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The Effect of Acute Urinary Retention on Serum Prostate-Specific Antigen Level

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ABSTRACT

Introduction: Our aim was to evaluate the effect of acute urinary retention on serum prostate-specific antigen (PSA) level.

Materials and Methods: Men aged 50 years and older who presented with acute urinary retention were studied. Patients with urethral stricture, neurogenic bladder, prostate cancer, and those with a history of recent instrumentation or prostate biopsy were excluded. Blood samples for serum PSA measurement were obtained (PSA1), and an indwelling urethral catheter was inserted for 2 weeks. Before catheter removal, a second blood sample for measurement of serum PSA level (PSA2) was obtained. In patients who were able to void, a third sample was obtained 3 weeks later (PSA3). In the first and second visits, digital rectal examinations (DRE1, DRE2) were performed to assess prostate volume. Mean PSA levels (PSA1, PSA2, and PSA3) and prostate volumes (DRE1, DRE2) were compared.

Results: Forty-five patients with a mean age of 70.18 years (range 56 to 85 years) participated in this study. Mean PSA1 and PSA2 levels were 9.8 ng/mL and 5.05 ng/mL, respectively ($P < 0.001$; medians, 6.2 and 4.2 ng/mL). Mean prostate volumes at the time of retention and 2 weeks later were 43.4 mL and 37.8 mL, respectively ($P < 0.001$; medians, 45 and 40 mL). PSA3 was measured in 31 patients 2 weeks after catheter removal. In this group of patients, mean PSA2 and PSA3 levels were 5.03 ng/mL and 4.97 ng/mL, respectively ($P = 0.49$; medians, 4.3 and 4.1 ng/mL).

Conclusion: Acute urinary retention can increase serum PSA levels by approximately 2 fold. In this series, we found that this effect may continue up to 2 weeks.

KEY WORDS: urinary retention, prostatic hyperplasia, prostate-specific antigen

Introduction

Prostate-specific antigen (PSA) has been introduced as the most useful tumor marker in urology.[1] Its accuracy for prostate cancer diagnosis has been demonstrated by several studies.[2] Serum PSA levels increase not only in prostate cancer, but also as a result of several urologic manipulations and benign conditions.[3] However, there are some reports about the inaccuracy of PSA in detecting prostate cancer in the presence of acute urinary retention (AUR).[4-6] To date, however, to the best of our knowledge, no study has precisely elucidated the duration

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and magnitude of this effect. Armitage and colleagues have observed that patients with AUR have a higher level of serum PSA,[2] and Hicks has reported a case with a dramatic increase in serum PSA level following AUR.[5] In 7 patients with AUR, Semjonow and colleagues showed that PSA levels at the time of retention are about twice as high as levels measured 24 to 48 hours after suprapubic catheterization.[4]

The precise mechanism of this effect is unclear, although Spiro et al have suggested that it is presumably secondary to prostatic infarction.[7] McNeill and Hargreave evaluated the efficacy of PSA for detecting prostate cancer in patients with AUR and concluded that PSA should not be measured at the time of AUR.[6] Since urinary retention is one of the most frequent indications for surgical intervention, and measuring serum PSA levels is usually necessary before surgery, it is important to know the magnitude and duration of increase in serum PSA levels following AUR. Given the preceding, in this prospective study, we aimed to more accurately assess the effect of AUR on PSA levels.

Materials and Methods

From October 2001 to September 2003, 136 men aged 50 years and older (mean age, 70.18 years; range, 56 to 85 years) with AUR due to benign prostatic hyperplasia (BPH) were referred to our center. Forty-five patients were enrolled in this study. Patients with urethral stricture, neurogenic bladder, prostate cancer, and those with a history of recent instrumentation or prostate biopsy were excluded. All cases were managed with an indwelling urethral catheter. A blood sample for PSA was obtained (PSA1), and a urethral catheter was left in place for 2 weeks. Urine samples (obtained by catheterization) were sent for culture. Prior to catheter removal, another blood sample for PSA (PSA2) was obtained. Also, in patients who were able to void, a third blood sample was obtained 2 weeks later (PSA3). The ELISA test was used to measure serum PSA levels. At the first and second visits, after taking blood samples, a digital rectal examination (DRE1, DRE2) was performed to assess prostate volume. Patients were asked about their last ejaculation time to consider its effect on serum PSA levels. Surgical intervention was performed for patients who could not void after removal of the urethral catheter. If the last serum PSA level was higher than 4 ng/mL, the patient was referred for a prostate biopsy. Mean PSA levels (PSA1, PSA2, and PSA3) and prostate volumes (DRE1 and DRE2) were compared using nonparametric statistical methods (Wilcoxon signed rank test), and P values less than 0.05 were considered statistically significant.

Results

Urine cultures performed at the time of retention were positive in 2 patients. None of the patients had a history of ejaculation within the preceding 48 hours. Prostatic adenocarcinoma was diagnosed during follow-up in 3 patients. The mean PSA level at the time of AUR (PSA1) was 9.8 ng/mL (median, 6.2 ng/mL; range, 0.3 to 39 ng/mL). The mean PSA2 level was 5.05 ng/mL (median, 4.2 ng/mL; range, 0.2 to 17.5 ng/mL), significantly lower than the PSA1 level ($P < 0.001$). The mean prostate volume at the time of DRE1 (43.4 mL; median, 45 mL; range, 30 to 60 mL) was significantly higher than at DRE2 (37.8 mL; median, 40 mL; range, 25 to 50 mL) ($P < 0.001$). Malignancy was not suspected by DRE in any of the patients.

