The Effect of BMI and Visceral Fat Percentage on the Development of Bone Metastases in Prostate Cancer

Fusun Aydogan1*, Ebuzer Kalender1, Murat Rafioglu M2, Taner Sumbul A3 and Erhan Yengil4
1Department of Nuclear Medicine, Mustafa Kemal University Faculty of Medicine, Hatay/Turkey
2Department of Urology, Mustafa Kemal University Faculty of Medicine, Hatay/Turkey
3Department of Oncology, Mustafa Kemal University Faculty of Medicine, Hatay/Turkey
4Department of Family Medicine, Mustafa Kemal University Faculty of Medicine, Hatay/Turkey
*Corresponding author: Fusun Aydogan, Assistant Professor, Department of Nuclear Medicine, Mustafa Kemal University Faculty of Medicine, Hatay/Turkey, Tel: +90 (505) 657 9710, E-mail: dfusunay@yahoo.com

Introduction
Prostate cancer (PCa) second leading cause of cancer-related deaths among men worldwide [1-3]. PCa metastases are seen almost entirely on the bones and the second leading cause of cancer-related deaths among men worldwide [1-3]. PCa metastases are seen almost entirely on the bones and they are typically in the osteoblastic forms [4,5]. Bone metastases are commonly detected by bone scintigraphy.

It is widely accepted that obesity increases the risk of several chronic diseases, including type II diabetes, cardiovascular disease, and several types of cancer [6]. The relation between obesity and PCa risk has been studied extensively but remains inconclusive [7]. Several studies reported that higher body mass index (BMI) is related with other imaging modalities.

Materials and Methods
Thirty-four patients with PCa who performed bone scintigraphy included to study. Mean age was 71.3 ± 6.9 years. All patients' height, weight, VFP and BMI were calculated. PSA levels, Gleason scores, VFP and BMI of patients with and without bone metastases were compared.

Methods
Thirty-four patients with PCa who performed bone scintigraphy included to study. Mean age was 71.3 ± 6.9 years. All patients' height, weight, VFP and BMI were calculated. PSA levels, Gleason scores, VFP and BMI of patients with and without bone metastases were compared.

Results
On the bone scintigraphy 14 patients had bone metastasis and there was no metastases in 20 patients. PSA levels and Gleason scores were higher in patients with bone metastases than in patients without bone metastases and this was statistically significant (p= 0.004). While the BMI level was 26.15 kg/m² (22.7-33.5) in patients with bone metastasis, it was 26.5 kg/m² (20.7-43.9) in patients without bone metastasis. VFP was 11 (6-27) in patients with bone metastasis and 9 (3-17) in patients without bone metastasis. Although the VFP was higher in patients with bone metastasis; this was not statistically significant (p=0.15).

Conclusion
Our data suggest that there is a significant correlation between bone metastasis and high Gleason score and PSA level, but there is not significant correlation between bone metastasis and BMI, VFP in PCa.

Keywords: Prostate cancer; Bone metastases; Body mass index; Visceral fat percentage
Statistical Analysis

SPSS for Windows 18.0 (Statistical Package for Social Sciences) package programme was used for statistical analysis. Continuous variables were examined with Kolmogorov-Smirnov test in terms of a normal distribution. Relations between nominal variables were examined by the chi-square test and difference of medians between groups were examined by Mann-Whitney U test. Spearman correlation test was used to determine the relations between continuous variables. All statistical datas with p<0.05 were considered as significant.

Results

On the bone scintigraphy 14 patients had bone metastasis and there was no metastases in 20 patients.

PSA levels were higher in patients with bone metastases than in patients without bone metastases and this was statistically significant (p=0.004). Also, Gleason scores were higher in patients with bone metastases than in patients without bone metastases and this was statistically significant (p=0.001) (Figure 1).

We found a positive correlation between total PSA level and Gleason score (p=0.0001/rho=835); and BMP, BFP, BMI and age values were similar in groups with and without bone metastasis. BMI, VFP, BMP, BFP, PSA levels and Gleason scores of patients with and without bone metastases were given in Table 1.

Table 1: BML, VFP, BMP, BFP, PSA levels and Gleason scores of patients with and without bone metastases.

