


Weekend Admission of Intracapsular Femoral Neck Fractures Not Associated With a Greater Rate of Mortality or Morbidity

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Abstract

Introduction: For a number of emergency conditions, admission over the weekend has been associated with rising morbidity and mortality rates. However, different studies have provided conflicting results regarding the increased rates of mortality and morbidity for patients with intracapsular femoral fracture who were admitted over the weekend, compared to weekdays. This study investigated the effect of weekend admissions on the surgical outcomes of patients with intracapsular femoral neck fractures. **Materials and Methods:** We conducted a retrospective cohort study of all the patients who were admitted to our level-II trauma center with an intracapsular femoral neck fracture between January 2009 and June 2011. Admission was classified as at the weekend if it took place between 18:00 PM on Friday until midnight on Sunday or on bank holidays. We compared the mortality rates within 30 days and 6 months after surgery for weekday and weekend admissions. Secondary outcomes considered included length of hospital stay, postoperative complications, and reoperation rates. Statistical analysis was performed using logistic regression models, which were adjusted for patient and surgical characteristics. **Results:** In total, 315 patients met our inclusion criteria. The mean age of this group was 77.9 years (standard deviation ± 13) and the female to male ratio was 5:2. The average follow-up period was 49 months. Under logistic regression analysis, weekend admission was not a significant independent risk factor for the 30-day mortality rate (odds ratio 1.85, 95% confidence interval, 0.74-4.62; $P = .19$). Seventy-seven patients admitted over the weekend were treated within 24 hours versus 125 patients for the weekday group (80.2% vs 57.9%; $P = .005$). There were no differences between the sample groups in relation to implant-related complications (24.9% vs 25.8%, respectively, $P = .89$) nor in relation to general complications (12% vs 18.6%, respectively, $P = .06$). The mean hospital stay of patients operated on during weekends or holidays was significantly shorter compared to patients operated on during weekdays (6.7 vs 8.5 days; $P = .009$). **Conclusion:** Patients with intracapsular femoral neck fractures who were admitted over the weekend at our trauma center did not have a higher risk of mortality or morbidity. Furthermore, temporary preoperative care provided over the weekend by an internal medical consultant can be safe and efficient even in the circumstances where there is a lack of dedicated geriatric support. The absence of an elective operating list at the weekend could be a potential factor in shortening waiting times for surgery for intracapsular femoral neck fracture at weekends and holidays.

Keywords

morbidity, geriatric support, weekend admission, mortality, intracapsular femoral neck fractures, waiting time to surgery, hip fracture service, standardized hip fracture protocol

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Introduction

Several studies have shown that the weekend admission of patients with urgent conditions, such as aortic artery aneurysms or intracranial injuries, is associated with an increased risk of mortality and morbidity.^{1,2} These poorer outcomes may be due to inadequate organization of health-care services at the

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weekend compared to weekdays or the admission of patients with more severe problems at the weekend.³ This variability in outcomes has raised serious concerns over staffing levels and hospital organizational structures at the weekend.⁴ Although no causal evidence has supported this link, a majority of politicians in England are pushing for 7-day health services in the National Health Service.^{5,6} It is a matter of debate whether the increased mortality rates for weekend admissions is applicable to acute orthopedic conditions such as intracapsular femoral neck fracture. The few available studies that have investigated the mortality rates of patients admitted over the weekend with an intracapsular femoral neck fracture have demonstrated conflicting results. A British study conducted by Thomas et al showed that the weekend admission of patients with a hip fracture was associated with a rise in 30-day mortality rates compared to weekday admissions (10.2% vs 8.2%, odds ratio [OR] 1.4, 95% confidence interval [CI], 1.02-1.9; $P = .039$).⁷ On the other hand, a study from Denmark showed that the 30-day mortality rate for patients admitted during weekends and weekdays was similar (10.2% vs 10.3%; $P = .2$).⁸ Furthermore, Foss et al found that the 30-day postoperative mortality rate was higher in patients who were admitted during holiday periods compared to weekends and weekdays, 19.3% versus 12.7% and 11.1%, respectively ($P = .05$).⁹ Besides these conflicting results, previous studies have not assessed the complication rates and long-term surgical outcomes for those patients who were admitted at the weekend. Finally, a majority of studies investigated a heterogeneous group of patients with different types of hip fracture. In order to address these shortcomings, we conducted a retrospective cohort study to assess the “weekend effect” on surgical outcomes of only those patients with an intracapsular femoral neck fracture at a level-II trauma center.