PSA3 was measured in 31 patients 4 weeks after retention (2 weeks after catheter removal). In this group of patients, mean PSA2 and PSA3 levels were 5.03 ng/mL and 4.97 ng/mL, respectively (median, 4.3 and 4.1, respectively, $P = 0.49$). By excluding 2 patients with positive urine cultures and 3 patients with prostate adenocarcinoma, mean PSA1, PSA2, and PSA3 levels were 9.8 ng/mL, 4.66 ng/mL, and 4.98 ng/mL, respectively (median: 6.5, 4.05, and 4.1 ng/mL). The difference was significant between PSA1 and PSA2 ($P < 0.001$), but not between PSA2 and PSA3 ($P = 0.72$). Of 30 patients with PSA1 levels greater than 4.0 ng/mL, 11 had a lower PSA2 level and 2 had a lower PSA3 level.

Of 40 patients with BPH, 24 underwent surgery (TURP or open prostatectomy) owing to recurrent retentions and 16 were able to void with medical therapy. In these 2 groups (surgical and medical therapy), the mean PSA1 levels were 10.44 ng/mL and 8.81 ng/mL, respectively (median, 6.9 and 6.05 ng/mL; $P = 0.49$), and the mean prostate volumes at the time of retention were 45 mL and 42.2 mL, respectively (median, 45 and 42.5 mL; $P = 0.48$).

Overall, after 2 weeks of free drainage in these 40 patients, PSA levels decreased in 38 patients, increased in 1, and remained unchanged in 1 (Table 1).

TABLE 1. *Number of patients in different PSA level ranges*

	PSA levels (ng/mL)			
	0 to 4	**4 to 10**	**10 to 20**	**> 20**
PSA1	10 (25%)	17 (42.5%)	8 (20%)	5 (12.5%)
PSA2	21 (52.5%)	16 (40%)	3 (7.5%)	-
PSA3	15 (48.4%)	14 (45.2%)	2 (6.4%)	-

Discussion

In the present study, we showed that AUR could increase serum PSA levels more than 2 fold. Since the half-life of serum PSA is 2 to 3 days,[8] we evaluated patients at 2-week intervals—more than 5 half-life periods—which is sufficient for PSA levels to return to normal values. In a study of 6 patients by Semjonow and colleagues, PSA levels decreased by 50% compared with those at the time of retention 24 to 48 hours after catheterization.[4] This indicates that free PSA, which has a serum half-life of 2 to 3 hours,[9] may be the major factor for the increase seen in serum PSA levels after AUR. McNeill and Hargreave have reported a significant difference between PSA levels at the time of admission for 11 patients with AUR and their respective follow-up PSA levels; however, the interval between retention and follow-up PSA is not clear in this article.[6] In our study, a nonsignificant difference between PSA2 and PSA3 suggests that the 2-week interval between retention and PSA measurement is acceptable and can prevent unnecessary biopsies in more than one third of patients (11 out of 30); nonetheless, in 2 patients, it took 4 weeks for the PSA level to decrease to lower than 4.0 ng/mL.

We excluded all patients with a history of disease other than BPH that could result in AUR (ie, urethral stricture, neurogenic bladder, prostate cancer) and patients who had a condition or procedure that could affect serum PSA levels (recent instrumentation, prostate biopsy, urinary tract infection, and ejaculation in the last 48 hours) to accurately evaluate the effect of AUR due to BPH.

The effect of catheterization or presence of an indwelling urethral catheter on serum PSA levels is controversial. By daily checking the PSA level in 21 patients catheterized due to nonurologic problems, Matzkin et al demonstrated that catheterization had no effect on serum PSA levels.[10] In another study of 35 patients with AUR, Erdogan and coworkers managed patients with either a urethral or suprapubic catheter and found that there was no difference in serum PSA levels between the two.[11] In 2 studies on 19 and 83 patients, respectively, Dutkiewicz et al and Batislam et al demonstrated that serum PSA levels increased in patients catheterized owing to AUR; these authors therefore concluded that catheterization, per se, could increase serum PSA levels.[12,13] Ignoring the effect of AUR seems to be a major flaw of these studies, however. Because we found no statistically significant difference between PSA2 and PSA3, we suggest that an indwelling urethral catheter has no effect on serum PSA level.

Although it has been reported that serum PSA concentration and prostate volume are powerful predictors of a need for surgery in men with BPH,[14] we did not find significant differences in serum PSA levels and prostate volumes between patients who needed surgery and those who did not.

In our study, prostate volume increased at the time of AUR and returned to its normal value after a period of time. We speculate that prostate congestion or inflammation is the factor responsible for both urinary retention and enhancement of serum PSA levels. Considering the shortcomings of DRE, we recommend transrectal ultrasonography to more precisely evaluate prostate volume changes in future studies.

Since serum PSA level is frequently recorded at the time of a patient's presentation with AUR, ignoring its effect on serum PSA levels could be associated with unnecessary and sometimes hazardous biopsies.

Conclusion

Acute urinary retention can increase serum PSA levels by approximately 2 fold. This impact will disappear after 2 weeks. Considering this effect, the clinician can prevent unnecessary biopsies in many patients. Also, we recommend PSA measurement at least 2 weeks after AUR. Given the decrease in prostate volume after the period of catheterization we observed in the current study, we suggest that the decision regarding treatment options (ie, TURP or open prostatectomy) should not be made based on the findings of DRE at the time of retention.

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