



Surgical treatment of osteoporotic fractures

Hirurško lečenje osteoporotičnih preloma

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Introduction

The world's older population continues to grow at an extraordinary rate. Thus orthopedic and traumatology surgeons are faced with an ascending rate of osteoporotic fractures. Mechanism of injury in osteoporotic fractures is presented as low energy trauma or as a spontaneous occurrence. Fixation of these fractures is considered as a challenge and there are several implant types used for this purpose – endoprosthetic implants, locking plates with screws and redesigned intramedullary nails for different types of fractures¹. External fixation also has a role in the treatment of osteoporotic fractures. Authors of this paper have a good experience with the use of Mitkovic type Selfdynamisable Internal Fixator, especially in the treatment of osteoporotic proximal, diaphyseal and distal femoral fractures and of periprosthetic femoral fractures after hip or knee arthroplasty²⁻⁵.

Osteoporosis

Osteoporosis is defined as an asymptomatic disease and it is the main risk factor in the fracture occurrence. Osteoporosis is described as a change of bone tissue structure quality and as a reduction of bone mass. There is a reduction of the bone tissue volume (bone mass) relative to the total bone volume, under the level required for normal bone function. The reduction of mineralized tissue is presented as a bone cortex thinning, decreasing number and volume of cancellous bone trabeculae and as the quantitative osteoblasts reduction. More than 10 million people from the United States have osteoporosis with T-score of -2.5 standard deviations (SD). About

34 million people have the osteopenia with T-score between -1 SD and -2.5 SD. More than 1.5 million fractures are caused by osteoporosis every year and more than 70% cases of osteoporosis are female patients. The basic mechanism of the bone homeostasis control is still unknown, but it is supposed that several factors are taking a part there: genetic, hormonal, nutritional and other factors. From pathophysiological aspect, osteoporosis is presented as a dysregulated osteoblast-osteoclast interaction, resulting in a relative increase of bone resorption or in bone formation reduction.

Primary (idiopathic) osteoporosis is classified into two groups: Type 1 (postmenopausal) osteoporosis associated with estrogen deficiency and Type 2 (senile) osteoporosis occurring both in male and in female patients after the age of 70 years. Secondary osteoporosis is presented as a consequence of some drugs, endocrinopathies, chronic illness, poor diet etc. Fracture occurred spontaneously or after low energy trauma is the main clinical sign of osteoporosis. Typical osteoporotic fractures are presented as hip fractures (femoral neck fractures and trans-trochanteric fractures), vertebral compression fractures and fractures of the distal radius. There is another group of fractures resulting from the action of low energy trauma in elderly patients with osteoporosis: proximal humeral fractures, subtrochanteric fractures, pelvic fractures, fractures of the distal femur, tibial plateau fractures, distal tibial and ankle fractures. Treatment of the osteoporosis is of great importance for the prevention of above-mentioned fractures. In most clinical cases, patients who have osteoporosis are firstly observed by an orthopedic surgeon due to the fracture presence. Parallel with improvements in drugs treatment of osteoporosis, new implants are being developed for the fixation of osteoporotic fractures. Hence there are locking plates,

intramedullary implants, and artificial joints. The gold standard in the biological stimulation of bone healing is cancellous autograft application. Autograft has an osteoconductive and osteoinductive effect and it is a source of pluripotent osteoprogenitor cells. Poly-methylmethacrylate (PMMA) cement may be useful if the fixation of osteoporotic bone has been compromised. Fixation failure before fracture healing, due to a poor bone quality, is the main problem in surgical treatment (osteosynthesis) of osteoporotic fractures. This situation requires a reosteosynthesis having a risk for later fracture nonunion and permanent functional problems^{1, 6-9}.

