

Analysis of Serum Prostate-Specific Antigen Levels in Men Aged 40 Years and Older in Yasuj, Iran

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ABSTRACT

Introduction: Serum prostate-specific antigen (PSA) is still the simplest marker for early diagnosis and follow-up of prostate cancer. Because racial differences in PSA levels have been found, we performed this study to determine the reference level of serum PSA for men in Yasuj, in southwest Iran.

Materials and Methods: Men aged 40 years and older who had been referred to any of the Yasuj hospitals for a blood cell count for any reason were randomly selected. Those with a history of prostate cancer, prostatitis, urinary tract infection, bladder outlet obstruction, or transurethral procedures were excluded. Blood samples were taken, and PSA levels were measured.

Results: Prostate-specific antigen levels in the 95th percentile were 1.35 ng/mL, 1.85 ng/mL, 3.2 ng/mL, and 4.4 ng/mL for men aged 40 to 49, 50 to 59, 60 to 69, and older than 69 years, respectively. Mean serum PSA levels were 0.7 ng/mL, 0.9 ng/mL, 1.6 ng/mL, and 2.2 ng/mL, respectively.

Conclusion: A comparison of our results with those from studies in the United States and Japan shows that the reference PSA level in our society is significantly lower than that for white and black Western men, and slightly lower than that for Japanese men. Although we examined men with no history of prostate cancer, cancer was not ruled out by diagnostic test; hence, our results may be overestimated. Further investigations in Iran are warranted.

KEY WORDS: prostate, serum prostate-specific antigen, Yasuj

Introduction

Currently, prostate cancer is the most common cancer diagnosed in men and the second most common cause of death due to cancers after lung cancer.⁽¹⁾ Its high prevalence, simple diagnostic methods, and definitive treatments have made early diagnosis essential. Although there have been recent reports opposing the value of prostate-specific antigen (PSA) as the best marker to detect prostate cancer, it remains one of the simplest ways of early diagnosis and follow-up of this disease.^(1,2) Prostate-specific antigen is not specific for prostate cancer and increases also

in other conditions, such as benign prostatic hyperplasia, inflammation due to diagnostic and therapeutic manipulation, and prostatitis. However, the main role of PSA is to screen patients with suspected prostate cancer.⁽¹⁾

Since the introduction of PSA as a diagnostic tool, there has always been a question of whether its normal value is influenced by other factors such as age and ethnicity. Determining reference ranges for PSA in all societies has been a significant challenge. Early studies have shown that PSA level in each society depends on age, race, and geographic characteristics of the region.⁽³⁾ Recently, attempts to determine the value of PSA in different populations have been done.^(2,4) The purpose of this study was to determine the normal serum PSA levels in Yasuj, a city in southwest Iran.

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Materials and Methods

In this cross-sectional study, between March 2003 and April 2004, 650 men aged 40 years and older who had been referred to any of the Yasuj hospitals for a blood cell count for any reason were randomly selected. Those with a history of prostate cancer, bladder outlet obstruction, bacterial prostatitis, urinary tract infection, any sign of inflammation (eg, pyuria), history of prostate surgery, or recent transurethral procedures were excluded. Also, patients were excluded if their blood samples were being tested for prostate cancer. After obtaining informed consent, blood samples were taken, and 1 mL centrifuged serum was used for the serum PSA test. An immunoradiometric assay using monoclonal antibodies (Kavoshyar-Iran, Tehran, Iran), which could measure PSA levels to within 0.05 ng, was used. To identify age-specific ranges, participants were categorized into 4 groups: 40 to 49, 50 to 59, 60 to 69, and older than 69 years. The normal range for serum PSA was defined as lower than the 95th percentile level. The borderline range was considered as those values falling between the 95th and 99th percentiles.

Data were analyzed using SPSS software (Statistical Package for the Social Sciences, version 10.0, SPSS Inc, Chicago, Ill, USA).

Results

Blood samples were taken from 210, 180, 150, 110, respectively, in the age groups 40 to 49, 50 to 59, 60 to 69, and 70 years or older ($n = 650$ men). The mean serum PSA level for men aged 40 to 49 years was 0.7 ng/mL. The normal level in this age group was 0 to 1.35 ng/mL, and the number of men with PSA levels in this range was 198. There were 8 men with levels in the borderline range, the serum PSA levels of whom

were 1.35 ng/mL to 1.50 ng/mL.

The mean serum PSA level of men aged 50 to 59 years was 0.9 ng/mL. Of 180 men, 167 had PSA levels lower than or equal to those in the 95th percentile, ranging from 0 to 1.85 ng/mL. The PSA levels of 10 men were in the borderline range, with PSA levels between 1.85 and 2.25 ng/mL.

Men aged 60 to 69 years had a mean PSA level of 1.6 ng/mL. The normal level in this age group was 0 to 3.2 ng/mL and was seen in 140 men. The borderline range was 3.2 ng/mL to 3.7 ng/mL and was seen in 8 men.

Finally, the mean PSA level was 2.2 ng/mL in men older than 69 years. The normal and borderline levels were 0 to 4.4 ng/mL and 4.4 to 4.6 ng/mL in 102 and 6 men, respectively.

