Prostate Cancer Screening and Detection in Inner-City and Underserved Men

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Context: In the era of serum prostate-specific antigen (PSA) screening, the incidence of prostate cancer has increased dramatically. Simultaneously however, stage migration has occurred, and treatment outcomes have improved. Inner-city men have lower screening rates and, thus, may be diagnosed with more advanced disease that it less likely to be successfully treated.

Objective: To assess the detection rate of prostate cancer and tumor stage at presentation in inner-city men.

Design, Setting, and Patients: A retrospective cohort of 368 men underwent transrectal ultrasound needle-guided biopsy at an inner-city hospital from January 2003 to May 2005. Clinical and pathologic data were collected and analyzed.

Main Outcome Measures: Clinic and hospital records were reviewed for several key outcomes, including prostate cancer incidence, tumor stage and tumor grade.

Results: The median age of the cohort was 67 ± 9.1 years (range, 23–93 years). Prostate cancer was diagnosed in 44% of subjects (161/368). The median PSA level at the time of diagnosis was significantly higher in African-American men than in Caucasian men (9.82 vs. 5.97 ng/mL, P=0.008). Abnormally high serum PSA levels (>20 ng/mL) were present in disproportionately more African-American men than Caucasian men with prostate cancer (32.9% vs. 19.7% P=0.011). African-American men in this inner-city cohort also had a higher incidence of advanced disease or distant metastasis (T3/T4, N1, or M1) than did Caucasians (16.1% vs. 3.8%; P=0.045).

Conclusions: Compared with inner-city Caucasian men, disproportionately more inner-city, African-American men present with advanced prostate cancer. This observation warrants prostate cancer education and consideration of early detection programs in underserved inner-city communities.

Key words: prostate cancer ■ metastasis ■ minorities ■ men's health

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INTRODUCTION

Despite recent advances in diagnosis, staging and treatment, prostate cancer remains the second most common cause of cancer-related death in American men older than 45 years.[1] African-American men suffer disproportionately from the disease, having a 50% higher incidence and a two-fold greater mortality than do Caucasian men.[2] This disparity has been variously attributed to: 1) biologically more aggressive tumors, 2) diagnosis at a higher stage, 3) lack of healthcare access, 4) cultural factors, and 5) less aggressive therapy.[3] In Florida, between 1990–1996, prostate cancer incidence rose from 120.69/100,000 to 162.21/100,000, an increase of 22%. Consistent with national trends, African-American men in Florida had the highest age-adjusted prostate cancer mortality rate (52.1/100,000 men). This is more than twice that of Caucasian men (20.08/100,000 men).[4]

More alarming are the death rates of men with prostate cancer in Duval County, FL, which are significantly higher than the U.S. mean.[5] As previous investigators have demonstrated, inner-city men are less likely to undergo prostate cancer screening due to a variety of factors, including lack of education and access to the healthcare system.[6-9] One study has shown that prostate screening programs appear to be effective when utilized irregardless of the patient's socioeconomic background.[10] Recent series among men undergoing early prostate cancer detection have demonstrated decreasing serum PSA (i.e., PSA migration) and stage migration (decreasing serum PSA and decreasing clinical stage over time, respectively, at the time of diagnosis).[11] Conversely, inner-city males (particularly African Americans) have

lower prostate cancer screening rates, and this has been associated with higher serum PSA levels, more advanced tumors and higher Gleason scores at presentation.[2,12] We hypothesized that inner-city men presenting for prostate biopsy at our center would have higher rates of cancer and present with more advanced and aggressive cancers. We tested this hypothesis by characterizing the clinical and pathologic features of men undergoing prostate biopsy for abnormal screening tests at an inner-city hospital.

METHODS

Study Population

Shands Jacksonville is a 696-bed tertiary-care teaching hospital serving Duval County, FL (population 817,480) and northeast Florida. The current study included 373 consecutive men who underwent a transrectal ultrasound needle-guided biopsy of the prostate between January 2003 and May 2005 at Shands Jacksonville after an abnormal digital rectal examination, an elevated PSA test result (>4.0 ng/mL) or both. Patients identified themselves as Caucasian (205, 52%), African-American (163, 41.6%), Hispanic (19, 4.8%) or Asian (5, 1.3%). Because of the small number of Hispanics and Asians, these two groups were excluded from this study. Furthermore, of these 368 men, 9% presented to the emergency room with severe voiding symptoms, hematuria or bony pain which prompted evaluation of serum PSA or digital rectal examination. Only 47% of the 368 men were asymptomatic and had routine PSA testing by their local physician. After institutional review board approval, patients were identified through a database search, and the medical records were reviewed for pertinent clinical and financial (i.e., payor status) information.

