THE ROLE OF KINESIOThERAPY IN THE MANAGEMENT OF OSTEOPOROSIS DURING POSTMENOPAUSE

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THE ROLE OF KINESIOThERAPY IN THE MANAGEMENT OF OSTEOPOROSIS DURING POSTMENOPAUSE (Abstract): Bone functional adaptation is influenced by many risk factors, such as the lack of estrogen during menopause, surgical menopause, premature menopause, a low weight to waist ratio, trauma, excessive alcohol use, tobacco, coffee, certain drugs (corticosteroids, anticonvulsants), food deficiencies (especially low intake of calcium), immobilization, sedentary lifestyle, hereditary and racial factors, various diseases (hyperthyroidism, diabetes). Material and methods: The study group included 115 postmenopausal women treated in the 1st Rheumatology Clinic of Clinical Rehabilitation Hospital of Iași between 1 June 2014 and 31 March 2016. Data gathering, processing and analysis were done by epidemiological, statistical and mathematical methods, using Epi Info 5, a software provided by the Epidemiology Program Office, Centers for Disease Control and the Global Programme on AIDS, World Health Organization. Results and discussion: The selection of patients was made based on a diagnosis of established postmenopausal osteoporosis (the diagnosis was made following clinical and radiographic exams and dual energy X-ray bone densitometry). The selected female patients had a bone mineral density (BMD) of less than -2.5 SDs, dorsal lumbar spine pain and limited joint mobility due to paravertebral muscle contraction. Patients in the study group received kinesiotherapy (local electrotherapy, diadynamic currents, interferential current, etc.). Conclusions: Kinesiotherapy was shown to play a major role in rehabilitation, relieving pain, correcting functional disorders of spine (spine mobility, defective spine statics, altered muscle balance), re-educating gait and balance and preventing the risk of falling. Keywords: OSTEOPOROSIS, KINESIOThERAPY, ASSESSMENT, TREATMENT.

Postmenopausal osteoporosis occurs in the first 10 years of lack of menstruation and is caused mainly by estrogen deficiency and other endocrine, metabolic and inherited disorders (1).

Postmenopausal osteoporosis is associated with physiological bone loss (occurring at around the age of 50 years), when women lose approximately 35-40% of cortical bone and 55-60% of trabecular bone, while men lose about 1/3 less (1, 2).

The risk of osteoporosis is mainly determined by two factors: bone mineral density at the beginning of menopause and the speed of bone loss after menopause, dependent on the rate of bone loss and on the years spent in post menopause (3, 4).

The present study aims to standardize an
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effective kinesiotherapy program and to assess its effectiveness on bone mineral density, pain, spinal functionality, stability, coordination, balance and gait, and on the quality of life in osteoporosis patients. Paraclinical methods (bone densitometry), clinical analytical methods (joint and muscle assessment), semi global (tests for balance and gait) and global approaches were used (3).

MATERIAL AND METHODS
The study group included 115 postmenopausal women treated in the 1st Rheumatology Clinic of Clinical Rehabilitation Hospital of Iasi between 1 June 2014 and 31 March 2016.

The 115 cases were divided into 4 groups: 16 female patients (13.91%) treated with estroprogestatives, 31 female patients (26.95%) treated with ibandronic acid, 48 female patients (41.75%) treated with alendronic acid and 20 female patients (17.39%) treated with calcium and vitamin D. The results of the therapy were assessed by measuring L4 bone mass density (BMD), the total BMD before the treatment and 2 years after and by comparing T and Z scores at the same time with student’s t-test. Increases or values of BMD, T and Z scores and the number of female patients who showed an increase or decrease in bone mass density following the four therapeutic approaches were also expressed as a percentage (fig. 1).

**Fig. 1.** Distribution of the 115 female patients in the four study groups

RESULTS AND DISCUSSION
According to their residence, most of the female patients were of urban origin (63%) as compared with the female patients of rural origin (37%). This difference is explained by better access to information and medical care in women from urban areas.

