

## ORIGINAL RESEARCH

## ERAS / GERIATRIC ANESTHESIA

# Accelerated operative recovery in elderly patients with femoral fractures: Our experience of ten years with 870 patients

Luiz Eduardo Imbelloni, MD, PhD<sup>1</sup>, Douglas M. P. Teixeira, MD<sup>2</sup>, Umberto Lima, MD<sup>3</sup>, Thaís Bezerra Ventura, MD<sup>4</sup>, Siddharta Lacerda, MD<sup>5</sup>, Bruno Brasileiro, MD<sup>6</sup>, Robson Barbosa, MD<sup>7</sup>, Micaela Barbosa L. Sales, MD<sup>8</sup>, Márcio Duarte, MD<sup>9</sup>, Geraldo Borges de Moraes Filho, MSc<sup>10</sup>

## Author affiliation:

1. Luiz Eduardo Imbelloni, Anesthesiologist of Complexo Hospitalar Mangabeira, João Pessoa, PB. Co-responsible for CET-SBA Hospital Clínicas Municipal de São Bernardo do Campo, SP, Brazil. INCA Senior Researcher, Rio de Janeiro, RJ, Brazil; E-mail: [dr.luiz.imbelloni@gmail.com](mailto:dr.luiz.imbelloni@gmail.com)
2. Douglas M. P. Teixeira, Orthopedic Surgeon, Complexo Hospitalar Mangabeira Gov. Tarcisio Burity, João Pessoa, PB, Brazil; E-mail: [drdouglasteixeira@hotmail.com](mailto:drdouglasteixeira@hotmail.com)
3. Umberto Lima, Orthopedic Surgeon, Complexo Hospitalar Mangabeira Gov. Tarcisio Burity, João Pessoa, PB, Brazil; E-mail: [limaumberto@gmail.com](mailto:limaumberto@gmail.com)
4. Thaís Bezerra Ventura, Anesthesiologist of Hospital Regional Wenceslaw Lopes, Piancó, PB, Brazil; E-mail: [thaisvenbez@hotmail.com](mailto:thaisvenbez@hotmail.com)
5. Siddharta Lacerda, Anesthesiologist of Hospital da Santa Clara, Campina Grande, PB, Brazil; E-mail: [siddharta\\_lacerda@hotmail.com](mailto:siddharta_lacerda@hotmail.com)
6. Bruno Brasileiro, Anesthesiologist of Hospital Alberto Urquiza Wanderley, João Pessoa, PB, Brazil; E-mail: [brunobrasileiro@gmail.com](mailto:brunobrasileiro@gmail.com)
7. Robson Barbosa, Anesthesiologist of Hospital Regional do Agreste, Caruaru, PE, Brazil; E-mail: [robsonjfilho@hotmail.com](mailto:robsonjfilho@hotmail.com)
8. Micaela Barbosa L. Sales, Anesthesiology of Hospital Dom Helder, Recife, PE, Brazil; E-mail: [micaelaaa@hotmail.com](mailto:micaelaaa@hotmail.com)
9. Márcio Duarte, Anesthesiologist of Hospital Polícia Militar General Edson Ramalho, João Pessoa, PB, Brazil; E-mail: [dr.marcioduarte@gmail.com](mailto:dr.marcioduarte@gmail.com)
10. Geraldo Borges de Moraes Filho, UFPB, João Pessoa-PB. Statistician of the Complexo Hospitalar Mangabeira, João Pessoa-PB, Brazil; E-mail: [geraldogoyakla@hotmail.com](mailto:geraldogoyakla@hotmail.com)

**Correspondence:** Dr. Luiz Eduardo Imbelloni; Phone: + 55.11.99429-3637; E-mail: [dr.luiz.imbelloni@gmail.com](mailto:dr.luiz.imbelloni@gmail.com)

## Abstract

**Background:** The WHO considers elderly as an individual who is  $\geq 60$  y of age, and there are  $\geq 37.7$  million elderly people. In 2006, the ACERTO Project (Acceleration of Total Post-Operative Recovery) was introduced in Brazil in colorectal surgeries, and in elderly orthopedic femur fractures in 2010, with primary objective for the patient to early return to independent life. The objective of this descriptive study is to evaluate the clinical results 870 elderly patients undergoing surgical treatment of femoral fractures in ten years (2010-2019) after employing the perioperative acceleration protocol.