Materials and Methods

We included all patients from the hip trauma database who were treated surgically for an intracapsular femoral neck fracture between January 1, 2009, and June 30, 2011, at our level-II trauma hospital in the Netherlands. We used the electronic patient record system to extract data regarding age, gender, time of injury, type of fracture, time of admission and time of operation, duration and type of operation, comorbidities, general health status according to the American Society of Anaesthesiologists (ASA) classification, hospital stay, and complications. Institutional approval was obtained for the use of medical records.

The admission was defined as at the weekend if it took place between 18:00 on Friday until 23:59 on Sunday or on bank holidays from midnight until the end of the day. Outside these hours, the admission was regarded as occurring during weekdays.

Our hospital has implemented a standardized hip fracture pathway, which defines the admission process for hip fracture patient during weekdays, weekends, and holidays. An emergency department nurse and a junior surgical trainee assess patients with a hip fracture in the emergency department on weekdays as well as at weekends and on holidays. Once the suspected hip fracture patient has arrived at the emergency

department, the surgical trainee performs a full physical examination and takes the patient's medical history. In addition, X-rays of hips and chest, a full blood test, and electrocardiography are carried out. All hip fracture patients are then transferred to the 16-bed trauma unit, which is staffed by 4 trained nurses regardless of the day of the week.

A geriatric consultant and an anesthetic consultant reviewed all patients prior to surgery on weekdays. At the weekend and during holidays, an anesthetic consultant reviewed patients. The patients were prepared as per hospital protocol before transfer to the operating theatre. There was a trauma theatre available from 8:00 until 18:00 from Monday to Friday. There was an on-call team available for acute procedures outside these hours. A trauma surgeon, or a senior trainee under the direct supervision of a trauma surgeon, carried out all operations in both groups. Patients underwent hip hemiarthroplasty (Mathys, Cemented Straight Stem Stryker, Canulated Screw System 7.3 mm.) or internal fixation by either dynamic hip screw or cannulated hip screw (Stryker) in accordance with the hip fractures guidelines of the Dutch Trauma Association.

Postoperatively, there was an intensive care unit available for the patient if necessary.

On weekdays, all patients were reviewed daily by the ward-based trainee and geriatric team. Patients were mobilized 1 day after surgery under the direct supervision of a physiotherapist. At weekends and holidays, patients were reviewed by the on-call surgical trainee and there was no geriatric or regular physiotherapist support (Table 1).

Outpatient follow-up ended 6 weeks postoperation in asymptomatic patients. The outpatient follow-up was continued for all symptomatic patients until the consolidation of fracture or implant-related complications were detected by plain radiography of the hip (X-ray). Computed tomography was considered in cases of dubious or ambiguous X-ray findings. For our study, we contacted all patients or the patient's general practitioner to exclude any complication since discharge from our outpatient clinic. We tracked the 30-day mortality rate, 6-month mortality rate, and survival status of each patient using the Dutch personal registration system. We had confidence in the information on mortality as the mortality data collected in the Dutch personal registration system are complete and have a high-accuracy rate. The average follow-up period was 49 months.

Implant-related complications recorded included wound bleeding, hematoma or anaemia requiring blood transfusion, wound infection requiring antibiotic or surgical intervention, protrusion or prominence of screw, intraoperative fracture, redisplacement of fracture, symptomatic collapse of femur head, nonunion, avascular necrosis, dislocation of prosthesis, prosthesis loosening, intraoperative fracture, periprosthetic fracture, and reported pain with no clear cause. All other complications were defined as general complications and these comprised delirium, urinary tract infection, renal insufficiency, respiratory infection, pulmonary embolism, cardiac event, and in-hospital death. It is hospital policy to note all surgical complications, including benign complications, on a patient's electronic record.

