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Techniques in Vascular and Interventional Radiology

Image-Guided Targeted Prostate Biopsies

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Prostate cancer is the second most common cancer in the United States. Screening for prostate cancer has increased through the usage of prostate specific antigen and biopsies. Traditionally, prostate biopsies are done using transrectal ultrasound with 10-12 cores obtained in a sextant pattern. Advances in prostate imaging with multiparametric magnetic resonance imaging has led to image guided targeted prostate biopsies. This can be done with cognitive fusion, MRI-fusion, and in-bore MRI. This article will review the indications, techniques, and outcomes for targeted image guided prostate biopsies using in-bore MRI and MRI fusion.

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KEYWORDS Prostate cancer, Magnetic resonance imaging, prostate biopsy, fusion biospy

Introduction

Prostate cancer is the second most common cancer in the United States making up 13.1% of new cancer diagnoses. Approximately 12.5% of men will be diagnosed with prostate cancer during their lifetime.[1] Additionally, this is the leading cancer diagnosis of men in Europe and the second most common cause of cancer death for men.[2,3] Screening for prostate cancer has become widespread using prostate specific antigen (PSA) with AUA guidelines recommending shared decision making and PSA screening for gentleman ages 55-69.[4] There is no consensus for a PSA level at which point a biopsy should be obtained and varied recommendations. The European Randomized Study of Screening for Prostate Cancer showed a reduction of mortality in men with a PSA level of 3 ng/ml or greater.[5,6] The most recent AUA recommends considering a prostate biopsy in men ages 55-69 with elevated PSA. The AUA does not specify a threshold PSA value for biopsy but recommends considering other possible benign factors which could elevate PSA, such as an enlarged prostate, inflammation of the prostate, and older age.[4] Alternatively, the National Comprehensive Cancer Network updated guidelines recommends work-up for biopsy be considered with a threshold of 3 ng/ml for those under 75 and 4 ng/ml for those over the age of 75.[7]

There are several ways that prostate biopsies can be performed. Traditionally, transrectal ultrasound guided prostate biopsies (TRUS) are performed with 10-12 cores obtained in a sextant pattern – peripheral base, midgland, and apex.[8] However, TRUS biopsies can miss up to a third of clinically significant prostate cancer.[9,10] TRUS offers the ability to acquire imaging in real time but is limited by poor spatial resolution and low sensitivity for prostate cancer, as lesions can often appear isoechoic on TRUS imaging, making them difficult to distinguish from background tissue. TRUS biopsies tend to miss anterior clinically significant prostate cancer which can represent up to 41% of prostate cancers.[11,12] This has led to a joint recommendation from the AUA and SAR that any man with a prior negative biopsy, elevated PSA, and MRI Prostate Imaging Reporting and Data System (PI-RADS) of 3-5 undergo an image guided prostate biopsy.[13] Additionally, multiple studies have shown the benefit of MRI guided prostate biopsies over TRUS even in biopsy naïve patients.[14-17] MRI guided prostate biopsies can also be utilized for patients who are candidates for focal therapy to determine not only eligibility and treatment, but for follow-up.[18] MRI targeted biopsies can be performed utilizing multiple techniques; In-Bore transrectal MRI guided biopsy, In-Bore transperineal MRI guided biopsy, and MRI-fusion biopsy. This article will review the techniques and specific indications for each of these modalities.

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In-Bore Transrectal MRI Guided Biopsy

Clinical Evaluation and Indications

All patients undergoing MRI guided prostate biopsy must have a diagnostic quality prostate MRI prior to undergoing MRI guided prostate biopsy with a targetable lesion identified on the MRI (PI-RADS 3-5). The clinical indication for biopsy may vary, as described above, but includes biopsy naïve men with an elevated PSA and concerning lesion on MRI, or elevated PSA with prior negative TRUS biopsy. Contraindications for the procedure include active infection/prostatitis, absent rectum or rectal stricture, and uncorrectable coagulopathy. Relative contraindications include markedly enlarged prostate with anterior lesion, inability to hold anticoagulation, and inability to tolerated transrectal probe.

Equipment Needed

We utilize a 1.5 Tesla MRI Scanner; however, this can be done on any clinical MRI scanner. In-bore transrectal MRI guided prostate biopsies are performed prone utilizing the DynaTRIM prostate biopsy system and DynaCAD software (Fig. 1) (Phillips, Invivo, Gainesville, FL). This accommodates the specified 18-gauge 150 mm and 175 mm biopsy devices with or without an additional 1 cm spacer.

Procedural Steps

The morning of the procedure the patient is instructed to undergo a Fleet enema to clear the rectum of excess stool. The

Figure 1 The DynaTRIM prostate biopsy system includes the needle guide and base plate. (Color version of figure is available online.)

