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Research Article

Evaluation of Results from Rehabilitation of Patients with Pertrochanteric Fracture Treated Surgically

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Abstract

Introduction: Adult population generally is more sensitive and exposed to various injuries, which means increased opportunity for the emergence of various kinds of geriatric trauma. By increasing average length of life, solving fractures of the upper end of the femur is a major problem for the modern surgery.

Aim of the Study: Aim is to evaluate the effects of treatment and physical rehabilitation with kinesiotherapy and magnetic therapy versus kinesiotherapy and therapy with interference currents of patients with surgically treated pertrochanteric fracture with DHS-type KYLE I, II, according to the protocol results monitoring.

Materials and Methods: The study represents a prospective randomized clinical trial implemented at the Institute for Physical Medicine and Rehabilitation - Skopje. Include two cohorts, with 90 participants with pertrochanteric fracture treated surgically with DHS- type KYLE I, II. Respondents are divided into two groups: Examined group - 45 patients, treated with kinesiotherapy and magnetic therapy and control group - 45 patients treated with kinesiotherapy and therapy with interference currents. Respondents were followed for one year, during which were performed three examinations, the first control on the day of discharge of the hospital, than after 6 and 12 months, from the first review which is input for selected patients who meet the criteria for inclusion in research.

Results: For $p > 0.05$, there is no statistically significant difference between the groups in terms of the gender of the respondents (Pearson Chi-square = 0.6527, df = 1, p = 0.4191. For $p < 0.05$, a significant difference was found between the respondents from the two groups in terms of the status of formed callus (Pearson Chi-square = 10,181, df = 1, p = 0,0014). It is recognized that, kinesio-therapy and magnetic therapy and kinesiotherapy and interference currents, for $p < 0,05$, increase Harris hip score (improve the condition of patients) in three time combinations. On physical examination after discharge, 6 and 12 months, Harris hip score for the group treated with magnetic therapy is significantly higher compared with the same in the group treated with interference currents,

Conclusion: In the postoperative rehabilitation of pertrochanteric fractures, with dynamic fixation implant-DHS, therapy of choice is kinesiotherapy and magnetic therapy. It resulted with improvement in the functional status, the stimulation of osteogenesis and quality of life in elderly patients.

Keywords: Pertrochanteric Fracture; DHS-dynamic Hip Screw; Magnetic Therapy; Interference Currents; Kinesiotherapy

Introduction

The extension of human age and better quality of life contributes to increased activity of the older population group [1]. Adult population generally is more sensitive and exposed to various injuries, which means increased opportunity for the emergence of various kinds of geriatric trauma [1]. Geriatric patients are at higher morbidity and mortality compared to young people, and it requires a different approach to treatment, which should reduce mortality and increase postoperative success [1].

By increasing average length of life, solving fractures to the upper end of the femur is a major problem of modern surgery. Pertrochanteric fractures are around four times more common fractures of the neck of femur and commonly occur in patients older than 65 years. In this population of patients, osteoporosis in women is very common especially because they are more prone to these fractures, as compared with the male population of 4: 1. 2/3 of the geriatric population involve other comorbidities such as: cardiovascular, respiratory, endocrine diseases [2]. Injury worsens existing conditions, resulting in a large percentage of mortality [2].

According to the Kyle classification [3], pertrochanteric femoral fractures are divided into four types in two groups: group of stable fractures (Type I and II), that are treated with the fixation of the femur with DHS (dynamic hip screw); and group of unstable fractures (type III and IV), which are treated with the fixation of the femur with the PFN (proximal femur nail).

Objective of the Study

To evaluate the effects of treatment and physical rehabilitation with kinesiotherapy and magnetic therapy versus kinesiotherapy and therapy with interference currents of patients with pertrochanteric fracture surgically treated with DHS- type KYLE I, II, according to the protocol results monitoring.

Materials and Methods

The study was conducted at the Institute for Physical Medicine and rehabilitation in Skopje, in cooperation with the University Clinic- TOARILUC, University Clinic for surgery diseases "Ss. Naum Ohridski" City hospital "8-th September " in Skopje, where patients were treated surgically. The research included two groups with 90 patients (examined and control group) with pertrochanteric fracture treated surgically, Kyle types I, II with dynamic fixation implant-DHS (Dynamic hip screw).

