Prostate Cancer and Prostatic Diseases (2008) 11, 270–273
 1365-7852/08 $30.00
www.nature.com/pcan

ORIGINAL ARTICLE

Sixteen gauge needles improve specimen quality but not cancer detection rate in transrectal ultrasound-guided 10-core prostate biopsies

GH Inal, VÇ Öztekin, Ö Uğurlu, M Kosan, Ö Akdemir and M Çetinkaya
Department of Urology 2nd, Ankara Numune Education and Research Hospital, Ankara, Turkey

Performance of 16 (16 g) ($n = 103$) and 18 gauge (18 g) ($n = 101$) biopsy needles in transrectal ultrasound (TRUS)-guided 10-core prostate biopsies were compared in terms of cancer detection and pre-defined specimen quality criteria in this prospective randomized study. Cancer detection rates of the two groups were similar, although the mean core volume of 16 g needles was almost twice that of 18 g needles. On the other hand, using 16 g needles significantly improved specimen quality by acquiring less empty cores, small cores and fragmented cores. There were no significant differences among the complication rates and VAS pain scores of the two groups. Sixteen gauge needles can safely be used in TRUS-guided prostate biopsies, as they improve specimen quality without increasing morbidity and patient discomfort.
Prostate Cancer and Prostatic Diseases (2008) **11,** 270–273; doi:10.1038/pcan.2008.34; published online 3 June 2008

Keywords: biopsy; needle; prostate; transrectal ultrasound

Introduction

Transrectal ultrasound (TRUS)-guided biopsy, which was developed from a blind finger-guided intervention performed under general anaesthesia to a lesion directed and systematic TRUS-guided biopsy, has become the standard procedure for prostate cancer detection.[1] Various sampling devices and biopsy techniques were used to reach the optimum performance–hazard ratio. The dilemma between higher sensitivity versus higher morbidity (which, in this case, are represented by the amount of tissue to be examined together with a degree of homogeneous sampling of the prostate and complications, respectively) has been going on since the sextant biopsy scheme was first described by Hodge *et al*.[2] Although more biopsy cores assure higher sensitivity, higher complication rates and poorer patient comfort are well-known major drawbacks. The sextant technique has been thoroughly evaluated in years and was shown to miss a relatively higher number of cancers, causing a significant sampling error.[3] The sensitivity could be improved by increasing the amount of sampled tissue, which in turn could be done either by increasing the number of cores or the amount of tissue per core, and by improving the quality of the biopsy specimens.[4–10] For the last few years, although sextant biopsy scheme is still used by some centres, at least 10–12 core biopsies have been recommended and are being performed by most urologists.[11] Similarly, the quality of the samples could be improved by obtaining more tissue, which could simply be achieved by using needles with longer or larger biopsy cores.[10,12,13]

Both 16 gauge (16 g) and 18 gauge (18 g) needles work with side-notch technique. Although the core lengths of the two needles are the same (17 mm), owing to the difference in the diameters of the two needles, the core volume of an 18 g needle is 12.18 mm^3, whereas that of a 16 g needle is 20.25 mm^3, which means a 75% theoretical increase in core volume.

Eighteen gauge biopsy needles are used as the standard biopsy equipment in most centres. Although some studies are present about needles with different core lengths and sampling techniques such as end-cutting versus side-cutting needles, there are no studies in the literature comparing 18 g needles to needles with larger calibres regarding cancer detection rates together with specimen quality.[12–15] Using 16 g needles may help increase specimen quality by acquiring more undistorted prostatic tissue per core, which in turn may facilitate better pathological examination.

This study evaluates the general performance of 16 g biopsy needles and compares it to that of 18 g needles in 10-core prostate biopsy procedures in terms of certain pre-defined pathological criteria, prostate cancer detection rates and morbidity.

