

Fine Needle Aspiration Biopsy vs. Ultrasound-Guided Transrectal Random Core Biopsy of the Prostate

Comparative Investigations in 246 Cases

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OBJECTIVE: To compare fine needle aspiration biopsy (FNAB) and ultrasound-guided transrectal core biopsy of the prostate.

STUDY DESIGN: FNAB and the random core biopsy were performed simultaneously on 246 patients who either had striking palpable signs or increased levels of prostate-specific antigen, at least 5 µg/mL, on two separate examinations over a six-week period.

RESULTS: The histologic and cytologic evaluations showed very close conformity between the two methods. Fifty-eight percent of the patients had benign prostate hyperplasia. Of the total number of patients, 103 (42%) had prostate carcinoma. This figure was confirmed in 101 (98%) of cases using FNAB. In two cases (0.8%) atypical prostate hyperplasia was diagnosed. In five cases the examination had to be repeated since insufficient prostate cell material was collected. Ultrasound-guided random core biopsy showed the presence of carcinoma in 96 of 103 patients (93%). It was

necessary to repeat the examination in one patient due to a lack of adequate cell material.

By means of fine needle aspiration a sufficient amount of cell material for primary diagnosis and follow-up of prostate cancer is achievable with less effort, with a lower rate of complications and lower cost.

CONCLUSION: In our hands, FNAB method has a sensitivity of 98%, whereas core biopsy attained 91%. Both methods showed 100% concurrence in specificity. (Acta Cytol 1997;41: 981-986)

Keywords: prostatic neoplasms, aspiration biopsy, ultrasound random core biopsy.

Diagnostic needle biopsy of the prostate has been performed since the turn of this century. Several techniques have been developed to remove an adequate amount of tissue for histologic or cytologic examination. For years digitally guided biopsy of the prostate using the Vim-Silverman or TrueCut needle has been the method of choice. Studies have shown that in the hands of experienced cytopathologists, fine needle aspiration biopsy (FNAB) may be

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Dedicated to my esteemed teacher, Prof. Dr. med Hans Achim Müller.

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as helpful as core biopsy.^{1,2,4,12-18} The complication rate is lower than with large-bore core biopsies, and the patient experiences less discomfort. Cytologic grading may contain the same amount of information with regard to biologic behavior and prognosis

***In the hands of experienced
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of prostate cancer as does an 18-gauge core biopsy specimen.^{1,4,14,17}

Transrectal prostatic ultrasound was developed in Japan and reported first by Watanabe and associates. A method of ultrasonically guided prostatic needle biopsy with a transrectal probe that scanned radially was described first by Holm and Gammelgaard.¹¹

With the introduction of high-frequency biplane or multiplane transrectal transducers in recent years, transrectal sonographic scanning of the prostate has become a popular method of studying the outline and parenchymal pattern of the gland. It can be taken for granted today that the standard sonographic picture of prostatic carcinoma is a hypoechoic or mixed echogenic pattern.^{20,21} However, only about half the hypoechoic areas seen on ultrasound are cancerous, as confirmed by biopsy or histology of the surgical specimen.^{10,23-27}

The aim of the current study was to compare the accuracy of the two methods and to elaborate on the advantages and disadvantages of each.

Materials and Methods

From February 1985 to September 1994, simultaneous examinations using both methods were carried out on 246 patients with striking findings on palpation or when increased prostate-specific antigen (at least 5 ng/mL) was found twice in one month.

Transrectal Ultrasound-Guided Random Core Biopsy

For transrectal sonography examinations we used a Brüel and Kjær (Nærum, Denmark) 90° sound wave probe operating at 7.5 MHz. Using the coordinate displayed on the ultrasound scanner, it is possible to determine and follow the puncture direction while closely observing the course of the

biopsy. A semiautomatic, spring-loaded biopsy system with a 1.4-mm diameter needle was utilized. The patients were placed in the lithotomy position and given either intravenous diazepam sedation or general anesthesia. The biopsy process was carried out transrectally. As a rule, six biopsies (three from the low-echo, suspect area and three at random from the contralateral prostate lobe) were taken (Figure 1).

