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## CLINICAL AND X-RAY EVALUATION OF LONG-TERM RESULTS OF HIP REPLACEMENT AND METALLOOSTEOSYNTHESIS IN ELDERLY PATIENTS WITH PERTROCHANTERIC AND INTERTROCHANTERIC FEMORAL FRACTURES

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**Summary.** *The purpose of this study was to conduct the comparative statistical analysis of late surgical treatment outcomes of femoral fractures in trochanteric segment. It has been established that the total average mark under Harris Hip Score of control group patients after osteometallosynthesis with extra- and internal fixation devices is significantly lower ( $p < 0,05$ ) than patients from endoprosthesis replacement experiment group.*

**Key words:** *perthrochanteric and intertrochanteric fractures, treatment outcome, osteometallosynthesis, hip arthroplasty.*

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### Introduction

Treatment strategies of pertrochanteric and intertrochanteric fractures of the femur in elderly people is an urgent and debatable problem of modern traumatology. Despite a large selection of developed surgical methods, published research papers covering the subject, the number of unsatisfactory long-term outcomes and mortality rates among elderly patients remain rather high [1, 2, 3, 8]. At the heart of this problem are comorbid diseases and polymorbid conditions of the patients: systemic osteoporosis,

dementia, vision and hearing loss, diminished tone of the skeletal muscles, orthostatic hypotension, chronic diseases of the cardiovascular and respiratory systems, endocrine disorders, osteoarthritis, reduction of adaptive-compensatory mechanisms [5, 6, 9]. Injury dramatically changes the life stereotype of older people. This breakdown of adaptive mechanisms often leads to a rapid escalation of concomitant chronic diseases, and also adds hypostatic complications of bed regimen. Current trends are reduced to the speedy

surgical treatment of the patients with fractures in the proximal femoral part, due to more predictable outcomes for the health and life of patients and an earlier mobilization of patients with self-care capacity [4, 7, 10].

Objective: the *aim* was to assess the long-term outcomes of operative treatment among patients with previous pertrochanteric and intertrochanteric fractures of the hip.

### Materials and methods

We evaluated patients with intertrochanteric fractures over a 5-year period. Inclusion required extraarticular intertrochanteric and pertrochanteric fractures of the hip. Patients who were lost during follow up or died due to cause not related to their skeletal injuries were excluded from the study. A total of 144 patients were included in study group. There were 42 (29.2%) males and 102 (70.8%) females. The mean age was  $73.2 \pm 8.1$  years (range, 61-94). The causes of injuries in most cases were low energy trauma 121 (84.0%), followed by road traffic accident 16 (11.1%) and industrial injuries 7 (4.9%). All patients were divided into two groups depending on the type of surgical intervention: the first group consisted of 93 (64.6%) patients who carried out using internal fixation fractures (IF-group), the second - 51 (35.4%), who performed the hip replacement (HR-group). Additionally, an intragroup analysis was performed taking into account the type of used orthopaedic implant. In IF-group the following implants were used for internal fixation: 30 (32.3%) patients had Dynamic Hip Screws (DHS), 30 (32.3%) had the Locking Compression Plates (LCP), Angled Blade Plates (ABP) was performed for 17 (18.2%) patients and Proximal Femoral Nails (PFN) - for 16 (17.2%). In HR-group total hip replacement (THR) was performed for 19 (37.3%) patients, bipolar hip replacement (BHR) for 19 (37.3%) and 13 (25.4%) patients had unipolar hip replacement (UHR). For the assessment of the results of hip surgery, we used Harris Hip Score. In addition, some X-ray criteria such as morphological cortical index, Singh's index were taken into account. The stage of osteoarthritis was evaluated according to the Kellgren-Lawrence classification. The type of fracture was determined by AO/OTA classification system. All patients had surgery in the same hospital and received typical inpatient rehabilitation.

