Original Paper

Morphoclinical Correlations In Senile Osteoporosis

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ABSTRACT Osteoporosis is a disease characterized by microarchitectural abnormal changes of bone tissue which lead to fragile bones and bone fractures at medium or minimal traumatism. This disease affects a large population, especially women, proportion women/men being 2/1-3/1. Histologically, the volumes of cortical and spongy bone are reduced in osteoporosis compare to normal bone, bone lost rate been different with bone type and is more accentuated at spongy bone level compare to cortical bone level. One of the most severe complications of senile osteoporosis is the fracture of femoral neck. In our study we concluded that fracture of femoral neck appears to be more frequently in old people, especially in the 7th and 8th decade. Statistic analysis regarding the habitat showed that fracture of femoral neck affects more patients who live in villages because this people are exposed to intense mechanic traumatism. Microscopic study of bone pieces collected from the patients who suffered a surgery for fracture of femoral neck, show a decrease number of bone trabeculaes, thinness, buckling and breaking up of the remaining trabeculaes, parceling disappearing of osteoprogenitors cells from endost, enlarged areolar cavities, distortion and thinning of cortical bone.

KEYWORDS *osteoporosis, fracture of femoral neck, bone tissue*

Introduction

Osteoporosis is the most common metabolic bone disorder, is considered a true "silent epidemic" with long asymptomatic development, becoming clinically manifest with age and / or by the appearance of minor trauma fractures.

WHO osteoporosis fall in major health problems of mankind, with ischemic heart disease, cancer and stroke and consider the impact on society is increasing. Statistical studies show that today that over 150 million people suffering from this disease. In Europe and the United States occur each year about 2.3 million osteoporotic fractures. Prospective studies indicate that over the next 50 years will double the number of osteoporotic fractures [1]. Social costs of this disease are high considering that 19% of patients with osteoporosis suffer a hip fracture requiring hospitalization between 20 and 30 days, and admission to special care facilities long-term permanent aid dependency the family or specialized institutions. Hip fracture is associated with a mortality of 30% in the first year of its production, most deaths occurring within the first 6 months.

It is considered that the number of hip fractures worldwide will increase from 1.7 million in 1990 to 6,300,000 in 2050, while the number of hospital beds needed treatment will double over the next 50 years [2].

With increasing life expectancy and the targeting of patients at medical cabinets increased alarming prevalence of this disease and its complications, osteoporosis thus becoming a major public health problem.

Therefore we decided to study morphoclinical aspects of hip fractures in osteoporotic patients hospitalized in the Orthopaedic Clinic Emergency Hospital of Craiova, in 2006-2010.

Material and methods

The clinical trial included a total of 458 patients aged 51-92 years of whom 189 were men and 249 were women who had suffered hip fractures and were hospitalized in Orthopaedic Clinic Emergency Hospital of Craiova in 2006-2010.

For histological study we collected fragments of bone from the femoral head and neck in 38 patients (27 female and 11 male) aged 55-82 years which required hip arthroplasty. Biological material collected has undergone surgery fixing 10% neutral formalin solution for 2 weeks. We chose this fixture because it is relatively inexpensive, has a high power of penetration in biological material gives little early, does not alter the color and structure of preparations enables multiple stains.

After fixation, bone fragments were decalcifying to be included in paraffin and sectioned on microtome. Decalcification was performed with increasing concentrations of trichloroacetic acid for 180 days. Then, the bone fragments were processed as fixed classical histological techniques including paraffin.

For evidence histological structures were performed serial sections were stained by two methods:

-the hematoxylin-eosin staining method (HE);

-light green staining method - the Goldner-Szeckeli technique (GS).

Results

Clinical study allowed us to observe that the incidence of femoral neck fractures in the 5 years under study, as observed in the fig. 1, was relatively homogeneous, recorded between 87 and 98 patients annually. Thus, in 2006, 87 patients were hospitalized, 91 patients in 2007, 97 patients were treated in 2008, in 2009 - 94 and 89 patients in 2010.

