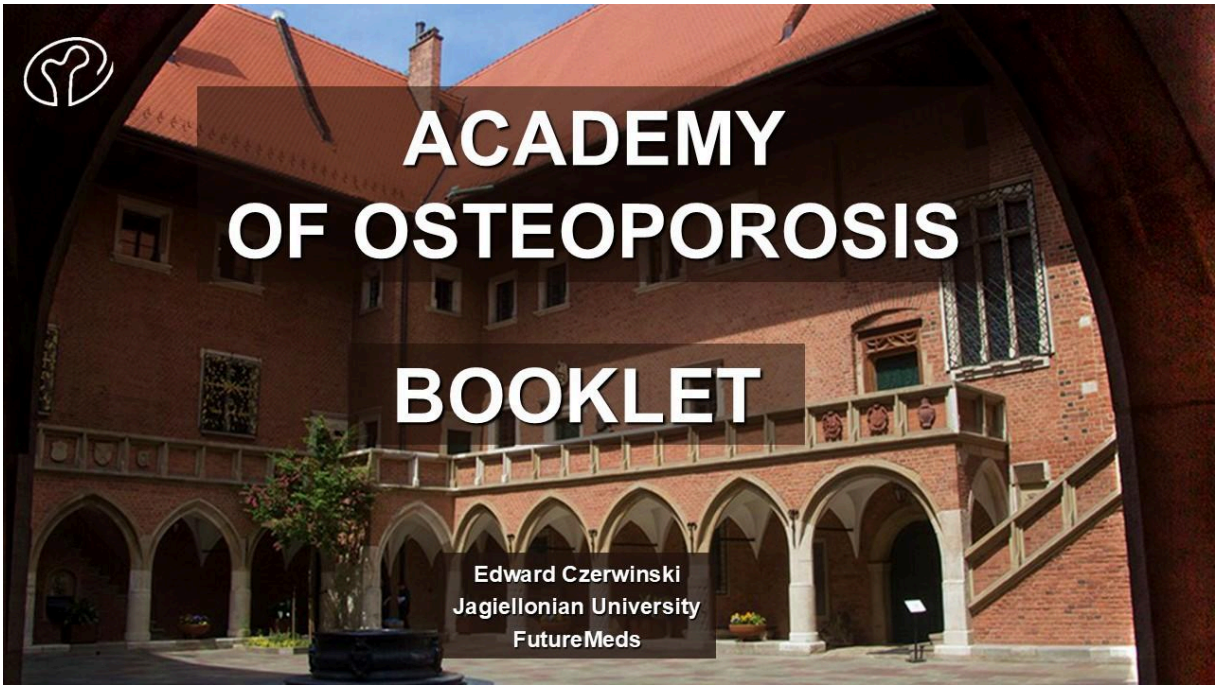
Edward Czerwinski
Jagiellonian University
Futuremeds
www.eczerwinski.pl
kontakt@osteoporoza.pl



CONTENT

a) About Academy of Osteoporosis
b) Prof. Edward Czerwinski BIO

LIST OF LECTURES

1. Definition and epidemiology of osteoporotic fractures
2. Pathophysiology of osteoporosis
3. Basic diagnosis of osteoporosis
4. Advanced diagnostics of osteoporosis
5. Fracture risk assessment
6. Current guidelines - imminent fracture risk
7. Antiresorptives in osteoporosis management
8. Bone forming agents
9. Osteoporosis: how long should we treat?
10. Osteoporosis prophylaxis
11. The importance of vitamin D for bones and muscles
12. Fall prevention

AO Academy Photo Gallery

a) **About Academy of osteoporosis**

The Academy of Osteoporosis is a video textbook in which I wanted to share the knowledge and experience I've gained treating patients with osteoporosis for over 30 years. In subsequent lectures, I have tried to present the knowledge vital to every physician treating osteoporosis on a daily basis. The content was based on contemporary publications as well as information from global and local scientific conferences. My views are undoubtedly influenced by the fact that I have been treating bone fractures since 1972. Across the 12 lectures of the Academy of Osteoporosis, I present information on the diagnosis, prevention, and treatment of osteoporosis. I invite you to 365 minutes of lectures containing 558 slides.

a) **Prof. Edward Czerwinski BIO**

Prof. dr hab. med. Edward Czerwinski is a professor emeritus at the Jagiellonian University with 53 years of professional experience as an orthopaedic surgeon. He worked at the Orthopaedic Department of the Jagiellonian University Medical College for 36 years, including 6 years as its head. Founder (1995) and director of the Krakow Medical Center (until 2020), currently Senior Medical Director at Futuremeds.

