Prostate Needle Biopsy Outcomes in the Era of the U.S. Preventive Services Task Force Recommendation against Prostate Specific Antigen Based Screening

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Abbreviations and Acronyms

AUA = American Urological Association

AUASS = AUA symptom score

CAPRA = Cancer of the Prostate Risk Assessment

PCa = prostate cancer

PCP = primary care physician

PNB = prostate needle biopsies

PSA = prostate specific antigen

USPSTF = U.S. Preventive Services Task Force

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Purpose: We determined whether the characteristics of patients undergoing prostate needle biopsies and prostate needle biopsy results changed after the U.S. Preventive Services Task Force recommendation in 2012 against prostate specific antigen based screening for prostate cancer for men of any age.

Materials and Methods: A prospective database of patients undergoing prostate needle biopsies at Virginia Mason from 2004 to 2014 was reviewed. Welch's t-test and chi-square tests were used to compare patients seen before to those seen after the USPSTF recommendation. Relative risks and corresponding confidence intervals were estimated by general linear regression.

Results: Patients in the post-USPSTF group (310) had a higher prostate specific antigen ($p < 0.001$), were more likely to be diagnosed with higher clinical stage (2b, $p=0.003$; 2c-3a, $p=0.027$) and D'Amico high risk prostate cancer ($p=0.036$), with an adjusted relative risk for high risk prostate cancer of 1.25 (95% CI 1.02−1.52) compared to those in the pre-USPSTF group (1,416). Limiting the pre-USPSTF group to the 30 months before the draft guidelines (448 patients) yielded similar results. The absolute number of biopsies performed decreased by 31%, with the majority of the decrease occurring in the detection of intermediate risk tumors.

Conclusions: In the 2 and a half years after the USPSTF recommendation against prostate specific antigen based screening, patients undergoing prostate needle biopsies were significantly more likely to be diagnosed with high risk disease. However, a reduction in the number of prostate needle biopsies performed occurred concomitantly with a decrease in the detection of intermediate risk, potentially curable prostate cancer. Future focus on informed application of screening techniques may prevent the reversal of decades of improvement in the prostate cancer mortality rate.

Key Words: prostatic neoplasms; prostate-specific antigen; early detection of cancer; government agencies; biopsy, needle

The U.S. Preventive Services Task Force issued a draft recommendation on October 7, 2011 against PSA based screening for prostate cancer for men of any age. On May 21, 2012 PSA based PCa screening received a final level D assessment from the USPSTF, suggesting that such screening causes harm to patients and should not be performed.[1] Their recommendation

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against PSA based screening was highly controversial, with many suggesting that evidence regarding the benefits and harms of testing had been misinterpreted.[2–5]

Central to the USPSTF recommendation were 2 landmark studies with conflicting results. The first was the U.S. Prostate, Lung, Colorectal, and Ovarian Cancer Screening Trial,[6,7] which concluded PSA screening did not result in fewer deaths due to PCa. In that study 76,685 men were randomly assigned to annual screening or "usual care," which sometimes included opportunistic screening. After 13 years of followup the incidence of death per 10,000 person-years was 3.7 (50 deaths) in the screening group and 3.4 (44 deaths) in the control group (RR 1.09, 95% CI 0.87−1.36). The authors concluded that there was no benefit to organized screening over opportunistic screening. However, almost half of the men in the nonscreened arm had undergone prior PSA based screening, resulting in "contamination"[8] and limiting the generalizability of the study results. In contrast, the second study, the European Randomized Study of Screening for Prostate Cancer, included 182,000 men between the ages of 55 and 74 years from 7 European countries, and revealed a 20% reduction in mortality from PCa in screened men compared to standard diagnosis.[9,10]

In the year after the USPSTF recommendation the AUA released recommendations suggesting that in a setting of shared decision making, men 55 to 69 years old should consider PSA based PCa screening. The AUA recommended against routine screening in men younger than 40 and older than 69 years, and concluded that there was insufficient evidence to recommend screening for men 40 to 54 years old. Despite the AUA guidelines the impact of the USPSTF recommendation was soon evident. The volume of patients seen in consultation for abnormal PSA findings decreased, particularly at institutions with widespread adherence to USPSTF recommendations.[11,12] The consequences of such a decrease may result in otherwise avoidable deaths due to PCa.[13] In this study we elucidate whether the characteristics of patients undergoing prostate needle biopsies and the PNB results changed at our center after the USPSTF recommendations.

