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Momcilo Todorovic[1], Zoran Golubovic[2], Predrag Stojiljkovic[2], Ivan Micic[2], Milovan Zecevic[1], Darko Kostic[1], Desimir Mladenovic[2], Sasa Karaleic[2], Nina Abbasher[2], Zoran Matovic[2], Katarina Kutlesic-Stojanovic[2], Aleksandar Visnjic[3],

[1]Orthopedic Department of the Health Center Cuprija
[2]Clinic for Orthopaedic Surgery and Traumatology, Clinical Center Nis
[3]Public Health Institute Nis

COMPARATIVE ANALYSES OF THE RESULTS OBTAINED FROM OPERATIVE AND NON-OPERATIVE TREATMENT OF THE TROCHANTER FRACTURES

SUMMARY

Trochanter fractures rank among severe injuries of the bone tissue and are most often encountered in elderly persons who already have a number of accompanying diseases of cardiovascular, respiratory and endocrine systems. The treatment and healing of such fractures is always a relevant problem because of high frequency and specific population it most often befalls.

In this paper, the results of the operative and non-operative treatments of the trochanter fractures are compared. The analyses involved 60 patients with trochanter fractures, older than the age of sixty. The patients were divided into two groups. The test group comprised 30 patients treated operatively at the Orthopedic Department of the Health Centre in Cuprija. The trochanter fractures were stabilized by dynamic intra-medullar implants (20 patients) and by static extra-medullar implants (10 patients). The control group also included 30 patients who were treated by supracondillar skeletal extension at the Clinical Centre in Kragujevac. The mean age of all patients was 70.52 years. The treatment having been completed, the final results were assessed based on Salvati-Willson's scale, which was modified by Todorovic and Jevtic. The following parameters were considered: pain, scope of movements, strength of muscles, support, walking and functioning of the injured extremity. Comparing the results of operative and non-operative treatment, it was found that operative treatment gave better results in all the analyzed parameters (time of mobilization, scope of movements of the injured hip, muscle strength, functioning of the injured extremity, shortening of the extremity, frequency of infections). Comparing the results of the operative treatment by dynamic intra- medullar fixation with the operative treatment by the rigid extra medullar fixation, we found that the treatment by dynamic fixation had better effects in all analyzed parameters.

Key words: **trochanter fractures, non-operative treatment, operative treatment**

INTRODUCTION

Trochanter region is a multidirectional stress carrier towards the acetabulum and femur head. This bone complex has a role of a shock absorber towards pelvic bone because of the specific organization of the bone mass which is arranged as bone joints. According to the literature data, the most often cause of such fractures in elderly people is a fall on a flat surface. The frequency of such fractures shows a significant growth in the late seventies. In the population older than the age of 65, about 20% fall once or more during one year. There is a high incidence of fractures registered in inmates of

Corresponding author. E-mail address: peckytt@ni.sbb.co.yu

gerontological centers, about 6% a year. Trochanter fractures rank among severe injuries of the bone tissue and are followed by a great loss of blood. High percentage of mortality after such fractures is caused not only by the great loss of blood but also by the accompanying diseases typical of this part of population, such as cardiovascular, pulmonary and endocrine diseases (1).

Trochanter fractures, unlike the femur neck fractures, mostly heal well, no matter which method is applied. Although the process of healing is fast, it is necessary to perform adequate reposition of fragments immediately after the fracture has occurred, either by operative or non-operative methods, if operative methods are contraindicated (2). If appropriate treatment is not applied, almost all such fractures heal unfavorably (great shortening of extremities, extreme outward and inward rotation), which leaves the patient with severe functional incapacities of the injured limb itself, but also of the whole locomotion (3).

MATERIAL AND METHODS

The analyses enrolled 60 patients with trochanter fractures, older than the age of 65.

The patients were divided into two groups. The test group of 30 patients with trochanter fractures received operative treatment at the Department of Orthopedics of the Cuprija Health Centre. These fractures were stabilized by the use of dynamic intra medullar implant (20 patients) and by static extra medullar implant (10 patients). The control group comprised 30 patients as well, treated by supracondylar skeletal extension in the Clinical Centre Kragujevac.

