Characteristics of Anteriorly Located Prostate Cancer and the Usefulness of Multiparametric Magnetic Resonance Imaging for Diagnosis

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Purpose: We analyzed the pathological and oncologic characteristics of anteriorly located prostate cancer and assessed the usefulness of magnetic resonance imaging to detect anterior prostate cancer.

Materials and Methods: We analyzed the records of 728 consecutive patients treated with radical prostatectomy. Patients were categorized with anterior or prostate cancer or tumors involving the anterior and posterior prostate according to the dominant tumor location on whole mount section.

Results: The anterior and posterior prostate cancer groups and the group with cancer at both locations represented 31.0%, 46.7% and 22.3% of the total number of patients, respectively. Anterior prostate cancer was less commonly palpable ($p < 0.001$) and needed more frequent repeat biopsy ($p = 0.012$) than posterior prostate cancer. Moreover, the anterior group had fewer positive cores than the posterior group ($p < 0.001$) despite comparable tumor volumes. Gleason score upgrading was more frequently observed in anterior than in posterior prostate cancer ($p = 0.003$). However, final pathological features did not significantly differ. Only the seminal vesicle involvement rate was lower in anterior than in posterior prostate cancer ($p < 0.001$). Estimated 5-year biochemical recurrence-free survival in patients with anterior prostate cancer was 87.5%, significantly higher than in patients with posterior prostate cancer (77.4%, $p = 0.001$) and patients with anterior plus posterior involvement (74.4%, $p < 0.001$). Multivariate analysis revealed that anterior location was an independent prognostic factor for biochemical recurrence (HR 0.403) along with other well-known prognostic factors. To detect anterior prostate tumors the sensitivity and specificity of magnetic resonance imaging were 78.1% and 58.2%, respectively.

Conclusions: Anterior prostate cancer had pathological features and favorable oncologic outcomes comparable to those of posterior prostate cancer but also more frequent Gleason score upgrading. Magnetic resonance imaging had moderate diagnostic performance for detecting lesions in the anterior prostate.

Abbreviations and Acronyms

APC = anterior prostate cancer
BCR = biochemical recurrence
DRE = digital rectal examination
ECE = extracapsular extension
LNI = lymph node involvement
MRI = magnetic resonance imaging
NPV = negative predictive value
PEAT = prostatic evasive anterior tumor
PI-RADS = Prostate Imaging Reporting and Data System
PPC = posterior prostate cancer
PPV = positive predictive value
PSA = prostate specific antigen
PSM = positive surgical margin
PZ = peripheral zone
SVI = seminal vesicle involvement
TZ = transitional zone

Accepted for publication March 6, 2016.

No direct or indirect commercial incentive associated with publishing this article.

The corresponding author certifies that, when applicable, a statement(s) has been included in the manuscript documenting institutional review board, ethics committee or ethical review board study approval; principles of Helsinki Declaration were followed in lieu of formal ethics committee approval; institutional animal care and use committee approval; all human subjects provided written informed consent with guarantees of confidentiality; IRB approved protocol number; animal approved project number.

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0022-5347/16/1962-0367/0
THE JOURNAL OF UROLOGY®

http://dx.doi.org/10.1016/j.juro.2016.03.075
Vol. 196, 367-373, August 2016
Printed in U.S.A.

Key Words: prostatic neoplasms; neoplasm recurrence, local; magnetic resonance imaging; diagnostic imaging; prognosis

PROSTATE specific antigen screening has resulted in robust clinical stage migration in newly detected prostate cancers.[1] However, diagnosis is delayed in a substantial portion of prostate cancer patients, especially those with APC. Because conventional diagnostic tools for prostate cancer such as DRE or transrectal ultrasound rely on a posterior approach to the prostate, the diagnosis of APC can be missed.[2,3] APCs are frequently not amenable to DRE and the relatively long distance from the rectum to the anterior compartment often hampers APC detection on transrectal ultrasound.[2,3] Therefore, APC more frequently requires repeat biopsies due to a higher frequency of negative biopsy cores compared to PPC despite similar tumor volumes.[3,4]

