

DOI: <https://doi.org/10.5554/22562087.e1080>

Experience in the perioperative management of patients with hip fracture in southwestern Colombia. Retrospective cohort study

Experiencia perioperatoria en pacientes con fractura de cadera en el suroccidente colombiano. Estudio de cohorte retrospectivo

Jossman Javier Carvajal Roa^a ; Diego Ferney Victoria Cuéllar^a ; Akemi Arango Sakamoto^b ; Gustavo Adolfo Cruz Suárez^{cd} ; Einar Sten Billefals Vallejo^{cd} ; Mabel Moreno^b ; Iván Fernando Quintero Cifuentes^{cd} ^aProgram of Specialization in Anesthesiology, School of Health Sciences, Universidad Icesi. Cali, Colombia.^bClinical Research Center, Fundación Valle del Lili. Cali, Colombia.^cDepartment of Anesthesiology, Fundación Valle del Lili. Cali, Colombia.^dSchool of Health Sciences, Department of Anesthesiology, Universidad Icesi. Cali, Colombia.**Correspondence:** Fundación Valle del Lili, Departamento de Anestesiología. Cra 98 No.18-49. Cali, Colombia.**E-mail:** ivan.quintero@fvl.org.co

Abstract

What do we know about this topic?

Hip fracture is one of the main causes of morbidity and mortality among the elderly population.

Timely surgical treatment before 48 hours improves the success of the intervention in terms of reducing complications and mortality.

There are a number of international scientific associations that collect information about perioperative management for improving the standards of care. However, there is a lack of evidence in the Colombian healthcare institutions.

What does this study contribute with?

This study offers the opportunity to learn about the characteristics of the population with hip fractures at a tertiary healthcare institution in the southwestern region of Colombia.

Spinal anesthesia is the most widely used technique for surgical procedures in this population.

The most frequent outcomes identified in this tertiary care institution are delirium and acute kidney failure.

Four out every five patients undergo surgery before 48 hours, with a low intra-hospital mortality.

How to cite this article:

Carvajal Roa JJ, Victoria Cuéllar DF, Arango Sakamoto A, Cruz Suárez GA, Billefals Vallejo ES, Moreno M, et. Al. Experience in the perioperative management of patients with hip fracture in southwestern Colombia. Retrospective cohort study. Colombian Journal of Anesthesiology. 2023;51:e1080.

Introduction

Hip fracture is one of the main causes of morbidity and mortality among the elderly population. In Colombia there is a shortage of scientific literature on the perioperative management of this population of patients.

Objective

To describe the perioperative management of hip fracture patients at a tertiary university hospital in Cali, Colombia.

Methods

An observational study was conducted with relational scope of a historical cohort of patients with hip fracture who underwent surgical management between January 2018 and June 2022. A non-probability sampling method was used and contingency tables were designed aimed at describing the relationship between the patients' characteristics and the postoperative outcomes.

Results

235 patients were included, of which 57 % were males. The mean age was 79 years and 49.8 % were classified as ASA III or higher. Spinal anesthesia was the most commonly used technique in 63.4 % of the cases. The most frequent outcomes were delirium in 17.9 %, and acute kidney failure in 6.8 %. 83.4 % of the patients underwent surgery within 48 hours of admission to the emergency department and intra-hospital mortality was 2.6 %.

Conclusions

The results of this study provide relevant information to identify opportunities for improvement and their implementation, such as the reduction in the time elapsed until surgical management and the development of care protocols in the region.

Keywords

Hip fractures; Perioperative care; Anesthesia; Elderly; Mortality; Anesthesiology.

Resumen

Introducción: La fractura de cadera es una de las principales causas de morbilidad en la población adulta mayor. En Colombia hay un déficit en la literatura científica acerca del manejo perioperatorio de esta población de pacientes.

Objetivo: Describir el manejo perioperatorio de pacientes con fractura de cadera en un hospital universitario de alto nivel de complejidad de Cali, Colombia.

Métodos: Se realizó un estudio observacional con alcance relacional de una cohorte histórica de pacientes con fractura de cadera, que recibieron manejo quirúrgico entre enero de 2018 y junio de 2022. Se hizo un muestreo no probabilístico y se diseñaron tablas de contingencia con el propósito de describir relaciones entre las características y los desenlaces posoperatorios.

Resultados: Se incluyeron 235 pacientes de los cuales el 57 % fueron hombres. La mediana de edad fue de 79 años y el 49,8 % tenían una clasificación ASA III o mayor. La anestesia espinal fue la técnica más utilizada en el 63,4 %. Los desenlaces más frecuentes fueron el delirio en el 17,9 %, y la falla renal aguda en el 6,8 %. El 83,4 % de los pacientes fueron intervenidos quirúrgicamente antes de las 48 horas desde el ingreso a urgencias y la mortalidad intrahospitalaria fue del 2,6 %.

Conclusiones: Los resultados de este estudio brindan información relevante que permite la implementación de oportunidades de mejora como disminución en los tiempos hasta el manejo quirúrgico y el desarrollo de protocolos de atención en la región.

Palabras clave: Fracturas de cadera; Atención perioperatoria; Anestesia; Anciano; Mortalidad; Anestesiología.

