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Relationship between one-year mortality in hip fractures and surgical delay

M.R. Sánchez-Crespo[a,*], R. Bolloque[a], A. Pascual-Carra[a], M.D. Pérez-Aguilar[a], M. Rubio-Lorenzo[a], M.A. Alonso-Aguirre[a] and P. Sánchez-Juan[b]

[a] *Traumatology Unit, Orthopaedic Surgery and Traumatology department, University of Cantabria, Santander, Spain*
[b] *Supporting unit for research, Marqués de Valdecilla foundation, University of Cantabria, Santander, Spain*

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KEYWORDS
Hip fracture;
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Abstract
Purpose: To analyze the relationship between surgical delay for hip fractures due to administrative-organizational reasons and the mortality index.
Materials and methods: We present a retrospective study of 634 hip fractures operated over a 5-year period. These also included patients whose surgery was postponed for organizational-administrative reasons but who were ready for surgery from the moment they were admitted. We excluded from the study patients who had a prior or an acute condition, patients under 65, patients with pathological fractures, multiple-trauma patients, and patients with anti coagulation or dementia. A comparison was made between the mortality rate of patients operated the same or the following day they were admitted with those operated the second or third days and with those operated after that time. Uni- and multivariate analyses were performed to analyze the relationship between surgical delay and several variables.
Results: About 18.6%of patients included in the study died at one year follow-up. Age, male gender and surgical risk were associated to higher mortality. The type of fracture, surgery or anesthesia did not influence final prognosis. Patients operated the same or the following day after admission had a lower mortality rate than those operated subsequently, regardless of age, gender or surgical risk.
Conclusions: The mortality index in autonomous patients, who did not present with an acute condition on admission and who were operated for a hip fracture the same or the following day they were admitted is significantly lower than that for patients operated at a later date.

*Corresponding author.
E-mail: e230@humv.es (M.R. Sánchez-Crespo).

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PALABRAS CLAVE
Fractura de cadera;
Mortalidad;
Retraso quirúrgico

Mortalidad al año en fracturas de cadera y demora quirúrgica

Resumen
Objetivo: Analizar la relación entre el retraso en la cirugía de fractura de cadera por causas administrativoorganizativas y el índice de mortalidad.
Material y método: Estudio retrospectivo de 634 fracturas de cadera intervenidas durante 5 años que incluían a pacientes que retrasaron su cirugía por motivos administrativo-organizativos y preparados para cirugía desde el momento de su ingreso. Se excluyó a pacientes con enfermedad previa o agudizada, a menores de 65 años, con fracturas patológicas, politraumatizados, con anticoagulación o con demencia. Se comparó la mortalidad de los pacientes intervenidos el día de su ingreso o al siguiente día con los pacientes intervenidos el segundo o el tercer día y con los pacientes intervenidos más tarde. Se efectuó un análisis univariado y multivariado para estudiar la relación del retraso quirúrgico con diversas variables.
Resultados: El 18,6%de los pacientes incluidos falleció al año. La edad, el sexo masculino y el riesgo quirúrgico se asociaron a una mayor mortalidad. El tipo de fractura, la cirugía y la anestesia no influyeron en el pronóstico vital. Los pacientes intervenidos el día del ingreso o al día siguiente tuvieron menor mortalidad que los intervenidos más tarde, independientemente de la edad, el sexo o el riesgo quirúrgico.
Conclusiones: El índice de mortalidad en pacientes autónomos, sin enfermedad aguda al ingreso e intervenidos por fractura de cadera durante el primer día desde su ingreso hospitalario o al siguiente es significativamente menor al de los pacientes intervenidos más tarde.

Introduction

Hip fractures are common injuries associated with high mortality rates in advanced age patients. Furthermore, life spans in our country continue to grow longer, which suggests greater incidences of such injuries in the future.[1] 1-year mortality rates following hip fractures are estimated between 14 and 36%,[2,3] which may be the cause of half of all early deaths in patients with musculoskeletal lesions.[4] Hip fractures are also the cause of over two thirds of all hospitalization time due to fractures [5]. Surgical treatment is indicated in the majority of cases, and must be carried out immediately following admission, although contradictory data does exist in the medical literature regarding the benefits of early surgical intervention.