The treatment having been completed, the assessment of the results was made based on the Salvati-Willson's scale modified by Todorovic and Jeftic (4).

After the treatment, the following parameters were statistically evaluated: time of mobilization, scope of the injured hip movements, muscle strength, function of the injured extremity, shortening of the injured extremity, frequency of infections.

In this scale, for each parameter, the values 0 -10 were introduced. By adding the maximum values of five parameters in the treatment of these fractures, the sum of 50 was obtained. This number, multiplied by the coefficient 2, makes 100%, the maximum sum in anatomical and functional aspect in the healing of the trochanter fractures. Based on these parameters, the achieved results were divided into five groups: excellent (81-100%), very good (61-80%), good (41-60%), satisfactory (21-40%) and unsatisfactory (0-20%).

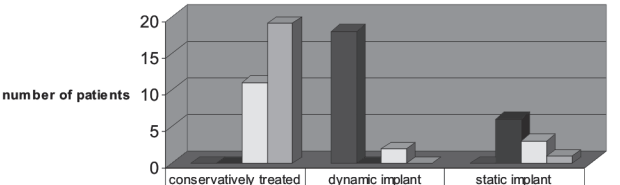
RESULTS

In the group of patients treated operatively, there were 16 males (53%) and 14 females (47%). In the group of patients treated conservatively, there were 14 males (47%) and 16 females (53%).

The mean age of all the patients, in the test and control group, was 70.52 + 7.89 years. The average age of the patients treated operatively was 70.53 + 9.03 years, while the patients treated non-operatively, by the skeletal extension, were 70.50 + 6.71 years old. There is not a statistically significant difference regarding average age of the analyzed groups.

The group of conservatively treated patients - mark C, the patients' time of mobilization within 30 – 45 days, registered in 11 patients (37%); mark D - time of mobilization after 45 days, registered in 19 patients (63%) *(Figure 1)*.

Figure 1. The patients straightening up time



	conservatively treated	dynamic implant	static implant
A (< 10 days)	0	18	0
B (10-30 days)	0	0	6
C (30-45 days)	11	2	3
D (> 45 days)	19	0	1

The group of operatively treated patients - mark A, the patients' time of mobilization within 10 days, registered in 18 patients (60%); mark B - the patients' time of mobilization 10-30 days, registe-red in 6 patients (20%). Mark C is registered in 5 patients (17%), and mark D in 1 patient (3%). As for the time of mobilization, there is a statistically significant difference between the patients treated conservatively and operatively.

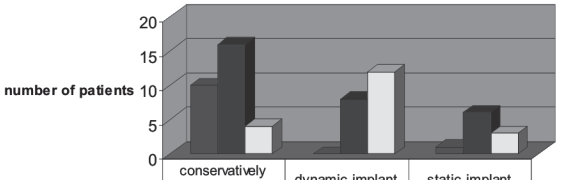
There were 18 patients (90%) treated by dynamic implant - mark A, mark C was registered in 2 patients (10%). There were 6 patients (60%) treated by static implant - mark B, mark C was registered in 3 patients (30%), and mark D in 1 patient (10%). Regarding the time of mobilization, there is a statistically significant difference between the patients treated by dynamic and by the static implants.

In the group of patients treated conservatively, ten patients (33%) had grade 6, the movement limitation of 50%, sixteen patients (54%) had grade 8, the movement limitation up to 30%, and four patients (13%) had grade 10 with full scope of movements. The medium grade in conservatively

treated patients was 7.33 + 1.21. In the group of patients treated by operative techniques, one patient (3%) had grade 6; fourteen patients (47%) had grade 8, and 15 patients (50%) had grade 10. The medium grade in operatively treated patients was 7.53 + 2.21. There is a statistically significant difference between the patients treated conservatively, by skeletal extension, and the patients treated operatively concerning the scope of movements.

By analyzing the scope of movements in the group of operatively treated patients where static and dynamic implants were used, we reached the following conclusions: in the group of patients treated by dynamic implant, eight patients (40%) had grade 8, while twelve patients (60%) had grade 10. Medium grade is 7.80 + 2.50. In the group of patients treated by static implants, one patient (10%) had grade 6; six patients (60%) had grade 8; three patients (30%) had grade 10. Medium grade in this group is 7.00 + 1.41. Concerning the scope of movements after the completion of the treatment, there is not a statistically significant difference between the patients treated by static and dynamic implants *(Figure 2)*.

