

OPTIMIZING THE MANAGEMENT OF OSTEOPOROSIS

MARIANA CEVEI¹, DORINA STOICĂNESCU², RAMONA SUCIU³^{1,3}University of Oradea, ²“Victor Babeș” University of Medicine and Pharmacy Timișoara**Keywords:**

osteoporosis, fracture, comorbidities, rehabilitation, multidisciplinary team

Abstract: Osteoporosis is a systemic disease, characterized by reduced bone mass and abnormal bone microarchitecture. There are several risk factors, one of them: positive family history emphasizes the importance of genetic factors in the pathogenesis of the disease. We report a case with severe osteoporosis and important comorbidities. Anamnesis, clinical and paraclinical examination revealed four risk factors: positive family history, osteoporosis of the hand with wrist fracture, decrease in height of more than 3 cm after 50 years of age, early menopause and a spine T score of -4.1, all these pleading for a severe, neglected postmenopausal osteoporosis, complicated with fractures. FRAX revealed 15% risk to have a major fracture in the next 10 years. The objectives of the treatment were pain relief, reducing fracture risk, increasing bone mineral density, joint stability and muscle tone. Prevention, complex rehabilitation performed by a multidisciplinary team and personalized therapy may be a promising approach.

INTRODUCTION

Osteoporosis is defined as a systemic skeletal disease, characterized by reduced bone mass and abnormal microarchitecture of the bone.(1,2) Its prevalence is increasing with the increasing of number of elderly individuals.(3) There are several risk factors, such as gender, age, race, menopause with the reduction of estrogens (4), dietary factors, corticosteroids, sedentarism, alcohol or tobacco use.(5) One of the most important is the positive family history, which emphasizes the importance of genetic factors in the pathogenesis of the disease. Recent studies have identified many bone mineral density loci and also loci that are associated with risk of fractures (6), but less is known about the genetics of age-related bone loss. Identification of these genes and molecular mechanisms could lead to new therapeutic and prevention measures.(7) It is estimated that these factors account for about 50% - 85% of the variance in peak bone mass.(8) The most important complication is represented by fragility fractures.(9) The number of osteoporotic fractures in the European Union (EU), in 2000, was estimated at 3.79 million.(3)

PURPOSE

The aim of this report is to reveal the importance of multidisciplinary team in patients with multifactorial conditions, for diagnosis, prevention, treatment and optimizing quality of life in cases with osteoporosis and comorbidities.

CASE REPORT

We report the case of a 63-year old female, from a rural area, admitted in “Băile Felix” Medical Rehabilitation Clinical Hospital. The patient's complains were dorsolumbalgia and pain in the right knee joint. The causes are mechanical in nature, pain is weather sensitive and is accompanied by morning stiffness phenomenon. She followed for 3 years rehabilitation therapy at I Mai Spa with discrete improvement of the symptoms.

The family history of the subject reveals that her mother had osteoporosis and hypertension. She has a brother, who also has hypertension. Her personal history showed that she had one birth and menopause occurred at 42 years old. Important data from her medical history: hypertension was diagnosed 30 years ago, coronary heart disease was diagnosed 25 years ago and 5 years ago she had a right wrist fracture.

She is retired and leads an active life.

Based on positive family history and her medical history we established the diagnosis of dorso-lumbar vertebral syndrome, static and dynamic, possible through osteoporosis.

Clinical examination revealed some abnormal signs:

- examination of skin and mucosa: varicose veins with dark brown skin discoloration
- examination of musculoskeletal system:
 - accentuated dorsal kyphosis, right paralumbar muscles contracture, interscapular-vertebral painful contracture, leading to the diagnosis of static spinal syndrome.
 - cervical spine had limited mobility in all axes; lumbar spine: Schober 10/12
 - knee crackles at mobilization
 - normal mobility of the hips
 - left wrist with slight axis deviation
 - absent radicular syndrome

Height was 162 cm, weight was 63 kg and body mass index (BMI) = 24.

