

## **TRANSRECTAL ULTRASOUND GUIDED PROSTATE BIOPSY UCSF Urology**

If there is a suspicion of prostate cancer risk, your urologist will typically schedule a test using Ultrasound Guided Biopsy. This is typically done on an out patient basis.

### **Indications for the initial biopsy**

TRUS alone should not be used as a first-line screening study as it lacks acceptable specificity, is relatively expensive when compared with digital rectal examination (DRE) and prostate specific antigen (PSA) testing and adds little information to that already gained by the use of serum PSA and digital rectal examination. The most important role for TRUS is to provide visual guidance for biopsy.

In general, most agree that TRUS guided prostate needle biopsy should be performed in men with an abnormal DRE, an elevated PSA, or rapidly rising PSA. Also, men who were diagnosed with atypia on a previous prostate needle biopsy should undergo a repeat biopsy 3 to 12 months later. Less commonly agreed upon recommendations for TRUS guided prostate needle biopsy include, age-specific PSA elevation, low percentage free PSA (< 22% to 25%), and prostate specific antigen density (PSAD) > 0.15, which is a measure of the amount of PSA relative to the overall prostatic volume ( $PSA \div \text{Prostate Volume in cubic centimeters}$ ).

In patients previously treated with curative intent for prostate cancer (i.e. radical prostatectomy, radiation therapy, and cryotherapy) relative indications for TRUS guided prostate needle biopsy includes a palpable abnormality on digital rectal examination or a rising PSA suggestive of local, rather than distant, recurrence.

### **Technique**

#### **Patient preparation**

At our institution, we routinely use a three-day course of antibiotics starting before the biopsy is performed. We instruct the patient to give a self-administered cleansing enema (sodium phosphate and dibasic sodium phosphate) prior to the biopsy to eliminate gas and remove feces. We also recommend that aspirin and non-steroidal anti-inflammatory (NSAIDs) be discontinued for seven and three days respectively prior to the scheduled prostate needle biopsy. Patients on anticoagulation therapy are not biopsied until the anticoagulant dosage is adjusted or held to allow the coagulation status to normalize.

#### **Transrectal ultrasound procedure**

The patient is positioned in either the right or left lateral decubitus position (lying on left side). This allows for easier insertion of the rectal probe. A topical anesthetic ointment is applied to the index finger prior to performing the DRE. A 5.0 to 7.5MHz transducer is used for transrectal imaging of the prostate. The probe is gently advanced into the rectum, to the base of the bladder until the seminal vesicles are visualized. Transverse images are then obtained as the

probe is moved back from the prostate base to the prostate apex. Hard copy images are made at the level of the seminal vesicles, base, mid-prostate and apex. With the transducer at the largest cross-sectional image in the transverse plane and in the mid-sagittal plane, prostate volume can be calculated. A simple prorated ellipsoid formula is commonly used to calculate prostate volume: (anterior-posterior diameter) x (transverse diameter) x (superior-inferior diameter) x  $\pi/6$  (approximately 0.52) is accurate and reproducible.

### Transrectal ultrasound findings

The most common appearance for cancer is a hypoechoic lesion (dark compared to normal tissue) in the peripheral zone. With PSA based screening and earlier cancer detection, fewer overt abnormal sonographic findings are being detected at the time of transrectal ultrasound guided biopsy. The sonographic finding of the classic hypoechoic peripheral zone lesion has a sensitivity of cancer detection of 85.5%, specificity of 28.4%, positive predictive value of 29%, negative predictive value of 85.2% and overall accuracy of 43%. The prevalence of isoechoic or nearly invisible prostate cancers on TRUS ranges from 25 to 42%. To date, no biologic differences have been noted between isoechoic and hypoechoic prostate cancers.

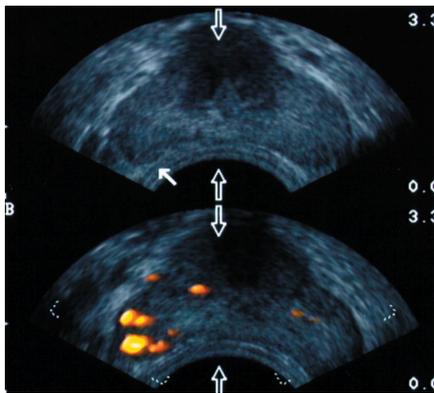


Figure 1

Transrectal ultrasonography.