METHODS

Patients

A retrospective cohort study with a historical control group was performed using data collected prospectively in an institutional review board approved database of patients undergoing transrectal ultrasound guided prostate needle biopsy. Patient demographics and biopsy characteristics were included for the first recorded PNB for each patient performed between September 10, 2004 and November 10, 2014. All PNBs included were performed by 1 of 2 attending urologists (JMC or CRP). Since 2006 a team of Virginia Mason pathologists led by a dedicated genitourinary pathologist reviewed all PNB specimens. PSA was categorized based on CAPRA score criteria[14] as patients with a PSA of 6.00 ng/ml or less, 6.01 to 10.00 ng/ml, 10.01 to 20.00 ng/ml, 20.01 to 30.00 ng/ml or greater than 30.00 ng/ml. Exclusion criteria were previous PCa diagnosis, no prior PSA test result, PNB performed during the USPSTF comment period (October 8, 2011 to May 24, 2012) and PNB with fewer than 10 biopsy cores. D'Amico risk[15] and CAPRA score were determined using previously published criteria.

Patient demographics, AUASS[16] and biopsy characteristics were compared between patients who underwent PNB in the 86 months before the USPSTF draft recommendation (September 10, 2004 to October 7, 2011, the pre-USPSTF group) and those who underwent PNB in the 30 months after the publication of the final recommendation (May 25, 2012 to November 10, 2014, the post-USPSTF group). To minimize potential confounding due to unrelated changes over time, a subset of the pre-USPSTF group selected from a period with comparable duration (April 7, 2009 to October 7, 2011, immediately pre-USPSTF group) was compared to the post-USPSTF group.

Statistical Analyses

Age (censored at 90 years), age category, AUASS ($\log_{10}$ transformed), clinical stage, PSA ($\log_{10}$ transformed), PSA category, Gleason category, D'Amico risk category and CAPRA score category were compared between groups

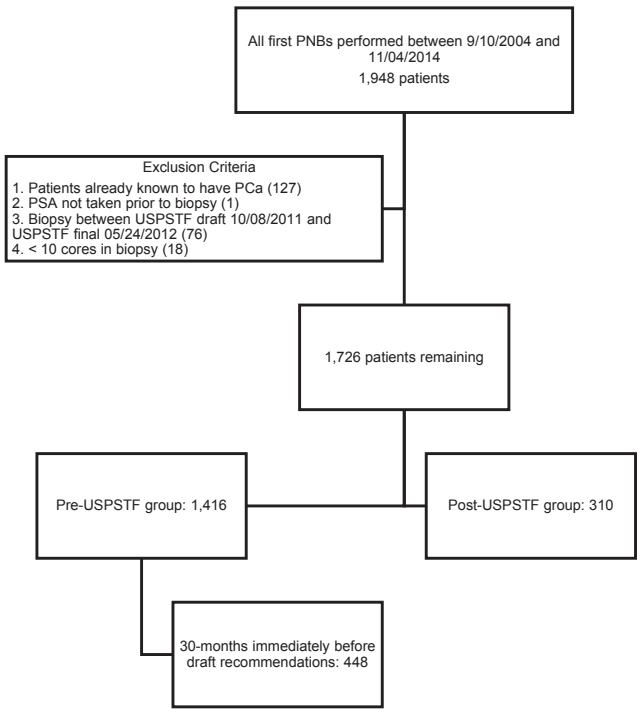

Figure 1. Patient inclusion and exclusion criteria

using univariate models. Hypothesis testing was by Welch's t-test or the chi-square test for univariate unadjusted comparisons as appropriate, with corresponding multivariate linear and logistic regression models adjusting for potential confounding factors. PNB date and provider were evaluated for confounding potential, with a threshold of $p < 0.10$ for inclusion in the multivariate adjusted model. Associations between time period and outcomes were considered statistically significant at $p < 0.05$.

