의학석사학위논문

전립선생검을 통한 전립선암 진단에 있어서 비만의 영향분석

Obesity is associated with higher risk of prostate cancer detection in a Korean biopsy population

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지도교수 김수웅

이 논문을 의학석사학위논문으로 제출함

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박주현의 석사학위논문을 인준함

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부위원장 __________ (인)

위 원 __________ (인)

ABSTRACT

Obesity is associated with higher risk of prostate cancer detection in a Korean biopsy population

Juhyun Park

Student Number: 2010-21795

Urology, Department of Medicine, Seoul National University

Objective: To evaluate the impact of obesity on prostate cancer detection, as measured by the body mass index (BMI) in a Korean biopsy population.

Patients and Methods: We retrospectively reviewed the records of 1,213 men who underwent transrectal ultrasound guided prostate biopsy at our institution. Biopsy outcomes were analyzed with respect to various variables, including patient age, prostate-specific antigen (PSA), prostate volume, digital rectal exam (DRE) finding, and obesity defined as BMI ≥ 25 kg/m2 as an Asian BMI category.

Results: Among 1213 men, 408 (33.6%) were obese, and 344(28.4%) had a positive biopsy. Obese men were younger (65.5 vs 67.1 years, $p = 0.003$), had a larger prostate (49.2 vs 42.9 cc, $p < 0.001$), were less likely to have any abnormality on DRE (8.1% vs 15.9% $p < 0.001$). In the multivariate analysis, obesity was significantly associated with a higher risk of detection on prostate cancer in biopsy subjects (OR = 1.446, P = 0.024). Also, obesity was significantly associated with a higher rate of high-grade (Gleason score ≥4 + 3) diseases detected from the biopsy, and this association remained after multivariate adjustment (OR = 1.498, P = 0.039).

Conclusion: Obese men were younger, had a larger prostate, and had less tendency to have an abnormality on DRE. Obesity was associated with a higher risk of prostate cancer detection as an independent factor, including high-grade prostate cancer in a Korean biopsy population.

Keywords: Prostate, Prostatic neoplasms, Biopsy, Obesity, Body mass index

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Introduction

Obesity and health problem

Obesity is a global epidemic of the 21st century. In US, the prevalence of obesity increased to 34.9% and the percentage of overweight adults increased till 58% in2011-2012 [1]. In Asian countries, the prevalence of overweight and obesity have also rapidly increased [2]. According to a global estimate by the World Health Organization (WHO), 35% of the world's adult populations were overweight and 11% were obese in 2008 [3]. It is important because obesity has been associated with an increased risk of several chronic diseases, including type II diabetes, cardiovascular disease, and various types of cancer such as colorectal cancer, postmenopausal breast cancer and endometrial cancer [1, 2].

Obesity and prostate cancer

Unlike other cancers, prostate cancer has been studied extensively in relation to obesity, but the findings remain inconclusive [4, 5]. Especially, many investigators have evaluated the impact of obesity on prostate cancer detection via biopsy, but they did not obtain consistent results [6-11]. Freedland et al. reported several papers about the relationship between obesity and prostate cancer, yet the results were slightly different depending on the research methods and targets used [8-9]. Presti et al. suggested that normal BMI was rather associated with higher prostate cancer detection and less favorable pathological features in a biopsy population [10].

Obesity and prostate cancer in Asia

In Asian countries including Korea, despite the fact that both obesity and prostate cancer are increasing explosively due to a Westernized diet and lifestyle changes [3, 12, 13], the studies about these subjects were less common than in the west, and the reported findings were inconsistent [6, 7, 14, 15]. Masuda et al reported that obesity was related with a higher risk of prostate cancer detection in a Japanese biopsy population [6]. In contrast, Lee et al. published that obesity was associated with lower risk of overall prostate cancer detection and high grade prostate cancer detection in Korean men [7].

So, we investigated the potential effect of obesity on prostate cancer detection among a Korean biopsy population.