Transrectal FNAB

The FNAB method, first described by Franzén in 1960,⁸ has remained unchanged to date. With the aid of a guide rail attached to the index finger, it is possible to puncture the prostate with a thin scraper needle (diameter, 0.6 mm). The needle tip is moved rapidly back and forth (10–15×) within the suspect area in order to procure cellular material. The material collected is smeared thinly onto a glass slide, fixed with spray fixative and stained according to an own modification of the Papanicolaou staining procedure. Thanks mainly to the extremely fine needle used and the transrectal access procedure, the examination is practically painless and can be carried out without the need of analgesia (Figures 2 and 3).

Both operations are carried out with the aid of antibiotics (gentamicin, 120 mg intramuscularly, or Ciprofloxacin, 500 mg taken orally twice on the day of the operation and additionally for three days afterwards).

Definition of Test Values

The data were analyzed according to the method of

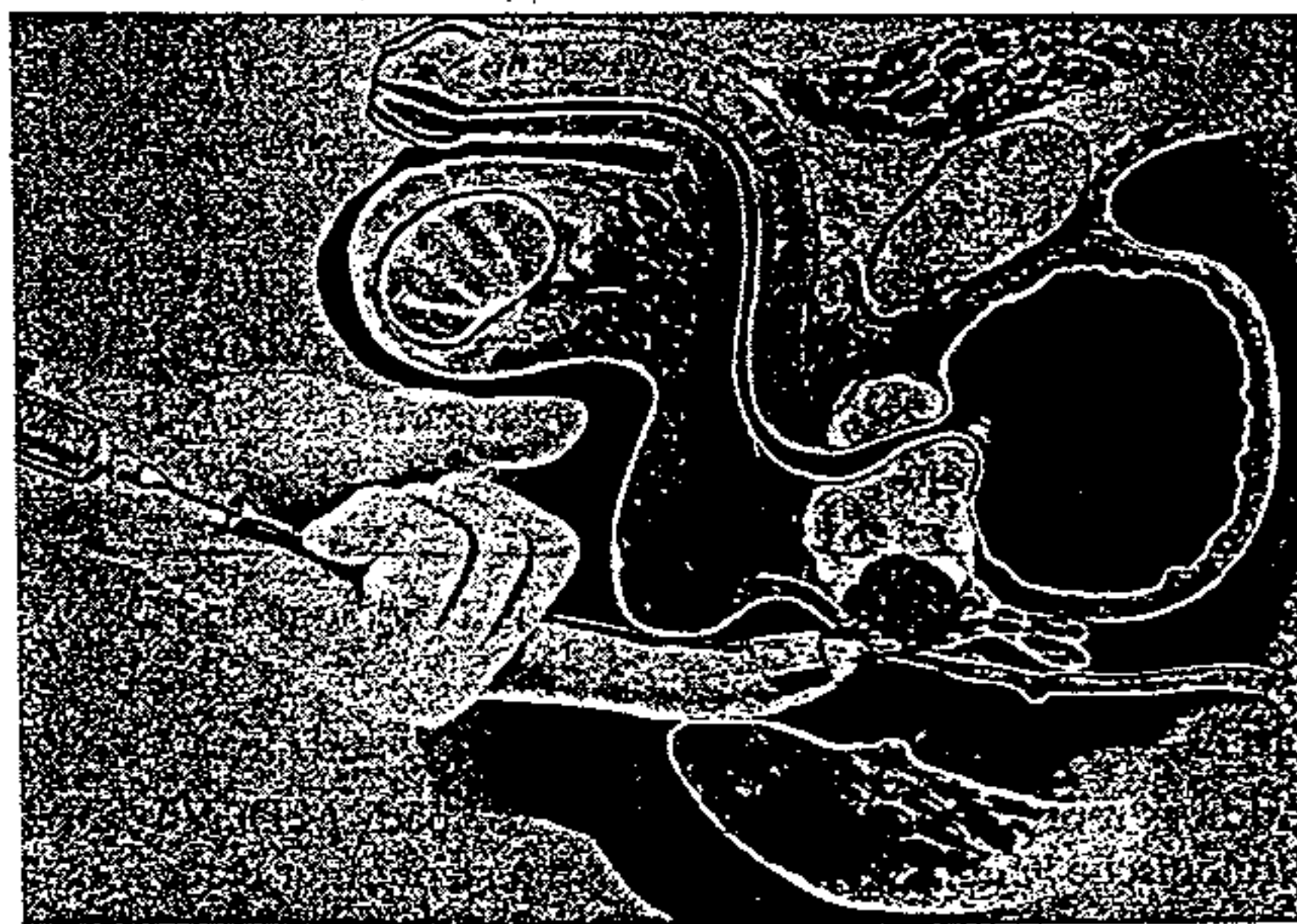


Figure 1 Principles of aspiration biopsy of the prostate according to Franzén.

