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ORIGINAL STUDY

Morbidity and mortality following femoral fractures in the elderly – is the 48 hours limit obligatory?

Tal Frenkel RUTENBERG, Maria VITENBERG, Nir COHEN, Yichayaou BELOOSESKY, Barak HAVIV, Steven VELKES

From the Orthopedic Department, Rabin Medical Center, Beilinson Hospital, affiliated to the Sackler Faculty of Medicine, Tel Aviv University, Tel Aviv, Israel

To study the influence of a national quality program for early surgical treatment for fragility hip fractures on patients' outcomes.

A retrospective study comparing consecutive patients, 65 years and older, who were operated for proximal femoral fractures in the two years preceding and succeeding the initiation of the national quality program in 2013. Primary outcome was 1-year survival. Secondary outcomes were surgery within 48 hours, in-hospital complications and mortality, recurrent hospitalizations and orthopedic complications in the post-operative year.

267 patients were treated in 2011-2012, and 328 patients in 2013-2014 were included. Patients' baseline characteristics were comparable. There was an 8% rise in the percentage of patients undergoing surgery within 48 hours. Other outcomes, including 1-year survival did not differ between groups.

While the national quality program increased the percentage of patients treated within 48 hours, this was not found to correlate with a beneficial effect, either in the immediate or delayed period.

Keywords : Fragility fracture ; hip fracture ; time to surgery ; mortality.

INTRODUCTION

Fragility hip fractures in the elderly are related to high morbidity and mortality. Nearly half of the patients do not regain their previous level of functioning and first year post-operative mortality rates reach 30%, and remain high despite technological improvements in surgery and patient care *(1,3,16)*. The purpose of early surgery is to reduce mortality, to decrease complications such as pain, pressure sores, pulmonary and urinary infections, venous thromboembolic events and to allow rapid mobilization and return to independent functioning *(1,2,11,14,17,18)*.

In the effort to reduce morbidity and mortality following proximal femoral fracturs, in recent years,

■ Tal Frenkel Rutenberg,
■ Maria Vitenberg,
■ Nir Cohen,
■ Yichayaou Beloosesky,
■ Barak Haviv,
■ Barak Haviv.

Orthopedic Department, Rabin Medical Center, Beilinson Hospital, affiliated to the Sackler Faculty of Medicine, Tel Aviv University, Tel Aviv, Israel.

Correspondence : Tal Frenkel Rutenberg, Orthopedic Department, Rabin Medical Center, Beilinson Hospital, affiliated to the Sackler Faculty of Medicine, Tel Aviv University, Tel Aviv, Israel,

E-mail : tal_frenkel@hotmail.com

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programs designed to encourage hastened surgical treatment (within 24 or 48 hours from admission) were introduced by health systems around the world. In Israel, such quality assessment program was initiated in January 2013 for patients 65 years old and older *(22)*.

The aim of this study is to evaluate whether indeed the introduction of this national quality assessment program increased the rate of patients operated within the destined time in our level 1 trauma center, and whether it improved patients' outcomes as presented by reduced in-hospital and one-year mortality, in-hospital complications and the rates of rehospitalizations within the first post-operative year.

PATIENTS AND METHODS

Data collection

Following approval by the institutional review board, data was retrieved from the medical records of consecutive patients who underwent surgery for the treatment of proximal femoral fractures between January 2011 to December of 2014. Demographic data was collected, along with hospitalization aspects such as length of stay (LOS), time to surgery, blood loss, in hospital complications and pre-surgical laboratory values (hemoglobin and INR (international normalized ratio). Finally, information regarding re-admissions (to our hospital and other hospitals in the country), orthopedic complications and mortality in the first year following surgery were gathered.

Patients 65 years and older who underwent surgical therapy of proximal femoral fractures, either closed reduction, open reduction or hemi-arthroplasty during the study period were included. Exclusion criteria were an additional coexisting skeletal trauma requiring further surgery, a pathological fracture, a fracture occurring due to a trauma during hospitalization for another cause and a fracture occurring 5 days or longer before patient presentation. For patients hospitalized with a second contralateral fracture during the study period, only the first admission was regarded.

