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·*Original Article*·

Ultrasound-guided transrectal extended prostate biopsy: a prospective study

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Abstract

Aim: To evaluate the diagnostic value of the 10 systematic transrectal ultrasound-guided (TRUS) prostate biopsy compared with the sextant biopsy technique for patients with suspected prostate cancer. **Methods:** One hundred and fifty-two patients with suspected prostate cancer were included in the study. Patients were entered in the study because they presented with high levels of prostate specific antigen (PSA) (over 4 ng/mL) and/or had undergone an abnormal digital rectal examination (DRE). In addition to sextant prostate biopsy cores, four more biopsies were obtained from the lateral peripheral zone with additional cores from each suspicious area revealed by transrectal ultrasound. Sextant, lateral peripheral zone and suspicious area biopsy cores were submitted separately to the pathological department. **Results:** Cancer detection rates were 27.6 % (42/152) and 19.7 % (30/152) for the 10-core and sextant core biopsy protocols, respectively. Adding the lateral peripheral zone (PZ) to the sextant prostate biopsy showed a 28.6 % (12/42) increase in the cancer detection rate in patients with positive prostate cancer ($P < 0.01$). The cancer detection rate in patients who presented with elevated PSA was 29.3 % (34/116). When serum PSA was 4–10 ng/mL TRUS-guided biopsy detected cancer in 20.6 %, while the detection rate was 32.4 % and 47.0 % when serum PSA was 10–20 ng/mL and above 20 ng/mL, respectively. **Conclusion:** The 10 systematic TRUS-guided prostate biopsy improves the detection rate of prostate cancer by 28.6 % when compared with the sextant biopsy technique alone, without increase in the morbidity. We therefore recommend the 10-core biopsy protocol to be the preferred method for early detection of prostate cancer. *(Asian J Androl 2005 Jun; 7:165–169)*

Keywords: ultrasonography; prostate; biopsy; diagnosis

1 Introduction

Digital rectal examination (DRE) coupled with the measurement of prostate specific antigen (PSA) is widely used for the early diagnosis and monitoring of prostate cancer. In the case of an abnormal DRE and/or a suspicious PSA-value, transrectal ultrasound-guided (TRUS-guided) prostate biopsy is then adopted.

TRUS-guided prostate biopsy has become a routine procedure in urology and can be performed safely without anesthesia as an outpatient procedure. Using Trucut needles and spring-loaded biopsy guns makes the procedure simple and well-tolerated by the patients. TRUS, as a means of detecting prostate cancer early, is still a point of discussion due to the non-uniform appearance of prostate malignancy at ultrasound; this non-uniform appearance of malignancy has resulted in the sextant TRUS-

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guided prostate biopsy technique first described by Hodge *et al.* [1]. In the case of a suspicious ultrasound image, lesion-directed biopsy is coupled with sextant biopsy [2]. Although the sextant biopsy approach has improved, the detection of prostate cancer – the sensitivity and specificity to diagnose cancer – has been disappointing, and the number of false-negatives in a single biopsy session reported ranges between 30 % and 45 % [3, 4]. Different protocols describing modifications in the technique of prostate biopsy in order to cover all regions of the prostate with more than six systematic biopsies were reported [5, 6]. This study was conducted to evaluate the diagnostic yield of TRUS-guided 10-core prostate biopsy compared with standard sextant biopsy.

2 Patients and methods

This study was conducted on 152 cases of 10 systematic TRUS-guided prostate biopsy performed at King Abdullah University Hospital in Jordan during the period from March 2002 to October 2003. Indications for TRUS-guided prostate biopsy were: abnormal digital rectal examination and/or a serum PSA over 4 ng/mL. None of these patients had had a previous prostate biopsy.

All patients provided signed informed consent. Digital rectal and TRUS examination of the prostate was performed for all patients before biopsy and prostate volume was calculated using ellipsoid formula, which is not different from the formula: n/6X lateralX anteroposteriorX supero-inferior diameters, used by Xia *et al.* [7]. Lidocaine gel 2 % was used for local anesthesia. All patients were placed in the lithotomy position. An 18-G core biopsy needle mounted on a spring-loaded automatic biopsy gun was used. All patients were given 500 mg of ciprofloxacin and 500 mg of metronidazoleorally 2 h before biopsy; this was continued for 7 days after biopsy. Rectal preparation involved the administration of a phosphate enema on the morning of the biopsy. All of the patients underwent a 10-core biopsy protocol with the addition of a 1- or 2-core biopsy from each suspicious area detected by TRUS. In addition to the standard sextant biopsy technique, four more biopsies were obtained from the lateral peripheral zone as shown in Figure 1. The lateral peripheral zone biopsies were taken from the base and mid-gland regions using the technique described by Chang *et al.* [8]. Biopsy specimens were divided into three groups and labeled as the following: A-sextant biopsy cores, B-lateral peripheral zone biopsy cores and C-lesion directed biopsy cores, and they were submitted in 3-formalin-filled containers to the department of pathology of the university hospital.