Data were analyzed using Predictive Analytics SoftWare Statistics. Means and standard errors were calculated for continuous variables. The continuous variables were tested for normality with the Shapiro-Wilk test. For the normally distributed variables, ANOVA and t-test for independent samples was used. Because of small sample subgroups size and skewed distribution nonparametric methods were also used for statistic analysis. The Kruskal-Wallis H-test and Mann-Whitney U-test were used for respective analyses of nonnormally distributed variables. Correlation was analyzed with Spearman's test.  $P < 0.05$  was considered as statistically significant.

### Results. Discussion

Clinical outcomes were shown, that the results of treatment of patients underwent hip replacement better according to all criteria of the Harris Hip Scale (Table 1). Excellent and good results were set in half part of the study group 72 (50.0%). In the HR-group excellent results were recorded in 27 (53.0%) patients, good - in 12 (23.5%), fair in 9 (17.6%) and in 3 (5.9%) patients had poor results. In the IF-group the vast majority of patients 45 (48.4%) had poor results, 15 (16.1%) - fair hip status, 20 (21.5%) patients showed good and 13 - (14.0%) excellent results.

The type of hip replacement also significantly influences the results of treatment. Thus, in patients who underwent THR the rates was significantly higher: excellent results were recorded in 16 (84.2%) patients, and good in the rest 3 (15.8%). In patients who performed BHR, the vast majority of patients had an excellent 11 (57.9%) and a good 3 (15.8%) results. Fair results were observed in 4 (21.0%) patients and in 1 (5.3%) cases the poor result was fixed. In the group of patients who had UHR, good results was founded in 6 (46.1%) patients, fair in 5 (38.5%) and in the remaining 2 (15.4%) the results was poor. The results of HR-group according to Harris Hip Score are shown in Table 2.

In addition, the strong negative relationship was obtained between age and overall treatment outcomes ( $r = -0.79$ ,  $p < 0.05$ ) in HR-group. With a high degree of certainty, it can be argued that as age grows the Harris score decreases. There is a strong inverse relationship that indicated better functional results of treatment in patients with unburdened pre-morbid background ( $r = -0.72$ ,  $p < 0.05$ ). The duration of pre-operative preparation also significantly affects the long-term results of treatment ( $r = -0.43$ ,  $p < 0.05$ ). It should be noted, that patients with this group have not established reliable effect of the fracture type, the presence of osteoporosis and the structural and functional status of bone tissue on the long-term results of treatment.

Having analyzed the Harris scale's criteria in the IF-group, the best functional results were established in patients who

**Table 1.** Clinical outcomes of surgical treatment in study group.

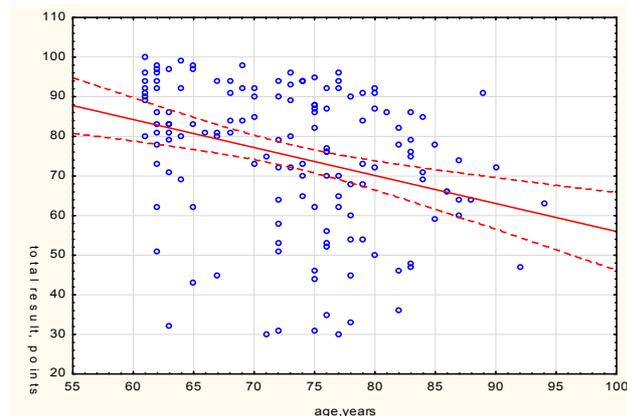
Characteristic	IF-group	HR-group	P-value
Pain	$34.5 \pm 7.8$	$42.3 \pm 2.6$	$< 0.001$
Function	$28.2 \pm 11.4$	$36.4 \pm 7.2$	$< 0.001$
Range of motion	$3.0 \pm 0.7$	$4.4 \pm 0.7$	$< 0.001$
Deformity	$2.7 \pm 0.7$	$3.8 \pm 0.4$	$< 0.001$
Total result	$68.4 \pm 18.5$	$86.8 \pm 9.5$	$< 0.001$