After anamnesis and objective examination we established the following diagnosis:

1. Postmenopausal osteoporosis with wrist fracture
2. Hypertension stage II, moderate cardio-vascular risk
3. Chronic coronary heart disease
4. Lower-extremity venous insufficiency C4a

To support these, we asked for the following laboratory examinations:

- Blood chemistry- normal data, under treatment
- CBC- normal data,

²Corresponding author: Dorina Stoicănescu, P-ța Eftimie Murgu, Nr. 2, Timișoara, România, E-mail: dstoicanescu@yahoo.com, Phone: +40256 204400

Article received on 10.05.2015 and accepted for publication on 17.08.2015

ACTA MEDICA TRANSILVANICA September 2015;20(3):83-86

CLINICAL ASPECTS

- Inflammatory markers- negative
EKG showed a sinus tachycardia, regular rhythm (heart rate = 97 beats / minute).

Dorsal spine *X-rays* (anterior and lateral views) revealed:

- dextroconvex dorsal kyphoscoliosis with vertebral fractures, predominantly anterior, in the middle-third, stage I and II, on osteoporotic background.
 - Moderate discarthrosis: marginal osteophytes, subchondral osteosclerosis, slightly narrowed disc spaces.
 - Aortic calcification with 'eggshell' aspect, atherosclerosis.
- DEXA investigation: T-score-4.1, advanced osteoporosis.

Conclusion: Osteoporosis associated with thoracic vertebral fractures, leading to the diagnosis of advanced osteoporosis.

Other recommended investigations: fundus of eyes, heart ultrasound, cardiac stress test, vitamin D dosage.

Based on family and medical history, objective and laboratory examinations we established the following positive diagnoses:

1. Postmenopausal osteoporosis with wrist and vertebral fractures
2. HTA stage II, moderate cardio-vascular risk
3. Chronic coronary heart disease
4. Lower-extremity venous insufficiency C4a
5. Hypercholesterolemia

Differential diagnosis can be made with vertebral disorders of dorsolumbar spine and extravertebral diseases.

Vertebral disorders:

- functional dorsalgia, dominated by back pain accompanied by burning and painful fatigue rapidly installed after effort.
- discarthrosis, with chronic dorsalgia of moderate intensity and mechanical nature.
- spondyloarthropathies were excluded
- post-menopausal trophostatic syndrome of the spine characterized by chronic dorsolumbalgia with painful radiation in the legs that occurs in an obese woman, excluded by BMI
- Osteomalacia, characterized by bone loss due to the mineralization defect of healthy matrix due to insufficient vitamin D
- malignant metastases with pathological fractures, suspected in the presence of nocturnal, violent pain, without a therapeutic response

Extravertebral conditions:

- Intercostal pain occurring in crisis, after effort and diminishes after vasodilator therapy
- Other causes of secondary osteoporosis: hyperthyroidism, hyperparathyroidism.

Treatment

For a correct therapeutic decision (10) we calculated FRAX to estimate a 10-year probability of fracture (11) and performed the risk test.(12) FRAX revealed a risk of 15% to have a major fracture in the next 10 years. Risk test revealed the presence of four risk factors: mother with osteoporosis, loss of height more than 3cm in recent years, early menopause, osteoporotic fracture from minor impact. Quality of life was assessed with Qualeffo score, which was decreased at 49.33, representing a moderate impairment of quality of life. Pain was appreciated with VAS scale and she had a VAS value of 9 at admission in the hospital and 3 at discharge.

- Objectives of the treatment (13):

1. pain relief
2. reducing the risk of falls and thus fracture risk

3. increase bone mineral density
4. increase joint stability and muscle toning

- Therapeutic means:

A. hygienic-dietary measures

- reduced dietary salt
- lifestyle changes with increased dietary calcium intake or increased intake of calcium and vitamin D, the most effective is calcium 1-gram/day, combined with 800 IU vitamin D3, with the effect of decreasing the number of fractures in women with osteoporosis.
- increased intake of calcium from natural sources like milk, yogurt, cheese, fish, vegetables, soy and fruits.

B. medication: antihypertensive, statins, venotonic, to stimulate bone formation and reduce bone breakdown

C. balneo-physical therapy

1. Hydrokinetotherapy: 36°, 20 minutes, water heat relieves pain, relaxes muscles. This procedure was prescribed with strict monitoring of blood pressure.

