ORIGINAL ARTICLE

Effect of ejaculation on serum prostate specific antigen level in screening and non-screening population

Mohammad Rajaei, Ali Momeni[1], Soleiman Kheiri[2], Hafez Ghaheri[3]

Departments of Urology, [1]Nephrology, [2]Clinical Biochemistry Research Center, Shahrekord University of Medical Sciences, Shahrekord, [3]Department of Surgery, Isfahan University of Medical Sciences, Isfahan, Iran

Background: The serum prostate specific antigen (PSA) levels are used for prostate cancer screening. Some conditions such as prostatitis, manipulation, and prostate cancer could influence on serum PSA. The impact of ejaculation on serum PSA is controversial. The aim of our study was to evaluate the relation of ejaculation and the levels of serum PSA. **Materials and Methods:** In this cross-sectional study, 60 healthy voluntary men below and over 50 years during the year 2009-2011 were participated. After history taking, physical examination, and identical lower urinary tract symptoms score (American Urologic Association Score = AUA); three blood samples were taken before, 1 and 24 h after ejaculation. **Results:** Patients categorized into a non-screening group (age less than 50 years, $n = 25$), and screening group (age ≥ 50 years, $n = 35$). Our data showed significant PSA rising in both groups 1 h after ejaculation (P value < 0.05); however, comparison of PSA levels in both groups, before and 24 h after ejaculation showed no significant differences. Spearman coefficient of correlation was showed a positive correlation between PSA in all stage and AUA score in the second group, but there were no such correlation in the first group. **Conclusion:** There was a significant relationship between ejaculation and the levels of serum PSA in screening and non-screening patients. However, in non-screening men significant rising of PSA after 1 h of ejaculation was not important clinically (not achieve to greater than 4 ng/ml). Taking a history of ejaculation in men older 50 years especially with high AUA score could prevent false positive results and subsequent un-necessary work-ups.

Key words: Ejaculation, prostate specific antigen, screening

INTRODUCTION

Currently most prostate cancers are diagnosed through screening with digital rectal examination (DRE) and measurement of serum prostate specific antigen (PSA). The serum PSA level correlates with prostate cancer risk, aggressiveness, outcome of treatment, and patients monitoring for tumor recurrence. The serum PSA levels are increased in different clinical conditions including benign hyperplasia, prostatitis, and prostate cancer. For the first time in 1991 PSA was reported as a first line test for prostate cancer screening.[1] In 1994 food and drug administration approved measurement of serum PSA level as an index of early detection of prostate cancer, with a threshold of 4.0 (ng/ml). PSA is relatively sensitive, but not specific for detection of prostate cancer. Unnecessary prostate biopsy may be carried out due to false-positive high titres of PSA. This would adversely affect both patients' emotional well-being and the cost-effectiveness of health-care resources. It is very important to identifying the factors that spuriously affect PSA levels serves to maximize the accuracy of screening and early detection of prostate cancer, increase detection rates, and lower false-positive rates for PSA testing.[2] Several strategies have been used to increase the specificity of PSA as a screening test of prostate cancer such as measurement of PSA velocity, free PSA measurement, PSA density, and age specific reference ranges. Several clinical conditions can cause rising in serum PSA level such as Benign prostatic hyperplasia (BPH),[2] infection,[3] inflammation, instrumentation, prostate surgery, and prostatic adenocarcinoma.[4]

Although, some authors have shown no significant effect of ejaculation on serum PSA level.[5-8] Tchetgen *et al*. reported a mild increase in PSA (0.4 ng/ml) at 1 h after ejaculation, which decreased to 0.1 ng/ml by 6 h and reached to baseline by 24 h.[9] Westphal *et al*.[10] and Simak *et al*.[11] reported a decrease in the serum PSA level 1 day after ejaculation. Because of controversial results of previous studies, the aim of our study was to the impact of ejaculation on the serum PSA is controversial. The aim of our study was to evaluate the relation of ejaculation and the levels of serum PSA on a prostate cancer screening population (over 50 years old) and non-screening men (less than 50 years).