Patients and Methods

Study Design and prostate biopsy protocol

We retrospectively reviewed the medical records of patients who underwent initial transrectal ultrasound-guided 12-core prostate biopsy at our clinic between January 2008 and February 2013. Indications for prostate biopsy were a serum PSA level ≥ 4 ng/ml or a positive digital rectal exam performed by urologists for all patients. Patients with a history of a previous biopsy at another institution, surgical treatment of prostatic disease, or incomplete clinical data were excluded from our study. An 18-gauge core biopsy needle and automatic spring loaded biopsy gun were used. Twelve-core biopsies were obtained routinely at the apices, midportions, bases, and peripheral area of both planes. If there were suspicious-appearing lesions on transrectal ultrasound images, additional biopsies were performed. A total of 1,213 patients were included in the analysis.

Clinical parameters and definition of obesity

Age, PSA, BMI, DRE findings, and prostate volume which was calculated from the transrectal ultrasound findings, and the biopsy Gleason sum were analyzed to assess the potential association between obesity and prostate cancer detection. Also, the effect on detection of high-grade cancer (Gleason ≥4 + 3) was analyzed supplementally. We defined obesity as a BMI over 25 kg/m^2, as an Asian BMI category (Table 1)[16]. The BMI was subcategorized as non-obese (less than 25) and obese (greater than 25 kg/m^2). Additionally, a subgroup analysis for age was assessed by decades and the PSA analysis was based on the cut-off level of 10 ng/ml.

Statistical analysis

We used Pearson's Chi-square test, Fisher's exact test, and the linear regression model to describe the relationship between the variables. Multivariate logistic and linear regression analysis was applied to examine the association between obesity and prostate cancer on biopsy, adjusting for age, prostate volume, PSA, and DRE findings. The association with detection of high-grade cancer was similarly evaluated. Statistical significance was considered at $p < 0.05$. All statistical analyses were performed using commercially available software (SPSS 14.0, Chicago, IL, USA).

Results

Patient characteristics

A total of 1,213 patients were included in this study. As shown in Table 2, the mean BMI was 23.9 kg/m^2. Applying the aforementioned Asian BMI categories, patients with obesity were 408 (33.6%) (Fig.1). Prostate cancer was detected from the biopsy in 344 (28.4%) patients, and high-grade (Gleason score ≥4 + 3) prostate cancer was found in 203 (16.7%).

Comparison according to obesity status

Table 3 shows the comparison by BMI category (not obese and obese). Obese men were younger (65.5 vs 67.1 years, $p = 0.003$), had a larger prostate (49.2 vs 42.9 cc, $p < 0.001$), and were less likely to have any abnormality on DRE (8.1 vs 15.9%, $p < 0.001$).

Clinical predictors with prostate cancer detection

In the univariate analysis for overall prostate cancer, obesity was not significantly associated with detection of prostate cancer via biopsy ($p = 0.924$). However, in the multivariate analysis incorporating the variables of patient age, PSA, prostate volume, and DRE findings, obesity was revealed to be significantly associated with a higher risk of prostate cancer detection in our biopsy populations (OR = 1.446, $p = 0.024$).

Similar with the prior result, for high-grade prostate cancer, obesity was not observed to be significantly associated with detection of high-grade disease from the biopsy ($p = 0.593$) in the univariate analysis. But in the multivariate analysis, obesity was observed to be significantly associated with lower odds of high prostate cancer detection via biopsy (OR = 1.498, $p = 0.039$) (Table 4, 5).

Additional subgroup analysis

For evaluation of the effects according to degree of obesity, we divided our biopsy population into 4 groups by BMI: normal weight (< 23.0 kg/m^2, n=440), overweight (25.0 > BMI ≥ 23.0 kg/m^2, n=365), mild obese group (27.5 > BMI ≥ 25.0 kg/m^2, n=300), mild to severe obese group (BMI ≥ 27.5 kg/m^2, n=108). After multivariate analysis, the mild obese group had a higher risk of prostate cancer detection (OR = 1.458 P = 0.054) and high-grade prostate cancer detection (OR = 1.769 P = 0.017) than the normal weight group. Meanwhile, the moderate to severe obese group did not any show significant difference compared to the normal weight group (Table 6).