The medical history of each female patient provided relevant data for a positive diagnosis of osteoporosis. The patients’ history showed major risk factors for osteoporosis.

Five age groups were identified at the beginning of the treatment (under 41 years old, 41-50 years old, 51-60 years old, 61-70 years old and 71-80 years old). The highest number of cases (48, 41.75%) of the group treated with alendronic acid were
found in patients aged between 51 and 60, followed by the age group 61-70. There were more cases in the age group 51 - 60 and 61-70 of the group treated with bisphosphonates. It was found that a slightly younger age of onset was associated with early menopause onset and earlier initiation of therapy.

There is a balance between bone resorption and bone formation in both sexes between the age of 30 and 35. After this age, the bone mass tends to decrease at a rate of 0.5-1% / year. At all ages, women have less bone mass than men, leading to higher rates of osteoporosis and higher risk of fractures with age (5, 6) (tab. I).

<table>
<thead>
<tr>
<th>Age groups (years)</th>
<th>No. of cases</th>
<th>%</th>
<th>Therapy</th>
</tr>
</thead>
<tbody>
<tr>
<td>41-50</td>
<td>16</td>
<td>13.91</td>
<td>Estroprogestatives</td>
</tr>
<tr>
<td>51-60</td>
<td>31</td>
<td>26.95</td>
<td>Ibandronic acid</td>
</tr>
<tr>
<td>61-70</td>
<td>48</td>
<td>41.75</td>
<td>Alendronic acid</td>
</tr>
<tr>
<td>71-80</td>
<td>20</td>
<td>17.39</td>
<td>Calcium and vitamin D</td>
</tr>
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</table>

At the beginning of treatment, the patients’ age was 31-54, with an average age of 46.67 +/- 7.553 years, but women treated with alendronic acid had the highest average age of onset most advanced (an average age of 61.81 years). This can be explained by the fact that the alendronic acid was administered in cases with lower bone mass density, typically at a T-score of less than -2.5 SDs and most often at a T-score between -3 SDs and -3.5 SDs. Alendronic acid was used as a cure rather than a preventive measure.

The age of first menstruation was not significantly different between the groups treated with calcium and vitamin D, alendronic acid and ibandronic acid; the group treated with estroprogestatives showed a two-point higher average without a plausible explanation.

The age of the last period was significantly lower (an average age of 41.51 years) in the group treated with estroprogestatives. As the age of menopause onset, defined as the age of the last period, was significantly lower in the group of women treated with estroprogestatives, this therapy was favored by patients with early menopause. Younger women accept treatment with estroprogestatives mostly for subjective reasons, including the need to achieve optimal vaginal trophicity and to combat vegetative disorders caused by estrogen deficiency. These patients disregard possible metabolic cardiovascular side effects of estroprogestatives and cancerphobia is less common in this group.

The duration of estrogen deficiency in the four groups cannot be compared with one another. Women treated with estroprogestatives had a duration of estrogen deficiency of 5.13 +/- 4.037 years. This is directly related to the fact that this therapy was administered early after the menopause. The therapy with ibandronic acid was accepted due to the fact that there is no potential risk of inducing estrogen-dependent neoplasia and breast diseases during therapy with estrogen receptor modulators. The alendronic acid was introduced after a long period of estrogen deficiency (15.81 +/- 8.314 years) in women with a severe decrease in bone mass density, but who were generally older. The female pa-
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tients with background therapy with calcium and vitamin D were older women who did not agree to hormonal treatments or had a digestive intolerance.

The anthropometric measurements of waist and weight showed close values as average, minimum and maximum. Overweight female patients have a lower exercise capacity, as the excess weight overloaded the joints with degenerative changes, leading to various conditions that worsen the health status of female patients. Height is one of the factors that cannot be influenced.

Overweight can aggravate spine deformities and stress the major joints, especially hips and knees. That is why it is important to maintain a healthy weight through a balanced diet and to achieve good muscle tone through regular physical exercise in osteoporosis patients.

