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Detection Rate of Prostate Cancer on the Basis of the Vienna Nomogram: A Singapore Study

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Purpose: The purpose of this study was to determine the efficacy of the Vienna nomogram prostate biopsy model in the detection of prostate cancer in our local population. We also assessed the incidence of complications from using such a template.
Materials and Methods: From January 2006 to June 2007, 120 men with either elevated prostate-specific antigen (PSA) scores (>4 ng/mL) and/or abnormal digital rectal examination were enrolled prospectively to undergo extraction of 6 to 18 cores for transrectal ultrasound-guided prostate biopsy, as indicated by the Vienna nomogram.
Results: The mean age was 62.6±8.3 years (range, 40–86 years). The mean PSA score was 13.42 ng/mL. The mean number of cores obtained was 9.68±3.1. According to the Vienna nomogram, 27 out of a total of 120 patients had prostate cancer, for a detection rate of 22.5%. In the group of patients with PSA scores <10 ng/mL, the detection rate was 14.9% (14 of 94 patients). The group of patients with PSA scores >10 ng/mL had a detection rate of 50% (13 of 26). The complication rate in our study was 7.5%.
Conclusions: With the use of the Vienna nomogram, our prostate cancer detection rate is comparable to previously published data for Asian patients. This nomogram offers an easy tool with which to select the optimal number of prostate biopsy cores to be taken on the basis of patient age and total prostate volume. With this biopsy strategy, we also have found that the complication rate from prostate biopsy is low.

Keywords: Biopsy; Nomogram; Prostate neoplasms

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INTRODUCTION

Prostate cancer (PCa) is the fifth-most-common cancer among men in Singapore, with an age-standardized rate of 17.4 cases per 100,000/y [1], and the incidence has been increasing steadily over the past 35 years. The average annual rate of increase between 1968 and 2002 was 5.6%, with the past 10 years showing a somewhat steeper increase. PCa could become a major public health issue with the aging of our country's population.

During the past decade, a considerable number of modifications have been made to improve the technique of PCa biopsy. Studies have shown that increasing the number of biopsy cores increases PCa detection rates [2,3]. Total prostate volume is also an important factor, and higher PCa detection rates have been reported in men with smaller prostates [4,5]. The current concept regarding prostate biopsy is that systematic sextant biopsies, even when directed laterally, do not provide adequate prostate sampling.

Several extended biopsy techniques have been introduced to improve the PCa detection rate compared with that of systematic sextant biopsy [2,3]. These techniques vary in the number of cores taken and the location from which samples are obtained, but none have taken into consideration the age of the patient or the volume of the prostate gland. Life expectancy is based on patient age and has a pivotal role in diagnosis and treatment. Over-diagnosis of clinically insignificant PCa is considered a major potential drawback of prostate-specific antigen (PSA) screening, especially in older patients. PCa volumes to be detected can be larger in older patients, and thus fewer cores are needed, which reduces over-diagnosis of tumors (insignificant

PCa) at biopsy [6].

On the basis of the above information and using data from the European Prostate Cancer Detection study, the use of the Vienna nomogram (VN) prostate biopsy model was developed. This model indicates the optimal number of cores based on patient age and total prostate volume. Thus, the use of the VN should result in higher PCa detection rates, especially in younger patients and those with larger prostates, and, at the same time, should avoid the detection of insignificant cancers, especially in older patients. This VN model has been validated in an European population [6].

In this study, we used the VN to determine the efficacy of this model in the detection of PCa in our local population. We also assessed the incidence of complications due to the use of such a template.

MATERIALS AND METHODS

With approval from our Institutional Review Board, 120 men were enrolled prospectively between January 2006 and June 2007. The study population consisted of consecutive referrals for evaluation of elevated PSA scores (>4 ng/mL) and/or abnormal digital rectal examination (DRE) findings. All patients underwent transrectal ultrasound (TRUS) examination of the prostate, which was followed by prostatic biopsies. Patients were excluded from the study if they had a history of PCa, acute or chronic prostatitis, histologic evidence of prostatic intraepithelial neoplasia of any grade, urinary retention, indwelling urinary catheter, or confirmed urinary tract infection.