The selection of the respondents for the study (the examined and the control group) was made according to pre-determined inclusion and exclusion criteria:

- **Inclusion criteria:** Surgically treated pertrochanteric fracture with the method – DHS, age over 65, readiness, ability and desire to participate in the study.
- **Exclusive criteria:** Fractures of the femoral neck, pertrochanteric fracture operatively treated by another surgical method (PFN), pathological fracture of the femur, age under 65 years, previous history of cerebrovascular stroke, absence of readiness, ability and desire to participate in the study.

Respondents are divided in two groups: Examined group- 45 patients with surgically determined pertrochanteric fracture treated surgically, Kyle types I, II with dynamic fixation implant-DHS (Dynamic hip screw), admitted to the Institute of Physical Medicine and Rehabilitation - Skopje, 2- 3 weeks after surgery. These patients are treated with kinesiotherapy and magnetic therapy, low-frequency pulse-field intensity 8mT, 25Hz, 30 minutes for 10 treatments (Magomil 2- Electronic Dizajn). Magnetic therapy application is applied to the mat, where the patient lies down on it. The therapy is administered through clothing in 30 minutes, once a day, 10 treatments.

Control group – 45 patients with pertrochanteric fracture treated surgically, Kyle types I, II with dynamic fixation implant-DHS (Dynamic hip screw), admitted to the Institute of Physical Medicine and Rehabilitation - Skopje, after 2-3 weeks of operating treatment, after early rehabilitation in the surgery departments. These patients are treated with kinesiotherapy and interference currents (Neoserv 824- Simens). Interference currents are applied using four rubber graphite quartered electrodes that before the application is coated with multilayer gauze soaked in warm water and good drainage. 10 treatments administered for a period of 30 minutes and once daily directly to the skin, well fastened with constantly frequency of 100Hz. The skin of the patient must be healthy and intact, and the treatment feels like a pleasant vibration.

Both groups of patients treated with kinesiotherapy. Kinesiotherapy consists of a progressive program of exercises for the lower limbs: for strengthening m. quadriceps of the operated and healthy leg, exercises for muscles of the hip (flexor, extensor, abductor, adductor and rotators muscles), first starting with isometric, then with isotonic exercises, walking exercises with or without

aid. In early rehabilitation of the surgery departments, patients started with exercises and verticalization. In our Clinic, they came after 2-3 weeks to continue rehabilitation treatment to strengthen muscles, respiratory exercises, balance and walking independently.

Respondents were followed for one year, during which were performed three examinations, the first control on the day of discharge the hospital, then after 6 and 12 months, from the first review which is input for selected patients who meet the criteria for inclusion in research.

The first, second and third control include physical treatment and completed questionnaire of the Harris hip score, which consists of 3 parts. The first part has 8 questions in the area of pain, support, everyday activities. The second part has 4 questions regarding the scope of the developments in the operated hip and length of the operated leg, and the third part consists of 4 questions to individual measurements of the operated hip flexion, abduction, adduction and external rotation. The ranking of scores of Harris hip score is as follows: less than 70 points = bad, 70- 79 rather good, 80 to 89 good and 90 excellent 100 points. (4,5,6) Questionnaire is filled out Harris hip score at first, second and third control by the researcher.

Statistics

Statistical evaluation was performed using appropriate statistical programs (Statistica for Windows 7,0 and SPSS 17.0). The data obtained are presented in tables and graphics. To test the significance of the differences between certain parameters analyzed were used, depending on the type and distribution of data, parametric Student t-test (two independent samples) and ANOVA (for more independent samples) and non parametric tests for independent samples and consequently test Mann Whitney U and Kruskal Wallis test. When analyzing more than two numerical series used the Post hoc - Tukey significant difference (HSD) test. Analysis of more than two dependent samples are consequently used Wilcoxon test and Friedman ANOVA test. to establish.

Results

In the eximinated group, 38 (85.4%) were women and 7 (15.6%) were men with a gender ratio of 5.43: 1. In the control group, of 45 patients, 35 (77.7%) are women and 10 (22.2%) are men with a gender ratio of 3.5: 1 (Graph 1). For $p > 0.05$, there is no statistically significant difference between the groups in terms of the gender of the respondents (Pearson Chi-square = 0.6527, df = 1, p = 0.4191).

