

Color Doppler ultrasonographic scanning in acute bacterial prostatitis.

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Summary

Objectives: The purpose of this study was to reveal parenchymal and vascular changes in acute prostatitis and to determine the role of color Doppler sonography in monitoring patients with this pathology.

Material and Methods: Twenty five patients with a clinical diagnosis of acute bacterial prostatitis (NIH 1) admitted to our institution were studied prospectively. Clinical, analytical and microbiological data were recorded. Color Doppler and transrectal ultrasonography (TRUS) were performed 1 week after antibiotic therapy and afterwards at 6 weeks, 3 and 6 month visits. The findings were recorded and scored using standardized criteria to characterize the degree and distribution of prostatic vascularity.

Results: Blood flow was observed to the entire prostate capsule (grade 2) in 23 (92%) patients at first visit (1 week) and were present in 11 (44%), 6 (24%) and 2 (8%) at 6 weeks, 3 and 6 month visits respectively. The amount and distribution of blood flow within the prostatic parenchyma were evaluated using several criteria. Using the 2-point scale flow were classified as grade 2 22 (88%), 18 (72%), 12 (48%) and 3 (12%) patients at first, second, third and fourth visit respectively. Similar findings were noted using the Doppler spot scale which revealed that flow was grade 2 (15 spots or more) in 23 (92%), 19 (76%), 11 (44%) and 3 (12%) patients respectively. Mean number of Doppler spots in the prostate parenchyma was 23.1 ± 11.1 at first visit, 10.3 ± 9.5 after the end of therapy and 8.3 ± 5.4 and 7.9 ± 5.1 at 3 and 6 months respectively.

Conclusions: Patients with acute prostatitis require prolonged treatment and subsequent follow up for at least 6 months. Color Doppler sonography is a useful tool in monitoring response to treatment and in predicting clinical outcome.

KEY WORDS: Transrectal ultrasonography; Color Doppler; Acute bacterial prostatitis.

INTRODUCTION

The prevalence of prostatitis in the general population is estimated at 12%, and is considered the most common urological diagnosis in men younger than 50 years (1). Traditionally the diagnosis and management of acute bacterial prostatitis depends on the clinical and laboratory assessment, these results may be subjective and lead to underdiagnosis of this entity, especially in cases that presents with a clinical picture of moderate or low intensity, which have their clinical and therapeutic implications on the management of the patient (2, 3). The value of prostatic transrectal ultrasound (TRUS) is controversial in patients with acute bacterial prostatitis, and is only indicated in the exclusion of prostatic abscess. The advent of Doppler allows the evaluation of blood flow, however, the only finding described in the literature up to now is a nonspecific increase of the Doppler signal in the prostat-

ic peripheral zone (4). In this study we evaluate the vascular and parenchymal changes of the prostate in acute prostatitis, trying to define evaluation criteria to enable the monitorization of patients with this pathology.

MATERIAL AND METHODS

Were involved in this study, 25 male patients with a mean age of 38 years (between 22-50 years old) admitted to our hospital with the clinical diagnosis of acute bacterial prostatitis (NIH category I). All patients underwent a medical history, physical examination and analytical evaluation (white blood count, prostate-specific antigen (PSA), urine II, and urine cultures). Acute bacterial prostatitis was defined as lower urinary tract symptoms with fever (axillary temperature $> 38^{\circ}\text{C}$) and tender prostate at rectal

examination and/or PSA > 10 ng/ml with positive urine culture (> 10⁵ cfu/ml) for a uropathogen.

Patients were treated with intravenous Ceftriaxone until defervescence with clinical improvement, followed by treatment with ofloxacin 200 mg twice daily for 6 weeks. TRUS with color Doppler was performed after 1 week of antibiotic therapy and afterwards at 6 weeks in the end of therapy and at 3 and 6 months. The TRUS was performed by the same physician, using a *Voluson 730 Expert* (General Electric Medical Systems) with a 5-9 MHz. end-fire transrectal lineal probe. Patients were approached in the left lateral decubitus position.

Color Doppler sonography was optimized. The pulse repetition frequency was 1.000 Hz and overall color gain was set just above the noise threshold. The high pass filter was lowered to 15 Hz and color write priority was maximized.

Representative images were recorded at each of the 3 ultrasound defined zones in the transverse plane (apical prostate apex, mid prostate and prostate base). Images representing the maximum demonstrable flow were recorded for each zone.

