

The “osteoporosis disease”

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Summary

The authors analyze the reason that make osteoporosis a complex, widespread and poorly controlled “disease”. In their work the authors take into account etiopathogenesis, epidemiology, risk factors, diagnosis and therapy. Author’s attention is focused on management both of patient whit osteoporotic fractures and preventive therapy, which are aspects of the osteoporotic disease that should not be exclusive problems for the orthopaedic’s sourceon.

KEY WORDS: osteoporosis, osteoporosis disease, menopause, bone, osteoporotic fracture, BMD, densitometry, Quantitative Ultrasound, alendronate.

Osteoporosis is a pathology with a multifactorial etiopathogenesis, characterized by an abnormal reduction of the bone mass, both of the mineral and osteoid components, as well as micro-architectural alterations of the bone, which becomes fragile and more exposed to the risk of fracture (1). Without going into the details of the mechanisms that regulate bone turnover, we can assert that in an osteoporotic patient the reabsorption is far more significant than the apposition phase and that the osteoclastic cells are more active than osteoblastic cells. The osteoblastic and osteoclastic cells work together in functional units known as BMUs (Bone Multicellular Units) which are located in the cortical portion of the bone as well as in the cancellous one. Any change of the functional balance of the osteoblasts and osteoclasts within the BMU, that is a reduction of the osteoblastic activity, results in loss of bony mass. Studies performed by Nishida (2), as the matter of fact prove that during the aging process there is a reduction of the number of CFU-Fs (Colony Forming Unit - Fibroblastoids) that produce phosphatase: these CFU-Fs are used as markers of osteoblastic activity. Osteoporosis thus is not only the result of an increase of osteoclastic activity, but also it is caused by the physiologic decrease of the osteoblastic activity.

The capacity a bone has to resist to a fracture is determined by its quality, which can be estimated through its mass. The bone mass of a normal individual increases constantly from birth throughout the third decade; at this time it reaches a peak (which is usually greater in males) and it remains stable in a

plateau state until the fifth decade. From then on, the bone mass decreases progressively (even more in females during menopause). The level of the peak and the speed at which it decreases are very important genetic aspects which determine the level of bone mass that the individual will have during his aging process. The risk of developing osteoporosis is genetically determined, but can be modified by following adequate behavior and dietetic patterns (3). It has been recently proven “that our children eat very badly, no longer practice sports nor perform any outdoor activity, because they spend all their free time in front of the TV or the Playstation; as a result by the time they finish junior high school they are not only usually obese, but also their skeleton is weaker. By the time they are thirty years old their bone mass will be 15% lower than what it should be and they will more likely develop osteoporosis. As a paradox males will be at major risk” (4).

The bone is a biological tissue which can be considered as a flexible tissue. With the progressive reduction of the bony mass, an osteopenic bone loses its capacity to resist to loads, because no longer flexible, thus becoming very fragile. Break point under stress load will be reached with progressively lower loads as the bony mass decreases, both in its cortical and cancellous components. Furthermore, there are intrinsic features in the bony conformation that vary from individual to individual and increase the risk of fracture, for example a long femur neck increases the load at the base of the neck itself, a varus angle also increases the load on the femur neck, a very important, kyphosis increases load on the lower dorsal and dorso-lombar vertebrae and once a dorsal vertebra has been deformed kyphosis itself also increases, thus determining a domino effect which in turn increases the risk of fracture (5).

Prospective studies performed in 2005 (6, 7) highlight Italy as the second nation in the world with the higher number of inhabitants over 75 years of age on the total population, as well as the third country in the world with the greatest number of individuals over 85 years of age. An ISTAT study performed in 2006 points out that 69% of the population over 75 years of age suffers from at least two chronic diseases, percentage that decreases to 59% for the population that ranges from 65 to 74 years of age. The elderly is therefore usually a complex patient for three reasons: psychological, pathological and biological. Psychological reasons: the elderly patient no longer considers a disease as temporary, but as a structural component of his life, often considering it debilitating and invalidating even when it is not. Pathological reasons: the elderly patient often suffers of respiratory, cardio circulatory, neuro-psychiatric and metabolic diseases combined together, therefore the corresponding therapies may also interfere.

Biological reasons: the metabolism of an older patient can no longer react to a disease in a proper manner (including the response to its therapy).

In this complex health context osteoporosis remains silent until the elderly falls and fractures a bone. At this point, all of the problems related to prolonged bed stays, loss of self autonomy and possible surgical treatment may arise. The elderly is also highly exposed to the risk of falling, because of frequent balance impairments and neurological diseases which he may often suffer from. All of these problems also make those defense

mechanisms the elderly can use when falling less effective, with severe consequences on gastroenteric, cephalic and encephalic segments. A simple trauma can cause a fracture and initiate those physiopathologic and/or psychopathologic complications that may change the patients life or even lead him to death. The patient does not die of osteoporosis, but dies because osteoporotic.

A multicentric national study in 2001 (ESOPO) (8) reveals that 23% of female individuals over 40 years of age and 14% of male individuals over 60 years of age are osteoporotic as well as 42% of females over 40 and 34% of males over 60 are osteopenic; this means that on our national population up to date there are 3.5 million females and 1 million males affected by osteoporosis, there also are 8.5 million of osteopenic individuals on "stand-by". Future estimates are not reassuring given the progressive increase of the average age of the population: this means that if today 300.000 females in Europe suffer from femur neck fractures, in the year 2050 they may be 800.000. The aging of the population will lead us towards a geriatric approach to orthopedics.