MATERIALS AND METHODS

This study was approved by Ethical Committee of Shehrekord University of Medical Sciences. In this

Address for correspondence: Dr. Hafez Ghaheri, Department of Surgery, Al Zahra Hospital, Soffeh Street, Isfahan, Iran. E-mail: ghaherih@gmail.com
Received: 23-08-2012; **Revised:** 11-02-2013; **Accepted:** 08-04-2013

cross-sectional study, 35 healthy voluntary men below 50 years (non-screening male) and 25 healthy voluntary men above 50 year old (screening male) selected based on convenient sampling method in out-patient Urology Clinic of Hajar hospital, Shahrekord during the year 2009-2011. After history taking, physical examination and identical lower urinary tract symptoms score (American Urologic Association Score = AUA), three blood samples were taken and coded. First sample before ejaculation, the second sample 1 h after ejaculation and third sample, 24 h after ejaculation were taken. Serum PSA level and semen analysis were carried out in one laboratory by commercially available enzyme-linked immunosorbent assay kit for PSA. No participant had manipulation, needle biopsy, and massage of the prostate gland, acute prostatitis, urethral catheterization or urinary retention just before sample taking. No one had ejaculation 3-5 days before study. Patients with azospermia, severe oligospermia, coagulation liquefaction problems, and pyospermia were excluded. Data from questionnaire, check-list, lab finding and PSA changes, 1 h and 24 h post-ejaculation compared with pre-ejaculation were analyzed by Mann-Withney test, Friedman test, and for correlation with AUA score Spearman coefficient of correlation test using of SPSS (version 16). This analysis has been carried out because of high positive skewness of data. *P* values less than 0.05 was considered significant.

RESULTS

In this cross-sectional study 60 voluntary men in two age groups were enrolled. The age group of less than 50 years (first group) included 35 men with an age range of 18-48 and mean age of 31.3 ± 8.6 years old and the age group of 50 years and higher (second group) included 25 cases with a mean age 56.9 ± 5.1 years (50-66 years). Mean AUA score of first and the second group were 2.2 ± 0.51 and 7.5 ± 5.9 respectively. The AUA score of the first group was significantly lower than the second group ($P < 0.05$). The result of PAS during the study was shown in the Table 1. Furthermore, the percentiles of PSA of all patients were shown in Figure 1. Based on the graph in Figure 1, one can conclude that for low and intermediate value of PSA, there was not any difference on 3 measurements, but in upper value, especially on five's tail upper percentage of PSA, the difference between three measurements exist, such that at 1 h after ejaculation the upper value of PSA are higher than upper value of PSA at before ejaculation and 24 h after ejaculation.

The Mann-Whitney test was showed a significant difference in serum PSA of two patients group ($P < 0.05$), with lower serum PSA in patients of the first group. The serum PSA levels were increased by more than 4 ng/ml, 1 h after ejaculation, but returned to baseline after 24 h. There was

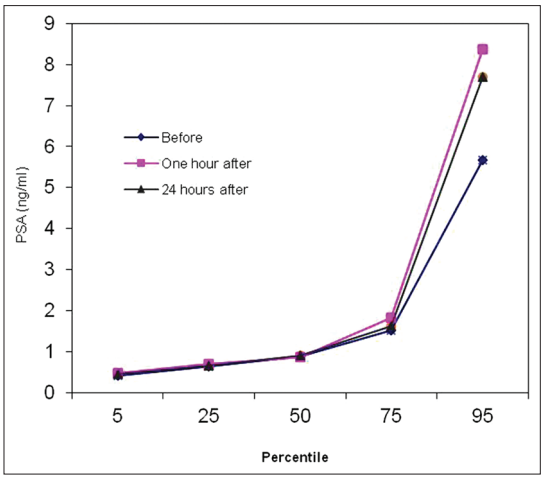

Figure 1: Percentiles of prostate specific antigen for all patients of three measurements

Table 1: Serum level of PSA during the study based on age group (ng/ml)

Age group (years old)	PSA	Min	Max	IQR*	Median
Less than 50	Before	0.37	2.59	0.4	0.71
	1 h after	0.41	2.24	0.46	0.76
	24 h after	0.37	2.44	0.4	0.74
50 and higher	Before	0.53	9.53	1.84	1.94
	1 h after	0.57	8.86	2.195	1.9
	24 h after	0.55	12.57	2.21	1.9

PSA=Prostate specific antigen; IQR=Interquartile range

a significant difference between serum PSA before and 1 h after ejaculation in the first group. The Friedman test with following Dunns multiple comparison test was showed that in first patients group, there was not any difference between PSA before and after 24 h of ejaculation. Based on above tests, in the second group, there was a significant difference between serum PSA before and after 1 h of ejaculation, but there was no any difference between serum PSA before and after 24 h of ejaculation. Furthermore, there was a significant difference between serum PSA of one and 24 h after ejaculation [Table 1].