Absolute risk differences and relative risks were estimated for dichotomous variables of cancer vs no cancer, Gleason score 4+3 or greater vs Gleason 3+4 or less (including no cancer), and D'Amico and CAPRA high risk cancer vs intermediate and low risk cancer. The confidence intervals for absolute risk differences were determined by Welch's t-test. The confidence intervals for relative risks were determined by a generalized linear model with a log-link and a sandwich variance estimator. All analyses were performed using R version 3.1.0.[17]

RESULTS

Of the 1,948 patients who underwent their first PNB at Virginia Mason between September 10, 2004 and November 4, 2014, a total of 1,726 met the inclusion criteria (fig. 1). Of these patients 1,416 underwent PNB before the USPSTF draft recommendation and 310 underwent PNB after publication of the final USPSTF recpommendation. The post-USPSTF group had a higher median PSA ($p < 0.001$), was significantly less likely to have a PSA of 6 ng/ml or less ($p < 0.001$), and was significantly more likely to have a PSA between 6.1 and 10 ng/ml ($p=0.019$) or 10.1 and 20 ng/ml ($p=0.002$) than the pre-USPSTF group (table 1). The post-USPSTF group was significantly less likely to be less than 50 years old ($p=0.038$). Patients were more likely to be diagnosed with Gleason 8-10 PCa (unadjusted $p=0.027$) in the post-USPSTF group, although these changes only

Table 1. *Comparison of patient characteristics and PNB results in the 86 months before and 30 months after the USPSTF recommendation*

	Before USPSTF (86 mos)	After USPSTF (30 mos)	p Value (unadjusted)	p Value (adjusted)*
No. pts	1,416	310		
Median demographic (IQR):				
Age	62 (57, 68)	64 (58, 69)	0.19	0.098
PSA (ng/ml)	4.7 (3.6, 6.4)	5.5 (4.2, 8.1)	<0.001	<0.001
AUASS	7 (3, 12)	7 (3, 14)	0.86	0.87
No. pt age (%):				
Less than 50	78 (6)	6 (2)	0.005	0.038†
50—74	1,221 (86)	285 (92)	0.008	0.073
75 or Greater	117 (8)	19 (6)	0.25	0.60
No. ng/ml PSA (%):				
6 or Less	1,010 (71)	176 (57)	<0.001	<0.001
6.01—10	271 (19)	82 (26)	0.005	0.019†
10.01—20	103 (7)	39 (13)	0.003	0.002
20.01—30	13 (1)	7 (2)	0.071	0.10
Greater than 30	19 (1)	6 (2)	0.43	0.41
No. biopsy result no Ca (%)	807 (57)	151 (49)	0.009	0.061
No. % biopsy cores pos for Ca (%):‡				
Less than 34	224 (18)	87 (29)	<0.001	0.001
34 or Greater	219 (18)	63 (21)	0.20	0.69
No. Gleason grade (%):				
6	289 (20)	76 (25)	0.13	0.26
7 (3+4)	154 (11)	39 (13)	0.45	0.55
7 (4+3)	66 (5)	10 (3)	0.34	0.32
8—10	100 (7)	34 (11)	0.027	0.088
No. clinical stage (%):‡				
T1-2a	495 (35)	106 (34)	0.93	0.45
2b	16 (1)	11 (4)	0.003	0.001
2c-3a	73 (5)	26 (8)	0.025	0.027†
No. D'Amico group (%):§				
Low	228 (37)	50 (31)	0.19	0.15
Intermediate	155 (25)	36 (23)	0.53	0.44
High	226 (37)	73 (46)	0.053	0.036†
No. CAPRA score (%):§				
0—2 (low risk)	310 (51)	77 (48)	0.64	0.62
3—5 (intermediate risk)	186 (31)	43 (27)	0.45	0.43
6—10 (high risk)	113 (19)	39 (25)	0.12	0.13

* Adjusted for provider.
† No longer statistically significant after correction for multiple comparisons by the Bonferroni method.
‡ Percentages reflect missing data.
§ D'Amico risk category counts and percentages restricted to patients with cancer.

tended toward statistical significance after adjustment (p=0.088). These patients were also significantly more likely to be diagnosed with clinical stage 2b (p=0.001) or stage 2c-3a PCa (p=0.027). Finally, among those with cancer, patients in the post-USPSTF group were significantly more likely to be diagnosed with D'Amico high risk PCa (p=0.036).