INTRODUCTION

Hip fracture (HF) is one of the primary causes of morbidity and mortality among the elderly population and represents a public health problem because of its frequency and high socio-economic cost. (1) The annual incidence in Colombia has been estimated at 8,000 to 10,000 cases. Moreover, there has been an increase among the population over 65 years old, from 7.68 % in 2005 to 8.5 % in 2020. (2)

Timeliness of a surgical treatment over the first 24-48 hours after the diagnosis significantly improves the success of the intervention. (3,4) Perioperative management involves the comprehensive healthcare practice during the surgical procedure. (5) Some of the big perioperative challenges are the choice of the anesthesia technique (6), the pharmacological reversal of anticoagulated patients (7), the antiplatelet therapy (8) and the assessment and optimization of any underlying pathologies prior to the surgical procedure. (9)

Notwithstanding the knowledge about multiple factors inherent to the health status, such as old age, the socio-economic condition, history of diseases (10), and the factors associated with the perioperative

care of patients with HF, there are few studies in Colombia addressing the socio-demographic and clinical characteristics to strengthen the management protocols, and to allow for improved quality of care and better health outcomes. (11) The purpose of this study is to explain the perioperative management of patients with HF and to document the clinical outcomes observed at a tertiary university hospital in Cali, Colombia.

METHODS

A retrospective, observational, cohort study was conducted in a historical cohort of patients diagnosed with HF and undergoing surgical management.

A non-probability sampling method was used for patients with HF admitted to the emergency department and receiving surgical management between January 2018 and June 2022. Both male and female patients over 18 years old with HF were included; these patients were admitted to the institution according to their diagnosis and underlying pathologies (assessed by the emergency department physician, internal medicine, orthopedics and

geriatrics). Pregnant women, patients with a diagnosis of osteogenesis imperfecta, and defined multiple trauma patients (i.e., patients with head and neck trauma, thoraco-abdominal blunt or open trauma) concomitant with the HF at the time of admission, were excluded.

The patients that met the inclusion criteria were selected upon approval of the research protocol. The information was collected by three trained investigators. The information was uploaded into the electronic database available in the institutional digital platform (BDClinic), and the databases were analyzed in order to address each of the specific objectives. 10% of the data were randomly selected to assess the quality of the information, and were compared against the source documents (medical record).

Primary outcomes: The primary outcome was the identification of delirium recorded in the medical record or suspicious of the event during the immediate postoperative period until discharge; acute kidney failure defined as a diuresis < 0.3 cm³/kg/h during 24 hours and/or an increase in serum creatinine of twice the baseline level, and the need for postoperative Intensive Care Unit

Table 1. Socio-demographic and clinical characteristics.

| Variable | Sample size (n = 235) |
|------------------------------------|--------------------------|
| Age and gender | |
| Age † | 79 (62 - 92) |
| Females ‡ | 101 (43.0) |
| Males ‡ | 134 (57.0) |
| ASA Classification | |
| ASA I‡ | 29 (12.3) |
| ASA II‡ | 89 (37.9) |
| ASA III‡ | 101 (43.0) |
| ASA IV‡ | 16 (6.8) |
| History | |
| Stroke‡ | 15 (6.4) |
| Anemia‡ | 113 (48.1) |
| Antiplatelet therapy‡ | 39 (16.6) |
| Anticoagulation‡ | 18 (7.7) |
| Dementia‡ | 54 (23.0) |
| Diabetes mellitus type 2‡ | 46 (19.6) |
| Cancer ‡ | 25 (10.6) |
| Chronic kidney disease ‡ | 21 (8.9) |
| Hypertension‡ | 133 (56.6) |
| CHF* LVEF** < 40%‡ | 5 (2.1) |
| Obesity ‡ | 21 (8.9) |
| Nursing home ‡ | 15 (6.5) |
| Type of fracture | |
| Extracapsular ‡ | 160 (68.1) |
| Intracapsular ‡ | 75 (31.9) |
| Pre-surgical care | |
| Request for TT ECG *** | 23 (9.8) |
| Pre-surgical assessment by IM **** | 133 (56.6) |

*CHF = Congestive heart Failure, **LVEF = Left ventricular ejection fraction. ***transthoracic ECG, ****IM = Internal medicine, † Median (interquartile range), ‡ n (%).

Source: Authors.

(ICU) monitoring. Finally, intra-hospital mortality also was taken into account.

Secondary outcomes: these considered the need for anti-fibrinolytics use, vasoactive support requirements, use of intraoperative blood products, ICU length of stay, stroke diagnosis, surgical site infection, diagnosis of pneumonia within 48 hours after hospital admission, and/or pulmonary thromboembolism during hospitalization, diagnosis of acute myocardial infarction and non-fatal cardiac arrest.

Once the quality of the information was ascertained, a univariate analysis was conducted to determine the behavior of the numerical variables. The data on asymmetric quantitative variables were submitted as medians and interquartile ranges. With regards to the categorical variables, absolute and relative frequencies were submitted; contingency tables were developed intended to describe the relationships between the clinical and demographic characteristics and the management of anesthesia against the postoperative outcomes based on the exact Fisher's test or the Pearson Chi square test. In order to compare the average length of hospital stay with the perioperative variables, a Student-t test was conducted for parametric distribution variables.

