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Hip Fractures in Elderly – Ten Years Analysis

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A B S T R A C T

Geriatric hip fractures (GHP) are the major problem in the geriatric traumatology and it is estimated that treatment of GHF will spend a large amount of health care resources[1–5]. The aim of this retrospective study was to compare differences in incidence of operatively treated patients with GHF, type of treatment depending of the type of fracture, early postoperative mortality, length of stay and costs of used implants within a 10 years period. Surgically treated 2478 patients, older than 65 years with hip fractures were included in the study. Patients were grouped according to the type of fracture (femoral neck fracture or intertrochanteric femoral fracture) and used implant. Results showed increasing trend in GHF in our County in the last 10 years. There was a shifting trend in used implants, and new surgical techniques were used more commonly in the last few years. In observed period there were no significant changes in revision surgery and length of hospital stay. The mortality decreased, especially in males, but generally it was not in correlation with used implant. At the 10-years period increase in patients with GHF of 179% was followed with 4 time higher increase in implant prices. Present reimbursement in health care system does not calculate the difference of implant costs in hospital expenses, therefore proper usage of modern implants and careful planning in the treatment of GHF is necessary.

***Key words**: hip fractures, elderly, treatment, implants, expenses, outcome*

Introduction

Hip fractures are the major problem in the geriatric traumatology. These fractures are the most devastating consequence of osteoporosis and the major source of morbidity and mortality in elderly patients[1,2]. Patients who survive usually need long-term medical care because of prolonged disability[2]. Majority of these patients sustained low-energy injury during fall from sitting or standing position[1]. Weakened reflexes to cushion the impact also have the important role in mechanism of these injuries[3]. From the patient's point of view, a hip fracture has a strong social and existential impact[4]. In the future geriatric hip fractures (GHF) will grow to be a major public health problem and treatment of these patients will spend a large amount of health and social care resources[5,6]. It is estimated that osteoporosis contributes to 90% of GHF in women and 80% in men[3]. Therefore it is necessary to establish a program with preventive measures, especially for older patients with previous osteoporotic fracture[2,7,8].

The change of surgical technique, improvement of implants, advances in anesthesiology, and perioperative multidisciplinary approach to the patient improved the overall result of treatment, but high incidence of complications and mortality still significantly influences the outcome[9–11]. Financial situation in Croatian health care system was improving. Today, modern implants are available at our department and patients with GHF were treated according to the modern principles of geriatric traumatology[9]. Data about economic impact of GHF in Croatians health system are unknown. Lack of trauma register and systematic evidence of GHF in Croatia disable us to provide the real significance of this problem in our community[12]. University Hospital Rijeka is a single acute hospital in Primorsko-goranska County where vast majority of patients with GHF are treated at the Department of Traumatology. Therefore, hospital records on GHF from University Hospital Rijeka will provide good insight into population of the County.

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The aim of this retrospective study was to analyze the incidence of operatively treated patients with GHF and type of treatment depending of the type of fracture. Outcome was assessed with early postoperative mortality, rate of revision surgery and length of stay (LOS) in last 10 years. Results were compared with costs of used implants.

Patients and Methods

Within a ten year period from 1999 to 2008 there were total of 15,697 surgically treated patients at the Department of Traumatology, University Hospital Rijeka, Croatia. In this period 2,478 patients older than 65 years with GHF were surgically treated. Non-operatively treated patients were excluded from this study. Patients with GHF were grouped according to the type of fracture: intracapsular femoral neck fracture (FNF) of extracapsular intertrochanteric femoral fracture (IFF). Data on used implants were documented for specific type of injury as well as the price of used implant. Results of the treatment were presented in in-hospital mortality rate, rate of revision of surgery and LOS.

Total cost of implants was calculated from the number of used implants and present prices from contracts with hospital suppliers. The price was calculated in EUR according to the Croatian National Bank exchange rate, middle rate at the day of calculation[13].

Incidence was calculated for the number of citizens according to the Census of Population, Households and Dwellings 31st March 2001, taking into account that the census before that was in 1991 and the war in Croatia was between 1991 and 1995. The population in 1999 was more likely to be similar to the population of 2001[14].