At KCM, he carried out 180 clinical trials and was the principal investigator for 58 projects. Almost all drugs introduced for the treatment of osteoporosis have been studied in KCM. He has been dealing with bone and joint diseases for 42 years, initially with fluorosis (habilitation), and for 31 years with osteoporosis. Since 2007, together with the National Specialist and the Chairman of the PTOiTr, he has been updating every two years the "Guidelines for the prevention, diagnosis and treatment of osteoporotic bone fractures". Founder of the Forum on Osteoporosis and Aging (previous Polish Society of Osteoarthrology), creator and driving force behind the Polish Osteoporosis Portal (www.osteoporosis.pl).

Prof. E. Czerwinski cooperated with Prof. John Kanis in creating the FRAX® calculator for the Polish population. He was appointed to a panel of experts working on international standards regarding, among others: management after the post-fracture management EULAR/EFORT and the the recommended Vitamin D3 levels IOF.

Since 1994, Prof. E. Czerwinski organized 28 symposia and congresses in the field of orthopaedics and osteoporosis, attended by approximately 16,000 participants. Since 1996, he has been organizing the Central European Congresses of Osteoporosis and Osteoarthritis. In 2002, he organized the first international EFORT course in Poland, and in 2018 he co-organized the World Congress on Osteoporosis in Krakow. He is a member of the editorial committees of 12 scientific publications and 20 20 national and international scientific societies.

In his free time, Professor Czerwinski likes lonely mountain hikes, especially in the Tatra Mountains and Bieszczady Mountains, skiing, Polish rivers and lakes, and exotic travels. “His greatest passions are photography and music. Publications: 537; Impact Factor: 240; H-index: 22; Citations: 3,301..

More: www.eczerwinski.pl.
kontakt@osteoporoza.pl

DEFINITION AND EPIDEMIOLOGY OF OSTEOPOROSIS

Academy of Osteoporosis,
Lecture 1

Topics

- Definition of Osteoporosis
- Prevalence of Osteoporotic Fractures
- Projections to 2050
- Consequences of Fractures
- Secular Trends

Summary

Osteoporosis is defined as a systemic skeletal disease characterised by low bone mass and microarchitectural deterioration, with a consequent increase in bone fragility and susceptibility to fracture. After the age of 50, osteoporosis occurs in about 30% of women and 8% of men. The fracture probability in women is 40% and is higher than the probability of breast cancer (12%).

The steady increase in the number of fractures results from the increase in the world population from 6.15 billion in 2000 to 9.74 in 2050 and the increase in the average life expectancy in 2010, there were 3.4 million fractures in Europe and in 2034, it will increase to 5.3 million.
The number of hip fractures in the world in 1950 amounted to 1.66 million and will reach 6.26 million in 2050. The number of hip fractures in women increases with age with a geometric progression, e.g., in Poland, we observed 16 fractures per 100,000 in the 50-54 age group and 1138 fractures in the 85 plus age group. The frequency of hip fractures varies in individual countries.

The biggest problem in osteoporosis are proximal femur fractures. Within a year after a fracture, 20% of women and 25% of men die, and of those who survive, 50% are disabled. Mortality after osteoporotic fractures in Europe amounts on average to 116 per 100,000. It is the lowest in Spain 74 and the highest in Slovakia 216. As a result of osteoporotic fractures, 26.3 thousand people die, and the loss of DALY is 1,160 thousand per year.

The annual cost of treating osteoporotic fractures in Europe amounted to 37 billion in 2010 and will reach 57 billion in 2029.
Reducing the incidence of fractures is possible. In 11 countries (including the US, UK, Denmark, Canada) a secular trend of decreasing fracture incidence was observed between 2005 and 2018
Reducing the incidence of fractures involves prevention, diagnosis and treatment of osteoporosis, and especially preventing another fracture

Keywords
Osteoporosis, Definition, Epidemiology, Fractures, Academy, Treatment, Science, Aging, Menopause

PATHOPHYSIOLOGY OF OSTEOPOROSIS

Academy of Osteoporosis,
Lecture 2

Topics

- Bone structure and physical characteristics
- Trabecular and cortical bone
- Histomorphometry
- Bone remodeling
- Pathophysiology of osteoporosis
- Summary

Summary

Bone serves mechanical, hematopoietic, and endocrine functions. Its macro- and microscopic structure and high degree of mineralization (30-75%) ensure bone's resistance to fractures with minimal mass. Cortical bone constitutes 80% of bone mass and has a low metabolism. Trabecular bone remodeling occurs across the entire surface of trabeculae and accounts for 80% of bone metabolism.