2. Physiotherapy, having as objectives:

- a) pain control achieved by passive physical therapy, namely antalgic posture. Static postural education aims to minimize lumbar lordosis, recommending a position very close to the vertical position. Dynamic postural education aims to avoid harmful posture.
 - b) correcting posture and body segment alignment
 - c) correcting dorso-lumbar spine, by extension and stretching exercises
 - d) increasing muscular strength and endurance
 - e) re-education of balance and coordination: by adopting static positions the patient will be unbalanced through small impulses by the physical therapist in order to regain active balance in different situations, being very useful in preventing falls
 - f) ensuring adequate blood circulation
 - g) respiratory re-education, because due to spine posture changes, respiratory dysfunctions-especially restrictive type, may occur. Education will be achieved by respiratory gymnastics, thoracic or diaphragmatic form.
3. Electrotherapy: dorsal interferential current, manual 100 Hz, range of 0-100, with decontracturant, analgesic, stimulant and vasculotropic effects.

Other procedures that were recommended to the patient were the following:

4. Massage of the superior trunk with the following effects: activation of local circulation, increase of elasticity of the structures involved in stiffness, increase nutrition and consumption of oxygen in the muscles and also antalgic effect. Ideally, massage should precede, intersperse and finish physiotherapy sessions.
5. Underwater shower with reduced pressure only on the vertebral column, just 10 minutes and Stanger bath, descending, 5 minutes.
6. Magnetodiatflux with sedative to decrease blood pressure values.
7. Laser, on the dorsal segment of the vertebral column, with anti-inflammatory and muscle relaxing effects.

Evolution depends on the patient's capacity to understand the need for osteoformation therapies, implementation of a kinetic program and avoiding falls.(14) The prognosis is severe because of bone loss that gets worse with age and increases the risk of falls and fractures.

Complications that can occur are other fragility fractures, hip fracture with prolonged immobilization in bed and the consequences resulting therefrom.

Recommendations at discharge (15):

- taking regularly the recommended medication (16)

CLINICAL ASPECTS

- complying with the hygienic-dietary mentioned measures
- preventing falls
- daily kinetic program, performing the exercises learned during hospitalization
- repeat DEXA after one year, to monitor treatment
- dorso-lumbar orthosis

The particularity of the case: this is a relatively young patient, in full activity, with four risk factors: a positive family history (mother with osteoporosis), osteoporosis of the hand with wrist fracture five years ago, decrease in height of more than 3 cm after 50 years of age and early menopause, and a spine T score of -4.1, all these revealing a severe, neglected osteoporosis, from the therapeutic point of view, with a severe prognosis.

DISCUSSIONS

Osteoporosis is a complex skeletal disorder characterized by fragile bones, which predispose to an increased risk of fractures. These fractures represent a significant cause of morbidity and mortality, especially in developed countries. A study performed by Johnell in 2000 estimated about 9.0 million osteoporotic fractures, of which the highest number was recorded in Europe (34.8%).(17)

Recent studies have reported associations between age-related cardiovascular disorders and bone loss, possible common etiologies and pathogenies for these diseases and osteoporotic fractures.(18,19)

Prevention of the disease and complications is essential to maintain quality of life and independence in the increasingly elderly population. Exercising regularly, optimum intake of calcium and vitamin D, with the recommendation of a serum 25-(OH)D concentration in old, fragile individuals of at least 30 ng/mL (20,21), appropriate life-style and pharmacological therapy will reduce the risk of falling.(22,23)

Kinetic programmes are tailored to the patient's needs and include muscle strengthening, improving balance and flexibility. A longitudinal prospective study demonstrated positive effects of a 12-months balance training, which was effective in improving functional and static balance, mobility and reducing falling frequency in old women with osteoporosis.(24)

The most effective programs combine exercises.(25) Englund and colab. proposed a programme of 50 minutes, which consisted of a combination of strengthening, aerobic, balance and coordination exercises, twice a week. Important increase in bone mineral density of the Ward's triangle and of maximum walking speed and isometric grip strength were noticed at the end of this program.(26)

Other studies aimed to determine the effect of long-term impact exercise on bone mass at various skeletal parts in old women with low bone mineral density. The number of falls that led to fractures was lower in the exercise group, compared to the control group, during the 30-month program. In conclusion, exercise may prevent fall-related fractures in elderly women with low bone mass.(27) A 1-year randomized, controlled exercise intervention study assessed the effects of two different training programs and their combination on physical functioning and bone in elderly women. Combination of strength, balance, agility, and jumping training prevented functional decline and positive effects were recorded for the structure of the loaded tibia, indicating that exercise play a role in preventing bone fragility.(28)

