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The weekend effect for hip fracture surgery

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ABSTRACT

Introduction: Increased mortality rates have been reported for emergency admissions during weekends and outside office hours. Research on the weekend effect in hip fracture patients is however limited and demonstrates conflicting results. The aim of this study was to determine the effect of weekend admission and weekend surgery on 30-day and 1-year mortality following hip fracture surgery.
Patients and methods: All patients who underwent hip fracture surgery in our hospital between 2004 and 2015 were included in this retrospective study. Patient characteristics including age, gender, fracture type, American Society of Anesthesiologists (ASA) score, Nottingham Hip Fracture Score (NHFS), Charlson Comorbidity Index (CCI) and length of stay were collected. Information on admission and surgery date and time of day was recorded, as were in-hospital, 30-day and 1-year mortality. Multivariable logistic regression analysis was performed to identify independent predictors of 30-day and 1-year mortality.
Results: A total of 1803 patients were included, 546 patients (30.3%) were admitted during the weekend. Patient characteristics did not differ between weekday and weekend admissions. Surgical delay was less frequent in patients undergoing weekend surgery. Multivariable analysis demonstrated that older age, higher ASA score, higher NHFS and increased surgical delay were independently associated with 30-day mortality. One-year mortality was associated with age, gender, ASA score, CCI and surgical delay. Weekend admission and weekend surgery were not associated with increased 30-day or 1-year mortality.
Conclusions: There was no weekend effect for hip fracture patients in our study. These results indicate an adequate level of perioperative care outside weekday office hours within our health care system.

Introduction

A fracture of the hip is a common injury in the elderly and associated with increased mortality [1]. The incidence of hip fractures is rising due to extended life expectancy and population growth. In the Netherlands, a total of 20.000 patients undergo hip fracture surgery every year, accounting for over 20% of injury-related medical costs [2].

The increased risk of death after a fracture of the hip is well documented [1,3,4]. Early mortality is high, with reported 30-day mortality around 13.3%, and 1-year mortality rates around 24.5%–29.3% [3,5,6]. Numerous studies have identified predicting factors for mortality after hip fracture surgery. Most of these factors are however patient characteristics such as age and comorbidities, which cannot be influenced by clinicians aiming to reduce patient mortality [1,3].

In an effort to understand and prevent adverse outcomes after hospital admission, several studies have reported on the 'weekend effect' [7–10]. Research demonstrates that emergency admission on a weekend day or public holiday is associated with an increased risk of mortality. This effect is caused in part by reduced availability of health services and lower levels of experience and seniority of the present staff, which might not be compensated for by increased care on subsequent weekdays [11–13]. While the weekend effect for general emergency admissions seems to be well established, studies on the effect in hip fracture patients demonstrate inconsistent results [14–17].

The objective of this study was to determine the effect of weekend admission and weekend surgery on both short (30-day) and long term (1-year) mortality in a large cohort of hip fracture patients. Furthermore, we aimed to study the effect of admission time of day, surgery time of day and seniority of operating surgeon.

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Patients and methods

In this retrospective study, all 1873 patients who underwent hip fracture surgery the OLVG West hospital between January 2004 and December 2015 were reviewed. The OLVG West is a medium-sized teaching hospital located in Amsterdam, the Netherlands, serving a predominantly urban population. After exclusion of incomplete cases (n = 24, 1.3%) and patients lost to follow-up (n = 46, 2.5%), 1803 hip fracture patients were available for analysis.

Treatment of hip fracture patients was in accordance with current guidelines. A contralateral hip fracture in the same patient on a different date was recorded as a separate case. Patients undergoing total hip replacement were excluded, as well as patients with periprosthetic fractures and children with slipped capital epiphysis. The local medical ethical committee approved this study. Individual informed consent was not required due to the observational nature of the research.

Patients admitted to the Emergency Department (ED) received first aid care including analgesia. The protocol in case of a suspected hip fracture dictates routine X-ray of the hip, intravenous access, blood sample and electrocardiography. Patients were treated by attending registrars and admitted to the ward regardless of time of day. Staffing levels ensured that at least one registrar was present on the ED at any given time. Patient admission and the decision to prepare for theatre were always done in consultation with the attending surgeon. Outside office hours (1700 h–0800 h) and during weekends and bank holidays, a consultant was on-call for deliberation with the registrar.

Hip fracture patients were intended to be operated within 48 h, based on nationwide standards. While theatre availability was always ensured, hip fracture surgery was preferably carried out between 0800 h and 1700 h on both weekdays and weekends. Preparation for surgery included review by the attending anaesthetist; patients could only be transferred to the operating theatre after approval by both the attending surgeon and anaesthetist.

