

# The impact of color Doppler ultrasound on treatment patterns of epididymitis in a university-based healthcare system

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## ABSTRACT

**Introduction and Objectives:** Evaluate the impact of scrotal color Doppler ultrasound (CDUS) on epididymitis treatment patterns in a university-based institution.

**Materials and Methods:** From 1 January 1999 to 30 July 2005, 870 patients from a single institution were diagnosed with epididymitis. A total of 480 men met the inclusion criteria for acute epididymitis. Scrotal ultrasound was included as a part of the diagnostic evaluation in 42.7% of men. Ultrasound reports were available for review in 187 cases. Information regarding patient demographics, diagnostic evaluation, and treatment was reviewed.

**Results:** Ultrasound findings consistent with epididymitis were identified in 69.3% of men. The four most commonly reported irregularities were scrotal wall thickening (84.2%), abnormal epididymal echotexture (74%), increased epididymal vascularity (72.9%), and an enlarged epididymis (71.5%). Scrotal ultrasound was performed in 67% men under age 20 compared to 36% men between ages 30 and 69. Patients presenting to the Emergency Department underwent sonographic evaluation 57% of the time versus 17.2% men presenting to primary care physicians ( $P < 0.001$ ). Ninety-five per cent (194/204) of patients who underwent CDUS were treated with antibiotics compared to 96% (263/275) of those who did not receive an ultrasound ( $P = 0.78$ ).

**Conclusions:** CDUS can be helpful in patients with a potential diagnosis of testicular torsion, however, the use of CDUS as a diagnostic adjunct in the evaluation of epididymitis is of limited value. Treatment patterns and antibiotic usage were not significantly altered by ultrasound findings at this institution.

**Key words:** Doppler, epididymitis, epididymo-orchitis, urinary tract infection, ultrasonography

## INTRODUCTION

Epididymitis represents the fifth most common urologic diagnosis in men between 18 and 50 years of age and can result in many days of lost work and pain.<sup>[1,2]</sup> It is a major cause of hospital admissions in the military and is the second most common diagnosis

in children presenting with an acute scrotum.<sup>[3,4]</sup> Clinical epididymitis is typically characterized by pain, swelling, and inflammation of the epididymis and may be associated with fever, dysuria, or urethral discharge. Causative organisms of infectious epididymitis vary by age group. *Escherichia coli* are the most common bacteria isolated in men over 35 and young children. *Chlamydia trachomatis* and *Neisseria gonorrhoea* are the predominate pathogens in younger men. Trauma, autoimmune disorders, and vasculitis represent known causes of non-infectious epididymitis.<sup>[5-8]</sup> Consequences of infectious epididymitis can include abscess formation, testicular infarction, chronic pain, recurrent infection, and infertility.

Color Doppler ultrasound (CDUS) allows for non-invasive evaluation of the scrotal contents and their blood supply. Diminishment of testicular blood flow relative to the contralateral testicle has been shown to correlate with spermatic cord torsion in 92-100% of patients, with a

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sensitivity of 82-92%.<sup>[4,9-11]</sup> The utility of this technology for diagnosis and management of epididymitis, however, remains unclear. Several small retrospective studies report sensitivities ranging from 70-93% and specificities from 88-92%.<sup>[10,12]</sup> These studies primarily dealt with patients at high risk for testicular torsion and may not accurately reflect ultrasound findings in men with clinical epididymitis.

The aim of the present study was to retrospectively review how practitioners at a large university-based hospital use ultrasound in the evaluation and management of clinical epididymitis. We similarly sought to determine its role as an adjunctive diagnostic tool and its influence on provider treatment patterns.

## MATERIALS AND METHODS

After obtaining approval from the Institutional Human Investigation Committee, the investigating institution's database was queried for inpatient and outpatient diagnoses of epididymitis or epididymo-orchitis using broad ranging ICD-9 codes for male genital inflammatory disorders. Records from 870 patients diagnosed with epididymitis or epididymo-orchitis between 1 January 1999 and 30 July 2005 were retrospectively reviewed. Patients were excluded from analysis if they had a clear history of genital trauma, antibiotic therapy prior to their evaluation, previous diagnosis and treatment of epididymitis within the preceding year, incomplete medical records, inpatient diagnosis of epididymitis, or orchitis alone.