All patients were instructed to come to the hospital if fever developed or they experienced any weakness, flushing or chills. A "major complication" was defined as a complication that required hospital admission. The Mann–Whitney *U*-test was used for statistical analysis of the results regarding the age, serum PSA levels and prostate volumes. The McNemar test was used as the statistical method to compare the cancer detection rates. $P < 0.05$ was considered statistically significant.

3 Results

The median age of patients with benign prostatic conditions was 65 years (range 45–80 years), while that for adenocarcinoma was 70 years (range 47–82 years) ($P < 0.01$).

Eighty-five patients (55.9 %) presented with irritative lower urinary tract symptoms, 59 (38.8 %) patients with irritative and obstructive symptoms and eight patients (5.3 %) with general weakness and lower back pain; two of them had chronic anemia and weight loss. Transurethral resection of the prostate (TURP) was done for seven patients to relieve urinary retention and two of them had advanced prostate cancer.

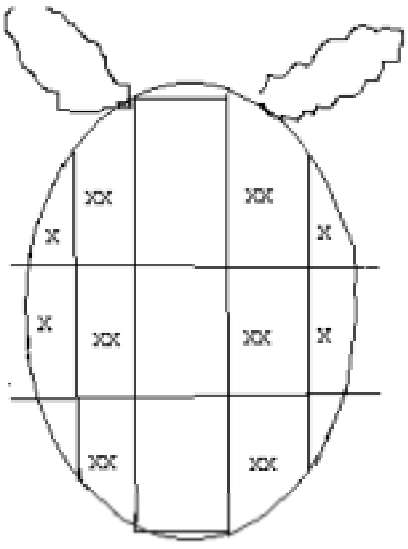

Figure 1. Site of the standard sextant biopsies and the four additional lateral peripheral zone biopsies. xx denotes standard sextant biopsies; x denotes lateral peripheral zone biopsies.

The median prostate volume which was detected by transrectal ultrasound was 40 cc (25–60) for cancer patients and 45 cc (20–120) for patients with benign prostatic conditions.

Prostate cancer was detected in 42 out of 152 patients. The cancer detection rates were 27.6 % (42/152) and 19.7 % (30/152) for the 10-core biopsy protocol and sextant biopsy protocol, respectively. So the 10-core biopsy technique increased the prostate cancer detection rate by 28.6 % (12/42) for all patients with positive biopsy ($P < 0.01$). TRUS examination of the prostate detected suspicious lesions in 30 patients and nine of them revealed cancer. Biopsy from a suspicious area revealed cancer in 21.4 % (9/42); however, in all of these patients cancer was already revealed by the 10-core biopsy, while lesion biopsy detected 7.1 % (3/42) additional cancers if sextant biopsy technique was used. A statistically significant number of additional cancers were detected with the 10-core biopsy technique compared with the sextant biopsy technique as seen in Table 1. A Gleason score of <7 was found in 40.4 % (17/42) of patients. The sextant biopsy technique was able to detect 30% (9/30) of the cancer cases have a Gleason score < 7, while the 10 systematic biopsy technique found 66.7 % (9/12) of the additional cancer cases diagnosed by this technique by additional biopsies to have Gleason score < 7. A high PSA (above 4 ng/mL) was seen in 116 cases (76.3 %). Cancer detection rate in patients with a high PSA was 29.3 % (34/116). When serum PSA was 4–10 ng/mL, TRUS-guided biopsy detected cancer in 20.6 %, while the detection rate was 32.4 % and 47 % when serum PSA was 10–20 ng/mL and above 20 ng/mL, respectively. Abnormal DRE with normal PSA was the indication in 36 (23.9 %) cases with a cancer detection rate of 22.2 % (8/36).

Although all patients have been compliant with the antibiotic prophylactic regimen used, two patients (1.3 %) developed a major complication (urosepsis) and were treated in the hospital for 4–6 days. Mortality was zero after ultrasound-guided prostate biopsy.

4 Discussion

In this series, 10 systematic prostate biopsy showed clinically significant improvement in terms of prostate cancer detection rate in comparison with sextant systematic biopsy (27.6 % *vs.* 19.7 %) ($P < 0.01$), which compares well with the results of other reported series [9–11]. TRUS-guided biopsy of the prostate is a common and valuable procedure in the diagnosis of prostate cancer. Serum PSA is used not only for follow up, but also to detect early prostate cancer. In addition to prostate cancer, serum PSA may also rise in benign prostatic diseases such as benign prostatic hyperplasia, infarction and prostatitis. These diseases may lead to unnecessary biopsies. Until today there has been no other means to diagnose or exclude prostate cancer except by biopsy. Many prostate cancers detected in this series are isoechoic on transrectal ultrasound (up to 37.3 %); this number is comparable to that previously reported [11] and these isoechoic tumors can only be identified by thorough tissue sampling during prostate biopsy. At first, the sex-

Table 1. Cancer detection rates of 10-core and sextant biopsy protocols.

