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Contemporary outcomes in the detection of prostate cancer using transrectal ultrasound-guided 12-core biopsy in Singaporean men with elevated prostate specific antigen and/or abnormal digital rectal examination

Alvin Lee [a], Sing Joo Chia [b,*]

[a] *Yong Loo Lin School of Medicine, National University of Singapore, Singapore*
[b] *Department of Urology, Tan Tock Seng Hospital, Singapore*

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Abstract *Objective:* Despite being the third commonest cancer in Singaporean men, there is a dearth of basic data on the detection rate of prostate cancer and post-procedure complication rates locally using systematic 12-core biopsy. Our objective is to evaluate prostate cancer detection rates using 12-core prostate biopsy based on serum prostate specific antigen (PSA) levels and digital rectal examination (DRE) findings in Singaporean men presenting to a single tertiary centre. The secondary objective is to evaluate the complication rates of transrectal prostate biopsies.
Methods: We retrospectively examined 804 men who underwent first transrectal-ultrasound (TRUS) guided 12-core prostate biopsies from January 2012 to April 2014. Prostate biopsies were performed on men presenting to a tertiary institution when their PSA levels were ≥4.0 ng/mL and/or when they had suspicious DRE findings.
Results: Overall prostate cancer detection rate was 35.1%. Regardless of DRE findings, patients were divided into four subgroups based on their serum PSA levels: 0–3.99 ng/mL, 4.00–9.99 ng/mL, 10.00–19.99 ng/mL and ≥20.00 ng/mL and their detection rates were 9.5%, 20.9%, 38.4% and 72.3%, respectively. The detection rate of cancer based on suspicious DRE findings alone was 59.2% compared to 36.5% based on serum PSA cut-off of 4.0 ng/mL alone. The post-biopsy admission rate for sepsis was 1.5%.

* Corresponding author.
E-mail address: sing_joo_chia@ttsh.com.sg (S.J. Chia).
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Conclusion: In conclusion, using contemporary 12-core biopsy methods, the local prostate cancer detection rate based on serum PSA and DRE findings has increased over the past decade presumably due to multiple genetic and environmental factors. Post-biopsy sepsis remains an important complication worldwide.

1. Introduction

According to the Singapore Cancer Registry, prostate cancer was the third commonest cancer in men during 2009—2013, making up 12.1% of all cancers reported locally [1]. The incidence of prostate cancer has been rapidly increasing in the last decade. Potential reasons for this increase include the advent of better detection methods, an aging population as well as a shift in dietary patterns [2]. However, the incidence of prostate cancer in Singapore is still much lower compared to other Western countries such as the USA [3]. In years to come, prostate cancer will likely become an increasingly important health issue as its diagnosis and management continues to evolve. Hence, it is essential to review and update our current diagnostic pathway based on the latest evidence so as to further improve patient outcomes.

Current established detection methods of prostate cancer include digital rectal examination (DRE), serum prostate specific antigen (PSA) and transrectal ultrasound (TRUS)-guided prostate biopsy using a systematic 12-core method. Serum PSA cut-offs of between 2.5 and 4.0 ng/mL have been used by studies on prostate cancer screening such as the European Randomized Study of Screening of Prostate Cancer (ERSPC) and Prostate, Lung, Colorectal and Ovarian cancer screening trial (PLCO) [4,5].

The median PSA in Singaporeans is lower than that reported in Caucasian men [6]. However, there is a dearth of basic data for the detection rate of prostate cancer according to serum PSA levels and DRE findings. In this retrospective study, we endeavored to examine the detection rate of prostate cancer on contemporary 12-core TRUS-biopsy in men with either PSA $\geq$4.0 ng/mL and/or have suspicious DRE findings and also to analyze the complication rates of biopsy.

2. Materials and methods

In our study, we retrospectively analyzed 804 men who underwent TRUS-guided prostate biopsy in a single institution from January 2012 to April 2014. The indications for prostate biopsy were serum PSA $\geq$4.00 ng/mL and/or DRE findings suspicious for malignancy (including induration, irregularity, nodularity and asymmetry). Subjects who had previous prostate biopsy, prostate surgery, known diagnosis of prostate cancer and previous use of 5-α reductase inhibitors were excluded from the study. All subjects had at least one or more serum PSA levels measured and were subjected to DRE. All PSA measurements were performed using PSA Hybritech Assay and only the latest results taken prior to prostate biopsy were used in our analysis.

For the prostate biopsy, patients were placed in the left lateral position and a TRUS-guided needle biopsy of the prostate was performed. The ultrasound scanner used was Siemens ACUSON X150. The prostate volume was measured using the ellipsoid formula (π/6 $\times$ craniocaudal $\times$ transverse $\times$ anteroposterior length). Patients underwent systematic 12-core or 18-core biopsy depending on the performing clinician's evaluation of the prostate volume and DRE findings. Additional cores were taken at the urologist's discretion such as taking a core from a hypoechoic lesion seen on ultrasound. The core specimens were examined by pathologists in the same institution. Prostate cancers with Gleason sum $\geq$7 were considered clinically significant. For peri-procedure sepsis prophylaxis, men were given 7 days of peri-procedural oral ciprofloxacin tablets (3 days pre- and 4 days post-procedure) and one dose of intra-muscular gentamicin 120 mg just before the procedure. Bisacodyl suppositories were given for rectal preparation on the day of the procedure. The rectum was cleansed using povidone-iodine solution just before needle biopsy.

We further evaluated the post-procedural complications which required inpatient admission such as infection. In men who developed post-procedure fever, they were given intravenous cefepime and a single dose of amikacin as per institution protocol. The antibiotic used would then be rationalised based on culture and sensitivities.

Statistical analysis was performed using IBM SPSS Statistics 20.0. *t*-test, Kruskal—Wallis and Pearson Chi-square tests were used to evaluate any differences in continuous and categorical variables respectively. Ethics approval was obtained from the Domain-Specific Review Board (DSRB) before commencement of data collection (2010/00318).

3. Results

Eight hundred and four men underwent first TRUS-guided prostate biopsy. Seven hundred and thirty-three (91.2%) were Chinese while 71 (8.8%) were from other races such as Malay, Indian and Caucasian. Their mean age was 68.2 $\pm$ 8.9 years, median prostate volume was 45.0 mL and median serum PSA levels were 8.6 ng/mL (Table 1). The systematic 12-core prostate biopsy were performed on 468/522 (89.7%) of men without cancer compared to 236/282 (83.7%) men with cancer ($p < 0.01$).

Two hundred and eighty-two men (35.1%) had a positive biopsy result for prostate cancer, which included 215 men (76.2%) who had clinically significant disease (Gleason