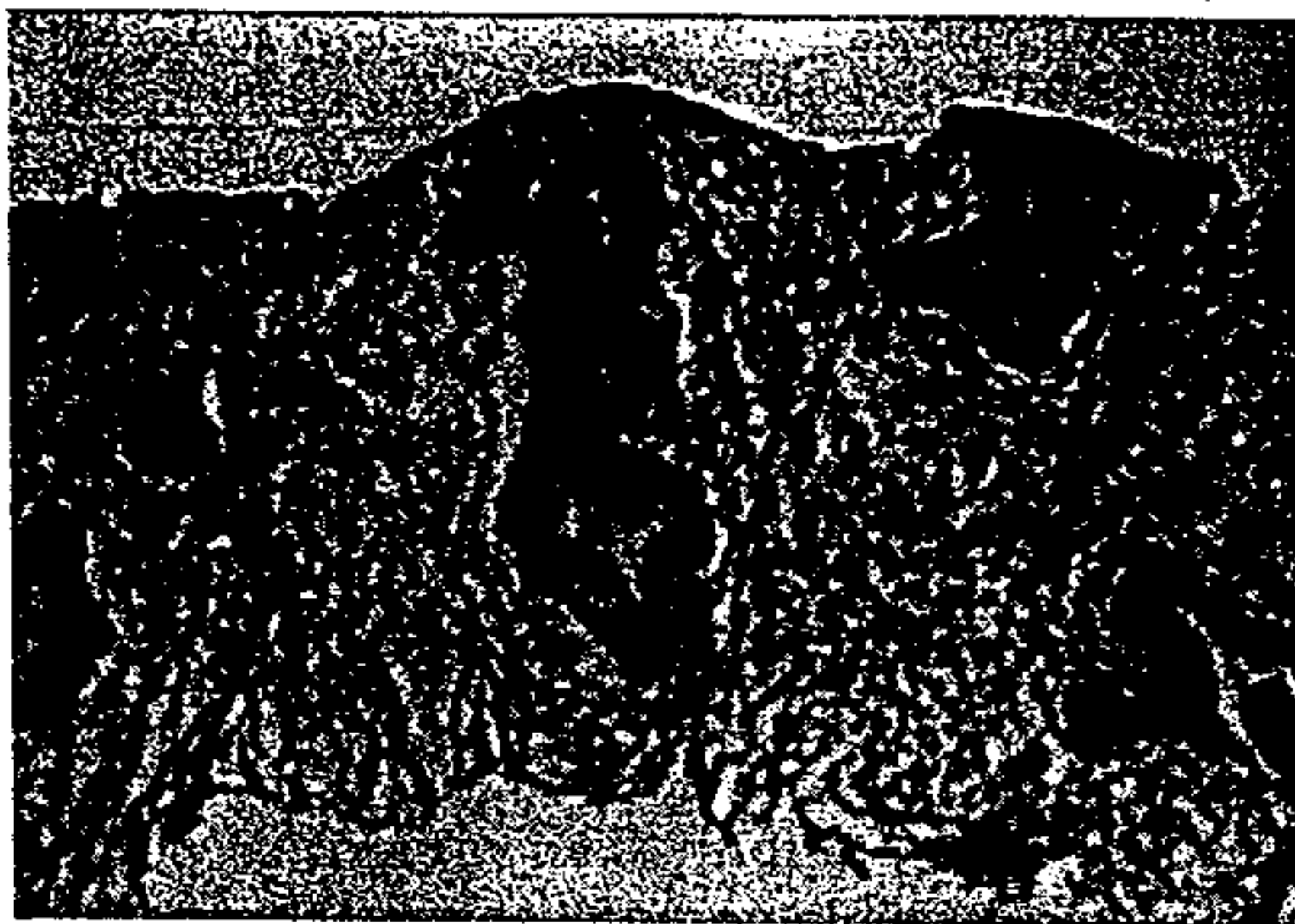


Figure 2 Core biopsies showing small amounts of prostate gland tissue.

