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Milan M. Mitković^{1,2,†}, Saša S. Milenković^{1,2}, Ivan D. Micić^{1,2}, Igor M. Kostić¹,
Predrag M. Stojiljković^{1,2}, Milorad B. Mitković²

**Hip function and health-related quality of life in intramedullary and
extramedullary internal fixation of trochanteric fractures**

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¹Clinical Center Niš, Clinic for orthopaedics and traumatology, Niš, Serbia;

²University of Niš, Medical Faculty, Niš, Serbia

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†Correspondence to:

Milan M. MITKOVIĆ

Romanijska 19/52, 18000 Niš

E-mail: milanmitkovic@hotmail.com

Hip function and health-related quality of life in intramedullary and extramedullary internal fixation of trochanteric fractures

Функција кука и квалитет живота повезан са здрављем код интрамедуларне и екстрамедуларне фиксације трохантерних прелома

SUMMARY

Introduction/Objective There are extramedullary and intramedullary methods of trochanteric fractures internal fixation including implants with lag screws. The objective of this study was to examine the difference in impact of these fixation types on final hip function and health-related quality of life.

Method There were 75 patients treated for a trochanteric fracture, using Self-dynamisable Internal Fixator (SIF group), as an extramedullary method, or Gamma Nail (GN group), as an intramedullary method. These patients were called for evaluation of Harris Hip Score (HHS) and SF-12 questionnaire at least two years after surgery. The SF-12 questionnaire has dual expression – physical component score (PCS) and mental component score (MCS).

Results There were not significant differences between SIF group and GN group regarding HHS, PCS and MCS. Positive correlation was confirmed between HHS, PCS and MCS, with the most strength relation between HHS and PCS. Negative correlation was confirmed between age and HHS.

Conclusion There was no difference in final hip function and health-related quality of life between SIF and GN methods in trochanteric fractures treatment ($p > 0.05$). These parameters of outcome were confirmed to have positive interrelation ($p < 0.05$). Both submuscular presence of extramedullary implant with dimensions of SIF and the need for bone reaming in cephalomedullary fixation were considered not to have significant impact in HHS and SF-12 scores after trochanteric fractures treatment by internal fixation.

Keywords: self-dynamisable internal fixator; gamma nail; hip function; health-related quality of life

САЖЕТАК

Увод/циљ У унутрашњој фиксацији трохантерних прелома се често користе екстрамедуларне и интрамедуларне методе са клизним завртњима. Циљ ове студије био је да се испита разлика у утицају ових врста фиксације на функцију кука и квалитет живота повезан са здрављем након завршеног лечења трохантерних прелома.

Метод Анализирано је 75 болесника са трохантерним преломом, који су лечени унутрашњом фиксацијом самодинамизирајућим унутрашњим фиксатором (SIF група), као екстрамедуларном методом, и гама клином (GN група), као интрамедуларном методом. Код ових испитаника је извршено бодовање према Harris Hip Score тесту (HHS) и према SF-12 упитнику, најмање две године након операције. SF-12 упитник је био исказиван кроз двојак резултат – физичка компонента (PCS) и ментална компонента (MCS).

Резултати Није било значајне разлике између група по питању HHS-а, PCS-а нити MCS-а. Између ова три параметра је потврђена линеарна корелација позитивног смера, при чему је ова веза била најјача између HHS-а и PCS-а. Између старости испитаника и HHS-а је потврђена линеарна корелација негативног смера.

Закључак Између самодинамизирајућег унутрашњег фиксатора и гама клина није потврђена значајна разлика по питању утицаја на функцију кука и квалитет живота повезан са здрављем на крају лечења ($p > 0.05$). Потврђена је повезаност између праћених параметара ($p < 0.05$). Додатно се закључује да субмускуларно присуство имплантата величине SIF-а, као и потреба за римовање медуларне кости не утичу значајно на крајњи резултат лечења трохантерних прелома унутрашњом фиксацијом.