Treatment

All patients presenting to the emergency department were evaluated by an orthopedic surgeon. Initial workout included pelvic and proximal femur imaging, laboratory examinations (complete blood count, comprehensive metabolic panel, international normalized ratio), an electrocardiography and a chest x-ray. Further medical assessment such as a medical, cardiology or hematology consultations, were performed based on specific patients' co-morbidities and medical status at presentation.

The type of fixation was determined based on fracture type and following consultation with a senior surgeon. In general, stable intracapsular fractures were treated with cannulated screws or a Targon FN, unstable intracapsular fractures underwent hemiarthroplasty, and extracapsular fractures were treated with a dynamic hip screw (DHS) or with a proximal femoral nail (PFN). Physiotherapy and thromboprophylaxis therapy with low molecular weight heparin were initiated at post-operative day one.

Statistical analysis

Continuous variables are presented as mean and standard deviation (SD). Quantitative and ordinal variables are presented as absolute and relative frequencies. The Fisher's exact tests was used for categorical variables, the Wilcoxon test for ordinal variables, and the Student's T-Test for numeric variables. Kaplan-Meier survival curves were used to demonstrate one month and one-year survival. All reported p-values will be two-tailed. Statistical significance will be defined as $p < 0.05$.

RESULTS

595 patients, ages 65-103 (average 82.5 ± 7.1) were included in the study ; 267 patients were treated in 2011-2012 and 328 patients were treated in 2013-2014. Patients' demographics and Charlsons' co-morbidity index (CCI) scores were comparable (Table I).

There was an 8% rise in the percentage of patients undergoing surgery within 48 hours from presentation following the implantation of the

Table I. — Patients' demographics

		Group 1 (n=267)	Group 2 (n=328)	p. Value
Gender (%)	Female	176 (65.9)	219 (66.8)	0.826
Age (SD)		82.3 (6.8)	82.7 (7.4)	0.486
Laterality (%)	Right	137 (51.3)	155 (47.3)	0.366
Walking aid (%)[a]	None	137 (54.6)	153 (53.7)	0.361
	Cane	41 (16.3)	66 (22.3)	
	Walker	69 (27.5)	73 (24.6)	
	Wheel chair	4 (1.6)	4 (1.4)	
Living arrangement (%)[b]	Independent living	187 (70.3)	214 (66.9)	0.374
	Assisted living	79 (29.7)	106 (33.1)	
Charlsons' co-morbidity index (SD)		6.3 (2.1)	6.4 (2.1)	0.639
Hemoglobin at admission (SD)		12.2 (1.7)	12.2 (1.6)	0.808
INR at admission (SD)		1.2 (0.4)	1.2 (0.5)	0.215
Implant (%)	Dynamic hip screw	17 (6.4)	107 (32.6)	<0.001
	Proximal femoral nail	79 (29.6)	51 (15.5)	
	Bi polar hemiarthroplasty	151 (56.6)	135 (41.2)	
	Cannulated screws	5 (1.9)	13 (4.0)	
	Targon femoral nail	15 (5.6)	21 (6.4)	
	Intramedullary nail	0 (0.0)	1 (0.3)	
Patient Placement (%)	Internal medicine/ Geriatrics	128 (47.9)	169 (51.5)	0.410
	Orthopedics	139 (52.1)	159 (48.5)	

[a] Data was NA for 16 patients from the first group and for 32 patients from the second group. [b] Data was NA for a single patient from the first group and for 8 patients from the second group. Assistant living refers to patients living in a nursing home or to patients living at home with a permanent professional caregiver.

national quality program (78.3% vs. 86.3%, p. value= 0.012). While the main etiology (35.6%) for surgical delay in the later period was a medical comorbidity requiring attention, in the earlier period the frequency of unexplained delays was the greatest (34.5% of cases), whereas only 22.4% of patients were delayed due to an active co-morbidity (Table II).

In the earlier period, a higher rate of patients was treated with partial hip replacement while in the later interval fixation was more frequently used (p. value = 0.002). Neither in hospital nor one-year mortality differed between groups (3.7% vs. 5.5% for in hospital mortality and 20.2% vs. 20.1% for one-year mortality in the pre- and post-national quality program groups, p. values = 0.338 and 1 respectively) (Fig.1). The incidence of in hospital complications, LOS, recurrent hospitalizations and orthopedic complications were similar (Tables II-IV).