Table 1. Comparison Weekday and Weekend Admission Procedures.

Weekend and Holiday Admission	Weekday Admission
Admission from 18:00 on Friday until 23:59 Sunday or on bank holidays	Admission on weekdays
An emergency nurse and a junior trainee admitted patients with a hip fracture	An emergency nurse and a junior trainee admitted patients with a hip fracture.
The admission led by a trauma surgeon	The admission led by a trauma surgeon.
Trauma ward coverage:	Trauma ward coverage:
Morning ward round performed by a junior doctor.	Morning ward round performed by ward-based junior doctor.
The junior doctor is on call for all surgical inpatients.	The junior doctor is permanently around until 18:00 PM
One trauma surgeon is on call	Four trauma surgeon are around until 18:00 PM
Preoperative assessment led by anesthetic consultant.	Preoperative reviewed by anesthetic consultant and geriatric consultant
A case mix trauma surgeon-led theatre list is available.	Two trauma surgeon-led theatre lists are available.
No geriatric support on weekend is available	Daily geriatric support available
Internal medicine support on weekend is available	
No multidisciplinary rehabilitation programme on weekend.	Multidisciplinary rehabilitation programme on weekdays.
Physiotherapy not routinely provided on weekends and holidays	Physiotherapy provided until 17:00

Statistical Analysis

SPSS version 20 for Mac OS was used for all data analysis. Nominal variables were tested with Fisher exact test. Continuous variables were tested with the Mann-Whitney *U* test. All tests were 2 sided. The results were considered significant at a 2-tailed level of .05. We used multivariate logistic regression analysis to calculate the OR of 30-day mortality, 6-month mortality, implant-related complications, and general complications for patients admitted on weekdays compared to patients admitted at weekends or during holidays. Patient age, sex, and ASA score, which are known to be associated with raised mortality, were defined as confounding variables and are adjusted in multivariate regression analysis.

Results

During the study period, 315 patients underwent a surgical procedure for an intracapsular femoral neck fracture: 173 underwent hemiarthroplasty (HA), 96 underwent closed reduction and internal fixation with canulated hip screws, and 46 underwent closed reduction and internal fixation with dynamic hip screw. The admission details of 1 patient were incomplete. 217 patients were admitted on weekdays and 97 patients were admitted during weekends or holiday periods. There were no significant differences between the groups with respect to age, sex, ASA score, and type of operation (Table 2). The number of patients who underwent surgical treatment within 24 hours from admission on weekends and holidays was significantly higher than during weekdays (80.2% vs 57.9%; $P < .005$).

The mean hospital stay of patients operated during weekends or holidays was significantly shorter compared to patients operated on during weekdays (6.7 vs 8.5 days; $P = .009$). There were no significant differences between the groups in relation to complications and reoperation rates (Table 3).

Weekend admission was not associated with a significant rise in 30-day and 6-month mortality, after adjusting for age, ASA classification, and gender (Table 4).

Table 2. Baseline Demographic and Clinical Characteristics in Weekend and Weekday Admission Groups.

	Weekends and Holidays Admission	Weekdays Admission	<i>P</i> Value
Number of patients	97	217	
Age (years)	78.7 (14.2)	77.5 (12.4)	.43
Sex			
Male	39 (40.2%)	77 (35.5%)	.45
Female	58 (59.8%)	140 (64.5%)	
ASA score			
1/2	61 (62.9%)	151 (69.6%)	.24
3/4/5	36 (37.1%)	66 (30.4%)	
Interval admission surgery (hours)			
<24	77 (80.2%)	125 (57.9%)	.005
24-48	11 (11.5%)	74 (34.3%)	
>48	8 (8.3%)	17 (7.9%)	
Length of hospital stay (days)	6.7	8.5	.009
Type of operation			
HA	48 (49.5%)	125 (57.6%)	.33
CHS	35 (36.1%)	61 (28.1%)	
DHS	14 (14.4%)	31 (14.3%)	
Number of operations by trainee	61 (62.9%)	131 (60.4%)	.71

Abbreviations: ASA, American Society of Anaesthesiologists; HA, hemiarthroplasty; CHS: canulated hip screws; DHS, dynamic hip screw.
Note: Significant values are shown in boldface.