Vertebral compression fractures

American Academy of Orthopaedic Surgeons reports over 700,000 of compression fractures annually. The incidence is increasing from 26% in female patients older than 50 years to 80% in female patients older than 80 years. Osteoporosis is reported as the most common cause of compression fracture occurrence (85%), but a malignant disease with bone metastasis also can cause these fractures (15%). There is the clinical presence of back pain, limited mobility of the spine, weight loss, spine deformity (kyphosis) and functional disability. Non-operative treatment is based on non-steroid analgesics, bed-rest, and physical therapy. Many authors recommend orthosis (orthopedic corsets) in patients with severe posttraumatic deformity (kyphosis). Surgical treatment includes percutaneous vertebroplasty using bone cement, kyphoplasty and vertebroplasty combined with posterior instrumentation (transpedicular vertebral fixation above and below the fracture site) (Figure 1). Transpedicular fixation with minimally invasive percutaneous technique is performed in recent years. Spinal cord compressions should be tre-

pression fractures corpectomy of the fractured vertebral body using anterior instrumentation, spinal cord decompression, and special titanium meshes or artificial vertebral bodies implantation can be performed^{10, 11}. Several dozen patients with osteoporotic fracture of the vertebral body are hospitalized every year at the Clinic for Orthopedics and Traumatology in Clinical Center of Niš. Their treatment is usually nonoperative – bed rest, analgesics, osteoporosis treatment and physical therapy.

Hip fractures

Hip fractures are encountered in everyday orthopedic practice. These fractures are often present in the elder population, older than 65 years, as the consequence of osteoporosis and it more often occurs in female patients. Age distribution of hip fractures is also referred to a fault of motor coordination, eyesight quality, standing balance and protective reflexes, neurological disorders and other factors unrelated to the osteoporosis but related to the aging process. There is also a disbalance referred to the relation between hip load during the gait and maximal force that a bone may be applied on and not to be broken. When a bone is weak by osteoporosis process the fracture can be induced by an indirect force as the result of uncoordinated and excessive muscles contraction. Protective factors are slower and more careful gait and weak muscle tone, in elders, and stronger bones, in the younger population. With a longer average human life, today hip fractures have become a major problem in modern civilization. Patients with this type of trauma occupy about 30% of hospital beds in orthopedic institutions and their treatment is spending a significant amount of economic resources. Hip fractures are much more than a medical problem and they af-

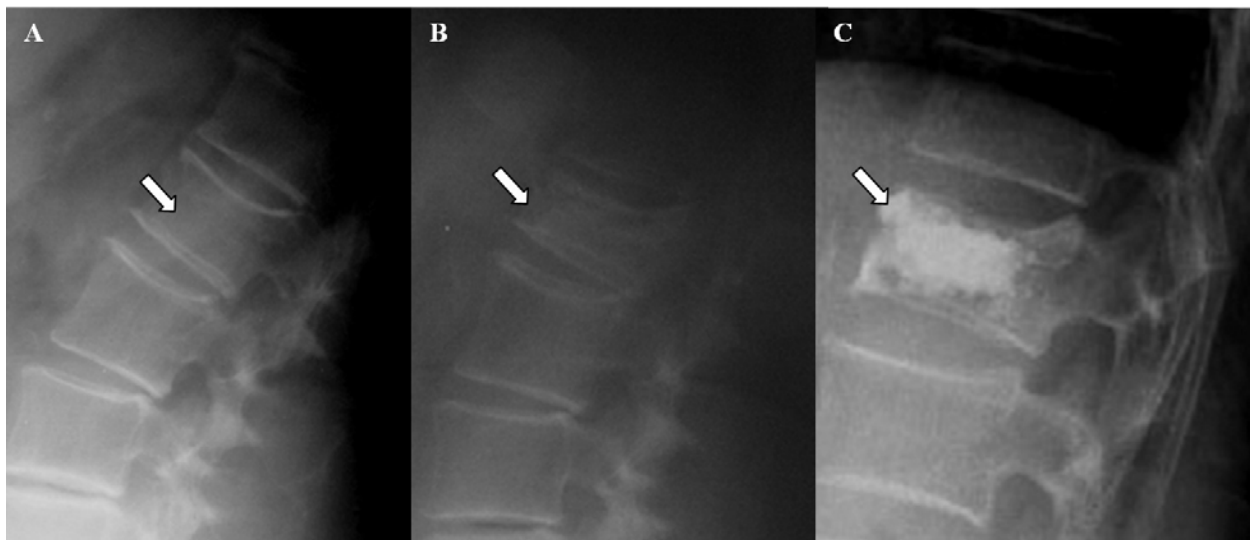


Fig. 1 – A) and B) Radiography of spontaneous vertebral compression fracture, without trauma; C) Radiography after vertebroplasty.