All patients were operated by a consultant or registrar. Experienced registrars could operate under supervision of a consultant in theatre or on-call, depending on the skill of the registrar and entrust. Registrars with enough training and experience were allowed to operate autonomously. Protocolled postoperative care included radiography, wound management and physiotherapy. Postoperative X-rays were preferably postponed till Monday. Nursing staff assisted patients during mobilisation on weekends since physiotherapists were not available outside office hours. Adequate ward staffing was insured on both weekends and weekdays. Surgery registrars were present in the hospital at all times and available for consultation with ward staff or in case of any postoperative complications. There was no medium care unit in our hospital; patients requiring more intensive treatment were postoperatively treated at the intensive care unit.

Admission and surgical data were added to an existing database containing hip fracture patients and their characteristics. Recorded variables included age, gender, fracture type, American Society of Anesthesiologists (ASA) score, comorbidities, and length of stay [18]. The Nottingham Hip Fracture Score (NHFS) was assessed for individual patients, since this is a validated prediction model specifically developed for 30-day mortality after hip fracture surgery [19–21]. The NHFS predicts individual 30-day mortality risk based on seven variables including age, gender and a number of comorbidities. Since this model is only validated for early mortality, the Charlson Comorbidity Index (CCI) was used for analysis of 1-year mortality [22]. Admission date and time of day were based on moment of diagnosis and determined using data from hip X-rays. Surgery date and time were collected, as well as the duration of surgery and grade of operating surgeon.

Weekend admission was defined as admission between Friday midnight and Sunday midnight or admission on a bank holiday. Admission outside office hours was defined as admission between 1700 h and 0800 h or on a weekend day or bank holiday. Likewise, surgery was classified into weekend surgery and surgery performed outside office hours, using the same definitions. Thirty-day mortality and 1-year mortality were recorded and defined as death following hip fracture surgery within 30 days and one year respectively.

Statistical analysis

Descriptive statistics were used to assess differences in patient characteristics, surgical variables and outcomes between weekday and weekend admissions. Similarly, patients undergoing weekday and weekend surgery were compared. Categorical data were expressed as n (%) and analysed with the Pearson's Chi-square test. Continuous variables were analysed using the independent samples *t*-test, unless the data were non-normally distributed, in which case the Mann-Whitney *U* test was used. Variables were excluded if they were missing for more than 10%. Significance level was set at $p < 0.05$.

Univariable and multivariable logistic regression analyses were used to determine independent predictors for both 30-day and 1-year mortality after hip fracture surgery. Factors associated with mortality in univariate analysis with a p value < 0.10 were eligible for inclusion in the multivariable model. A p value < 0.05 was required for remaining in the final multivariable model. All statistical analyses were performed using SPSS Statistical software (version 22.0, SPSS Inc., Chicago, USA).

Results

Of the 1803 consecutively admitted hip fracture patients, 95 (5.3%) died before discharge. Thirty-day mortality was observed in 137 patients (7.6%), and 493 patients (29.0%) died within one year following surgery. Data for 1-year mortality were not available in 103 cases (5.7%), in part due to short follow-up for patients included in 2015.

A total of 546 patients (30.3%) were admitted on a weekend day. Patient characteristics for weekday and weekend admission are shown in Table 1. Both groups demonstrated similar age, gender, comorbidity rates and fracture types. There was no difference in in-hospital, 30-day or 1-year mortality between weekday and weekend admission.

Weekend surgery was performed in 523 patients (29.0%), whereas 1280 patients (71.0%) underwent surgery on a weekday. Patient characteristics did not differ between groups (Table 2). Delay to surgery was significantly less frequent on weekends (95.4% versus 91.0% of patients operated within 48 h on weekdays, $p < 0.001$). Weekend surgery was more often performed by registrars (76.3% versus 62.2% on weekdays, $p < 0.001$). There was no significant difference in duration of surgery or mortality between weekday or weekend surgery.

Multivariable analysis demonstrated that older age, high ASA score, higher NHFS and longer time to surgery were independent predictors for increased 30-day mortality (Table 3). Grade of surgeon was not associated with mortality. Admission or surgery on weekends, holidays, Fridays or outside office hours were not associated with increased 30-day mortality in univariate analysis and consequently not included in the multivariable model. The adjusted effect of weekend admission and weekend surgery on mortality remained not significant after re-entry in the final multivariable model ($p = 0.500$ and $p = 0.752$ respectively).

Univariate analysis of factors associated with 1-year mortality demonstrated an unadjusted effect of age, ASA score, CCI and time

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