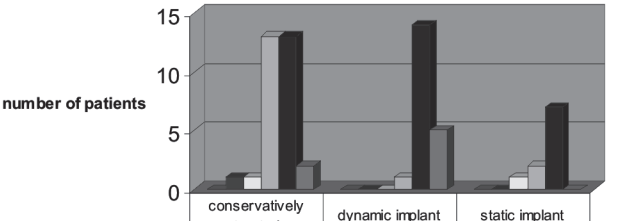
Figure 2. The scope of movements after the completion of the healing



	conservatively treated	dynamic implant	static implant
6(movement limitation of 50%)	10	0	1
8(movement limitation to 30%)	16	8	6
10(full scope of movements)	4	12	3

Having analyzed the muscle strength after the completion of the treatment in the patients treated conservatively, we found that one patient (3%) had grade 2 (10% of the total muscle strength), one patient (3%) had grade 4 (25% of the total muscle strength), thirteen patients (44%) had grade 6 (50% of the total muscle strength), thirteen patients (43%) had grade 8 (75% of the total muscle strength), and two patients (7%) had grade 10 (100% of the total muscle strength) *(Figure 3).* The medium grade of the muscle strength in the non-operatively treated patients' group was 6.93% + 1.64. Having analyzed the muscle strength in the patients treated operatively, after the completion of the treatment, we found the following results: one patient (3%) had grade 4, three patients (10 %) had grade 6, twenty-one patients (70%) had grade 8, and five patients (17%) had grade 10. The medium grade was 8.00 + 1.29. Concerning the scope of movements, there is a statistically significant difference between the patients treated conservatively and those treated operatively.

Figure 3. Muscle strenght after the completition of healing

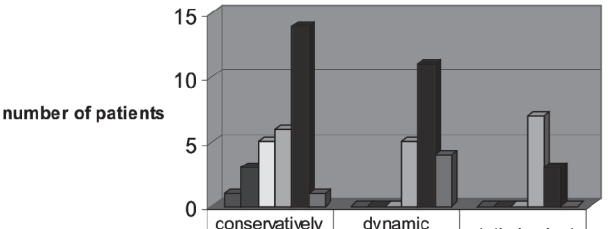


	conservatively treated	dynamic implant	static implant
grade 0(0%)	0	0	0
grade 2(10%)	1	0	0
grade 4(25%)	1	0	1
grade 6(50%)	13	1	2
grade 8(75%)	13	14	7
grade 10(100%)	2	5	0

Having analyzed the muscle strength in the patients treated operatively by static and the dynamic implants, we obtained the following findings: in the group of patients treated by dynamic implant, one patient (5%) had grade 6, fourteen patients (17%) had grade 8, and five patients (17%) had grade 10. The medium grade was 8 + 1.29. In the group of patients treated by static implant, one patient (10%) had grade 4, two patients (20%) had grade 6, and 7 patients (70%) had grade 8.The medium grade in this group was 7.20 + 1.40. Concerning the scope of movements after the completion of the healing, we found that there was a statistically significant difference between the patients treated by dynamic and static implants.

In the group of patients treated conservatively, one patient (3%) had grade 0 (remained bedridden), three patients (10%) had grade 4 (confined to a walking device) *Figure 4*, ten patients (33.5%) had grade 6 (walking stick – up to five buildings far), ten patients (33.5%) had grade 8 (walking stick – long

Figure 4. The functioning of the injured extremity



	conservatively treated	dynamic implant	static implant
grade 0	1	0	0
grade 2	3	0	0
grade 4	5	0	0
grade 6	6	5	7
grade 8	14	11	3
grade 10	1	4	0

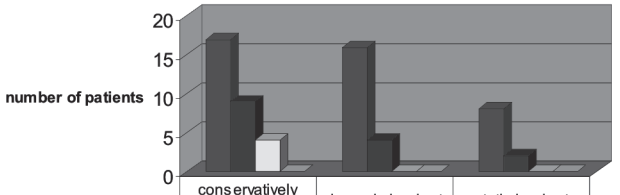
distances), and six patients (20%) had grade 10 (walking without any aids). The medium grade in the patients treated conservatively was 7.07 + 2.27.