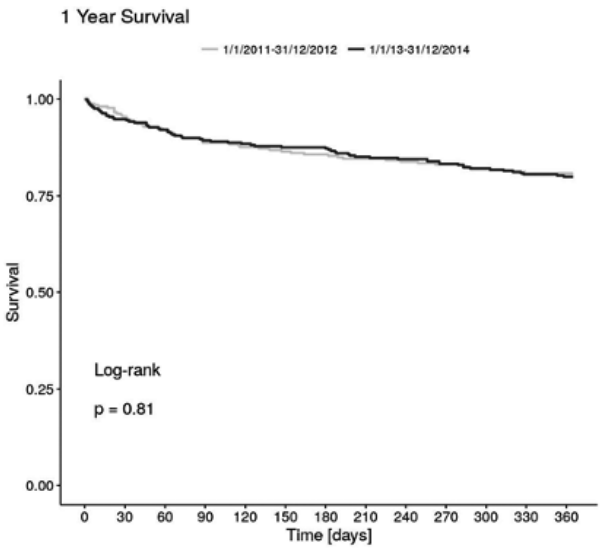

Fig. 1. — One-year survival before and after the initiation of the national quality program.

Table II. — Results

		Group 1 (n=267)	Group 2 (n=328)	p. Value
Mortality within hospitalization (%)		10 (3.7)	18 (5.5)	0.338
One-year mortality (%)		54 (20.2)	66 (20.1)	1
Blood transfusions (SD)		0.8 (6.1)	0.6 (0.9)	0.477
Surgery within 48 hours (%)		209 (78.3)	283 (86.3)	0.012
Cause for surgical delay beyond 48hr (%)	Anticoagulation treatment	6 (10.3)	8 (17.8)	0.108
	Medical reason	13 (22.4)	16 (35.6)	
	Concurrent infection	7 (12.1)	9 (20.0)	
	OR availability	9 (15.3)	4 (8.9)	
	Other	3 (5.1)	2 (4.4)	
	Not specified	20 (34.5)	6 (13.3)	
Length of stay (SD)		10.3 (6.6)	9.4 (5.8)	0.099
In-hospital complications (SD)		0.73 (1.0)	0.64 (1.0)	0.303
In-hospital complications (%)	Urinary retention	28 (10.5)	35 (10.7)	1
	Acute renal failure[a]	30 (11.2)	25 (7.6)	0.155
	Delirium	24 (9.0)	24 (7.3)	0.545
	Urinary tract infection	22 (8.2)	26 (7.9)	0.881
	Pneumonia	21 (7.9)	18 (5.5)	0.249
	Atrial fibrillation[a]	15 (5.6)	23 (7.0)	0.616
	Pulmonary congestion	9 (3.4)	13 (4.0)	0.828
	Gastrointestinal bleed	6 (2.2)	6 (1.8)	0.775
	Myocardial infraction	5 (1.9)	6 (1.8)	1
	Pressure sore	2 (0.7)	6 (1.8)	0.306
	Cerebrovascular event	3 (1.1)	4 (1.2)	1
	Systemic inflammatory immune syndrome	3 (1.1)	4 (1.2)	1
	Deep vein thrombosis	2 (0.7)	2 (0.6)	1
	Pulmonary emboli	1 (0.4)	0 (0.0)	0.449
	Chronic obstructive pulmonary disease exacerbation	1 (0.4)	0 (0.0)	0.449
	Other	23 (8.6)	19 (5.8)	0.200

[a] Either acute or an exacerbation of a prior condition.

