Review

Assessment of life quality in patients with osteoporosis

Janković Slavica (1), Duspara Barbara (1), Muftić Mirsad (2)

(1) College of Applied Sciences "Lavoslav Ružička", Vukovar, Croatia
(2) Faculty of Health Studies, University of Sarajevo

ABSTRACT

In recent times, osteoporosis has taken epidemic proportions. It is a disorder that in time of industrialization and application of new technologies is starting to impact even the younger population. The use of modern devices in everyday life is resulting in a reduce level of human physical activity, consequently leading to inactive way of life and increase in number of people suffering from osteoporosis. According to WHO definition, osteoporosis is a disease state characterized by loss of bone mineral density and bone loss which over time eventually result in fractures. As a disease, osteoporosis represents a great medical, social and economic challenge. Due to the recent years increase in number of people diagnosed with osteopenia and osteoporosis there is a growing interest for this problem within scientific community and among health professionals, and there has been a great number of attempts to develop guidelines for diagnosis, diagnostics and treatment for patients who are suffering from it. The person with the problem of osteoporosis have impaired quality of life. Objective of this paper is to show that all questionnaires can improve the assessment of the condition of patients with osteopoeroze and thus have a positive impact on quality of life.

INTRODUCTION

In the more recent times, osteoporosis has essentially taken epidemic proportions. Osteoporosis is a condition that hand in hand with widespread industrialization and presence of new technologies is becoming increasingly more prevalent among young demographics. Widespread presence and use of technology in everyday life has cropped up and displaced physical activity. Moreover, with increasingly prevalent inactive lifestyle, the extent of demographics with osteoporosis has been gaining momentum.

Osteoporosis as a disease is as old as the humans. It is a condition that is closely linked to lifespan, gender, lifelong habits and diet preferences (1). However, even though osteoporosis has posed heath and socioeconomical challenges, World Health Organization (WHO) identified it as a problem only about two twenty years ago and designated it a whole decade (2000-2010). In that period, on WHO initiative, world leading experts made significant contributions in identifying solutions to advance prevention, improve diagnostics and treatment as well as to slow down prevalence and reduce number of people with the disease (2). In 1994th WHO defined osteoporosis as a metabolic rheumatoid disease that destroys skeletal system manifested in reduction of bone mass and changes in microarchitecture level of bone structure (3). It is characterized by reduction of mass per unit of volume relative to normally mineralized bone that is consistent with body size, age, gender and racial affiliation (4). According to the World Health Organization, in order for a condition to be

identified as osteoporosis the measured reduction in bone mineral density should exceed 2,5 standard deviations relative to healthy young population. Dosimetry has been designated as the method of choice to diagnose and monitoring of the treatment progress. Osteoporosis is with a reason designated as „quiet epidemic" or „quiet thief of bones" as it tends to sneak in unnoticed and with no symptoms (5). Bone mass loss starts far ahead of (believed to be two decades or more) appearance of the first clinical symptoms (6). As a disease, osteoporosis is typically diffusely distributed with some typical manifestations in wrist, vertebrae or thigh bone (femur) fracture (7). In general, the changes in bone composition and/or structure result in increase in fracture risk (8).

In the Republic of Croatia there is neither registry of patients with osteoporosis nor a registry of subjects with osteoporosis who had fractures. However, in a 6000 subjects international study, consisting of subjects between 20 to 70 years age, subjects from Croatia participated alongside the participants from 12 other countries. It was determined that participants from Croatia had similar bone mass as the participants from the other European countries. It is estimated that 90 000 men (about 14% of man over 55 age) and 77 000 women (about 9% of women over 55) in Croatia suffer vertebrae fractures after age of 55 (9).According to studies, the most common risk factors for development of osteoporosis are age, low mineral density of bones as well as prior fractures (10). World Health Organization indicated a number of other contributing factors, such as: gender, positive family predisposition for hip fracture, early menopause, secondary osteoporosis, cigarette smoking and everyday consumption of alcohol (11). A number of clinical factors that indicate high probability of osteoporosis have been identified and which also indicate increased likelihood of fractures regardless of bone mineral density (12).