**Methodology:** It was a cross-sectional, prospective study in patients  $\geq 60$  y, of both genders, undergoing corrective hip fracture for ten years at a hospital covered by the Brazilian Public Health System (SUS). The data regarding preoperative condition of the patients, fasting status, mode of anesthesia, drugs used, intra-operatively measured variables and immediate post-operative variables measured in the PACU, quality of lumbar plexus block analgesia, presence of delirium in the first day of postoperative was obtained from the study protocol. The deaths during the first postoperative month were noted.

**Results:** A total of 829 patients underwent surgery for a fracture of the hip, under spinal anesthesia, of whom 583 were women and 246 were men. The average hospital stay was  $10.2 \pm 7.1$  days, and it was associated with the age. The mean fasting time was  $2:50 \pm 0:32$  h. The dose of isobaric bupivacaine was  $9.62 \pm 1:85$  mg. The cephalad spread varied from T12 to T5. The duration of the spinal block was  $2:50 \pm 0:38$  h, the time for the use of dextrinomaltose in PACU was  $1:39 \pm 0:47$  h, the time in the PACU was  $2:03 \pm 0:46$  h and the time to reintroduce normal meals was  $6:18 \pm 1:02$  h. Arterial hypotension occurred in 36 (4.3%) patients, bradycardia in 4 (0.4%), and delirium in 16 patients.

Eleven (1.3%) patients were sent to the ICU due to surgical problems. There were no deaths directly related to anesthesia or surgery.

**Conclusion:** The implementation of the ACERTO Project in 829 patients with femur fracture of the Brazilian Public Health System, showed favorable results regarding length of stay, patient satisfaction, decreased use of bladder tube and drains, and referral to ICU, with early discharge to residence.

**Key words:** Anesthesia, Spinal; Elderly patient; Fasting; Fast-track surgery; Human; Intensive Care Unit; Mortality; Perioperative care; Surgery, Orthopedic.

**Citation:** Imbelloni LE, Teixeira DMP, Lima U, Ventura TB, Lacerda S, Brasileiro, Barbosa R, Sales MBL, Duarte M, Filho GBDM. Accelerated operative recovery in elderly patients with femoral fractures: Our experience of ten years with 870 patients. *Anaesth. pain intensive care* 2022;26(5):608-615; DOI: [10.35975/apic.v26i5.1992](https://doi.org/10.35975/apic.v26i5.1992)

**Received:** May 03, 2022; **Reviewed:** July 25, 2022; **Accepted:** August 24, 2022

## 1. Introduction

The World Health Organization (WHO) considers elderly as an individual who is 60 y of age or older. There are 37.7 million elderly people in Brazil.<sup>1</sup> It has been estimated that the proportion of elderly people, which in 2010 was 7.3%, could reach 40.3% in 2100.

The introduction of a fast recovery system in elective operations has been an important boost in the recent past. After the initial application of the method in colorectal surgeries in 2000,<sup>2</sup> Brazil adopted it with Acceleration of Total Post-Operative Recovery (ACERTO) Project in general surgery in 2006.<sup>3</sup>

The data from the Hospital Information System of the Unified Health System (SIH-SUS), and the Poisson regression model, showed that more than 181 thousand cases of femur fractures in the elderly occurred during the period between 2008-2012, with a predominance of females.<sup>4</sup>

In 2021, 13% of the population of Paraíba was people ≥ 60 y old. In a recent study using data from DATASUS, hospitalization 2,091 cases, with 1,494 (71.45%) female and 597 (28.55%) male with femoral fractures were recorded between 2013 and 2016 in the state of Paraíba.<sup>5</sup>

In 2010, a project was started at João Pessoa to accelerate postoperative recovery, as the ICU had only eight beds, and all old patients with femur fractures, were admitted to the Complexo Hospitalar Mangabeira (CHM), were operated upon under spinal with morphine and shifted to the ICU.<sup>6</sup> In 2010, the implementation of the ACERTO Project began with patients over 60 y of age, with a complete modification of the conduct in patients with femoral fractures, and the results were published in 2014.<sup>6</sup> Use of this new approach allowed an earlier return to food while still in the post-anesthesia care unit (PACU), withdrawal of spinal opioids, and analgesia by regional blocks, with an earlier return to home.

