

Evaluation of the Relationship Between Prostate-Specific Antigen and Prostate Size and Also PSA and BMI in Subjects Referred to the Check-up Clinic of Razavi Hospital

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Background: Defining the optimal prostate-specific antigen threshold to identify the patients at the highest risk of prostate cancer has always been a controversial issue.

Objectives: This study aims to analyze the diagnostic value of PSA and also evaluate the relationship between PSA (prostate-specific antigen) and BMI (body mass index) as well as PSA and prostate size and volume in asymptomatic subjects referred to the Check-up Clinic of Razavi Hospital.

Patients and Methods: In this descriptive, cross-sectional and retrospective study; the demographic data as well as total PSA and also prostate size of 1149 subjects who had referred to the Check-up Clinic of Razavi Hospital from 2006 to 2011 were evaluated according to their sonography reports. All the subjects were asymptomatic. Data were analyzed using SPSS as well as descriptive and statistical tests.

Results: The mean age of the subjects was 45 ± 12 and BMI was reported 27 ± 8 . Very low and inverse correlation was determined between PSA and BMI. Non-significant correlation was reported ($P = 0.08$, $r = 0.054$). It was also observed that the correlation between PSA and prostate volume was greater than the correlation between PSA and height, width and length of prostate separately ($P = 0.001$, $r = 0.394$).

Conclusions: According to this study, there is a direct relationship between the age and PSA level. The more the age increases, the more PSA level increases. The highest average of PSA level is reported at the age of 60-69, so it can be considered as an appropriate suggestion for the screening of prostate cancer at least in North East of Iran. Although non-significant relationship is observed between PSA level and BMI in this study; but a significant relation has been reported in other studies focusing on the symptomatic subjects up to now. The mentioned significant relation may be the result of $PSA > 10$. The relation between these factors may become more obvious if a high amount of PSA is reported. This may lead us to develop other studies including the comparison between the mentioned factors on symptomatic and non-symptomatic subjects.

Keywords: Prostate-Specific Antigen; Prostate; Body Mass Index

1. Background

Prostate cancer is the second life threatening cancer in men and one of the most common cancers in the world. One out of every six men is diagnosed with prostate cancer (1, 2). The highest frequency of prostate cancer has been reported in African population and the lowest frequency in Asians (3). Since prostate cancer includes about 30% of cases (4) and also it leads to a high mortality; screening methods play an important role in diagnosis and follow-up of the disease. In general, many factors have to be considered in screening of prostate cancer. Early diagnosis of prostate cancer is possible through the following methods:

- 1) Rectal examination by finger
- 2) Prostate specific antigen in serum

3) Rectal ultrasound and biopsy

The first step in prostate cancer screening is the combination of PSA (prostate-specific antigen) and rectal examination by finger; but PSA is considered as the most used and accessible tumor marker to diagnose prostate cancer and its follow-up (5). A direct relationship has been reported between serum PSA level and the patient's age as well as prostate volume (6), but the relation between PSA level and the prostate size separately as well as BMI (body mass index) has been less investigated.

The aim of this study is early diagnosis of prostate cancer through applying inexpensive, simple and noninvasive methods. On the other hand, several epidemiological studies have evaluated the relationship between BMI

Implication for health policy/practice/research/medical education:

According to the results of the study; the more increasing the age, the more increasing PSA level. Regarding the normal level of PSA at any ages, it can be used for prostate cancer screening. Most specialists suggests 50 years old as the maximum age for prostate cancer screening, but according to this study the maximum age is 60 years old at least in north east of Iran.

and risk of prostate cancer. It seems that the relation between obesity and the advanced prostate cancer is logical. Cancer prevention studies and analysis of prostate cancer prevention trials indicate that there is a positive relation between obesity and high risk prostate cancer and there is a negative relation between obesity and low risk prostate cancer. Obesity is associated with the multiple prostatectomy stages; in other words, risk of prostate cancer in obese patients may be similar to others, but is more likely to be more invasive (7). According to the studies, larger prostate glands and lower serum PSA levels are seen among obese men. It seems that PSA level after correction is lower than the prostate volume (8).

Considering that obese men have lower PSA and also more invasive pathological and clinical protests, the question are that: "does PSA screening should be corrected based on BMI?" Until a more malignant prostate cancer does not lead to a higher mortality in a group undergone treatment and screening, changes in clinical practices are not recommended. It is clear that more information is needed. Stabilizing the interaction of genetic and environmental factors is regarded as the most important challenging aspect of the study. There are a lot of statistical epidemiologic data about the relationship between obesity and risk of prostate cancer. To indicate a clear relation between obesity and prostate cancer, the relation between PSA levels and BMI should be evaluated. The relation between PSA and BMI had been evaluated in asymptomatic subjects.

2. Objectives

This study aims to analyze the diagnostic value of PSA and also evaluate the relationship between PSA and BMI as well as PSA and prostate size and volume in asymptomatic subjects referred to the Check-up Clinic of Razavi Hospital.