Osteocyte is the main bone cell. Its projections form a "neural network" allowing intercellular communication with the blood and other organs. Thanks to mechanoreceptors, the osteocyte ensures bone quality by controlling bone remodeling and growth. It lives for 1-40 years.

The osteoblast forms and mineralizes bone. It controls the osteoclast. It secretes osteocalcin, a hormone and bone-building protein. The osteoclast is a macrophage of phagocyte family. Its resorptive activity is controlled by feedback from the osteoblast and the influence of numerous cytokines, such as osteoprotegerin, RANKL, TGFα and β, interleukins, and others. Osteocytes initiate bone remodeling when excessive mineralization results in microfractures. The resorption phase is followed by osteoid formation and then mineralization. Once mineralization is complete, osteoblasts become osteocytes. The remodeling cycle lasts approximately three months. Within 12 months, 25% of the trabecular bone is replaced.

The main cause of osteoporosis in women is menopause, which causes a rapid decline in estrogen levels. In Europe, with the average age of 84.0, women live through menopause for 34 years. Estrogen receptors are found in the cells of virtually all organs. This results in direct and indirect effects on bone cells. The direct effect of the lowering of estrogen levels is increased bone resorption and inhibition of bone formation. The development and progression of osteoporosis depend primarily on genes, which determine (up to 80%) peak weight and the aging process. Nutrition, exercise, lifestyle, and associated diseases and medications also play a significant role.

Keywords

Osteoporosis, Bone, Bone structure, Quality, Pathophysiology, Biology,. Osteoblast, 0steoclasts, Osteocyte, Mechanoreceptor, Bone metabolism, Rank L, Cytokine, Menopause, Academy of osteoporosis.

BASIC DIAGNOSTICS

Academy of Osteoporosis
Lecture 3

Topics

- Interview
- Patient examination
- Densitometry
- Ultrasounds
- Additional tests
- Differential diagnosis

Summary

DXA is the standard method for measuring bone density and the reference sites are the proximal femur and the lumbar spine L1-L4. The densitometric measurements made with other methods and from other sites are not equivalent and cannot lead to the diagnosis of osteoporosis. The goal of osteoporosis diagnosis is to determine fracture risk. According to WHO criteria, the diagnostic threshold for osteoporosis is a T-score of ≤ -2.5. A decrease in BMD requires differential diagnosis.

A decrease in BMD indicates an increased fracture risk, but a normal BMD does not rule it out. Seventy percent of fractures occur in patients who do not meet the WHO criteria for osteoporosis. The current standard is to examine both the proximal femur and spine. The proximal femur examination best predicts the risk of fracture in this location. The advantage of spine examination include an early appearance of changes and a faster response to pharmacological treatment. The disadvantages include degenerative changes that occur with age and vertebral fractures. In practice, BMD measurement in the proximal femur is not influenced by degenerative changes in the hip joint, and the measurement in the "neck" region is the basis for calculating the fracture risk using the FRAX calculator.

QUS Examination – Quantitative Ultrasound (transmission beam). It determines the parameters of bone quality and helps assess the risk of fracture. Currently, it is not used in the diagnosis of osteoporosis. REMS: Radiofrequency Echographic Multispectrometry produces results that correlate well with BMD by DXA. REMS can be used in the diagnosis of osteoporosis and is gradually being introduced into standards.

Keywords

Osteoporosis, Diagnostics, Patient examination, Densitometry, Dual energy X-ray absorptiometry, Ultrasounds, Differential diagnosis, DXA, BMD, Fracture risk, QUS, Quantitative Ultrasound, FRAX, REMS, Radiofrequency Echographic Multispectrometry,

ADVANCED DIAGNOSTICS OF OSTEOPOROSIS

Academy of Osteoporosis

Lecture 4

Topics

- Trabecular Bone Score
  - Principles of the TBS program
  - TBS in fracture risk assessment
  - TBS in treatment outcome assessment
- X-ray – morphometry
- DXA – morphometry
- QCT – Quatitative Computerized Tomography

Summary

The Trabecular Bone Score allows for an indirect assessment of the quality of bone structure based on image analysis of a spine densitometry test. TBS predicts fracture risk independently of BMD. It improves the accuracy of FRAX fracture prediction. TBS is used to predict fractures, assess treatment outcomes, and analyze bone abnormalities in diseases that may cause them.