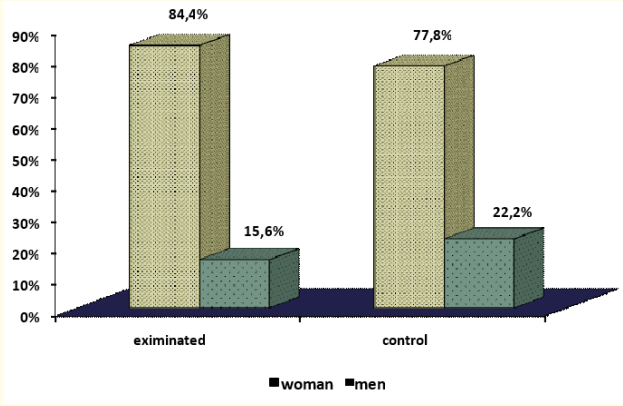

Figure 1: Descriptive analysis of a sample by gender.

Patients from both groups were analyzed by age and gender. In the eximinated group, the average age of female patients was 74.8 ± 7.1 years with a minimum age of 65 and a maximum age of 88 years. In male patients, the mean age was 70.4 ± 4.5 years with a minimum age of 67 years and a maximum age of 80 years. The analysis showed that fifty percent of the female or male patients are consequently older than 74 or 70 years.

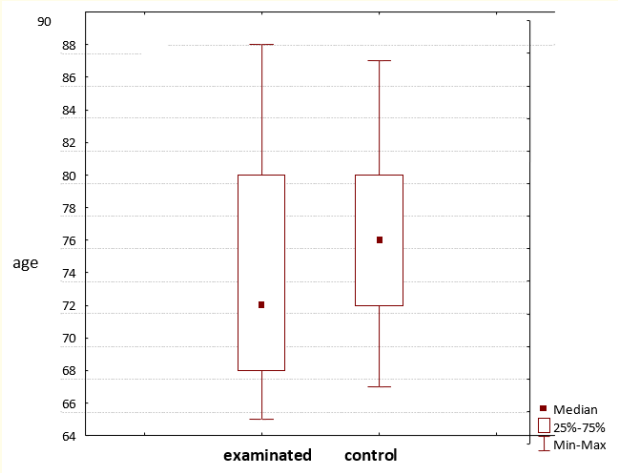

Figure 2: Descriptive analysis of a sample by age and groups.

All patients, according to the protocol, are referred for X-ray of the operated hip.

The reading of the radiographic results, from the aspect of formed callus, is performed by a specialist radiologist in three gradations:

- No callus,
- Callus in formation and
- Formed callus

From the total number of respondents in the sample, formed callus had 51 (56.7%). In the examined group, 33 (73.33%) of the patients had formed callus, while in the control group this number was 18 (40%).

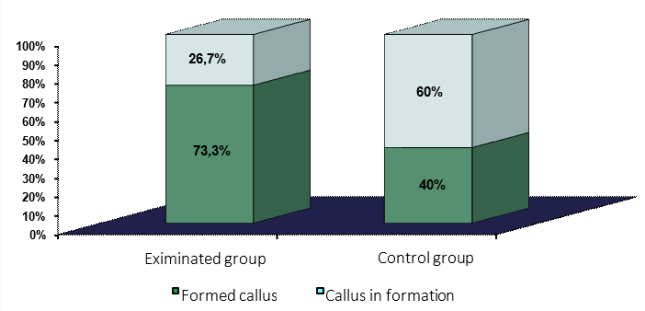

Figure 3: Descriptive analysis of the sample by group and callus status.

For $p < 0.05$, a significant difference was found between the respondents from the two groups in terms of the status of formed callus (Pearson Chi-square = 10,181, df = 1, p = 0,0014).

According to the analysis, patients treated with kinesiotherapy and magnetic therapy are 4,125 times more likely to have formed callus after 12 months, compared with patients treated with kinesiotherapy and interference currents [OR = 4,125 (1,694 - 10,046) 99% CI].

In the eximinated and control group was calculated questionnaire of Harris hip score, composed of four parts, by the examiner. Harris hip score for each patient is calculated with electronic software.

Within the experimental group was made a single analysis three times of Harris hip score. In this group, the average value of Harris hip score at discharge, 6 months and 12 months is consequently 57,5 ± 12,1 v.s 74,3 ± 9,9 v.s 86,6 ± 10,2. The minimum or maximum value in discharge amounted to 34,8 v.s 83,1; after 6 months amounted to 44,1 v.s 93 and after 12 months was 64,4 v.s 96.