	Detection rates/total 10-core sextant		Increased in cancer detection/total (%)		*P*-value
Abnormal DRE with PSA <4 ng/mL	8/36 3/36		5/8 (62.5)		<0.005
PSA =4 ng/mL	34/116	9/116	25/116	(21.5)	<0.005
PSA 4–10 ng/mL	7/46	2/46	5/7	(71.4)	<0.005
PSA 10–20 ng/mL	11/39	3/39	8/11	(72.7)	<0.005
PSA >20 ng/mL	16/31	4/31	12/16	(75)	<0.019
Prostate volume =40 cc	22/67	12/67	10/22	(45.4)	<0.005
Prostate volume >40 cc	20/85	8/85	12/20	(60)	<0.005
Age =60 years	10/62	7/62	3/10	(33.3)	<0.005
Age >60 years	32/90	23/90	9/32	(28.1)	<0.005
Total	42/152	30/152	12/42	(28.6)	<0.005

tant biopsy technique described by Hodge *et al.* [1] was considered to be the standard or routine method. According to this technique, three biopsy cores are taken from each side (right and left) of the prostate, 1 cm apart along the parasagital area. However, concerns have arisen that the sextant biopsy method under-samples the prostate, and consequently may fail to detect a significant proportion of clinically important tumors [12]. The optimum number of biopsy cores is unknown. Currently, many clinics perform extended prostate biopsy protocols consisting of 10 plus x cores [9, 11–15]. It was reported that systematic 12-core biopsy detected 31.3 % more prostate cancers than sextant biopsy cores [13]. In prospective studies, the addition of lateral PZ biopsies to the standard sextant protocol detected an additional 14–31 % of cancers that would have remained undetected by the sextant method [9–11]. Naughton *et al.* [12] reported no significant improvement (27 % *vs.* 26 %) in cancer detection when a 12-core extended biopsy protocol including the PZ was prospectively compared with standard sextant biopsy. Fink *et al.* [14] reported that the 10-core prostate biopsy is superior to the commonly used sextant technique and could spare patients unnecessary repeated biopsy. Even after including a second set of sextant biopsies, the total detection rate with these 12 biopsies was inferior to the 10-core technique. In this series the detection rate of an additional 28.6 % of tumors confined exclusively to the lateral PZ compares well with results of other reported series [9, 10, 13]. Prostate cancer detection rate by biopsy in this series was 27.6 % and most of them were with advanced prostate cancer (64.4 %) and with a Gleason score of 7 or more (69.5 %), while Durkan *et al.* [16] reported 33 % cancer detection rate and most tumors detected (90 %) were clinically organ-confined and 56 % were stage T1c, and the commonest tumor grade was 6 (41 %). In this series, the cause of prostate cancer progressing to an advanced stage was mainly the patient's lack of awareness; most prostate biopsies were done on the basis of raised PSA detected when patients presented with symptoms of the lower urinary tract, having suffered from these for a long time before attending the urologist.

The cancer detection rate in Saudi Arabia (a middle-eastern country like Jordan) was shown to be 28.8 % in one series [17]; this is comparable with the rate shown in this series.

All articles reviewed in this study proposed the use of a perioperative antibiotic prophylaxis. Differences may be found in the type, dosage and duration of this perioperative application, which can last from 1 day to 7 days. Paul *et al.* [18] used prophylactic antibiotics in prostate biopsy for 5 days and Jeon *et al.* [19] used antibiotic prophylaxis before biopsy and continually for 7 days. Recently, it was reported that there is no clinical or statistical difference between the 1-day and 3-day antibiotic prophylaxis regimen for patients undergoing TRUS-guided prostate biopsy [20]. Larsson *et al.* [21] concluded that no prophylactic therapy was considered good.

The high rate of sepsis (1.3 %) in this series could be as a result of prostate biopsy being performed while the prostate was inflamed. Also, each of the two patients were at higher risk factor of sepsis: one of them was a diabetic and recently had been treated by ciprofloxacin for urinary tract infection and the other one was on a Foley catheter for 2 weeks before biopsy.

5 Conclusion

The 10 systematic TRUS-guided prostate biopsy improves the detection rate of prostate cancer by 28.6% when compared with the routine sextant biopsy technique; additionally, it does this without increasing morbidity. Biopsy from the suspicious lesions detected by transrectal ultrasound showed no further benefit if 10-core biopsy technique was used. We therefore suggest that the 10-core prostate biopsy protocol be the preferred method for early detection of prostate cancer.