Previous studies have shown that 15.0% to 20.1% of prostate tumors have been located anterior to the prostatic urethra in prostatectomy specimens and the proportion of APCs is increasing annually.[3–5] Such trends may be attributable to stage migration toward clinical T1 prostate cancer.[6] The increasing detection of low risk prostate cancer enables active surveillance, which is a viable treatment option for prostate cancer.[7–9] Existing protocols for active surveillance indicate DRE with or without transrectal ultrasound and the number of positive cores on biopsy as important selection criteria and triggers for intervention.[10–12] However, in cases of APC biopsies may yield false-negative cores or a shorter tumor length on the core,[3,4] consequently underestimating the risk of prostate cancer.

Furthermore, little is known about the pathological and oncologic characteristics of APC. Several previous studies demonstrated the prognosis of this disease with conflicting results.[4,13,14] Some groups reported that APC has oncologic outcomes better than or similar to those of PPC.[4] However, others reported that the prognosis of APC might be poorer than that of PPC due to latency in diagnosis.[13,14] In particular, Lawrentschuk et al found it important to define anterior predominant tumors visible on MRI as PEATs and PEATs have poor oncologic outcomes.[14]

To draw more definitive conclusions regarding APCs we investigated the distinguishing pathological and oncologic characteristics of APCs in a consecutive radical prostatectomy cohort. We hypothesized that the diagnosis of APC might differ and the risk of APC may be underestimated because conventional diagnostic tools rely on a posterior approach. This situation might affect the oncologic outcomes of APC. We also investigated whether multiparametric MRI is valuable for evaluating tumors in the anterior prostate.

MATERIALS AND METHODS

Patient Selection

The protocol of this study was approved by our institutional review board (No. 2015-1279). The study population consisted of all consecutive patients treated with radical prostatectomy between September 2007 and October 2012 at our tertiary referral institution. Study exclusion criteria were neoadjuvant androgen deprivation therapy before surgery, previous transurethral surgery, lack of extended (10 or more cores) systematic biopsy, lack of preoperative multiparametric MRI, pathological T0 (vanishing tumor syndrome) and incomplete clinical data or lost to followup upon review. Eventually, 728 patients were included in the final analysis. Median followup from radical prostatectomy was 37.0 months (IQR 28.7–54.4).

Pathological Evaluations and Tumor Localization

All prostatectomy specimens underwent whole mount section processes as previously described.[15] From the review of whole mount tissue sections the dominant location of each tumor was determined. In each case the dominant location was identified at a section level where the tumor had the largest surface area. When tumors were multifocal, the largest index tumor was used. APC was defined as a tumor predominantly (70% or more of tumor surface area) located in the anterior portion of the urethra, PPC was a tumor predominantly located in the posterior portion of the urethra and both-involved was defined as prostate cancer that could not be categorized as APC or PPC (fig. 1). In each specimen the zonal origin of tumor (PZ or TZ) was determined, considering the histological architectural features and location of the index tumor.

MRI Settings and Interpretation

In each patient T2-weighted, diffusion-weighted and dynamic contrast enhanced images were routinely obtained preoperatively. Images were reevaluated according to PI-RADS proposed in 2012 by ESUR (European Society of Urogenital Radiology).[16] Evaluation was performed by expert uroradiologists and examiners were blinded to final pathological results. Overall PI-RADS scores were given for the anterior and the posterior prostate by

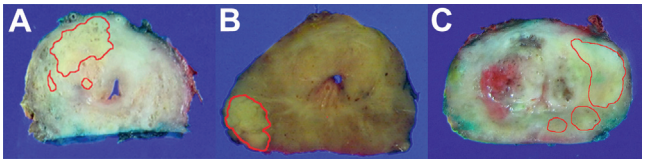

Figure 1. Determining dominant location by pathological evaluation. *A*, APC with 70% or greater of tumor surface area in anterior portion of urethra. *B*, PPC predominantly located in posterior portion of urethra. *C*, both-involved prostate cancer with dominant location not determined because of anterior and posterior tumor involvement.