The analysis of median indicated that in 50% of patients in the examinated group treated with kinesiotherapy and magnetic therapy, Harris hip score is: a) to 55.8 in printouts - Median (IQR) = 55,8 (47-67,8) - BAD; b) over 76 after 6 Months - Median (IQR) = 76 (67.9 to 81) - a rather good; and c) more than 93 after 12 months - Median (IQR) = 93 (75.3 to 96) - EXCELLENT. In each subsequent measurement perceived improvement of the condition of patients in this group, according to the Harris hip score.

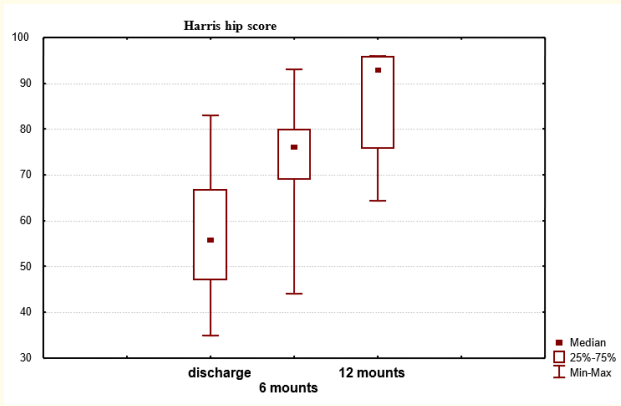

Figure 4: Analysis of the examined group in Harris hip score three times.

For $p < 0,05$, in the eximinated group found a significant difference between Harris hip score in the three times of physical examination (Fridman test: N = 45 Chi-Square = 89,034 df = 2 p = 0, 00001).

Analysis of the control group according to Harris hip score.

In the control group, made a single analysis three times of Harris hip score. In this group, the average value of Harris hip score at discharge, 6 months and 12 months is consequently 48,1 ± 11,6 v.s 63,6 ± 10,1 v.s 74,6 ± 8,1. The minimum or maximum value in

printouts amounted to 29,7 v.s 77; after 6 months amounted to 44,8 v.s 84 and after 12 months was 58,6 v.s 96.

The analysis of median indicated that in 50% of patients in the control group treated with kinesiotherapy and interference currents, Harris hip score is: a) to 45.7 in printouts - Median (IQR) = 47,5 (41,1-57, 8) - BAD; b) to 66.4 after 6 Months - Median (IQR) = 66,4 (56,8-71) - BAD; and c) over 73 after 12 months - Median (IQR) = 73 (69.3 to 79) - rather GOOD. In discharge and after 6 months according to the Harris hip score, the condition of patients in this group is BAD, and after 12 months the situation has improved GOOD.

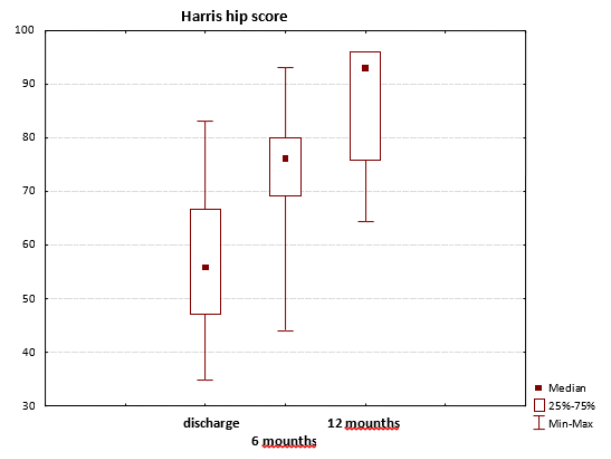

Figure 5: Analysis of the control group in Harris hip score and three times.

For $p < 0,05$, in the control group established, found a significant difference between Harris hip score (the patient) in the three times of physical examination (Fridman test: N = 45 Chi-Square = 89,508 df = 2 p = 0,00001).

Upon discharge, 6 months and 12 months, $p > 0,05$, the analysis indicated a statistically significant difference between the two groups in terms of Harris score of hip. For $p < 0,05$, there is a significant difference between the two groups in terms of Harris hip score for discharge, after Mann Whitney U test = 620 Z = 3,168 p = 0,002; after 6 Months to Mann Whitney U test = 451 Z = 4,535 p = 0,0000, after 12 Months of Mann Whitney U test = 385 Z = 5,085 p = 0,0001. On physical examination after discharge, 6 and 12 months, Harris hip score for the group treated with magnetic therapy is significantly higher compared with the same in the group treated with interference currents, i.e., the condition of patients was significantly better in the group treated with magnetic therapy.