In the group of patients treated by the operative techniques, nine patients (30%) had grade 6, fifteen patients (50%) had grade 8, and six patients (20%) had grade 10, medium grade being 7.80 + 1.42. Concerning the functioning of the injured extremity after the completion of the healing, there is a statistically significant difference between the patients treated conservatively and operatively.

Having analyzed the scope of movements in the group of operatively treated patients by static and dynamic implants, we obtained the following results: in the group of patients treated by dynamic implant, five patients (25%) had grade 6, ten patients (50%) had grade 8, five patients (25%) had grade 10. The medium grade was 8.00 + 1.45. In the group of patients treated by static implant, four patients (40%) had grade 6, five patients (50%) had grade 8, one patient (10%) had grade 10. The medium grade in this group was 7.40 + 1,35. Concerning the quality after the completion of the healing, there is a statistically significant difference between the patients treated by dynamic and static implants.

Seventeen conservatively treated patients (57%) had mark A, no shortening of the extremities, nine patients (30%) had mark B, shortening up to 3 cm, four patients (13%) had mark C, shortening up to 5 cm *(Figure 5)*.

Figure 5. The shortening of the extremities



	conservatively treated	dynamic implant	static implant
A (no shortening)	17	16	8
B (< 3 cm)	9	4	2
C (3-5 cm)	4	0	0
D (> 5 cm)	0	0	0

Twenty-four patients (80%) treated operatively had mark A, six patients (20%) had mark B. Concerning the shortening of the injured extremity after the completion of the healing, there is a statistically significant difference between the patients treated operatively and conservatively.

Sixteen patients (80%) treated by dynamic implant had mark A, four patients (20%) had mark B. Eight patients (80%) treated by static implant had mark A, two patients (20%) had mark B. Concerning the shortening of the injured extremity after the completion of the healing, there is a statistically significant difference between the patients treated by dynamic and the static implants.

In three patients (10%) treated conservatively and one patient (5%) treated by dynamic implant, superficial infections were registered. In one patient (10%) treated by static implant, a deep infection was found. The same patient had the implant removed.

In the group of conservatively treated patients, one case (3.33%) resolved with the fatal consequence, due to the hypostatic pneumonia.

DISCUSSION

Trochanter fractures rank among severe injuries of the bone tissue, which can be followed by profuse blood loss. In severe cominutive fractures, the loss of blood can amount to 1000 ml (5). Trochanter fractures most often occur in elderly people and their incidence rises after the seventies. Such fractures more rarely occur in younger persons, and, most often, they are a consequence of the fall from a height or of traffic accidents. Trochanter fractures occur four times more frequent in female persons than in male persons, which is explained by the postmenopausal osteoporosis (6).

Trochanter fractures are most often associated with elderly people. According to the literature data, trochanter fractures are most frequent in the patients in the seventh and eighth decade of life. In the analyzed group, the average age of the treated patients was 70.52 + 7.89 years.

The incidence of the trochanter fractures is higher in females, which is explained by the postmenopausal osteoporosis. According to the literature data, the incidence of trochanter fractures in females ranges from 67% to 82% (7,8).

Activating the patients and walking with crutches are of vital importance for elderly patients with trochanter fractures. After a long time spent in bed, complications start to appear (hypostatic pneumonia, deep blood vessels' thrombosis with resulting thromboembolism, urinary infections – urosepsis, decubital lesions which could be fatal for the elderly patients having a trochanter fracture. The time of mobilization in eleven conservatively treated patients (37%) was between the thirtieth and the forty-fifth day, and in nineteen patients (63%) after the forty-fifth day. In the group of operatively treated patients, eighteen patients (60%) straightened up within the first ten days after the surgery, six patients (20%) from the tenth to the thirtieth day, five patients (17%) between the thirtieth and the forty-fifth day, and one patient (3%) after the forty-fifth day. There is a statistically significant difference between the patients treated conservatively and operatively, concerning their time of mobilization, which is a normal result regarding the fact that the patients treated conservatively, by skeletal extension, were bedri-

dden from six to eight weeks. The aim of the operative treatment of the patients with trochanter fracture is the earliest possible activation, including their mobilization, in order to avoid complications that long staying in bed brings about, which is often fatal for elderly patients.