The group treated with estroprogestatives had lower height and weight, due to the fact that some patients were suffering from Turner syndrome (reduced height and weight). The study groups treated with calcium and vitamin D, alendronic acid and ibandronic acid were slightly overweight.

Physical activity performed by the patients was mostly moderate, as most women were sedentary and before retirement most of them had sedentary jobs.

Although osteoporosis has a long asymptomatic period, vertebral pain was a common symptom and the main reason for hospitalization.

The required parameters (BMD of the lumbar vertebra = L4 BMD; total BMD; the T-score of the 4th lumbar vertebra - TL4; total T-score - Tt; total Z score - Zt) were used for analyzing bone mass density. These parameters have also been investigated at the beginning of the treatment. There was no significant difference between the group treated with calcium and vitamin D and the group treated with estroprogestatives; the group treated with ibandronic acid had a slightly lower L4 BMD; the group receiving alendronic acid had a significantly lower BMD.

Total BMD was correlated with L4 BMD at the beginning of the treatment and it was minimal in the group treated with alendronic acid. It had intermediate values in the group treated with ibandronic acid and the highest averages in the groups receiving calcium and vitamin D, and estroprogestatives, respectively. Women in all study groups had a T-score of less than -2.5 SDs in the L4 vertebra, confirming the diagnosis of osteoporosis. The group treated with alendronic acid had the most severe score (-3.384).

The total T-score at the beginning of the treatment was comparable in the groups treated with estroprogestatives and calcium with vitamin D. It was less severe than in women treated with alendronic acid and ibandronic acid. The correlation between the therapeutic choice and the L4 T-score and the total T-score showed that either alendronic acid or ibandronic acid was preferred when this score showed a higher risk of osteoporosis and a more severe form of osteoporosis (7, 8).

The Z-score shows a negative difference between a subject in the study group and a subject of the same age in terms of bone mass density. It was found that women had a more severe bone mass loss in relation to the average of the same aged female patients as compared with those treated with calcium and vitamin D (7, 9).

It was found that women treated with alendronic acid and ibandronic acid, respectively showed a more severe deficit in BMD in relation to the average of the same aged women as compared with those treated with calcium and vitamin D.
The results showed that the values of the total BMD and of the T-score tend to be lower in patients who are older at the beginning of the treatment. The same applies if the period of estrogen deficiency is prolonged: at the beginning of the treatment, L4 BMD, total BMD and total T are lower when there has been a longer duration of estrogen deficiency.

The results of therapeutic regimens were assessed after two years by analyzing specific parameters. L4 BMD values had a moderate increase in all study groups. The highest increase was found in the group treated with alendronic acid. A low increase occurred in groups receiving calcium and vitamin D, ibandronic acid and estroprogestatives.

The L4 T-score has improved in groups treated with calcium and vitamin D, ibandronic acid and estroprogestatives, with a significant increase in the group treated with alendronic acid. The total T-score has improved in all study groups. The highest increase of the Z-score was found in the group treated with alendronic acid. More moderate increases were seen in the other study groups.

Physical therapy aimed at achieving pain relief, spine mobilization, toning paravertebral muscles, correcting the posture and regaining the ability to exercise.

Local electrotherapy was used for pain relief and for reducing muscle contracture, which is the main cause of pain. The transverse galvanization had an antalgic and anticontractile effect. It is important that the size of the electrodes entirely covers the area to be treated, the intensity of the current fits the threshold and the duration of treatment is long enough (more than 20 minutes).

Diadynamic currents act therapeutically through muscle contractions induced by the excitomotor system. Here too, it is important to adjust the intensity of the current and the duration of treatment for a therapeutic effect.

The interferential current in static and particularly in dynamic mode with excitomotor frequencies is essential in preparing the muscles for the sessions of kinesiotherapy.

*Kinesiotherapy* is not synonymous with therapeutic exercises. Its scope is more limited, both in terms of resources needed and goals (12).