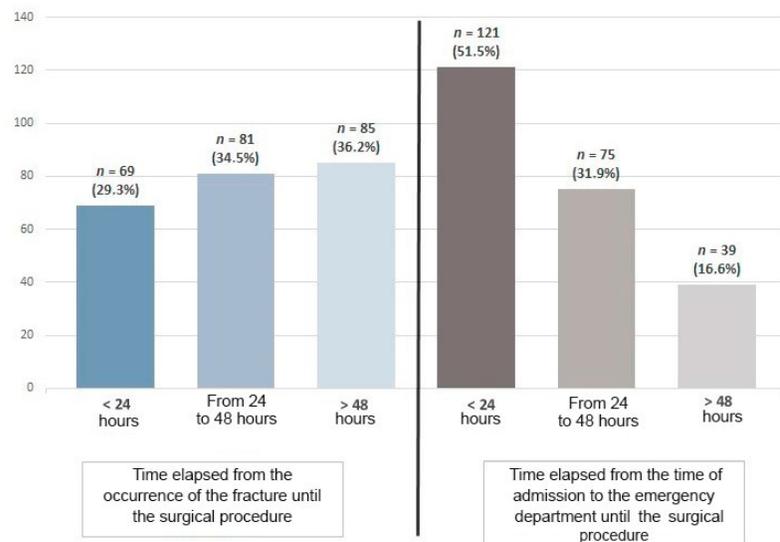
This study was approved by the Ethics in Biomedical Research Committee of the Fundación Valle del Lili, according to the administrative act No. 17 of August 16, 2022. Because of the retrospective nature of the study and pursuant to Article 11 of Resolution 8430 of 1993 of the Colombian Law, this study was considered "no risk", and hence did not require signing of an informed consent.

RESULTS

235 patients undergoing surgery between January 2018 and June 2022 were included. The demographic and clinical characteristics of the population are shown in Table 1. The mean age was 79 years and 57% (n=134) were males. 7.7% (n=18) of the patients had been receiving anticoagulation therapy and 16.6% (n=39) were taking antiplatelet medication such as aspirin and P2Y12 inhibitors.

68.1% (n=160) of the patients experienced an extracapsular fracture. In 83.7% (n=196) of the patients, the time elapsed since admission to the emergency department and the surgery was less than 48 hours, whilst in 64.5% (n=150) less than 48 hours elapsed between the time of the trauma and/or fracture and the surgical

Figure 1. Time elapsed from the occurrence of the fracture and admission to the emergency department, until the surgical procedure.



Source: Authors.

Table 2. Intraoperative characteristics.

| Anesthetic technique (n = 235) | |
|---|------------|
| General [‡] | 61 (26.0) |
| General + regional [‡] | 18 (7.7) |
| Spinal [‡] | 101 (43.0) |
| Spinal + regional [‡] | 55 (23.4) |
| Regional block (n = 73) | |
| Femoral block [‡] | 45 (61.6) |
| Fascia Iliaca block [‡] | 18 (24.7) |
| Lateral femoral cutaneous block [‡] | 3 (4.1) |
| PENG Block [‡] | 7 (9.6) |
| Monitoring and support (n = 235) | |
| Use of tranexamic acid [‡] | 56 (23.8) |
| Invasive blood pressure monitoring [‡] | 30 (12.8) |
| Vasopressor support requirement ^{‡*} | 73 (31.1) |
| Transfusion of blood products [‡] | 13 (5.5) |
| Transfusion of blood products (n = 13) | |
| Red blood cell transfusion [‡] | 12 |
| Transfusion of fresh frozen plasma [‡] | 2 |
| Platelet transfusion | 1 |

* Continuous norepinephrine infusion [‡] n (%), [‡] n.

Source: Authors.

Table 3. Outcomes during the hospital stay.

| Measured outcome (n = 235) | |
|---|---------------|
| Need for postoperative ICU ^{* ‡} | 52 (22.1) |
| Stroke [‡] | 1 (0.4) |
| Non-fatal cardiac arrest [‡] | 1 (0.4) |
| Pulmonary complications [‡] | 3 (1.3) |
| Delirium [‡] | 42 (17.9) |
| Acute kidney failure [‡] | 16 (6.8) |
| Acute myocardial infarction [‡] | 1 (0.4) |
| Surgical site infection [‡] | 0 |
| Intra-hospital mortality [‡] | 6 (2.6) |
| Length of stay | |
| Number of ICU days ^{* †} | 3.0 (2.0-4.0) |
| Number of hospitalized days [†] | 4.0 (3.0-7.0) |

* ICU= Intensive care unit, [†] Median (interquartile range), [‡] n (%).

Source: Authors.

procedure. The time elapsed from the moment of the fracture, the admission to the emergency department, and the choice of the anesthetic technique are illustrated in [Figure 1](#) and in [Table 2](#).

31.1% (n=73) of the patients required a continuous norepinephrine infusion, and 12.8% (n=30) required invasive blood pressure monitoring during the intraoperative period. Tranexamic acid was administered to 23.8% (n=56) of the patients. Blood products transfusion was administered based on the opinion of the treating anesthesiologist in 5.5% (n=13) of the patients. The intraoperative variables of the patients are shown in [Table 2](#).

22.1% (n=52) of the patients needed to be transferred to the ICU during the postoperative period, with a mean length of stay of 3 days (IQR 2-4) ([Table 3](#)). The need for ICU transfer was associated with old age, ASA III-IV classification, a history of cardiovascular disease, chronic kidney disease, dementia, time of patient admission to the emergency department until surgery of more than 48 hours, need for vasoactive support, and use of general anesthesia ([Table 4](#)). The mean hospital stay until discharge was 4 days (IQR 3-7).