Statistical analysis

Descriptive analysis of data was performed using descriptive statistics. Bivariate correlation analyses using nonparametric Spearsons test were performed between groups of patients with different types of GHF and treatment outcomes. A p-value of <0.05 was considered significant. Analyses were carried out by SPSS 15.0 (SSPS Inc., Chicago, IL, USA) statistical software package.

Results

In the period from 1999 to 2008 total number of surgically treated patients with GHF raised from 176 in 1999 to 315 in 2008 (increase of 1.8 times). Proportion of surgically treated patients with GHF comparing to total number of surgically treated patients rose from 14.1% to 19.4% (Figure 1). Calculated incidence of GHF crude rate per 1000 inhabitants shows increase with constant ratio between females and males (Figure 2). Incidence of GHF was almost doubled in 10 years, from 3.56 to 6.37 where incidence in female population is higher as expected Mean (95% CI) = 6.4350 (5.4310–7.4390), SD=1.40347, and incidence in male population lower, Mean (95% CI) = 2.9000 (2.3735–3.4265), SD=0.73598. Ratio between FNF and IFF did not change during whole period (Figure 3).

In 2008 the increase in use of compression hip screw (CHS) and intramedullary nail (IMN) instead of angled blade plate (ABP) for treatment of IFF was observed (Table 1). Change was also observed in the treatment of FNF

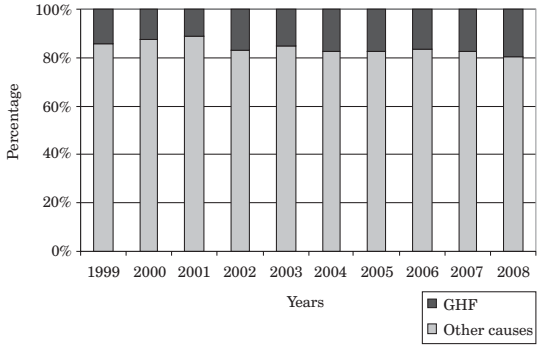

Fig. 1. Proportion of surgically treated GHF and other surgically treated patients, GHF – geriatric hip fractures.

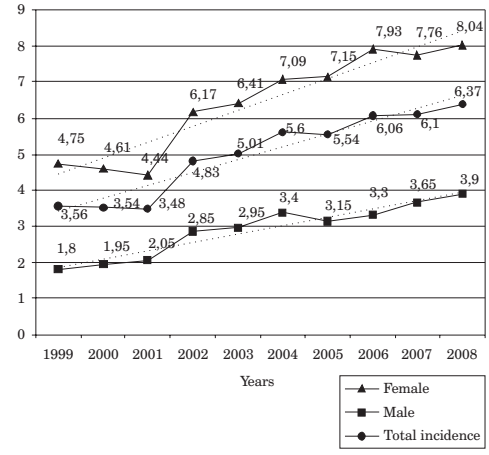

Fig. 2. Trend in incidence by gender of geriatric hip fractures, crude rate per 1000 inhabitants.

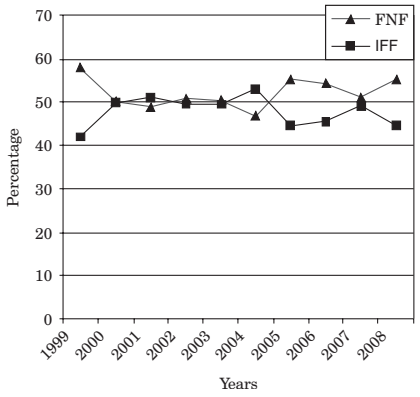

Fig. 3. Percentage of patients with FNF and ITF in 10 year period, FNF – femoral neck fractures, IFF – intertrochanteric femoral fractures.