**Table 2.** Clinical outcomes of treatment of the patients who underwent hip replacement.

Characteristic	THR	BHR	UHR	P-value
Pain	$43.2 \pm 1.7$	$42.6 \pm 3.4$	$40.6 \pm 1.5$	0.0005
Function	$41.2 \pm 4.0$	$35.7 \pm 6.6$	$30.3 \pm 7.1$	0.0001
Range of motion	$4.7 \pm 0.5$	$4.4 \pm 0.7$	$3.8 \pm 0.7$	0.003
Deformity	$3.9 \pm 0.2$	$3.8 \pm 0.4$	$3.5 \pm 0.5$	0.007
Total result	$93.0 \pm 4.3$	$86.5 \pm 9.7$	$78.2 \pm 7.9$	0.0001

**Table 3.** Clinical outcomes of treatment of the IF-group's patients.

Characteristic	DHS	LCP	ABP	PFN	P-value
Pain	35.7±7.4	34.3±7.5	30.5±9.3	37.1±6.2	0.13
Function	31.3±11.0	27.7±12.3	20.5±10.6	31.7±6.9	0.01
Range of motion	3.1±0.9	3.1±0.9	2.5±0.7	3.4±0.7	0.01
Deformity	2.7±0.6	2.7±0.7	2.5±0.7	2.9±0.7	0.03
Total result	72.8±17.4	67.7±19.7	55.7±19.3	75.1±10.1	0.02

**Fig. 1.** Correlation diagram between age and total results of surgical treatment in all cohorts.

had their fractures fixation using by PFN or DHS and assessed as fair. In the groups where the ABP and LCP was used, the treatment results were poor (Table 3).

Among the patients in the group where DHS was used to fix the fracture, the vast majority of patients 12 (40.0%) had the poor results, 5 (16.7%) - fair, 7 (23.3%) patients had good and 6 (20.0%) - excellent results. In half of the patients in the group where the fracture was recorded using LCP poor results were observed 15 (50.0%). In 6 (20.0%) patients in this group was found fair results and in the same number 6 (20.0%) - excellent, in the remaining 3 (10.0%) patients had good results. In the group where the ABP was used excellent results was not observed in any patient, the vast majority of patients 12 (70.6%) had poor results, the remaining 5 (29.4%) - good. In the group where PFN was used, excellent results were observed in only 1 (6.3%) patient, good in 5 (31.2%), and fair hip status were found in 4 (25.0%) patients, the highest proportion of patients in this group had poor results 6 (37.5%).

In the IF-group the strong negative correlation between the severity of osteoarthritis and the functional results of treatment ( $r=-0.80$ ,  $p<0.05$ ) was found, the higher level of results indicated in patients with less manifestations of osteoarthritis. An inverse mean relationship was found between Singh's index and total treatment results ( $r=-0.51$ ,  $p<0.05$ ): higher functional results of treatment was observed

in individuals with a higher Singh's index - in individuals with less pronounced signs of osteoporosis. Between the indications of the morphological cortical index and the results of treatment, a positive mean correlation is determined, indicating the best functional results in patients with a higher morphological cortical index ( $r=0.42$ ,  $p<0.05$ ). In the IF-group an inverse correlation between age and the results of treatment ( $r=-0.63$ ,  $p<0.05$ ) was found. Thus, it can be argued that the increase in age is associated with worse treatment outcomes, according to the Harris scale. Also, patients of this group have a weak negative correlation between the premorbid background and functional treatment outcomes ( $r=-0.21$ ,  $p<0.05$ ). The presence of concomitant pathology leads to worse functional results of treatment.