Figure 2 The patient is positioned prone on the MRI table with the DynaTRIM baseplate positioned between the patient's legs and centered to the midline of the patient. A surface coil is placed on the patient's lower back and buttock to improve image quality. (Color version of figure is available online.)

patient is given 1 gram of Rocephin pre-procedure. Most procedures were done under moderate sedation (fentanyl and versed) unless otherwise desired by the patient. The patient is positioned prone on the MRI table with the DynaTRIM baseplate positioned between the patient's legs and centered to the midline of the patient (Fig. 2). A digital rectal exam is performed to ensure no rectal strictures that would prohibit passage of the biopsy needle guide. The needle guide is subsequently inserted into the rectum until minimal resistance is met. Care should be made to inject significant lidocaine jelly into the tip of the needle guide as this not only aids in patient comfort but as a fiducial marker on T2 imaging. The needle guide should not be advanced so far as to significantly indent the rectum, as this creates difficulty with movement of the needle in the future. The needle guide should then be leveled on the clamp stand so the lock will easily slide into place. The initial settings should be confirmed (0 right to left, 45 − head to foot, 0 − anterior to posterior). An additional surface coil is placed posteriorly on the patient. Confirmatory T2 weighed sagittal and axial imaging is obtained.

The needle guide is set as the fiducial marker and the targeted lesion identified (Fig. 3). If difficulty is had identifying the lesion on T2 weighted images additional diffusion weight imaging can be performed and fused to the T2 weighted sequence (Fig. 4). The necessary adjustments as determined by the DynaCAD software for left/right, anterior/posterior, and head/foot movement is made in that order. Of note, one often has to overcorrect for the projected left/right movement

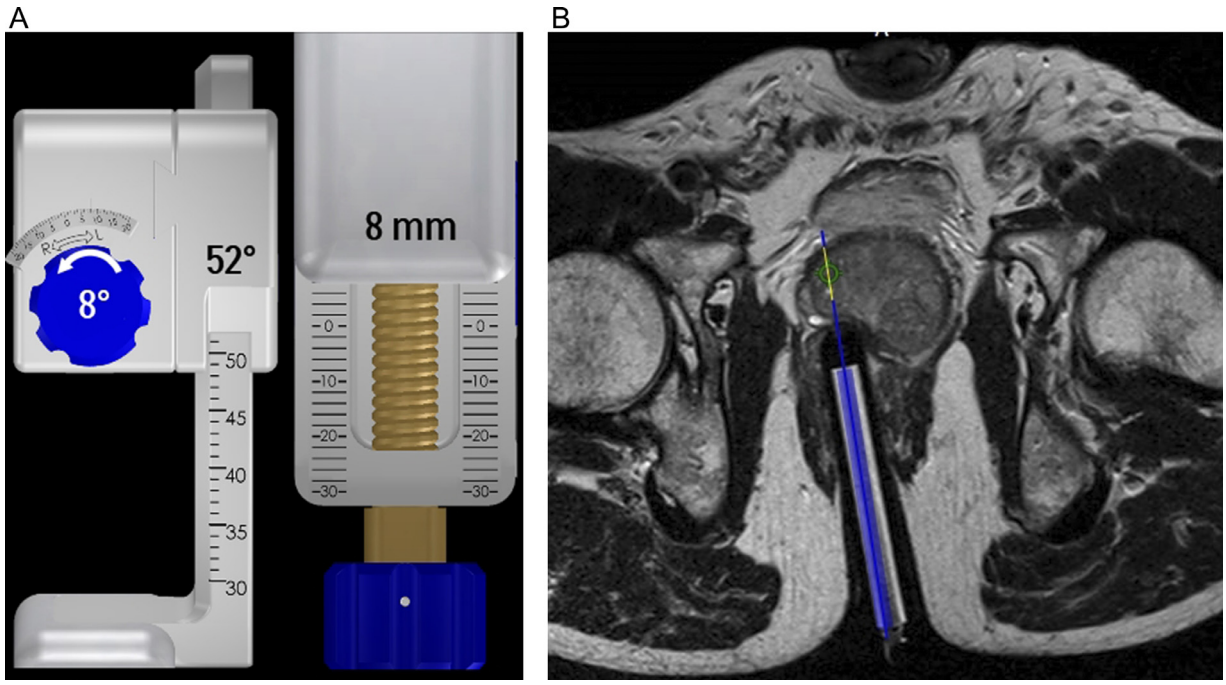

Figure 3 (A) Dynacad software demonstrated the desired coordinates for biopsy including Right/Left, Anterior/Posterior, and Head/foot. (B) Corresponding imaging on the confirmatory MRI demonstrating the needle guide to be aligned with the desired lesion prior to biopsy. (Color version of figure is available online.)

by several degrees to get the actual desired positioning. Oblique coronal confirmatory imaging is then performed off of the needle guide to confirm appropriate targeting. If needed, the needle guide can be re-adjusted and repeat confirmation imaging performed. Once confirmed the pre-determined length of 18-gauge Titanium MRI compatible needle (Invivo, Gainesville, FL) with or without spacer is inserted and 3 core samples obtained. The needle guide is then removed.