When stratified by age, there were no significant findings for overall prostate cancer, including high grade prostate cancer (Table 7). We also performed a subgroup analysis after dividing the PSA level based on the cut-off level of 10 ng/ml. For overall prostate cancer, there were no significant findings. But for high-grade prostate cancer, patients with a PSA level over 10 ng/ml, obesity was significantly associated with a much higher risk of detection of high risk prostate cancer from multivariate adjustments (OR = 2.405 p = 0.008) (Table 8).

Discussion

Difficulty of study due to discrepancy of obesity definition between Asians and Westerns

As mentioned before, in the Asian area, studies about obesity and prostate cancer are less common than in the west [6, 7, 14, 15]. Because the features and shape of Asians and Westerns show an obvious difference, and the definition of obesity is also different, as obesity is defined as a BMI ≥ 25 kg/m^2 for Asians, contrasting with a BMI ≥ 30 kg/m^2 for westerners (table 1) [16], there are many obstacles for making a generalized hypothesis and conducting a study.

Lee et al. also stated these problems while conducting a study investigating obesity and prostate cancer detection in 3,113 South Korean people. In that study, patients with a BMI ≥ 30 kg/m^2, which is the Western criteria for obesity, were only 1.4% [7]. Similarly, in our study, patients with a BMI ≥ 30 kg/m^2 were only 1.9%, showing that these results were markedly different to the results of a representative western study of Freedland et al. [8, 9], which showed that 24-28% of their population were obese.

Common clinical findings in Asian and Western biopsy population

However, despite these differences in the definition of obesity and proportions of the BMI classification, the characteristics of obese men from biopsy populations were similar in several studies. In our study, the obese men were younger, had a larger prostate, and had fewer DRE abnormalities. These findings are consistent with those of several other investigators who also clarified that obese men are younger in the biopsy and prostatectomy population [9, 17]. Additionally, larger prostate size has also been observed in obese men [9, 11, 17]. The fewer abnormal DRE findings in obese men has also been noted previously, and this may be because DRE is more difficult in obese men, so the finding may be compromised [17].

Obesity and prostate cancer

Lee et al. reported opposite results to ours with respect to the relationship between obesity and prostate cancer although both studies targeted identical South Korean people. In that study, obesity (BMI ≥ 25 kg/m$^{2)}$ was significantly associated with lower odds of prostate cancer detection via biopsy among their subjects. Also, obesity was significantly associated with a lower rate of high-grade (Gleason score >4 + 3) diseases detected from biopsy, which was also the case after multivariate adjustment [7].

In a similar Asian study, Masuda et al. analyzed the BMIs and prostate cancers of 3,966 Japanese biopsy patients and reported that a significant positive association was present between BMI and prostate cancer risk at biopsy, with an increased risk observed in men whose body mass index was ≥27.0 compared with the reference group. A significantly increased risk starting at body mass index ≥25.0 was found in high-grade disease [6]. Those results have some similarity to our study in the sense that with higher BMI, obese men have a significantly higher risk of detection of prostate cancer including high-grade prostate cancer.

Freedland et al. conducted a similar study of 441 western patients. In that study, obesity (BMI ≥ 30 kg/m^2) was observed to be associated with a significantly increased prostate cancer risk after adjusting for multiple clinical variables. But there was no significant association between obesity and high-grade disease [8].

Meanwhile, Presti et al. analyzed 787 western men, conducting a comparison among 3 BMI category groups (< 25, 25 - 29.9, 30 > kg/m^2), and reported that men with a BMI < 25 kg/m^2 had a higher risk of prostate cancer detection than those with a higher BMI [11]. That study did not involve the additional analysis of high-grade disease [11].

Freedland et al. divided the total patients into 4 groups by BMI: normal weight (<25.0 kg/m^2), overweight (≥25.0 to <30.0 kg/m2), mild obese (≥30.0 to <35.0 kg/m2), moderately and severe obese (≥35.0 kg/m2). After multivariate analysis, they showed that higher BMI (>30.0 or >35.0 kg/m2) was associated with increased risk of overall and high-grade prostate cancer [10].