In addition to the type of used fixator, it was determined that the unmodified factors were absorbed into long-term treatment outcomes in older patients in whole group. It was established that the older patient ( $r=-0.37$ ,  $p<0.05$ ) (Fig. 1), the higher the degree of osteoporosis ( $r=-0.25$ ,  $p<0.05$ ) in the preoperative period, prolonged preoperative preparation ( $r=-0.31$ ,  $p<0.05$ ), as well as pronounced osteoarthritis changes in the hip joint ( $r=-0.62$ ,  $p<0.05$ ), the worse the distant results of the functional activity of patients. In addition, the inverse correlation relationship indicates that the difficulty of the fracture also significantly affects the long-term results of treatment ( $r=-0.20$ ,  $p<0.05$ ).

Hip replacement is a method of choice for the intertrochanteric and pertrochanteric hip fractures in older people. Since it provides early mobilization of patients and a rapid recovery of the motor stereotype. In a satisfactory state of the cavity, the bipolar hip replacement should be preferred, which, with a small traumatic effect, provides rapid functional recovery of the patients. In the presence of degenerative changes in the hip joint, a total hip replacement should be remains as a main method.

### Conclusions and prospects of further developments

1. The hip replacement in the course of femoral fractures in trochanteric segment is the method of choice for people of senior age group as it provides the early mobilization of patients and rapid recovery of locomotor stereotype.

2. In the course of satisfactory condition of femoral cathole the preference should be given to bipolar single-pole endoprosthesis replacement which provides the fastest functional recovery of patients and has low traumatic level.

3. In the course of degenerative changes of the hip joint, the total endoprosthesis replacement is the only method.

In future the further study of this issue including the development of differentiate criteria related to choice of hip endoprosthesis depending on age, density of bone tissue, premorbid status of a patient is planning.

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#### КЛІНІКО-РЕНТГЕНОЛОГІЧНА ОЦІНКА ВІДДАЛЕНИХ РЕЗУЛЬТАТІВ ЕНДОПРОТЕЗУВАННЯ КУЛЬШОВОГО СУГЛОБА ТА МЕТАЛООСТЕОСИНТЕЗУ ПРИ ЧЕРЕЗВЕРТЛЮГОВИХ ТА МІЖВЕРТЛЮГОВИХ ПЕРЕЛОМАХ СТЕГНОВОЇ КІСТКИ У ЛЮДЕЙ СТАРШОЇ ВІКОВОЇ ГРУПИ

**Резюме.** В дослідженні проведено порівняльний статистичний аналіз віддалених результатів хірургічного лікування переломів стегнової кістки у вертлюговій ділянці. Встановлено, що сумарна середня оцінка за функціональною шкалою Харріса у хворих контрольної групи після остеометалосинтезу екстра- та інтрамедулярними фіксаторами достовірно нижча ( $p < 0,05$ ), ніж у дослідної групи ендопротезування.

**Ключові слова:** черезвертлюгові та міжвертлюгові переломи, результати лікування, остеометалосинтез, ендопротезування кульшового суглоба.

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#### КЛИНИКО-РЕНТГЕНОЛОГИЧЕСКАЯ ОЦЕНКА ОТДАЛЕННЫХ РЕЗУЛЬТАТОВ ЭНДОПРОТЕЗИРОВАНИЯ ТАЗОБЕДРЕННОГО СУСТАВА И МЕТАЛЛООСТЕОСИНТЕЗА ПРИ ЧРЕЗВЕРТЕЛЬНЫХ И МЕЖВЕРТЕЛЬНЫХ ПЕРЕЛОМАХ БЕДРЕННОЙ КОСТИ У ЛЮДЕЙ СТАРШЕЙ ВОЗРАСТНОЙ ГРУППЫ

**Резюме.** В исследовании проведен сравнительный статистический анализ отдаленных результатов хирургического лечения переломов бедренной кости в вертлужной зоне. Установлено, что суммарная средняя оценка по функциональной шкале Харриса у больных контрольной группы после остеометалосинтеза экстра- и интрамедулярными фиксаторами достоверно ниже ( $p < 0,05$ ), чем в исследовательской группе эндопротезирования.

**Ключевые слова:** чрезвертельные и межвертельные переломы, результаты лечения, остеометалосинтез, эндопротезирование тазобедренного сустава.

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