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Relationship Between Serum Prostate Specific Antigen and Transrectal Prostate Sonographic Findings in Asymptomatic Ugandan Males

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ABSTRACT

Background: Prostate disorders are among the leading causes of morbidity and mortality in men above the age of 40 years globally. Serum prostate-specific antigen (PSA) levels may be used to screen men at risk of prostate cancer while prostate sonography determines prostate volume (PV) and detects nodules. In this study, we aimed at determining the relationship between serum PSA levels and transrectal prostate sonographic findings among asymptomatic Ugandan males.

Methods: Ugandan males above 30 years of age or older without lower urinary tract symptoms (LUTS) were cross-sectionally enrolled into the study. Serum PSA determination and transrectal ultrasound were performed. Association between PSA levels and PV was assessed using Spearman's correlation coefficients (ρ).

Results: A total of 277 men were studied. The median serum PSA level was 1 (95% CI: 1-2). The median sonographic PV was 26 (95% CI: 26-29) mls. Both PSA levels and PV progressively increased with age from 0.9ng/ml and 22mls in the 30 - 39-year age group to 7ng/ml and 38mls in the 60 - 69-year age group, respectively. PSA levels weakly correlated with PV (ρ=0.27) (p<0.0001). 130 (47%) participants had prostatic nodules. Of these, 100 (77%) had features of benign nodules and 23% had suspicious nodules for prostate cancer. The median (range) serum PSA level in those with nodules was 2.0 (0.1 - 16.0) ng/ml and for those without nodules was 1.1 (0.1 - 8.0) ng/ml (p<0.0001).

Conclusions: Serum PSA has a weak direct correlation with PV and not a reliable marker for the prediction of presence or absence of prostatic nodules in asymptomatic adult males.

Keywords: Prostate-specific antigen, PSA density, Prostate volume, Benign Prostatic Hyperplasia

INTRODUCTION

The morbidities of prostate diseases have increased sharply all over the world during the past several years especially benign prostatic hyperplasia (BPH) and prostate cancer [1]. BPH is the most common neoplasm and a significant cause of lower urinary track symptoms (LUTS) in the adult males [2]. Both prostate diseases, BPH and prostate cancer, are chronic diseases that take a long period for development from a small lesion to clinical manifestation of symptoms [3]. To detect or diagnose early prostate disease, serum PSA is one of the most widely acceptable screening tools but the concentration levels vary widely in different populations [4].

On the other hand, PV is an important determinant of BPH [5]. They stated that most prostate abnormalities are diagnosed by measuring their dimensions and the study further highlighted the relevance of prostate volume estimation in prostate cancer, of which ultrasonography proved very essential [6]. Prostate cancer is usually seen as a hypoechoic lesion (60-70% of the lesions), commonly in the peripheral zone [7], whereas the typical sonographic feature of BPH is enlargement of the inner gland (transition zone) which can exhibit diffuse enlargement or distinct hypoechoic, isoechoic, or hyperechoic nodules [8].

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Transrectal ultrasound (TRUS) is a widely used imaging modality for prostate evaluation as it has good resolution and remains the gold standard for prostate volume measurement in the diagnosis and management of BPH and prostate cancer [9]. PV is reported to vary widely across different populations [10]. Given these considerations, the present study undertook to evaluate the relationship between serum PSA levels and transrectal prostate sonographic findings among asymptomatic Ugandan adult males attending a large-tertiary clinical center.

REVIEW

Methods

This was a single center descriptive cross-sectional study carried out in the radiology department of Mulago National Referral Hospital in Kampala Uganda.

Ugandan adult males above 30 years of age without LUTS as determined by the international prostatic symptom score (IPSS) who attended the hospital for prostate cancer screening and general medical check-up between December 2018 and July 2019 were recruited in to the study. Adult males with contraindications to transrectal ultrasound and adult males who were not eligible to serum PSA testing where excluded from the study.

A Sample size of 283 was determined using the Kish Leslie (1965) formula.

Blood samples for serum PSA levels were drawn and taken to the laboratory and transrectal prostate ultrasound scan was done to determine prostate volume and presence or absence of prostatic nodules.

Data analyses were performed using GraphPad Prism version 8.1 for Mac (GraphPad Software, La Jolla California USA). All tests were two-tailed and $p<0.05$ was considered statistically significant. Association between any two categorical variables was assessed using Pearson's chi-square test of independence. Nonparametric Spearman's rank-correlation (ρ) was performed to assess for strength of associations between two continuous, non-normally distributed data and Mann-Whitney-U signed ranked tests was used to compare medians of nonparametric data.

RESULTS

We enrolled 277 participants with a median (range) age of 52 (30-86) years. Overall, the median (range, 95% confidence interval of median) serum PSA level was 1.0 (0.1-16.0; 95% CI: 1-2) ng/mls. The serum PSA levels progressively increased within each 10-year age There was a moderate positive correlation between participants' age and serum PSA levels (ρ =0.52).

Overall, the median (range, 95% confidence interval of median) sonographic PV was 26 (13-99; 95% CI: 26-29) mls.

There was a strong positive correlation between participants' age and prostate volume (ρ = 0.6).

Both serum PSA levels and prostate volume increased progressively with age from 0.9ng/ml and 22mls in the 30–39-year age group to 7ng/ml and 38mls in the 60–69-year age group respectively. There was a very weak positive correlation between participants serum PSA levels and prostate volumes (ρ = 0.27). One hundred and thirty (47%) participants had prostatic nodules. Of this, one hundred (77%) participants had nodules with benign features while 23% had suspicious nodules for prostate cancer.

The median (range) PSA level in participants with nodules was 2(0.1 - 16) ng/ml and for those without nodules was 1.1(0.1 - 8) ng/ml. The difference between medians of serum PSA levels between participants with nodules and those without was 0.9 (2.0 vs. 1.1: $p< 0.0001$).

DISCUSSION

Both PSA and PV have an age-dependent increase though the rate of increase in each decade being higher for PSA than PV, at 35.9% and 12.4%, respectively [11]. In this study, both serum PSA levels and PV increased progressively with age from 0.9ng/ml and 22mls in the 30 - 39-year age group to 7ng/ml and 38mls in the 60–69-year age group respectively but there was a very weak direct positive correlation between participants serum PSA levels and PV (ρ = 0.27). Studies from Western countries have reported correlation coefficients ranging between 0.37 and 0.6. [12-14]. The studies performed in Asian countries reported somewhat higher coefficient values between PSA level and PV than those performed in Western countries.

Elevated serum PSA can be detected with either benign or malignant nodules of the prostate. In this study, the median serum PSA level was significantly higher for participants with nodules compared to those without (2.0 vs 1.1: $p< 0.0001$), however there was a great overlap in the ranges of PSA levels in men with prostatic nodules and those without. Therefore, PSA levels may predict the presence of nodules but doesn't discriminate the presence or absence of nodules. Besides different nodules cause varying levels of PSA elevation depending on the histological disease process.

CONCLUSION

Both serum PSA levels and PV progressively increased with age but there was a weak direct correlation between serum PSA levels and PV. There was a great overlap in serum PSA levels of those with nodules and those without. Hence serum PSA cannot predict the presence or absence of prostatic nodules. Therefore, Serum PSA levels should be interpreted together with age and transrectal prostate sonographic findings in asymptomatic males.

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