60% of spinal fractures are asymptomatic. A height loss of 4.0 cm indicates a prior fracture.. Radiographic examination is the most accurate method for diagnosing spinal fractures. It should be performed according to the principles of spinal morphometry. The fracture threshold is defined as a 20% reduction in vertebral height compared to the posterior height. The advantage of DXA morphometry is 20-fold lower exposure .to X-ray radiation: 40 µSv in morphometry and 820 µSv in X-Ray. The diagnosis of a vertebral fracture has an incomparably greater diagnostic significance than the T-score.

QCT - qualitative computed tomography allows for the measurement of actual bone density D = m/v. DXA method gives a false result in this respect due to the variable bone volume but therefore better predicts the risk of fracture. By means of QCT, we can measure BMD separately in cortical and trabecular bone. Knowing the actual density and precise voxel location allows us to calculate and even test the mechanical strength of bone

Keywords

Osteoporosis, Diagnostics, Trabecular Bone Score, TBS, Fracture risk, X-ray morphometry, DXA morphometry, DXA, Quatitative Computerized Tomography, Spinal fractures, Bone structure, Voxel. FEM, Mechanical strength, Fracture, Bone, Menopause

FRACTURE RISK ASSESSMENT

Academy of Osteoporosis
Lecture 5

Topics

- Whom to treat?
- Calculator FRAX
- FRAX tutorial
- TBS (Trabecular Bone Score) and fracture risk
- Diagnostic and therapeutic threshold

Summary

The goal of diagnostics is to identify individuals at risk of a fracture. We treat patients at higher risk of a fracture than the general population. FRAX calculates absolute fracture risk by integrating other factors such as: BMD, age, gender, BMI, prevalent fracture, fractures in parents, steroids, RA, secondary osteoporosis, smoking, and excessive alcohol consumption.
FRAX calculates the 10-year absolute risk of a MOF (Major Osteoporotic Fracture, e.g.: proximal femur, spine, radius, and humerus) and only of proximal femoral fracture. The therapeutic threshold is the FRAX value for a person with a prevalent fracture without other CRFs (Clinical Risk Factors). In the UK, for a 50-year-old woman, it is 7.0% MOF (Mojor Osteoporotic Fracture).
Trabecular bone score is an independent fracture risk factor and refines the FRAX calculations. A high score can lower the risk percentage (e.g., from 12% to 10%), while a very low score can increase it (from 12% to 23%). "FRAX plus" - Beta version takes into account, among others: TBS, location and date of fracture, dose of glucocorticoids, falls, duration of diabetes, spine BMD vs. neck and length of the femoral neck

Kedy words

Osteoporosis, Diagnosis, Fracture risk, FRAX, FRAX tutorial, ,Fracture, Fracture risk, Academy of Osteoporosis, Treatment, Trabecular Bone Score, Diagnostic threshold, Therapeutic threshold,

CURRENT GUIDELINES - IMMINENT FRACTURE RISK

Academy of Osteoporosis
Lecture 6

Topics

- Definition of imminent fracture risk (IFR)
- Quantitative assessment of IFR
- Qulitative assessnet of IFR

Summary
Imminent fracture risk means a very high probability of a subsequent fracture within 1-2 years after a prior fragility fracture. Very high fracture risk is used interchangeably with „Imminent fracture risk".
IOF based on FRAX calculation - very high fracture risk indicates the absolute value of the fracture risk above „upper threshold" for a patient at a particular age.When additional CRFs are entered into FRAX, algorytm identifies individuals at a very high fracture risk even without osteoporosis as measured by T-score (WHO) [i.a. recency and types of fractures, falls, TBS].
American Association of Clinical Endocrinologists Guidelines are based on the findings of opinion leaders and take into consideration one numerical value of FRAX.
Patients at very high risk of fracture should be treated with bone-forming drugs.