Top image, solid white arrow depicts hypoechoic lesion within the peripheral zone concerning for prostate cancer. Lower image depicts hypervascular area seen with color Doppler imaging, yellow and red area corresponds to the hypoechoic area seen on the grayscale ultrasonography above.

### Prostate biopsy technique

An 18-gauge biopsy needle loaded in a spring-action automatic biopsy device is commonly used to procure multiple 1.5cm prostate biopsy specimens (Figures 2,3). When a biopsy is directed at a suspicious lesion, it is important for the needle tip to be placed precisely at the boundary of the lesion before activating the biopsy gun. This technical point can improve sampling accuracy. If the

prostate capsule is “tented up” by the needle tip, tissue may be taken too deep inside the gland and a tumor located in the peripheral zone may be missed. The excursion of the needle tip during a biopsy is approximately 2.5cm and the biopsy notch, which procures the tissue, is approximately 1.5cm. These parameters should be taken into account when performing a prostate needle biopsy.



Figure 2

18-gauge prostate  
needle biopsy core  
specimen.

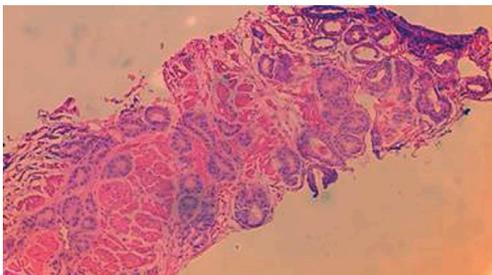


Figure 3

Histology.  
Prostate cancer  
in the core needle  
biopsy stained with  
Hematoxylin and Eosin (low power).

#### Local anesthesia and prostate needle biopsy

Systematic sextant TRUS-guided prostate biopsies have traditionally been done with no form of anesthesia and have been relatively well tolerated. Recent studies have reported that 65% to 95% of men report some level of discomfort during transrectal ultrasound guided prostate needle biopsy. Specifically 10% to 25% of patients undergoing sextant biopsy experience moderate to severe pain. Pain during a transrectal ultrasound guided prostate biopsy predominantly occurs when the needle penetrates the prostatic capsule and stroma, which has a rich supply of autonomic nerve fibers.

However, men who receive a local injection of 1% lidocaine (5ml) have significantly less pain. At our institution, we apply a topical anesthetic Hurracaine® gel as lubricant at the time of the digital rectal examination. After the prostate gland has been completely imaged (transaxial and sagittal planes) and the prostate volume has been calculated, 10ml of 1% lidocaine is injected

into the prostate gland at the lateral edge of the gland on each side from the base to the apex.

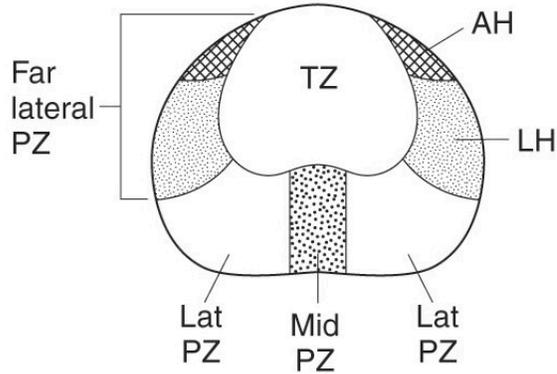
### **Complications**

Modern TRUS guided prostate needle biopsy is associated with frequent minor (range 60% to 79%) and rare major (range 0.4% to 4.3%) complications and the need for hospitalization ranges from 0.4% to 3.4%. Persistent blood in the urine (hematuria) is the most common complication. Immediate complications of TRUS guided prostate needle biopsy included a vasovagal episodes (feeling faint) (5.3%), rectal bleeding (8.3%) and hematuria (70.8%). Delayed complications of TRUS guided prostate needle biopsy at 3 to 7 days post biopsy included dysuria (pain with urination) (9.1%), vague pelvic discomfort (13.2%), persistent hematuria (47.1%), hematochezia (rectal bleeding) (9.1%) and hematospermia (blood in the semen) (9.1%).