The scope of movements in the group of patients treated conservatively after the completion of medical rehabilitation was marked by grade 7.33 + 1.21, and in the group of operatively treated patients by grade 7.53+2.21. The greatest scope of movements in the injured hip after the completion of the healing was registered in the patients treated by dynamic implant and it amounts to 7.80 + 2.50. Concerning the scope of movements after the completion of the healing, there is a statistically significant difference between the patients treated conservatively, by skeletal extension, and the patients treated operatively.

Lying in bed for a long time, because of inactivity, brings about the loss of muscle strength and volume. The longer stay in bed, the more significant loss of muscle strength and volume are. This is especially evident in the patients having the trochanter fracture treated conservatively by the skeletal extension, which means lying in bed for six to eight weeks. By the analyses of the manual muscle test (MMT) of the injured extremity at the end of the conservative treatment, the medium grade of 6.93 was established, which is about 60% of the normal muscle strength. Analyzing the MMT with the operatively treated patients by the static implant, medium grade of 8.0 was established, while the dynamic implant amounted to 8.4. The Student's t-test showed that there is a statistically significant difference in the muscle strength of the injured leg between the patients treated conservatively and operatively.

Other authors found that the muscle strength was 60% – 76% (9).

One of the aims in the treatment of the patients with the trochanter fracture is reestablishing of the function of the injured extremity and the quality of life as before the injury. In the group of conservatively treated patients, we registered one patient (3%) who was bedridden after the completion of healing and three patients (10%) confined to a walking device. Ten patients (33.5%) had to use a walking stick and could move as far as five blocks of flats. Fifteen patients (50%) could walk long distances with a walking stick. In the group of operatively treated patients, nine patients (30%) could walk with a walking stick as far as five blocks or flats, and fifteen patients (50%) could walk long distances with a walking stick. Walking without any aid was registered in six patients (20%). The medium grade by the score is 7.80 + 1.42. Vukmanovic et al. found 36.36% patients enabled to walk without any aid (9). According to the functional capability, in the group of conservatively treated patients, we had twenty-one patient (70%) capable of everyday activities without any help, and in the group of operatively treated patients, all thirty (100%) were capable of everyday life. Concerning the function of the injured extremity after the completion of the treatment, we found that there is a statistically significant difference between the patients treated conservatively and operatively. The operative treatment by dynamic implant is the best method of choice in the treatment of patients with the trochanter fracture (10-12).

One of the frequent complications that occur in the non-operative treatment of the trochanter fractures in the patients that cannot be treated by skeletal extension but only by the positioning of the leg in the bed is shortening of the extremity. The shortening of the injured extremity can be up to 5cm, which significantly affects the quality of walking; even with the shoe with elevated heel, the patient walks with difficulties and with the aid of the walking stick. After the conservative treatment, the shortening of the extremities up to 3cm was registered in nine patients (30%), and four patients (13%) had the shortening of 3 to 5cm. In operatively treated patients, a shortening up to 3cm was registered in six patients (20%). In other patients treated operatively, there was not any shortening registered. Concerning the shortening of the injured extremity after the completion of the treatment, there is a statistically significant difference between the patients treated conservatively and operatively.

In the treatment of patients with trochanter fractures, common infections around the wedge are usual and relatively frequent in the course of treatment by skeletal extension. According to the literature data, the incidence of infections ranges between 2% and 16% (13-15). In the group of patients treated by skeletal traction, the infection around the wedge was registered in three patients (10%). In the group of patients treated operatively, one patient (3.33%) had a surface infection of the wound, and in one patient (3.33%) there was a deep infection registered. According to literature data, the incidence of a deep, postoperative infection ranges from 1.2% to 8.9% (16-18).

In the group of patients treated conservatively, one fatal incident was recorded. According to the literature data, the percentage of mortality after the trochanter fractures ranges between 14% and 36% (19-21).