Кључне речи: самодинамизирајући унутрашњи фиксатор; гама клин; функција кука; квалитет живота повезан са здрављем

INTRODUCTION

Trochanteric fractures are occurred in proximal part of the femur between greater and lesser trochanter. These fractures are mostly treated by internal fixation with lag screws if the lateral wall is preserved („no lateral wall no hip screw“). There are intramedullary and extramedullary implants containing lag screws [1-3]. In this way, Self-dynamisable Internal Fixator (SIF) with trochanteric unit [4-6], as an extramedullary method, and Gamma Nail [6-11], as an intramedullary method, are in routine use in trochanteric fractures treatment at

Clinic for Orthopaedics and Traumatology in Clinical Center of Niš. There are two types of Self-dynamisable Internal Fixator with trochanteric unit – the type with multiple (up to three, mostly used two) non-cannulated lag screws and the type with a single cannulated lag screw [12].

It is desired to compare intramedullary and extramedullary methods regarding final hip function, general physical health and mental health at the end of the trochanteric fracture treatment, due to specificities in some of these methods – position of the implant or the need to ream the bone [13-15].

Papers from the literature refer about health-related quality of life in cephalomedullary fixation and also in DHS fixation of trochanteric fractures. There are no the results about health-related quality of life after the use of Self-dynamisable Internal Fixator. The aim of this study was to compare the two methods in trochanteric fractures treatment - third generation of Gamma Nail and Self-dynamisable Internal Fixator with trochanteric unit, regarding final results in hip function and health-related quality of life.

METHOD

Two groups of patients treated for unilateral trochanteric fracture treatment had been analysed. There were 75 cases – 42 (SIF group) were treated by Self-dynamisable Internal Fixator with trochanteric unit, having two non-cannulated lag screws (Figure 1) and 33 cases (GN group) were treated by third generation Gamma Nail (Figure 2). Excluding criteria were implant presence in the other hip, other fracture or polytrauma at the same time as a trochanteric fracture, malignant tumor, disfunction of parathyroid gland. Consecutive patients who were available for clinical exam and interview at least two years after surgery (surgery was performed in the year of 2012 or later) were analyzed in this study. All patients were

treated for trochanteric fracture internal fixation at Clinic for Orthopaedics and Traumatology in Clinical Center of Nis. Referring to AO classification, there were A1 and A2 types of proximal femoral fractures.

There were 26 males and 49 females. Hip function was assessed using Harris Hip Score (HHS), which is based both on questionnaire and on clinical measures of hip movements and leg length[13,14]. Bone union was achieved in all cases and there were no mechanical complications. The SF-12 questionnaire had been used to assess health-related quality of life. This questionnaire is used in many clinical conditions, including patients treated for hip fractures. This questionnaire has been accepted as a good alternative for previously defined SF-36 questionnaire, if just dimensions of health-related quality of life have to be analyzed - physical components score (PCS) and mental component score (MCS). More detailed analysis in health-related quality of life, including its subdimensions evaluation, requires SF-36 questionnaire though [16-18]. Age was considered for the time of the clinical assessment mentioned above.

Both Harris Hip Score test and SF-12 questionnaire values (PCS and MCS) can have values between 0 and 100, with higher value means better outcome.

Regarding statistical analyzes, T-test and Mann-Whitney U test were used for differences in average values, while Chi-square test was performed to compare distributions between groups. Relation between measured parameters was assessed by bivariate correlations. The level of significance was 0.05.

This study was approved by the Committee on Ethics of the Clinical Center of Niš.

RESULTS

Average values and distributions of followed parameters, with its statistical differences are listed in the Table 1. There were no significant differences between groups

regarding age, gender distribution, hip function and health-related quality of life after trochanteric fracture union ($p>0.05$).

Statistics of correlation between measured parameters are listed in the Table 2. Significant correlation was confirmed for HHS to PCS, MCS and age ($p<0.05$). It was also confirmed for PCS to MCS ($p<0.05$). Correlation was not confirmed for age to PCS and MCS ($p>0.05$). Confirmed correlations were both positive and negative and they were moderate ($\pm 0.5 \leq r < \pm 0.7$) and high ($\pm 0.7 \leq r < \pm 0.9$).

DISCUSSION

It could be considered that gender and age didn't have the influence in relations between groups regarding final hip function and health-related quality of life after trochanteric fracture treatment, because there was not significant difference in average age and in gender distribution.