We also divided our biopsy population into 4 groups by BMI. After multivariate analysis, the mild obese group had higher risk of prostate cancer detection and high-grade prostate cancer detection than the normal weight group. Meanwhile, the moderate to severe obese group did not show any significant difference compared to the normal weight group.

Hypothesis about relationship between obesity and prostate cancer

These inconsistent results from several studies suggest that the relationship between obesity and prostate cancer is very complicated because of the influence of various uncontrollable factors. Meanwhile, many researchers have found that obese men have a lower PSA than normal weight men due to the hemodilutional effect. The fact that the hemodilutional effect on the PSA of obese men may affect the PSA level is widely recognized, and a calibrating calculation for this distortion of the PSA level among obese men has already been introduced (Figure 2) [18-20].

The equation standardizes the PSA level to a man who has the height of 175.77 cm and 25 kg/m^2 of BMI. The PSA value which is adjusted with height and weight could be compared with standard prostate biopsy thresholds. Using this equation, a man who is 183 cm and 100 kg, with a PSA of 3 ng/mL, would have an adjusted PSA value of 3.45; if he were 143 kg, the adjusted PSA value would be 4.0 [20]. Therefore clinicians should consider the prostate biopsy for the obese patients with slightly lower PSA than standard biopsy thresholds.

However, the equation is not perfectly representative of the relationships between obesity and prostate cancer, because the impact of obesity on the PSA level is not the same as the impact of obesity on prostate cancer. Therefore, our results that obesity was associated with a higher risk of prostate cancer detection as an independent factor as well as high-grade prostate cancer need to be reinforced with other scientific theory or hypothesis.

Parekh et al. tried to explain the association between obesity and prostate cancer by relating it to the effect of testosterone. They hypothesized that obese men might not undergo a prostate biopsy because obese men are likely to have a lower PSA level, possibly due to a lower testosterone level and increased blood volume. They proved that obesity was associated with a lower PSA-driven biopsy rate from three national surveys [20, 21].

Testosterone is the important hormone in the growth and the function of the prostate and it is also thought to affect the development and deterioration of the prostate cancer. Obesity might be related with low testosterone, but this hormonal disturbance is difficult to assess objectively. In addition, comorbidities such as diabetes mellitus, the duration of obesity, and even diet also affect the testosterone level [22]. It is impossible to assess the degree of hormonal disturbances from the testosterone level and their potential effects on the prostate.

We paid attention to the underestimation of PSA in obese men rather than trying to find other evidences. In the biopsy population, obese men who underwent prostate biopsy had already reached the biopsy threshold in spite of the underestimation of the PSA, so their real PSA level was higher than the measured level. Therefore, it seems that obese men were observed to have a higher risk of prostate cancer detection including detection of high-grade disease in the biopsy population (Figure 3).

Characteristics of Korean prostate cancer

We found that several studies including ours reported that there was a higher portion of high grade prostate cancer in the Korean prostate cancer population [7, 15, 23]. Song et al. reported that Korean prostatic cancer showed higher Gleason scores, lower rates of HPIN and multifocality, and lower p53 expression in comparison to Western prostatic cancer [23]. Oh et al. also suggested that the PSA threshold should be lower in obese men to discriminate between prostate cancer and benign conditions in the real clinical situation [15].

Limitation and implication

As mentioned before, several factors could have affected both obesity and prostate cancer, but our study did not control for the confounding factors, such as comorbidities, diet, exercise, and recent weight gain or loss. And our study used the Asian BMI category which is different from the standard western BMI category, so the results need to be interpreted carefully. Some researchers insisted the men with PSA ≥ 50 ng/mL which almost assuredly had prostate cancer should be excluded the study because of the selection bias. In this study, there were 30 males with PSA ≥ 50 ng/mL and 1 male had PSA level over 1,000 ng/mL (the exact PSA level was

1,870 ng/mL) (Table 9). Several papers that have investigated the relationship between prostate cancer and obesity have not excluded patients with excessive PSA. We have used a similar criteria, and thus have included people with PSA ≥ 50 ng/mL [7-11]. Nevertheless, our study presented novel results in the Asian area, which were different from the results of existing research about the relationship between obesity and prostate cancer. And it should be considered that we also suggested possible explanations for our results.