### **Strategies to optimize prostate biopsy templates**

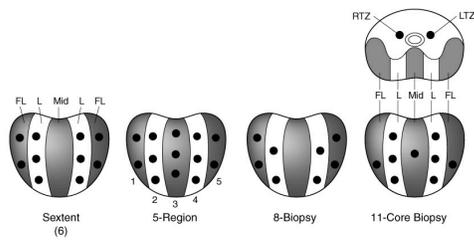
Clinically, the sampling error of the sextant biopsy template has been evident by the 20% to 30% cancer detection rate in men undergoing a repeat transrectal ultrasound guided biopsy. This has lead investigators to question the sampling adequacy of the standard sextant (6 – core) prostate biopsy template and to propose alternate “extended pattern” biopsy schemes to improve prostate cancer detection. The alternate prostate biopsy templates aim to improve sampling of the prostate by either increasing the number of core biopsies taken and/or by directing the biopsies more laterally to better sample the anterior horn (the far lateral regions of the peripheral zone).

Some of the pitfalls in terms of cancer detection by biopsy site can be explained by the prostatic zonal anatomy. For example, at the prostate base lateral biopsies will sample the peripheral zone, while medially directed biopsies are more likely to sample the central zone, a zone that rarely develops prostate cancer. In the mid gland, especially in patients with significant benign prostatic hypertrophy, a medially directed biopsy in this area can traverse the peripheral zone and predominantly sample the transition zone. If biopsies in this area are directed laterally, the so called anterior horns of the peripheral zone are more likely to be sampled as they wrap around the transition zone in this area. Biopsies directed at the prostatic apex have a higher detection rate for prostate cancer as this area is comprised entirely of peripheral zone. Carefully, directed apical biopsies can also sample the distal aspect of the transition zone. Three popularized methods for optimizing the number and location prostate needle biopsies are the five-region, eight systematic core template and the 11-multisite biopsy



**Figure 4**

**Cross-sectional view of commonly biopsied zones.**  
**TZ-transition zone, Mid PZ-mid peripheral zone, Lat PZ-lateral peripheral zone, AH-anterior horn, LH-lateral horn.**



**Figure 5**  
**Popular biopsy strategies to optimize prostate cancer detection.**  
**Contemporary sextant biopsy template, five-region biopsy template, eight-biopsy systematic template, and the eleven-core biopsy multi-site directed template.**  
**FL-far lateral peripheral zone, L-lateral peripheral zone, Mid-peripheral zone, RTZ-right transition zone, LTZleft transition zone**

### Indications for a second biopsy

It is important for physicians and patients to understand that a prostate biopsy is not a perfect technique and it may miss prostate cancer that exists. Usually, these are limited, organ – contained cancers. However, on occasion, due to sampling error, larger cancers can be missed. The overall cancer detection rates for patients undergoing repeat prostate needle biopsy with various biopsy templates ranges from 10% - 38%.

Although the majority of prostate cancer arises in the peripheral zone, approximately 24 percent of prostate carcinomas originate in the transition zone (TZ). The overall increase in cancer detection using TZ biopsies ranges from 0.9 to 4.3%. Therefore, there is little data supporting the routine use of TZ biopsies in the initial prostate biopsy template. The highest yield in prostate cancer detection was in men with persistently elevated PSA undergoing repeat prostate needle biopsy. Thus, TZ biopsies may be beneficial in this subgroup of patients.

Indications for a repeat prostate biopsy include the following:

- 1) A highly suspicious DRE (digital rectal examination)
- 2) A persistently rising serum PSA (> 0.4 – 0.75 ng/ml/yr.)
- 3) A low free PSA (certainly < 10%, maybe < 22% - 25%)
- 4) Presence of atypia on prior biopsy