Before the procedure, a urine culture was performed to exclude any urinary tract infection. Prophylactic antibiotics were given before the procedure. Patients were observed for a minimum of 4 hours after the procedure for immediate complications and were given advice to return to hospital if they had delayed complications.

In each of the 120 patients, 6 to 18 cores were taken from the peripheral zone for TRUS-guided biopsy, as indicated by the VN (Table 1). No transition zone cores were taken. Each biopsy core was labeled according to location on the prostate and was sent separately for histologic review. Biopsy tissue was considered positive if adenocarcinoma was diagnosed, and the number of positive cores, the

Gleason score, and the grade were reported. All other findings (high-grade prostatic intraepithelial neoplasia, atypia, and dysplasia) were considered negative. In this study, TRUS-guided biopsy performed according to the VN protocol was restricted to the first biopsy. Further management was dependent on individual urologists, and complication rates were subsequently updated by chart reviews.

Data were analyzed by using the SPSS ver. 12.0 (SPSS Inc., Chicago, IL, USA) and stratified for age, PSA, and TRUS findings.

RESULTS

The patients' mean age was 62.6±8.3 years (range, 40–86 years). The mean PSA score was 13.42 ng/mL, and the mean number of cores obtained was 9.68±3.1. According to the VN, 27 out of a total of 120 patients had PCa, for a detection rate of 22.5%. In the group of patients with PSA scores <10 ng/mL, the detection rate was 14.9% (14 of 94 patients). The group of patients with PSA scores >10 ng/mL had a detection rate of 50% (13 of 26).

Histopathologic features presented on prostate biopsy in 27 PCa patients whose Gleason scores were 3+3, 3+4, 4+3, 4+4, and 4+5 in 11.1% (3 patients), 37.0% (10), 29.6% (8), 18.5% (5), and 3.7% (1) respectively (Fig. 1).

Four patients with initial negative TRUS biopsy were subsequently diagnosed to have PCa. Two of these cases were diagnosed on repeat TRUS biopsy, and two were discovered on transurethral prostatectomy, for a false-negative rate of 3.3%.

A total of 9 patients (7.5%) had complications. Four patients (3.3%) had sepsis that resolved with inpatient administration of antibiotics. Four patients (3.3%) had bleeding per rectum: one of them required adrenaline injection, another required hemostasis under spinal anaesthesia, and the other two had rectal bleeding that resolved spontaneously without further intervention. One patient with both rectal bleeding and sepsis responded to medical management.

TABLE 1. Vienna nomogram: optimal number of biopsy cores according to patient age and total prostate volume

Prostate volume (mL)	Age (y)			
	<50	51–60	61–70	>70
0–30	8	8	8	6
31–40	12	10	8	6
41–50	14	12	10	8
51–60	16	14	12	10
61–70	18	16	14	12
>70	18	18	16	14
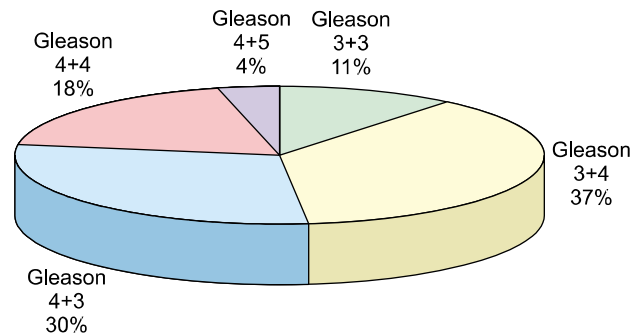
FIG. 1. Histopathological breakdown of the prostate cancer patients.