Very telling about the magnitude of osteoporosis as a widespread problem, the data from 2002 show that 10 million people in the US was diagnosed with osteoporosis, 33,6 million had osteopenia (1). In the UK, in the 50 year old age group one third women and one twelfth or men had osteoporosis (13). Even though for decades osteoporosis has been considered a female gender disease because of the established rate of bone density decline of 0,5% or more per year for women over 40-years age (14, 15), some recent research in that area have shown that men get affected by osteoporosis as well. That especially occurs after

65 year age when bone density starts to decline at 1,0% annual rate (16). In their research Tai and Watts point out that at age of 50 one in twelve men is at risk of osteoporotic fracture (17). According to European records it was noted that at age 50 risk from bone fracture increases by 40% and risk from hip fractures is close to 20%. It is noted that the prevalence of vertebra fractures in men and women is nearly identical in 50 to 79 year olds, at nearly 12% (18). At present times human life span has got extended globally and according to the UN records demographics is shifting in favor of rise in number of elderlies. The expectations are set to expect the number of people affected by osteoporosis to nearly double. Consequently the number of fractures that are frequent in older age are to rapidly increase. The consequences of osteoporosis are significant, posing medical and social problems as well as significant economic burden from costs incurred from medical treatment of fractures (19). Falls and injuries caused by falls, such as fractures, are a rapidly developing problem among the third age group, with the falls and injuries causing pain, functional disability, reduced life quality, elevated heath cost and the need for health care as well as causing increase in mortality (5). Turns out that the most effective method of osteoporosis treatment is to work on prevention from young age. A number of studies have shown a notably lower risk to develop osteoporosis and consequently lower risk of fractures when a person exercises regularly and has a diet rich in calcium – which is considered the most effective method of prevention (20). The research conducted in 2000th by Johnell and the collaborators on cost of rehabilitation of fractures caused by osteoporosis has shown that 1,1 million women worldwide, among 50 and over age group, had hip fracture as a consequence of osteoporosis, while 826 000 had vertebrae fracture. That clearly demonstrates extent of the problem due to osteoporosis. A study of expenses due to rehabilitation of hip and vertebrae fractures in the US during 2005 shows the costs reaching 19 billion dollars, while the costs are expected to reach 25,3 billion dollars by 2025 (21).

As pointed out, one of the most effective osteoporosis treatments is prevention of the conditions from young age. Numerous studies have found notably lower risk to develop osteoporosis and suffer fractures in subjects who exercise regularly and maintain diet rich in calcium, two habits that are considered the key in prevention of osteoporosis (5). While primary osteoporosis comprises almost 95% of osteoporosis types,

osteoporosis caused by gluco-carotides is the most prevalent secondary type of osteoporosis. Different from the outdated beliefs, now we know that gluco-carotid osteoporosis can develop regardless of type of usage of gluco-carotides (11). Gluco-carotid osteoporosis appears within a few months of application of gluco-carotides and affects more significantly sponge than cortical bone tissue (12). Expanding of knowledge of bone biology, function of osteoblasts and osteoclasts helps advance new therapeutic paths and strategies in inhibiting excessive resorption of bone tissue while in the same time increasing bone formation.

Thirty years ago osteoporosis has been considered an undesirable side-effect of aging process. However, the subsequent developments brought new insights on prevention options, diagnostics and treatment of the disease. Even at that time, Dr. Larry Riggs predicted that solutions for osteoporosis prevention and treatment options that would reduce and even eliminate the most difficult consequences such as immobility and mortality would be avoided. The efforts conducted during the decade of fight against osteoporosis were not in vain and brought some significant advancements.