Figure 6: Median score of Harris hip score after group three times.

According to the comparison of median Harris hip score in both groups, analysis indicated that the situation after 12 months in 50% of patients treated with kinesiotherapy and magnetic therapy are assessed as excellent compared to the situation in 50% of patients treated with kinesiotherapy and interference currents which are assessed as rather good.

Discussion

The worldwide increase in the incidence of hip fractures is a major challenge for the health system and society. Appropriate treatment of fractures of the hip in adults is still controversial, even from an international perspective. Optimizing and standardizing treatment for better results, it is mandatory for both humanitarian and economic reasons. The importance of incorporating the results of treatment in clinical trials of patients is recognized today there are numerous tools for evaluating the quality of life for this group of patients [7].

In our study the Harris hip score was much better in the eximinated group compared to the control group which proves that magnetic therapy plays an important role in the rehabilitation of patients with pertrochanteric hip fracture [8].

In adults, the effect of hip fracture could be the beginning of a significant decline in the level of functioning, and the transition

from living in their own home to live in homes for adults. Marotolli., *et al*. in a cohort of 2086 adults living in the nursing homes and were targeted overseen a period of 6 years, 120 cohort members who sustained a hip fracture in the 6-year study period, 22 died within 6 months of the fracture. Among survivors there was a sustained decline in function at 6 weeks after the fracture with little improvement by 6 months. At baseline, 86% could dress independently versus 49% at 6 months; 90% could transfer independently versus 32% at 6 months; 75% could walk across a room independently versus 15% at 6 months; 63% could climb a flight of stairs versus 8% at 6 months; and 41% could walk one-half mile versus 6% at 6 months. Physical function and mental status were the only baseline factors significantly associated with physical function at 6 months after the fracture in bivariate analysis, while physical function and depression were associated in multivariate analysis [8]. Adult patients have less satisfactory results when the fracture of the hip were treated with surgical treatment than younger patients [9].

The Sharrard study included 45 patients with tibial fracture, treated conservatively and divided into two groups: in the first (examined) group there were 20, in the second (control) 25 patients, of which the first received magnetic therapy, the second didn't receive, for a period of 12 weeks. X-rays were then taken, which were evaluated blindly and independently by a radiologist and orthopedic surgeon. In the examined group, the radiologist assessed formed callus in 5 patients, callus in formation in 5 patients, and no callus in 10. In the control group, 1 patient had callus and callus in formation, in 23 there wasn't callus. In the examined group the orthopedic surgeon have 9 with callus, 11 didn't have callus. In control group 3 had callus, 22 didn't have callus. These results were significant in favor of the study group ($p = 0.02$). It was concluded that the pulsed electromagnetic field significantly affects the healing and osteogenesis of tibial fractures [10].

The Borsalino study included 32 patients with intertrochanteric osteotomy with the same type of plate, up to 70 years of age, divided into two groups. All were discharged from the hospital on 10 - 14th day postsurgically. Until the 40th day they weren't allowed to load on a sore leg, from the 40 - 90th day with half a load, and after the 90th day they could be loaded with the entire weight of the sore leg. On the third day postoperatively, the first group was given stimulator, that they had to apply daily for 90 days, the other hadn't stimulation. X-rays were taken on days 40 and 90 and read on a computer with a special software package for callus density. At 40 days, there was more pronounced bone callus and larger trabecular bridging in the stimulated group, both of which were significant at $p < 0.02$. Although bone callus density is relatively higher in the stimulated group, it isn't statistically significant. At 90 days, all measurements were significantly better in the stimulated group, $p < 0.001$ for trabecular bridges and callus density [11].

The main tendency in the acquired hip fracture is to avoid the patient's resting for a longer time interval. Because adults usually have difficulty in walking, with limited ability to carry weight goal, election of the surgical approach in fixation and implants should be faster, to provide faster verticalisation and bearable carry weight. Intensive rehabilitation for elderly patients may have a positive impact on the ability of a patient with hip fracture to live independently, even in situations of the presence of some degree of dementia. Seitz conclusion is that are needed effective strategies to prevent hip fractures and improve postoperative outcomes for older adults with dementia [12].

The study of Huusko in 2000 patients with hip fracture and presence of dementia, conducted an assessment of three months and one year after surgery. Ability to live independently within a year after receiving a hip fracture in the test compared with the control group there were significantly fewer patients with moderate dementia who have been subjected to intensive rehabilitation, and should be sent to an institution [13].