The use of various exercises, techniques or methods for the functional rehabilitation was based on the knowledge of the functional deficit through a joint and muscle assessment. This provided the angle of movement, muscular endurance and strength, changes in prehension and gait and a thorough physical examination, leading to a scientific validation of the kinesiotherapy protocol.

The efficacy of the rehabilitation treatment and the results were assessed through measurements with goniometer, centimeter and a series of tests that could estimate the range of motion in the damaged joints. Balance and gait were also assessed by using the Tinetti scales.

As in other studies (12), patients in our study groups received the following procedures: re-education of posture and correction of the alignment of body segments (postural disorders of the lumbar spine: kyphosis, lordosis, scoliosis) through self-correcting exercises, muscle stretching for contractured muscle groups, the use of lumbar orthosis, the increase in muscle strength and endurance, improved mobility of lumbar spine through extension exercises, stretching exercises for the muscle groups with a tendency to contraction-retraction: pectoral muscles paravertebral...
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muscles, the iliopsoas muscles; improvement of balance and coordination; effort training through aerobic exercises, walking, treadmill exercises, ergometer bicycle, jogging, sports, rhythmic gymnastics; respiratory re-education.

Similar to the results in the literature (11, 13, 14, 15) and based on a comparison of data from initial measurements with final measurements and with the control group, we have found a major improvement both in joint range of movement and in muscle strength. The assessment of pain showed a positive outcome both in the control and in the study group.

BMD assessment showed no statistically significant differences compared to the beginning of treatment, but the positive outcome of female patients (joint mobility, muscle strength, improved quality of life, decreased risk of fracture) leads to the conclusion that, even if kinesiotherapy does not replace medication, it may bring significant benefits as additional therapy.

CONCLUSIONS
Our study shows the importance of early detection of risk factors for osteoporosis, as a key element in diagnosing and in adopting a healthy lifestyle.

The results of our study confirm that kinesiotherapy plays a major role in the rehabilitation of patients with postmenopausal osteoporosis, as it relieves pain, it manages spinal functional disorders (spine mobility, defective spine statics, altered muscle balance) and it re-educates gait and balance, preventing the risk of falling.

Rehabilitation and kinesiotherapy must be adapted to each patient, considering individual needs and associated comorbidities; the exercise protocol should be varied, in order to gain patient’s interest, adherence and active involvement.

REFERENCES
Cardiovascular disease is the leading cause of death worldwide attributed with more than 31% of global deaths (17.5 million people/year) and an estimated 7.4 million deaths due to coronary artery disease (CAD) alone. Coronary artery bypass grafting (CABG) is nowadays one of the most frequent surgical interventions in Europe (between 18 and 91 per 100,000 inhabitants) and according to both European and American societies’ guidelines, is associated with an increase in quality of life and survival in patients with unprotected left main (or equivalent) and multi-vessel disease but the ideal grafting technique has not been established. The research group led by dr. Shohei Yoshida aimed to identify the optimal graft for the right coronary territory. Their study evaluated the short- and long-term outcome of radial artery (RA) grafts and saphenous vein grafts (SVGs) to the right coronary artery through propensity score analysis. Superior survival was noted in the unmatched RA group, but after propensity-score matching for late outcomes analysis there were identified 91 patient pairs similar in the two groups. Graft failure did not correlate with overall mortality, but displayed a strong correlation with cardiac events in all patients (RA and SVG). The predictors of graft occlusion in the RA group were mild proximal stenosis and low indexing glomerular filtration rates for body surface area, whereas those in the SVG were female gender and off-pump coronary artery bypass grafting. The authors concluded that there were no significant differences in long-term outcomes between the RA and SVG groups but predictors of graft occlusion differed between the two groups. Renal dysfunction in particular impaired RA patency, emphasizing the importance of careful graft selection for preventing long-term cardiac events. (Yoshida S, Numata S, Tsutsumi Y, Monta O, Yamazaki S, Seo H, et al. Short- and long-term results of radial artery and saphenous vein grafts in the right coronary system: a propensity-matched study. Surg Today 2017; 47(3): 335-343)