Conclusions

In a Korean biopsy population, obese men were younger, and had a larger prostate and less tendency to have any abnormality on DRE. Obesity was associated with a higher risk of prostate cancer detection as an independent factor, including the detection of high-grade prostate cancer. Further investigations are needed to elucidate the effect of obesity on prostate cancer detection and behavior.

Ethical standards

This study design and the use of patients' information stored in the hospital database were approved by the Institutional Review Board (IRB) at the Seoul Metropolitan Government - Seoul National University Boramae Medical Center. The approval number is 26-2013-84. We were given exemption from getting informed consents by the IRB because the present study is a retrospective study and personal identifiers were completely removed and the data were analyzed anonymously. Our study was conducted according to the ethical principles laid down in the 1964 Declaration of Helsinki and its later amendments.

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Table 1. Proposed classification of BMI in adult Asians and Westerns

Asians BMI (kg/m^2)	Classification	Westerns BMI (kg/m^2)
< 18.5	Underweight	< 18.5
18.5 - 22.9	Normal range	18.5 - 24.9
23.0 - 24.9	Overweight	25.0 - 29.9
25.0 - 29.9	Obese I	30.0 - 34.9
≥ 30	Obese II	35.0 - 39.9
-	Obese III	≥ 40

Table 2. Patient characteristics

Parameter	
No. Patient	1213
Mean Age (range)	66.5 (30-91)
Median PSA (range)	6.7 (1.0-1870.0)
Median PSAD (range)	0.17 (0.03-13.32)
Mean BMI (range)	23.9 (14.7-56.3)
No. abnormal DRE finding (%)	161 (13.3%)
Mean Prostate volume (range)	45.0 (13.0-262.0)
No. Overall Pca (%)	344 (28.4%)
No. High-grade Pca (GS ≥ 4+3) (%)	203 (16.7%)

Table 3. Patient characteristics and biopsy outcomes according to BMI

Variables	**Non-obese**	**Obese**	P-value
No. Patient	805 (66.4%)	408 (33.6%)	
Mean Age	67.1	65.5	0.003
Median PSA	6.9	6.4	0.932
Median PSAD	0.18	0.15	0.140
Mean BMI	22.4	26.9	<0.001
No. abnormal DRE finding (%)	128 (15.9%)	33 (8.1%)	<0.001
Mean Prostate volume	42.9	49.2	<0.001
No. Overall Pca (%)	229 (28.4%)	115 (28.2%)	0.490
No. High-grade Pca (GS ≥ 4+3) (%)	138 (17.1%)	65 (15.9%)	0.327

Table 4. Multivariate analysis of clinical predictors with overall prostate cancer or high-grade (Gleason score ≥ 4+3) prostate cancer detection on prostate biopsy

Overall prostate cancer detection				
	Unadjusted		**Adjusted**	
	OR (95% CI)	**P-value**	**OR (95% CI)**	**P-value**
Age	1.066 (1.048-1.084)	<0.001	1.075 (1.055-1.097)	<0.001
PSA	1.037 (1.023-1.051)	<0.001	1.039 (1.022-1.056)	<0.001
Prostate volume	0.969 (0.961-0.978)	<0.001	0.953 (0.943-0.963)	<0.001
Abnormal DRE finding	2.647 (1.843-3.801)	<0.001	1.889 (1.233-2.894)	0.003
Obesity (BMI ≥ 25)	0.987 (0.758-1.286)	0.924	1.446 (1.051-1.989)	0.024
High-grade prostate cancer				
	Unadjusted		**Adjusted**	
	OR (95% CI)	**P-value**	**OR (95% CI)**	**P-value**
Age	1.063 (1.042-1.085)	<0.001	1.065 (1.041-1.089)	<0.001
PSA	1.004 (1.002-1.007)	0.002	1.054 (1.035-1.074)	<0.001
Prostate volume	0.966 (0.955-0.977)	<0.001	0.945 (0.932-0.959)	<0.001
Abnormal DRE finding	2.484 (1.652-3.736)	<0.001	1.711 (1.050-2.789)	0.031
Obesity (BMI ≥ 25)	0.916 (0.664-1.264)	0.593	1.498 (1.020-2.200)	0.039