Similar results were found when the post-USPSTF group (310) was compared to a subset of the pre-USPSTF group selected from period of comparable duration (448, 30 months pre-USPSTF group, table 2). The post-USPSTF group was significantly older (p=0.042), had a higher median PSA (p=0.002), remained significantly less likely to have a PSA of 6.0 ng/ml or less (p <0.001) and more likely to have a PSA of 10.1 to 20 ng/ml (p=0.006). In addition, the post-USPSTF group was significantly more likely to be diagnosed with clinical stage 2b (p=0.012) or stage 2c-3a PCa (p=0.017). Among those with cancer, patients in the post-USPSTF group were significantly less likely to be diagnosed with D'Amico intermediate risk PCa and significantly more likely to be diagnosed with D'Amico high risk PCa (p=0.042 and p=0.027, respectively). Similar trends were found using CAPRA score based categories, although the changes did not reach statistical significance (p=0.10 and p=0.093, respectively).

After the release of the USPSTF recommendation the absolute number of biopsies performed decreased by 31% (448 to 310 per 30 months) (table 2). The absolute number of biopsies revealing high risk disease did not decrease (Gleason 8-10—106%, D'Amico intermediate risk—100%, CAPRA scores 6-10—105%). While the number of potentially unnecessary biopsies performed was reduced (no PCa—36%, Gleason 6—15%, D'Amico

Table 2. *Comparison of patient characteristics and PNB results in the 30 months immediately before and the 30 months after the USPSTF recommendation*

	Immediately Before USPSTF (30 mos)		After USPSTF (30 mos)		p Value (unadjusted)	p Value (adjusted)*
No. pts	448		310			
Median demographic (IQR):						
Age	62	(57, 68)	64	(58, 69)	0.078	0.042
PSA (ng/ml)	4.9	(3.9, 6.5)	5.5	(4.2, 8.1)	<0.001	0.002
AUASS	7	(3, 13)	7	(3, 14)	0.57	0.73
No. pt age (%):						
Less than 50	16	(4)	6	(2)	0.27	0.41
50—74	405	(90)	285	(92)	0.55	0.99
75 or Greater	27	(6)	19	(6)	>0.99	0.57
No. ng/ml PSA (%):						
6 or Less	312	(70)	176	(57)	<0.001	<0.001
6.01—10	93	(21)	82	(26)	0.082	0.14
10.01—20	32	(7)	39	(13)	0.016	0.006
20.01—30	3	(1)	7	(2)	0.10	0.072
Greater than 30	8	(2)	6	(2)	>0.99	0.85
No. biopsy result no Ca (%)	236	(53)	151	(49)	0.32	0.51
No. % biopsy cores pos for Ca (%):†						
Less than 34	87	(22)	87	(29)	0.031	0.066
34 or Greater	81	(20)	63	(21)	0.85	0.90
No. Gleason grade (%):						
6	89	(20)	76	(25)	0.15	0.18
7 (3+4)	64	(14)	39	(13)	0.57	0.37
7 (4+3)	27	(6)	10	(3)	0.11	0.12
8—10	32	(7)	34	(11)	0.088	0.14
No. clinical stage (%):†						
T1-2a	182	(41)	106	(34)	0.18	0.056
2b	5	(1)	11	(4)	0.021	0.012
2c-3a	18	(4)	26	(8)	0.012	0.017‡
No. D'Amico group (%):§						
Low	71	(33)	50	(31)	0.76	0.72
Intermediate	68	(32)	36	(23)	0.059	0.042‡
High	73	(34)	73	(46)	0.033	0.027‡
No. CAPRA score (%):§						
0—2 (low risk)	101	(48)	77	(48)	0.96	0.87
3—5 (intermediate risk)	74	(35)	43	(27)	0.13	0.10
6—10 (high risk)	37	(17)	39	(25)	0.12	0.093

* Adjusted for provider.
† Percentages reflect missing data.
‡ No longer statistically significant after correction for multiple comparisons by the Bonferroni method.
§ Category counts and percentages restricted to patients with cancer.

low risk— 30%, CAPRA scores 0-2—24%), the majority of the decrease in the absolute number of PNBs performed occurred in the detection of intermediate risk tumors (Gleason 4+3—63%, D'Amico intermediate risk—47%, CAPRA scores 3-5—42%).