TABLE 2. Detection rate of prostate cancer in patients with high prostate-specific antigen (PSA) scores in various countries

Country of origin	Detection rate (%)	PSA range (ng/mL)	Biopsy method
Korea (Yang et al. [7])	15.9	4–10	6 Core biopsy
Singapore (Ng et al. [8])	19.3	4–10	10 Core biopsy
Malaysia (Mariappan et al. [9])	24.0	<20	Prostate volume
Japan (Egawa et al. [10])	15.8	4–10	6 Core biopsy
Taiwan (Yu and Lai [11])	14.6	4–20	-
Austria (Remzi et al. [6])	36.7	2–10	Vienna nomogram
Our study	14.9	4–10	Vienna nomogram

DISCUSSION

Detection rates of PCa have varied, and review of the literature from several Asian countries found that the detection rate of PCa in patients with raised PSA scores is in the range of 14.6% to 26.5% [7-11]. The Austrian study that used the VN had a detection rate of 36.7% [6] (Table 2). Data from other countries in Asia uniformly reported a low cancer detection rate in connection with PSA scores ranging from 4 to 10 ng/mL. In comparison, the detection rate of PCa with PSA scores ranging from 4 to 10 ng/mL has always been about 25% in Western countries [12].

The low positive predictive value of elevated PSA scores in Asian countries may be due to the low incidence of PCa in this geographic area, but it also may be partly due to inadequate sampling. Recent reports in the literature have queried the adequacy of sextant biopsy for the detection of small nonpalpable PCa. In our study, we used the VN, and the positive predictive value was 22.5%, a value that is comparable to other published data from Asian countries.

The key to higher PCa detection rates with the use of the VN is varying the number of cores according to prostate volume [13]. Because larger prostate glands can result in more sampling errors during biopsy, prostate volume needs to be taken into account during TRUS biopsy. The studies by Remzi et al. [5] and Ung et al. [14] stressed the importance of prostate volume in PCa detection and showed that detection rates are, in fact, dependent on prostate volume. Rietbergen et al. [15] also found that the most important factor in a failure to diagnose PCa at the primary screening was a large prostate volume. Evaluating the variation of PCa detection in relation to prostate size through random systematic sextant biopsies, Uzzo et al. [16] found that 23% of the patients had PCa in a large prostate (>50 mL), whereas 38% of patients with smaller prostates had PCa (p<0.01). Rietbergen et al. [15] concluded that significant sampling errors may occur in men with large glands.

Although a study by Lecuona and Heyns [17] found that the detection rates for the VN and an eight-core prostate biopsy were similar, the detection rate in the VN group was higher for patients with larger prostate volume (>50 mL). Thus, the VN could be useful in patients with larger prostates in which potential undersampling could occur.

Age is the other important variable in the VN. The rationales for using age as one of the parameters to determine the number of biopsy cores taken are twofold: first, younger men have a longer life expectancy, which makes even smaller cancers clinically significant, and, thus, more cores are needed; and, second, older men may require fewer biopsy cores to avoid oversampling and overtreatment. If the time to critical PCa volume is less than life expectancy, there might be no need for PCa detection, as these PCas will be clinically insignificant.

Standard sextant biopsies have reported high false-negative rates of 15% to 28% [18,19]. By combining systematic and target sampling, the sensitivity increases to 93% to 98%. The sensitivity of the VN biopsy strategy was high (96.7%).

The advantages of using a VN are, first, higher PCa detection rates, especially in younger patients and larger prostates; second, at the same time, the avoidance of detection of insignificant cancers, especially in older patients; and, third, the fact that it provides urologists with a clear and fixed number of biopsy cores on the basis of patient age and prostate volume.

In our study, the complication rate was low (7.5%). This rate was comparable to the rates in large-scale studies looking at morbidities of TRUS prostatic biopsy [20]. Moreover, our complication rate was low despite our having performed more biopsies on each patient (than we would have with the sextant biopsy).

CONCLUSIONS

With the use of the VN, our PCa detection rate of 22.5% is comparable to published data for Asian patients. The nomogram offers an easy tool with which to select the optimal number of prostate biopsy cores on the basis of patient age and total prostate volume. With this biopsy strategy, we have also found that the complication rate from prostate biopsy is low.

CONFLICTS OF INTEREST
The authors have nothing to disclose.

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