal opportunity for use of an

accurate bedside test by EPs, such as color Doppler.

Necessity led us to explore this application for bedside use of ultrasound in the ED when prolonged waiting times to obtain an ultrasound examination and decreased access to formal ultrasound examinations during off hours began to jeopardize the quality of care provided to these patients.

There exists a clear need for rapid and accurate diagnosis in patients with acute scrotal pain. Our study suggests that bedside ultrasound of the scrotum may be another reasonable application of emergency ultrasound. We were able not only to identify patients who required operative intervention (i.e., the patients with torsion and testicular fracture), but also to accurately differentiate patients with epididymitis and orchitis from testicular torsion. This ability not only would provide the treating EP with reassurance about correct diagnosis, but may also help to avoid the morbidity associated with unnecessary surgical exploration.

#### LIMITATIONS AND FUTURE QUESTIONS

The primary limitation of this study is its retrospective design. In addition, the total number of patients enrolled and with each presenting pathology is small. However, to the best of our knowledge, this is the first study of testicular ultrasonography by EPs. No long-term follow-up was available for most patients. Follow-up to 30 days was obtained

for the testicular torsion patients from their urologists. Surrounding hospitals were not queried as to whether any of these patients presented there. It is also possible that some patients who were scanned by EPs were not entered into our ED logbook, but we believe this is unlikely.

Additional studies with more enrolled patients are required to define the training needed for EPs to accurately use testicular ultrasonography in their daily practice. Further, larger studies are required to evaluate the accuracy that can be achieved by EPs using bedside ultrasonography in diagnosing the acute scrotum.

#### CONCLUSIONS

This study suggests that EPs using bedside ultrasonography are able to accurately diagnose patients presenting with acute scrotal pain. In addition, they appear able to differentiate between surgical emergencies such as testicular torsion and other etiologies.

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