To determine whether the changes observed after the release of the USPSTF recommendation were also occurring before the recommendations, we subdivided the 86 month pre-USPSTF group into the 30 months immediately before the draft guidelines (448, immediately pre-USPSTF group) and the preceding 56 months (968, early pre-USPSTF group) (table 3). There was a significant increase in the proportion of patients age 50 to 74 (p=0.008) in the immediately pre-USPSTF group. In addition, patients were significantly more likely to be diagnosed with Gleason 3+4 disease (p=0.007) and clinical stage T1-2a disease (p=0.009), and patients with cancer were significantly more likely be diagnosed with D'Amico intermediate risk PCa (p=0.009).

Compared to patients who underwent PNB before the USPSTF recommendation, those who underwent PNB after the recommendation had an adjusted absolute risk difference of 9.30% (95% CI 0.64−17.98) and an adjusted relative risk of 1.25 (95% CI 1.01−1.52) for D'Amico high risk PCa (table 4). Limiting the pre-USPSTF group to the 30 months before the draft guidelines (448) yielded similar results, with an adjusted absolute risk difference of 11.55% (95% CI 1.35−21.75) and an adjusted RR of 1.33 (95% CI 1.03−1.72) for D'Amico high risk PCa. No significant adjusted absolute risk differences or adjusted relative risks were found for the frequency of cancer, high grade PCa or high risk PCa between the early pre-USPSTF group and the immediately pre-USPSTF group (data not shown).

Table 3. *Comparison of patient characteristics and PNB results in the earliest 56 months in the pre-USPSTF cohort and the 30 months immediately before the USPSTF recommendation*

	Early Pre-USPSTF (56 mos)	Immediately Pre-USPSTF (30 mos)	p Value (unadjusted)	p Value (adjusted)*
No. pts	968	448		
Median demographic (IQR):				
Age	63 (57, 69)	62 (57, 68)	0.26	0.35
PSA (ng/ml)	4.7 (3.3, 6.4)	4.9 (3.9, 6.5)	0.008	0.066
AUASS	7 (3, 12)	7 (3, 13)	0.42	0.44
No. pt age (%):				
Less than 50	62 (6)	16 (4)	0.041	0.065
50—74	816 (84)	405 (90)	0.003	0.008
75 or Greater	90 (9)	27 (6)	0.048	0.072
No. ng/ml PSA (%):				
6 or Less	698 (72)	312 (70)	0.37	0.56
6.01—10	178 (18)	93 (21)	0.33	0.48
10.01—20	71 (7)	32 (7)	0.98	0.81
20.01—30	10 (1)	3 (1)	0.77	0.43
Greater than 30	11 (1)	8 (2)	0.33	0.29
No. biopsy result no Ca (%)	571 (59)	236 (53)	0.030	0.063
No. % biopsy cores pos for Ca (%):†				
Less than 34	137 (16)	87 (22)	0.026	0.10
34 or Greater	138 (16)	81 (20)	0.12	0.32
No. Gleason grade (%):				
6	200 (21)	89 (20)	0.78	0.57
7 (3+4)	90 (9)	64 (14)	0.007	0.007‡
7 (4+3)	39 (4)	27 (6)	0.13	0.10
8—10	68 (7)	32 (7)	>0.99	0.86
No. clinical stage (%):†				
T1-2a	313 (32)	182 (41)	0.003	0.009
2b	11 (1)	5 (1)	>0.99	0.89
2c-3a	55 (6)	18 (4)	0.23	0.18
No. D'Amico group (%):§				
Low	157 (40)	71 (33)	0.17	0.15
Intermediate	87 (22)	68 (32)	0.008	0.009
High	153 (39)	73 (34)	0.36	0.36
No. CAPRA score (%):§				
0—2 (low risk)	209 (53)	101 (48)	0.28	0.27
3—5 (intermediate risk)	112 (28)	74 (35)	0.11	0.083
6—10 (high risk)	76 (19)	37 (17)	0.69	0.52

* Adjusted for provider.
† Percentages reflect missing data.
‡ No longer statistically significant after correction for multiple comparisons by the Bonferroni method.
§ Category counts and percentages restricted to patients with cancer.