Overcoming Technical Challenges

Several issues may arise while performing the in-bore transrectal MRI guided prostate biopsies. First, if the needle guide is inserted too deeply and indents the prostate it is difficult to accurately adjust the needle guide as it will move the prostate with it. If this occurs the needle guide should be retracted so as not to cause indentation to the prostate and repeat imaging obtained. Difficulty can arise with patients with a large abdominal girth as due to the required height the needle guide cannot be leveled. This can be mitigated by elevating the whole DynaTRIM baseplate with a pad or towels. Finally, difficulty can arise with biopsies of anterior lesions in very large prostates. The Invivo MRI compatible needle only comes in a 150 mm and 175 mm. The software will occasionally recommend a 200 mm needle. There are 2 options for this. First, you are able to select a shorter needle length on the dropdown and the software will re-adjust the coordinates. Second, you can use a 20 cm non-MRI compatible 18-gauge biopsy needle, such as the Biopince (Argon Medical, Frisco TX), however care needs to be taken not to get this needle too close to the MRI gantry as it is not MRI compatible. We have not had issues using it with the patient pulled all the way out of the gantry however one should note you cannot image the patient with this needle in the needle guide.

In-Bore Transperineal MRI Guided Biopsy

Indications

MRI-guided trans-perineal prostate biopsy is an emerging prostate gland biopsy technique that can decrease a patient's infection risk by avoiding trans-rectal access, while accomplishing targeted lesion sampling under direct visualization, and hence avoiding the image misregistration pitfalls of MRI-ultrasound fusion biopsies. Specific indications for this technique include: suspicious anterior lesions difficult to access from a posterior trans-rectal approach; surgically absent rectums or rectal strictures that preclude trans-rectal access; patients for whom the trans-rectal infection risk is clinically unacceptable or undesirable. But, because this technique can be used for both targeted and systematic prostate biopsies, virtually any patient without uncontrollable coagulopathy, who can safely undergo an MRI, is a candidate for MRI-guided trans-perineal prostate biopsy. Institutional limitations in cost, scanner availability, and proceduralist experience are the current barriers to widespread adoption of this technique.

Equipment Needed

Patients can typically undergo MRI-guided in-bore trans-perineal prostate biopsy with locally injected lidocaine anesthesia. As procedure time can exceed 1-hour, moderate sedation

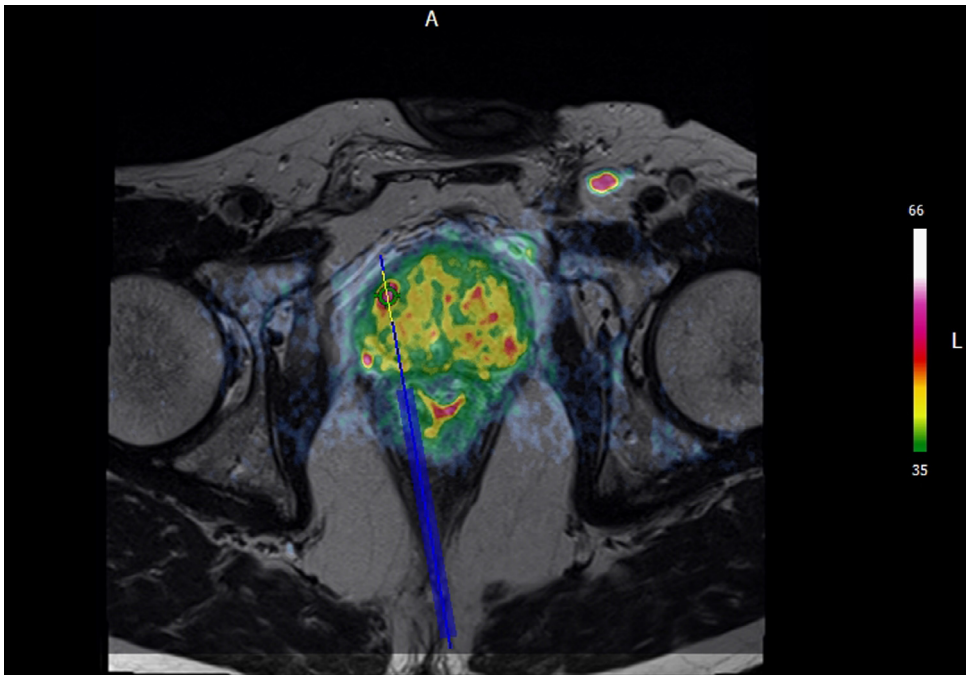

Figure 4 T2 weighted intraprocedural MRI with diffusion weighted imaging overlay shows the target lesion. This can be helpful for target lesions best seen on diffusion. Of note, this patient also had a left inguinal lymph node which was enlarged and seen to have restricted diffusion. (Color version of figure is available online.)

with IV fentanyl and midazolam should be available for patients who might have difficulty remaining in lithotomy position in the scanner bore for such periods. General anesthesia may be needed for patients who cannot remain still or have claustrophobia issues. Anticoagulation medications should be held and any coagulopathies adequately corrected. No bowel preparation or pre-procedural antibiotic regimen is necessary. A single dose of an IV antibiotic for treating urinary tract infections is given at the time of the procedure.