Table 5. Odds ratio of obesity being associated with overall prostate cancer or high-grade (Gleason score ≥ 4+3) prostate cancer detection on prostate biopsy

Overall prostate cancer	OR	P-value
Crude OR	0.987 (0.758-1.286)	0.924
Age-adjusted OR	1.108 (0.843-1.455)	0.463
PSA-adjusted OR	1.034 (0.787-1.359)	0.809
Prostate volume-adjusted OR	1.092 (0.816-1.460)	0.555
DRE-finding-adjusted OR	1.079 (0.824-1.414)	0.580
Multivariate-adjusted OR	1.446 (1.051-1.989)	0.024
High grade prostate cancer	**OR**	**P-value**
Crude OR	0.916 (0.664-1.264)	0.593
Age-adjusted OR	1.024 (0.736-1.423)	0.890
PSA-adjusted OR	0.924 (0.667-1.279)	0.633
Prostate volume-adjusted OR	1.125 (0.795-1.591)	0.507
DRE-finding-adjusted OR	1.000 (0.720-1.388)	0.999
Multivariate-adjusted OR	1.498 (1.020-2.200)	0.039

Table 6. Odds ratio of detailed obesity categories being associated with overall prostate cancer or high-grade (Gleason score ≥ 4+3) prostate cancer detection on prostate biopsy

Overall prostate cancer	OR	P-value
Multivariate-adjusted OR		
normal weight (BMI < 23.0 kg/m^2)	reference	-
overweight (25.0 > BMI ≥ 23.0 kg/m^2)	1.031 (0.719-1.478)	0.869
mild obese (27.5 > BMI ≥ 25.0 kg/m^2)	1.458 (0.994-2.139)	0.054
mild to severe obese (BMI ≥ 27.5 kg/m^2)	1.490 (0.831-2.672)	0.181
High grade prostate cancer	**OR**	**P-value**
Multivariate-adjusted OR		
normal weight (BMI < 23.0 kg/m^2)	reference	-
overweight (25.0 > BMI ≥ 23.0 kg/m^2)	1.446 (0.938-2.233)	0.096
mild obese (27.5 > BMI ≥ 25.0 kg/m^2)	1.769 (1.107-2.826)	0.017
mild to severe obese (BMI ≥ 27.5 kg/m^2)	1.807 (0.876-3.727)	0.109

Multivariate-adjusted OR: Odds ratio from multivariate analysis with age, PSA, prostate volume, DRE finding, and detailed obesity categories

Table 7. Odds ratio of obesity being associated with overall prostate cancer or high-grade (Gleason score ≥ 4+3) prostate cancer detection on prostate biopsy according to age

Overall prostate cancer detection				
	Age < 70, n=793		Age ≥ 70, n=420	
	OR (95% CI)	**P-value**	**OR (95% CI)**	**P-value**
Crude OR	1.155 (0.822-1.624)	0.407	0.989 (0.633-1.544)	0.961
Multivariate-adjusted OR	1.383 (0.935-2.044)	0.104	1.280 (0.748-2.190)	0.368
High-grade prostate cancer				
	Age < 70, n=793		Age ≥ 70, n=420	
	OR (95% CI)	**P-value**	**OR (95% CI)**	**P-value**
Crude OR	0.967 (0.630-1.485)	0.878	1.056 (0.636-1.754)	0.833
Multivariate-adjusted OR	1.192 (0.726-1.959)	0.487	1.738 (0.936-3.227)	0.080

Multivariate-adjusted OR: Odds ratio from multivariate analysis with PSA, prostate volume, DRE finding, and obesity.