Table 4. *Adjusted risk changes for frequency of PNB results after the USPSTF recommendation*

	Before USPSTF (86 mos) vs After USPSTF		Immediately Before USPSTF (30 mos) vs After USPSTF	
	% Absolute Risk Difference (CI)	Relative Risk (CI)	% Absolute Risk Difference (CI)	Relative Risk (CI)
Ca	5.94 (−0.25, 12.13)	1.13 (0.99, 1.28)	2.46 (−4.87, 9.80)	1.05 (0.91, 1.22)
Gleason 4+3 or greater	1.74 (−2.35, 5.84)	1.14 (0.83, 1.56)	1.74 (−1.88, 5.37)	1.15 (0.86, 1.56)
D'Amico high risk*	9.30 (0.64, 17.98)	1.25 (1.01, 1.52)	11.55 (1.35, 21.75)	1.33 (1.03, 1.72)
CAPRA high risk*	5.50 (−1.60, 12.60)	1.29 (0.92, 1.80)	7.24 (−1.21, 15.69)	1.42 (0.94, 2.15)

Adjusted for provider.
* High risk analysis restricted to patients with cancer.

DISCUSSION

In the 2 and a half years after the USPSTF recommendation against PSA based screening, patients undergoing PNB at our center were significantly more likely to be diagnosed with D'Amico high risk disease and significantly less likely to be diagnosed with intermediate risk disease. This trend was not evident before the release of the draft USPSTF recommendations.

PSA testing has been under scrutiny since its emergence in 1985.[18] Due to PSA based screening, detection rates for PCa increased dramatically through the 1990s. While such screening often detects indolent disease, the PCa mortality rate has decreased sharply.[19] Use of PSA screening is supported by results from the Göteborg trial, which revealed reductions in mortality of almost 50% in 14 years of followup.[20] This 44% relative risk reduction in PCa mortality (95% CI 0.28−0.68, p=0.0002) compares favorably with that of other cancer screening programs. Recently Gulati et al applied 2 models developed by the Cancer Intervention and Surveillance Modeling Network, concluding that continuing to screen men less than 70 years old could prevent half of PCa associated deaths.[13] Similarly Zeliadt et al[21] and Fenner[22] concluded that the impact of the USPSTF recommendation against PSA screening might be a reversal of 3 decades of mortality benefits.

Results from our study support the argument that decreasing PSA screening may result in delayed diagnosis, potentially leading to avoidable cancer deaths. When compared to patients who underwent PNB in the 30 months before the USPSTF recommendation, those who underwent PNB in the 30 months after had a 33% higher relative risk of being diagnosed with high risk PCa. While the absolute number of biopsies revealing high risk disease did not decrease, the reduction in the number of potentially unnecessary biopsies appears to have occurred at the cost of detecting fewer intermediate risk PCa tumors (fig. 2). Thus, the key concern is not only the increased risk of being diagnosed with high risk disease but, more importantly, the missed opportunity to offer curative intervention for patients with intermediate risk PCa.

Our results are supported by a recent study evaluating a large cohort at the University Health Network.[12] The number of total and first time biopsies decreased from a median of 58 per month to 35.5, and the percentage of patients diagnosed with Gleason 8-10 PCa increased. Conversely, Perez et al did not see a difference in the percentage of positive biopsies, D'Amico risk or Gleason grade distribution.[23] Patients in this series were more likely to get PCA3 and repeat PSA tests rather than a prostate biopsy at their initial visit.