Evidence-based guidelines recommend first walk after hip fracture surgery within 48 h. Early mobilization is resource and effort intensive and needs rigorous investigation to justify implementation. Oldmeadow., *et al*. investigate the effect of early ambulation after hip fracture surgery on patient and hospital outcomes. Sixty patients were studied (41 women and 19 men; mean age 79.4 years) for surgical management of a hip fracture. Randomization was either EA (first walk 1 or 2 postoperative day) or delayed ambulation (DA) (first walk 3 or 4 postoperative day). Functional levels were compared on 7 day post-surgery, acute hospital length of stay and destination at discharge [14].

At 1 week post-surgery, patients in the EA group walked further than those in the DA group and required less assistance to transfer and negotiate a step. Patients in the EA group were more likely to be discharged directly home from the acute care than those in

the DA group (26.3 compared with 2.4%) and less likely to need high-level care (36.8 compared with 56%). A failed early ambulation subgroup had significantly more postoperative cardiovascular instability and worse results for all outcome measures [14].

Although care and surgical techniques have vastly improved in the past, in recent years, the treatment of patients with hip fractures can have worse results than expected. The treatment is assessed, whether the patient recovered, and is independent in daily activities, prior to the fracture. There is now strong evidence that well-designed exercise and physical training interventions can enhance muscle strength and balance and prevent falls in older people. There is also mounting evidence that exercise and physical training can enhance recovery of function and independence in older people after hip fracture. Beaupre., *et al*. conclusions is that Physical therapy and/or activity should be provided during the acute care stay and for an extended period after discharge. This should likely include progressive strength training exercises and other strategies to address the individual deficits that are identified [15].

The results of several authors, it is estimated that 12 months after pertrochanteric fracture, the patient has lost 6% of body weight., Portegijs., *et al*. attached the rehabilitation treatment of 6 months in a study of 90 elderly people. In the study experimental group conducted intensive rehabilitation program, and in the control group conducted a program with exercises with less intensity. It is recognized that in the experimental group and despite the increase in muscle strength in patients also increased the speed and stability of walking, balance and ADL (activities for daily living) features [16].

The Harris Hip Score is used to evaluate the results of surgical treatment and rehabilitation in patients with hip fractures. In the study of Liang., *et al*. is to compare the efficacies of four surgical treatments, i.e. total hip arthroplasty (THA), internal fixation (IF), hemiarthroplasty (HA), and artificial femoral head replacement (artificial FHR), by performing a network meta-analysis based on Harris hip score (HHS) in elderly patients with femoral neck fracture. Conclusions of the network meta-analysis results suggest that IF is the superlative surgical procedure for femoral neck fracture patients, and IF significantly improves the Harris hip score in femoral neck fracture patients [17].

In another study of Zuh., *et al*. are aimed to determine the correlations between instruments and analyse the possibility of replacing HHS with the VAS in evaluating the results of hip surgery in patients. In study included 37 women and 4 men (53 hips), with a mean age of 50.96 years (35-58 years), followed for a mean of 4 years postoperatively. Both assessment instruments were used preoperatively and at the follow-up visits. They observed a positive correlation of the values of the Visual Analogue Scale and the Harris Hip Score both preoperatively and postoperatively. They assumed that the Visual Analogue Scale could replace the Harris Hip Score in the evaluation of patients after total hip replacement. Still it is recommended to combine the Visual Analogue Scale with objective measurements and radiological examination in order to identify significant postoperative changes [18].

In the study of Hoeksema is to compare responsiveness of the Harris Hip Score with generic measures (the Short Form-36 (SF-36), and a test of walking speed and pain during walking) in patients with osteoarthritis of the hip [19].

Conclusion

The obtained results indicate the importance of postoperative rehabilitation, primarily in the stimulation of osteogenesis, to improve the trophy of the muscles of the lower extremities with the help of kinesiotherapy and the independence and autonomy of the patient in performing daily activities.

All this leads to the movement of the patients independently or with the help of an orthopedic device (walker, crutches, cane).

From all this, it can be concluded that in the postoperative rehabilitation of pertrochanterIC fractures, with dynamic implant fixation-DHS, therapy of choice is kinesiotherapy and magnetic therapy, from which there is an improvement both in functional status, in the stimulation of osteogenesis and quality of life in elderly patients.

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