Kedy words
Osteoporosis, Fracture, Current, Guidelines, Fracture Risk, Imminent Fracture Risk
IOF, FRAX, Bone, Akademy of Osteoporosis, Menopause

ANTIRESORPTIVES IN OSTEOPOROSIS MANAGEMENT

Academy of Osteoporosis
Lecture 07

Topics

- Bisphosphonates - mechanism of action
- Oral and intravenous bisphosphonates
- Denosumab

Summary

The goal of osteoporosis treatment is to prevent fractures, improve the quality of life, and extend it. The basis of osteoporosis treatment are: Ca (1000 mg) and vitamin D (800-2000 IU) supplementation pharmacological therapy; exercise and a healthy lifestyle; fall prevention. The mechanism of action of bisphosphonates is based on physicochemical and biological effects. Reducing the solubility of hydroxyapatite inhibits osteoclast adhesion and subsequent resorption. BP uptake disrupts osteoclast metabolism. The effect of bisphosphonates is the inhibition of resorption and remineralization, which leads to increased strength and a reduced fracture risk. BPs do not increase bone mass but inhibit its loss. The issues with BP include poor absorption, the need to take it on an empty stomach, and the risk of gastric complications. After a year, only 40% of patients continue treatment. Oral bisphosphonates are administered weekly and monthly, and intravenously once every 3 months. The effectiveness of bisphosphonates, with the exception of ibandronate, is similar. The risk of vertebral fractures is reduced by approximately 60%, and non-vertebral fractures by 40-60%.

Denosumab is a RANK-L antibody. Administered subcutaneously once every 6 months, it reduces the risk of vertebral fractures by 68%, non-vertebral fractures by 20%, and proximal femoral fractures by 40%. Denosumab produces faster and greater BMD gains than BP. After 10 years of treatment with Dmab and BF, clinical trials showed an increase in BMD (%): n the spine: Dmab 21.7; AL 13.6; in the femoral neck: Dmab 9.2; AL 7.0. The anti-fracture efficacy of denosumab is maintained throughout the 10-year treatment period (virtual control group). After denosumab discontinuation, within 3 weeks, there is a sudden increase, a "rebound" of markers to approximately 60% above normal. BMD decreases by 50% within a year in the spine and by 100% in the total hip. The overall incidence of vertebral fractures returns to pre-therapy levels after treatment discontinuation. A higher incidence of multiple spontaneous vertebral fractures has been observed in individuals with a prevalent fracture.
After DSB discontinuation, administration of an antiresorptive medication is mandatory; zoledronate is most commonly recommended. It helps to partially reduce the effects of discontinuation.

Keywordss
Osteoporosis, Treatment, Fractures, Bisphosphonates, Alendronate, Ibandronate, Zoledronate, Denosumab, RANK-L, Antibody, BMD, Rebound effect, bone markers, Bone, Prophylaxis, Calcium, Menopause

BONE FORMING AGENTS

Academy of Osteoporosis
Lecture 8

Topics

- Teriparatide
- Abaloparatide
- Romosozumab

Summary

Bone remodeling and modeling are continuous processes of bone homeostasis. In osteoporosis, bone remodeling predominates, with increased resorption activity. PTH derivatives – teriparatide and abaloparatide are administered via daily subcutaneous injections. After one year of treatment, therapy should be continued with an antiresorptive medication. Teriparatide and abaloparatide lead to a faster increase in BMD. They bring anti-fracture effect faster and more effectively than bisphosphonates.

Romosozumab is an antibody that targets sclerostin, a cytokine that osteocytes use to inhibit osteoblast activity. It's administered monthly via subcutaneous injection for a year. Afterwards, an antiresorptive therapy should be continued. Head-to-head studies have shown that romosozumab is more effective at preventing fractures than alendronate, including a 37% greater reduction in non-vertebral fractures. Romosozumab is more effective than both alendronate and denosumab in preventing refractures.

In the first year of the ARCH study, cardiovascular events occurred more frequently in the group treated with romosozumab (2.5%) compared to alendronate (1.9%; difference of 0.6%). However, over three years of treatment, complications were slightly more frequent in the alendronate group (1.3%). Although recent publications do not confirm an increased cardiovascular risk, romosozumab (Evenity) should not be prescribed to patients with cardiovascular risk.

The optimal treatment scheme for osteoporosis starts with a bone-forming medication to rebuild bone mass, followed by antiresorptive therapy to maintain it. Bone-forming medications are the preferred therapy for patients with very high fracture risk.

Keywords
Osteoporosis, Treatment, Teriparatide, Romosozumab, Abaloparatide, Romosozumab, Bone remodeling, Bone modelling, PTH, Sclerostin, Osteocyte, ARCH, FRAME, Evenity, Fracture, Very high fracture risk, Bone, Menopause

OSTEOPOROSIS: HOW LONG SHOULD WE TREAT?