A total of 480 patients were identified who met the inclusion criteria. Scrotal ultrasound was performed in 205 (43%) of these patients who presented to the main hospital or an affiliated clinic. The decision to obtain an ultrasound was at the discretion of the practitioner. The ultrasound examinations were performed using 7.5 MHz transducers and CDUS technology. Equipment manufacturer and model selection varied based on location of ultrasound performance. Ultrasound reports were available for review in 187 cases. Each report consisted of comments and an overall diagnostic impression by the attending radiologist. Reports were evaluated for terminology indicative of radiographic epididymitis and epididymo-orchitis including: size of the affected epididymis, epididymal and testicular vascularity and echotexture, as well as scrotal wall thickness. Information regarding patient demographics, diagnostic evaluation, and treatment was reviewed.

## RESULTS

Four hundred and eighty men met the inclusion criteria for clinical epididymitis. Within this population, 205 (42.7%) patients with ages ranging from 7 to 85 underwent scrotal ultrasound. Patients under the age of 20 were more likely to undergo ultrasound than those over 20 years of age (67% vs. 40%;  $P < 0.01$ ). The remainder of the age groups had a comparatively similar rate of ultrasound usage [Table 1].

Sixty-nine per cent (142/205) of patients undergoing scrotal ultrasound for clinical epididymitis had sonographic findings consistent with epididymitis. Detection of epididymitis was highest in men over 50, with 86% (51/59) having positive ultrasounds. In comparison, 62% (91/146) men less than 50 years of age demonstrated diagnostic ultrasound findings consistent with epididymitis ( $P < 0.01$ ). Patients between ages 30-39 were the least likely to have ultrasound findings consistent with epididymitis (46%;  $P < 0.01$ ).

Fifty-seven per cent of emergency room patients underwent scrotal ultrasound as part of their diagnostic workup ( $P < 0.01$ ). The Department of Urology had a similar predilection for adjunctive ultrasound with 45% using CDUS as a part of their assessment. In comparison, both the Internal Medicine and Family Medicine Departments had statistically significant lower rates of usage, at 18% and 16% respectively. Regardless of department, the percentage of ultrasounds diagnostic for epididymitis remained relatively constant at 58-70% [Table 2].

The most common epididymal ultrasound characteristics are recorded in Table 3. Increased testicular vascularity (91.4%), epididymal size (73.3%), and epididymal vascularity (71.1%) were the most commonly documented findings. A thickened scrotal wall was only commented on in 10.2% of reports, but was frequently abnormal (84.2%) when recorded. The ultrasound characteristics most likely to

**Table 1: Patient demographics**

Age	% Receiving ultrasound	P Value*	% with Positive ultrasound	P Value*
All ages	43% (205/480)	-	69% (142/205)	-
<20	67% (32/48)	<.01	69% (22/32)	0.94
20-29	45% (45/100)	0.60	62% (28/45)	0.25
30-39	36% (39/107)	0.14	46% (18/39)	<.01
40-49	38% (30/79)	0.35	77% (23/30)	0.34
50-59	38% (22/58)	0.43	95% (21/22)	<.01
> 60	42% (37/88)	0.89	81% (30/37)	0.08

\* P value assessed via chi square test for differences between each age group and the rest of the population or each clinic group and the rest of the population

**Table 2: Prevalence of ultrasound use by department**

Clinic	% Receiving Ultrasound	P Value*	% with Positive Ultrasound	P Value*
All clinics	43% (205/480)	-	69% (142/205)	-
ED	57% (130/230)	<.01	70% (91/130)	0.76
Internal Med.	18% (10/54)	<.01	70% (7/10)	0.96
Family Med.	16% (12/74)	<.01	58% (7/12)	0.40
Urology	45% (51/115)	0.68	70% (36/51)	0.81
Other	29% (2/7)	0.44	50% (1/2)	0.55

\* P-value assessed via chi square test for differences between each age group and the rest of the population or each clinic group and the rest of the population

**Table 3: Ultrasound characteristics in patients with clinical epididymitis**

Ultrasound Characteristic	% Which Commented	% With Abnormal Finding
Size of epididymis	73.3% (137/187)	71.5% (98/137) enlarged
Epididymal vascularity	71.1% (133/187)	72.9% (97/133) increased
Epididymal echotexture	14.4% (27/187)	74% (20/27) abnormal *
Testicular echotexture	63.4% (126/187)	14% (18/126) abnormal *
Testicular vascularity	91.4% (171/187)	32.2% (55/171) increased
Scrotal wall thickness	10.2% (19/187)	84.2% (16/19) thickened