These biopsies require a scanner with 1.5T or 3T magnet strength and a wide gantry diameter. The patient is placed in lithotomy position with legs elevated to permit access to the perineum for localizer grid placement and needle insertion, and thus an MRI-compatible stirrup device is necessary. While this previously required a custom-made device,[19] at least 1 MRI-compatible stirrup device is now commercially available in versions compatible with commonly used MRI scanners (Uni-Lift, Noras, Hoechberg, Germany). At our institution, biopsies are performed in a 1.5T scanner with a 70 cm diameter gantry using standard matrix body coils (Magnetom Aera, Siemens, Malvern, PA). The MRI-compatible stirrup device made for this scanner is used for patient positioning and procedure planning (Fig. 5). This device contains a reusable perineal localizer grid and marker block with a small reservoir to be filled with liquid such as water, to serve as a visible reference marker for each procedure (Fig. 6).

Once a patient is positioned, a standard MRI-compatible single-use biopsy kit is used to mark and sterilize the patient's skin and then drape the procedure area. Lidocaine anesthetic is administered in the skin of the targeted entry sites using either a 22 g or 25 g needle, followed by deeper administration up to the gland capsule using a 22 g or 25 g spinal needle. Small skin incisions are made using an #11 blade. Biopsies are then performed using an MRI-compatible 18g or larger bore needle device. At our institution, a fully automatic titanium 175 mm long 18g biopsy device (Invivo, Gainesville, FL) is placed coaxially within a 4 French sidearm sheath (Pinnacle, Terumo, Somerset, NJ) (Fig. 7). This sheath permits maintenance of access to a particular biopsy location while the biopsy device is removed for sample collection, as an MRI-compatible introducer needle is not yet available for co-axial technique. An MRI-compatible procedural light aimed from behind and over the operator's shoulder at the procedure area is helpful for visualization.

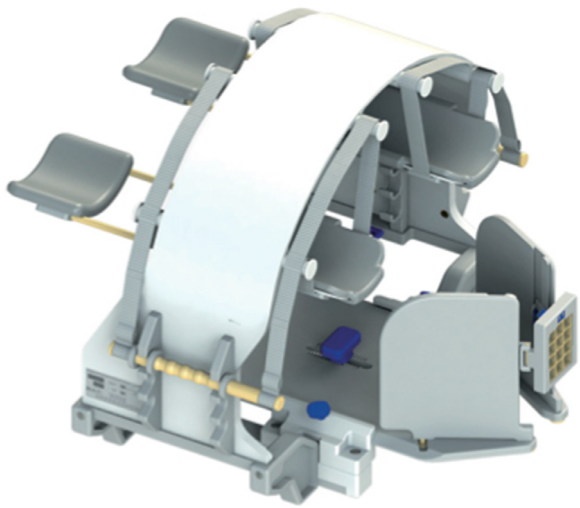

Figure 5 The MRI-compatible stirrup device used for patient positioning and procedure planning during transperineal in-bore MRI biopsy. (Color version of figure is available online.)

Figure 6 The reusable perineal localizer grid and marker block used during transperineal in-bore MRI biopsy. (Color version of figure is available online.)

Procedural Steps

The previously obtained diagnostic contrast-enhanced multiparametric prostate MRI scan is reviewed before proceeding with biopsy, to confirm unobstructed trans-perineal access to any suspicious lesions and to bilateral peripheral zones if systematic biopsy is needed. Informed consent is obtained, the patient is placed supine in the MRI scanner gantry with a body coil beneath his pelvis, and his legs are positioned within the leg rests of the stirrup device (Fig. 8). Padding is placed at any pressure points between the patient's legs and the stirrup device surfaces. The genitalia are taped up away from the perineum. The reservoir of the marking block is filled with water or oil, and the block is inserted into the localizer grid. The plastic localizer grid in the stirrup device is then positioned against the perineum as snugly as possible (Fig. 8).

Non-contrast T2-weighted (T2W) imaging is then performed of the pelvis, making sure to include the entire prostate gland, the bladder base, the rectum (if present), and the localizer grid including the liquid-filled marking block. Using the diagnostic MRI scan images for confirmation, the targeted lesions are identified on the current T2W images, as are bilateral entry points into peripheral zone tissue if needed for systematic biopsy. The 3-dimensional coordinates of each target are then recorded, and 3-dimensional distances to these targets are measured from the T2-hyperintense fluid within the marking block where it contacts the perineal skin. The marking block is then removed, the point where the marking block contacted the perineal skin is marked, and then skin entry points are measured and marked. The perineal skin and adjacent positioning device surfaces are then sterilely prepped and draped. A commercially available sterile single-use guiding needle block is available that can be plugged into the localizer grid to help with needle placement (Invivo, Gainesville, FL). However, if this block is to be used, the localizer grid needs to be kept in place and sterilely prepped as well, which can be challenging. Additionally, the desired needle entry sites are sometimes blocked by the septa of the localizer grid. For these reasons, at our institution we remove the localizer grid altogether just after marking the patient's skin, and instead advance the biopsy needles using free-handed technique without the guiding needle block.