Academy of Osteoporosis
Lecture 09

Topics

- The longest clinical trials
- Long-term treatment standards
- Criteria for efficacy
- Drug holiday and risk of complications

Summary

Osteoporosis is treated throughout the patient's life and pharmacological treatment continues as long as its benefits outweigh the risk of complications. The goal of treatment is to prevent fractures. An indirect measure of fracture risk reduction is BMD. „Treat-to-target" determines as efficacy criteria a lack of fractures (including diagnostic imaging of spine) and an increase in BMD to at least T score -2.5 and in special cases to T- 1.5.

Drug holidays are recommended after the treatment goal is achieved. After bisphosphonate treatment an interruption of up to several years is possible, but after discontinuing DSB, BMD decreases rapidly and fracture risk returns to the initial level.
Drug holiday reduces the risk of major complications,i.e. jaw necrosis and atypical femoral fracture. Atypical fractures most often result from hypermineralization casued by a persistent antiresorptive therapy.

The greatest risk of ONJ occurs when medications are taken in the following sequence: DSB – ZOL – oral BP. For DSB it can occur even after 1 dose. The risk of complications increases notably after 5 years of treatment. After 10 years, the benefits of treatment and the risk of complications should be evaluated very individually.

Key words

Osteoporosis, Treatment, Trial, Bisphosphonates, Denosumab, PTH, Zoledronic acid, Antiresoption, Bone Forming, Complications, Jaw Necrosis, BMD, Drug Holidays, Vitamin D, Bone, Muscle, Falls, Fractures, Fracture Risk, FRAX, Fracture threshold, Prevention, Guidelines, Calcium, Exercises, Lifestyle,

OSTEOPOROSIS PROPHYLAXIS

Academy of Osteoporosis

Lecture 10

Topics

- Pregnancy and breastfeeding
- Childhood
- Postmenopausal woman
    - Calcium,
    - Vitamin D,
    - Exercises,
    - Diet

Summary

Osteoporosis prevention includes: vitamin D and calcium supplementation, fall prevention, physical exercise, and healthy diet. Osteoporosis prevention begins during pregnancy and breastfeeding. Adequate intake of vitamin D and calcium is essential for proper skeletal development, which can influence peak bone mass. During pregnancy and breastfeeding, a mother can lose up to 11.5% of spinal BMD and up to 7.2% of hip BMD, which may lead to spinal fractures. From birth to age of 14, bone mass increases tenfold. Vitamin D supplementation prevents rickets. Adequate intake of vitami and calcium, along with physical activity, is essential for building high-quality bone mass in the skeleton.

Childhood and adolescence are crucial periods for building peak bone mass. A very concerning phenomenon is the decline in physical activity among youth worldwide. Our youth spend an average of **4.1** hours per day on smartphones.In postmenopausal women, adequate calcium intake is essential for maintaining calcium homeostasis. The daily calcium requirement for postmenopausal women is approximately 1200 mg.Pharmacological calcium supplementation increases the risk of kidney stones by about 17%, whereas dietary calcium supplementation reduces it. Supplementation with calcium and vitamin D does not increase the risk of cardiovascular events. In adults, the optimal level of vitamin 25(OH)D is 20–40 ng/ml. A lower level reduces the risk of falls, higher might increase falls risk but not fracture risk.

Recent meta-analyses have shown that vitamin D does not have pleiotropic effects. It does not influence, i.a., the risk of cardiovascular disease, cancer, depression, etc. Endocrine Society Clinical Practice Guideline 2024: In the general population aged 50 to 74 years, we suggest against routine vitamin D supplementation beyond the recommended Dietary Reference Intake for this population e.g. 600 IU aged 50 to 70 years and 800 IU for those older than 70 years.

The goal of exercising in osteoporosis is primarily to prevent falls and to maintain or even increase BMD. Resistance exercises have the greatest impact on bone mass. Weight-bearing exercises improve overall fitness and help maintain BMD. Tai Chi is a scientifically proven method for reducing the risk of falls. The simplest exercise for osteoporosis is Nordic Walking. It improves overall fitness and may positively affect BMD.

In a healthy diet, vegetables and fruits should make up half of the food intake. Whole grain products are recommended, especially wholemeal. In osteoporosis, daily consumption of dairy products is advised. The calcium requirement for postmenopausal women is 1200 mg/day. Studies have shown that the Mediterranean diet reduces the risk of proximal femoral fractures.

