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Original Research

EVALUATION OF BONE HEALING TIME AFTER INTERNAL FIXATION SURGERY IN PATIENTS WITH OSTEOPOROTIC FRACTURES

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Abstract: To evaluate the impact of osteoporosis on bone healing time. A total of 405 fracture patients were divided into two groups: Group A consisting of 242 patients with fractures and osteoporosis; Group B consisting of 163 patients with corresponding fractures but without osteoporosis from January 2020 to January 2024. The age of the osteoporotic patient group was higher and females predominated with p <0.05. The most common fracture type was intertrochanteric fractures with 81 cases accounting for 20%, of which the majority were patients with osteoporosis with 52 patients (64.2%). Osteoporosis prolonged bone healing time in patients with intertrochanteric fractures and femoral shaft fractures. Bone healing time is affected by osteoporosis at intertrochanteric and femoral shaft fracture sites.

Keywords: Osteoporosis; bone healing; slow bone healing.

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1. INTRODUCTION

Osteoporosis is a metabolic disorder of the skeletal system, leading to reduced bone strength and increased risk of fractures. Bone strength depends on two main factors: bone mass and bone quality [1]. Bone mineral density (BMD) is an index to assess bone mass, reflecting the amount of minerals in a unit area or volume of bone, while bone quality is determined through bone structure, bone turnover rate, degree of mineralization, level of accumulated damage, and characteristics of the bone matrix [2].

The bone healing process is a series of complex biological reactions, including overlapping phases that can occur through direct or indirect mechanisms. Direct bone healing occurs when fracture fragments are reduced and firmly fixed, while indirect bone healing occurs through phases of: inflammation, cartilage formation, new bone formation, and bone remodeling. For successful bone healing, four important factors are needed: osteoblasts, appropriate environment, stability of the fracture site, and growth factors [3].

Osteoporosis is often considered a risk factor that can impair bone healing ability. Although the impact of osteoporosis on biological and mechanical factors in the bone healing process has been recognized, there is still debate about whether osteoporosis affects bone healing time [4].

Therefore, to contribute to clarifying this issue, we conducted the study "Evaluation of bone healing time after internal fixation surgery in patients with osteoporotic fractures" with the objectives:

Describe general characteristics of fracture patients

Evaluate the impact of osteoporosis on bone healing time after internal fixation surgery.

2. SUBJECTS AND METHODS

2.1. Study Subjects

405 fracture patients divided into 2 groups: Group A consisting of 242 patients with fractures and osteoporosis; Group B consisting of 163 patients with corresponding fractures but without osteoporosis from January 2020 to January 2024

Inclusion Criteria

+ Patients aged 18 years and above diagnosed clinically and radiographically with fractures at one of the following sites: femoral intertrochanteric, femoral shaft, tibia, tibial plateau, proximal humerus, humeral shaft, distal radius

+ Patients with indication for internal fixation surgery

+ Patients without other related fractures in the injured limb

+ Patients without contraindications to local or general anesthesia

+ Patients followed for at least 6 months

Exclusion Criteria

+ Patients who did not cooperate with the study

+ Patients with pathological fractures

+ Patients with previous surgical intervention at the fracture site

2.2. Study Methods

Prospective study from January 2020 to January 2024. Study method: cross-sectional descriptive comparison of two phases

Information collection: direct examination. Collection of general patient characteristics and fracture characteristics: age, gender, osteoporosis status, injury location, surgical method, bone healing time on X-ray according to Tran Dinh Chien's description and clinical examination:

+ Grade I: Fracture edges are no longer sharp, with shadows around the fracture site.

+ Grade II: There are shadows connecting the two fracture ends but gaps remain.

+ Grade III: There is a callus mass connecting the two fracture ends, no fracture line remains.

Follow-up and examination after surgery for at least 6 months from the time of surgery.

Study Content:

General patient characteristics: gender, age, osteoporosis status, fracture location,

surgical method.

Evaluate bone healing time, compare healing time between groups with and without osteoporosis.

Data collection, processing and analysis: Data processing and analysis using SPSS 16.0 software.

3. RESULTS

We conducted research on 405 fracture patients divided into 2 groups: Group A consisting of 242 patients with fractures and osteoporosis; Group B consisting of 163 patients with corresponding fractures but without osteoporosis from January 2020 to January 2024. With average follow-up time of Group A: 12.7 ± 3.6 months, Group B: 13.6 ± 3.25 months. Our research results are as follows:

The average age of Group A was 67.4 years and Group B was 41.7 years (P=0.042).

The age of the osteoporotic patient group was higher and females predominated with P <0.05, consistent with the epidemiology of osteoporosis commonly seen in elderly people and women. For the group of patients without osteoporosis, there was no difference between men and women, mainly patients of working age.

We can see in our study that the rate of intertrochanteric fractures was the highest with 81 cases accounting for 20%, of which the majority were patients with osteoporosis with 52 patients (64.2%).