While it is possible that the significant increase in high grade PCa diagnosis after the USPSTF recommendation in our study was due to Gleason grade migration,[24] this explanation is unlikely for several reasons. We found no evidence of a trend toward high risk disease before the USPSTF

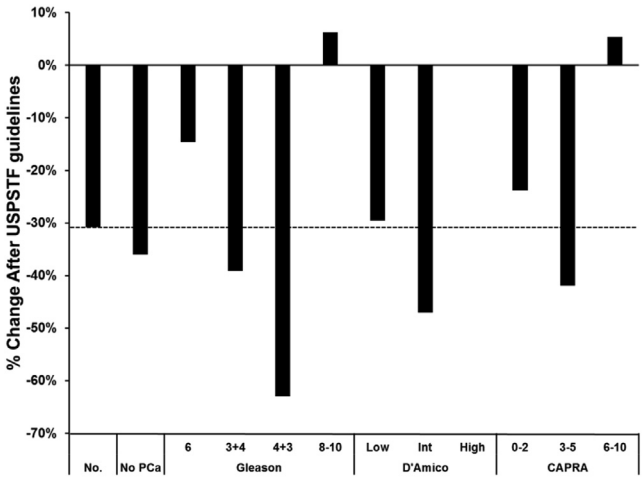

Figure 2. Changes in PNB results after USPSTF recommendation. Percent change was calculated by comparing results in 30 months immediately before (448) and 30 months after (310) USPSTF recommendation (table 2). Absolute number of biopsies performed decreased by 31% (broken black line). Absolute number of biopsies revealing high risk disease did not decrease (Gleason 8-10—106%, D'Amico intermediate risk—100%, CAPRA scores 6-10—105%). However, reduction in number of potentially unnecessary biopsies (no PCa—36%, Gleason 6—15%, D'Amico low risk—30%, CAPRA scores 0-2—24%) appears to have occurred at cost of detecting intermediate risk PCa (Gleason 4+3—63%, D'Amico intermediate risk—47%, CAPRA scores 3-5—42%).

recommendation. In addition, while Gleason grade migration is likely a result of a change in the Gleason grading system in 2005,[25,26] the majority of PNB specimens were reviewed by an expert genitourinary pathologist who was an early adopter of the new Gleason grading system. Finally, the increased finding of high grade disease was also accompanied by significant increases in PSA and age, suggesting a true change in the characteristics of patients undergoing PNBs at our center.

Virginia Mason is an urban multispecialty institute with approximately 500 providers. The majority of the patients in this study were referred from primary care physicians within the institution. Since Virginia Mason PCPs have historically been early adopters of USPSTF recommendations, it is likely that our results are a consequence of the USPSTF recommendation. Specifically the changes we observed may be due to the less frequent referral of patients with lower PSA values or more selective PSA based screening after the USPSTF recommendations. This would potentially result in higher proportions of African-American men and men with a family history.[27,28] Unfortunately our data set was limited in patient demographics so we were unable to assess these differences.

Our study has several limitations. We only have historical PSA information for patients whose PCPs are part of our health care system. However, even in this patient population, of which a segment is likely undergoing ongoing PSA screening, we still see changes after the USPSTF recommendations. Therefore, it is likely that if we excluded patients receiving ongoing PSA screening, these changes would be more pronounced. In addition, as urologists at a tertiary referral center, we collaborate with our PCPs and have presented our perspective on the risk of adherence to USPSTF recommendations. Therefore, our results may be an underestimation compared to other centers. In addition, since this is a single center experience, these results may not be generalizable to other populations. Finally, as this is an observational study, we are unable to determine causality, even with the associated temporal changes.

The importance of this study is not only in the evolution in patient and tumor characteristics seen at PNB, but also the rapidity with which statistically significant changes occurred after the release of the USPSTF recommendations. The goal of PCa screening is to maximize the benefit of screening tools such as PSA while minimizing the harm associated with over diagnosis and overtreatment. Rather than relegating PSA into oblivion, the balanced answer may be best found in the more intelligent use of available tools, the implementation of shared decision making as recommended by the American Cancer Society[29] and the development of more effective screening techniques.

CONCLUSIONS

In the 2 and a half years after the USPSTF recommendation patients undergoing prostate needle biopsies at our institution were significantly more likely to be diagnosed with high risk disease. Furthermore, although the goal of avoiding unnecessary biopsies is laudable, in this series such a reduction occurred concomitantly with a decrease in the detection of intermediate risk, potentially curable PCa. Future focus must be on the informed application of screening techniques to prevent the potential reversal of decades of improvement in the prostate cancer mortality rate.

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