STEREOTACTIC TRANSPERINEAL PROSTATE BIOPSY

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Abstract

This study investigates the detection rate of non-palpable, isoechoic occult prostate malignancy using a stereotactic transperineal prostate biopsy (STPB) technique in patients with previously negative transrectal ultrasound-guided prostate biopsy.

INTRODUCTION:

Occasionally, patients present with persistently rising PSA despite having had prior negative transrectal extended systematic prostate biopsies. Not only is this scenario worrisome for the physician, but it can create significant anxiety for the patient. Numerous investigators have reported results using a perineal approach to obtain biopsy specimens from the prostate gland[1-7]. Using transrectal ultrasound guidance and a perineal prostate brachytherapy template, comprehensive tissue sampling is feasible. Furthermore, the biopsy cores can be identified as to the area of the prostate from which they were obtained.

MATERIALS AND METHODS:

Stereotactic transperineal prostate biopsy (STPB) is accomplished using an identical clinical setup as that for prostate brachytherapy, including bowel preparation instructions and pre-operative medication. General anesthesia is administered via a laryngeal mask airway. With the patient in dorsal lithotomy position, the perineum is gently washed using a betadine scrub solution, and the scrotum is secured anteriorly. Using a biplanar transrectal ultrasound probe, Stepper Stabilizer device and a perineal brachytherapy template, the prostate is positioned on the implant grid. While viewing the sagittal image, adjust the pitch of the TRUS probe to align the posterior aspect of the prostate such that it is parallel to the anterior rectal wall (Figure 1A). This will avoid unnecessary puncture or laceration of the anterior rectal wall during the biopsy procedure. The axial image is positioned with row one 2-3 mm inside the posterior capsule (Figure 1B). The prostate is then equally divided into 1 of 8 anatomic regions which we have

conceptually termed octants. The midplanes of axial and sagittal prostate gland images for each patient determine the x, y, z coordinates that will occupy each octant. Octants are assigned accordingly: (I) right anterior base, (II) left anterior base, (III) right posterior base, (IV) left posterior base, (V) right anterior apex, (VI) left anterior apex, (VII) right posterior apex and (VIII) left posterior apex (Figure 2A,B).

Using a biopsy gun, comprehensive tissue cores of 2 cm length are obtained initially from the apical octants using 5-10 mm spacing on the template grid, followed by identical x and y coordinates of the basilar octants (Figure 2C). The number of biopsy cores per patient approximates the prostate gland volume; the larger the volume of the gland, the more specimens are obtained. Prostates in which the anterior apical specimen adequately samples the tissue do not require a basilar specimen of the identical x and y coordinates. Therefore, these specimens should be assigned to the respective apical octant. Upon retrieval, all specimens, regardless of how many obtained, are deposited into 1 of 8 total formalin-filled specimen jars corresponding to the 8 octants. Pathologic review is reported according to the octant from which it was obtained.

This procedure begins with needle placement on the x and y axis on the mid-gland axial image. Switching to the sagittal image reveals the z-axis depth of the biopsy needle and is required to ensure the biopsy needle is properly positioned before sampling the desired apical and basilar core. A note of caution is that small glands (less than 25 cm^3) require more reliance upon both axial and sagittal ultrasound images prior to obtaining the biopsy core. Regarding larger prostate volumes, one does not absolutely need to verify x and y coordinates on every biopsy core provided they have confidence they are obtaining the core from the assigned octant using the z axis sagittal image only. Biopsies are obtained in a clockwise fashion from the left side of the template to the right side. As none of the patients undergoing STPB had palpable

abnormality, every effort was made to avoid placement of the biopsy needle outside of the gland to minimize neurovascular trauma. As a rule, we identify the biopsy coordinates at the beginning of the procedure. The peripheral coordinates should all be a minimum of 2-3 mm within the prostate gland on a mid-gland axial printed paper image. The biopsy cores are marked on this to identify coordinates where specimens have been obtained.