<table>
<thead>
<tr>
<th></th>
<th>Bone Metastasis (+)</th>
<th>Bone Metastasis (-)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (year)</td>
<td>72.50 (54-82)</td>
<td>71 (61-85)</td>
<td>0.899</td>
</tr>
<tr>
<td>PSA (ng/ml)</td>
<td>100 (100-355)</td>
<td>14 (13-100)</td>
<td>0.004</td>
</tr>
<tr>
<td>Gleason</td>
<td>8 (5-9)</td>
<td>6 (4-9)</td>
<td>0.001</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>26.15 (22.7-33.5)</td>
<td>26.5 (20.7-43.9)</td>
<td>1</td>
</tr>
<tr>
<td>VFP</td>
<td>11 (6-27)</td>
<td>9 (3-17)</td>
<td>0.14</td>
</tr>
</tbody>
</table>

VFP was 11 (range 6-27) in patients with bone metastasis and 9 (range 3-17) in patients without bone metastasis. Although the VFP was higher in patients with bone metastases; this was not statistically significant (p=0.14).

In patients, BMI was positively correlated with VFP and BFP (p=0.0001/rho=716; p=0.0001/rho=0.604), and negatively correlated with BMP (p=0.029/rho=-0.380). We found positive correlation between BMI and VFP, BFP; and negative correlation between BMI and BMP.

Discussion

PCa is recognized as one of the major medical problems facing the male population [11]. Advanced prostate cancer is frequently accompanied by the development of metastasis to bone. Bone is the most frequent site of prostate carcinoma metastasis. Bone metastases identified in up to 90% of patients dying from prostate carcinoma at autopsy series [12,13].

The sensitivity of bone scintigraphy is 95% for bone metastases. The most important factor that affecting this sensitivity is tumor type. Bone metastases can be detected easily in PCa as scintigraphically, because the metastases are primarily in osteoblastic form [14].

According to the literature, the increase in serum PSA level is an important indicator for distant organ metastasis in PCa, especially for bone metastasis [15,16]. In our study, in accordance with the literature, serum PSA levels in patients with bone metastasis were
higher than in patients without metastasis and this was statistically significant (p<0.05).

Yigitbasi et al. and Epstein et al. have reported that the Gleason score promotes higher risk of PCa patients with bone metastases [17,18]. In our study, in accordance with the literature, Gleason scores of patients with bone metastasis were higher than in patients without metastasis and this was statistically significant (p<0.05).

Obesity is an important problem all over the world and its incidence is increasing day by day. On the worldwide more than half of the adults categorized as being overweight (BMI ≥ 25) and up to 30% categorized as obese (BMI ≥ 30 kg/m²) [19]. Obesity is related with a number of chronic diseases such as diabetes, coronary artery disease, hypertension and some cancers [20,21]. In recent years several studies focus on the relationship between obesity (BMI) and prostate cancer.

The relationship between obesity (BMI) and prostate cancer is variable in epidemiological studies. Positive [10,22], insignificant [23-26] and inverse [27,28] associations were reported between BMI and PCa risk. Several mechanisms could explain the association of obesity with prostate cancer risk, including the sex steroid hormone, insulin and IGF signaling, and inflammation pathways [7]. Some investigators have reported that higher BMI is related to increased risk of advanced and higher grade-stage PCa [8-10,21,29]. Rodriguez et al reported that obesity increases risk of prostate cancer mortality [21]. Snowdon et al have suggested that there is a correlation between VFP and bone metastases in PCa. Although the VFP was higher in patients with bone metastases; this was not statistically significant (p>0.5).

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Although intraabdominal fat makes up only 10% of total body fat, it is metabolically more active than subcutaneous or peripheral fat [33]. There are a limited number of publications on the literature about the relation between PCa and VFP. In these publications the relation between the presence of cancer and VFP was examined, but the relation between VFP and bone metastasis was not investigated. A study by von Hafe et al showed that PCa patients had a significantly higher abdominal fat area [34]. In our study, we investigated whether there is a correlation between VFP and bone metastases in PCa. Although the VFP was higher in patients with bone metastases; this was not statistically significant (p>0.5).

Conclusion

The relation between BMI and PCa is still controversial and there is no consensus on this issue. Positive, inverse and insignificant associations were reported in several studies. The first time in the literature, we investigated the relation between bone metastasis and PSA level, Gleason score, BMI and VFP in PCa. In conclusion our data suggest that there is a significant correlation between bone metastasis and high Gleason score and serum PSA level, but there is no significant correlation between bone metastasis and BMI, VFP in PCa.

References