Pretreatment evaluations included medical history; physical examination, including height, weight and digital rectal examination; and measurement of free and total PSA levels (Abbott Laboratories, Abbott Park, IL). Body mass index (BMI) was calculated by dividing weight (kg) by height (m^2).

Table 1. Payor status of 368 men undergoing transrectal ultrasound needle-guided biopsy of prostate at inner-city tertiary care center

Payor	Number of Men (%)
Commercial insurance	36 (9.8%)
Medicare	230 (62.5%)
Medicaid	22 (6.0%)
Other governmental insurance	46 (12.5%)
Uninsured	34 (9.2%)

Transrectal Ultrasonography and Prostate Biopsy

A 7.5-MHz transrectal probe (B-K Medical Systems Inc., Wilmington, MA) was introduced into the rectum. Transverse and sagittal images were obtained. Three-dimensional volume was calculated by multiplying the prostate gland's height (cm) by width (cm) by depth (cm) and dividing by 0.51. Prostate-specific antigen density (PSAD) was calculated by dividing serum PSA level by prostate weight (g); a PSAD ≤0.2 ng/mL/g is considered normal.[13] Specific ultrasonographic findings were not categorized since each patient underwent an extended biopsy (≥10 cores) regardless of the ultrasonographic appearance of the prostate. Biopsies were obtained transrectally by utilizing an 18-gauge spring loaded biopsy gun.

Tumor Grading and Staging

Biopsy specimens were graded histologically according to the Gleason grading system.[14] When applicable, the presence of prostatic intraepithelial neoplasia (PIN) and atypia were noted. Tumors were staged by either bone scan or computed tomography, according to the preference of the treating urologist. The 2002 Tumor-Node-Metastasis (TNM) staging system was used for clinical staging.[15]

Outcome Assessment

Clinic and hospital records were reviewed for several key outcomes, including prostate cancer incidence, tumor stage and tumor grade.

Statistical Analysis

The two subgroups of patients were compared statistically in terms of demographic features (age, race) and clinical features (height, weight, digital rectal examination result, serum PSA level, transrectal ultrasound volume, PSAD, free/total PSA ratio). Differences in distribution of demographic, clinical and pathologic variables among the three subgroups of patients were evaluated using the Pearson's Chi-squared test with $p<0.05$ considered statistically significant. Statistical analyses were performed using SAS (Cary, NC).

RESULTS

Three-hundred-sixty-eight men with an abnormal digital rectal examination, elevated serum PSA level or both were evaluated for prostate cancer. Only 36 patients (9.8%) of the patients had commercial insurance (Table 1), indicative of a hospital serving an inner-city community. Demographic, clinical and pathologic characteristics of the study cohort are presented in Table 2. Age at presentation (median 67 ± 9.3 years; range 23–93 years) was similar across

all ethnic groups. Prostate cancer was diagnosed in 161 of 368 men (44%). Of these, 79 (49%) were Caucasian, 81 (50%) were African-American. Payor status and higher BMI were not associated with prostate cancer (P=0.214, 0.189, respectively). A high proportion of men with prostate cancer presented after an abnormal digital rectal examination: 37.8% of African Americans and 50% of Caucasians. The median PSA level at the time of prostate cancer diagnosis was significantly higher in African-American than in Caucasian men (9.82 vs. 5.97 ng/mL, respectively, P=0.006). The mean prostate volume was similar in ethnic groups (P=0.235) (Table 2). The rates of high-grade PIN or atypia were also similar across ethnic groups (P=0.301) (Table 2).