Health related quality of life, assessed by generic and osteoporosis-specific instruments is decreased in patients with vertebral fractures that occur due to osteoporosis, especially in old patients who usually also have comorbidities.(29) Low-

intensity back-strengthening exercise was effective in improving the quality of life in osteoporotic patients.(30)

If a patient already had an osteoporotic fracture, a complex rehabilitation program performed by a multidisciplinary team, with early mobilization, future falls prevention, use of orthoses and noninvasive surgical procedures may be promising approach.(31)

It is important to mention that there is a need of properly screening, treating and following cases with osteoporosis, to prevent the disease and its complications.(32) Recent advances in the genetics of osteoporosis will better define the disease process and lead to another approach to the patient, personalized prevention and therapy.(33)

CONCLUSIONS

1. We underline the importance of early detection of risk factors for osteoporosis.
2. Multidisciplinary team approach is essential in cases with osteoporosis and comorbidities for diagnosis, prevention and treatment in such complex cases.
3. Optimizing management of osteoporosis by personalized therapies will improve quality of life of these patients.

REFERENCES

1. Seeman E, Delmas PD. Bone quality-the material and structural basis of bone strength and fragility. *N Engl J Med.* 2006;354(21):2250-2261.
2. Sandhu SK, Hampson G. The pathogenesis, diagnosis, investigation and management of osteoporosis. *J Clin Pathol.* 2011;64(12):1042-1050.
3. Reginster JY, Burle N. Osteoporosis: A still increasing prevalence. *Bone.* 2006;38:S4-S9
4. Watts NB, Bilezikian JP, Camacho PM, Greenspan SL, Harris ST, Hodgson SF et al. American Association of Clinical Endocrinologists Medical Guidelines for Clinical Practice for the diagnosis and treatment of postmenopausal osteoporosis. *Endocr Pract.* 2010;16 (3):1-37.
5. Smith R, Wordsworth P. Osteoporosis. In: *Clinical and Biochemical Disorders of the Skeleton.* 2005:123.
6. Estrada K, Styrkarsdottir U, Evangelou E, Hsu YH, Duncan EL, Ntzani EE et al. Genome-wide meta-analysis identifies 56 bone mineral density loci and reveals 14 loci associated with risk of fracture. *Nat Genet.* 2012;44(5):491-501
7. Mitchell BD, Yerges-Armstrong LM. The genetics of bone loss: challenges and prospects. *J Clin Endocrinol Metab.* 2011;96(5):1258-1268.
8. Ralston SH, de Crombrughe B. Genetic regulation of bone mass and susceptibility to osteoporosis. *Genes & Dev.* 2006;20:2492-2506
9. Rosen C. Osteoporosis. In: Goldman L, et al. *Cecil Medicine.* 24th ed. Philadelphia, Pa.: Saunders Elsevier; 2011
10. Kanis JA, McCloskey EV, Johansson H, Cooper C, Rizzoli R, Reginster JY and on behalf of ESCEO, IOF. European guidance for the diagnosis and management of osteoporosis in postmenopausal women. *Osteoporos Int.* 2013;24(1):23-57.
11. The World Health Organization Fracture Risk Assessment Tool. Available at <http://www.shef.ac.uk/FRAX/>. Accessed May 5, 2008.
12. Nayak S, Roberts MS, Greenspan SL. Cost-effectiveness of different screening strategies for osteoporosis in postmenopausal women. *Ann Intern Med.* 2011;155(11):751-761.
13. Francis RM, Aspray TJ, Hide G, Sutcliffe AM, Wilkinson