Correspondence: Dr VÇ Öztekin, Angora Caddesi, Özbeykent Bloklari 184/17, Beysukent Çayyolu, 06530 Ankara, Turkey.
E-mail: volkan.oztekin@gmail.com
Received 23 July 2007; revised 12 December 2007; accepted 10 May 2008; published online 3 June 2008

Methods

Between June 2004 and January 2005, 204 prostate biopsy candidates with elevated prostate-specific antigen (PSA) levels (2.6–20 ng ml^{-1}) were included in the study. All were first biopsies and no repeat biopsies were included. Patients were randomized into 16 g (group 1, $n=103$) and 18 g (group 2, $n=101$) groups. Antibiotic prophylaxis was applied with 500 mg ciprofloxacin twice daily, starting 1 day before and continuing for 3 days after the procedure.

Each patient filled the consent form related to the procedure. Transrectal ultrasound imaging was performed by using Hitachi EUB 420 ultrasound system with a 6.5 MHz biplanar probe (Hitachi, Tokyo, Japan). After the probe was inserted, the prostate was imaged on the transverse and sagittal planes, and prostate volume (Vp) was calculated by using the ellipsoid formula. Any pathological sonographic findings were noted. TRUS-guided systematic 10-core prostate biopsies (sextant +2 lateral apex +2 far lateral base cores) were obtained from each patient by the same urologist (GI).

Each core was placed in a different tube with a tag indicating the related localization of the prostate. Samples were analysed by the same pathologist regarding diagnosis and specimen quality blindly for needle calibres. Criteria for specimen quality were as follows: presence and number of fragmented cores, number of empty cores (zero biopsy), number of cores with non-prostatic tissue (no glandular or stromal prostatic tissue, but else) and with insufficient prostatic tissue sample for appropriate pathological evaluation, which was defined as core length <5 mm in a non-fragmented specimen (Small biopsy).[13,14]

Morbidity rates were surveyed 1 week after the procedure. Haematuria, rectal bleeding, pain, fever and analgesic requirements were evaluated. Haematuria and rectal bleeding lasting for more than 3 days were considered as persistent haematuria and persistent rectal bleeding.

To assess the differences between the groups, independent samples *t*-test, Mann–Whitney *U* and χ^2 tests were used. *P*-values <0.05 were considered as statistically significant.

Results

There were no statistically significant differences among mean patient ages, PSA values and Vp of group 1 and group 2 (Table 1).

Pathological data concerning the specimen quality were eligible for 143 patients ($n=72$ for group 1, $n=71$ for group 2), whereas histopathological diagnosis was reported for every patient.

There were significantly smaller number of small biopsy cores in group 1 when compared to group 2 ($P=0.000$), which was defined as a core length of <5 mm in a non-fragmented specimen. Sixteen gauge needles obtained adequate amount of prostatic tissue in all biopsy cores of 75% of patients, whereas in group 2 this ratio was 36.6%.

Sixteen gauge needles caused significantly less fragmentation of the biopsy cores when compared to 18 g needles ($P=0.000$). In group 1, 52 patients (73.7%) had three or less fragmented cores, whereas in group 2, this ratio was 28 (43.7%). Likewise, there were only two patients (2.8%) in group 1 with five or more fragmented cores, while there were 26 (36%) in group 2.

Table 1 Age, Vp and PSA levels of the two groups

	Group 1	*Group 2*	P[a]
Age (year)	65.03 ± 7.54	65.05 ± 8.69	0.986
Vp (ml)	53.95 ± 24.77	51.30 ± 19.64	0.484
PSA (ng ml^{-1})	8.88 ± 4.03	8.39 ± 3.85	0.459

Abbreviations: PSA, prostate-specific antigen; Vp, prostate volume.
[a]Independent samples *t*-test.

Table 2 Cancer detection rates of 16 and 18 g needles

	Benign (%)	*Cancer (%)*	*Total* (n)
16 g	78 (75.7)	25 (24.3)	103
18 g	85 (84.2)	16 (15.8)	101
Total	163 (79.9)	41 (20.1)	204

Abbreviations: 16 g, 16 gauge; 18 g, 18 gauge.
$P=0.133$, χ^2 test.

In group 2, there were significantly more zero biopsy cores than in group 1 ($P=0.036$). Only 5 patients (6.9%) in group 1 had one empty core each, whereas 10 patients (14.1%) had one and three patients (4.2%) had two empty cores in group 2.