African-American men *with* prostate cancer generally had more adverse prognostic indicators (Table 2). The mean PSAD was significantly greater in African Americans than in Caucasians (0.37 vs. 0.24, respectively, P=0.006), and the mean free/total PSA ratio was significantly lower (10.5% vs. 17%; P=0.003). Disproportionately more African Americans than Caucasians had an abnormally high serum PSA level (>20 ng/mL) at presentation (32.9% vs. 19.7%; P=0.011), a higher median Gleason score on biopsy (7 vs. 6; P=0.431) and a Gleason score >7 on biopsy (35% vs. 25%; P=0.023). African-American men also had a higher incidence of advanced disease or distant metastasis (i.e., combined categories T3/T4, N1 or M1) than did Caucasians (16.1% vs. 3.8%; P=0.045) (Table 3). Overall, a substantial percentage of men in our cohort (14%) presented with advanced disease (Table 3).

Comments

Although prostate cancer remains the second most commonly diagnosed cancer and the second most common cause of cancer deaths in American men over age 45,[1] prostate cancer mortality rates here in the United States have been steadily declining over the past 10 years.[1] However, the prostate cancer mortality rate in Duval County, FL, is significantly above the U.S. mean and increasing.[7] Overall, prostate cancer was diagnosed in 44% of men in our study cohort who underwent prostate biopsy after an abnormal digital rectal examination, an elevated serum PSA level >4 ng/mL or both. This handily exceeds the rates of 22–32% reported in previous studies. It should be noted that there were differ-

Table 2. Demographic, clinical and pathologic characteristics of study cohort

	Caucasians			African Americans		
Characteristic	**Benign (n=121)**	**Cancer (n=80)**	**All (n=201)**	**Benign (n=86)**	**Cancer (n=81)**	**All (n=167)**
Median age, years (range)	66 (23–81)	69 (48–88)	68 (23–88)	66 (42–83)	66† (49–93)	66‡ (42–93)
Median BMI (range)	29.1 (20.3–47.1)	27.7 (21–41.4)	28.6 (20.3–47.1)	28.2 (21.3–43.4)	28.8 (20.5–44.3)	28.8 (20.5–44.3)
Median PSA, ng/mL (range)	4.05 (0.25–93.73)	5.97 (0.40–5000)	4.90 (0.25–5000)	4.71 (0.01–28.86)	9.82† (2.1–5000)	6.00‡ (0.01–5000)
Median free PSA, ng/mL (range)	0.61 (0.06–6.14)	0.92 (0.13–289.3)	0.86 (0.06–289.3)	0.84 (0.16–3.76)	0.76† (0.22–47.11)	0.79 (0.16–47.11)
Median free/total PSA, % (range)	26.05 (6.6–60.1)	17.0 (2.7–41.1)	19.9 (2.7–60.1)	18.7* (5.1–50.4)	10.45† (4.3–22.1)	14.35‡ (4.3–50.4)
Median prostate volume§ (range)	29.1 (9.3–165.8)	24.3 (8.9–165.8)	26.8 (8.9–165.8)	32.4 (10.2–158.3)	24.15 (5.7–208.6)	27.65 (5.7–208.6)
Median PSAD (range)	0.103 (0.01–1.29)	0.24 (0.013–59.07)	0.144 (0.01–59.07)	0.125* (0.001–1.28)	0.365† (0.091–29.41)	0.211‡ (0.001–29.41)
Median Gleason score	6 (5–10)			7 (3–10)		
Presence of atypia	3.98%			3.09%		
Presence of PIN	1.49%			1.85%		

BMI: body mass index; PSA: prostate-specific antigen; PSAD: prostate-specific antigen density; PIN: prostatic intraepithelial neoplasia; * P<0.05, compared with Caucasians having benign tumors; † P<0.05, compared with Caucasians having prostate cancer; ‡ P<0.05, compared with all Caucasians; § Prostate volume = (height [cm] x width [cm] x depth [cm] ÷ 0.51

Table 3. Tumor stage at presentation by ethnicity

	Caucasians			African Americans			All	
Stage	**No.**	**% Race**	**% Overall**	**No.**	**% Race**	**% Overall**	**No.**	**% Overall**
T								
T1c	42	52.5%	25.15%	47	58.0%	28.14%	89	55.3%
T2	30	37.5%	17.96%	25	30.9%	14.97%	55	34.2%
T3	7	8.75%	4.19%	7	8.6%	4.19%	14	8.7%
T4	1	1.25%	0.6%	2	2.5%	1.20%	3	1.9%
N								
N1	1	1.27%	0.6%	3	3.7%	1.8%	4	2.5%
N0	0	0%	0%	0	0%	0%	0	0%
Nx	78	98.7%	46.99%	78	96.3%	47.0%	156	97.5%
M								
M1	3	3.8%	1.9%	13*	16.1%	8.13%	16	10%
Mx	76	96.2%	47.5%	68	84%	42.5%	144	90%