For patients with intertrochanteric femoral fractures, intramedullary nail treatment clearly predominated at 81.5%, consistent with modern literature on intertrochanteric femoral fracture

Table 2. Fracture locations

Fracture Location	Intertrochanteric Femur	Femoral Shaft	Tibial Plateau	Proximal Humerus	Humeral Shaft	Distal Radius	Total
Group A	52	27	46	49	27	41	242
Group B	29	31	30	22	24	27	163
Total	81	58	76	71	51	68	405

Table 3. Internal Fixation Methods

Fracture Location	Intertrochanteric Femur	Femoral Shaft	Tibial Plateau	Proximal Humerus	Humeral Shaft	Distal Radius
Plate and Screws	15	20	76	71	44	68
Intramedullary Nail	66	38	0	0	7	0
Total	81	58	76	71	51	68

Table 4. Bone Healing Time

	Bone Healing Time (Weeks)					
Fracture Location	**Intertrochanteric Femur**	**FemurFemoral Shaft**	**Tibial Plateau**	**Proximal Humerus**	**Humeral Shaft**	**Distal Radius**
Group A	18.75	19.17	15.35	13.35	13.32	11.28
Group B	13.26	14.6	14.32	12.26	12.14	10.36
p	0.042	0.032	0.21	0.26	0.44	0.53

treatment.

Through our study, we can see that bone healing time was prolonged in the osteoporotic patient group compared to the non-osteoporotic patient group in cases of intertrochanteric femoral fractures and femoral shaft fractures with P values of: 0.042 and 0.032, respectively.

4. DISCUSSION

We can see the difference between the 2 groups in age is statistically significant with P= 0.042. This is consistent with WHO studies providing statistics on osteoporosis rates and fracture risk, particularly emphasizing the importance of age in increasing osteoporosis risk. WHO reports on osteoporosis are often considered important reference documents in this field [5]. Furthermore, a study by Eastell et al. (2016) emphasized that osteoporosis weakens bone structure, making elderly patients prone to fractures even with minor trauma, while young people usually fracture due to more severe trauma [6].

The age of the osteoporotic patient group was higher and females predominated with P <0.05, consistent with the epidemiology of osteoporosis commonly seen in elderly people and women. For the group of patients without osteoporosis, there was no difference between men and women, mainly patients of working age. According to NOF, women have a higher risk of osteoporosis than men, especially after menopause. About 80% of osteoporosis patients are women, due to estrogen decline accelerating bone mass loss. Other studies show that postmenopausal women lose bone mass rapidly in the early years after menopause, with a rate of 2-3% bone density loss per year. Men lose bone more slowly and experience fewer osteoporosis problems than women [7].

We can see in our study that the rate of intertrochanteric fractures was the highest with 81 cases accounting for 20%, of which the majority were patients with osteoporosis with 52 patients (64.2%). This is one of the most common fracture sites in osteoporotic patients, especially in the elderly. Additionally, fractures in other bone head regions such as tibial plateau fractures are related to direct trauma or strong torsional force. The high rate in the osteoporotic group (in our study: 60.53%) may reflect the severity of bone density reduction. Proximal humerus fractures are a very typical fracture site in osteoporotic patients (in our study: 60.3%), especially postmenopausal women. Osteoporosis reduces bone load-bearing capacity, leading to fractures when falling and bracing with hands. Shaft fractures such as: femoral shaft fractures are more common in people without osteoporosis due to high-energy trauma, such as traffic accidents. In the osteoporotic group, femoral shaft fractures usually occur with minor trauma combined with reduced bone density. Humeral shaft fractures are less related to osteoporosis compared to other sites.

For patients with intertrochanteric femoral fractures, intramedullary nail treatment clearly predominated at 81.5%, consistent with modern literature on intertrochanteric femoral fracture treatment. Intramedullary nailing is the standard method because of: minimal invasion, reliable fixation capability, especially in osteoporotic cases, reduced functional recovery time [8]. For femoral shaft fractures, we used both plate-screw fixation (34.5%) and intramedullary nailing (65.5%). Using intramedullary nailing helps patients bear optimal weight, using plate-screw fixation in cases of complex fractures of the proximal or distal femur. In cases of tibial plateau, proximal humerus, or distal radius fractures, we performed 100% plate-screw fixation method for accurate fixation and joint surface restoration.

Through our study, we can see that bone healing time was prolonged in the osteoporotic patient group compared to the non-osteoporotic patient group in cases of intertrochanteric femoral fractures and femoral shaft fractures with P values of: 0.042 and 0.032, respectively. This is consistent with Kanis and colleagues who indicated that osteoporotic patients require an additional 20-40% bone healing time at the intertrochanteric site [9]. For other types of fractures, our study did not show differences in bone healing time. This may differ from some authors such as: Court-Brown CM and colleagues reported that osteoporosis increases healing time in proximal humerus, but does not always reach statistical significance [10]. There may be some differences due to our study's small sample size, and bone healing time also depends on many other factors such

as age, treatment method, and patient's general condition.

5. CONCLUSIONS

The age of the osteoporotic patient group was higher and females predominated with P <0.05. The rate of intertrochanteric fractures was the highest with 81 cases accounting for 20%, of which the majority were patients with osteoporosis with 52 patients (64.2%). Osteoporosis prolonged bone healing time in patients with intertrochanteric and femoral shaft fractures.

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