Galen and Gambino.^{9,11} Absolute sensitivity was the positivity of fine needle aspiration when malignancy was present—that is, the fraction of patients with histologically documented malignant neoplasms for whom the test was unequivocally positive:

$$\text{Absolute sensitivity} = \frac{\text{true positive}}{\text{true positive} + \text{false negative}}$$

Complete sensitivity was the fraction of patients in whom histologically malignant neoplasms were detected by fine needle aspiration either as unequivocally positive or suspicious:

$$\text{Complete sensitivity} = \frac{\text{true positive}}{\text{true positive} + \text{true suspicious} + \text{false negative}}$$



Figure 3 FNAB showing a substantial amount of prostate gland epithelium.

The false negative rate, or the fraction of patients with histologically malignant disease in whom fine

Why are transrectal and transperineal core biopsies still widely used despite a higher complication rate and more discomfort for the patient as compared to FNAB?

needle aspiration failed to detect any abnormality, was 100% minus complete sensitivity. Specificity, which measured the ability of the test to have unequivocally benign results when malignancy was absent, was the fraction of patients with benign histologic diagnoses who had unequivocally benign cytologic diagnoses:

$$\text{Specificity} = \frac{\text{true negative}}{\text{true negative} + \text{false positive}}$$

Results

The histologic and cytologic evaluations showed very close conformity. In 58% of the patients benign prostate hyperplasia was found. One hundred three patients (42%) had prostate carcinoma, which was confirmed in 101 patients (41%) using FNAB. In two cases (0.2%) (Table I) the FNAB diagnosis showed atypical prostate hyperplasia. The puncture had to be repeated on five occasions since inadequate cell material was collected originally. Minor complications were noted in 0.4%; these were mainly small temperature changes along with brief hematuria or hemospermia.

Sonographically guided random core biopsy diagnosed the presence of a carcinoma in 96 cases

Table I Correlation of FNAB and Core Biopsy Diagnosis in 246 Patients with a Clinical Suspicion of Prostate Cancer Diagnosis

Diagnosis	FNAB		Core biopsy	
	n	%	n	%
Benign	142	57.7	150	61.0
Carcinoma	101	41.0	96	39.0
Atypical hyperplasia	3	1.2	—	—
Complications		0.4		13.0
Repetition	5	2.0	1	0.4

Table II Comparison of FNAB and Core Biopsy in Clinically Proven Prostate Cancer

Result	FNAB		Core biopsy	
	n	%	n	%
Carcinoma	101	98	96	93
False negative	2*	2	7*	7
False positive	0		0	

N = 103.

*In these nine patients we could confirm the suspicion of carcinoma afterwards because of an operation, elevated prostate-specific antigen score, another biopsy and a positive bone scan.

(39.2%). In one case the examination had to be repeated due to a lack of adequate prostate cell material. Complications arose in 13% of the patients, consisting of 12 cases of urethral bleedings, 6 cases of rectal mucosa bleeding, hemospermia, 14 cases of epididymitis and prostatitis (Table I).

In the comparison between cytologic and histologic results of clinically confirmed prostate carcinomas, the FNAB method yielded an accurate diagnosis in 98% of the 101 patients. Two cases (1.9%) showed a false negative result. Sonographically guided core biopsy showed a correct carcinoma diagnosis in 96 cases (93%). In 7 patients (6.9%) a false negative diagnosis was found with transrectal ultrasound-guided core biopsy. The false negative diagnosis in these nine patients was confirmed later by radical prostatectomy, transurethral resection of the prostate (TURP) or another core biopsy and positive bone scan (Table II).

From these results it is possible to calculate FNAB shows an absolute and complete sensitivity of 98.2% vs 91% for core biopsy. Both methods showed a 100% congruence in specificity (Table III).

The cellular material obtained by FNAB in our study was of high quantity and excellent quality and was suitable not only for routine diagnosis of prostatic carcinoma but also for experimental research (DNA cytometry, immunocytochemistry

Table III Sensitivity and Specificity of FNAB in Correlation with Core Biopsy in 246 patients

Procedure	Absolute sensitivity (%)	Complete sensitivity (%)	Specificity (%)
FNAB	98	98	100
Core biopsy	91	91	100

Table IV Advantages (+) and Disadvantages (-) of FNAB and TRUS-Guided Random Core Biopsy

Advantage/disadvantage	FNAB	Core biopsy
Detection rate for small suspicious areas	+	-
Fan-shaped biopsy	+	-
Complications	Low	High
Grading	+	+
DNA analysis	+	(-)
Cost-effectiveness	Low	High

(-) = impossible.

and molecular biologic investigations) (Figure 2).