Confusion also exists regarding the definition of early surgery, as this has been described as those procedures undertaken within 6, 24, 48, and even 72 hrs following hospital admission.[2,6,9] The objective of our study was to determine whether surgical delay increases mortality rates in patients with hip fractures and to determine the minimum time for surgery.

Material and methods

During the period between January 2000 and December 2004, 1,485 hip fractures (femoral neck and pertrochanteric regions) were surgically treated in the traumatology unit at our hospital. We performed a retrospective study analysing fractures treated during those 5 years with the objective of determining the influence of surgical delay stemming from strictly organizational causes on 1-year postoperative mortality rate. In order to eliminate biases, all patients whose surgical delay was due to medical causes were excluded from the study, usually due to indications from internal medicine, anaesthesiology, treatment using anticoagulants, or in ASA (American Society of Anesthesiologists) class V patients. Patients under the age of 65, polytraumatized patients, and those suffering from pathological fractures or high-energy traumas were also excluded. As a result, all surgeries included in this study experienced surgical delay due to strictly organizational causes, whether for the lack of availability of an operating room, anaesthesiologist, or surgeon.

At the time of data collection, all cases had at least 1 year of follow-up time. All information was collected through a systematic revision of medical histories.

Surgical delay was calculated as the interval of time between the day of hospital admission and the day of the procedure.[7] In order to determine whether surgical delay influenced postoperative mortality, we performed an analysis comparing patient mortality in cases operated on in days 0 and 1, that is, patients operated on during the same day they were admitted to the hospital or the following, with those operated on 2 or 3 days following admission, and those operated on 4 or more days post-admission. We also analysed other variables and their relationships with morbidity, such as age, sex, fracture type, surgical and anaesthetic technique, and surgical risks according to ASA classification and postoperative complications.

All patients included in the study were assigned an ASA class (functional classification system created by the ASA)

for application of anaesthesia. This classification system evaluated each patient based on the severity of past conditions, functional capacity, and surgical risk. Patients were then divided into two study groups: ASA class I-II patients and ASA class III-IV patients. ASA class V patients were not included in the study, since this status implies a terminally ill patient regardless of treatment.

Surgical complications were divided into local (related to the surgical wound) and general (with systemic repercussions) categories.

One-year postoperative mortality rates were then calculated. We analysed the influence of various clinical and demographic factors on patient mortality. The differences in qualitative and quantitative variables were analysed using Chi squared tests and ANOVAs, respectively. We used a multivariate analysis to analyse the relationship between surgical delay and patient mortality using logistic regression. In order to incorporate possible confounding factors, we used a model that included age, sex, surgical risk according to ASA classification, type of surgery, type of anaesthesia, and time of surgical delay (0-1 days, 2-3 days, and 4 or more days post-admission) as variables to analyse 1-year mortality rates. We used the computer program SPSS 13.0 for Windows XP (SPSS, Inc., Chicago, Illinois) for statistical calculations.

Results

Of the initial 1,485 fractures, 634 met the study criteria, 81.6% of which were women (n=519) and 18.4 % were men (n=115). Mean age was 83 years old (range: 65–102).

45.8% of fractures (n=291) were located in the neck of the femur and 54.2% were pertrochanteric fractures. 256 cases were treated with partial or complete arthroplasty (40.4%), and 378 with osteosynthesis (59.6%) using pins or screws. Spinal anaesthesia was applied in 267 patients (42.2%) and general anaesthesia in 367 patients (57.8%). Of all patients included in the study, 281 presented as ASA class I-II and 353 as ASA class III-IV.

A total of 154 patients were operated on the same day of admission or the following, 267 patients were operated on the second or third day after admission, and 213 patients were operated on 4 or more days following admission (table 1).

Of the 634 patients included in the study, 118 (18.6%) died during the first year following surgery.

