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ORIGINAL ARTICLE / ОРИГИНАЛНИ РАД

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

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SUMMARY

Introduction/Objective There are extramedullary and intramedullary methods of trochanteric fractures' internal fixation with implants having a lag screw. 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 the 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 no significant differences between the SIF group and the GN group regarding HHS, PCS, and MCS. Positive correlation was confirmed between HHS, PCS, and MCS, with the strongest 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

INTRODUCTION

Trochanteric fractures occur in the proximal part of the femur between the greater and the lesser trochanter. These fractures are mostly treated with 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, 2, 3]. In this way, self-dynamisable internal fixator (SIF) with trochanteric unit [4, 5, 6], as an extramedullary method, and gamma nail [6–11], as an intramedullary method, are in routine use in trochanteric fractures' treatment at the Clinic for Orthopaedics and Traumatology of the Clinical Center of Niš. There are two types of SIF 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, 14, 15].

The literature refers to health-related quality of life in cephalomedullary as well as dynamic hip screw (DHS) fixation of trochanteric fractures. There are no results about health-related quality of life after the use of SIF. The aim of this study was to compare the two methods in trochanteric fractures' treatment – the third generation of gamma nail and SIF with trochanteric unit, regarding final results in hip function and health-related quality of life.

METHODS

Two groups of patients treated for unilateral trochanteric fracture were analyzed. There were 75 cases – 42 cases (the SIF group) were treated with SIF with trochanteric unit, having two non-cannulated lag screws (Figure 1) and 33 cases (the GN group) were treated with third-generation gamma nail (Figure 2). The excluding criteria were an implant presence in the other hip, other fracture or polytrauma at the same time as the trochanteric fracture, malignant tumor, disfunction of the parathyroid gland. Consecutive patients who were available for clinical examination and interview at least two years after surgery (surgery was performed in 2012 or later) were analyzed in this study. All the patients were treated for trochanteric fracture with internal fixation at the Clinic for

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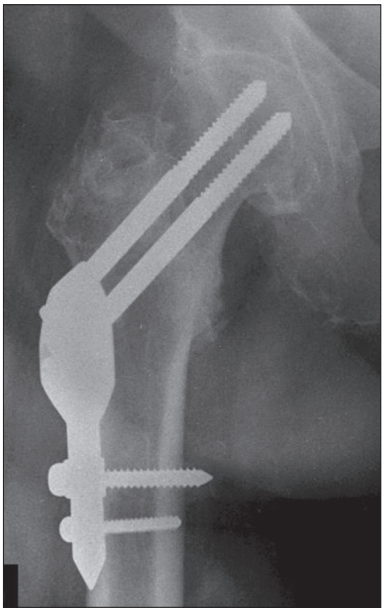

Figure 1. Self-dynamisable internal fixator with trochanteric unit, having two lag screws, used in a case with a trochanteric fracture

Figure 2. Gamma nail third generation, used in a case with a trochanteric fracture

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

Parameter	SIF	GN	t/z/χ^2	p
Sex	13 M, 29 F	13 M, 20 F	$\chi^2 = 0.581$	0.446
Age	76.3 ± 11	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

HHS – Harris Hip Score; PCS – physical component score; MCS – mental component score; SIF – self-dynamisable internal fixator; GN – gamma nail

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

Parameter	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			$r_s = 0.687$ $p < 0.001$

HHS – Harris Hip Score; PCS – physical component score; MCS – mental component score

Orthopaedics and Traumatology of the Clinical Center of Niš. According to the AO classification, there were A1 and A2 types of proximal femoral fractures.

There were 26 male and 49 female patients. Hip function was assessed using Harris Hip Score (HHS), which is based on both the questionnaire and 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 and 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, 17, 18]. Age was considered for the time of the clinical assessment mentioned above.

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

Regarding statistical analyzes, t-test and Mann–Whitney U-test were used for differences in average values, while χ^2 test was performed to compare distributions between the groups. The relation between measured parameters was assessed by bivariate correlations. The level of significance was 0.05.