Table III. — Orthopedic complications in the first post-operative year

	Group 1 (n=267)	Group 2 (n=328)	p. Value
Complication (%)	21 (7.9)	17 (5.2)	0.238
Superficial infection (%)	4 (1.5)	4 (1.2)	1
Deep infection (%)	7 (2.6)	10 (3.0)	0.809
Dislocation (%)	2 (0.7)	0 (0.0)	0.201
Peri-prosthetic fracture (%)	4 (1.5)	1 (0.3)	0.179
Non-union (%)	1 (0.4)	1 (0.3)	1
Cut-out (%)	0 (0.0)	2 (0.6)	0.504
Revision for any cause (%)	14 (5.2)	8 (2.4)	0.082
Time to revision (months) (SD)	2 (2.3)	1.7 (1.9)	0.712

As no cardinal differences were found between groups, both in terms of morbidity and mortality, either in-hospital or in the first post-operative year, we did a further analysis comparing the outcomes of patients who were operated upon within the desired 48 hours from admission to the patients who

Table IV. — Recurrent unplanned hospitalizations in the first post-operative year

	Group 1 (n=257)	Group 2 (n=310)	p. Value
Hospitalizations per patient (SD)	0.7 (1.1)	0.8 (1.3)	0.602
Time to first re-hospitalization (months) (SD)	3.4 (3.3)	3.8 (3.2)	0.364
Pneumonia (%)	26 (10.1)	36 (11.6)	0.686
Urinary tract infection (%)	13 (5.1)	34 (11.0)	0.014
Abdominal pain/ gastroenteritis/ cholecystitis (%)	21 (8.2)	25 (8.1)	1
Laboratory anomaly (%)	19 (7.4)	20 (6.4)	0.740
Cerebrovascular event (%)	15 (5.8)	13 (4.2)	0.438
Congestive heart failure exacerbation/ Pulmonary congestion (%)	8 (3.1)	15 (4.8)	0.393
Systemic inflammatory immune syndrome (%)	12 (4.7)	12 (3.9)	0.679
Myocardial infraction (%)	7 (2.7)	11 (3.5)	0.637
Deep vein thrombosis / Pulmonary emboli (%)	5 (1.9)	8 (2.6)	0.780
Fall (%)	6 (2.3)	7 (2.6)	1
Gastrointestinal bleeding (%)	4 (1.6)	8 (2.6)	0.560
Atrial fibrillation (%)[a]	3 (1.2)	4 (1.3)	1
Pressure sore (%)	4 (1.6)	3 (1.0)	0.707
Acute renal failure (%)[a]	0 (0.0)	4 (1.3)	0.130
Orthopedic related to surgery (%)	15 (5.8)	20 (6.5)	0.861
Orthopedic not related to surgery (%)	10 (3.9)	8 (2.6)	0.472
Other (%)	21 (8.2)	21 (6.8)	0.629

[a] Either acute or an exacerbation of a prior condition.

Table V. — Patients treated within or after 48 hours from presentation

	Within 48 hours	Over 48 hours	p. Value
Age (SD)	82.4 (7.2)	82.9 (7.1)	0.538
Charlsons' co-morbidity index (SD)	6.3 (2.1)	6.8 (2)	0.022
Mortality within hospitalization (%)	27 (5.5)	1 (1.0)	0.068
One-year mortality (%)	24 (19.1)	26 (25.2)	0.176
Length of stay (SD)	9.3 (5.6)	12.5 (7.7)	<0.001
In-hospital complications (SD)	0.73 (1.1)	0.74 (1.2)	0.934
Orthopedic complications (%)	27 (5.5)	11 (10.7)	0.073
Recurrent hospitalizations (SD)	0.7 (1.1)	1 (1.7)	0.081

failed meet that time goal, regardless of the surgical period. 103 patients were delayed beyond 48 hours compared with 492 who entered the operating theater on time. While the two groups did not differ in age (82.9 ±7.1 for the delayed group and 82.4 ± 7.2 for the other group, p. value= 0.538), the delayed group had a significantly worse CCI, 6.8 ± 2 compared with 6.3 ± 2.1 for the other group (p. value= 0.022). Length of stay was significantly longer for the delayed group (12.5 ± 7.7 days compared with 9.3 ± 5.6 days for the other group, p. value<0.001). However, when comparing in-hospital and 1-year mortality rates, in-hospital complications and one-year re-admission rates or the number of orthopedic complications, none of the above were found to significantly differ between groups (Table V, Fig. 2).

DISCUSSION

While the national quality program to expedite the surgical treatment for elderly patients presenting with proximal femoral fractures increased the percentage of patients treated within 48 hours, in our tertiary trauma center, this was not found to correlate with a beneficial effect, either in terms of mortality or in immediate or delayed morbidity.