\* Abnormal was defined as heterogeneous, hypoechoic, or hyperechoic

impact the diagnosis of epididymitis were similarly reviewed [Table 4]. Enlargement of the epididymis was present in 96.9% (96/99) of cases. Of those reports commenting on epididymal echotexture and vascularity, findings were abnormal in approximately 95% of cases. Abnormal echotexture was defined as heterogeneous (65%, 13/20), primarily hyperechoic (20%, 4/20), or primarily hypoechoic (15%, 3/20). Testicular echotexture was described in 55.6% of reports with 19% described as abnormal. Abnormal testicular echotexture was described as heterogeneous (60%, 9/15), primarily hypoechoic (20%, 3/15), or demonstrating microlithiasis (20%, 3/15).

Patient charts were also reviewed for frequency of antibiotic usage. Antibiotics were prescribed for 95% (194/204) of men who underwent scrotal ultrasound. Correspondingly, 95% (60/63) of men with a normal ultrasound received antibiotics. Of men diagnosed with epididymitis without ultrasound assistance, 96% (263/275) were given empiric antimicrobial therapy ( $P = 0.78$ ).

## DISCUSSION

Five per cent of all ambulatory visits by males over age 18 include genitourinary symptoms. Epididymitis accounts for 0.29% of office visits in men under the age of 50.<sup>[1,13]</sup> Despite the establishment of treatment guidelines in both the United States and Europe, prior publications have demonstrated poor adherence. A survey-based assessment in the United Kingdom found that in men less than 35 years old, fewer than 20% underwent the recommended diagnostic evaluation. Fewer than half the patients received what was considered appropriate treatment.<sup>[14]</sup> In the United States, Center for Disease Control (CDC) guidelines for evaluation and treatment of epididymitis are followed in less than 35% of patients.<sup>[15]</sup>

We sought to determine the role of CDUS in the diagnostic evaluation of epididymitis and its impact on treatment selection in a university-based academic medical center. CDUS represents the gold standard in imaging for acute scrotal pain when the diagnosis of testicular torsion is equivocal. There is paucity of data; however, as to the role of

**Table 4: Ultrasound characteristics of men with positive ultrasounds and clinical epididymitis**

Ultrasound Characteristic	% of Positive reports (n=142) Which Commented	% of Positive Reports with Abnormal Finding
Size of epididymis	69.7% (99/142)	96.9% (96/99) enlarged
Epididymal vascularity	71.1% (101/142)	95.0% (96/101) increased
Epididymal echotexture	14.7% (21/142)	95.2% (20/21) abnormal *
Testicular echotexture	55.6% (79/142)	19% (15/79) abnormal *
Testicular vascularity	77.5% (110/142)	39.1% (43/110) increased
Scrotal wall thickness	11.3% (16/142)	93.7% (15/16) thickened

\* Abnormal was defined as heterogeneous, hypoechoic, or hyperechoic. Includes diagnosis of testicular microlithiasis

CDUS in epididymitis. Whereas CDUS of the scrotum marks an improvement over gray-scale imaging, such diagnostic advancements for the evaluation of epididymitis have failed to change practice patterns in the past. Our hypothesis was that radiologic evaluation would parallel improvements in laboratory analysis such as urethral swab PCR, in that its use would not alter provider practice and treatment.<sup>[15]</sup> Indeed, 95% of patients in this cohort were treated with antibiotics despite the low prevalence of positive urinalysis, urine cultures, and urethral swab PCR for *Neisseria gonorrhoea* and *Chlamydia trachomatis*.

Epididymitis is defined as a clinical syndrome of pain, swelling, and inflammation of the epididymis which lasts up to six weeks in its acute stage and greater than six weeks in its chronic stage.<sup>[7]</sup> The diagnosis of epididymitis in this study was based on the clinical presence or absence of signs and symptoms of clinical epididymitis. At present, no “gold standard” measure exists for the diagnosis of epididymitis. Laboratory evaluation, including urine culture and urethral swab PCR testing was performed by less than one-third the practitioners in our study. Of those patients who underwent laboratory evaluation, less than 25% had an abnormal finding. The lack of objective laboratory evidence to support a diagnosis of epididymitis is common. Mitemeyer found positive urine cultures in only 20.7% of patients with the clinical diagnosis of epididymitis. Antibiotics, however, were prescribed in 75% of cases.<sup>[2]</sup> A prior study at our institution found that only 29.5% of adult patients’ urine cultures demonstrated bacterial growth, however, 97% men were treated empirically with antibiotics, often without adherence to the CDC epididymitis guidelines.<sup>[15]</sup> Similarly, in the current study, 69% of patients had sonographic findings of epididymitis; however, 95% received antibiotics. In comparison, 96% of patients who did not undergo ultrasound also received antimicrobial therapy ( $P = 0.78$ ).

