Bone mineral density and coronary atherosclerosis

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Received 20 October 2010; revised 11 February 2011; accepted 7 March 2011
Available online 14 March 2011

KEYWORDS
Atherosclerosis; Low bone mineral density; Coronary angiography; T score

Abstract  Background: The association between low bone mineral density (BMD) and atherosclerosis is still unknown. In this study BMD assessed in patients with and without coronary artery atherosclerosis is determined by angiography.
Methods: A total number of 123 consecutive patients referred for coronary angiography were evaluated by dual X-ray absorptiometry. Obstructive CAD was diagnosed when ≥ 50% of lumen was narrowed. Conventional atherosclerosis risk factors were also assessed.
Results: The mean age of the patients was 59 ± 8 years. There was frequency of 48.7% male. The prevalence of diabetes was 31.2%, hypertension 57%, dyslipoproteinaemia 51%, vitamin D deficiency 50% and history of smoking 80.8%. Coronary angiography was normal in 15 patients (12.6%) while 67 patients (55.5%) had obstructive CAD. DXA scan showed 25 patients (21%) with normal BMD, 39 patients (32.7%) with osteopenia, and 55 others (46.2%) with osteoporosis. Lower BMD results were significantly associated with older age and lower BMI but it was not associated significantly with diabetes, hypertension, lipids levels or smoking. Moreover the prevalence of obstructive CAD and minimal CAD differed between groups with normal and low bone density but this was not significant (p = 0.67 and 0.52, respectively). The mean T score comparison between patients with and without CAD was also not different.

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Peer review under responsibility of King Saud University.
doi:10.1016/j.jsa.2011.03.001
1. Introduction

Atherosclerosis and osteoporosis are two major causes of morbidity and mortality in the world which are thought to be linked together in recent years. While in vitro studies showed interesting connections between these conditions (Shanahan et al., 1994; Bostrom et al., 1993) clinical significance of this relation is still unknown. Some clinical studies pointed out the association between low bone mineral density (BMD) and vascular calcifications (Tanko et al., 2003; Barengolts et al., 1998; Kiel et al., 2001; Hak et al., 2000; Hofbauer et al., 2007), and more recent investigations focused on coronary angiography determined atherosclerosis. Most of these studies concerned postmenopausal women or patients otherwise susceptible to low BMD score due to taking steroids, chronic renal failure, etc. (Marcovitz et al., 2005; Tekin et al., 2008; Varma et al., 2008). To date there are only a few studies on patients without low BMD risk factors or on men (Beer et al., 2010). The aim of this study was to investigate the association between low BMD and coronary atherosclerosis in patients without risk factor for abnormal BMD.

2. Methods

The investigation designed as cross-sectional study from July 2008 to August 2009 enrolling 123 consecutive patients referring for elective coronary angiography evaluating for possible coronary artery disease (CAD). Demographic data and information on cardiovascular risk factors were obtained by standard forms before angiography. Biochemical measurements to assess blood levels of lipids, creatinine, fasting glucose, vitamin D, testosterone and thyroid hormones were also performed. Vitamin D level and hormonal assay carried out to find any risk factor to cause low BMD score. Angiographic images were reviewed by expert cardiologists. Percentage of stenoses was assessed by visual analysis. The diagnosis of obstructive CAD was confirmed in the presence of at least 50% lumen narrowing in one or more coronary artery branch. Stenoses that was less than 50% was classified as minimal CAD.

Patients underwent BMD scans by dual energy X-ray absorptiometry (DXA) on the same admission. BMD scan was performed at the lumbar spine (L1–L4) and left femur site. BMD results were categorized according to WHO classification in which T scores below –2.5 SD of peak bone mass were considered osteoporosis while osteopenia was diagnosed if T score was between –1 and –2.5 SD below peak bone mass and normal BMD result when T score > –1 SD was below bone peak mass.