There were no significant differences between the two groups regarding the per cent of the cores including non-prostatic tissue ($P=0.592$).

When patients in group 1 and group 2 were subgrouped with respect to Vp ($\leqslant 40$ ml and >40 ml) and their PSA values (2.6–4, 4.1–10 and 10.1–20 ng ml^{-1}), the patient distribution was similar ($P>0.05$ for all).

The overall cancer detection rate was 20.1%. Both needles caught similar number of cancers, which were 25 patients (24.3%) for group 1 and 16 patients (15.8%) for group 2 ($P=0.133$) (Table 2). This similarity among cancer detection rates continued when patients in each group were further evaluated with respect to Vp ($P=0.133$ and $P=0.595$ for Vp >40 ml and Vp $\leqslant 40$ ml, respectively) and PSA ranges ($P=0.129$, 0.213 and 0.679 for PSA: 2.6–4, 4.1–10 and 10.1–20 ng ml^{-1}, respectively).

Perceived pain levels were similar in both groups. In group 1, mean VAS pain score was 6.62 ± 1.56, whereas mean VAS score in group 2 was 5.95 ± 1.87 ($P=0.155$). Fever occurred in one patient in group 1. Persistent haematuria was observed in 19 patients in group 1 and in 13 patients in group 2 ($P=0.127$). Persistent rectal bleeding occurred in nine and seven patients in groups 1 and 2, respectively ($P=0.567$).

Discussion

Although several different imaging techniques were studied, TRUS has been the most widely used modality for imaging during prostate biopsies. Likewise, sextant prostate biopsy scheme under TRUS guidance has been used as the standard biopsy procedure at most centres after it was described by Hodge *et al.*,[2] until certain

sensitivity issues have been reported.[3–7,16–18] The debate has been going on since then, and various well designed studies have been constructed in an effort to increase the sensitivity of TRUS-guided biopsies without increasing the morbidity and patient discomfort.

At present, it is well known that standard six-core biopsy technique involving six para-sagittal mid-lobar biopsy cores is not sufficient in terms of sensitivity and specificity and that it misses up to 35% of the present cancers.[3,19] 'What is the optimal number of cores to be obtained?' remains the major question that is yet to be answered. It has clearly been shown that added number of cores over the sextant scheme significantly improves cancer detection and that studies with 8, 10, 12 and even 21 cores and with regional biopsy techniques have been published, all demonstrating superior cancer detection rates when compared to sextant biopsies.[4–6,19,20] As the spirit is to achieve the highest cancer detection with minimal possible number of cores, there should be a limit. Gore *et al*., in their well-designed study, compared classic sextant biopsies to 8-, 10- and 12-core biopsies with different location combinations of the added cores.[20] They demonstrated that two different strategies, both including 10 biopsy cores, caught 95.6 and 98.5% of cancers and are better than 6 or 8, but not worse than 12-core biopsies independent from Vp and PSA level, stating that 10-core biopsies strategy taken in either sets of locations are reasonable schemes with sufficient gland covering and cancer rates. On the basis of evident data and our own experiences, 10-core scheme has been the choice for prostate biopsies in our institution for over 5 years.

Our biopsy scheme does not specifically sample the transition zone, and hence a fair question of missed transition zone cancers could arise. All biopsies in our study were the first set of biopsies and studies showed that with adequate sampling of posterolateral peripheral zone of the prostate, missed transitional zone cancers account for 2% of the total number of cancers and are negligible,[21,22] concluding that transition zone sampling in the first set of biopsies is not necessary.