The intra-hospital mortality was 2.6% (n=6), and was associated with a history of dementia, more than 48 hours between the occurrence of the fracture and surgery, the use of spinal anesthesia and older age ([Table 4](#)). The most frequent outcomes were postoperative delirium diagnosed in 17.9% (n=42) of the patients, followed by acute kidney failure in 6.8% (n=16). The bivariate analysis showed a statistically significant relationship of these outcomes with older age, ASA III and IV classification, a history of high blood pressure, and preoperative anemia. The analysis of the factors associated with the outcomes assessed are illustrated in [Table 4](#).

DISCUSSION

HF is a frequent pathology among the elderly population. In the world context,

Table 4. Factors associated with the outcomes assessed.

| Variable | Outcome | | | | | | | | | | | |
|---|-----------------|-----------------|------------|-----------------|-----------------|------------|------------------|-----------------|------------|--------------------------|-----------------|------------|
| | Delirium | | | Kidney failure | | | ICU* requirement | | | Intra-hospital mortality | | |
| | Yes (n = 42) | No (n = 193) | P value | Yes (n = 16) | No (n = 219) | P value | Yes (n = 52) | No (n = 183) | P value | Yes (n = 6) | No (n = 229) | P value |
| Age † | 85 (80 - 90) | 78 (62 - 84) | 0.001 | 90 (80 - 92) | 78 (63 - 85) | 0.001 | 84 (73 - 89) | 78 (63 - 84) | 0.023 | 91 (85 - 92) | 79 (65 - 85) | 0.009 |
| ASA classification | | | 0.005 | | | 0.014 | | | 0.001 | | | 0.063 |
| ASA I‡ | 1 (2.4) | 28 (14.5) | - | 0 | 29 (13.2) | - | 2 (3.8) | 27 (14.8) | - | 0 | 29 (12.7) | - |
| ASA II‡ | 13 (31.0) | 76 (39.4) | - | 5 (31.2) | 84 (38.4) | - | 9 (17.3) | 80 (43.7) | - | 2 (33.3) | 87 (38.0) | - |
| ASA III‡ | 21 (50.0) | 80 (41.5) | - | 7 (43.8) | 94 (42.9) | - | 31 (59.6) | 70 (38.3) | - | 2 (33.3) | 99 (43.2) | - |
| ASA IV‡ | 7 (16.7) | 9 (4.7) | - | 4 (25.0) | 12 (5.5) | - | 10 (19.2) | 6 (3.3) | - | 2 (33.3) | 14 (6.1) | - |
| Stroke‡ | 3 (7.1) | 12 (6.2) | 0.9 | 1 (6.2) | 14 (6.4) | 0.9 | 8 (15.4) | 7 (3.8) | 0.007 | 0 | 15 (6.6) | 0.9 |
| Pre-operative anemia ‡ | 29 (69.0) | 84 (43.5) | 0.005 | 15 (93.8) | 98 (44.7) | 0.001 | 36 (69.2) | 77 (42.1) | 0.001 | 3 (50.0) | 110 (48.0) | 0.9 |
| Dementia‡ | 21 (50.0) | 33 (17.1) | 0.001 | 6 (37.5) | 48 (21.9) | 0.3 | 19 (36.5) | 35 (19.1) | 0.014 | 5 (83.3) | 49 (21.4) | 0.002 |
| Diabetes mellitus type 2‡ | 9 (21.4) | 37 (19.2) | 0.9 | 7 (43.8) | 39 (17.8) | 0.028 | 18 (34.6) | 28 (15.3) | 0.004 | 1 (16.7) | 45 (19.7) | 0.9 |
| Chronic kidney disease‡ | 6 (14.3) | 15 (7.8) | 0.3 | 9 (56.2) | 12 (5.5) | 0.001 | 9 (17.3) | 12 (6.6) | 0.034 | 1 (16.7) | 20 (8.7) | 0.9 |
| Hypertension ‡ | 33 (78.6) | 100 (51.8) | 0.003 | 14 (87.5) | 119 (54.3) | 0.02 | 32 (61.5) | 101 (55.2) | 0.5 | 5 (83.3) | 128 (55.9) | 0.4 |
| CHF** LVEF*** <40%‡ | 0 | 5 (2.6) | 0.6 | 1 (6.2) | 4 (1.8%) | 0.8 | 4 (7.7) | 1 (0.5) | 0.009 | 1 (16.7) | 4 (1.7) | 0.3 |
| Time from admission to the emergency department until surgery of more than 48 hours ‡ | 10 (23.8) | 29 (15.0) | 0.4 | 4 (25.0) | 35 (16.0) | 0.5 | 15 (28.8) | 24 (13.1) | 0.016 | 2 (33.3) | 37 (16.2) | 0.2 |
| Time from the occurrence of fracture until surgery of more than 48 hours ‡ | 20 (47.6) | 65 (33.7) | 0.2 | 8 (50.0) | 77 (35.2) | 0.2 | 26 (50.0) | 59 (32.2) | 0.059 | 80 (34.9) | 5 (83.3) | 0.046 |
| Anesthetic technique | | | 0.2 | | | 0.9 | | | 0.001 | | | 0.006 |
| General anesthesia ‡ | 9 (21.4) | 52 (26.9) | - | 4 (25.0) | 57 (26.0) | - | 27 (51.9) | 34 (18.6) | - | 0 | 61 (26.6) | - |
| General + regional anesthesia ‡ | 2 (4.8) | 16 (8.3) | - | 1 (6.2) | 17 (7.8) | - | 3 (5.8) | 15 (8.2) | - | 0 | 18 (7.9) | - |
| Spinal anesthesia ‡ | 24 (57.1) | 77 (39.9) | - | 6 (37.5) | 95 (43.4) | - | 13 (25.0) | 88 (48.1) | - | 1 (16.7) | 100 (43.7) | - |
| Spinal + regional anesthesia ‡ | 7 (16.7) | 48 (24.9) | - | 5 (31.2) | 50 (22.8) | - | 9 (17.3) | 46 (25.1) | - | 5 (83.3) | 50 (21.8) | - |
| Use of antifibrinolytics ‡ | 8 (19.0) | 48 (24.9) | 0.5 | 2 (12.5) | 54 (24.7) | 0.4 | 7 (13.5) | 49 (26.8) | 0.071 | 0 | 56 (24.5) | 0.4 |
| Invasive blood pressure monitoring ‡ | 13 (31.0) | 17 (8.8) | 0.001 | 4 (25.0) | 26 (11.9) | 0.3 | 28 (53.8) | 2 (1.1) | 0.001 | 3 (50.0) | 27 (11.8) | 0.032 |
| Need for vasopressor support ‡ | 18 (42.9) | 55 (28.5) | 0.1 | 3 (18.8) | 70 (32.0) | 0.4 | 28 (53.8) | 45 (24.6) | 0.001 | 3 (50.0) | 70 (30.6) | 0.6 |