- P. Back pain in osteoporotic vertebral fractures. *Osteoporos Int.* 2008;19:895-903.
14. Compston J. Monitoring osteoporosis treatment. *Best Pract Res Clin Rheumatol.* 2009;23:781-788.
15. Järvinen T, Sievänen H, Khan K, Heinonen A, Kannus P. 2008. Shifting the focus in fracture prevention from osteoporosis to falls. *British Medical Journal.* 2008;336:124-126.
16. Czerwinski E, Badurski JE, Marcinowska-Suchowierska E, Osieleń J. Current understanding of osteoporosis according to the position of the World Health Organization (WHO) and International Osteoporosis Foundation. *Ortop Traumatol Rehabil.* 2007;9(4):337-356.
17. Johnell O, Kanis JA. An estimate of the worldwide prevalence and disability associated with osteoporotic fractures. *Osteoporos Int.* 2006;17:1726-1733.
18. Marini F, Brandi ML. Genetic determinants of osteoporosis: common bases to cardiovascular diseases? *Int J Hypertens.* 2010. p. 394-579.
19. Sennerby U, Farahmand B, Ahlbom A, Ljunghall S, Michaëlsson K. Cardiovascular diseases and future risk of hip fracture in women. *Osteoporos Int.* 2007;18:1355-1362.
20. Bolland MJ, Avenell A, Baron JA, Grey A, MacLennan GS, Gamble GD et al. Effect of calcium supplements on risk of myocardial infarction and cardiovascular events: meta-analysis. *BMJ.* 2010;341:c3691.
21. Rizzoli R, Boonen S, Brandi ML, Bruyère O, Cooper C, Kanis JA et al. Vitamin D supplementation in elderly or postmenopausal women: a 2013 update of the 2008 recommendations from the European Society for Clinical and Economic Aspects of Osteoporosis and Osteoarthritis (ESCEO). *Curr Med Res Opin.* 2013;29(4):305-313.
22. Lecart MP, Reginster JY. Current options for the management of postmenopausal osteoporosis. *Expert Opin Pharmacother.* 2011;12(16):2533-2552.
23. Cummings SR, San Martin J, McClung MR, Siris ES, Eastell R, Reid IR et al. Denosumab for prevention of fractures in postmenopausal women with osteoporosis. *N Engl J Med.* 2009;361(8):756-765.
24. Madureira MM, Takayama L, Gallinaro AL, Caparbo VF, Costa RA, Pereira RMR. Balance training program is highly effective in improving functional status and reducing the risk of falls in elderly women with osteoporosis: A randomized controlled trial. *Osteoporos Int.* 2007;18:419-425.
25. Howe TE, Shea B, Dawson LJ, Downie F, Murray A, Ross C et al. Exercise for preventing and treating osteoporosis in postmenopausal women. *Cochrane Database Syst Rev.* 2011;CD000333.
26. Englund U, Littbrand H, Sundell A, Pettersson U, Bucht G. A 1-year combined weight-bearing training program is beneficial for bone mineral density and neuromuscular function in older women. *Osteoporos Int.* 2005;16:1117-1123.
27. Korpeläinen R, Keinänen-Kiukkaanniemi S, Heikkinen J, Väänänen K, Korpeläinen J. Effect of impact exercise on bone mineral density in elderly women with low BMD: A population-based randomized controlled 30-month intervention. *Osteoporos Int.* 2006;17(1):109-118.
28. Karinkanta S, Heinonen A, Sievänen H, Uusi-Rasi K, Pasanen M, Ojala K et al. A multi-component exercise regimen to prevent functional decline and bone fragility in home-dwelling elderly women: Randomized, controlled trial. *Osteoporos Int.* 2007;18:453-462.
29. Salaffi F, Cimmino MA, Malavolta N, Carotti M, Di Matteo L, Scendoni P et al. The burden of prevalent fractures on health-related quality of life in postmenopausal women with osteoporosis: the IMOF study. *J Rheumatol.* 2007;34(7):1551-1560.
30. Hongo M, Itoi E, Sinaki M, Miyakoshi N, Shimada Y, Maekawa S et al. Effect of low-intensity back exercise on quality of life and back extensor strength in patients with osteoporosis: a randomized controlled trial. *Osteoporos Int.* 2007;18:1389-1395.
31. Schwab P, Klein RF. Nonpharmacological approaches to improve bone health and reduce osteoporosis. *Curr Opin Rheumatol.* 2008;20(2):213-217.
32. Schnatz PF, Marakovits KA, Dubois M, O'Sullivan DM. Osteoporosis screening and treatment guidelines: are they being followed? *Menopause.* Oct 2011;18(10):1072-1078.
33. Li WF, Hou S-X, Yu B, Jin D, Férec C, Chen JM. Genetics of Osteoporosis: Perspectives for Personalized Medicine. *Personalized Medicine.* 2010;7(6):655-668.