Effects of increased amount of sampled tissue and sampling homogeneity were evaluated by increasing the number of biopsy cores and sampling some specific localizations of the prostate such as anterolateral horns or visible lesions. It is obvious that one other way of increasing the amount of sampled tissue is to increase the tissue volume obtained per biopsy core, which can be achieved by increasing the length, the diameter or both. Sampling devices with different cutting techniques and core lengths have been studied.[12–15] Moreover, a preliminary *ex vivo* study evaluated the comparison of cancer detection rates of 16 and 18 g biopsy needles on radical prostatectomy specimens,[9] but as far as we know, there are no prospective randomized studies in the literature that evaluate the performance of biopsy needles with calibres larger than 18 g. It has been reported that long-core needles with end-cutting technique do not improve cancer detection,[12] and their effects on tissue quality are controversial. Ozen *et al*.[12] and Patel *et al*.[13] reported higher glandular coverage and better specimen quality with more abundant prostatic tissue obtained and less fragmentation, whereas Baltaci *et al*.[14] found higher small biopsy (<5 mm) and similar fragmentation rates when compared to standard 18 g needles. All three authors agreed on high failure (zero biopsy) rates as high as 27%, which were probably due to the 'end-cutting' technique, not the increased length of the biopsy cores.

In our study, we evaluated the effects of increasing the core volume by increasing the needle calibre on cancer detection rates and pre-defined specimen quality parameters. Sixteen gauge needles performed better than 18 g needles, especially in terms of specimen quality criteria, although cancer detection rate was not significantly improved. Sixteen gauge needles caused significantly lower small biopsy and zero biopsy rates and less fragmentation.

Sixteen gauge needles did not significantly increase the detection of high-grade prostatic intraepithelial neoplasia as well. Another entity, atypical small acinar proliferation was not statistically evaluated, as it was not routinely reported by our pathology department during the early phase of our study, so related data is insufficient. Patients with both high-grade prostatic intraepithelial neoplasia and atypical small acinar proliferation were excluded from the study as repeat biopsies were needed, which could be the subjects for other studies. All of our patients had histological benign prostatic hyperplasia (BPH), and at least one of the non-cancer cores of each patient included hyperplastic prostatic tissue.

It was previously shown by some studies that the amount of tissue in a biopsy core correlates with cancer rates. Iczkowzki *et al*.[8] showed that both the total length of the cores and the length of each biopsy core individually correlate with the detection of non-benign pathological conditions in sextant prostate biopsies. Moreover, Fink *et al*.[9] demonstrated that 16 g needles increase cancer detection rates both in sextant biopsies and in 10-core biopsies when four far lateral cores are added in an *ex vivo* model. Although 16 g needles were shown to increase cancer detection *ex vivo*, in our study cancer detection rate did not significantly improve with 16 g needles despite the higher amount and quality of the specimen acquired. This may be due to a statistically insignificant imbalance in patient distribution between the groups, even though the groups were not significantly different with respect to age, Vp and PSA. However, increasing the number of patients may help to expose this expected difference.

Although higher morbidity rates and VAS pain scores would be expected with 16 g needles because of the increased needle calibre, rates of fever, haematuria and rectal bleeding as well as VAS pain scores were similar in both groups.

When their major advantage over 18 g needles of obtaining higher quality specimens without increasing the morbidity and pain during the biopsies is considered, the usage of 16 g needles in TRUS-guided prostate biopsies may be safely recommended.

Conclusion

Although the use of 16 gauge needles does not increase cancer detection, it significantly improves specimen quality without increasing morbidity and patient discomfort when compared to 18 g needles in TRUS-guided 10-core prostate biopsies.