TABLE 1
TYPE OF IMPLANTS USED FOR TREATMENT OF IFF

	ABP N (%)	CHS N (%)	IMN N (%)	HA N (%)	Revisions N (%)
1999.	72 (97.30)	0 (0.00)	0 (0.00)	2 (2.00)	0 (0.00)
2000.	85 (97.70)	0 (0.00)	2 (2.30)	0 (0.00)	1 (1.15)
2001.	83 (94.32)	0 (0.00)	4 (4.55)	1 (1.14)	0 (0.00)
2002.	107 (90.68)	0 (0.00)	2 (1.69)	9 (7.63)	5 (4.24)
2003.	121 (98.37)	0 (0.00)	0 (0.00)	2 (1.63)	7 (5.69)
2004.	134 (91.16)	3 (2.04)	0 (0.00)	10 (6.80)	6 (4.08)
2005.	119 (97.54)	0 (0.00)	0 (0.00)	3 (2.46)	1 (0.82)
2006.	132 (96.35)	1 (0.73)	4 (2.92)	0 (0.00)	2 (1.46)
2007.	140 (94.59)	3 (2.03)	1 (0.68)	4 (2.70)	2 (1.35)
2008.	93 (65.96)	16 (11.35)	23 (16.31)	9 (6.38)	2 (1.42)

IFF – intertrochanteric femoral fracture, ABP – angled blade plate, CHS – compression hip screw, IMN – imtramedullary nail, HA – hemiarthroplasty

TABLE 2
TYPE OF IMPLANTS USED FOR TREATMENT OF FNF

	HA N (%)	THA N (%)	UTHA N (%)	Revisions N (%)
1999.	101 (99.02)	1 (0.98)	0 (0.00)	3 (2.94)
2000.	88 (100.00)	0 (0.00)	0 (0.00)	5 (5.68)
2001.	75 (89.29)	9 (10.71)	0 (0.00)	2 (2.38)
2002.	117 (96.69)	4 (3.31)	0 (0.00)	1 (0.83)
2003.	113 (90.40)	12 (9.60)	0 (0.00)	2 (1.60)
2004.	113(86.92)	17(13.08)	0 (0.00)	8 (6.15)
2005.	114 (75.00)	38 (25.00)	0 (0.00)	3 (1.97)
2006.	140 (85.89)	11(6.75)	12 (7.36)	5 (3.07)
2007.	132 (85.71)	22 (14.29)	0 (0.00)	4 (2.60)
2008.	141 (81.03)	5 (2.87)	28 (16.09)	6 (3.45)

with trend towards total hip arthroplasty (THA) versus hemiarthroplasty (HA) in last years (Table 2). One year in-hospital mortality among surgically treated patients with GHP decreased from 7.4% in 1999 to 3.4% in 2000 (Figure 4). Mortality rate was higher in male patients comparing to females. The rate of revision surgery in both groups was low and it did not significantly change in 10 years period (Table 1, 2). Average LOS for surgi-

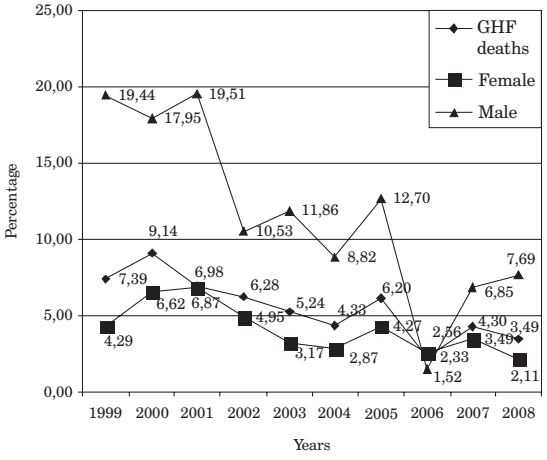

Fig. 4. Mortality in patients with GHF – geriatric hip fracture.