RESULTS:

747 previously untreated consecutive patients with continued rising total PSA underwent STPB at our institution between 04/2004 and 1/2008. All patients had a minimum of 1 prior benign transrectal prostate biopsy (median 3, range 1-8), with an average of 13.6 cores (median 12, range 5-22 cores) obtained on the transrectal biopsy. Median patient age, total PSA and prostate volume and number of specimens obtained per patient were 61 years (range 44.5 - 81.6 years), 9.3 ng/ml (range 4 – 40.1 ng/ml), 46.1 cm^3 (range 12.9 – 123.0 cm^3) and 40 specimens (range 13 – 117 specimens), respectively. STPB identified adenocarcinoma in 291/747 (39%) patients. Gleason scores ranged from 3+3=6 to 5+5=10. While approximately 50% of the positive biopsies were in 1 or 2 octants, 20% of patients were found to have adenocarcinoma in at least 6 to all 8 octants. Multivariate analysis demonstrated there was a significant difference in detection rates with the apical octants having a higher incidence of malignancy than the basilar octants of the prostate gland (p=.000). Furthermore, the anterior apex harbored more malignant cores when compared to the posterior apex (p=.026). In all patients, estimated blood loss was less than 5 cc and pain levels in the recovery room following the procedure were reported to be minimal. 77/747 (10.3%) developed acute urinary retention requiring an indwelling Foley

catheter upon discharge; 95% of which were removed within 3 days. There was no re-catheterization reported. Only one patient developed infection within 4 weeks after the procedure.

COMMENT:

Published data has clearly demonstrated a higher yield of malignant biopsies when a more comprehensive approach obtaining specimens is utilized. Using this technique, we are able to differentiate the precise location of malignant versus benign regions of the prostate gland. A possible explanation for the significant finding in this study that occult malignancies occupy a higher percentage of apical biopsies using STPB may be related to difficulty and limitations of apical sampling using a standard transrectal biopsy approach. This is also what distinguishes STPB from a transrectal saturation biopsy with 24 or 48 cores. Furthermore, the parallel orientation of the biopsy needle within the prostate gland samples more of the peripheral zone compared to a perpendicular orientation used with a transrectal biopsy technique.

STPB is well tolerated and efficacious for diagnosis of non-palpable, isoechoic occult prostate malignancy. Utilizing a concept of geographic octants, we were able to identify malignant biopsy cores and assign them to one or more of eight octants within the prostate gland. Many of our community urologists, including Dr. Jerrold Seckler, have stated that they find STPB extremely helpful in the evaluation of patients with worrisome or rising PSA's whose prior standard transrectal ultrasound guided biopsies have shown only benign tissue. With STPB, Dr. Seckler feels far more confident that if a cancer is present, it will be detected and the chance of a false negative biopsy is minimal.

CONCLUSIONS:

In the future, STPB will play a significant role in the diagnosis of prostate cancer. It may also eliminate carcinoma from the differential diagnosis of patients with an elevated PSA. Because of the comprehensive nature of this procedure, a benign outcome will be welcomed as it may relieve much anxiety for both the patient and physician. As a result, the clinician may be less inclined to continue repeating transrectal biopsies, and may be unlikely to prefer repeated transrectal prostate biopsy. Finally, in selected patients with minimal disease, STPB pathology, if validated, may have a monumental impact on efforts toward focal or targeted therapy directed only to malignant prostate octants.

FIGURE LEGENDS

Figure 1A: Posterior prostate is parallel to the rectum

Figure 1B: Row 1 is 2-3 mm inside the posterior capsule

Figure 2A: Octant assignments in axial view

Figure 2B: Octant assignments in sagittal view

Figure 2C: Apical and basilar specimens

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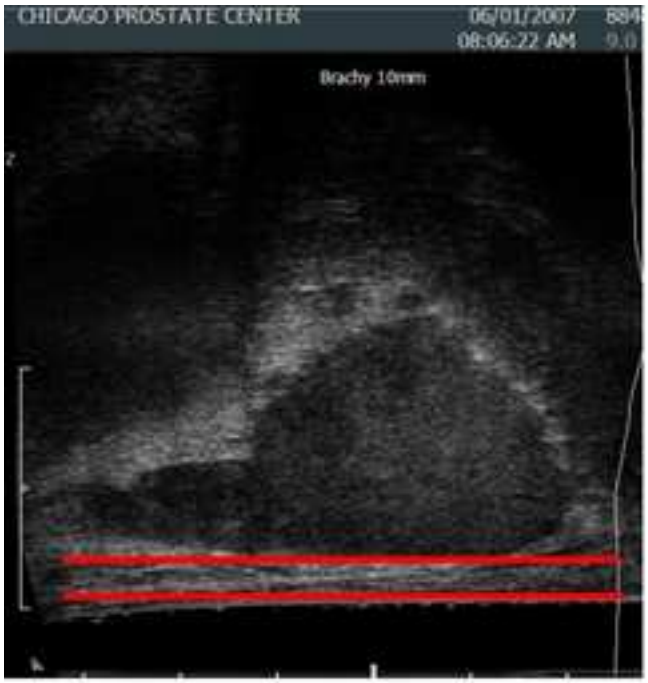

