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Effect of Chronic Coal Dust Exposure on Bone Properties: An Involvement of Inflammation and Oxidative Stress  
Bambang Setiawan, Zairin Noor, Izaak Z. Akbar, Nia Kania, Dian Nugrahenny, Frans Tony
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DOES VISCOSUPPLEMENTATION FOLLOWING ARTHROSCOPIC DEBRIDEMENT IMPROVE OUTCOME IN OSTEARTHRITIS?
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Objective: To study the effectiveness of arthroscopic debridement followed by viscosupplementation in selected patients with mild to moderate knee osteoarthritis by means of a prospective, randomized control study.

Material and Methods: The study included 82 patients (mean age 55±5 years; range 40–70 years) who had knee osteoarthritis according to the Kellgren Lawrence grade I, II & III. At 3 weeks from arthroscopic debridement (inclusive of synovectomy, meniscal balancing, loose body removal, removal of blocking osteophytes, cartilage microdebridement), the patients were randomly assigned to single intra articular injection of hyaluronan G-F 20 (n=41). Evaluations were made preoperatively, at three weeks. Post injection evaluations were done at 3, 12,24, 52 weeks using a patient satisfaction questionnaire, visual analog scale (VAS), and the WOMAC osteoarthritis index. The results in two groups, viscosupplementation and no viscosupplementation group were compared.

Results: All patients had significant improvement with pain and improvement in function following both arthroscopic treatment and viscosupplementation. Following viscosupplementation, patient satisfaction, WOMAC and VAS scores were significantly improved.

<table>
<thead>
<tr>
<th>Group</th>
<th>Arthroscopy</th>
<th>Arthroscopy+</th>
<th>Viscosupplement (3w/52w)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(assessment week)</td>
<td>(3w/52w)</td>
<td>(3w/52w)</td>
<td></td>
</tr>
<tr>
<td>% change in VAS</td>
<td>70 / 42</td>
<td>68 / 87</td>
<td></td>
</tr>
<tr>
<td>WOMAC</td>
<td>67 / 62</td>
<td>60 / 32</td>
<td></td>
</tr>
<tr>
<td>Analgesic use</td>
<td>67 / 70</td>
<td>65 / 48</td>
<td></td>
</tr>
</tbody>
</table>

Conclusion: Arthroscopic debridement combined with viscosupplementation is an effective treatment option for selected patients with knee osteoarthritis. Though arthroscopic debridement alone improves outcome initially, additional visco supplementation results in sustained improvement and reduction in analgesic use.

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PREVALENCE OF DEFICIENCY AND INSUFFICIENCY OF VITAMIN D IN PATIENTS WITH TYPE 2 DIABETES MELLITUS ON ORAL ANTIDIABETIC DRUGS
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Objective: 1/ To describe the prevalence of vitamin D insufficiency and deficiency in type 2 diabetes patients on oral antidiabetic drugs, and 2/ to compare it to the results of a recent representative Bulgarian epidemiological survey.

Material and Methods: 56 men and 44 women with type 2 diabetes participated. The mean age of the women was 59 years, of men 58 years. The mean diabetes duration in women was 9.8±6.3 and 7.7±4.5 years in men. Serum levels of 25-(OH)-vitamin D total (Immunotest, Roche Diagnostics, Switzerland) as well as PTH (iPTH, electrochemiluminescent analysis), serum and urinary calcium and phosphates, creatinine and glomerular filtration rate, together with HbA1c, fasting blood glucose, lipid profile were measured. Vitamin D sufficiency was defined as serum vitamin D ≥50 nmol/l (20 ng/dl), whereas deficiency <25 nmol/l (10 ng/dl).

Results: The mean serum 25-OH-vitamin D levels were 23.8±12.1 nmol/l in women and 33.3±20.0 nmol/l in men, and therefore, lower than the country specific means. Vitamin D deficiency was found in 49 % of the diabetic patients whereas insufficiency in 42 %. Only 18.1 % of the diabetic men and 1.7 % of the women had sufficient vitamin D levels. Comparing our results to Bulgarian population data a higher prevalence of vitamin D deficiency and lower prevalence of sufficiency are found (see Table 1).

Table 1. The prevalence of vitamin D deficiency and insufficiency (in percentages) in the type 2 diabetes patients is compared to the Bulgarian population data.

<table>
<thead>
<tr>
<th>Vitamin D status</th>
<th>Women</th>
<th>Men</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>DM2 National data</td>
<td>DM2 National data</td>
</tr>
<tr>
<td>Deficiency %</td>
<td>57.2</td>
<td>38.7</td>
</tr>
<tr>
<td>Insufficiency %</td>
<td>41.1</td>
<td>43.2</td>
</tr>
</tbody>
</table>

Conclusion: Practically all type 2 diabetes patients are expected to have vitamin D insufficiency or deficiency and would benefit from optimal supplementation.

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EFFECT OF CHRONIC COAL DUST EXPOSURE ON BONE PROPERTIES: AN INVOLVEMENT OF INFLAMMATION AND OXIDATIVE STRESS
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Objective: To investigate the effect of ethanolic extract of red seaweed (Eucheuma cottoni) in bone properties (turnover, microstructure, mineral elements) of rats exposed to chronic coal dust.