ated by posterior decompression (laminectomy). To avoid fixation loss, transpedicular screws are attached to the vertebral body by the cement augmentation. To stabilize the fracture in patients who have a neurological deficit (paraparesis or potential paraplegia) caused by spinal cord injury in com-

fect both family and the whole society. Around 340 thousands of hip fractures are treated annually in the United States. It is supposed that there would be around 650 thousands of annual hip fractures by the year of 2050. About 20 billion dollars (40 thousand dollars *per* fracture) are spent for the

treatment of these fractures annually. At the world level, there are around 1.6 million of annual hip fractures and it is supposed that it will be around 6.3 million of annual hip fractures by the year 2050. More than 90% of patients with hip fractures are older than 65 years. The average age of the population in Serbia is 42 years and 17.3% of the population is older than 65 years. Our country is considered as the country with a very old nation. Several thousand patients with hip fracture are hospitalized every year in Serbia with a mean annual incidence of 51.7 *per* 100,000 adults¹². A significant amount of Serbian Health Fund resources is spent for the treatment of patients with hip fracture. In the period from the year 2005 to 2010, there were 1,806 patients hospitalized with hip fracture at the Clinic for Orthopedics and Traumatology in the Clinical Center Niš. The average age of patients was 73.5 years and the osteoporosis was found to be the cause of 90% of these fractures. Hip fractures are considered as injuries at risk for life. It can also decrease the quality of life if it is not properly treated. Most of these patients are in very old age and two-thirds of them are suffering

from cardio-vascular, respiratory, cerebral, endocrine, genitourinary and other diseases. This type of trauma is often followed by an acute exacerbation of existing disease resulting in a high rate of mortality (15–35%). More than 4% of patients with a hip fracture die during their initial hospitalization, while 10–35% die within the first year of the fracture occurrence. Many patients with hip fracture are not able for an independent life and they need the help from family or they go to an institution specialized for elders help. These patients can not return activity levels they had before the injury. There are also dementia presence or depression signs in many patients with hip fracture, worsening their condition and affecting their quality of life. Hip fracture treatment depends on the type of the fracture. Displaced femoral neck fractures are treated surgically – arthroplasty, implanting a partial or total hip endoprosthesis (Figures 2 and 3). Transtrochanteric fractures are usually treated surgically by intramedullary nailing (Figure 4) or by other implants for proximal femoral fractures fixation (Dynamic hip screw, Selfdinamysable Internal Fixator by



Fig. 2 – A) Bipolar hip endoprosthesis; B) Total hip cemented endoprosthesis.

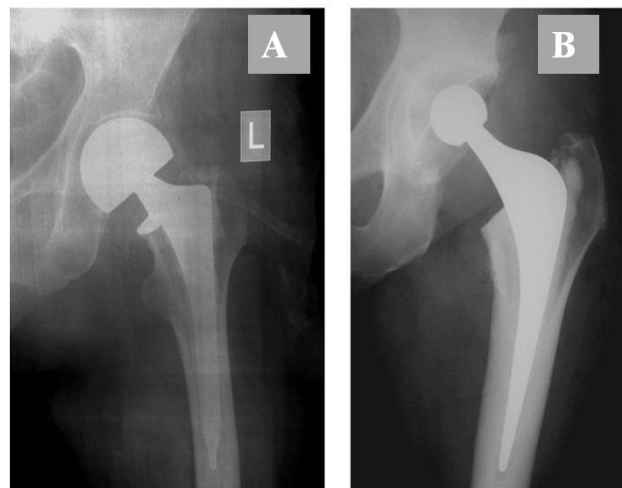


Fig. 3 – A) Radiography of bipolar hip endoprosthesis; B) Radiography of total cemented hip endoprosthesis.