Findings were recorded according to standardized criteria, using a 2 point scale to characterize the degree of vascularity in the prostatic capsule and parenchyma (Appendix 1). In addition, we counted the number of Doppler spots and considered the distribution of those Doppler spots as focal or diffuse. The Doppler spot scale was also classified as grade 1 (less than 15 points) or grade 2 (15 points or more).

We used the SPSS 11.5 statistical model to evaluate, analyze and compare the data obtained.

RESULTS

Of the 25 patients diagnosed with acute bacterial prostatitis, 12 (48%) reported previous infections of the urinary tract. The average duration of fever was 1.5 ± 0.7 days before diagnosis. Nineteen (76%) patients had perineal pain or discomfort and 22 (88%) had a tender prostate at rectal examination.

The mean admission serum PSA level was 19.3 ± 11.3 ng/ml. After 6 weeks, at the end of antibiotic therapy, the median PSA was 5.3 ± 7.6 . All patients except two had at this time PSA < 10 ng/ml. Six (24%) patients had a PSA between 4 and 8 ng/ml and the remaining 17 (68%) had a PSA < 4 ng/ml.

Urine culture was positive for *Escherichia coli* in 19 (76%) patients. The other agents were *Proteus mirabilis*, *Klebsiella sp.*, *Enterococcus faecalis*, *Pseudomonas aeruginosa* and *Enterobacter sp.*. All patients had clinically and bacteriologically remission, just one case of recurrence during the follow-up.

The mean prostatic volume in the first assessment was 40.5 ± 17.9 ml. Eleven (46.6%) patients had sonographic lesions in peripheral prostatic lobules [unilateral hypoechoic lesion in 3 (12%), bilateral hypoechoic lesion in 2 (8%), unilateral hyperechoic lesion in 4 (16%) and bilateral heterogeneous lesion in 2 (8%)]. No prostatic abscess were detected. Six weeks after this assessment, at the end of antibiotic treatment, these lesions regressed or disappeared in 61.1% of patients,

and the mean prostatic volume was 24.3 ± 10.5 ml. Absence of significant variations in terms of mean prostatic volume on 3 and 6 months assessments.

Blood flow was observed over the entire length of the prostate capsule (grade 2) in 23 (92%) patients in the first assessment (1 week), present in 11 (44%), 6 (24%) and 2 (8%) at 6 weeks, 3 and 6 months respectively. The volume and distribution of blood flow in the prostatic parenchyma was evaluated using multiple criteria. Using the scale of two values, the flow was classified as grade 2 in 22 (88%), 18 (72%), 12 (48%) and 3 (12%) patients in the first, second, third and fourth draft assessment respectively. Similar findings were recorded using the Doppler point scale, which revealed grade 2 flow (15 or more points) in 23 (92%), 19 (76%), 11 (44%) and 3 (12%) patients respectively. The mean number of points in the Doppler prostatic parenchyma was 23.1 ± 11.1 in the first evaluation, 10.3 ± 9.5 at the end of antibiotic treatment and 8.3 ± 5.4 and 7.9 ± 5.1 to 3 and 6 months respectively.

There were no episodes of urosepsis after manipulation with the ultrasound probe during the acute phase of infection.

DISCUSSION

The evaluation and the diagnostic management of acute bacterial prostatitis is well defined in worldwide accepted *National Institutes of Health* (NIH) classification for prostatitis syndromes (5). In patients with symptoms of acute bacterial prostatitis (NIH category 1) urine culture is considered the only laboratory evaluation of the lower urinary tract that is required. And a possible sonographic evaluation of the prostate only to exclude a prostatic abscess.

Some previous studies describing the sonographic findings of acute bacterial prostatitis, including an increased volume of the prostate, a global hypoechoicogenicity of the gland, a hypoechoic zone around the urethra and peripheral focal hypoechoic lesions (6-9). This study detected sonographic lesions at the peripheral lobules in approximately half of the patients involved, and an increase in prostate volume in most patients. These lesions disappeared or decreased after antibiotic therapy in two thirds of patients and the volume has decreased overall. The color Doppler ultrasonography has some limited features, it is more subjective and operator dependent than standard gray scale ultrasonography (10, 11, 12), hence the need and importance of this study in an attempt to quantify the sonographic findings. There is no consensus about the optimal technique for the TRUS with color Doppler, because color Doppler signals vary shades of the color spectrum depending on the direction and speed of flow. The operator dependent and independent parameters such as color gain, the pulse repetition frequency and the wall filter settings, influence the quality image quality.