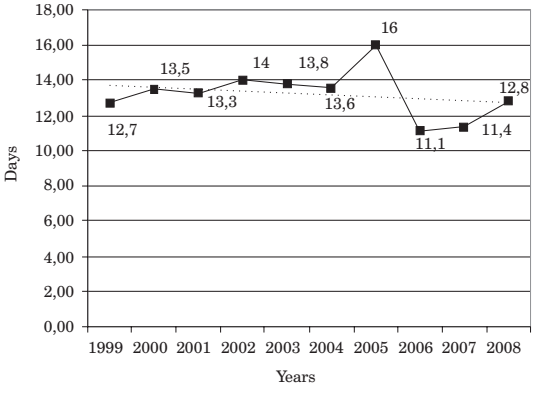

Fig. 5. Trend in average length of stay (days).

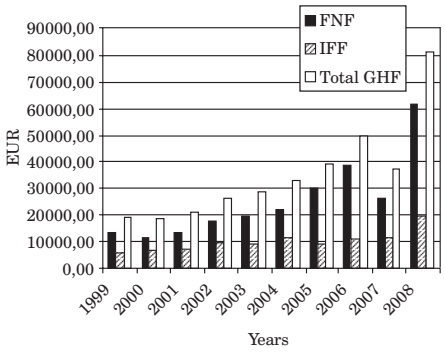

Fig. 6. Costs of implants within 10 year period, FNF – femoral neck fractures, IFF – intertrochanteric femoral fractures, GHF – geriatric hip fractures.

TABLE 3
CORRELATION BETWEEN DIFFERENT TYPES OF IMPLANTS AND MORTALITY DUE TO GHF

Type of implant	R*	p**
HA/-FNF	–0.299	0.401
THA	–0.025	0.946
UTHA	–0.694	**0.026**
ABP	–0.160	0.659
CHS	–0.640	**0.046**
IMN	–0.511	0.131
HA/IFF	–0.012	0.973

GHF – geriatric hip fracture, HA – hemiarthroplasty, FNF – femoral neck fracture, THA – total hip arthroplasty, UTHA – uncemented total hip arthroplasty, ABP – angled blade plate, CHS – compression hip screw, IMN – imtramedullary nail, IFF – intertrochanteric femoral fracture
* Spearman's rho R – correlation coefficient
** p<0.05 was considered significant

TABLE 4
CORRELATION BETWEEN DIFFERENT TYPES OF IMPLANTS AND REVISION SURGERY DUE TO FNF

Type of implant	R*	p**
HA/FNF	0.242	0.500
THA	0.086	0.814
UTHA	0.493	0.147

FNF – femoral neck fracture, HA – hemiarthroplasty, THA – total hip arthroplasty, UTHA – uncemented total hip arthroplasty
* Spearman's rho R – correlation coefficient
** p<0.05 was considered significant

cally treated patients with GHF did not change in the all 10 years [Mean (95% CI) = 13.220 (12.232– 14.208), SD = 1.3807] (Figure 5). Total implants cost showed increase from 19,026 to 80,969 EUR per year (Figure 6).

Correlation between different techniques and implants used showed significantly lower mortality with CHS and uncemented THA (Table 3). No difference was observed in correlation between implants used for treatment of FNF and revision surgery (Table 4), but in the surgical stabilization of IFF with ABP has higher revision rate than other implants (Table 5). Average LOS was not in correlation with different type of implants (Table 6).

TABLE 5
CORRELATION BETWEEN DIFFERENT TYPES OF IMPLANTS AND REVISION SURGERY DUE TO IFF

Type of operation	R*	p**
ABP	0.698	0.025
CHS	0.349	0.323
IMN	–0.180	0.620
HA-IFF	0.498	0.143

IFF – intertrochanteric femoral fracture, ABP – angled blade plate, CHS – compression hip screw, IMN – imtramedullary nail, HA – hemiarthroplasty
* Spearman's rho R – correlation coefficient
** p<0.05 was considered significant

TABLE 6
CORRELATION BETWEEN DIFFERENT TYPES OF IMPLANTS AND AVERAGE LENGTH OF STAY DUE TO GHF

Type of operation	R*	p**
HA/FNF	–0.316	0.374
THA	0.164	0.651
UTHA	–0.493	0.148
ABP	–0.042	0.907
CHS	–0.487	0.154
IMN	–0.428	0.217
HA-IFF	0.330	0.351