Logistic regression analysis revealed no significant difference in local and general complication rates between the weekend and weekday admission cohorts (Table 5).

Discussion

In this study, we found that weekend admission for patients with an intracapsular femoral neck fracture is not associated with a rise in mortality or morbidity, compared to weekday

Table 3. Comparison of Local and General Complications Between Weekend and Weekday Admissions.

	Weekends and Holidays Admission	Weekdays Admission	P Value
Number of patients	97	217	
Local complication	25 (25.8%)	54 (24.9%)	.89
Prominent screw	7 (7.2%)	11 (5.1%)	
AVN	4 (4.1%)	10 (4.6%)	
Nonunion	4 (4.1%)	7 (3.2%)	
Deep infection	3 (3.1%)	5 (2.3%)	
Others	7 (7.2%)	21 (9.7%)	.06
General complication	18 (18.6%)	26 (12.0%)	
Delirium	4 (4.1%)	12 (5.5%)	
Respiration infection	4 (4.1%)	4 (1.8%)	
Renal dysfunction	4 (4.1%)	0 (0.0%)	
Others	6 (6.3%)	10 (4.7%)	.63
Reoperation rate	19 (19.6%)	37 (17.1%)	

Abbreviation: AVN, femoral head avascular necrosis.

admission. To our knowledge, this is one of the few studies that compared postoperative mortality and morbidity for weekend and weekday admission in a specific orthopedic patient group, namely, patients with an intracapsular femoral neck fracture.

The results of our study stand in contrast to the existing literature.^{7,9} According to Foss et al, 5- and 30-day postoperative mortalities were significantly higher in patients admitted during holiday periods and weekends than during weekdays.⁹ It was suggested that this could be caused by a reduction in the number of available staff by 20% and nurses in particular by 50%. Additionally, postoperative rounds were not performed by orthopedic trauma consultant during weekends and holiday periods. However, in our study, a junior surgical trainee cared for the patients over the weekend. This could be interpreted as comparable quality of pre- and postoperative care during weekends and weekdays in our hospital. Furthermore, the similarity between surgical complication rates in both groups illustrated the comparable performance of surgical teams during weekends and weekdays.

Thomas et al reported that weekend admission, but not weekend surgery, was a predictor of greater postoperative death for hip fracture.⁷ Interestingly, weekend surgery was reserved for patients with lower ASA classification in their study. Patients with higher ASA, who were admitted at the weekend, encountered longer surgical waiting times, probably due to the reduction in numbers of medical staff, especially geriatric consultants, and a delay in obtaining diagnostic investigations. This could explain why fewer patients with ASA grade III or IV underwent surgical intervention at the weekend compared to weekdays in their study. This is inconsistent with our findings. In our study, there was no difference in the number of patients with high ASA grade who underwent surgery on weekends or weekdays. Access to sufficient preoperative care, irrespective of the admissions day, was available. Different studies have shown that daily geriatric care may reduce in-hospital mortality and complication rates.^{10,11} Sayers et al

showed that Sunday operations on hip fractures, discharge from hospital on a Sunday, or out-of-hours discharge in general, were associated with an increase in 30-day mortality rates.¹² This is perhaps due to the availability of resources such as geriatrician-led hip fracture care during the weekend.

There was no geriatric support in our hospital at the weekend; however, an internal medicine consultant was available to review preoperative care for patients with comorbidities, in cooperation with an anesthetic consultant. Our study shows that temporary preoperative care provided by an internal medicine consultant at the weekend can be safe and efficient in cases where there is a lack of dedicated geriatric support.