3. Patients and Methods

In this descriptive, cross-sectional and retrospective study; the demographic data as well as total PSA and also prostate size of 1149 subjects who had referred to the Check-up clinic of Razavi hospital from 2006 to 2011 were evaluated according to their sonography reports (sampling was census). All the subjects were asymptomatic and did not have cancer (It was inclusion criteria). The normal level of PSA was considered 0-4 ng/mL and the borderline was 4-10 ng/mL. Since the purpose of this study included determining an appropriate age for prostate cancer screening as well as finding a relationship between BMI and PSA in subjects with normal and borderline PSA levels, 26 subjects with PSA > 10 were excluded.

The average of PSA level was calculated in four age groups: 40-49, 50-59, 60-69 and 70-79. Subjects were divided in to normal group (BMI: 18-27) and abnormal group (18 < BMI > 27) based on their BMI. Normal level of PSA and the borderline werthe obtained for both groups.

To evaluate the relation between prostate size and PSA level, Pearson correlation test was used for the analysis of the correlation between sonography and blood test reports. Data were analyzed by SPSS.

4. Results

1123 men with the mean age of 45 ± 12 and BMI: 27 ± 8 included in the study. Only 1% of subjects with normal BMI were reported with PSA, 4-10 ng/mL. Totally 98% had normal PSA (0-3.9 ng/mL) and 2% had PSA in borderline (4-9.9 ng/mL). 1% was reported with BMI < 18, 49% with BMI > 27 and 50% with $18 < \text{BMI} > 27$. According to Pearson correlation test, it was revealed that there was very low but inverse correlation between PSA and BMI. A non-significant correlation was reported between BMI and PSA ($P = 0.08$, $r = 0.054$). Regarding Table 1, the correlation between PSA level and height, width and length of prostate was not high separately, but there was a non-significant difference between them, meanwhile the correlation between PSA level and prostate volume was greater than the correlation between PSA and prostate size separately.

The correlation between age and PSA level reveals that PSA level is age dependent but this dependency is not high ($P = 0.001$, $r = 0.279$). Table 2 shows PSA levels based on the subjects' age. Totally 36% of subjects aged 40-49 were reported with normal PSA 0-2.5; 18% aged 50-59 with PSA 0-2.5; 6% aged 60-69 with PSA 0-4.5 and 4% aged 70-79 with PSA0-6.5.

5. Discussion

Although using PSA test is considered as the best prostate cancer screening test, but the incidence of this

Table 1. Correlation Between PSA and Prostate Sizes and Volume

| Variable | PSA Levels Correlation | PSA Levels Significant Amount, P |
|----------------------------------|------------------------|----------------------------------|
| Prostate height, mm | 0.274 | 0.001 |
| Prostate length, mm | 0.239 | 0.001 |
| Prostate width, mm | 0.213 | 0.001 |
| Prostate volume, cm ² | 0.394 | 0.001 |

Table 2. Prostate-Specific Antigen (PSA) Level at Age Ranges

| Age | Prostate-Specific Antigen | |
|-------|---------------------------|-----------------|
| | Minimum-Maximum | Mean \pm SD |
| 40-49 | 0.08-4.73 | 0.75 \pm 0.57 |
| 50-59 | 0.02-7.8 | 1.08 \pm 1.08 |
| 60-69 | 0.09-9.36 | 1.66 \pm 1.64 |
| 70-79 | 0.12-8.41 | 1.42 \pm 1.42 |

cancer is quite different based on the age, race and also serum PSA level (9). This study aims to evaluate the relationship between serum PSA level and BMI as well as prostate sizes and its volume.

The results revealed that there was a high correlation between all the evaluated factors. Some factors showed higher correlation and some others lower one. The correlation between PSA level and prostate volume ($r = 0.394$) was analyzed in this study too. The results were similar to the results of the study achieved by Ayatollahi (10). The correlation between PSA level and prostate volume was higher than the correlation between PSA level and each prostate size; because to calculate the prostate volume, each prostate size should be added together. Prostate volume is getting larger in each dimension equally and it is observed only in one dimension during the correlation calculation, whereas volume is considered as the total changes in different dimensions. Very low and inverse correlation was determined between PSA and BMI. Non-significant correlation was reported, whereas a significant correlation was observed between PSA and BMI in the study achieved by Pater et al. (11). Up to now the relation between the two mentioned factors has been evaluated in symptomatic subjects who may have $PSA > 10$. The created ambiguity is that the relation between these factors may be more obvious in high levels of PSA. This leads us to conduct other studies such as the comparison between the mentioned factors in asymptomatic as well as symptomatic subjects.

The significant level of the results and their effect on the diagnostic value do not reject the normality of diagnostic value in obese subjects. Clinical framework and also other effective factors on PSA level should be considered in diagnostic procedure. PSA level was evaluated at different age groups and the highest level of PSA was reported in ages 60-69 with the mean of 1.66. According to the results of the study; the more the age increases, the more PSA level increases. Regarding the normal level of PSA at any ages, it can be used for prostate cancer screening. Most specialists believe that age 50 is the maximum age to start cancer screening, but according to this study, the maximum age is age 60 at least in north east of Iran.

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Authors' Contribution

The corresponding author of this manuscript is Ali Abdolhosseini and contribution of the authors as mentioned below with their responsibility in the research; Ali Abdolhosseini and Kambiz Totonchi saraf doing and supervision of the study; Azra IZanloo Analysis and writing the manuscript, Najme Jafari collecting data.

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