ACG CASE REPORTS JOURNAL

CASE REPORT | ENDOSCOPY

Piling Gold in the Prostate

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ABSTRACT

Radiation beams precisely directed at a tumor can attenuate the radiation to contiguous tissues. Image-guided radiation therapy using fiducials allows accurate delineation of tumor location. Traditionally, fiducials in the prostate have been placed by urologists or radiation oncologists. With the evolution of endoscopic ultrasound (EUS), fiducials have been successfully placed under the EUS guidance in different organs. In this case series, fiducials were placed in 3 patients with prostate cancer. All patients completed their radiation therapy, and no complications were reported except mild dysuria in one case. EUS-guided fiducial placement is safe and offers a new modality for fiducial placement in the prostate.

INTRODUCTION

External beam radiation plays an important role in managing localized prostate cancer, which is one of the most common cancers in the United States.[1,2] Prostate is a mobile organ whose positioning depends on the adjacent strictures such as the bladder and the rectum. Thus, image-guided radiation therapy (IGRT), which allows precise and accurate delivery of the radiation beams to the tumor tissue, is crucial in minimizing radiation to the adjacent normal tissue. Fiducial markers (FM) can serve as reference points to accurately target tumor tissue and allow precise radiation beam delivery. Traditionally, FMs have been placed by urologists or radiation oncologists either transrectally or transperineally.[3] With the evolution of advanced endoscopic ultrasound (EUS), FMs have been increasingly placed under the EUS guidance in various gastrointestinal organs such as the pancreas, liver, and esophagus.[4] We present a case series discussing our experience with EUS-guided FMs placement in the prostate (Table 1).

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Technique: All cases underwent flexible sigmoidoscopy, followed by EUS using a curvilinear array echoendoscope (GF-UC 0P with an Aloka processor; Olympus America Inc, Central Valley, Pa) under conscious sedation. The base and the apex of the prostate was identified by transrectal EUS as a hypoechoic, round structure about the rectum and seminal vesicle location (Figure 1). Four cylindrical gold fiducials (Best Medical International, Springfield, Va) 3 or 5 mm long with a 0.8-mm diameter were placed in a 4-quadrant fashion (bilateral base and apex) with at least 1 cm of distance between each fiducial. After removing the stylet and flushing the needle with saline solution to avoid gas entrapment, the fiducials were backloaded into a 22-gauge needle. Under the EUS guidance, the needle tip with the gold seed in place was inserted into the target area and each fiducial was deployed by advancing the stylet forward (Figure 2). Average procedure time was 40 minutes. All cases were discharged on the same day on ciprofloxacin and metronidazole for 5 days.

Patient 1: A 60-year-old man with a strong family history of prostate cancer presented with elevated prostate-specific antigen (PSA). The patient was asymptomatic, and his digital rectal examination was normal. EUS showed a hypoechoic lesion in the left middle posterior zone. International prostate symptom score (IPSS) was 6/35. Two of 12 cores on prostate biopsy were reported as adenocarcinoma with a Gleason grade of 3 + 3 in left posterior zone and 3 + 4 in left middle zone. The patient successfully completed 6 months of stereotactic body radiation therapy (SBRT) and androgen deprivation therapy after FM placement. No symptoms of bladder or bowel dysfunction were reported 8 months after completion of treatment.

ACG Case Rep J 2020;7:e00426. doi:10.14309/crj.0000000000000426. Published online: July 10, 2020

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Table 1. Patients characteristics

Patient	Age (yr)	Gleason score	PSA (ng/mL)	IPSS	No. of fiducials	Complications related to FM
1	60	3 + 3 left PZ 3 + 4 left MZ	5.2	6/35	4	None
2	73	3 + 4	4.7	13/35	4	None
3	53	3 + 3	5.1	13/35	4	Dysuria

FM, fiducials markers; IPSS, international prostate symptom score; MZ, middle zone; PSA, prostate-specific antigen; PZ, posterior zone.

Patient 2: A 73-year-old man who was on active surveillance for low-risk prostate cancer for almost 4 years had a rising trend in PSA. Prostate biopsy revealed 1 of 1 core with adenocarcinoma prostate with a Gleason grade of 3 + 4 in the left middle lateral zone. IPSS was 13/35. The patient completed definitive SBRT successfully after FM placement. The patient sought medical attention for urinary retention after one month of FM placement and after he received his first session of radiotherapy. The patient was found to have prostatitis and cystitis that were attributed to radiotherapy. His symptoms improved with topical steroid and tamsulosin. No other complications were reported.

Patient 3: A 53-year-old man presented with elevated PSA. The prostate was normal on digital rectal examination. Pelvic MRI showed left peripheral zone prostatic lesion with a PI-RADS score of 4. Prostate biopsy was performed, and the histopathology reported adenocarcinoma in 1 of 6 cores with a Gleason score of 3 + 3. IPSS was 13/35. The patient completed SBRT successfully after FM placement. Only mild burning urination was reported during a follow-up visit otherwise no other complications were reported.