A summary of these results in comparison with the results of other studies is shown in Tables 1 and 2.

Discussion

The comparison of this study with others (Tables 1 and 2) shows that serum PSA levels in our study population are lower than those in studies from the United States and Japan. In fact, in all age groups over 40 years, the serum PSA level in the normal and borderline ranges in our region was lower than those of other countries. However, our values are close to those of the Japanese, corresponding to a probable difference between Asians and Americans and African-Americans.

In a study of 2119 residents of Olmsted County, Minnesota, in the United States, in 1994, Osterling and colleagues reported that the maximum normal level of PSA for different age groups was between 2.50 and 6.50 ng/mL, and PSA levels of 2.60 ng/mL to 6.50 ng/mL were considered borderline. An important result of this

TABLE 1. The 95th percentile of serum PSA levels in the present study and studies from different regions

Age group (years)	PSA levels (ng/mL)			
	Current Study	Oesterling et al ⁽⁵⁾ (Minnesota)	DeAntoni et al ⁽⁶⁾ (Denver)	Oesterling et al ⁽⁷⁾ (Japan)
40 to 49	1.35	2.50	2.00	1.50
50 to 59	1.85	3.50	3.80	2.00
60 to 69	3.20	4.50	4.20	3.40
≥ 70	4.40	6.50	5.50	4.50

TABLE 2. *The 99th percentile of serum PSA levels in the present study and studies from different regions*

Age group (years)	PSA levels (ng/mL)			
	Current Study	Oesterling et al ⁽⁵⁾ (Minnesota)	DeAntoni et al ⁽⁶⁾ (Denver)	Oesterling et al ⁽⁷⁾ (Japan)
40 to 49	1.50	2.60	2.40	1.70
50 to 59	2.25	4.50	4.10	2.40
60 to 69	3.70	5.10	5.00	3.90
≥ 70	4.60	6.50	6.50	4.80

study was that the normal PSA level in different races was different; Africans had a higher and Asians had a lower PSA level than did Americans.⁽⁵⁾

In another study of 286 healthy Japanese men aged 40 to 79 years, it was shown that PSA concentration was lower for the Japanese than it was for the Americans ($P < .001$). The studied population showed no evidence of prostate cancer by digital rectal examination and transrectal ultrasonography.⁽⁷⁾ Although the findings of our study are from a small province of Iran and may not be generalizable to the entire country, it seems that PSA levels in our study population are similar to those of the Asian race rather than those of Western society.

Morgan and colleagues measured serum PSA in 3475 men (1802 white Americans and 1673 African-Americans) with no clinical evidence of prostate cancer and found reference serum PSA levels of 2.1 ng/mL, 3.6 ng/mL, 4.3 ng/mL, and 5.8 ng/mL for white men and 2.4, 6.5, 11.4, and 12.5 ng/mL for African-American men in their 40s, 50s, 60s, and 70s.⁽⁸⁾

It has been shown that African-American men are more likely to have inflammation, and this difference may contribute to elevated serum PSA levels in African-American men compared with white men in the United States.⁽⁹⁾ Such differences may be the reason for racial differences in PSA levels.

Studies in the United States have shown that the Asian race has a lower PSA level than do other races (African-Americans and white Americans). Although the etiology of this effect is not known, it may be a result of lower serum androgen levels in Asians; however, this remains to be elucidated.^(10,11)

Benign prostate hyperplasia is another reason

for slight increases in PSA level. There is even a possibility that nutrition and geographic region, or distance from the equator, affect PSA level, but none of the previous studies have compared these factors between different races.^(2,12)

In 2004, Stamey and colleagues reviewed the PSA levels of 1317 patients with prostate cancer in a retrospective study and mentioned that in the prior 5 years, serum PSA was related only with benign prostatic hyperplasia. They concluded that there is an urgent need for another marker that will be more specific to screen for prostate cancer.⁽²⁾ However, their sample was from patients with cancer and not from the general population. No new serum marker has been found that is better for screening for prostate cancer. Therefore, serum PSA level remains one of the best screening tools for detecting prostate cancer and following patients.^(2,13)

The limitations of this study may have led to our reporting even higher reference levels for serum PSA than the actual values of the study population; patients were not examined for evidence of prostate cancer by digital rectal examination, transrectal ultrasonography, or biopsy, and there may have been cases of undiagnosed malignancies among our sample. Also, if we were able to follow the patients with borderline PSA levels, some would be excluded from the population of healthy men. Consequently, we suggest that the reference PSA level in our study sample may be even lower.

Conclusion

This study shows that men older than 40 years in Yasouj have lower normal levels of serum PSA than do African-American and American men. Comparison of PSA levels in this study with

studies of Japanese men and with those of Western society shows that PSA levels in Asian men are lower. Current study limitations preclude generalization of the results to the entire Iranian population; however, owing to the significant differences of our results with the reference ranges used currently in Iran, we suggest that a nationwide study be undertaken to better determine the age-specific reference serum PSA levels in Iranian men. Exclusion of patients with any evidence of prostate cancer (by transrectal ultrasonography and other diagnostic tools) would be a requisite of such studies.

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