*ICU = Intensive Care Unit, **CHF = Congestive Heart Failure, ***LVEF = Left Ventricular Ejection Fraction, † Median (interquartile range), ‡ n (%).

Source: Authors.

the likelihood of a hip fracture increases by 3.1 % in males and by 18.2 % in females over 65 years old. (12) In Colombia, the incidence is estimated at 8,000 and 10,000 cases per year. (2) In this study, an average of 4.3 cases of patients undergoing surgery per month was estimated, which is similar to the average of 4.8 cases per month reported in a tertiary hospital in the study conducted by Caicedo et al., in another city in Colombia. (13)

Some of the characteristics of the patients with HF undergoing surgical management in the population herein studied are different from the characteristics described in the literature. The mean age of 79 years is lower than what is reported in a British database which is 83 years (14). This may be due in part to the longer life expectancy in developed countries. Also noteworthy is the gender-based incidence, since according to the literature, women present with hip fractures more often than men because of osteoporosis (15); in this paper, the proportion between males and females was similar.

The high burden of the disease becomes obvious according to the ASA classification, indicating that most of these patients exhibit at least one chronic condition as a comorbidity when they come to receive medical care because of the HF, and this is consistent with literature. (14) This fact is a challenge for the medical team. As shown in the results of this study, some patients require a preoperative assessment by internal medicine to optimize or control their underlying pathologies, as well as a transthoracic ECG to stage the cardiovascular risk of the patient. It should be highlighted that such interventions, particularly the ECG are not recommended on a routine basis, since it has been shown that reducing the time elapsed to administer care not only lowers the morbidity and mortality, but also shortens the hospital stay and improves patient satisfaction (16,17); hence, the ECG is only reserved for patients with a high burden of cardiovascular morbidity, for example in patients with suspicious heart failure,

severe valve disease and/or significant decline of the functional class since their last ECG. (18) The current recommendation is to conduct a preoperative ECG pursuant to the medical opinion of the multidisciplinary team, based on institutional protocols developed in accordance with the scientific evidence. (19,20)

In 16.6% of the patients there was a delay of more than 48 hours between their admission to the emergency department of the institution and the surgical procedure, which is a shorter time as compared to the time elapsed between admission to the emergency department and surgery as described by Caicedo et al., in a tertiary Colombian hospital, where the mean delay was more than 4 days. (13) In the study by Moran et al., the percentage of patients who experienced a delay of more than 48 hours from the time of admission to the emergency department was 7.9% (21), suggesting a wide variability among the various health centers. Among the probable causes for the delay of surgery there is the acute decompensation of conditions such as hypertension, diabetes mellitus type 2 and congestive heart failure, which require complementary assessments and preoperative management.

The results of this study indicate that 36.2% of the patients underwent surgery after 48 hours of the trauma event, which is consistent with other reports with regards to delays, such as Smektala et al., who reports that 31.6% of the patients has a waiting time of over 48 hours from the time of fracture until the surgical intervention. (22) This paper collected the potential causes for such delay, which included adjournment of the visit to the emergency department and consults with healthcare centers that were unable to deliver comprehensive care and referred the patient to the institution.

The discussion about the selection of the anesthesia technique is extensive and there is no consistency favoring any particular anesthetic approach. Scientific associations such as NYSORA and ASRA tend to favor regional anesthesia in addition to multimodal analgesia for the

management of patients with HF. (23,24) The recommendations of the clinical guidelines focus on improving the practice within each technique, which involves adjusting for the appropriate dosing of medications based on age, the joint administration of regional block as part of multimodal analgesia, and a careful intraoperative blood pressure control. (25) In this study, the most frequently used technique was pure spinal anesthesia, or in combination with a regional block as an adjuvant for the management of analgesia, as part of the multimodal analgesia strategy. The criteria regarding the choice of the anesthetic technique was not assessed in the study; however, one may assume that to a large extent, the experience of the anesthesiologist in charge of the case and the patient's comorbidities play a key role.