Kepy words

Osteoporosis, Bone, Prophylaxis, Pregnancy, Fracturs during breastfeeding, Breastfeeding, Diet, Calcium, Vitamin D, Exercises, Lifestyle, Smartphones. Thai Chi, Quality, Nordic Walking, Pathophysiology, Menopause

THE IMPORTANCE OF VITAMIN D FOR BONES AND MUSCLES

Academy of osteoporosis

Lecture 11

Topics

- Bone and Muscle
- Vitamin D receptors in the human body
- The role of vit. D in bone metabolism
- Functional structure of the muscle
- The role of vit. D in muscle function
- Vit. D supplementation and fractures. Where is the truth?
- Pregnancy and breastfeed**ing**

Summary

Vitamin D metabolite 1,25(OH)2D is a hormone, and the VDR is found in all organs. It is an important element of the body's calcium metabolism and the proper functioning of many organs, including bones and muscles. Vitamin D has both genetic and non-genetic effects: it increases the calcium absorption in cell membranes. Proper vitamin D levels are essential for bone development, structure, and remodeling. Vitamin D deficiency causes rickets in children and osteoporosis/ osteomalacia i adult.

Vitamin D is essential for proper muscle function. Deficiency weakens muscle strength and increases the risk of falls and fractures. In patients with a history of vertebral or non-vertebral fractures, serum 25(OH)D concentrations were below 20 ng/mL, and fracture risk was higher at lower levels. Evidence suggests that a threshold of approximately 12.5 ng/mL in serum 25(OH)D represents the critical level of increased fracture risk. Vitamin D supplementation in individuals with deficiency reduces the risk of both falls and fractures. However, there is no linear correlation between rising 25(OH)D concentrations and fracture risk reduction, and considerable variability in results has been observed.

The largest clinical trial to date, the VITAL study, which included 25,871 participants with a mean follow-up of 5.3 years, demonstrated that vitamin D supplementation at a dose of 2000 IU/day had no significant effect on fall risk, fracture incidence, or pleiotropic outcomes. In the commentary on the VITAL trial, it has been emphasized that serum 25(OH)D concentrations were not measured, and that more than 40% of participants, including those in the control group were already taking vitamin D supplements. The Endocrine Society Clinical Practice Guidelines published in 2024 recommend vitamin D supplementation only in age groups up to 18 years and over 75 years, as well as during pregnancy and breastfeeding.

Key words

Vitamin D, Bone, Muscle, Falls, Fractures, Prevention, Guidelines, Osteoporosis, Calcium, Exercises, Lifestyle, Thai Chi, Quality, Nordic Walking,

FALL PREVENTION

Academy of Osteoporosis
Lecture 12

Topics

- Clinical significance of falls
- Causes of falls
- Sarcopenia
- Fall prevention

Summary

One in three women over the age of 65 falls. 25% of falls result in injury, and 11% require hospitalization. 5-10% of falls result in fractures. 90-100% of non-vertebral fractures result from a fall. Falls account for 38,742 deaths in the U.S. Mortality rates from falls increase with age. Compared to the U.S. population, the mortality rate after fall is approximately 8.3 times higher in the 65-74 age group, 14.6 times higher in the 75-84 age group, and 21.4 times higher in the 85 and older age group. Falls are caused by a variety of internal and environmental factors. Most falls result from three or more coexisting factors.

Sarcopenia coexists with osteoporosis. It increases the fall risk and mortality. Reduced functionality of the musculoskeletal system plays a central role in delayed protective responses, leading to an increased susceptibility to falls and fall-associated injuries. By eliminating environmental factors, falls can be reduced by up to 40%.

Eliminating the influence of internal factors on the occurrence of falls is challenging, as it depends on the possibility of treating the underlying condition, such as circulatory insufficiency or vertigo. Performing isolated exercises at home has proven ineffective in preventing falls. However, the inclusion of Tai Chi practice yields remarkable results. Since falls result from the interaction of multiple internal and external factors, effective prevention can only be expected through a multifactorial intervention

Keywords

Osteoporosis, Falls, Sarcopenia, Exercises, Tai Chi, Mortality, injuries, Multifactorial intervention, Bone, Prophylaxis, Calcium, Vitamin D, Exercises, Lifestyle, Pathophysiology, Menopause