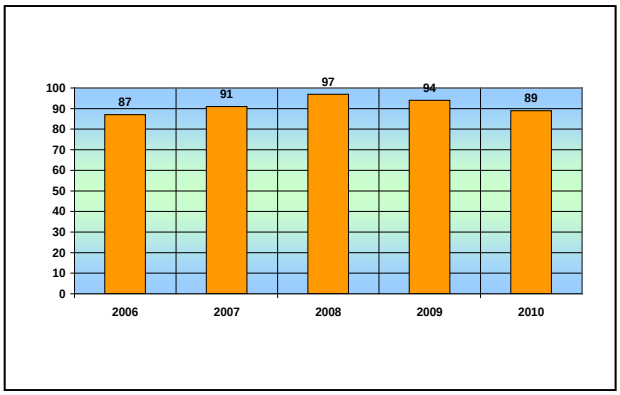

Figure 1.The number of people with femoral neck fractures between 2006-2010

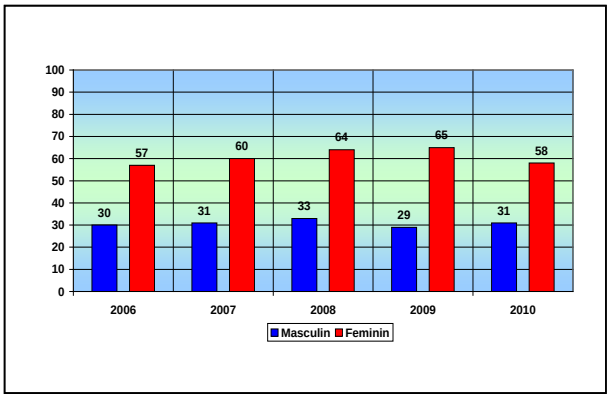

Figure 2.Femoral neck fractures distribution by gender

Based on data from the literature showing that femoral neck fractures due to osteoporosis are more common in females, we aim to see sex incidence of these fractures in the group of patients studied, and sex ratio. From figure 2 we notice that the females were most affected by hip fracture, sex ratio varies between 1.87 five years (2010) and 2.24 (2009) generally report being 1.97. So, we can say that, in females, the incidence of hip fractures is 1.97 times more often than males.

As the incidence of femoral neck fractures by age for our study showed that the incidence of this type of fracture is more increased with age, the highest incidence being present in 71-80 age group years. After the age of 80 years the incidence of osteoporotic hip fractures presents a false decrease as the number of people over 80 is less than the other ages studied.

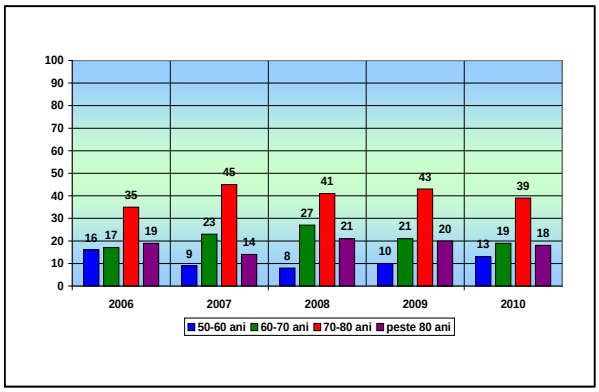

Figure 3.Distribution of femoral neck fractures by age

Regarding the area of origin of patients with hip fractures, most patients were from the countryside, the report rural / urban was 1.17 in 2006, 1.65 in 2007, 1.42 in 2008, in 2009 report rural / urban was 1.24, and in 2010 this ratio was 1.22.

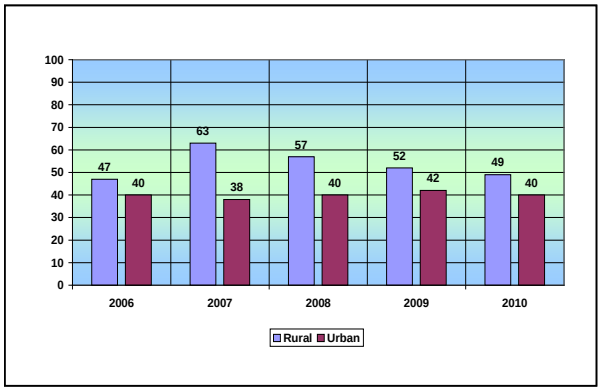

Figure 4.Distribution of patients with fractures of the femoral neck on social media

Studying figure 4 I noticed that the ratio of patients in rural and urban was relatively low,

probably due to a decreasing tendency to hip fractures in the countryside and a progressive increase in urban areas. Possible explanations of this process may be that rural living conditions were close to those in urban, the rural food gets better and exercise, that is particularly important in maintaining musculoskeletal functionality, is higher in rural areas than in urban areas.