There is an ongoing debate in the orthopedic literature regarding the preferred time for surgi-

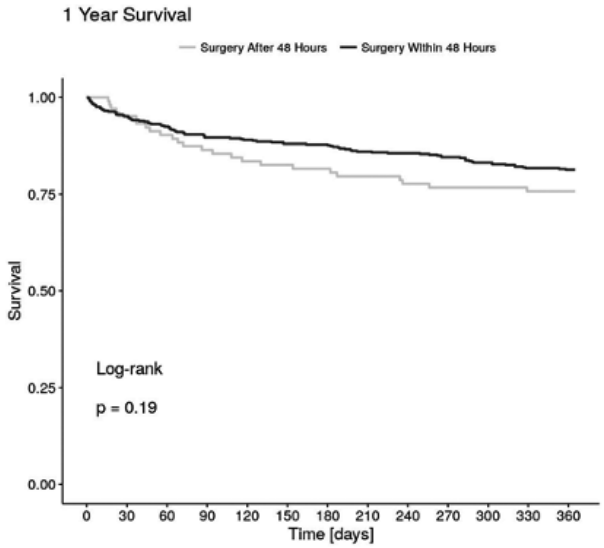

Fig. 2. — One-year survival for patients operated within and following 48 hours from admission.

cal intervention following proximal femoral fracture in the elderly. While early surgery was related to reduced mortality and morbidity by some *(1,2,11,14,17,18)*, sometimes operations are delayed due to patient co-morbidity, and others have stated that the most frail patients do not benefit from a hasten operation, as their medical status needs to be optimized prior to surgery to reduce post-operative complications *(8,9,19)*.

In our cohort early surgery was not related to decreased mortality, either when comparing pre- and post- national quality program results or when comparing all patients who were not operated upon the sought 48 hours' time frame. Similar results were found by Al- Ani et al. *(1)* who did not report a mortality difference among patients operated within 24, 36, 48 and over 48 hours from admission, by Anthony et al. *(2)* who reported similar 1 month mortality whether surgery was performed within 24, 48 or over 72 hours from presentation, by Vidan et al. *(21)* who found that only a delay of over 120 hours increased mortality and by others who reached similar outcomes *(8,13,14)*. Delaying patients' surgery in order to stabilize or even improve their medical condition, may be the cause for the similarity in mortality between groups as only the minority of patients were delayed for non-medical reasons.

In-hospital complications were also similar pre- and -post the national quality program application. Like others *(13)* we found urinary, pulmonary and cardiac complications to be the most frequent. While some have claimed pressure sores to increase with surgical delay *(1,8,11)*, we did not found an increase incidence of decubitus ulcers neither in the pre-national quality program period or in the sub-analysis of delayed patients. This may be related to the beneficial work of our nursing and physiotherapy teams who encourage frequent position changing.

As fragility fractures are associated with impaired functioning in the post-surgical year *(3)*, we choose one-year readmissions as a representative of the patients' wellbeing in that critical time period. several studies looked into the prevalence and etiology for early (30-days) *(4,6,7,10,12,15)* and late (1-year) *(4,5,10,20)* readmissions following hip fragility fractures. They found readmission rates to be as high as 8.4%-15% and 12%-43% for both time periods respectively. Causes for readmissions were mainly medical with bronchopulmonary and infectious diseases being the leading causes in most published papers. We did not find the prevalence of readmission to differ between groups (42.8% of patients from the earlier period were re-admitted within the first post-operative year, compared with 45.5% of the patients from the later period, p. value= 0.553). The only cause for readmission that differed between time periods was urinary tract infection, which was more common in the later period, despite similar prevalence of UTI during the index hospitalization.

This study presents several limitations. First due to its' retrospective nature of data collection. Second, we analyzed data from one tertiary trauma center, which might affect the ability to generalize the results. Finally, for the earlier time some data regarding the cause for surgical delay was missing, however this may be expected as a result of the reduced control over time to surgery before the national quality program.

CONCLUSION

The Israeli national quality program to accelerate the surgical treatment for elderly patients presenting

with proximal femoral fractures increased the percentage of patients treated within 48 hours. In our cohort, this was not found to correlate with a beneficial effect in term of reduced immediate of delayed morbidity and mortality.

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