References

1 Paul R, Korzinek C, Necknig U, Niesel T, Alschibaja M, Leyh H *et al*. Influence of transrectal ultrasound probe on prostate cancer detection in transrectal ultrasound-guided sextant biopsy of prostate. *Urology* 2004; **64**: 532–536.
2 Vanderkerken J, de la Rosette J, Laguna P, Debruyne F. How and when to take prostate biopsies. *Eur Urol* 2002; (Suppl 1): 15–20.
3 Norberg M, Egevad L, Holmberg L, Sparen P, Norten BJ, Busch C. The sextant protocol for ultrasound-guided core biopsies of the prostate underestimates the presence of cancer. *Urology* 1997; **50**: 562–566.
4 Naughton CK, Miller DC, Mager DE, Ornstein DK, Catalona WJ. A prospective randomized trial comparing 6 versus 12 prostate biopsy cores: impact on cancer detection. *J Urol* 2000; **164**: 388–392.
5 Pepe P, Aragona F. Prostate needle biopsy: 12 vs 18 cores—is it necessary? *Urol Int* 2005; **74**: 19–22.
6 de la Taille A, Antiphon P, Salomon L, Cherfan M, Porcher R, Hozneck A *et al*. Prospective evaluation of a 21-sample needle biopsy procedure designed to improve the prostate cancer detection rate. *Urology* 2003; **61**: 1181–1186.
7 Taylor JA, Gangarczyk KJ, Fant GV, Mcleod DG. Increasing number of core samples taken at prostate needle biopsy enhances the detection of clinically significant prostate cancer. *Urology* 2002; **60**: 841–845.
8 Iczkowski KA, Casella G, Seppala RJ, Jones GL, Mishler BA, Qian J *et al*. Needle core length in sextant biopsy influences prostate cancer detection rate. *Urology* 2002; **59**: 698–703.
9 Fink K, Hutarew G, Szlauer R, Goetschl R, Schmeller NT. Evaluation of 16-gauge needles for prostate biopsy. *Eur Urol Suppl* 2006; **5**: 312.
10 Ficarra V, Martignoni G, Novella G, Cerruto MA, Galfano A, Novara G *et al*. Needle core length is a quality indicator of systematic transperineal prostate biopsy. *Eur Urol* 2006; **50**: 266–271.
11 Scattoni V, Zlotta AR, Nava L, Roscigno M, Montorsi F, Rigatti P. Prostatic transrectal ultrasound (TRUS) guided biopsy schemes and TRUS prostatic lesion-guided biopsies. *Eur Urol* 2002; (Suppl 1): 28–34.
12 Dogan HS, Eskicorapci SY, Ertoy-Baydar D, Akdogan B, Gunay LM, Ozen H. Can we obtain better specimens with an end-cutting prostatic biopsy device? *Eur Urol* 2005; **47**: 297–301.
13 Ubhayakar GN, Li WY, Corbishley CM, Patel U. Improving glandular coverage during prostate biopsy using a long-core needle: technical performance of an end-cutting needle. *BJU Int* 2002; **89**: 40–43.
14 Özden E, Göğüş Ç, Tulunay Ö, Baltaci S. The long core needle with end-cut technique for prostate biopsy: Does it really have advantages when compared with standard needles? *Eur Urol* 2004; **45**: 287–291.
15 Haggarth L, Ekman P, Egevad L. A new core-biopsy instrument with an end-cut technique provides prostate biopsies with increased tissue yield. *BJU Int* 2002; **90**: 51–55.
16 Levine MA, Ittman M, Melamed J, Lepor H. Two consecutive sets of transrectal ultrasound guided sextant biopsies of the prostate for detection of prostate cancer. *J Urol* 1998; **159**: 471–475.
17 Karakiewicz PL, Bazinet M, Aprikian AG, Trudel C, Aronson S, Nachabe M *et al*. Outcome of sextant biopsy according to gland volume. *Urology* 1997; **49**: 55–59.
18 Guichard G, Larré S, Gallina A, Lazar A, Faucon H, Chemama S *et al*. Extended 21-sample needle biopsy protocol for diagnosis of prostate cancer in 1000 consecutive patients. *Eur Urol* 2007; **52**: 430–435.
19 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.
20 Gore JL, Shariat SF, Miles BJ, Kadmon D, Jiang N, Wheeler TM *et al*. Optimal combinations of systematic sextant and laterally directed biopsies for the detection of prostate cancer. *J Urol* 2001; **165**: 1554–1559.
21 Morote J, Lopez M, Encabo G, de Torres I. Value of routine transition zone biopsies in patients undergoing ultrasound-guided sextant biopsies for the first time. *Eur Urol* 1999; **35**: 294–297.
22 Terris MK, Pham TQ, Issa MM, Kabalin JN. Routine transition zone and seminal vesicle biopsies in all patients undergoing transrectal ultrasound guided prostate biopsies are not indicated. *J Urol* 1997; **157**: 204–206.