Among the postoperative outcomes, the most frequent complication was delirium in 17.9% of the patients. This percentage is similar to that described in a multicenter study conducted in the United States and Canada, which compared general anesthesia vs. spinal anesthesia in patients with HF, with an incidence of delirium of around 20%, with no statistical difference between the two groups. (26) Delirium was associated with preoperative anemia, a history of dementia, progressively older patients, and a high burden of morbidities based on the ASA classification.

Kidney failure was the second most frequent complication among the population in this study, with a 6.8%. An incidence between 4.5% and 7.6% of acute kidney failure has been described in patients with HF undergoing surgery (26), which is consistent with the results herein discussed. Furthermore, the percentage obtained is similar to the 8.1% reported in a study conducted on the incidence of acute kidney failure in major surgery. (27)

The frequency of surgical site infection described in the literature is of 0.3% (26). This complication was not present in this study during the study period. Although having zero surgical site infections is encouraging, the compliance with the

protocols of asepsis and antisepsis, and the standardized use of antibiotic prophylaxis during the observation period, could have had an impact.

Another aspect that has given rise to a significant controversy in the perioperative management of patients with HF is the anticoagulation and antiplatelet therapy. In accordance with the current evidence, it is clear that there is no need to adjourn surgery in patients with HF receiving antiplatelet therapy as monotherapy or dual anti-aggregation with aspirin plus a P2Y₁₂ receptor inhibitor such as clopidogrel, prasugrel and ticagrelor. (28,29) In patients anticoagulated with warfarin or direct oral anticoagulants, the surgical procedure should not be deferred for more than 48 hours, individualizing the approach for each patient. (30,31) No significant statistical relationship was found in this study between the history of anticoagulation and/or antiplatelet therapy with the outcomes assessed. One of the causes for a longer than 48-hour delay between the time of fracture and surgery was the referral of patients with dual antiplatelet therapy or anticoagulated from other healthcare institutions.

Occasionally, patients may require ICU monitoring after surgery. (32) Consequently, some management guidelines recommend having an ICU available in the institutions that take care of patients with HF. (33) In this study, 22.1% of the patients required postoperative ICU monitoring, which contrasts with a multicenter study conducted in the United States and Canada where the postoperative ICU requirement was 2.3% and 3.7%, respectively. (26) This difference may be due to differences in the level of complexity of the institutions where the studies were conducted, and to the high burden of morbidity of the patients, since in this case we were dealing with a referral center in the southwestern region of Colombia.

When comparing the number of hospitalized days, an average of 4 days (IQR 3-7) was identified in the institution, similar to the length of stay described in the

study from the United States with a mean of 3 days (IQR 2-5) and 6 days (IQR 4-9) in the centers in Canada. According to the authors, the difference between the two countries reflects the differences in clinical practice. (26)

The mortality until hospital discharge for the population in this study was 2.6%, as compared to the 5% documented in a study by Nurmi et al., in Finland, early in 2000. (34) This difference in intrahospital mortality is probably due to the improved healthcare protocols, the technological progress with regards to monitoring and the safe use of medications in the anesthetic techniques, since the population characteristics in terms of age and ASA classification are similar in both studies.

The bivariate analysis of the intrahospital mortality outcome showed raw associations with a history of dementia and with the time elapsed since the occurrence of the fracture until the surgical procedure which exceeded 48 hours; this is consistent with the literature. (10) Furthermore, a significant relationship was established with the spinal anesthesia technique, which could probably be explained based on the intent of the anesthesiologist to avoid general anesthesia in elderly patients, with a history of dementia and increased morbidity. None of these associations has a causal interpretation.

In terms of the limitations, this study was conducted in a single center in the city; however, the institution is a referral center for lower level hospitals in the southwestern region of the country. Multiple trauma was considered to extend the hospital stay and affected decision-making vis a vis the management of the hip fracture; hence, this exclusion criteria also reduced the size of the sample of the population. Moreover, due to the nature of the study, no further follow-up was conducted after discharge and hence mortality and outcomes were only considered until the patient's discharge. Finally, in contrast to a study conducted at the San Ignacio University Hospital in Bogotá, where malnutrition

and functional disability were considered as independent variables for morbidity and mortality in patients with HF (35), these variables were not measured in the study herein discussed.

The results enable the characterization of the population with hip fracture in a tertiary healthcare institution in the southwestern region of Colombia, emphasizing that most of these patients are elderly individuals with a high burden of morbidity as evidenced by the ASA III and IV classification; these characteristics have been described as independent factors for morbidity and mortality. Moreover, they allow for the identification of opportunities for improvement in care, such as improving timeliness of surgery. The expectation is that this study may contribute to the development of protocols and/or clinical management guidelines based on scientific evidence, to lower the incidence of unfavorable outcomes in patients.

ETHICAL RESPONSIBILITIES

Ethics Committee approval

This study was approved by the Ethics in Biomedical Research Committee of Fundación Valle del Lili, through administrative Act 17 of August 16, 2022.

Protection of Humans and Animals

The authors declare that no experiments in human beings or animals were conducted for this research project. The authors declare that the procedures followed were consistent with the ethical standards of the responsible human experimentation ethics committee and pursuant to the World Medical Association and the Declaration of Helsinki.

Confidentiality of the data

The authors declare that they followed the protocols of their work center on the publication of patient data.

Right to privacy and informed consent

The authors declare that no patient data are disclosed in this article. Given the retrospective nature of the study, and in accordance with Article 11 of Resolution 8430 of 1993 of the Colombian Law, this study was considered “no risk”, hence voiding the requirement for a signed informed consent.