Material and Methods: A total of 30 Wistar male rats, were randomly divided into three groups including one control group, two group for chronic exposure of coal dust at concentration 6.25 mg/m² on hour/day for 6 months and 12.5 mg/m² on hour/day for 6 months. The exposure to coal dust exposure was conducted using equipment that was designed by and available from Pharmacology Laboratory, Medical Faculty, Brawijaya University of Malang. Malondialdehyde (MDA) level was analyzed by spectrophotometer. Expression of C-telopeptide collagen type I (CTX), osteocalcin (OC), and tumor necrosis factor-alpha were analyzed by ELISA technique. Bone microstructure was assayed using scanning electron microscope (SEM). Bone mineral elements were assayed by X-ray fluorescence. ANOVA test was used to analyze the different level of all parameter. This study was approved by Local Ethics Committe, Faculty of Medicine, University of Lambung Mangkurat, Banjarmasin.

Results: Chronic coal dust exposure increased oxidative stress in circulation and bone turnover marker significantly compared to control group (p<0.05). There was no significant different of inflammation in rats exposed to chronic coal dust compared to control (p>0.05). SEM showed similar porosity of trabecular and cortical thickness in chronic coal dust exposure compared to control group. Chronic dust exposure changed calcium, phosphorus, iron, zinc, and copper levels significantly compared to control group (p<0.05).

Conclusion: There is involvement of oxidative stress in change of bone properties in male rats exposed to chronic coal dust.

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INCREASED LEVELS OF ALKALINE PHOSPHATASE IN OSTEOPENIC WOMEN RECEIVING ORAL DAILY DOSE OF MENAQUINONE 7 (VITAMIN K2)

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Objective: This preliminary study aims to assess the effect of a supplement containing 45 μg of menaquinone 7 on the activities of osteoblasts. Bibliographic evidence suggests that menaquinone 7, of exogenous origin, acts as an enhancer of bone metabolism through direct activation of osteocalcin carboxylation which induces osteogenesis.

Material and Methods: The study population consisted of 43 women with ages between 50–75 years, in menopause for at least 6 months and a T-score between −1 and −2.5. An active group of 23 women were treated with single daily dose of supplement containing calcium, vitamin D3, MenaQ7 and gammalinoletic acid. A control group of 20 women did not take any therapies that stimulate the osteoblast activity, but only calcium and vitamin D. At time zero, the subjects analyzed made a MOC DXA of the lumbar spine and nondominant femur for the determination of T-score, and at time 0 and after 6 months of therapy, they have made a blood tests for markers of bone metabolism and conventional liver function tests, renal and of coagulation.

Results: At the end of the observational period there were no indications of changes in hepatic or renal functions nor of coagulation parameters. Blood levels of Ca and P showed no significant changes. Of particular interest, however, is the increased serum level of ALP in 87 % of women treated compared to the 30 % in the control group. The average increase of ALP in the active group was percentage of 44.7 % compared to a decrease of 1.6 % in the control group.

Conclusion: The increased levels of ALP in women treated could be attributed to an improvement of bone metabolism induced by menaquinone 7, the only therapy that patients had taken during the period of observation. In conclusion, this nondrug treatment represented by menaquinone 7, may be useful in the treatment of the osteopenic patient. Additional studies measures actual bone density would be useful to confirm this.

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A RANDOMIZED, PROSPECTIVE STUDY OF THE EFFECTS OF EXERCISE ON QUALITY OF LIFE IN POSTMENOPAUSAL WOMEN WITH VERTEBRAL FRACTURES

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EFFECT OF CHRONIC COAL DUST EXPOSURE ON BONE PROPERTIES: AN INVOLVEMENT OF INFLAMMATION AND OXIDATIVE STRESS

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Introduction

- The mechanical strength of trabecular bones in both rats and humans are influenced by mechanical, hormonal, biological and/or toxic processes (Shen et al., 2009; Gao et al., 2011).

- The rats exposed to subchronic levels of coal dust had a decreased number of osteoblasts and increased number of osteoclasts (Akbar et al., 2012).

- Sub-chronic inhalation of cigarette smoking and coal dust PM₁₀ significantly increases iron levels in the femur of rats (Noor & Setiawan, 2013).

Objective

- To investigate the effect of chronic coal dust on bone properties (turn over, microstructure, mineral elements) of rats.

Methods

30 Wistar male rats, 3 months old

Control

Coal dust exposure: 6.25 mg/m²/day for 6 months

Coal dust exposure: 12.5 mg/m²/day for 6 months

- MDA level (μg/mL), ASO-4 level (μg/mL), CTX level (μg/mL), and CRP level (μg/mL) were analyzed by spectrophotometer.
- Tumor necrosis factor-α (TNF-α) was analyzed by ELISA technique.
- Osteoclast type II (CTX) was analyzed by ELISA technique.
- Bone microstructure was analyzed using Scanning Electron Microscope (SEM).
- Bone mineral elements were analyzed by X-ray Fluorescence.

Coal dust exposure chamber

We put weighed coal dust in bottom hole (red arrow) of black pipe then the coal dust will circulated (white arrow) and entering the chamber again via upper hole (yellow arrow). This airstream will inhaled by rats in plastic chamber. To avoid discomfort, this chamber also supply by external oxygen and air in conditioned room.

Results

<table>
<thead>
<tr>
<th>MDA level (μg/mL)</th>
<th>TNF-α level (μg/mL)</th>
<th>CTX level (μg/mL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>Control</td>
<td>Control</td>
</tr>
<tr>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

Scanning electron microscope

Discussion

SEM showed similar porosity of trabecular and cortical thickness in chronic coal dust exposure compared to control group.

Conclusion

There is involvement of oxidative stress in change of bone properties in male rats exposed to chronic coal dust.

References


Shen Y, Zhang ZM, Jiang SY, Jiang LS, Dai LG. Postmenopausal women with osteoporosis and osteomyelitis show different structural characteristics of trabecular bone of the femoral head. BMC Musculoskeletal Disorders 2009;10:35.

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