References

1 Hodge KK, McNeal JE, Terris MK, Stamey TA. Random systematic versus directed ultrasound guided transrectal core biopsies of the prostate. J Urol 1989;142: 71-5.

2 Beerlage HP, de Reijke TM, de la Rosette JJ. Considerations regarding prostate biopsies. Eur Urol 1998; 34: 303–12.

3 Levine MA, Ittman M, Melamed J, Lepor H. Two consecutive sets of transrectal ultrasound guided sextant biopsies of the prostate for the detection of prostate cancer. J Urol 1998; 159: 471–6.

4 Steven D, McCabe K, Peretsman S, Klein E, Levin H, Optenberg S, *et al.* Prostate rebiopsy is a poor surrogate of treatment efficacy in localized prostate cancer. J Urol 1998; 159: 1606–8.

5 Presti JC Jr, Chang JJ, Bhargava V, Shinohara K. The optimal systematic prostate biopsy scheme should include 8 rather than 6 biopsies: results of a prospective clinical trial. J Urol

2000; 163: 166–7.
6 Babaian RJ, Toi A, Kamoi K, Troncoso P, Sweet J, Evans R, *et al.* A comparative analysis of sextant and an extended 11-core multisite directed biopsy strategy. J Urol 2000; 163: 152–7.
7 Xia SJ,Xu XX,Teng JB, Xu CX, Tang XD. Characteristic pattern of human prostatic growth with age. Asian J Androl 2002; 4:269-71.
8 Chang JJ, Shinohara K, Bhargava V, Presti JC Jr. Prospective evaluation of lateral biopsies of the peripheral zone for prostate cancer detection. J Urol 1998; 160: 2111–4.
9 Eskicorapci SY, Baydar DE, Akbal C, Sofikerim M, Gunay M, Ekici S, *et al.* An extended 10-core transrectal ultrasonography guided prostate biopsy protocol improves the detection of prostate cancer. Eur Urol 2004; 45: 444–9.
10 Norberg M, Egevad L, Holmberg L, Sparen P, Norlen BJ, Busch C. The sextant protocol for ultrasound-guided core biopsies of the prostate underestimates the presence of cancer. Urology. 1997 Oct;50(4):562-6.
11 Eskew LA, Bare RL, McCullough DL. Systematic 5 region prostate biopsy is superior to sextant method for diagnosing carcinoma of the prostate. J Urol 1997; 157: 199–202.
12 Naughton CK, Smith DS, Humphrey PA, Catalona WJ, Keetch DW. Clinical and pathologic tumor characteristics of prostate cancer as a function of the number of biopsy cores: a retrospective study. Urology 1998; 52; 808–13.
13 Singh H, Canto EI, Shariat SF, Kadmon D, Miles BJ, Wheeler TM, *et al.* Improved detection of clinically significant, curable prostate cancer with systematic 12-core biopsy. J Urol 2004; 171: 1089–92.
14 Fink KG, Hutarew G, Pytel A, Esterbauer B, Jungwirth A, Dietze O, *et al*. One 10-core prostate biopsy is superior to two sets of sextant prostate biopsies. BJU Int 2003; 92: 385-8.
15 Philip J, Ragavan N, Desouza J, Foster CS, Javle P. Effect of peripheral biopsies in maximizing early prostate cancer detection in 8-, 10- or 12-core biopsy regimens. BJU Int 2004; 93: 1218–20.
16 Durkan GC, Sheikh N, Johnson P, Hildreth AJ, Greene DR. Improving prostate cancer detection with an extended-core transrectal ultrasonography-guided prostate biopsy protocol. BJU Int 2002; 89: 33–9.
17 Tayib AM, Mosli HA, Al-Ammari AA. Results of prostate biopsies in a teaching hospital in Western Saudi Arabia. Saudi Med J 2003; 24: 859–62.
18 Paul R, Scholer S, van Randenborgh H, Kubler H, Alschibaja M, Busch R, *et al*. Morbidity of prostatic biopsy for different biopsy strategies: is there a relation to core number and sampling region? Eur Urol 2004; 45: 450–6.
19 Jeon SS, Woo SH, Hyun JH, Choi HY, Chai SE. Bisacodyl rectal preparation can decrease infectious complication of transrectal ultrasound guided prostate biopsy. Urology 2003; 62: 461–6.
20 Sabbagh R, McCormack M, Peloquin F, Faucher R, Perreault JP, Perrotte P, *et al*. A prospective randomized trial of 1-day versus 3-day antibiotic prophylaxis for transrectal ultrasound guided prostate biopsy. Can J Urol 2004; 11: 2216–9.
21 Larsson P, Norming U, Tornblom M, Gustafsson O. Antibiotic prophylaxis for prostate biopsy: benefits and costs. Prostate Cancer Prostatic Dis 1999; 2: 88–90.