The needle entry sites and underlying soft tissue are then anesthetized and small skin incisions are made. At our institution, the biopsy needle device is placed coaxially within a coaxial 4F slim vascular sheath, and are advanced into the patient together as a unit. Images are obtained as the needle is advanced, with sequence parameters adjusted to optimize visualization of the biopsy needle using its metallic artifact.

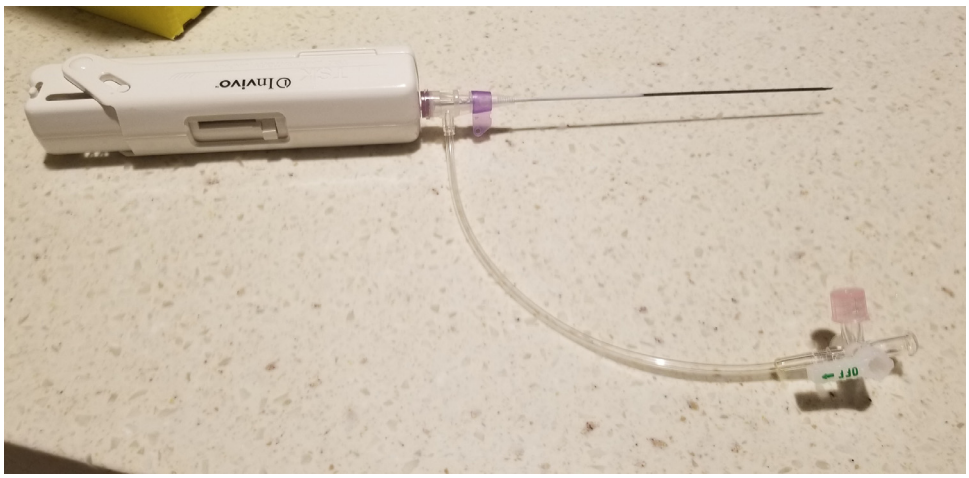

Figure 7 The fully automatic titanium 175 mm long 18g biopsy device (Invivo, Gainesville, FL) is placed coaxially within a 4 Frenchsidearm sheath (Pinnacle, Terumo, Somerset, NJ) to allow for a co-axial system and multiple cores from the target lesion. (Color version of figure is available online.)

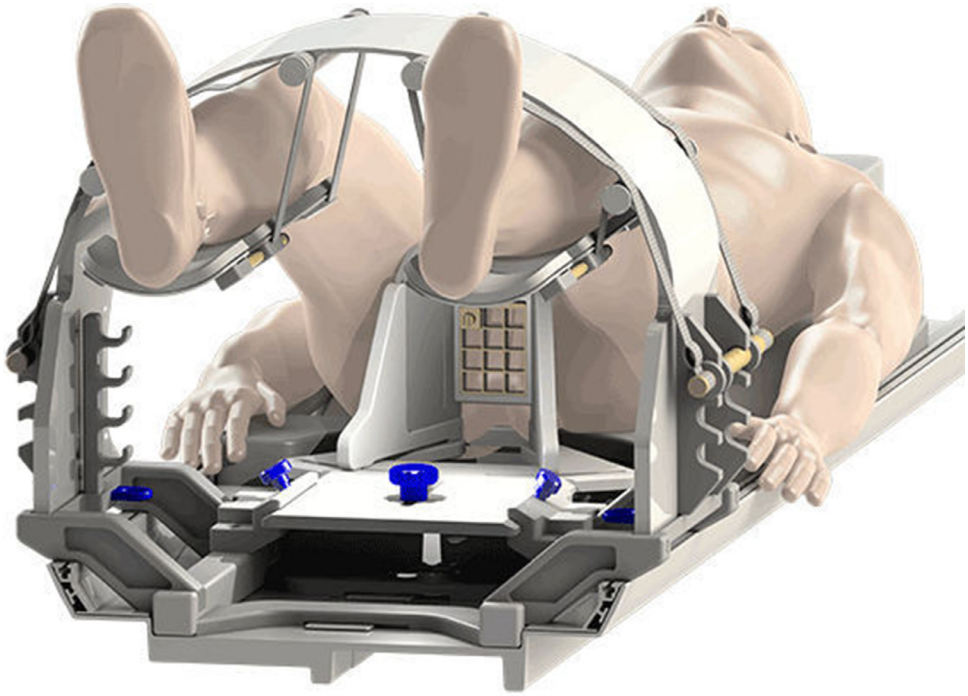

Figure 8 Patient positioning for the procedure with a body coil beneath the pelvis and legs positioned within the leg rests of the stirrup device. The plastic localizer grid is positioned against the perineum. (Color version of figure is available online.)