LIFE QUALITY OF SUBJECTS AFFECTED BY OSTEOPOROSIS

The term „life quality" dates from the times of Aristotle and Plato and it usually represents general category of factors directly or indirectly linked to an individual or a group of people. Most frequently, life quality is studied from the point of heath, economic and social aspects, with surveys and studies geared toward the aims of characterizing those three aspects.

Osteoporosis gets often designated as a „quiet epidemic" with the key reason behind it being that the condition is becoming prevalent in people of both gender following soon after 50 year age. A while ago osteoporosis had been a disease of elderly demographics as it strongly correlated with age of a person. However, modern lifestyle has brought notable changes in prevalence of the disease. Numerous studies of world experts suggest that already after 40 year age imbalance between functioning of osteoblasts and osteoclasts occurs. Eventually, osteoclasts get an upper hand in quickening the process dissolving bone structure over osteoblasts which become unable to keep up and fall behind in regenerating bone tissue and thus in countering the bone degradation process

(8).

That initial process - the first phase of quickening bone loss lasts around 5 years, with the bone mass loss reaching about 3% annually in vertebrae area (22). In that initial period subjects typically see/feel no obvious symptoms. As that first phase progresses further, toward the end the subjects typically start to feel back pain, motion difficulties, there are noticeable changes in subject's body posture and subjects can even note reduction in height. In the second phase the bone loss slows down to around 0,5% per year but the loss becomes more widespread throughout overall skeletal tissue (23). It is not unusual that a decade passes by before subjects note their bone loss, with the condition at that point being in form of osteopenia/osteoporosis.

Also, it is not uncommon that a subject suffers a fracture, and that only at that point during diagnostic treatment of the patient it is determined that the fracture occurred amid previously undiagnosed osteoporosis. Considering that WHO has designated a whole decade to fight against the disease, during that period numerous questionnaires and tests have been created. Those, alongside the standard diagnostics and laboratory procedures, aimed to provide a more complete assessment of condition of patients with osteoporosis and aimed to establish life quality of the affected. The questionnaires most frequently used in Europe and broader in the world are: 1) the Women's Health Questionnaire, 2) Osteoporosis Quality of Life Questionnaire, 3) Osteoporosis Assessment Questionnaire, 4) Osteoporosis Functional Disability Questionnaire, 5) Quality of Life Questionnaire of the European Foundation for Osteoporosis, 6) Osteoporosis-Targeted Quality of Life Questionnaire, 7) Japanese Osteoporosis Quality of Life Questionnaire, 8) the 16-item Assessment of Health-Related Quality of Life in Osteoporosis, and 9) the Quality of Life Questionnaire in Osteoporosis (QUALIOSTTM), 10) The Fracture Risk Assessment Tool (FRAX) (24).

Women's Health Questionnaire (WHQ) has a broad application to assessment of quality of life of women in menopause and the consequent post-menopause period, as link between changes in levels of estrogen production and symptoms that women feel during that period of life has been established (25).

Osteoporosis Quality of Life Questionnaire is a questionnaire that takes only about 20 minutes to complete and which aims to provide quality of life assessment from five key categories. The questionnaire contains questions about presence

of symptoms such as pain, low energy (feeling tired) and such; questions about body function, about emotional state of the subject as well as about ability to conduct and nature of everyday activities and activities during leisure time (26).

Mini Osteoporosis Quality of Life Questionnaire (mini-QQLQ) is a short version of QQLQ questionnaire which contains the same categories as QQLQ but each having fewer number of questions. This questionnaire contains only ten questions thus being very convenient in clinical practice as it on one side does not require too much time to complete while provides a good deal of information about quality of life of subjects with osteoporosis (27).

Osteoporosis Assessment Questionnaire (OPAQ) focuses on assessment of quality of life in subjects with osteoporosis who are in menopause or post-menopause period, and who had or have not had fractures. The questionnaire is very detail, consisting of a large number of questions that are grouped into 18 different categories that are subsequently split in four different domains: physical function, physical condition, existing symptoms and social state of subject (28).