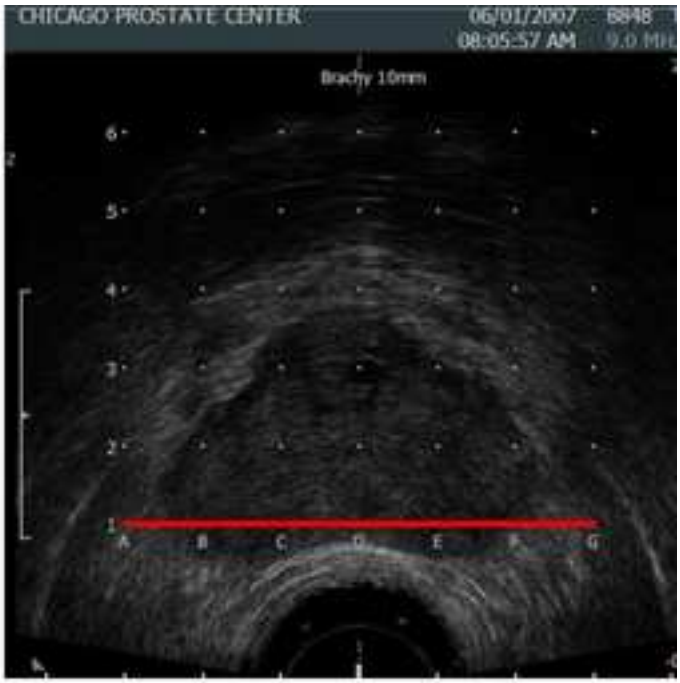

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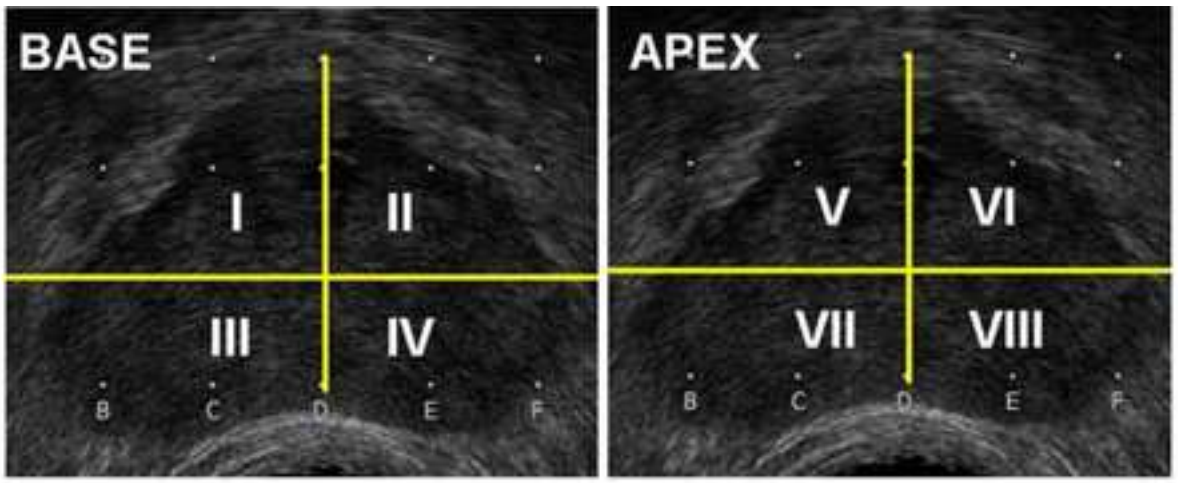

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