ACKNOWLEDGEMENTS

Contributions of the authors

IFQC, GACS, ESBV and MM: Planning of the study, interpretation of the results and drafting of the manuscript.

JJCR: Planning of the study, data collection, interpretation of the results and drafting of the manuscript.

DFVC: Data collection, interpretation of the results and drafting of the manuscript.

AAS: Planning of the study, data collection, interpretation of the results.

Assistance for the study

None declared.

Financial support and sponsorship

None declared.

Conflicts of interest

None declared.

Presentations

None declared.

REFERENCES

- Cooper C, Campion G, Melton LJ 3rd. Hip fractures in the elderly: a world-wide projection. *Osteoporos Int.* 1992;2(6):285-9. doi: [10.1007/BF01623184](https://doi.org/10.1007/BF01623184). doi: <https://doi.org/10.1007/BF01623184>
- González L, Vásquez G, Molina J. Epidemiology of osteoporosis. *Rev Colomb Reumatol.* 2009;16(1):61-75. doi: [https://doi.org/10.1016/S0121-8123\(09\)70119-7](https://doi.org/10.1016/S0121-8123(09)70119-7)
- Buse GL, Bhandari M, Sancheti P, Rocha S, Winesmaker M, Adili A, et al. Accelerated care versus standard care among patients with hip fracture: The HIP ATTACK pilot trial. *CMAJ.* 2014;186(1). doi: <https://doi.org/10.1503/cmaj.130901>
- Merchán-Galvis Á, Muñoz DA, Solano F, Velásquez JC. Delay in hip fracture surgery and its outcomes. A reflection. *Colombian Journal of Anesthesiology.* 2021;49(1). doi: <https://doi.org/10.5554/22562087.e915>
- National Cancer Institute. Perioperative Management [Internet]. [cited 2 Jul 2022]. Available at: <https://www.cancer.gov/publications/dictionaries/cancer-terms/def/perioperative>
- Neuman MD, Ellenberg SS, Sieber FE, Magaziner JS, Feng R, Carson JL. Regional versus General Anesthesia for Promoting Independence after Hip Fracture (REGAIN): protocol for a pragmatic, international multicentre trial. *BMJ Open.* 2016;6:13473. doi: <https://doi.org/10.1136/bmjopen-2016-013473>
- Tafur A, Douketis J. Perioperative management of anticoagulant and antiplatelet therapy. *Heart.* 2018;104(17):1461-7. doi: <https://doi.org/10.1136/heartjnl-2016-310581>
- Tarrant SM, Kim RC, McGregor KL, Palazzi K, Atia J, Balogh ZJ. Dual antiplatelet therapy and surgical timing in geriatric hip fracture. *J Orthop Trauma.* 2020;34(10):559-65. doi: <https://doi.org/10.1097/BOT.0000000000001779>
- Simunovic N, Devereaux PJ, Sprague S, Guyatt GH, Schemitsch E, DeBeer J, et al. Effect of early surgery after hip fracture on mortality and complications: Systematic review and meta-analysis. *CMAJ.* Canadian Medical Association. 2010;182:1609-16. doi: <https://doi.org/10.1503/cmaj.092220>
- Bhandari M, Koo H, Saunders L, Shaughnessy SG, Dunlop RB, Schemitsch EH. Predictors of in-hospital mortality following operative management of hip fractures. *Int J Surg Investig.* 1999;1(4):319-26.
- Uribe Ríos A, Castaño Herrera DA, García Ortega AN, Pardo Aluma EE. Morbilidad y mortalidad en pacientes mayores de 60 años con fractura de cadera en el Hospital Universitario San Vicente Fundación, de Medellín, Colombia. *Iatreia.* 2012;25(4):305-13. doi: <https://doi.org/10.17533/udea.iatreia.13104>
- Odén A, McCloskey E, Kanis JA, Harvey NC, Johansson H. Burden of high fracture probability worldwide: secular increases 2010-2040. *Osteoporosis Internat.* 2015;26(9):2243-8. doi: <https://doi.org/10.1007/s00198-015-3154-6>
- Caicedo Sanguino DF, Araque Melo AE, Rojas Quintero NR, Villamizar Quintero SE. Epidemiology of hip fracture in adults treated at a tertiary level hospital. *Rev Invest Salud Universidad de Boyacá.* 2020;7(2). doi: <https://doi.org/10.24267/23897325.551>
- National Hip Fracture Database [Internet]. s.f. [cited 2022 Jun 11]. Available at: <https://www.nhfd.co.uk>
- Martínez Rondanelli A. Hip fractures in the elderly: prognosis, epidemiology. Overview: Experience. *Rev Colomb Ortop Traumatol.* 2005;19(1)20-8.
- Jiang M, Liu S, Deng H, Liang X, Bo Z. The efficacy and safety of fast track surgery (FTS) in patients after hip fracture surgery: a meta-analysis. *J Orthopaedic Surg Rese. BioMed Central.* 2021;16. doi: <https://doi.org/10.1186/s13018-021-02277-w>
- Seong YJ, Shin WC, Moon NH, Suh KT. Timing of hip-fracture surgery in elderly patients: Literature review and recommendations. *Hip Pelvis.* 2020;32(1):11. doi: <https://doi.org/10.5371/hp.2020.32.1.11>
- Rostagno C, Ranalli C, Polidori G, Cartei A, Boccaccini A, Peris A. Outcome in elderly patients with aortic stenosis undergoing hip fracture surgery. Results may suggest a different postoperative strategy? *Trauma Surg Acute Care Open.* 2019;4(1): e000218. doi: <https://doi.org/10.1136/tsaco-2018-000218>
- Halvorsen S, Mehilli J, Cassese S, Hall TS, Abdelhamid M, Barbato E, et al. 2022 ESC Guidelines on cardiovascular assessment and management of patients undergoing non-cardiac surgery. *Eur Heart J.* 2022;43(39):3826-924. doi: <https://doi.org/10.1093/eurheartj/ehac270>
- Eagle KA, Berger PB, Calkins H, Chaitman BR, Ewy GA, Fleischmann KE, et al. ACC/AHA