Spearman coefficient of correlation was showed a positive correlation between PSA in all stage and AUA score in the second group, but there were no such correlation in the first group [Table 2]. Furthermore, the change of PSA until 1 h was correlated with AUA score in the second group [Table 2].

DISCUSSION

There is a controversy about the effect of ejaculation on serum PSA in previous studies.[5,6,8-12] The results of our study showed that there is a significant increase in the serum PSA level 1 h after ejaculation both in the screening population (over 50 years old) and non-screening population (less than 50 year old men). These significant

Table 2: Correlation of AUA score with PSA and change in PSA

Variable	Less than 50 years		50 years and higher	
	Spearmen's rho	*P*	Spearmen's rho	*P*
PSA 0	−0.005	0.978	0.667	<0.001
PSA 1	0.008	0.965	0.687	<0.001
PSA 24	0.037	0.832	0.697	<0.001
Difference of PSA 0 and PSA 1	0.051	0.772	0.44	0.028
Difference of PSA 0 and PSA 24	0.27	0.116	0.304	0.14
Difference of PSA 1 and PSA 24	0.27	0.116	−0.101	0.631

PSA=Prostate specific antigen; AUA=American urologic association score

changes are more common in cases with high AUA score of prostatism symptoms. There was no significant change in serum PSA levels 24 h after ejaculation with basal PSA level in both groups.

Serum half-life of total PSA is 2.0-3.1 (2.6 days) and the free PSA fraction have a shorter half-life (1.5 h) than the bound fraction (3.0 days).[13-15] The main source of PSA in the body is seminal fluid; e.g., PSA concentration is 10^6 times higher than serum.[16-18]

Some researchers suggested that PSA in the blood, 1 h after ejaculation, would substantially decline;[10,11,19] however, even if with ejaculation PSA source completely would be emptied and PSA leakage into blood tends to be zero, this decrease should be applied through blood metabolization and it is not acceptable that PSA would decline in the blood (after 1 h) because of its half-life.

Our findings showed that there is a significant correlation between baseline serum PSA and amount of increasing titer of PSA, which it means that in higher titers of PSA, greater changes occur. Clinically, significant change in serum PSA occurred in 2 out of 25 (%8) voluntary patients (more than 50) who had pre-ejaculation serum PSA level less than 4 mg/ml and post-ejaculation greater than 4 mg/ml. This significant clinical change was not seen in non-screening population. Based on Catalona's study, if baseline PSA threshold decreased from 4-2.5 ng/ml,[20] the impaction of ejaculation on serum PSA would become clinically more significant. However, the frequency of ejaculation in men older than 50 years are lower than younger men, so clinical significance of ejaculation effect in this population is less important than men younger than 50 years.

It is believed that ejaculation in men 30-40 years old or younger could effect on serum PSA with no significant change in PSA[7] or significant decrease in serum PSA.[10,11] However, in 50 years and older men, in which PSA testing is primarily used for early detection of prostate cancer, ejaculation could lead to an increase in PSA which could elevate false-positive.[9,21]

Results of our study were similar to the Tchectgen's study,[9] which contraction of pelvic muscles and periprostatic tissue may increase the leakage of PSA into the blood stream during ejaculation. This leakage was prominent in patients with lower urinary tract obstruction symptoms and high AUA score.

CONCLUSION

There was a significant relationship between ejaculation and the levels of serum PSA in screening and non-screening patients. However, in non-screening men significant rising of PSA after 1 h of ejaculation was not important clinically (not achieve to greater than 4 ng/ml). Taking a history of ejaculation in men older 50 years especially, with high AUA score could prevent false positive results and subsequent un-necessary work-ups.

