

PSA Density in the diagnosis of prostate cancer in Chinese population — results from the Chinese Prostate Cancer Consortium



Rui Chen

**Department of Urology, Shanghai Changhai Hospital,
Second Military Medical University, Shanghai, China**



Abstract

Purpose: We performed this study to investigate the diagnostic performance of PSAD in a multicenter cohort of Chinese Prostate Cancer Consortium.

Inclusion Population:

5220 outpatients were included from 18 large referral hospitals in China.

Inclusion Criteria:

PSA greater than 4.0 ng ml⁻¹ regardless of DRE results or PSA less than 4.0 ng ml⁻¹ but abnormal DRE results

Results

Table1 Characteristics of the study cohort (n=5220)

<i>Variables</i>	PSA 4.0-10.0 ng ml ⁻¹	PSA 10.1-20.0 ng ml ⁻¹	PSA above 20.0ng ml ⁻¹	All PSA
Age at time of biopsy(year)				
Mean±s.d.	66.4±8.5	68.9±8.5	70.6±8.2	68.4±8.7
Median(IQR)	67.0(61.0-73.0)	69.0(69.0-70.0)	71.0(71.0-72.0)	69.0(63.0-75.0)
PSA at time of biopsy(ng ml ⁻¹)				
Mean±s.d.	7.18±1.64	13.79±2.82	119.85±248.01	43.00±145.61
Median(IQR)	7.20(5.80-8.60)	13.30(11.30-15.90)	41.70(39.30-44.20)	12.00(7.50-24.50)
Prostate Volume(ml)				
Mean±s.d.	51.0±27.2	58.7±33.4	55.5±37.6	54.2±32.7
Median(IQR)	44.2(32.1-63.0)	49.7(33.9-77.0)	44.3(43.5-46.2)	45.0(32.2-68.0)
PSA density				
Mean±s.d.	0.18±0.10	0.33±0.83	2.87±7.98	1.03±4.58
Median(IQR)	0.15(0.11-0.22)	0.27(0.17-0.41)	1.06(0.99-1.12)	0.26(0.14-0.59)
%fPSA				
Mean±s.d.	0.16±0.08	0.15±0.07	0.13±0.09	0.15±0.09
Median(IQR)	0.15(0.11-0.20)	0.14(0.10-0.19)	0.11(0.10-0.11)	0.14(0.09-0.20)
Transrectal ultrasound				
Positive (+)	244 (13.7%)	220 (14.0%)	340 (21.5%)	902 (17.3%)
Negative (-)	1532 (86.3%)	1346 (86.0%)	1241 (78.5%)	4318 (82.7%)

The mean and median PSAD were 1.03 (sd 4.58) and 0.26 (IQR 0.14 - 0.59).

Results

Univariate and multivariate analysis of variables at the time of biopsy in predicting the risk of PCa and HGPCa

Variables	PSA 4-10 ng/ml				All PSA			
	PCa		HGPCa		PCa		HGPCa	
	Odds ratio(95%CI)	P	Odds ratio(95%CI)	P	Odds ratio(95%CI)	P	Odds ratio(95%CI)	P
Age at biopsy(year)								
Univariate analysis	1.05(1.04-1.07)	<0.0001	1.06(1.04-1.08)	<0.0001	1.05(1.05-1.06)	<0.0001	1.05(1.04-1.06)	<0.0001
Multivariate analysis	1.07(1.05-1.08)	<0.0001	1.07(1.05-1.09)	<0.0001	1.06(1.05-1.07)	<0.0001	1.06(1.05-1.06)	<0.0001
PSAD								
Univariate analysis	45.15(15.70-129.83)	<0.0001	25.38(8.19-78.69)	<0.0001	1.15(1.12-1.19)	<0.0001	1.11(1.09-1.14)	<0.0001
Multivariate analysis	52.55(16.42-168.22)	<0.0001	26.05(7.53-90.07)	<0.0001	1.10(1.07-1.14)	<0.0001	1.08(1.05-1.10)	<0.0001
TRUS (Nodule) Positive VS Negative								
Univariate analysis	1.13(0.91-1.41)	0.2728	1.02(0.78-1.33)	0.8907	1.39(1.25-1.54)	<0.0001	1.29(1.16-1.43)	<0.0001
Multivariate analysis	1.06(0.83-1.35)	0.6303	0.93(0.70-1.24)	0.6252	1.38(1.23-1.55)	<0.0001	1.28(1.15-1.43)	0.0002
%fPSA								
Univariate analysis	0.07(0.02-0.30)	0.0003	0.09(0.02-0.48)	0.0049	0.02(0.01-0.05)	<0.0001	0.02(0.01-0.04)	<0.0001
Multivariate analysis	0.07(0.01-0.34)	0.0010	0.07(0.01-0.45)	0.0051	0.02(0.01-0.03)	<0.0001	0.01(0.01-0.03)	<0.0001

In patients with PSA from 4.0-10.0 ng ml⁻¹ and in all patients, PSAD could be an independent predictor of PCa and HGPCa.