- Guideline Update for Perioperative Cardiovascular Evaluation for Noncardiac Surgery-Executive Summary A Report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines (Committee to Update the 1996 Guidelines on Perioperative Cardiovascular Evaluation for Noncardiac Surgery) Committee Members [Internet]. 2002 [cited 2023 Apr 12]. Available at: www.acc.org
21. Moran CG, Wenn RT, Sikand M, Taylor AM. Early mortality after hip fracture: Is delay before surgery important?. 2005;87(3):483-89. doi: <https://doi.org/10.2106/JBJS.D.01796>
 22. Smekotala R, Endres HG, Dasch B, Maier C, Trampisch HJ, Bonnaire F, et al. The effect of time-to-surgery on outcome in elderly patients with proximal femoral fractures. *BMC Musculoskelet Disord*. 2008;9:171. doi: <https://doi.org/10.1186/1471-2474-9-171>
 23. Hadzic A. Spinal or general anesthesia for hip fracture [Internet]. 2022 [cited 2023 Jan 11]. Available at: <https://www.nysora.com/news/spinal-or-general-anesthesia-for-hip-fracture/>
 24. Beaudoin FL, Haran JP, Liebmann O. A comparison of ultrasound-guided three-in-one femoral nerve block versus parenteral opioids alone for analgesia in emergency department patients with hip fractures: A randomized controlled trial. *Acad Emerg Med*. 2013;20(6):584-91. doi: <https://doi.org/10.1111/acem.12154>
 25. Griffiths R, Babu S, Dixon P, Freeman N, Hurlford D, Kelleher E, et al. Guideline for the management of hip fractures 2020: Guideline by the Association of Anaesthetists. *Anaesthesia*. 2021;76(2):225-37. doi: <https://doi.org/10.1111/anae.15291>
 26. Neuman MD, Feng R, Carson JL, Gaskins LJ, Dillane D, Sessler DI, et al. Spinal anesthesia or general anesthesia for hip surgery in older adults. *New Eng J Med*. 2021;385(22):2025-35. doi: <https://doi.org/10.1056/NEJMoa2113514>
 27. Quan S, Pannu N, Wilson T, Ball C, Tan Z, Tonelli M, et al. Prognostic implications of adding urine output to serum creatinine measurements for staging of acute kidney injury after major surgery: A cohort study. *Nephrol Dialysis Transplant*. 2016;31(12):2049-56. doi: <https://doi.org/10.1093/ndt/gfw374>
 28. Yang Z, Ni J, Long Z, Kuang L, Gao Y, Tao S. Is hip fracture surgery safe for patients on antiplatelet drugs and is it necessary to delay surgery? A systematic review and meta-analysis. *J Orthop Surg Res*. 2020;15(1). doi: <https://doi.org/10.1186/s13018-020-01624-7>
 29. Collinge CA, Kelly KC, Little B, Weaver T, Schuster RD. The effects of clopidogrel (plavix) and other oral anticoagulants on early hip fracture surgery [Internet]. [cited 2023 Apr 12]. Available at: www.jorthotrauma.com
 30. Papachristos I, Giannoudis P. Proximal femur fractures in patients taking anticoagulants. *EFORT Open Rev*. 2020;5(10):700-6. doi: <https://doi.org/10.1302/2058-5241.5.190071>
 31. Godier A, Dincq AS, Line Martin AC, Radu A, Leblanc I, Antona M, et al. Predictors of pre-procedural concentrations of direct oral anticoagulants: A prospective multicentre study. *Eur Heart J*. 2017;38(31):2431-9. doi: <https://doi.org/10.1093/eurheartj/ehx403>
 32. Gibson AA, Hay AW, Ray DC. Patients with hip fracture admitted to critical care: Epidemiology, interventions and outcome. *Injury*. 2014;45(7):1066-70. doi: <https://doi.org/10.1016/j.injury.2014.02.037>
 33. Griffiths R, Alper J, Beckingsale A, Goldhill D, Heyburn G, Holloway J, et al. Management of proximal femoral fractures 2011: Association of Anaesthetists of Great Britain and Ireland. *Anaesthesia*. 2012;67:85-98. doi: <https://doi.org/10.1111/j.1365-2044.2011.06957.x>
 34. Nurmi I, Narinen A, Lüthje P, Tanninen S. Functional outcome and survival after hip fracture in elderly: A prospective study of 106 consecutive patients. *J Orthopaedics Traumatol*. 2004;5(1):7-14. doi: <https://doi.org/10.1007/s10195-004-0033-x>
 35. Caicedo-Correa SM, Aruachan-Torres SA, Segura-Valencia AI, Chavarro-Carvajal DA. Asociación del estado nutricional y funcional en ancianos con fractura de cadera. *Acta Med Colomb*. 2019;44(1):7-10. doi: <https://doi.org/10.36104/amc.2019.1035>