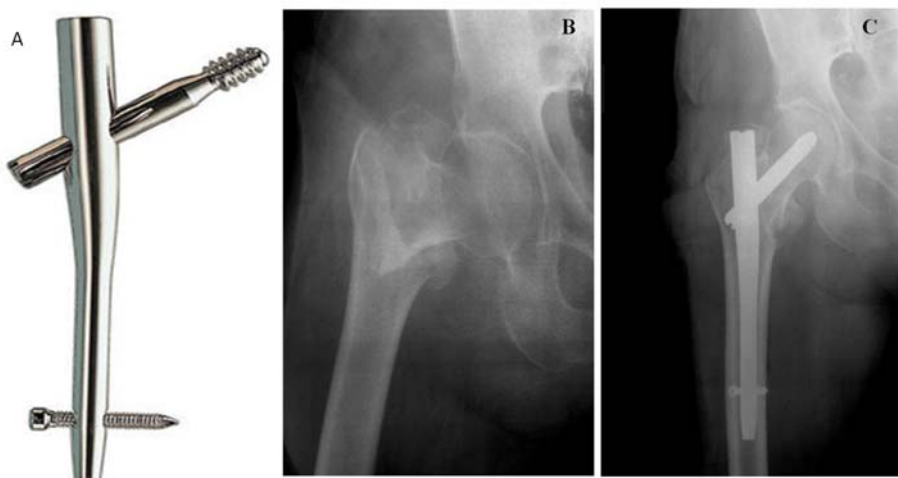


Fig. 4 – A) Gamma interlockin nail; B) Radiography of transtrochanteric fractures; C) Radiography after transtrochanteric intramedullary osteosynthesis.

Mitkovic). Patients with transtrochanteric fractures are rarely treated by hemiarthroplasty or by total arthroplasty. In addition to surgical treatment of hip fractures, it is necessary to provide medical treatment of osteoporosis to avoid refracture in the contralateral hip or in another part of the body. Such cases are not rare in orthopedic practice. There is a group of patients with periprosthetic femoral fractures at the upper part of the femur, around the top of endoprosthetic stem or below in supracondylar part of the femur. Periprosthetic femoral fractures occur most often by an effect of low energy trauma, in elderly patients with osteoporosis who have had a hip fracture and afterward hip arthroplasty (Figures 5 and 6). Treatment of these fractures can be very complex and there are different options, from a simple fracture fixation to the replacement of endoprosthesis followed by fracture fixation. Osteoporotic femoral fractures may also occur after a knee arthroplasty as periprosthetic fractures. The treatment of these fractures can also be very complex and it consists of osteosynthesis or revision knee arthroplasty with or without osteosynthesis^{8, 9, 13-19}.

Fractures of the distal radius

Fractures of distal radius account for 20% of all fractures observed in emergency departments. This is the most common fracture type in our daily orthopedic practice. Distal radial fractures occur primarily after falling on the wrist of the stretched arm, usually as the effect of low energy trauma on osteoporotic bone. These fractures are most often in women at middle age, with an increasing incidence just after menopause. These fractures are for men most common under 70 years of age. The main clinical signs are a pain, swelling, and characteristic deformity. These fractures are treated surgically or nonsurgically. Nonsurgical treatment consists of orthopedic reduction and plaster cast immobilization and it is recommended for stable fractures. Unstable fractures are treated surgically and it is performed by open surgical reduction and fixation (osteosynthesis) with locking plates and screws (Figure 7). Closed reduction – ligamentotaxis and external fixation with or without minimal internal fixation with Kirschner wires is also a solution and gives good results (Figure 8)²⁰⁻²³. Several hundred patients with fracture of the