T1 gradient echo imaging can have the advantages of faster image acquisition and better needle visualization and is better suited for systematic biopsy needle passes, but suspicious lesions that are T2 hypointense will not be delineated. On the other hand, T2W images will give excellent visualization of suspicious peripheral zone lesions and adequate needle visualization, but acquisition times can be longer. Axial imaging often provides better initial needle tracking, whereas coronal or sagittal images can be more useful for confirming adequate targeting of focal lesions. Once a biopsy sample is taken and the needle is removed to collect the sample, the sidearm sheath functions like an introducer needle by remaining in place to maintain access. At least one 18g core is obtained from each targeted lesion, with cores then also obtained if indicated from bilateral apical, mid, and base regions of the prostate gland. Once all desired specimens are obtained, the needle(s) and sheath(s) are removed, the patient is removed from the positioning device, the perineum is cleaned, and a sterile gauze pad is placed within a disposable undergarment. Post-procedure imaging is obtained to look for any immediate complications such as hemorrhage. Tissue samples are placed in standard formalin solution vials.

Overcoming Technical Challenges

The procedure can be ergonomically challenging for the proceduralist, and some find that moving one's head within the scanner's magnetic field can cause dizziness. One should confirm that neither of these potential issues will pose a problem before embarking on in-bore trans-perineal prostate biopsies. As the biopsy needle is advanced, whether using free-hand technique or a guiding needle block, the needle will commonly be deflected by structures such as the inferior pubic rami or prostatic capsule. Bevel-steering technique can be used, whereby the bevel angle of the needle is oriented away from the desired direction of needle advancement, so that as the needle is pushed in further, the tip is deflected towards the target. For cases when samples will be taken from more than 1 site, simultaneously advancing 2 separate biopsy needles towards different sites is straightforward and can save substantial time. When performing systematic biopsies, it is important to realize that the typical 2.5 cm biopsy needle throw coming from an inferior-to-superior approach can sample the entire extent of the gland from apex to base. Such a single core can make localization of any detected malignancy challenging. Hence it is advisable to obtain separate specimens with the needle centered at the apex, mid, and base regions of the gland, respectively. Careful labeling of all vials with specimen locations is critical.

MRI Fusion Biopsy

Indications

Indications and contraindications are similar to in-bore targeted MRI prostate biopsies. MRI fusion biopsies have the added advantage similar to the in-bore transperineal approach that a templated biopsy can be performed at the same time as the targeted biopsy.

Equipment Needed

A good quality prostate multiparametric 3 Tesla (3T) prostate MRI (mpMRI) or 1.5T with endorectal coil consisting of T2W, diffusion-weighted, and dynamic contrast enhanced

sequences is utilized. Utilizing T2W imaging, the prostate is semiautomatically contoured with DynaCad software (Phillips, USA) and targets defined on multiple slides to produce a 3-dimensional (3D) volume. There are several fusion systems that can be utilized and are reviewed in Luijtelaar, et al. *Expert Review of Anticancer Therapy*, 2019.[20] No head-to-head clinical trials exist, and due to variations in patient and system-specific variables (workflow and technique) it is difficult to compare these in retrospective studies.[21]

Differences exist in the image registration being either rigid or non-rigid (elastic). Rigid image registration occurs by aligning the mpMRI on the TRUS images while not accounting for movements by the patient, and without adjustment for possible deformation of the prostate by the pressure on the prostate by the TRUS probe. Non-rigid image registration matches corresponding point landmarks, and happens during the procedure by accounting for any real-time changes of the prostate and patients' movements. As non-rigid registration is compensating for the deformation during the biopsy, it is likely that non-rigid image registration would be more accurate compared to rigid but this has not yet been shown.[22] We utilize the UroNav R3 System (Invivo, Gainesville, FL) which utilizes the T2W images. Fusion of pre-procedural acquired MRI images with real-time TRUS allows alignment of the biopsy needles under ultrasound guidance.

A transrectal (TR) or transperineal (TP) approach can be utilized for fusion biopsies. For the transrectal approach we utilize a sidefire probe, and for the transperineal approach we utilize a biplanar endfire probe. The transperineal approach can be performed in the clinic as a "free-hand" procedure (with x2 skin punctures) or in the operating room using a disposable brachytherapy-like Civco grid template which requires a custom-designed, articulating stepper system, and the option for either a mobile (wheeled) stepper stand or a rail-mounted stepper support. The transperineal approach to biopsies has the added benefit of a more direct anterior approach, and minimizing the risk of infection. However, the TP approach requires more time in the clinic or general anesthesia in the case of a grid template due to multiple needle punctures.