The majority of ultrasounds were performed in younger patients and those presenting initially to the Emergency Department. One may postulate that the motivation for

ultrasound evaluations in these groups was to rule out spermatic cord torsion. However, this does not explain why 42% of men over the age of 60 years, a low-risk population in terms of testicular torsion, underwent CDUS. Whereas the indication for CDUS in evaluation of testicular torsion is clear, its use in chronic pain has been refuted. Van Haarst *et al.*, reviewed 111 ultrasounds in men with a normal clinical examination and scrotal pain greater than five months. No clinically significant abnormalities were identified.<sup>[16]</sup> Thirty to forty percent of patients with testicular tumors may describe lower abdominal or scrotal discomfort; however, acute pain on presentation is uncommon.<sup>[17]</sup> Physical examination is rarely benign in these cases. Comiter *et al.*, reported only 15 cases of nonpalpable intratesticular masses from a series of 3,019 scrotal ultrasounds performed for various indications, including pain. This suggests that in patients presenting with scrotal pain and a normal physical examination, the risk of testicular neoplasia is low.<sup>[16,18]</sup>

In CDUS performed for epididymitis, the most commonly reported ultrasound characteristics are epididymal enlargement, hypoechogenicity, reactive hydrocele, and scrotal skin thickening.<sup>[19]</sup> While our findings confirm the presence of epididymal hypervascularity, testicular hypervascularity was also present in 91% of patients with primary epididymal pathology. Therefore, epididymal inflammation may spread locally to the testis, even in the absence of clinical orchitis. Abnormal epididymal architecture was also common in our cohort, but the primary abnormality was heterogeneity, not hypoechogenicity as previously reported.<sup>[20]</sup> In fact, a hypoechoic epididymis was the least likely architectural defect, with only 15% of patients demonstrating this abnormality. Holden *et al.*, previously documented that up to 68% of patients may have scrotal thickening in the setting of epididymitis.<sup>[21]</sup> In our cohort, however, only one in ten men had scrotal wall thickening, suggesting that this abnormality is far less common than previously reported.

A principle weakness of our study lies in its retrospective approach. No attempt was made to examine all patients with CDUS or to randomize them to a defined diagnostic or treatment regimen. Chart documentation of radiographic findings and diagnostic evaluation in regards to infectious workup was heterogeneous, precluding a meaningful conclusion of the ability of ultrasound to predict infection in epididymitis. Future prospective studies are needed to determine resolution rates based on ultrasound findings and patient symptomatology as well as to evaluate the use of CDUS to predict which patients may benefit from antibiotics.

Not all patients with scrotal pain can be classified as having spermatic cord torsion or infectious epididymitis. While ultrasound is helpful in diagnosing the former, when the diagnosis is equivocal, its use in the later is poorly described.

It is possible that testicular torsion or a testicular mass may be identified fortuitously on scrotal ultrasound, however, these findings should primarily be clinical diagnoses rather than radiographic. A reasonable use for adjunctive CDUS in the diagnosis of clinical epididymitis might be when there is concern over the presence of a scrotal abscess.

In this large population of men with epididymitis, ultrasound did not change the diagnosis or management of epididymitis with regard to antibiotic use. The findings from this study, therefore, would seem to indicate there is no role for CDUS when the diagnosis of epididymitis is suspected and testicular torsion or mass can be ruled out by history and physical exam.

## CONCLUSIONS

Epididymitis is an extremely common urologic diagnosis, yet diagnostic testing and management have not been consistent among practitioners. Empiric use of antibiotics is common and frequently does not follow CDC guidelines.<sup>[14,15]</sup> In this study, CDUS demonstrated a relatively poor ability to diagnose epididymitis and did not significantly alter treatment patterns. CDUS therefore has a limited role in men where the diagnosis of epididymitis is reasonably certain. CDUS may be useful in younger men presenting with acute scrotal pain when the diagnosis of torsion must be considered. The authors caution that testicular torsion remains a clinical diagnosis and surgical exploration should not be delayed for performance of an ultrasound.

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