* P<0.05, compared with Caucasians

ences in the study populations of these previous studies and our own.[16-18] Of note, a disproportionate number of inner-city, African-American men (16.1% vs. 3.8% of Caucasians) had their cancers diagnosed only after their tumors were well advanced and aggressive. Data from this study support the hypothesis that increased prostate cancer mortality in Duval County is related in part to advanced stage at presentation as approximately 13% of inner-city men with prostate cancer had metastatic disease at presentation.

To our knowledge, this is the first report on the incidence of prostate cancer, serum PSA level, clinical stage and Gleason score in men (and especially African-American men) presenting with symptoms of prostate cancer at an inner-city hospital. Our results are in line with results presented by Powell and others that inner-city, African-American men presented with more advanced disease.[10] Forty-seven percent of our patient cohort were African-American men, a population known to present with higher serum PSA levels, higher Gleason scores and higher clinical-stage tumors.[2,12,19,20] Previous reports have commented on the high rate of adverse prognostic features at presentation in men of other minorities as well.[2,12] However, because the numbers of Hispanics and Asians in our study were so low, we cannot say with certainty whether this was also true in our study population and, thus, these groups should be evaluated.

Reports from institutes with large prostate cancer screening programs have clearly documented clinical stage migration[21-23] (i.e., more patients presenting with lower-stage disease) and, more recently, PSA migration[12,23] (i.e., more prostate cancer patients presenting with lower PSA values) over the past 20 years. Both migrations are thought to be due to aggressive prostate cancer screening. In the late 1980s, approximately 27% of men presented with palpable prostate cancer. Fifteen years later, only 17% of men presented with palpable disease, with a median serum PSA of 9.3 ng/mL.[24] These figures are not congruent with our data, which show that 45% of inner-city men with prostate cancer presented with palpable disease and a median serum PSA 10.8 ng/mL. The data demonstrate that inner-city men present with more advanced and more aggressive prostate cancers and thus have a poorer prognosis. The inner-city population is somehow not receiving the message about aggressive screening and treatment of potentially life-threatening prostate cancers.

Prostate cancer screening is controversial, even though recent data suggest that screening and treatment improve survival.[1] Since the advent of PSA screening in the late 1980s, prostate cancer mortality in the United States has been steadily decreasing.[1,25] In the Olmstead County (Minnesota) study, routine prostate cancer screening decreased the incidence of prostate cancer over time from 45% to 25%.[25] Similarly, in two large European studies, survival improved in men who underwent prostate cancer screening and treatment, but not in men who did not.[26,27] Together, these findings clearly suggest that prostate cancer screening programs can significantly increase the detection of treatable cancers and thus decrease mortality. They also argue strongly for proactive education and screening of underserved men who are at risk for more advanced disease and prostate cancer death. Indeed, in our entire cohort of men with prostate cancer, approximately 22.6% had tumors of clinical stage T3 or higher, 29.2% had a Gleason scores of >7 and 42% had serum PSA levels of >10 ng/mL.

Our present findings strongly suggest that, despite two decades of increasing emphasis on prostate cancer screening and detection in the United States, such programs may not be reaching or having the desired effect on underserved inner-city populations. Clearly, there is a disparity in prostate cancer screening and detection among men of differing social strata. This is supported by Vijayakumar and others who found that socioeconomic differences are directly responsible for some differences noted in prostate cancer prevalence and stage.[28] This is especially worrisome at a time when the underserved (especially African Americans) stand to benefit the most from such programs. Underserved men in Duval County exhibited higher rates of prostate cancer and presented with a higher rate of palpable disease. The African-American cohort among this group exhibited higher-stage, higher-grade and prognostically more adverse tumors. One way to rectify this disparity is to establish in underserved inner-city communities across the United States large-scale and innovative screening programs to educate men about prostate cancer, screen them for the disease and assist them in obtaining follow-up care. This is substantiated by the fact that early-stage prostate cancer treated appropriately results in equal outcomes.[29-35]

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