The advantages and disadvantages of each method are illustrated in Table IV.

Discussion

Prostatic carcinomas are usually visualized on ultrasound as hypoechoic areas or foci of mixed echogenicity (Table V). Approximately 60% of tumors thus appear suspicious on ultrasound alone. Shinohara et al were able to detect 36% of stage A tumors by ultrasound.²³ The tumors were generally underestimated in size. Thus, 89% of the small, incidental foci of cancer present in the postoperative whole mount sections aside from the primary tumor could not be visualized sonographically.¹⁰ Lee et al examined 784 self-referred men over age 60 years to compare the clinical usefulness of transurethral ultrasound (TRUS) and digital rectal examination. TRUS was twice as sensitive as digital rectal examination in detecting prostate cancer (2.6% vs. 1.3%).¹⁴ The predictive value of a sonographic scan positive for malignancy was 37% in 118 patients examined by Andriole et al.³ Areas of mixed echogenicity and hypoechoic areas are pathognomonic of a prostatic malignancy, but only

Table V Sensitivity of FNAB and Core Biopsy: Review of Literature

Author	FNAB (%)	Core biopsy (%)
Esposti (1966) ⁷	96	—
Carter et al (1986) ⁵	97	94
Chodak et al (1986) ⁶	98	81
Ljung et al (1986) ¹⁷	94	76
Bruins et al (1989) ⁴	96	94 (US)
Al-Abadi et al (1993) ²	96	83 (US)
Present study	98	87 (US)

US = ultrasound.
— = not cited.

0-52% of biopsies obtained from hypoechoic areas contain malignant tissue.^{22,24} Screening 10,000 consecutive men, Watanabe detected only 8 patients with incidental, nonpalpable cancer of the prostate.²⁵ Rosenberg et al detected only one patient with pathologically confirmed stage A cancer of the prostate in 2,214 men.²²

In order to confirm whether FNAB is a reliable method of detecting stage A prostate carcinoma preoperatively, Agatstein et al¹ carried out transrectal FNA biopsy on 120 patients with prostate hyperplasia before undertaking a transurethral resection to confirm their findings. In 19 patients (18.6%) a histologically confirmed stage A prostate carcinoma was found. In 15 patients a stage A2 carcinoma and in 4 patients a stage A1 prostate carcinoma was identified. In 96% of patients it was possible to obtain adequate aspirate to carry out a cytologic diagnosis.¹

Layfield¹³ carried out a correlation of cytologic gradings obtained with FNAB biopsy and histologic grading in 30 patients who later underwent a prostatectomy. The cytological polymorphy grade was obtained using methods agreed upon by three qualified technicians. These results showed that in 80% of all cases a direct correlation was found with the Gleason grade.^{12,14}

In our study FNAB had a sensitivity of 98%, far exceeding that of core needle biopsy (91%). Numerous studies over the last 15 years have shown that in the hands of experienced cytopathologists, FNAB may be as helpful as core biopsy.

Narayan et al¹⁹ concluded from a study on 121 patients that FNAB and core biopsy performed on the same patient yields a higher percentage of positive diagnoses than does either method of biopsy performed alone.^{15,16,18}

In a study of 400 patients at the University of California at Los Angeles undergoing transrectal FNAB, a complication rate of <1% was encountered.

Why are transrectal and transperineal core biopsies still widely used despite a higher complication rate and more discomfort for the patient as compared to FNAB? FNAB requires a skilled cytopathologist, a physician proficient in the biopsy technique and a technician preparing good-quality smears. These conditions may not always be available.

Conclusion

In contrast to the 91% sensitivity of ultrasound-

controlled punch biopsies, the 98% sensitivity of FNAB in our patients can be explained by the fan-like aspiration, which is more representative of the whole of the prostate. If performed by a skilled physician, both methods are suitable for the diagnosis of primary cancer of the prostate. However, by means of fine needle aspiration a sufficient amount of cell material for primary diagnosis and follow-up of prostate cancer is achievable with less effort, with a lower rate of complications and lower cost.

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