Osteoporosis Functional Disability Questionnaire (OFDQ) aims to assess quality of life in subjects with osteoporosis who had compressional vertebrae fractures. The questionnaire contains 59 questions covering five different areas. The questions relate to pain, depression, physical function, social activities as well as suggestion and recommendations about quality of care and rehabilitation. Based on the given answers it is possible to gain a quality and comprehensive information about effectiveness of rehabilitation program (29).

41-item Quality of Life Questionnaire of the European Foundation for Osteoporosis (QUALEFFO-41) focuses on quality of life in people with osteoporosis who already had vertebrae fractures. It consists of 41 questions that are split in five categories: pain, physical function, social component, mental health and individual self-assessment about his/her own state of health (30).

31-item Quality of Life Questionnaire of the European Foundation for Osteoporosis (QUALEFFO-31) is a short version of the questionnaire QUALEFFO-41. This particular questionnaire focuses on three domains only: pain, mental health and physical function; thus notably shortening the time needed to complete the questionnaire (31).

16-item Assessment of Health-Related Quality of Life in Osteoporosis (ECOS-16) is a short questionnaire that combines a shortlist of questions from two other questionnaire that also focus on quality of life of people with osteoporosis. It contains 16 questions of which four originate from QQLQ and 12 come from QUALEFFO. Questions are characterized in four groups: pain, fear of the disease, physical function and psychological condition of subject (32).

Quality of Life Questionnaire in Osteoporosis is a more general quality of life questionnaire that focuses on categories of questions that target: self-image, fear of disease and future, well-being, mobility, pain and mental health. It is also used in assessment of condition in people post vertebrae fractures (33).

The Fracture Risk Assessment Tool (FRAX) questionnaire is a straightforward questionnaire typically filled-in in electronic format. Patient information and questionnaire responses are then used in a computer conducted assessment of hip area fracture risk. The questionnaire has been translated to and adopted for a number of languages: English, French, German, Italian, Japanese and Spanish. The end result of the FRAX questionnaire is to calculate an estimate of risk (in probabilistic terms, i.e. likelihood of the adverse event to occur expressed in percent) that a person could suffer fracture in next ten years. The assessment Accounts for gender, age, BMI, height, weight, prior history of fractures, smoking habits, usage of glucocorticoids, rheumatoid arthritis, secondary osteoporosis (if present) and alcohol consumption. FRAX questionnaire, as an important tool in assessment of risk from osteoporosis, can with significant importance assist health providers in providing care to patients with reduced bone mass (34).

MATERIALS AND METHODS

Researching literature from the following research publications databases: Pubmed, scopus, Medline, Hrčak and Znalac, the literature search was focused on the prior research work that tapped into quality of life of people with osteoporosis and impact of risk factors on quality of life as well as on which specific questionnaires have historically been used to investigate those.

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RESULTS

Bones and skeletal tissue, as everything else in human body, functions as seamless mechanism until the moment when balance in functioning osteoclasts and osteoblasts gets disturbed. The height of bone mass maturity is typically reached between 25 and 30 year age, thus the importance of person's life style during that period as well as later on. Specifically, habits around ones regular daily physical exercise, complemented by a diverse diet, make an important base for solid and healthy bone development and bone tissue health (35). Within the scope of this research study, while investigating the prior studies on the subject of osteoporosis, it has been noted that more recent research frequently relies on FRAX questionnaires, with the studies predominantly focused on risk factors and assessment of fracture risk over a ten year period. The studies suggest that people who conduct daily, routine physical exercises (as part of their life style), relative to those who do not maintain such physically active life style, can have up to three times lower FRAX score, as noted in a recent research work - Janković iz 2013/14 (22). With the study participants (71 subjects) split into two groups with one group being a reference group (baseline) – physically „non-active" subjects, and the other one consisting of participants who actively and regularly performed physical exercises – „active" subjects, the study has found the „active" group to have lower FRAX score.