Some studies carried out in Brazil showed that femur fractures in the elderly had a high incidence of adverse events, a constant increase in hospitalization, high

mortality and high cost.<sup>7</sup> It is known that to reduce the length of hospital stay and mortality in this group of patients, the operative procedure needs to be performed within 48 h of hospital admission,<sup>8</sup> and that a delay for more than seven days, due to non-availability of an ICU bed, contributed to the high mortality and the bad outcome.<sup>9</sup> In 2010, the CHM (SUS) did not have an electronic medical record, so the implementation group of Project ACERTO used an Excel spreadsheet to record the data.

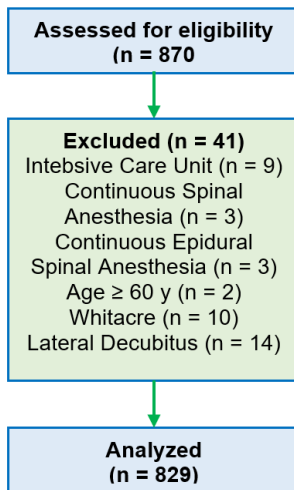
The objective of this descriptive study was to evaluate the clinical results after implantation of a perioperative acceleration protocol in the target population of the patients over 60 y of age undergoing surgical treatment of femoral fractures over a period of 10 y (2010-2019).

## 2. Methodology

The prospective study was carried out during 10 y, for all patients over 60 y, who underwent corrective operations for femur fractures. The protocol was approved by the Research Ethics Committee (No. 171,924) and registered on Platform Brasil (CAAE: 09061312.1.0000.5179). During the pre-anesthetic visit the project was explained to the patient and family, and all patients signed an informed consent.

The inclusion criteria were; all elderly patients with a fracture femur, admitted to the CHM, normovolemic, without neurological disease or coagulation disorders, no infection at the lumbar puncture site, no evidence of agitation and/or delirium, no indwelling urinary catheter, hemoglobin level > 10 g%, anesthetized under spinal anesthesia without opioids and lumbosacral plexus block for analgesia and who were not admitted to the ICU.

The exclusion criteria for this study were: use of spinal anesthesia with puncture in lateral decubitus position, use of a pencil point needle (Whitacre), undergoing continuous spinal anesthesia (CSA) or combined epidural spinal anesthesia (CESA).



**Figure 1: Patient flow diagram**

The CHM did not have magnetic resonance imaging (MRI) or equipment to perform echocardiography. Thus, the elderly were evaluated jointly by a geriatrician, by the anesthesiologist responsible for the implementation of the ACERTO project and by an orthopedic surgeon.

Patients included in the study received food the day before the operation, 200 mL of maltodextrin 2 to 4 h before shifting to the operating room (OR). The surgeries were performed until 2 pm and the patients were retained in the PACU until the end of the block effect, when they were again given 200 mL of maltodextrin. After 30 to 60 min, if the patients accepted oral feeding without nausea or vomiting, they were referred to the ward, without intravenous hydration and with free diet allowed in the ward. All these times were recorded.