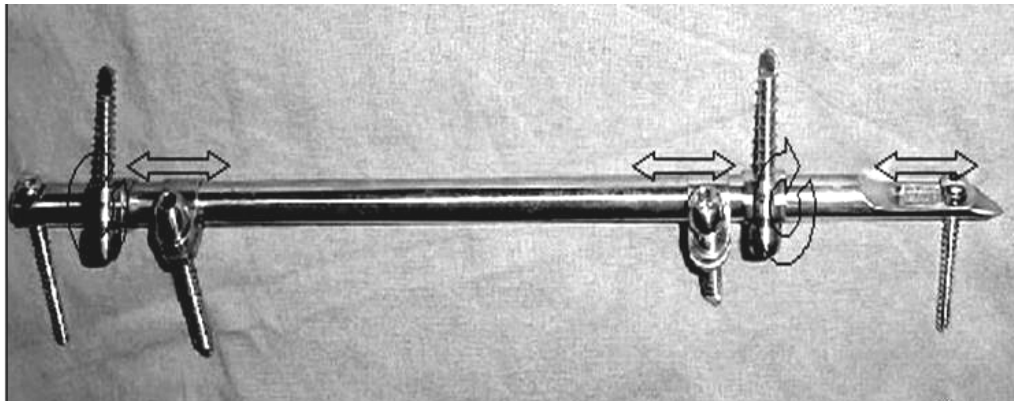


Fig. 5 – Selfdynamisable internal fixator according to Mitkovic.

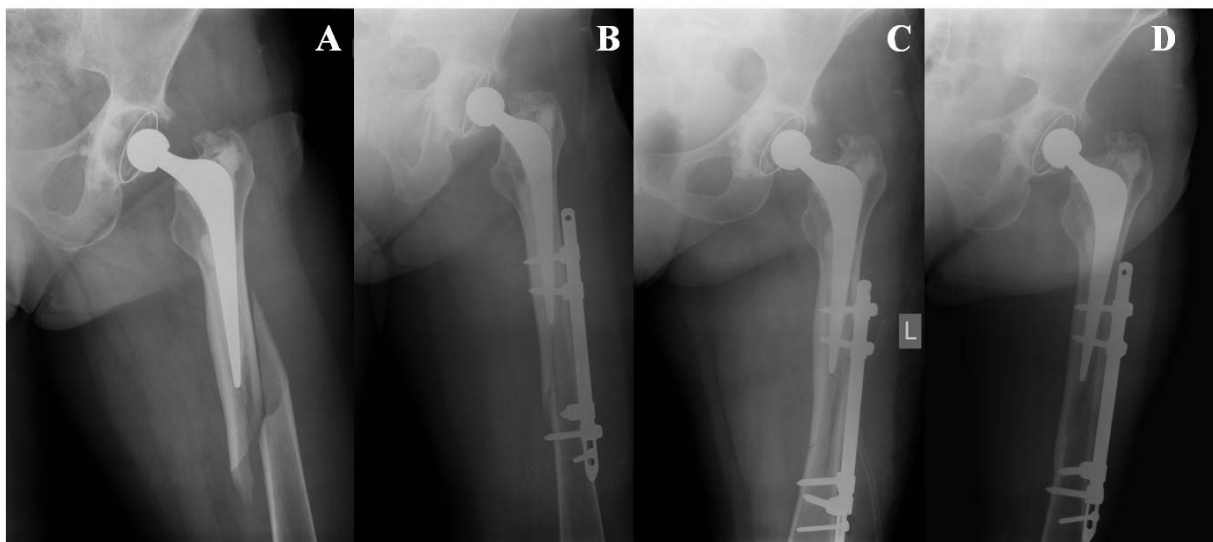


Fig. 6 – A) Radiography of periprosthetic femoral fractures; B) Radiography after periprosthetic femoral fracture osteosynthesis; C) Radiography three months after osteosynthesis; D) Radiography one year after osteosynthesis.



Fig. 7 – A) Locking compression plate for distal radius osteosynthesis; B) Radiography after distal radius osteosynthesis.



Fig. 8 – A) Radiography of distal radius fracture; B) Radiography after external fixation of distal radius fracture.

distal radius are treated every year at Clinic for Orthopedics and Traumatology in Clinical Center Niš. About 30% of patients are treated surgically – open reduction and internal fixation or closed reduction (ligamentotaxis) and bridging external fixation with or without additional K-wires.

Conclusion

The main clinical presence of osteoporosis is a bone fracture. Despite actual pharmacotherapy of osteoporosis, more and more of osteoporotic fractures occur every year

and it becomes a major orthopedic problem. Contemporary orthopedic implants used in surgical treatment of osteoporotic fractures provide high-quality fixation with lower risk for mechanical complications or nonunion.

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