Table 8. Odds ratio of obesity being associated with overall prostate cancer or high-grade (Gleason score ≥ 4+3) prostate cancer detection on prostate biopsy according to PSA level

Overall prostate cancer detection				
	PSA < 10 ng/mL, n=875		PSA ≥ 10 ng/mL, n=338	
	OR (95% CI)	**P-value**	**OR (95% CI)**	**P-value**
Crude OR	1.148 (0.832-1.584)	0.400	0.804 (0.496-1.303)	0.375
Multivariate-adjusted OR	1.374(0.954-1.978)	0.088	1.658 (0.879-3.127)	0.119
High-grade prostate cancer				
	PSA < 10 ng/mL, n=875		PSA ≥ 10 ng/mL, n=338	
	OR (95% CI)	**P-value**	**OR (95% CI)**	**P-value**
Crude OR	0.955 (0.622-1.467)	0.834	1.000 (0.598-1.674)	0.999
Multivariate-adjusted OR	1.225 (0.764-1.962)	0.399	2.405 (1.253-4.613)	0.008

Multivariate-adjusted OR: Odds ratio from multivariate analysis with age, prostate volume, DRE finding and obesity

Table 9. Patient distribution according to PSA level

PSA level (ng/mL)	No. Patient
PSA < 4	128 (10.6%)
10 > PSA ≥ 4	747 (61.6%)
20 > PSA ≥ 10	246 (20.3%)
50 > PSA ≥ 20	62 (5.1%)
PSA ≥ 50	30 (2.5%)

Figure 1. Patient distribution according to Asian BMI categories

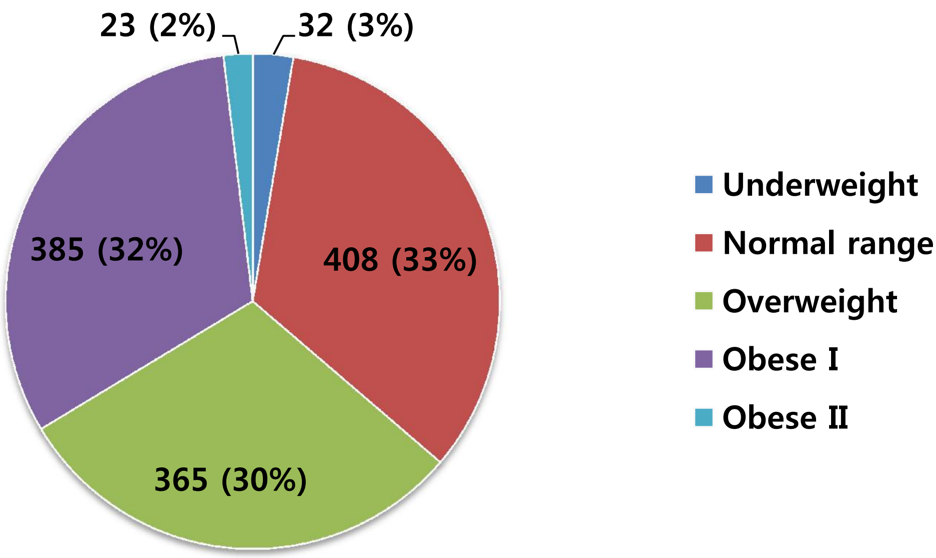
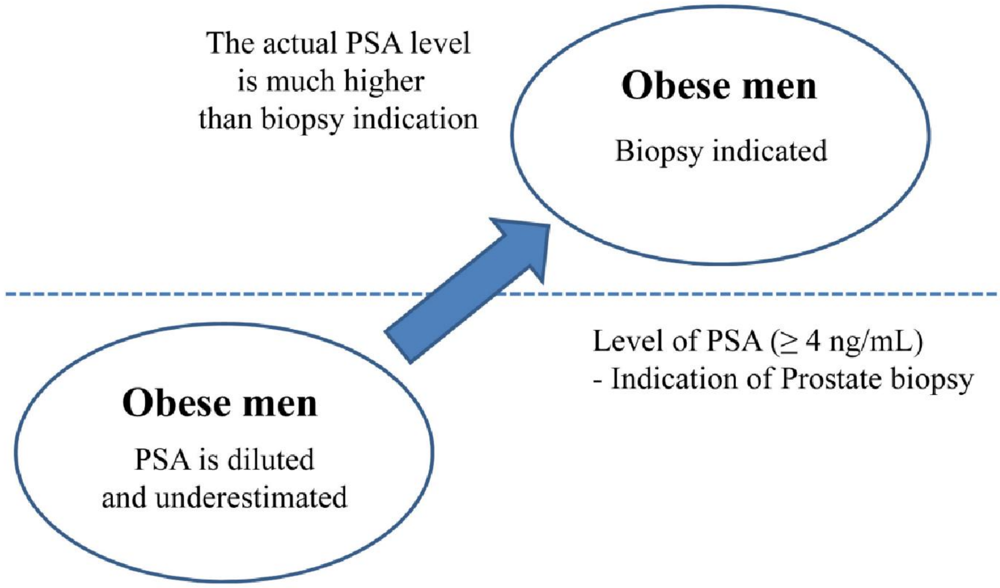