For either TR or TP approach we utilize a probe sensor which attaches to the ultrasound probe directly. For the TP approach, we additionally have the disposable PrecisionPoint Transperineal Access System which allows the ability to maintain your needle in the sagittal plane at all times. The stepper allows the operator to move the needle up or down to accommodate for the height of the prostate. The TRUS 3D model is then segmented semiautomatically (with manual adjustments if necessary) and "fused" to the prostate MRI with registration software (Fig. 9).

The major technological challenge with MRI TRUS fusion biopsy is the registration process that fuses MRI to the US image. The prostate contours are simply manipulated to allow for rotation or translational alignment between images using a mathematical algorithm. In elastic registration, the software algorithm stretches or "warps" the MRI image prostate shape to match the TRUS prostate contour.

Procedural Steps

Here we will focus on describing the office-based approach and point out important differences when compared to an operating room-based approach. In summary, MR image acquisition and lesion segmentation, ultrasound prostate segmentation, and image registration, followed by fusion-guided biopsy.

Probe preparation: Good probe preparation is critical. A condom and ultrasouond (US) jelly are used to prepare the probe (Fig. 10). Care is taken to remove all bubbles from the condom as this can obscure the US images enough that the prostate sweep is difficult to perform, and lateral borders of the prostate are hard to delineate.

Patient preparation and positioning: The patient is asked to perform an enema at home the morning of the procedure. For a TR approach, patients are seen earlier in the week for a rectal swab to direct antibiotic administration. The morning of the procedure they either receive culture-specific PO or IV antibiotics. For an OR TP approach we give ancef to cover skin flora due to the increased number of skin punctures.

The patient is placed supine and moved to a dorsal lithotomy position. The scrotum is tacked up to the abdominal wall using a towel and tape. A rectal exam is performed and documented. The perineum is then cleaned with betadine. The TR probe is inserted and borders of the prostate are delineated. The perineal muscles are identified on each side of the prostate.

Local anesthesia administration: A location about 1 cm above and 1 cm lateral to the superior aspect of the anal verge is infiltrated with 5 cc of 50% one to two percent lidocaine to create a weal. These medications have an onset of action of <2 minutes and can last up to 2 hours, with a max dose of 4.5 mg/kg. A spinal needle is used to infiltrate deeper tissues including the muscles of the pelvic floor which are innervated by branches of the pudendal nerve. Using a sagittal view one can see the boundaries of the periapical triangle, which is bounded by the medial edge of the levator ani muscle, the urethral rhabdosphincter and the external anal sphincter muscle.[23] Usually, 1-2 needle punctures are required per side.

Fusion biopsy: After local anesthetic administration a prostate sweep using 8.5 Hz probe is performed in the sagittal plane ensuring that minimal pressure is exerted on the prostate and the probe is maintained parallel to the detector. The prostate boundaries are then marked on the Uronav system and 3D US representation of the prostate is compared to that annotated on the MRI. The image can then be aligned using anatomical anchors such as the bladder neck, and/or prostate benign prostatic hyperplasia nodules ("internal fiducials"). Elastic deformation can be performed to account for the prostate deformation created by the pressure of the ultrasound. This can be turned on and off during the actual procedure. The target lesion is then identified and at least 3-4 biopsies taken of the lesion depending on the lesion size.

Standard template prostate biopsy: 83% of prostate cancer is multifocal and index lesions are much larger than secondary tumors.[24] After completion of the fusion biopsy a standard template TP or TR biopsy is performed. These biopsies can