Another statistical parameter studied was the mechanism of fracture. Most of them were produced by falls from height very small (usually standing), and trauma intensity was assessed as very low in 89-94 % of cases on average 5.1 to 9.2 % of cases and major between 0 and 1.15 % of cases (caused by road accidents). Large number of small fractures secondary to trauma confirms reduced bone strength in people affected by osteoporosis.

Another parameter studied was the number of days of hospitalization that ranged from 3 to 45 days, most patients benefiting from 20-22 days. This requires prolonged hospitalization and high social costs, and after discharge from hospital, the patient has healed, it requires special care which may extend up to 3-6 months, recovery is long and difficult.

Microscopic study allowed us to observe quantitative and qualitative changes in cancellous bone and cortical bone compact, both in the head and femoral neck.

Histological aspects of osteoporotic bones varied from one case to another and even from one area to another of the same bone and the degree of atrophy osteoporosis. The first finding was that the bone had a tinctorialitate range from a fragment of bone from another, although bones were processed identically. We believe that this is because microscopic osteoporotic bone mineral salts contain varying amounts from one area to another, which led to inhomogenous decalcified bone matrix.

It is known that spongy bone contains bones trabeculaes with variables thickness, some of these trabeculaes, called resistance trabeculaes, are thicker and have the path of the main lines of force acting on the head and femoral neck. These trabeculaes are connected by linking trabeculaes which are perpendicular or oblique to the resistance trabeculaes. Damage to these two types of trabeculaes was very variable depending on the degree of osteoporosis. Most linking trabeculaes appeared to be thinned, amputated or more rarefied to disappearance, which resulted in decreased trabecular bone elastic resistance.

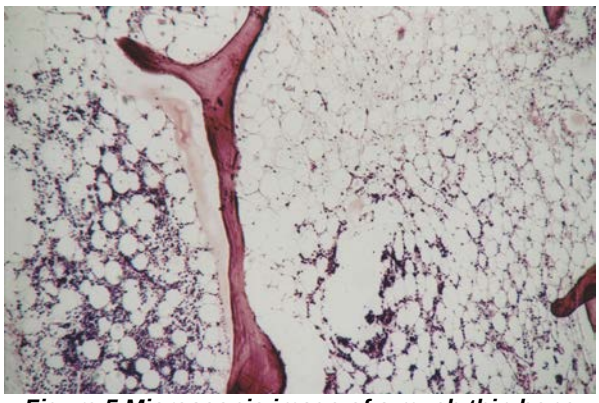

Figure 5.Microscopic image of a much thin bone trabecul. Coloration Hematoxiline-Eosin, Ob 4X

Resistance trabeculaes were also thinned heterogeneous, sometimes rarefied and discontinuities. Bone bays have limited spaces filled with large areola bone marrow, adipose or fibrous. Bone,s trabeculaes rarefaction is the result of poor bone remodeling process in which bone resorption is more intense than its reconstruction.

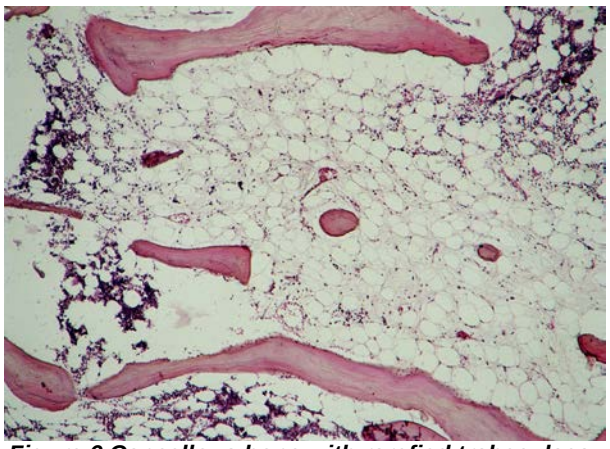

Figure 6.Cancellous bone with rarefied trabeculaes, fragmented and disorganized. Coloration Hematoxiline - Eosin , Ob 4x

Powerful microscopic lens histological study allowed us to observe that in bone trabeculaes structure, bone lamellas were thinned but have kept the parallel disposal. Bone trabeculaes contained a few osteocite, which demonstrates that, in osteoporosis, process of osteoblastic division and differentiation are deficient. In addition, the remaining osteocitele were small with hyperchrome, pyknotic nucleus, which indicating a predominance of the apoptotic process suffered by bone cells in osteoporosis.