All patients received standard anesthesia. No preanesthetic medication was administered in the room. After insertion of a 20G or 18G IV catheter, infusion of Ringer's lactate solution was started in parallel with 6% hydroxyethyl starch solution. Cefazolin 2 G and dexamethasone 10 mg were administered IV. Monitoring in the OR included continuous ECG in the CM5 position, NIBP, pulse oximetry and capnography. No patient was passed a urinary catheter. After sedation with intravenous ketamine (0.1 mg/kg) and midazolam (0.5 to 1 mg), skin was cleansed with alcoholic chlorhexidine, spinal puncture was performed with the patient in the sitting position, through the median route in the L2-3 or L3-4 interspaces, after skin infiltration with 1% lidocaine. Quincke needles 25, 26 or 27G were used without introducer. Isobaric bupivacaine 0.5%, 6–15 mg was injected. Patients were immediately placed in the supine position to start the operation. Hypotension (SBP decrease  $\geq 30\%$ ) was treated with etilefrine (2 mg IV) while bradycardia (HR  $\leq 50$  bpm) was treated with atropine (0.5 mg IV). At the end of the operation, the patients received tenoxicam 40 mg and dipyrone 40 mg/kg in 50 mL of Ringer's solution.

Postoperative analgesia was performed using anterior (inguinal) or posterior (psoas compartment) lumbar plexus block. In patients scheduled for the first time, the block was performed before spinal anesthesia in the PACU and, in the others, at the end of the surgical

procedure in the OR. Blockade was performed with a 50 mm needle for inguinal or 100 mm needle for psoas compartment block, connected to a peripheral nerve stimulator (HNS 12 Stimuplex®, B.Braun Melsungen AG) regulated to release a square pulsatile current of 0.5 mA, with a frequency of 2 Hz, seeking to obtain contraction of the quadriceps femoris muscle. Once the desired contraction was achieved, 20 mL of 0.5% enantiomeric excess levobupivacaine + 20 mL of 2% lidocaine with epinephrine were injected in the block performed before the operation or 40 mL of 0.25% enantiomeric excess levobupivacaine at the end of the operation. The CHM did not have an ultrasound device for performing peripheral nerve blocks.

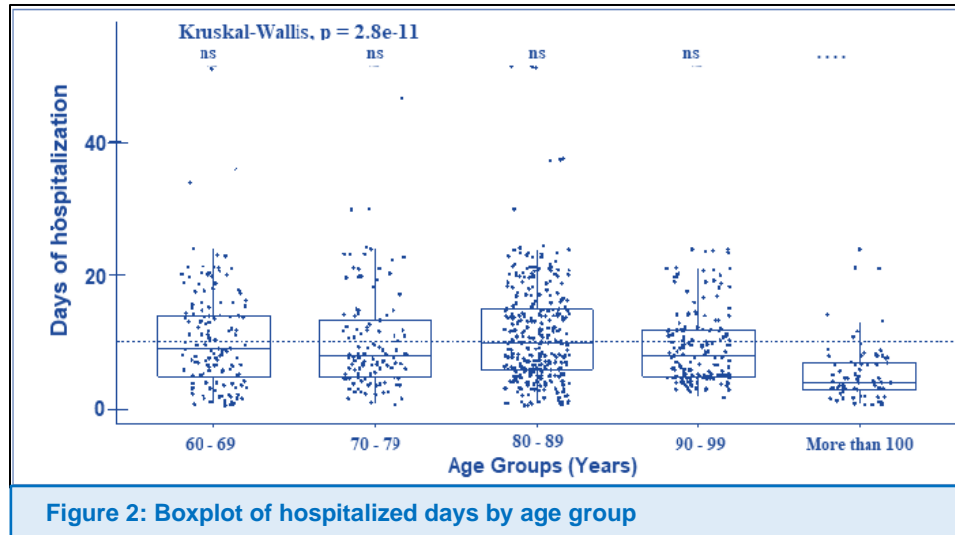
Analgesia was evaluated by the needle prick and cold test to determine the extent of sensory block in the anterior thigh region (quadriceps femoris muscle) after the block was completed in the PACU and on the morning after the operation in the ward. The moment of the first painful complaint was noted. Patients were transferred to the room without IV hydration, and received dipyrone 1 g 6/6 h and cefazolin 1 g 6/6 h.