Mann–Whitney U-test was used to examine the continuous variables and categorical variables which were compared using the χ²-test or Fisher’s exact test. Moreover, mean BMD values were compared using Student’s t-test. Two-sided p values < 0.05 were considered significant. Results are given as the mean ± SD. To determine predictors of CAD, significant variables with a p value < 0.1, which was identified from univariate analysis, were included in a step-down multivariate logistic regression analysis. All statistical analyses were performed with the software package SPSS 16.0 for Windows (SPSS Inc., Chicago, IL, USA).

3. Results

Out of the 123 patients referred for coronary angiography four patients did not appear for the BMD scan and were excluded from the study. Baseline characteristics of 119 patients are summarized in Table 1. They are subgrouped according to the BMD results. The mean age of the patients was 59 ± 8 years. There was frequency of 48.7% male. The prevalence of diabetes was 31.2%, hypertension 57%, dyslipoproteinemia 51%, vitamin D deficiency 50% and history of smoking 80.8% in this cohort. Coronary angiography was normal in 15 patients (12.6%) while 67 patients (55.5%) had obstructive CAD. DXA scan results revealed that 25 patients (21%) had a normal BMD, 39 patients (32.7%) had osteopenia, and 55 others (46.2%) had osteoporosis. All the patients were taking statins at the time of the study but none of them

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Baseline demographics of patients with osteoporosis, osteopenia, and normal bone mineral density.</th>
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</thead>
<tbody>
<tr>
<td>Gender (m)</td>
<td>Normal BMD (N = 25)</td>
</tr>
<tr>
<td>Age</td>
<td>55 ± 7</td>
</tr>
<tr>
<td>DM</td>
<td>27%</td>
</tr>
<tr>
<td>Hx of smoking</td>
<td>16.7%</td>
</tr>
<tr>
<td>BMI</td>
<td>32 ± 9</td>
</tr>
<tr>
<td>TG level</td>
<td>204 ± 96</td>
</tr>
<tr>
<td>LDL-C level</td>
<td>96 ± 22</td>
</tr>
<tr>
<td>HDL-C level</td>
<td>40 ± 11</td>
</tr>
<tr>
<td>Hypertension</td>
<td>20.4%</td>
</tr>
<tr>
<td>Minimal CAD</td>
<td>(n = 11) 44%</td>
</tr>
<tr>
<td>Obstructive CAD</td>
<td>(n = 11) 44%</td>
</tr>
<tr>
<td>Vit. D deficiency</td>
<td>22.9%</td>
</tr>
</tbody>
</table>
were receiving calcium supplements, biphosphonate or hormone replacement therapy. Lower BMD results were significantly associated with older age and lower BMI but it was not associated significantly with diabetes, hypertension, lipids levels or smoking. Moreover the prevalence of obstructive CAD and minimal CAD differed between groups with normal and low bone density but this was not significant ($p = 0.67$ and $0.52$, respectively). The mean $T$ scores comparison between patients with and without CAD are summarized in Table 2. There was no significant difference in all regions.

4. Discussion

The association between low bone mineral density and atherosclerosis has widely been suggested (Varma et al., 2008; From et al., 2007; Pierre-Louis et al., 2009). Our study is the first to assess this association in a population with 47% male patients and without risk factor for osteoporosis.

Our results showed that there is no significant relation between osteoporosis and coronary atherosclerosis. Previously, Marcovitz et al. (2005) suggested that this relation is strongly significant and osteoporosis is even more important than traditional risk factors. Also studies with exercise test (From et al., 2007) and stress echocardiography (Pierre-Louis et al., 2009) suggested an association between higher ischemia and myocardial infarction in osteoporotic patients but a recent study performed on men with no risk factor for osteoporosis proved no association between these situations (Beer et al., 2010). In our study there is a good trend of higher coronary atherosclerosis in patients with osteoporosis and probably the small size of the population is responsible for not proving the relation. Previous studies pointed out an association between low BMD and cardiovascular disease and also related mortality however; coronary angiogram does not reflect same aspects of atherothrombotic disease as the clinical cardiovascular event precipitated by plaque instability and thrombosis (Tanko et al., 2005; Trivedi and Khaw, 2001).

In conclusion, low BMD score is not associated with angiographically determined coronary atherosclerosis although further studies with larger samples are needed.

References