The most affected anatomical sites are the wrist (33% of cases), the proximal femur (29%), the vertebrae (27%), the proximal humer (5%) (8). Death rate in femur fractures in osteoporotic patients is 5% in the early stage and 15-25% within a year from the date of the surgery: some authors compare it to the death rate of breast cancer and only 40% of patients fully recovers their skills and autonomy (9). All this because the osteoporotic patient is usually an elderly individual with associated internistic, neurologic and psychiatric diseases. Osteoporosis represents a surgical challenge, due to the technical difficulties deriving from the poor bone quality the surgeon works with. It also represents a postoperative challenge which requires an active multidisciplinary cooperation, in order to achieve a timely recovery of these patients.

Cost estimates of consequences related to osteoporosis disease (10) range from 10 billion dollars in the United States of America for 250 million people, to 614 million pounds in the United Kingdom for 70 million people. In Italy (11), the major costs for this type of pathology are not those related to the pharmacologic therapy (approximately 20%), but those related to the consequences of a misdiagnosed osteoporotic disease such as early care, rehabilitation, temporary and permanent handicap, premature death. The total costs for hospitalization of patients over 65 years of age with femur neck fractures, are greater than the total expenses required for patients affected by miocardic stroke in the same age bracket, although the number of these individuals is greater.

A correct diagnosis of osteoporosis is important to adequately assess the risk of fractures, as well as to prescribe an appropriate therapy. The diagnostic procedure always begins with a physical examination during which the physician collects a detailed medical history of the patient in order to assess the major risk factors (Table I) (12); following the physical examination, blood tests can be useful to determine the patient's bone metabolism. Finally, if necessary, bone densitometry can directly assess the bone density of the patient. Bone densitometry, in fact, finds its proper indication only when the knowledge of the patient's densitometric values are important for his clinical follow up (diet, physical activities, life-style, reduction of the risk of falling, medical and rehabilitative treatments).

Currently, bone ultrasonography represents a valid first stage screening test: this technique provides an indirect evaluation of bone density using techniques known as Quantitative Ultrasound (QuS). Quantitative ultrasound measures either the propagation speed of ultrasounds (SOS Speed Of Sound) or the frequency reduction of the ultrasounds (BUA Broadband Ultrasound Attenuation) at limb extremities (such as fingers and heel), using probes with frequency ranging from 200 khz

Table I - Risk factors and criteria suggesting bone densitometry.

MAJOR CRITERIA (one is sufficient)

- Over 65 years of age
- Vertebral fracture
- Risk fracture after 40 years of age
- Family history of osteoporotic fracture (especially femoral fracture of the mother)
- Intake of glucocorticoid drugs for more than 3 months
- Malabsorption syndrome
- Primary hyperparathyroidism
- Inclination to falls
- X-ray documented osteopenia
- Hypogonadism
- Menopause occurred prior to 45 years of age

MINOR CRITERIA (the presence of only three of them is enough)

- Rheumatic arthritis
- Clinical history of hyperthyroidism
- Anticonvulsivaant chronic medications
- Low calcium intake in diet
- Smoke
- Alcohol abuse
- Caffeine abuse
- Body weight < 57 kg
- Weight loss > 10% of total body weight before 25 years of age
- Chronic medication with heparin

and 1.5 mhz. These techniques are as accurate as dexa in predicting the risk of fracture.

Reference 79 (Nota 79 ndt.) of the National Italian Health Care System (SSN ndt) considers bone ultrasonography a diagnostic practice for osteoporosis and for prescription of anti-osteoporotic medication.

The treatment of osteoporotic fractures in an elderly patient often requires a multidisciplinary approach. During the acute stage, for example, a patient with a compromised general health condition may require hospitalization in an intensive or sub intensive care unit, in order to treat the preoperative stage more effectively. The fracture must be reduced and fixed as soon as possible, preferably as an urgent procedure.

Following surgery, an internistic follow up by an internist is highly recommended; in our unit we benefit of an internist specialized in after treatment of the proximal third fracture of the femur in elderly patients.

Once the acute phase has been stabilized the main goal is to prevent long bed stays and to maintain the patient active: this stage may require a major effort from the patient and his family as well as a multidisciplinary approach to rehabilitation. At the same time we also need to exactly assess the risk of future fracture and prescribe adequate medical treatment and behavioural patterns in order to reduce such risks. This last crucial phase (13) is not and can not be the sole responsibility of the orthopaedic surgeon whom often treats this kind of patient once the fracture has occurred: a recent study by Franchin et al. highlights that at the time of hospitalization only 11% of the patients was on medication for osteoporosis and/or was using calcium and vitamin D integrators; in the other cases (89%) no previous therapy had been administrated (14). In any case, this is a common problem since in the USA, 81% of 300 patients whom had suffered from femoral neck fracture were discharged without medical therapy for osteoporosis; 13.3% only with calcium and only 18% had been adequately treated to prevent bone reabsorption (15).

The fracture itself should always be considered as an acute

pathologic condition that needs to be timely treated with stable osteosynthesis. It is not recommended to treat such patients exclusively with an orthopaedic approach just because it is "only a broken bone": postoperative treatment of patients with osteoporotic fractures should include both physical and psychosocial rehabilitation. Depression and low self esteem are, in fact, common in elderly patients after a fracture and these aspects need to be taken care of by the whole rehabilitation staff, also taking into consideration the medical, psychological and social issues such patients may have (16). Elderly patients with fractures should also be encouraged to begin treatment with biphosphonates because research suggests that alendronate reduces the risk of future fractures after femur fractures. The treatment of osteoporosis is part of the treatment of the fracture.

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