GHF – geriatric hip fracture, HA – hemiarthroplasty, FNF – femoral neck fracture, THA – total hip arthroplasty, UTHA – uncemented total hip arthroplasty, ABP – angled blade plate, CHS – compression hip screw, IMN – intramedullary nail, IFF – intertrochanteric femoral fracture; * Spearman's rho R – correlation coefficient; ** p<0.05 was considered significant

Discussion

Increased number of surgically treated patients with GHF in past decade is expected because of the burden of osteoporosis and aging population of Primorsko-goranska County where 16.2% of population is older then 65[5,7,10]. However some epidemiological analyses from different countries show different trends in incidence of hip fractures[15–17]. According to other researchers, by the year of 2050 expected increase in incidence of hip fractures will be 310% in men and 240% in women[18]. If we follow this prognosis the total number of GHF in 2050 will raise up to 810 patients per year. This number is very important factor for future calculation and future development of trauma department and other necessary facilities in our hospital. Several authors showed that in-hospital mortality after hip fracture was approximately

3%[11,19,20]. Reported 30-day mortality was 5.2%[10]. Our data in the last year of observation showed similar mortality in-hospital rate of 3.49%. Higher mortality rate was observed in males than females, and this-was in accordance to results reported by Stone et al.[20]. More detailed analysis of patient's age and comorbidity should be done for future analysis. These results suggest that male patients with GHF should be carefully assessed before surgery and carefully monitored for postoperative complications[21].

The mean LOS in recent studies was from 5.6 to 10.27 days[10,11]. LOS in our study varies from 11.1 to 16 days and trend to be shorter. Although the change of implants and surgical technique was made to allow early mobilization and weight bearing, the overall LOS did not decrease dramatically. Possible reason for longer in-hospital stay was that management of co-morbidities and complications that influenced the duration of treatment, as well as engagement and possibilities for treatment by other health professionals such as nurses or physiotherapists. Reported results from the literature show that 86.3% of GHF patients have one or more comorbidities and 41.2% had at least one in-hospital complication[11].

The main goal of GHP management is early mobilization, prevention of bed-ridden complications and return to functional activities for independent living[9]. To achieve this goal surgical implant for GHP were changed in the past few decades. ABP were replaced, first with sliding CHS, than with IMN to allow immediate full weight bearing after surgical stabilization of IFF[22–24]. Common expert opinion that IMN fixation for IFF is superior to sliding CHS and side plate is not well proven[24]. Despite of a lack of scientific evidence that IMN is superior to sliding CHS, most of the trauma and orthopedic surgeons in nowadays are using intramedullary fixation for treatment of IFF[24–27]. This change resulted in higher expenses because of two to four times higher prices of IMN[28]. An extensive geographic variation in the use of differentially reimbursed IFF procedures persists in the United States, and these variations are not the consequence of patient-related factors. The question why surgeons select the device on the basis of non-patient factors is not explained[29].

Sliding CHS and side plate fixation resulted in fewer complications rate compared with intramedullary nail fixation[24,25]. Geriatric patients managed with IMN had slightly greater rate of revision surgery in the first year, an increased rate of hospital stay and higher hospital cost in comparison with patients treated with sliding CHS[26,27]. Our study showed that fracture fixation with ABP correlated with higher rate of revision surgery. It can be explained with large number of treated patients and fact that the most of the unstable fractures and »worst cases« were treated with this implant. Currently, there are some published articles with favorable results in the treatment of unstable pertrochanteric fractures with 95° ABP[30,31]. This implant is abandoned in most of the institutions even its price is very low in comparison to the other implants.

The number of patients treated with CHS in our study was very low and this difference could be not explained by medical reasons[20]. Shifting trend to use more CHS and IMN in the treatment of IFF at 2008 was according to expert opinion and modern trauma care. Appropriate choose of fixation technique and implant, depending on fracture and patient personality, should be made to allow early weight bearing and immediate rehabilitation program.