The data were recorded at four times:

1. Before arrival in the OR: (a) time of hospitalization until the date of the operation, (b) number of postponements of the surgery, (c) fasting time.
2. During the surgical procedure: (a) dose of the anesthetic used, (b) volume replacement with Ringer's lactate and 6% hydroethyl starch solutions, (c) need for blood replacement, (d) hypotension and correction with etilephrine, (e) bradycardia and correction with atropine, (f) surgical time (from venous access to the end of the operation);
3. In the PACU: (a) motor blocking time, (b) food time (completion of the operation until oral maltodextrin), (c) length of stay in the PACU (completion of the operation until high of the PACU), (d) feeding time (end of operation to oral feeding in the ward), (e) incidence of nausea and vomiting;
4. In the ward on the morning of the 1st postoperative day: (a) duration of analgesia provided by the block, (b) oral feeding and time for the first meal, (c) need of a urinary catheter, (d) mental confusion, (e) need of venous hydration, (f) condition at hospital discharge.

#### Statistical Analysis

To analyze the interval data, we used the Kruskal-Wallis test. The Kruskal-Wallis test is indicated to test the hypothesis that three or more populations have equal distribution or not. Kruskal-Wallis test is a non parametric one way ANOVA. To analyze the categorical data, we used the chi-square independent test. A significant value of P suggests association between



**Figure 2: Boxplot of hospitalized days by age group**

### 3. Results

Eight hundred and seventy patients patients were admitted of both sexes, with femur fracture, out of which 829 patients fulfilled the criteria to participate in the study (Figures 1). Five hundred eighty-three (70.3%) female patients and 246 (29.7%) male patients underwent different types of surgical correction of the femur. Demographic data for different age groups of patients are shown in Table I. One hundred and forty-five elderly people between 60 and 69 y old, 116 between 70 and 79 y old, 328 between 80 and 89 y old, 166 between 90 and 99 y old and 74 had more than 100 y old, being the oldest with 112 y old. Forty patients had physical status ASA I, 698 patients ASA II and 91 patients ASA III.

The major pre-existing illnesses in the 789 patients in elderly patients were as a result of arteriosclerotic, cardiac diseases and diabetes. Of the 829 patients, only 11 (1.32%) were referred to the ICU due to surgical problems. There were no problems related to anesthetic management.

The vast majority (753 patients) entered the project directly. Of the remaining 76 patients, 52 patients were suspended once, 13 patients suspended twice, 8 patients suspended three times, and 3 patients suspended four times. The mean fasting time was 2:50 ± 0:32 h, with the shortest time being 1:20 h and the longest fasting time of 4:00 h. Using the Kruskal-Wallis test, no significant difference was observed between fasting times in all groups studied (P = 0.083). This behavior with the reduction of fasting time reflected on the presence of thirst in only 10 elderly people and no reports of hunger.

The mean length of hospital stay was 10.2 ± 7.1 days, varying from one to 51 days. Using the Kruskal-Wallis test, it was shown that the shortest length of stay was obtained with the oldest group (Figure 2). The cancellation of surgery, the time of fasting, the presence of hunger and thirst in the different age groups are shown in Table 2.

All patients underwent spinal anesthesia in the sitting position and there was no need for supplementation with general anesthesia. The needles used were 25G Quincke in 139 times, 26G Quincke in 349 times, 27G Quincke in 341 times, all without introducer. The average dose of 0.5% isobaric bupivacaine was 9.62 ± 1.85 mg, with the lowest dose used being 6 mg and the highest dose being 15 mg. The doses used in the different age groups of patients are shown in Table 3. There was significant differences in the isobaric bupivacaine doses in the different groups of patients (P = 0.000048) (Table 3).

The cephalad dispersion varied between T12 and T5, in all patients. (Figure 3). Eight hundred and nine patients

**Table 1: Demographic data**

Variables	60-69 y (n = 145)	70-79 y (n = 116)	80-89 y (n = 328)	99-99 y (n = 166)	100/+ y (n = 74)	P-value
Age (y)	64.54 ± 2.75	75.30 ± 2.85	83.92 ± 2.56	93.17 ± 2.56	102.24 ± 2.35	0.0000 *
Weight (kg)	63.96 ± 10.21	63.41 ± 10.55	63.85 ± 11.87	61.31 ± 10.70	58.82 ± 14.44	0.0005 *
Height (cm)	159.70 ± 9.08	157.97 ± 8.45	158.69 ± 9.74	158.29 ± 8.97	154.42 ± 9.51	0.0029 *
Gender: F/M	85 / 60	86 / 30	237 / 91	111 / 5	64 / 10	00003 **
ASA I/II/III	15 / 128 / 2	7 / 105 / 4	5 / 281 / 42	9 / 124 / 33	4 / 60 / 10	0.0000 **