Also, bone trabeculaes were separated by a thin endosteal layer, sometimes discontinuous, with small flattened cells, which indicates that, in osteoporosis, is reduced endosteal activity which decreased regenerative capacity of cancellous

bone and increased consecutively risk for fractures.

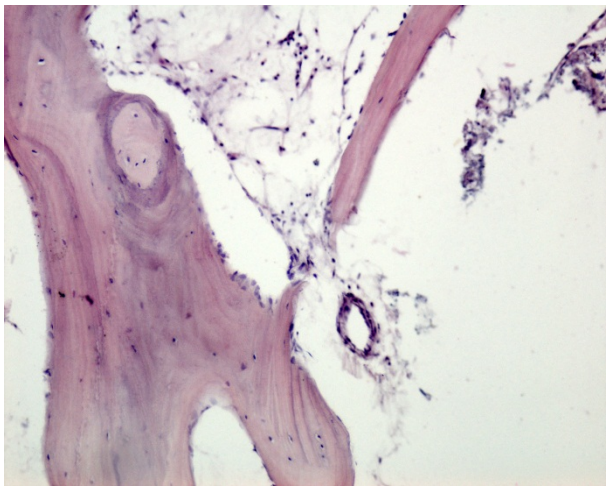

Fig 7.Bone trabeculae with thin endosteal layer and small osteocytes with pyknotic nucleus. Coloration Hematoxiline – Eosin, Ob.10 X

We highlighted on some preparations, near trabeculelor of spongy bone, multinucleated giant cells, representing osteoclasts, cells responsible for bone resorption. It appeared as increased cell size, with irregular contour, with cytoplasm rich and inhomogeneous, evidence of local phagocytosis processes attended by.

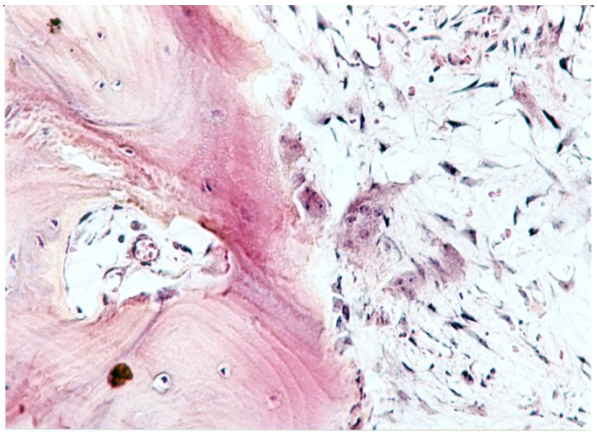

Figure 8.Osteoclasts in bone cortical edge. Coloration Hematoxiline - Eosin , Ob 20X

In our study we observed that sometimes the trabeculaes of spongy bone resorption surfaces appeared with smooth resorption surfaces, which demonstrates that osteoclasts are inactive, or appeared irregular and jagged zigzag, which suggests that bone remodeling activity of osteoclasts was in progress at the time of sampling biological material.

At the level of haversian bone from cortical structure of femoral neck and head were noted osteons of shapes and sizes, with Havers dilated and deformed channels. Many of Havers channels containing predominantly yellow bone marrow and rare hematopoietic cells.

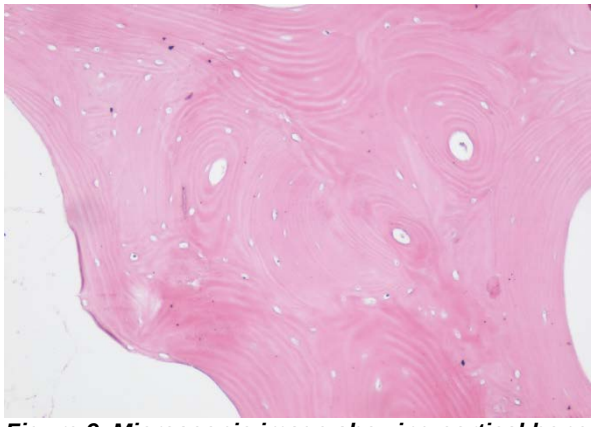

Figure 9. Microscopic image showing cortical bone haversiene systems of various sizes and shapes and bone lamellas with different tinctoriality. Coloration Hematoxiline - Eosin , Ob 10X

From the structural point of view, osteons had bone lamellas that contained small rarefied osteocite similar in structure to those of cancellous bone trabeculaes. Structure of an osteon bone lamellas were reduce their number, and sometimes were so disorganized that not allowed recognition of osteons.