In this study we tried to minimize these variables by defining and setting the parameters of work in order to allow the reproducibility of the same, and all examinations were performed by the same physician.

There is no agreement on the optimal scheme for classifying color Doppler images of the prostate. Some recom-

mend a variety of criteria to delineate scales with 3 (13, 14) and 4 (15, 4) degrees. Each of these grading systems has a high degree of intra-observer variation. After the study of different classification schemes, we chose to build one, which has a scale with a smaller number of degrees, that would be less subjective in its application, and more easily interpretable and therefore reproducible. In this study we observed that the infectious process of acute bacterial prostatitis is reflected by ultrasound by a diffuse increase of prostate vascularisation, both in the capsule or in parenchyma. There is a relationship between the clinical improvement during the

antibiotic therapy and the decrease of vascularisation degree. Noted that even after 6 months of follow-up exists in some patients an increased vascularity that can translate the presence of residual foci of infection.

CONCLUSION

Patients with acute prostatitis require prolonged treatment with a subsequent follow up at least six months. The use of color Doppler sonography is a valuable tool in monitoring treatment response and prediction of clinical outcome.

APPENDIX 1

Color Doppler scoring of prostatic blood flow.

Anatomical Site	Blood Flow
Prostate capsule	
Grade 1	Nonvisualized or sparse
Grade 2	Complete or in all extension
Prostate parenchyma	
Grade 1	Nonradiating flow, short segments of vessels
Grade 2	More than 1 radiating vessel penetrating parenchyma
Prostate parenchyma Doppler spot scale	
Grade 1	Less than 15 points
Grade 2	15 points or more
Doppler spots distribution	
Focal	
Diffuse	

Figure 1.

Capsular flow grade 2 and parenchymal flow grade 2.

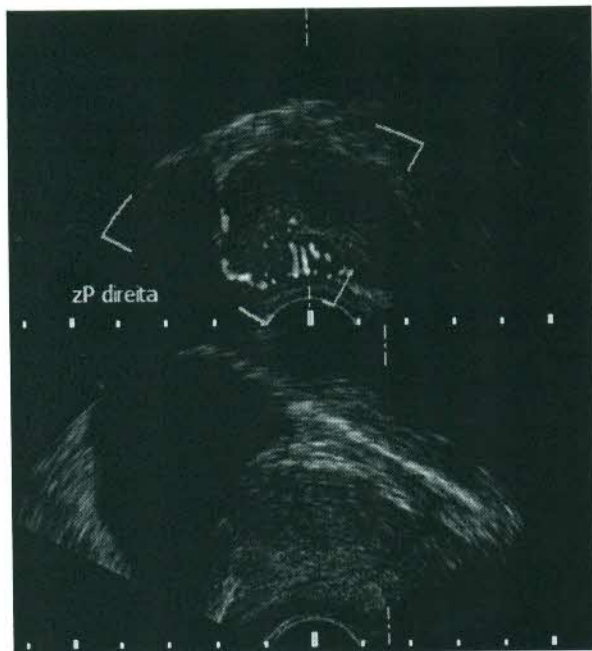
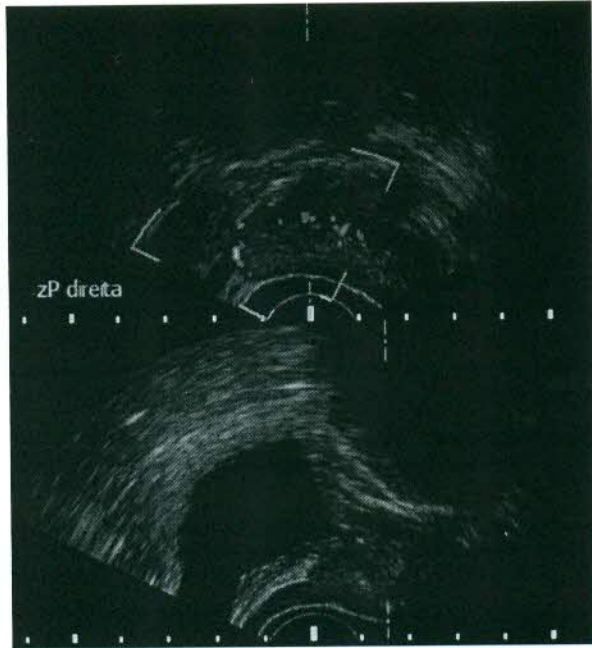


Figure 2.

Doppler spot grade 2 diffuse.



Figure 3.
Doppler spot grade 1 diffuse at 6 weeks.



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