Regular physical exercise has shown favorable results with respect to bone mass rebuilding (34) even in elderly age group participants, also investigated and shown in a number of other studies, such as the one from Gregova (9) that investigated types of physical exercises that would be appropriate for people with reduced bone density. Ahmad H Alghadir, in a study conducted in 2016 and including one hundred female subjects, has shown that following a 12 week long program of regular, moderate intensity aerobic there was a notable improvement in bone mass, Ca and Mn as well as bone trace of alkali phosphatase (36). However, the study has not used FRAX assessment of ten year fracture risk. Babić (23) in a research study has investigated Pilates exercises which the study participants have conducted over a period of six months. The study has shown notable improvements and also deducted that life quality of the subjects improved as well. A number of authors, e.g. Vlak, stress importance of well controlled, supervised, medical exercises programs that focus on specifically strengthening of postural, pelvic muscles and thigh muscles (2), however do not conduct FRAX assessment, or any other questionnaires which would be able to provide assessment of life quality in people with osteoporosis. Also, the studies fall short of conducting a strict comparison of initial (start) and final (end) results. The literature search reveals that FRAX questionnaire as an fracture risk assessment tool has not been used extensively. On the other hand, some of the prior studies do utilize FRAX in fracture risk assessment for subjects that have smoking habits, consume alcohol, those with rheumatoid arthritis as well as for those who use/consume corticosteroids. In the research studies, e.g. Bautista-Molana (37) et al, correlation between osteoporosis development and rheumatoid arthritis presence has been noted in only 17,1% of subjects. The study uses FRAX questionnaire and ten years fracture risk assessment as one of the tools. Moreover, the study, conducted on more than thousand participants, has shown that subjects with rheumatoid arthritis have higher risk of cardiovascular diseases than of osteoporosis related fractures. FRAX questionnaire as an instrument for ten year fracture assessment is not only used on rheumatoid arthritis patients but also in research studies that were conducted on neurological and allergies patients who as an undesirable side-effect of corticosteroid therapies tend to suffer secondary osteoporosis (38, 39). Assessment of fracture risk is then conducted via FRAX questionnaire for those groups. Chan et al point out in their studies that patient are often unaware of the side-effects related to long term usage of corticosteroids, which consequently additionally increases risk of osteoporosis related fractures, especially in people who require the constant use of corticosteroids via inhalers in order to control their asthma symptoms. A number of studies point out damaging effect of smoking, such as Kapetanović et al (39), and about its negative influence on functioning of estrogens and testosterones, while also stressing out negative impact of nicotine which leads to bone calcium reduction and consequently leading to higher likelihood of developing osteoporosis. Surprisingly, only one study, conducted by Sanela, has focused on investigating a link of fracture risk via FRAX method and nicotine risk factor (40). A single participant with the condition in the study also suffered from chronical obstructive lung disease, thus making any conclusions more difficult to interpret as it is difficult to determine the definitive root cause of the subject's hip fracture, the long term exposure to nicotine or the long term exposure

to corticosteroids that were administered via inhalation. Similar is the case in negative impact on bone density from alcohol consumption. Alcohol is believed to be inhibiting activity of osteoblasts and that the process impacts BMD. Abukhadir et al (41) in their research study point out the link but also warn of in general lack of studies focusing on the link between alcohol consumption, osteoporosis and assessment of ten year fracture risk.

The bulk of research work whose focus was on life quality in people with osteoporosis has been related to usage of the questionnaires whose design targets quality of life in post vertebrae fracture period. QUALEFFO-41 and QUALEFFO-31 have been the most frequently used. Based on the study conducted by Nagammai et al on 215 post-menopause women as well as on a separate study by Tadić et al it was shown that QUALEFFO-41 questionnaire has very high degree of sensitivity and that based on the questionnaire it is possible to accurately assess quality of life of people with osteoporosis. The difference between quality of life of individuals who suffered vertebrae fracture and those have not, has been specially notable. QUALEFFO-41 is significantly more used (42, 43) than its shorter version QUALEFFO-31, which contains only 31 questions and focuses on three category of questions only.