Hip replacement in FNF management has changed towards THA instead HA which remains a treatment of choice for very old patients with short life expectancy and very low functional demands[32–34]. THA after intracapsular FNF shows superior results than HA[32–34]. Jain et al. reported greater utilization of HA and decrease in utilization of THA comparing a period 1990 to 1993 to period from 1998 to 2001 in United States[35]. This trend is also shown in our study. Advantages of THA for older patients are obvious, and THA is a treatment of choice for elderly, mobile, independent patients[32,33]. Uncemented THA should be used for younger patients[36]. Our results showed significant increase in the uncemented THA in last years, and there is no medical explanation to use almost six times more uncemented than cemented THA in 2008.

Additional research is necessary to establish a proper indication for bipolar HA, because implants are more expensive than unipolar HA, and there is no difference in outcome after bipolar or unipolar HA[10,37]. Current data from literature suggest that use of unipolar implants for HA could save healthcare expenses, without jeopardizing patient's outcome[10]. In our study low numbers of patients were treated with bipolar HA. Additionally, almost four times higher price of bipolar prosthesis suggests that use of this implant should be abandoned because there is no benefit for the patient.

In the United States changing of fixation strategy in IFF has resulted in higher implant cost and surgeon fees with no improvement in patient outcome[24,28]. United States Federal Register reimbursed an average of $272 more for IMN then for plate-and- screw device[38]. Present reimbursement of hospital costs in Croatia does not calculate difference in implant prices[39–45]. Therefore the shift in the treatment with modern and more expensive implants should be carefully monitored and changed only because of medical indications and better patient's outcome. In implant cost analysis there was significant increase in implant prices in last years. In observed period total costs for implants have risen up from 19,000 to more than 80,000 EUR for year. This economic aspect should be carefully monitored to avoid extreme hospital expenses for implants without proven benefits for the patients. Recently introduced reimbursements in Croatian health care system calculate the hospital expenses according to the diagnosis and presence of complications, but not of type of surgery or used implant[39–45].

Proper usage of modern implants and careful planning in the treatment of GHF is necessary to improve the patients' outcome. Furthermore, rational care of finan-

cial resources is necessary because of the burden of the GHF. Future analysis of the GHF epidemiology and treatment is needed to improve strategies in prevention, quality of care and economic efficiency of GHF management[40].

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PRIJELOMI KUKA U STARIJOJ DOBI – ANALIZA KROZ 10 GODINA

SAŽETAK

Prijelomi kuka u starijoj dobi su najveći problem u gerijatrijskoj traumatologiji i može se očekivati da će se na liječenje ovih prijeloma u budućnosti utrošiti velika količina sredstava iz zdravstvenih fondova. Cilj ove retrospektivne studije bio je usporediti razlike u: incidenciji operativno liječenih bolesnika s prijelomom kuka u starijoj dobi, načinu liječenja ovisno o tipu prijeloma, ranom poslijeoperacijskom mortalitetu, dužini trajanja hospitalizacije i cijeni korištenih implantata, u razdoblju od 10 godina. U studiju je uvršteno 2478 pacijenata, starijih od 65 godina, s prijelomom u području kuka koji su razvrstani s obzirom na tip prijeloma (prijelom u području vrata bedrene kosti ili prijelom u području trohanterne regije bedrene kosti). Retultati su pokazali porast incidencije prijeloma kod bolesnika starije dobi u našoj Županiji. Prisutan je trend korištenja novijih implantata u posljednjim godinama. U analiziranom razdoblju nije uočena značajnija promjena u broju reoperacija i dužini hospitalizacije. Mortalite je bio u opadanju, naročito u muškoj populaciji, ali ukupno gledano nije bio u korelaciji s tipom korištenog implantata. U desetogodišnjem razdoblju, porast bolesnika starije dobi s prijelomom kuka od 179% bio je praćen s 4 puta većom cijenom implantata, stoga je u liječenju prijeloma kuka kod starijih bolesnika potrebno pravilno indicirati i pažljivo planirati upotrebu modernih implantata.