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New aspects of osteoporosis – a literature review

Osteoporosis is characterized by low bone mass with structural deterioration of bone tissue leading to bone fragility and increased susceptibility to fracture and resorption. The normal balance between bone formation and bone resorption becomes dysfunctional. Actually, 8 million people all over the world have osteoporosis, and another 17 million have low bone mass. Osteoporosis is considered a 'silent disease', assumed to start often without symptoms – in young adults and progress women after menopause, when bone loss accelerates. This disease can affect entire skeleton, also the bone of cranium, zygomatic process, maxilla and mandible. The available data suggest that osteoporosis is influenced by genetics, sex, age, physical condition and a number of risk factors. Still, the actual mechanisms causing the disease are not completely understood. Also the specific molecular mechanisms for the pathogenesis of osteoporosis have not been known yet (6, 11).

Now we are in revolution of osteoporosis. It is the revolution on the five fronts: genetics, local factors, bone density, bone markers and prevention and therapy of osteoporosis. All of these aspects are radically changing.

Recent studies suggest that specific genes may determine bone mass, bone turnover and bone loss. They are e.g. vitamin D receptor alleles, genes for the collagen type I and for local growth factors. Genetically determined changes in the biosynthesis of collagen may concern both processes of transcription and translation (10, 13, 14). But not all researches have confirmed these findings. Maybe studies which will be carried out on the human genome, would explain the genetic mechanism of osteoporosis and several genes that predispose a person to the development of osteoporosis might be identified.

The next problem which is widely discussed is the role of local factors in pathogenesis of osteoporosis. Various cytokines and related substances, including interleukin-1, tumor necrosis factor-alpha, interleukin 6, and prostaglandin E_2, have been implicated as causes of bone loss after ovariectomy in animal models of osteoporosis (8). In humans, the data on the role of local cytokine production in the response to estrogen deficiency and in

osteoporosis have been studied over the past decades. Numerous reports have been published demonstrating that natural or surgical menopause increases saliva blood, bone marrow, and monocytic levels of IL-1, IL-6, TNF, and the related factors IL-1ra and IL-6R. *In vitro* studies have also documented the ability of estrogen treatment to suppress the production of these cytokines by bone and bone marrow cells (2, 12). In spite of these observations, controversy persists concerning the specific contribution of each of these factors to postmenopausal bone loss.

In the past, the diagnosis of osteoporosis often was made too late, when a fracture occurred. The picture of bones was diagnosed on the basis of X-ray examination. Now, densitometry is the basic method used in diagnosis of osteoporosis. Dual-energy X-ray absorptiometry of the lumbar spine, proximal femur or forearm determines bone mineral density. The World Health Organization (WHO) has recommended that osteoporosis should be diagnosed when bone mineral density is at least 2.5 SD below the mean for young adults. A range of ± 1.0 SD is defined as normal, and a range between –1.0 and –2.5 SD is defined as low bone mass or osteopenia (4). But this definition is based on epidemiological data of postmenopausal white women, and sometimes may not apply to other population. Also, dual-energy X-ray absorptiometry of the lumbar spine and proximal femur is expensive, therefore, densitometry is currently recommended for high-risk populations (3). In this way we could find the most cost-effective and simpler measurements of the bone density.

In diagnosis of osteoporosis also markers of bone turnover could be estimated. Earlier, they were: the total alkaline phosphatase level, urinary hydroxyproline or calcium levels. Now, new measures of bone resorption (such as collagen crosslinks) and of bone formation (such as bone-specific alkaline phosphatase or osteocalcin) are better indicators of bone turnover (5). Several of these assays are now available for clinical use. They could be useful diagnostic tools that indicate a risk for fractures. Markers for bone turnover also can be used to assess the response to a new antiresorptive therapy, sooner than bone mineral density can be detected by dual-energy X-ray examination. This measurement is developing rapidly, and it can assay bone turnover very carefully and quickly. Maybe, it will be soon a universal method in diagnosis of osteoporosis.

The last goal which is now discussed, is prevention and therapy in osteoporosis. Alendronate (a bisphosphonate) and a nasal spray of calcitonin have been recently approved by the Food and Drug Administration (11). Alendronate is appropriate therapy for postmenopausal women with established osteoporosis who cannot take estrogen. Also alendronate is indicated for patients who have had vertebral fractures associated with low bone mass. Calcitonin is recommended for patients with painful vertebral fractures. Nasal calcitonin is easy to administer and can prevent bone loss. Also, calcium and vitamin D intake have been recommended as part of a preventive regimen. The current Recommended Dietary Allowance for adults is 800 to 1000 milligrams of calcium per day. In postmenopausal women, hormone replacement therapy with estrogen is highly effective in preventing bone loss and reducing the incidence of fractures. The risk of endometrial

cancer is reduced by adding progestin. Hormone replacement therapy has a positive effect on health of women and is effective in older women who are many years past menopause (1). Lately, new therapy is being developed. Antiestrogens, such as tamoxifen, raloxifen and droloxifen, can have beneficial effects on bone and might reduce the incidence of breast cancer. Trials with raloxifen and droloxifen are under way and may provide an exciting new approach to prevention of osteoporosis in postmenopausal women (7, 9).

Although we have extensive information about osteoporosis in women, we still have little information on how to prevent or treat osteoporosis in men. It will become an increasing problem in the future.

Maxillofacial surgeon should be interested in osteoporosis (in women and men), because this disease may be one of the confounding variables in the etiology, pathogenesis, diagnosis and therapy for specific forms of periodontal disease, temporomandibular disorders, trauma-induced oral maxillofacial surgery in mature and elderly people, and in the success or failure of dental implants.

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SUMMARY

On the basis of the literature the author describes some aspects of osteoporosis (pathogenesis, diagnosis, prophylaxis, and treatment). He focuses attention on the new factors which take part in this process such as: markers of bone turnover, local factors – cytokines and genetics. He also notices that osteoporosis can concern maxilla and mandible, therefore, maxillofacial surgeon should know this disease.

Nowe aspekty osteoporozy – przegląd piśmiennictwa

Autor na podstawie piśmiennictwa przedstawia wybrane zagadnienia dotyczące osteoporozy (patogeneza, rozpoznawanie, profilaktyka i leczenie). Zwraca uwagę na nowe czynniki biorące udział w tym procesie, takie jak: markery obrotu kostnego, lokalne czynniki – cytokiny oraz uwarunkowania genetyczne. Stwierdza ponadto, że osteoporoza może dotyczyć także kości szczęk i dlatego chirurg szczękowy powinien znać tę chorobę.