REFERENCES

1. Catalona WJ, Smith DS, Ratliff TL, Dodds KM, Coplen DE, Yuan JJ, *et al*. Measurement of prostate-specific antigen in serum as a screening test for prostate cancer. N Engl J Med 1991;324:1156-61.
2. Oesterling JE, Jacobsen SJ, Chute CG, Guess HA, Girman CJ, Panser LA, *et al*. Serum prostate-specific antigen in a community-based population of healthy men. Establishment of age-specific reference ranges. JAMA 1993;270:860-4.
3. Dalton DL. Elevated serum prostate-specific antigen due to acute bacterial prostatitis. Urology 1989;33:465.
4. Pruthi RS. The dynamics of prostate-specific antigen in benign and malignant diseases of the prostate. BJU Int 2000;86:652-8.
5. Glenski WJ, Klee GG, Bergstralh EJ, Oesterling JE. Prostate-specific antigen: Establishment of the reference range for the clinically normal prostate gland and the effect of digital rectal examination, ejaculation, and time on serum concentrations. Prostate 1992;21:99-110.
6. McAleer JK, Gerson LW, McMahon D, Geller L. Effect of digital rectal examination (and ejaculation) on serum prostate-specific antigen after twenty-four hours. A randomized, prospective study. Urology 1993;41:111-2.
7. Kirkali Z, Kirkali G, Esen A. Effect of ejaculation on prostate-specific antigen levels in normal men. Eur Urol 1995;27:292-4.
8. Netto NR Jr, Apuzzo F, de Andrade E, Srulzon GB, Cortado PL, Lima ML. The effects of ejaculation on serum prostate specific antigen. J Urol 1996;155:1329-31.
9. Tchetgen MB, Song JT, Strawderman M, Jacobsen SJ, Oesterling JE. Ejaculation increases the serum prostate-specific antigen concentration. Urology 1996;47:511-6.
10. Heidenreich A, Vorreuther R, Neubauer S, Westphal J, Engelmann UH, Moul JW. The influence of ejaculation on serum levels of prostate specific antigen. J Urol 1997;157:209-11.
11. Simak R, Madersbacher S, Zhang ZF, Maier U. The impact of ejaculation on serum prostate specific antigen. J Urol 1993;150:895-7.
12. Shearer RJ. Prostatic specific antigen. Br J Urol 1991;67:1-5.
13. Stamey TA, Yang N, Hay AR, McNeal JE, Freiha FS, Redwine E. Prostate-specific antigen as a serum marker for adenocarcinoma of the prostate. N Engl J Med 1987;317:909-16.

14. Oesterling JE, Chan DW, Epstein JI, Kimball AW Jr, Bruzek DJ, Rock RC, *et al*. Prostate specific antigen in the preoperative and postoperative evaluation of localized prostatic cancer treated with radical prostatectomy. J Urol 1988;139:766-72.
15. Björk T, Ljungberg B, Piironen T, Abrahamsson PA, Pettersson K, Cockett AT, *et al*. Rapid exponential elimination of free prostate-specific antigen contrasts the slow, capacity-limited elimination of PSA complexed to alpha 1-antichymotrypsin from serum. Urology 1998;51:57-62.
16. Sensabaugh GF. Isolation and characterization of a semen-specific protein from human seminal plasma: A potential new marker for semen identification. J Forensic Sci 1978;23:106-15.
17. Lilja H, Abrahamsson PA. Three predominant proteins secreted by the human prostate gland. Prostate 1988;12:29-38.
18. McCormack RT, Rittenhouse HG, Finlay JA, Sokoloff RL, Wang TJ, Wolfert RL, *et al*. Molecular forms of prostate-specific antigen and the human kallikrein gene family: A new era. Urology 1995;45:729-44.
19. Stenner J, Holthaus K, Mackenzie SH, Crawford ED. The effect of ejaculation on prostate-specific antigen in a prostate cancer-screening population. Urology 1998;51:455-9.
20. Catalona WJ, Smith DS, Ornstein DK. Prostate cancer detection in men with serum PSA concentrations of 2.6 to 4.0 ng/mL and benign prostate examination. Enhancement of specificity with free PSA measurements. JAMA 1997;277:1452-5.
21. Mazokopakis EE, Batistakis AG, Starakis IK. The effect of ejaculation on serum total and free prostate-specific antigen concentration. Hell J Nucl Med 2007;10:119.

How to cite this article: Rajaei M, Momeni A, Kheiri S, Ghaheri H. Effect of ejaculation on serum prostate specific antigen level in screening and non-screening population. J Res Med Sci 2013;18:387-90.

Source of Support: This study was supported by Shahrekord University of Medical Sciences, Shahrekord, Iran, **Conflict of Interest:** None declared.