Figure 2. Formula for the adjusted PSA value according to the height and weight [20]

Adjusted PSA value

$$= \frac{((0.007184 \times (\text{height in } cm^{0.725}) \times (\text{weight in kg}^{0.425})) \times 1578 \times \text{PSA test level})}{(0.007184 \times (1.75.77\ cm^{0.725}) \times (77.25\ \text{kg}^{0.425}) \times 1578)}$$

Figure 3. Hypothetical concept of relationship between obesity and prostate cancer in biopsy population



국문초록

전립선생검을 통한 전립선암 진단에 있어서 비만의 영향분석

박주현

학번: 2010-21795

서울대학교 의학과 비뇨기과학교실

서론: 목적: 전립선생검를 통한 전립선암의 진단에 있어서 비만의 영향은 아직까지 명확하게 밝혀지지 않았다. 본 연구에서는 체질량지수 (Body mass index, BMI)를 이용해 비만을 정의하고, 이를 통해 전립선암의 진단에 있어서 비만의 영향을 분석해보고자 하였다.

대상 및 방법: 2008 년 1 월부터 2013 년 2 월까지 본원에서 경직장 전립선 생검을 시행 받은 1,213 명의 환자를 후향적으로 분석하였다. 전립선생검은 전립선특이항원 수치가 4ng/ml 이상이거나 직장수지검사에서 결절이 있는 경우에 시행하였다. 비만은 체질량지수 25kg/m2 이상으로 정의하였으며, 비만 여부에 따라 환자 군을 나누고 비교 분석하였다. 조직검사 소견과 함께 환자의 나이, 전립선 특이항원수치, 전립선 크기, 직장수지검사 상 결절유무, 비만 여부를 조사하여 로지스틱 회귀분석을 시행하였다.

결과: 총 1,213 명의 대상자 중 408 명 (33.6%)이 비만이었으며, 344 명 (28.4%)에서 전립선암이 발견되었고, 그 중 203 명 (16.7%)는 고등급 (high-grade) 전립선암으로 진단되었다. 비만 여부에 따른 환자군 비교에서 비만 환자는 비만이 아닌 환자에 비해 더 젊고 (65.5 vs 67.1 세, p = 0.003), 전립선의 크기가 더 컸으며 (49.2 vs 42.9 cc, p < 0.001), 직장수지검사에서 결절이 더 적게 나타났다 (8.1% vs 15.9% p < 0.001). 다변량 로지스틱 회귀분석에서 비만 여부는 환자의 나이, 전립선특이항원 수치, 전립선크기, 적장수지검사상 결절 유무와 함께 전립선암 진단에 대한 유의한 독립인자로 나타났으며, 비만 환자에서 전립선암의 진단 위험도가 높아지는 것으로 나타났다 (OR = 1.446, P = 0.024). 이러한 양상은 고등급 전립선암의 진단에 있어서도 동일하게 나타났다 (OR = 1.498, P = 0.039).

결론: 본 연구에서 비만 환자는 전립선 조직검사에서 전립선암의 진단 위험도가 유의하게 높은 것으로 나타났다. 추후 전향적 다기관 연구를 통해 전립선 생검을 통한 전립선암 진단에 있어서 비만의 영향에 대한 보다 면밀한 분석이 필요하겠다.

주요어: 전립선암, 전립선생검, 비만, 체질량지수