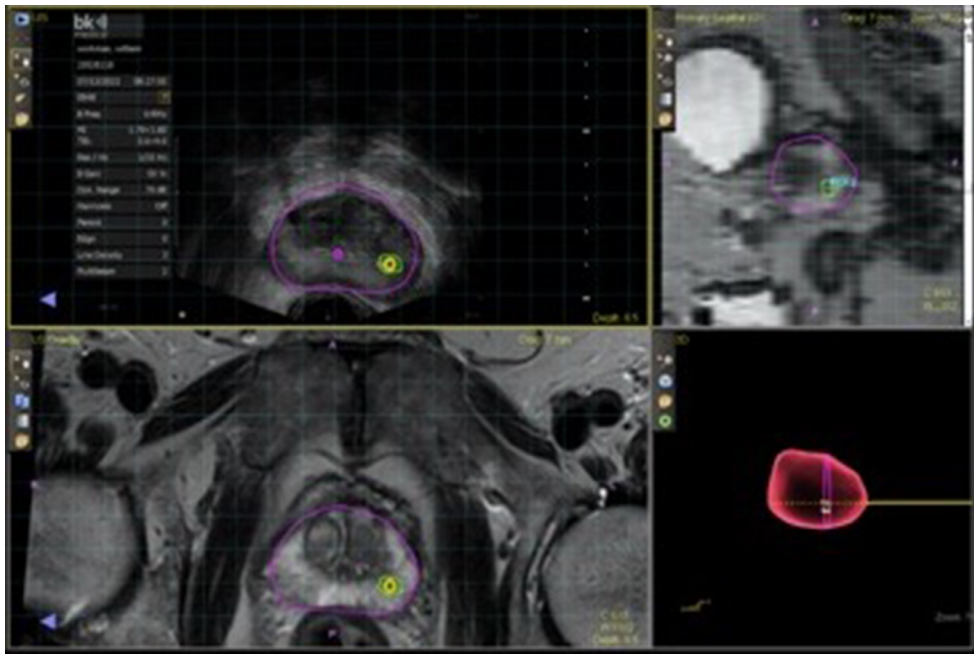

Figure 9 The target lesion in the left peripheral zone "fused" to the ultrasound images to allow for MRI fusion targeted biopsy. (Color version of figure is available online.)

also be tracked in the Uronav system and saved for comparison in future biopsies.

Overcoming Technical Challenges

Misregistration: The prostate US sweep is a critical portion of the procedure and subsequent steps dependent on this. Probe positioning, minimizing bubbles, and movement while performing the sweep are critical. The lateral borders of the prostate, apex and base should be clearly visible to be able to properly perform the fusion biopsy. Large prostates can be challenging as the entire prostate can sometimes be difficult to register or sweep. In these cases, the base of the prostate/median lobes are not registered.

Anterior lesions/pubic symphysis: Pubic symphysis can be encountered in very anterior lesions using a TP approach. The patient can be asked to increase the degree of lithotomy but this can be challenging in the clinic. The needle can be inserted in a more inferior position and lesion targeted from an apical to anterior approach.

Recognizing and Treating Complications

The most common complications after prostate biopsies are bleeding and infection. Infection rates after prostate biopsy range in the literature from 0.1%-7%.[25-27] Trans-perineal approach and limited sampling with MRI guided prostate biopsies has been shown to have decreased rates of infection. The trans-perineal route for prostate biopsy has specifically been found to decreases the risk for bacterial prostatitis, urinary tract infection, and urosepsis. Infection rates after trans-perineal biopsy range from 0.0%-0.7%, with hospital admission rates for sepsis ranging from 0.0%-0.7%. This is compared to infection rates ranging from 0.1%-7% and hospital admission rates for sepsis ranging from 0.6%-6.9% with trans-rectal prostate biopsy.[28] Periprocedural antibiotics should be given to help decrease the risk of infection, however there is controversy on the ideal protocol given increasing fluoroquinolone resistance. In the event of post-biopsy urinary tract infection, a course of antibiotic can be administered in accordance with current urological societal guidelines. As progression to urosepsis can be rapid, any sign of urinary tract infection after biopsy should be taken seriously and acted upon swiftly.

Blood can be seen in urine, semen, or stool however should be self-limited. Significant bleeding can be seen in 1%-4% of patients.[29] Retroperitoneal bleeding rates in prostate biopsies overall are so low as to be infrequently reported. As MRI imaging of the patient's pelvis is obtained every several minutes during in-bore MRI guided biopsies, any such bleeding can be detected early and monitored actively.

Hematuria after biopsy itself is common and typically self-limited. Rarely (less than 1%), when hematuria is severe or persistent, consultation with a urologist should be obtained with consideration given to an adjunctive embolization or cystoscopic procedure as needed. Hematospermia after biopsy is also common, and typically self-limited with no additional therapy needed.[28] Rectal bleeding can be seen in the trans-rectal prostate biopsy, but is not reported for the trans-perineal approach.

Urinary retention is another uncommon complication, although this may be slightly more with the trans-perineal approach. Retention can result from compression on the prostatic urethra from swelling or hematoma after a biopsy, or from hematuria severe enough to cause clot formation that obstructs the bladder outlet. Patients should be warned that if they are unable to urinate post procedure to go to the

Figure 10 The transrectal ultrasound probed used to guide the MRI-fusion biopsy. (Color version of figure is available online.)

closest emergency room as urinary retention is an emergency. A urinary catheter must be placed to decompress the bladder, which is typically left in place for up to a week before a voiding trial is attempted.

Apart from the management of any complications, follow-up after biopsy is necessary to discuss further management of any detected prostate cancer. This is often done by our urology colleagues. MRI-guided biopsy achieves similar overall cancer detection rates as TRUS-guided biopsy, with increased sensitivity for clinically significant cancers and decreased sensitivity for clinically insignificant cancers.[30]

Expected Outcomes

Targeted image guided prostate biopsies are used for diagnosis, monitoring patients undergoing active surveillance, or to guide focal therapy. The trend has been moving towards more targeted biopsies with the increased utilization of prostate MRI (with or without the traditional non-targeted systematic cores) rather than the traditional TRUS biopsy alone. The published positive biopsy rates for in-bore and fusion biopsies range from 54.2%-85%.[31-34] It is important for interventional radiologists to be aware of these procedures so as to best be able to assist and collaborate with our urology colleagues in the care of this patient population.

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