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

RESULTS

Average values and distributions of followed parameters, with their statistical differences, are listed in Table 1. There were no significant differences between the groups regarding age, sex distribution, hip function, and health-related quality of life after trochanteric fracture union ($p > 0.05$).

Statistics of the correlation between measured parameters are listed in 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 sex and age did not have any influence on relations between the groups regarding final hip function and health-related quality of life after trochanteric fracture treatment, because there was no significant difference in average age and in sex distribution.

Average final functional result of the treated hip was fair (HHS had values 70–79) in both groups [19]. There was no significant difference between the groups neither in hip function nor in the quality of physical life (PCS) or mental life (MCS) ($p > 0.05$) at least two years after internal fixation of a trochanteric fracture. These results suggest the following:

– submuscular presence of an extramedullary implant with dimensions of SIF does not significantly influence final functional results of the treated hip and health-related quality of life in trochanteric fractures internal fixation;
– the need for bone reaming in cephalomedullary fixation does not significantly influence final functional results of the treated hip and health-related quality of life in trochanteric fractures' internal fixation.

There was a 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 older age means lower function of the hip. It could be explained by the influence of different comorbidities and osteoarthritic changes on gait and hip function in the older population. This correlation was accepted, 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]. The age of patients was not significantly correlated to PCS and MCS ($p > 0.05$). These results mean that in older population poorer 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 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 the physical component of the health-related quality of life.

Correlation between HHS and MCS was also confirmed ($p < 0.05$). This corelation was positive and moderate ($0.5 \leq r_s < 0.7$). It could mean that hip function has influence on the 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 point to the explanation that the quality of general physical health has higher influence on the quality of mental health than just hip function and gait.

Vaquero et al. [13] analyzed the treatment of trochanteric fractures by gamma nail. Their reported results of HHS were similar, while PCS and MCS were lower than those in our study, 12 months after surgery. Li et al. [14] reported values of HHS after trochanteric fracture treatment that were higher in cephalomedullary (PFNA) and similar in the extramedullary fixation method (DHS) compared to our study. Saarenpää et al. [15] found that hip function was better in the extramedullary (DHS) than in the cephalomedullary method (gamma nail) after four months, but authors concluded that both implants are useful in the treatment of trochanteric femoral fractures.

CONCLUSION

Final hip function and health-related quality of life are expected to be similar between SIF with trochanteric unit and third generation 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: The author Milorad B. Mitković at the moment of writing the paper has an agreement with Traffix d.o.o., producer of SIF implants, on temporary assignment to the use of the patent. Other authors declare no conflict of interest.

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

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САЖЕТАК

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

Методе Анализирано је 75 болесника са трохантерним преломом, који су лечени унутрашњом фиксацијом самодинамизирајућим унутрашњим фиксатором, као екстрамедуларном методом, и гама клином, као интрамедуларном методом. Код ових испитаника је извршено бодовање према бодовном систему за кук по Харису и према упитнику СФ-12, најмање две године после операције. СФ-12 упитник је био исказиван кроз двојак резултат – физичка компонента и ментална компонента.

Резултати Није било значајне разлике између група по питању бодовног система за кук по Харису, физичке компоненте нити менталне компоненте. Између ова три параметра је потврђена линеарна корелација позитивног смера, при чему је ова веза била најјача између бодовног система за кук по Харису и физичке компоненте. Између старости испитаника и бодовног система за кук по Харису потврђена је линеарна корелација негативног смера.

Закључак Између самодинамизирајућег унутрашњег фиксатора са трохантерном јединицом и гама клина треће генерације није потврђена значајна разлика по питању утицаја на функцију кука и квалитет живота повезан са здрављем на крају лечења трохантерног прелома ($p > 0,05$). Потврђена је повезаност између праћених параметара ($p < 0,05$). Додатно се закључује да субмускуларно присуство имплантата величине самодинамизирајућег унутрашњег фиксатора, као и потреба за римовањем 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