Results

The AUCs for PSAD and PSA in predicting risk of PCa

Variables	PSA 4.0-10.0 ng ml ⁻¹		PSA 10-20 ng ml ⁻¹		PSA above 20 ng ml ⁻¹		All PSA	
	PCa	HGPCa	PCa	HGPCa	PCa	HGPCa	PCa	HGPCa
Age	0.620	0.630	0.624	0.606	0.575	0.552	0.626	0.617
PSA	0.526	0.524	0.545	0.556	0.650	0.647	0.700	0.726
PV	0.623	0.625	0.666	0.655	0.58	0.568	0.600	0.588
PSAD	0.627	0.630	0.675	0.668	0.675	0.664	0.744	0.760
TRUS	0.513	0.503	0.528	0.517	0.564	0.543	0.535	0.527
%fPSA	0.563	0.563	0.593	0.600	0.560	0.552	0.612	0.617

The AUCs of PSAD in predicting PCa and HGPCa in men with PSA 4.0-10.0 ng ml⁻¹ were **0.627** and **0.630**, respectively.

However, the AUCs of PSA were **0.526** and **0.524**, respectively.

Results

Diagnostic efficacy of PSAD

cutoff	Sensitivity (95% CI)		Specificity (95% CI)		HGPCa missed	Unnecessary Biopsies avoided
	PCa	HGPCa	PCa	HGPCa		
0.10	88.7(85.4-91.5)	89.9(85.8-93.1)	23.3(21.0-25.6)	22.2(20.1-24.4)	27/296(9.1%)	299/1325(22.6%)
0.11	83.8(80.1-87.1)	84.5(79.8-88.4)	28.5(26.1-31.0)	27.4(25.1-29.7)	45/296(15.2%)	367/1325(27.7%)
0.12	78.7(74.6-82.4)	80.7(75.8-85.1)	35.8(33.2-38.4)	34.7(32.2-37.1)	57/296(19.3%)	462/1325(34.9%)
0.13	73.8(69.5-77.8)	77.0(71.8-81.7)	42.4(39.7-45.1)	41.4(38.8-43.9)	67/296(22.6%)	554/1325(41.8%)
0.14	70.7(66.3-74.9)	74.0(68.6-78.9)	47.0(44.3-49.7)	45.8(43.2-48.4)	75/296(25.3%)	616/1325(46.5%)
0.15	64.8(60.1-69.2)	67.2(61.6-72.5)	52.5(49.8-55.2)	51.2(48.6-53.8)	96/296(32.4%)	688/1325(51.9%)
0.16	61.6 (57.0-66.2)	63.9 (58.1-69.3)	58.6(55.9-61.2)	56.9(54.3-59.4)	104/296(35.1%)	770/1325(58.1%)

The statistically optimal cutoff value of PSAD in our study was **0.16**, with the highest sum of specificity and sensitivity. However, the sensitivity was only **61.6%**.

Results

Diagnostic efficacy of PSAD

cutoff	Sensitivity (95% CI)		Specificity (95% CI)		HGPCa missed	Unnecessary Biopsies avoided
	PCa	HGPCa	PCa	HGPCa		
0.15	64.8(60.1-69.2)	67.2(61.6-72.5)	52.5(49.8-55.2)	51.2(48.6-53.8)	96/296(32.4%)	688/1325(51.9%)
0.16	61.6(57.0-66.2)	63.9(58.1-69.3)	58.6(55.9-61.2)	56.9(54.3-59.4)	104/296(35.1%)	770/1325(58.1%)

In CUA guideline, the cutoff value of **0.15** would detect **64.8%** (293/451 cases) of PCa and **67.2%** (200/296 cases) of HGPCa by performing biopsies in nearly half of the patients (930 cases, 52.3%).

At the same time, a total of 158 cases of PCa and 96 cases (32.4%) of HGPCa will be missed.

Results

The cutoff value of PSAD

cutoff	Sensitivity (95% CI)		Specificity (95% CI)		HGPCa missed	Unnecessary Biopsies avoided
	<u>PCa</u>	<u>HGPCa</u>	<u>PCa</u>	HGPCa		
0.10	88.7(85.4-91.5)	89.9(85.8-93.1)	23.3(21.0-25.6)	22.2(20.1-24.4)	27/296(9.1%)	299/1325(22.6%)

With the PSAD threshold of **0.10**:

1. Nearly all (**89.9%**) of HGPCa could be detected
2. Avoid the biopsies in **19.5 %** of patients (356/1776 cases).

Among these patients avoided biopsies, only 30 (**10.1%**) cases were with HGPCa.

3. In contrast, if the 0.15 cutoff was applied, there would be 96 (**32.4%**) HGPCa patients missed.

Conclusion

1. The diagnostic performance of PSAD was higher than PSA in all PSA ranges.
2. In patients with PSA from 4.0-10.0 ng ml⁻¹, PSAD could be an independent predictor of PCa and HGPCa.
3. We recommend 0.10 as the cutoff value of PSAD, which will get a sensitivity of nearly 90% (88.7% for PCa and 89.9% for HGPCa) in the 5220 cohort for both PCa and HGPCa.