\*Test Kruskal-Wallis; \*\* Chi-square test; Data presented as Mean ± SD

**Table 2: Days of hospitalization, number of suspensions of surgery, time fasting, incidence of hunger and thirst in different age groups**

Variables	60-69 y (n = 145)	70-79 y (n = 116)	80-89 y (n = 328)	99-99 y (n = 166)	100/+ y (n = 74)	P-value
Hospitalization (d)	10.45 ± 7.24	10.53 ± 7.66	11.37 ± 7.73	9.52 ± 5.48	5.59 ± 4.53	0.0000 *
Cancelled (n)	12	10	36	3	0	0.1200 *
Time fasting (h)	2:49 ± 0:32	2:47 ± 0:31	2:54 ± 0:30	2:51 ± 0:33	2:42 ± 0:35	0.0630 *
Hunger	0	0	0	0	1	0.0000 **
Thirst	1	1	7	1	0	0.3769 **

\*Test Kruskal-Wallis; \*\* Chi-square test; Data presented as Mean ± SD

**Table 3: Doses of isobaric bupivacaine, blood transfusion, bradycardia, and hypotension in different age groups**

Variables	60-69 y (n = 145)	70-79 y (n = 116)	80-89 y (n = 328)	99-99 y (n = 166)	100/+ y (n = 74)	P-value
Bupivacaine (mg)	9.79 ± 2.10	9.72 ± 1:80	9.67 ± 1.56	9.77 ± 2.00	8.64 ± 2.04	0.0000 *
Blood transfusion (n)	14	11	26	38	5	0.0000 **
Bradycardia (n)	1	1	0	2	0	0.3757 **
Hypotension (h)	3	7	15	8	3	0.6002 **

\*Test Kruskal-Wallis; \*\* Chi-square test; n = number of patients

**Table 4: Block duration, time to feeding dextrinomaltose in PACU, duration of stay in the PACU, time of oral food reintroduction in the ward and the duration of analgesia**

Variables	60-69 y (n = 145)	70-79 y (n = 116)	80-89 y (n = 328)	99-99 y (n = 166)	100/+ y (n = 74)	P-value
Surgery duration (h)	1:55 ± 0:35	1:50 ± 0:29	1:56 ± 0:37	1:47 ± 0:31	1:28 ± 0:30	0.0000 *
Duration spinal (h)	2:51 ± 0:41	2:51 ± 0:34	2:54 ± 0:35	2:48 ± 0:40	2:33 ± 0:44	0.0069 *
CHO PACU (h)	1:33 ± 0:40	1:33 ± 0:41	1:39 ± 0:47	1:47 ± 0:55	1:42 ± 0:48	0.36 *
Time PACU stay (h)	2:00 ± 0:44	2:00 ± 0:43	2:06 ± 0:49	2:05 ± 0:47	2:04 ± 0:42	0.77 *
Food (h)	6:30 ± 0:58	6:09 ± 1:01	6:18 ± 1:02	6:21 ± 1:04	6:08 ± 1:01	0.045 *
Analgesia (h)	22 ± 4	21 ± 4	22 ± 4	22 ± 3	22 ± 3	0,78 *