During the background database search, it was noted that the key aim in administering both questionnaires was to determine if the same questionnaires were applicable across different nations and their respective populations and also if the questionnaires results were able to represent „accurate" state of quality of life of people with osteoporosis in respective countries. For example, Zhou et al conducted a study on two group of post-menstrual women, with one group consisted of women with osteoporosis and the other being a reference group, with nominally all healthy subjects. The results have shown a high degree of correlation in answers of QUALEFFO-31 questionnaire and SF-36 one among the Chinese women and also concluded that QUALEFFO-31 can be used in assessment of quality of life (44). Assessment of quality of life, especially in subjects who had vertebrae fractures, is a very important type of assessment both for the respective patient as well as for the health workers who work and treat the patient. Among the numerous questionnaires that are able to assess quality of life, Quality of Life Questionnaire in Osteoporosis is notable. Marquis et al in their research study analyzed in what degree such questionnaire is able to provide

information about everyday life and functioning of an individual in post vertebrae fracture period as well as about emotional and social challenges that such individual faces. In its research, similar to some other authors, the team used also SF-36. The conclusion derived from the study was that QUALIOST questionnaire can provide an accurate assessment about quality of life of individuals with osteoporosis and also give key points on which to focus during the treatment. 16-item Assessment of Health-Related Quality of Life in Osteoporosis (ECOS-16) is a questionnaire that because of its reduced number of questions represents a unique opportunity for the care providers as it provides comprehensive enough assessment of quality of life on one side while not costing too much time to complete (45). Considering that the questionnaire contains a subset of questions from the highly regarded QUALEFFO-41 and OQLQ, even though it is relatively short and quick to administer it provides a quality assessment about quality of life in persons with osteoporosis. That is also confirmed by the studies such as conducted by Lee, whose study included Korean women with menopause (46). Hunter et al conducted a research on women in menopause, controlling for their life quality via WHQ questionnaire which goes beyond everyday life physical function assessment to also assess mental health of persons with osteoporosis (46).

With purpose of composing this work a comprehensive background literature search has been conducted. It should be noted that the extensive list of prior studies scoured across a number of various questionnaire all of which to larger or smaller degree were able to assess quality of life in people with osteoporosis and get assessment on direction to take in treating individuals with osteoporosis. A notable exception is FRAX which has been absent from those studies. In our opinion, it should be noted that FRAX as a questionnaire has some important advantages as it is based on densitometry results as well as questions based on risk factors that are related the onset of the diseases. Moreover, FRAX questionnaire is able to assess 10 year risk of fractions, and because of that also being recommended as a tool for assessment of quality of life in people with osteoporosis as well as in prevention of fractures. The other questionnaires that were mentioned and detailed in this study provide also fertile ground to be used as tools in assessment of patients, thus also providing important compatible information that can ultimately lead to better quality of life of the osteoporosis patients.

CONCLUSION

Everybody desires to have better quality of life all the time. Individuals living with osteoporosis, and consequences that the disease brings - e.g. fractures, have significantly negatively impacted quality of life. Considering the worldwide widespread progression of the disease that we are all witnessing, and the rapid increase in the number of impacted by osteoporosis here and worldwide while knowing that the most effective way to fight the disease is prevention, it is important to explore and make use of all available „tools" that help with improving quality of life of individuals impacted by osteoporosis. Because of that, along with the standard diagnostics protocols and laboratory tests, treatment and education about the disease should be complemented by questionnaires about quality of life with the disease. In that case one would achieve a more complete view of each individual patient, about their needs and what best approach to take to improve the patient's everyday life and bring back normal functioning.

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