The deceased patients were significantly older than those who survived the first year following operation. Mean age of deceased patients was 86 years, while those who survived averaged 82 years of age (p<0.001).

Regarding the sex of the patient, 17% of women (n=88) and 26.1% of men (n=30) died in the first year following the operation, with a significant predominance of mortality among men (p=0.02).

Depending upon the type of fracture, 16.8% of patients with fractures of the neck of the femur (n=49) and 20.1% of patients with pertrochanteric fractures (n=69) passed away within the first year following surgery. No significant difference was found (p=0.3). Nor was there a difference observed regarding the type of surgical procedure; 16.8% of patients (n=43) who received arthroplasty and 19.8% of patients (n=75) who received osteosynthesis died within the first year (p=0.334).

Table 1 Clinical and demographic data for the 634 patients

	n	%
Mean age, years (SD)	83 (7)	
Women	519	81.6
Type of fracture		
Cervical	291	45.8
Pertrochanteric	343	54.2
Type of surgery		
Arthroplasty	256	40.4
Osteosynthesis	378	59.6
Type of anaesthesia		
Spinal	267	42.2
General	367	57.8
ASA classification		
Class I-II	281	44.3
Class III-IV	353	55.7
Days between admission and surgery		
0 o 1 days	154	24.3
2 o 3 days	267	42.1
> 4 days	213	33.6

ASA: American Society of Anesthesiologists; SD: standard deviation.

25.2% of ASA class III-IV patients (n=82) and 10.3% of ASA class I-II patients (n=29) died during the first year. Patients with higher associated surgical risk exhibited a significantly higher mortality rate (p<0.001).

No differences were observed in mortality rates for different types of anaesthesia used during surgery: 19.5% of patients who received spinal anaesthesia (n=52) and 18% of patients who received general anaesthesia (n=66) died during the first year following the procedure (p=0.8).

Based on delay (in number of days) of the surgical procedure following hospital admission, we observed that patients operated on the same day or day following admission had a 1-year mortality rate of 9.7% (n=15), patients operated on the second or third day following admission had a mortality rate of 21.7% (n=58), and those patients operated on later than 3 days following admission had a mortality rate of 21.1% (n=45). Mortality rate of patients operated on later than 1 day following hospital admission was double that of patients operated on immediately.

No statistical differences were found in surgical delay based on sex, type of fracture, anaesthetic technique, or surgical risk. However, we did find differences in mortality rates, post-operative complications, type of surgery, and age (table 2).

Table 2 Information for different patient groups based on surgical delay

	Days passed between admission and surgery			*P*
	0 or 1 day (n=154)	2 to 3 days (n=267)	> 3 days (n=213)	
Mean age, years (SD)	84 (7)	83 (7)	81 (7)	< 0.001
Female, n (%)	129 (83.8)	221 (82.8)	169 (79.3)	0.48
Type of fracture, n (%)				0.12
Cervical	67 (43.5)	114 (42.7)	110 (51.6)	
Pertrochanteric	87 (56.5)	153 (57.3)	103 (48.4)	
Type of surgery, n (%)				< 0.001
Arthroplasty	46 (29.9)	103 (38.6)	107 (50.2)	
Osteosynthesis	108 (70.1)	164 (61.4)	106 (49.8)	
Type of anaesthesia, n (%)				0.15
Spinal	66 (42.9)	124 (46.4)	77 (36.2)	
General	88 (57.1)	143 (53.6)	136 (63.8)	
ASA class III-IV, n (%)	89 (57.8)	150 (56.2)	111 (52.1)	0.77
General complications, n (%)	15 (9.7)	29 (10.9)	33 (15.5)	0.026
Mortality n (%)	15 (9.7)	58 (21.7)	45 (21.1)	0.005

ASA: American Society of Anesthesiologists; SD: standard deviation.