\*Test Kruskal-Wallis; \*\* Chi-square test; Data presented as Mean ± SD

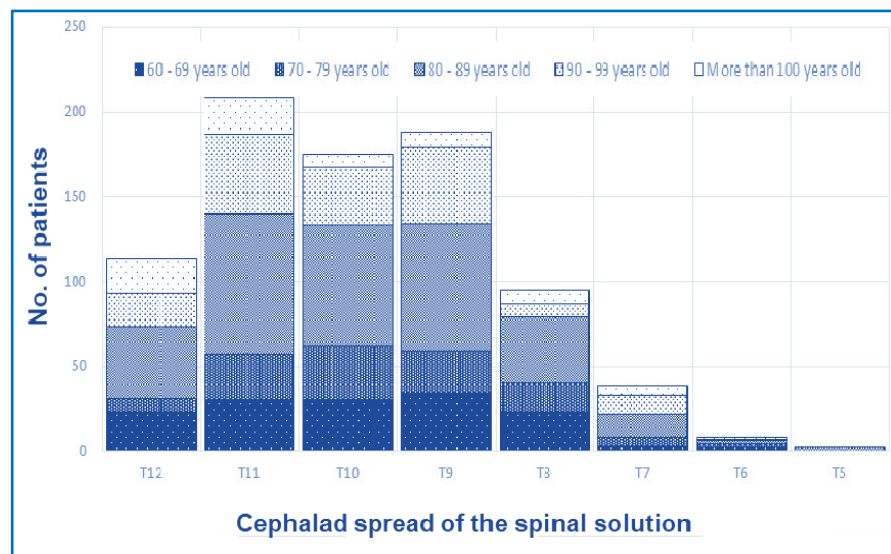
had complete motor blockade, and twenty patients had grade 2 motor block.

All patients received 500 mL of 6% hydroxyethyl starch in 0.9% sodium chloride and Ringer Lactate solution. Ninety-five patients (11.4%) received blood transfusion during surgery. Arterial hypotension occurred in 36 (4.3%) patients, and was easily treated with only one dose of ethylephrine. Bradycardia occurred in 4 (0.4%) patients, treated with a single dose of atropine 0.50 mg (Table 3).

Table 4 shows the mean duration of the surgery, mean duration of spinal block, administration of dextrinomaltose in PACU, length of stay in PACU, and

time to reintroduction of food in the ward. Patients' analgesia was performed with a lumbar plexus block. Before surgery, 489 neurostimulator blocks were performed (484 inguinal and 5 psoas) and 340 after the end of surgery (180 inguinal and 160 psoas), with a mean duration of analgesia in the 829 patients was 22 ± 6 h. Data relating to the different age groups are shown in Table 4.

One patient required the use of a urinary catheter in the PACU, and one patient used a surgical drain due to bleeding, having been referred to the ICU. Postoperative delirium was noted in 16 patients. Nausea or vomiting



**Figure 3: Cephalad spread of isobaric bupivacaine in different groups**

occurred in only two patients. Eleven patients were transferred to the ICU, all due to surgical problems.

After being referred to the ward without intravenous hydration, none of the patients required hydration due to a drop in blood pressure and accepted oral feeding very well. The 820 patients transferred from PACU directly to the ward and were ready for hospital discharge on the first postoperative day. Hospital discharge for residency depended on the CHM Social Service. There were 17 deaths at home in the first month after surgery.

## 4. Discussion

This study aimed to implement the ACERTO project in order to improve the results of the orthopedic patients accelerating their recovery after the operation. The success of this project depended upon a multidisciplinary team and multimodal methods aimed at optimizing the patient's passage through the hospital, in order to accelerate postoperative recovery, reduce complications and morbidity and mortality. The result in 829 elderly people in this study showed a decrease in surgery postponements, length of stay, decrease in fasting time, surgical time, and time to dextrinomaltose feeding in PACU, decreased length of stay in PACU, decreased oral refeeding time, without the use of a urinary catheter and drain, and better quality of postoperative analgesia with less opioids, resulting in changes in previously used anesthesia protocols.<sup>1</sup>

At the CHM there was no MRI, echocardiography or ultrasound for regional anesthesia, and no orthopedic residents. Thus, the preoperative meeting between the orthopedic surgeon, the geriatrician and the anesthesiologist was of paramount importance for changing the routine of surgical procedures for femoral

fractures in the elderly. The implementation of the ACERTO Project was supported by all concerned at the CHM in that period.<sup>10</sup>