Average final functional result of the treated hip was fair (HHS had values 70-79) in both groups [19]. There was not significant difference between groups neither in hip function nor in quality of physical and mental quality of life ($p>0.05$) at least 2 years after internal fixation of a trochanteric fracture. These results suggest that:

- submuscular presence of extramedullary implant with dimensions of Seldynamisable Internal Fixator does not have significant influence in both final functional results of the treated hip and in health-related quality of life, than in absence of its presence in cephalomedullary fixation of trochanteric fractures;
- the need for bone reaming in cephalomedullary fixation does not have important influence in in both final functional results of the treated hip and in

health-related quality of life, than in absence of it need in extramedullary fixation of trochanteric fractures.

There was significant correlation between hip function (HHS) and the age of the patients ($p < 0.05$). This correlation was negative, thus it could be considered that higher age means lower function of the hip. It could be explained by the influence of different comorbidities and of osteoarthritic changes on gait and on hip function, because these occur more often in older population. This correlation was approved, but the strength of relation between hip function and age is not strictly defined, due to the moderate correlation ($-0.7 \leq r_s < -0.5$) [20]. Age of patients was not significantly correlated to qualities of both physical (PCS) and mental health (MCS) ($p > 0.05$). These results mean that in older population worse final hip function can be expected, but the quality of life is not necessarily lower, at the end of the trochanteric fracture treatment.

There was significant correlation between hip function (HHS) and quality of physical health (PCS) ($p < 0.05$). This correlation was positive and high ($r \geq 0.7$), meaning that the strength of the relation was higher than between age and HHS. This result confirms the importance of the gait (that is directly related to the hip function) in general physical health, thus in physical component of health-related quality of life.

Correlation between HHS and MCS was also confirmed ($p < 0.05$). This relation was positive and moderate ($0.5 \leq r_s < 0.7$). It could mean that hip function has influence on quality of both physical and mental health, with more defined relation to the quality of physical health (PCS). Additionally, there could be concluded that quality of mental life can be kept more stable although the hip function is weaker. There was significant positive correlation between qualities of physical (PCS) and mental health (MCS) ($p < 0.05$) with almost high strength ($p \approx 0.07$). These results could explain that quality of general physical health has higher influence in the quality of mental health than just hip function and gait.

Vaquero et al. had analysed treatment of trochanteric fractures by Gamma Nail. They referred about similar HHS and lower PCS and MCS values 12 months after surgery regarding to the results of our study [13]. Li et al. referred about values of HHS after trochanteric fracture treatment, that were higher in cephalomedullary (PFNA) and similar in extramedullary fixation method (DHS) in relation to our study [14]. Saarenpaa et al. had found that hip function was better in extramedullary (DHS) than in cephalomedullary method (Gamma Nail) after four months, but authors concluded that both implants useful in the treatment of trochanteric femoral fractures [15].

CONCLUSION

It is concluded that there final hip function and health-related quality of life are expected to be similar between Self-dynamisable Internal Fixator and Gamma Nail methods in trochanteric fractures treatment. Furthermore, these parameters of outcome were confirmed to have positive interrelation.

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Conflict of interest: Milorad B. Mitković at this moment has agreement with Traffix d.o.o., producer of SIF implants, on temporary assignment to the use of patent. Other authors declare no conflict of interest.

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Table 1. Age, hip function (HHS) and health-related quality of life (SF-12: PCS and MCS) at least two years after surgery

Parameters	SIF	GN	t/z/ χ^2	p
Gender	13M, 29F	13M, 20F	$\chi^2=0.581$	0,446
Age	76.3 ± 11.0	73.3 ± 12.2	z=-1,213	0,225
HHS	72.1 ± 17.3	76.3 ± 17.8	t=1.041	0.301
PCS (SF-12)	63.1 ± 24.8	68.2 ± 24.3	t=0,880	0.382
MCS (SF-12)	67.0 ± 24.8	70.7 ± 17.6	z=-0.710	0.477

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Table 2. Correlations between age, hip function (HHS) and health-related quality of life (SF-12: PCS and MCS) at least two years after surgery

Parameters	HHS	PCS	MCS
Age	$r_s = -0.503$ $p < 0.001$	$r_s = -0.238$ $p = 0.090$	$r_s = -0.184$ $p = 0.113$
HHS		$r = 0.701$ $p < 0.001$	$r_s = 0.582$ $p < 0.001$
PCS			$r_s = 0.687$ $p < 0.001$

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Figure 1. Selfdynamisable internal fixator (SIF) with trochanteric unit, having two lag screws, used in the case with a trochanteric fracture

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Figure 1. Gamma Nail third generation, used in the case with a trochanteric fracture

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