Using a logistic regression analysis to examine all variables together, we observed that surgical delay, advanced age, sex (male), and surgical risk (ASA classification) all increased the risk of 1-year mortality independently. Patients operated on 2–3 days, or 4 or more days following hospital admission suffered a significantly higher risk of mortality than those operated on within one day of admission (OR = 3.0, 95%CI = 1.6–5.6 [p<0.00]; OR = 3.5, 95%CI = 1.8–6.9 [p<0.001]). Type of anaesthesia and type of surgery did not have any influence on 1-year mortality.

Regarding complications, we observed that 7%of patients operated on the first day of admission had local complications, and 9.7% had general complications. 12.7% of patients operated on 2 to 3 days following admission had local complications and 10.9%had general complications; 5.6%of patients operated on 4 or more days following admission had local complications, and 15.5%had general complications. As surgery was delayed longer, general complications increased significantly (p=0.03). Of all patients who died during the first year, 15% had no surgical complications, 19.3% had local complications, and 41.6%had general complications. Surgical risk and complications were significantly correlated with mortality (p<0.001).

Discussion

Hip fractures are an important cause of mortality and disability in elderly people; as well as incurring a high health cost, the frequency of these fractures has risen in recent years. The estimated prevalence of this type of injury in the United States is 4.5%in people older that 70.[10] The incidence in the general population in Spain is 84.9 hip fractures per 100,000 persons per year, and 80%of those injured are older than 70 years.[11]

The optimal time passed between diagnosis of the hip fracture and a surgical intervention is controversial, and doubts exist regarding the benefits of early surgery. In the medical literature there are various contradictory findings: some authors are in favour of urgent surgery, claiming that it reduces mortality risks,[4,6,8,9,12] while other authors find no correlation between early surgery and lower mortality rates.[3,13-15]

The presence of comorbidity in patients is a confounding factor, since in some cases it necessitates surgical delay in order to first stabilize the patient; these patients have the highest probability of dying.[4] This study eliminated these confounding factors by excluding those patients who, due to their comorbidity, required a surgical delay as indicated by medical or anaesthetic services, or because the functional capacity or previous independence of the patients was scarce, implying a poor response to rehabilitation.[4,7] The multivariate analysis allows us to estimate the effect of surgical delay independently of other possible confounding factors, such as age, ASA classification, sex, or type of surgery, anaesthesia, or fracture. ASA classification determines the functional state of the patient before the surgery and facilitates an evaluation of the patient according to their surgical risk and helps predict possible post-operative complications. Other studies have utilized these criteria for patient classification.[4,10] We used this system to divide our study into two groups: ASA class I-II patients with little or no limitations and ASA class III-IV patients with important functional limitations. We used calendar days of surgical delay starting from hospital admission, a method less precise than measuring time in hours, but more practical.[7,8,14] The medical literature does not specify what is meant by urgent or early surgery in hip fractures. Moran et al[8] define early surgery as that which is performed on the

day of admission or the following one, and Zuckerman et al[7] define it as performed in the first 3 calendar days following admission. The Sund and Liski[9] definition is within the first two nights, Dorotka et al[6] within the first 6 hrs, and others within the first 24 hrs.[3,12]

In our results, we observed that deceased patients were significantly older than the rest, a result that is biologically logical. Men also died disproportionately to women, independently of age and surgical risk, which could be explained by better basic conditions found in women. Another expected result was the higher mortality rates in patients with greater surgical risk according to ASA classification.

Type of fracture, surgical procedure, and anaesthetic administered were variables that were not found to be associated with mortality.

We have observed in this study that mortality rates in patients operated on later than 1 day following hospital admission are double those found in patients with early operations. Furthermore, this correlation is independent of sex, age, surgical risk, and type of surgery, fracture, or anaesthetic technique. We also observed that as surgical delay increased, general postoperative complications also increased, significantly contributing to a higher mortality rate.

From our results we can conclude that the 1-year mortality rate of patients who were operated on during the first day of admission to the hospital was significantly lower than that of patients operated on later due to organisational causes. As a result, we recommend that the surgical intervention for all hip fractures, whenever the state of the patient permits it, be performed in this time frame.

Conflict of interest

The authors affirm that they have no conflicts of interest.

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