CONCLUSION

Trochanter fractures most often occur in elderly persons and their incidence grows after the seventies. They are rarely registered in younger persons and they are usually the consequence of the fall from a height or after a traffic accident. Trochanter fractures stand for a severe and very serious damage of the bone tissue, which can be followed by a profuse loss of blood, even 1000 ml. Trochanter fractures are four times more frequent in the female persons, which is explained by the postmenopausal osteoporosis. The patients with trochanter fractures occupy a large part of the available beds at orthopedic clinics, which is not only a problem for the clinics, but for the society and economics as well. The treatment of the trochanter fractures is always a relevant problem. If adequate treatment is not applied, almost all trochanter fractures heal in an unfavorable position (great shortening of the extremities, extreme internal or external rotation) leaving the patients with severe functional impediments.

Comparing the results of the operative and non-operative treatments, it was established that the operative treatment gave better results in all the analyzed parameters (time of mobilization, scope of movements of the injured hip, muscle strength, functioning of the injured extremity, shortening of the extremity, frequency of infections).

Comparing the results of the operative treatment by dynamic intra medullar fixation with the results of the operative treatment by rigid extra medullar fixation, we found that the treatment by dynamic fixation gave better results in all the analyzed parameters.

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KOMPARATIVNA ANALIZA REZULTATA LEČENJA TROHANTERNIH PRELOMA NEOPERATIVNIM I OPERATIVNIM PUTEM

Momčilo Todorović[1], Zoran Golubović[2], Predrag Stojiljković[2], Ivan Micić[2], Milovan Zečević[1], Darko Kostić[1], Desimir Mladenović[2], Nina Abbasher[2], Aleksandar Višnjić[3], Zoran Matović[2], Katarina Kutlešić-Stojanović[2], Jablan Stanković[2]

[1]Ortopedsko odeljenje, Zdravstveni centar Ćuprija
[2]Ortopedsko-traumatološka klinika, Klinički centar u Nišu
[3]Institut za zdravstvenu zaštitu u Nišu

SAŽETAK

Trohanterni prelomi spadaju u teške povrede koštanog tkiva i najčešće se sreću kod osoba starije životne dobi, kod kojih postoji veliki broj pratećih bolesti kardiovaskularnog, respiratornog i endokrinog sistema. Zbog učestalosti preloma i specifičnosti populacije kod koje se najčešće sreću, lečenje trohanternih preloma predstavlja uvek aktuelni problem.

U radu se kompariraju rezultati lečenja trohanternih preloma operativnim i neoperativnim metodama. Analizom je obuhvaćeno 60 bolesnika sa trohanternim prelomom koji su stariji od šezdesete godine života. Bolesnici sa trohanternim prelomima podeljeni su u dve grupe. Grupu ispitanika čini 30 bolesnika koji su lečeni operativno na Ortopedskom odeljenju Zdravstvenog centra u Ćupriji. Trohanterni prelomi su stabilizovani dinamičkim intramedularnim implantatom kod 20 bolesnika i statičkim ekstramedularnim implantatom kod 10 bolesnika. Kontrolnu grupu čini 30 bolesnika koji su lečeni suprakondilarnom skeletnom ekstenzijom u Kliničko-bolničkom centru Kragujevac. Prosečna starost svih bolesnika iznosi 70,52 godina. Po završenom lečenju vršena je procena krajnjih rezultata na osnovu Salvati Wilsonove skale koja je modifikovana od strane Todorovića i Jevtića. Praćeni su sledeći parametri: bol, obim pokreta, snaga mišića, oslonac, hod i funkcija povređenog ekstremiteta.

Upoređujući rezultate operativnog i neoperativnog lečenja utvrđeno je da je operativno lečenje dalo bolje rezultate u svim analiziranim parametrima (vreme vertikalizacije, obim pokreta povređenog kuka, snaga mišića, funkcija povređenog ekstremiteta, skraćenje ekstremiteta, učestalost infekcija). Upoređujući rezultate operativnog lečenja dinamičkom ekstramedularnom fiksacijom sa operativnim lečenjem rigidnom ekstramedularnom fiksacijom, utvrdili smo da je lečenje dinamičkom fiksacijom dalo bolji efekat u svim analiziranim parametrima.

Ključne reči: **trohanterni prelomi, konzervativno lečenje, operativno lečenje**