Discussion

We selected for this study patients with fractures of the femoral neck because cervical humeral fractures are more rare and most are treated orthopedic in an outpatient, vertebral body fractures are rare as incidence, and fractures of the distal radial epiphyses, which are quite common in the elderly, especially in winter, rarely receive surgical treatment in hospital, over 95% of them benefit of ambulatory orthopedic treatment.

It is also known that osteoporosis is a disease induced and aggravated by multiple factors whose importance in the development of the disease is variable depending on gender, hormonal status, physical training, nutrition, treatments performed for other conditions, etc. All these factors reduce bone strength by acting on different structural components of bone tissue: cells, fibers, mineral composition, the fundamental substance.

In development of osteoporosis, one of the causes is to reduce bone forming activity of bone cells, a process that appears to be genetically determined. Studies from the specialized literature have shown that, after the age of 40, bone formation is progressively reduced due to decreased number and function of osteoblasts,

whereas bone resorption processes remain at the same level which leads to a decrease in mass bone after age, decrease observed in both sexes. By the age of 50-55 years bone loss resorption affects almost exclusively trabecular bone and, after that age, becomes more important osteoclastic resorption in cortical bone. As a result, at the age of 80 years total bone loss of cortical bone tends to become equal to that of cancellous bone.

Bone loss is attributed to the so-called diminished bone resorption, in contrast with lacunar resorption achieved by multinucleated osteoclasts in osteodystrophy [3].

In senile osteoporosis can meet and reparative a compensatory remodeling processes in the the remaining trabeculaes that are thickened by inuniform deposition of bone matrix. Due to this, alongside very thinned osteoporotic trabeculaes are found thickened resistance trabeculaes, making appearance of hypertrophic bone atrophy. [4]. In the case of advanced osteoporosis, even cortex undergoes a process atrophy and thinning. Haversiene channels in the cortex are enlarged, but however fine edges [5].

Females are affected early majority and report women / men is 3:1, 4:1, male or female climacterium being the main causal factor incriminated [2]. Other authors [6] claim that in women after menopause is an acceleration of bone loss reaching 10% / year. Trabecular bone resorption due to estrogen deficiency is accelerated and fractures in this group of women interested in spine and radiocarpian joint [7]. Differences between postmenopausal and senile osteoporosis are sometimes arbitrary because the distinction between aspects in different types of osteoporotic fractures is difficult [8].

Biochemical markers which measures the total bone destruction are represented by the degradation products of bone collagen present in the blood or urine, such as: N-telopeptide, C-telopeptide, deoxypyridinoline [4]. They must be evaluated in all women with osteoporotic fractures or those in menopause, with clinical symptoms suggest osteoporosis.

Another factor involved in decreased bone mass is reducing intestinal absorption of calcium. Calcium absorption is correlated with age and becomes more important after 70 years in both sexes, due to relative deficiency of vitamins and serum levels of parotid growth hormone [9].

Alcoholism is a relative risk factor for osteoporosis because bone mass is reduced in alcoholics [10,11]. The mechanisms by which alcohol acts are little understood. Chronic users of alcohol have a decrease in bone volume trabeculaes, in the number of osteoblasts and a decrease in bone formation[12]. This category of patients had other nutritional factors frequently encounter in alcoholism such as hypocalcemia, hypophosphatemia, hypomagnesaemia. Low levels of vitamin D and its metabolites were revealed in alcoholism but the osteomalacia is rare [12]. Furthermore, chronic alcoholism induces a progressive hypogonadism illustrated by infertility and testicular atrophy. Toxic action of alcohol on bone cells may be explained by the reduction of osteocalcin [13]. However, responsibility osteoporosis in alcoholics does not belong exclusively to alcohol but is associated with other factors such as coexisting liver disease, malnutrition, decreased solar exposure etc. .

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