DISCUSSION

Higher doses of radiation have shown to improve the outcomes in patients with localized prostate cancer. However, increasing the radiation dose risks damages surrounding tissues if the radiation beams are not precisely steered toward the target tissue.[2,5] Thus, proper prostate localization and delineating the normal and target tissues are crucial in delivering the radiation to the target tissue and minimizing the adverse events. Daily transabdominal US has been used as a technique for prostate localization before radiotherapy. However, it has several limitations including long procedure time, being operator-dependent, and patient's body habitus. Therefore, FM placement has emerged as a new technique for IGRT allowing a precise and reliable delivery of high radiation doses to the target tissue with minimal toxicity to the adjacent tissues. Indeed, several studies have shown that FMs are more accurate for prostate localization than ultrasound-based techniques.[6,7] Traditionally, prostate FMs have been placed transrectally or transperineally by urologist or radiation oncologists.[8,9] More recently, and with the evolution of the EUS, FMs have been placed under EUS guidance in different body organs including the prostate.[4,10] However, the data about EUS-guided FM placement in the prostate are scarce. Yang et al[10] reported no complications in 16 patients who underwent EUS-guided FM placement in the prostate. In our case series, only one patient experienced mild dysuria after FM placement, otherwise no complications were reported. To date, no studies have compared between EUS-guided FM placement and other techniques for FM placement in the prostate. Nonetheless, EUS-guided FM placement can be an alternative technique that is well-tolerated because it uses conscious sedation.

Potential difficulties with the technique include the introduction of air into the prostate or implantation of FMs into calcified area that will make the visualization of FMs difficult. Similar to other FM placement techniques, there is risk of adverse events such as prostatitis, bleeding, urinary tract infection, and urinary retention. In our case series, prophylaxis antibiotics

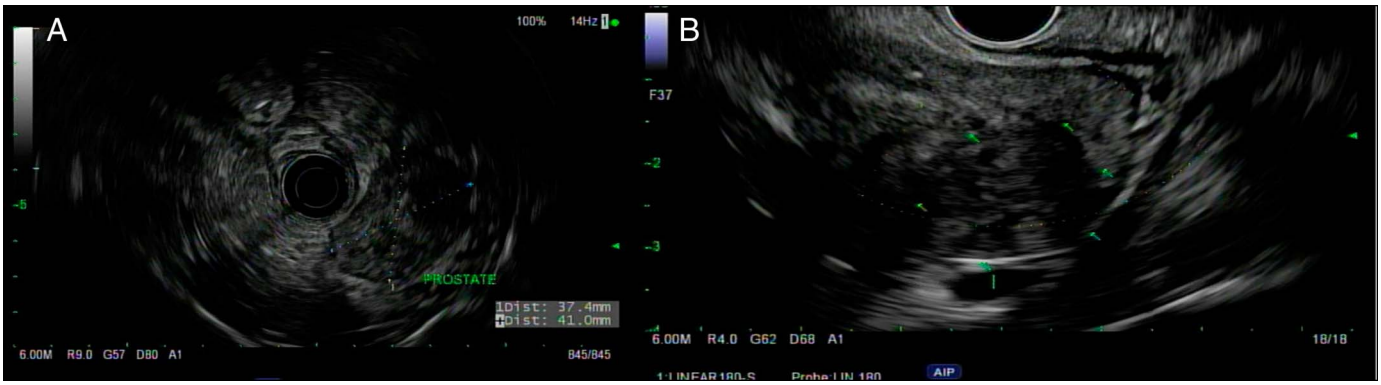

Figure 1. (A) A 360° image of the prostate with a radial echoendoscope and (B) image of prostate with a localized lesion using a linear echoendoscope.

Figure 2. Image of the prostate after implantation of one of the fourth fiducials. White arrow shows fiducials marker in place.

for 5 days were prescribed for the patients to reduce the risk of urinary tract infection and prostatitis.

In conclusion, EUS-guided FM placement for IGRT for prostate cancer is safe and feasible and offers a new modality for FM placement. Further larger studies evaluating the clinical outcomes and comparing EUS-guided FM placement and other techniques are warranted.

DISCLOSURES

Author contributions: Abrahim Hanjar, MD, and Yazan Fahmawi, MD contributed equally to this work. All authors contributed equally to this manuscript. M. Mizrahi is the article guarantor.

Financial disclosure: None to report.

Previous presentation: This case was presented at the American College of Gastroenterology Annual Scientific Meeting, October 25-30, 2019; San Antonio, Texas.

Informed consent was obtained for this case report.

Received January 27, 2020; Accepted May 8, 2020

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