Daugard et al argued that the mortality rates for patients admitted during weekends, public holidays, and weekdays were similar.⁸ This is a multicenter Danish study with a heterogeneous study population, in which different types of hip fractures were included. They did not mention whether the structure of hip fracture services was consistent between the different hospitals. We believe that such studies cannot properly represent the mortality rate for hip fracture patients at a local level, as the hip care provision depends on local primary care, the organization of hip fracture services and hospital facilities. Ozdemir et al emphasized that there is a significant variance in mortality rates between different care providers in the United Kingdom, in relation to emergency admissions, due to variability in staffing, infrastructure facilities, and admission processes.¹³

Our results are in line with a recent single-center study by Nandra et al.¹⁴ However, this study was performed in a major tertiary referral center, providing high-level trauma care allied with 7-day working rotas. Pincus et al also found no relationship between the timing of surgical procedures for hip fracture and adverse outcomes.¹⁵

One other study, moreover, failed to show a “weekend” effect on postoperative mortality for hip fracture patients.¹⁶ However, this study investigated a heterogeneous group of patients with different types of hip fracture.

Early mobilization after surgery for hip fracture has been shown to be associated with reduction of general complications such as delirium, urinary tract infection, respiratory infection, and thromboembolic events.¹⁷ Siu et al demonstrated that delayed ambulation of hip fracture patients is associated with poorer function at 2 months and higher mortality at 6 months.¹⁸ In line with these findings, Daruk et al reported that early surgical treatment of hip fracture could lead to faster ambulation and an earlier return to normal daily activities.¹⁹

In our study, the waiting time for surgery at the weekend was significantly shorter compared to weekdays owing to the lack of an elective theatre list at the weekend. Furthermore, there were more diagnostic facilities available at the weekend due to the absence of outpatient clinics. A less hierarchical structure of care at the weekend may also shorten waiting times for surgery, probably due to an early and efficient decision-making process. This could explain why the length of hospital stay for the weekend admission cohort is significantly shorter compared to the weekday admission cohort. Mariconda et al

Table 4. Logistic Regression Models for 30-Day and 6-Month Mortality.

	30-Day Mortality		6-Month Mortality	
	Multivariate P Value	Multivariate Odds Ratio (95% CI)	Multivariate P Value	Multivariate Odds Ratio (95% CI)
Age	.000	1.14 (1.06-1.22)	.00	1.09 (1.05-1.13)
ASA	.03	2.82 (1.12-7.10)	.29	1.39 (0.76-2.56)
Gender	.05	2.52 (1.01-6.31)	.05	1.89 (1.02-3.48)
Weekend admission	.19	1.85 (0.74-4.60)	.36	1.34 (0.72-2.50)

Abbreviations: CI, confidence interval; ASA, American Society of Anaesthesiologists.

Table 5. Logistic Regression Model for Local and General Complications.

	Local Complications		General Complications	
	Multivariate P Value	Multivariate Odds Ratio (95% CI)	Multivariate P Value	Multivariate Odds Ratio (95% CI)
Age	.001	0.97 (0.95-0.99)	.01	1.04 (1.01-1.07)
ASA	.44	0.79 (0.43-1.44)	.01	2.09 (1.16-3.77)
Gender	.59	0.86 (0.49-1.50)	.36	1.32 (0.72-2.43)
Weekend admission	.71	1.12 (0.63-1.97)	.10	1.65 (0.90-3.00)

Abbreviations: ASA, American Society of Anaesthesiologists.

showed in a prospective study that relative waiting time for surgery was the main predictor of the length of hospital stay.²⁰

The major limitation of this study was the retrospective character of the cohort, which made it impossible to track all relevant data on functional outcomes. Therefore, we could not exclude the possibility that there are significant differences in functional outcomes between weekend and weekday admissions.

Conclusion

In conclusion, this study demonstrated that weekend admission to our trauma center of patients with intracapsular femoral neck fractures is not associated with a higher risk of mortality or morbidity compared to weekday admission. Furthermore, temporary preoperative care provided at the weekend by an internal medicine consultant can be safe and efficient in cases where there is a lack of dedicated geriatric support. Among other things, the absence of an elective operating list at the weekend could be a potential factor in reducing waiting time to surgery for intracapsular femoral neck fracture during weekends and holidays. This study determined that comparable surgical outcomes for hip patients could be achieved at weekends and weekdays by implementation of a standardized protocol.

Authors' Note

WR and GR made an equal contribution to this work.

Declaration of Conflicting Interests

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