Almost every anesthesiology society in the world recommends two-hour fasting for liquids without residues and a light meal without fat for six hours. However, this conduct is not followed by most professionals, who require fasting for more than 8 h. Another important aspect is that the conventional fasting time is often prolonged due to delays in the surgery, non-availability of the concerned staff or materials, among other causes. In a previous study

with elderly people with femur fractures, the mean fasting time was 13:38 h before the implementation of the ACERTO Project and 2:48 h after the implementation, with a decrease of 82% in this time.<sup>11</sup> In this study with 829 old patients the mean fasting time was 2:50 h, with the shortest time being 1:20 h and the longest fasting time of 4:00 h, similar to other studies.<sup>10,11</sup>

The absence of a strict hospitalization protocol and surgery results in the suspension of the surgical procedure on the scheduled day. Of the total of 829 patients, 753 entered directly into the project, with no suspension of their operation. All of suspensions were due to availability problems of surgical material. No patient was postponed by the anesthetic team.

The lower dose of the anesthetic drug used reflected in significantly less spread of anesthesia, with less motor block and shorter PACU stay, being sufficient for surgical correction of hip fractures.<sup>12</sup> The knowledge of the orthopedic team allowed the isobaric bupivacaine dose to be administered according to the proposed surgery and the orthopedic surgeon scheduled for the surgery. Thus, the low dose resulted in a low incidence of easily reversible arterial hypotension (4.3%) and bradycardia (0.4%). The use of 500 ml colloid (6% hydroxyethyl starch) in all patients during the surgical procedure contributed to a decrease in the incidence of arterial hypotension, the same fact observed in hip arthroplasty.<sup>13</sup> With rigorous hydration and colloid use in all patients, blood replacement was required in 95 patients (11%), much lower than 17% in hip arthroplasty,<sup>12</sup> and 16.1% in another study.<sup>1</sup> In a recent meta-analysis, using a generic inverse variance model, including 28 prospective observational studies with

31,242 patients, fewer complications (8% vs. 17%) were demonstrated in patients who had early surgery.<sup>14</sup> Early hip surgery within 48 h was associated with lower risk of mortality and fewer perioperative complications.<sup>8</sup> In a previously published article, the time to perform the surgery before the project was on an average 20 days compared to 10 days after the implementation of the ACERTO Project.<sup>7</sup> In our study the mean length of stay was also 10 days. Another study demonstrated reduced length of hospital stay and reduced mortality in six months when surgery in the elderly was performed within 48 h. In the Brazilian Public Health System (SUS) performing surgery within 48 h is very difficult, due to the scarcity of surgical material.

Waiting for surgery for more than seven days, due to the absence of ICU bed and the concurrent surgical risk contributed to the increased length of hospital stay and the mortality rate.<sup>9</sup> In our study, the surgical risk assessed by the cardiologists was not considered, and was replaced by the meeting between the treating physicians with excellent results.

The average use of 9.63 mg of 0.5% bupivacaine isobaric for spinal anesthesia resulted in an average duration of spinal block motor block of 2:50 h, allowing maltodextrin to be started orally around 1:39 h after the end of the operation in the PACU, corresponding to a stay in the PACU, on average, of 2:03 h. The use of maltodextrin did not cause nausea and vomiting and allowed the reintroduction of the free diet, just 6:18 h after the end of the surgical procedure. Early refeeding has potential benefits for patients, such as early discharge, lower incidence of infectious complications and reduced costs.<sup>15</sup> This study showed that, in orthopedic surgery, early refeeding did not cause an increase in the incidence of nausea and vomiting.

Pain relief after a surgical procedure is a prerequisite for a quick recovery, being a fundamental part of the success in the implementation of a hospital discharge acceleration project. Thus, this project used a protocol involving regional anesthesia, both for the operative act (spinal anesthesia) and for perioperative analgesia (lumbar plexus block), with a decrease in the use of intrathecal opioids, which are associated with the appearance of nausea, vomiting, itching and drowsiness. Pain control is undoubtedly the most important aspect that stimulates all postoperative care in each team member multidisciplinary. This control was achieved with lumbar plexus block with a mean duration of 22 h. Thus, analgesia started in most cases before entering the OR.<sup>16,17</sup>

## 5. Conclusion

With the aging of the world population, the incidence of femur fractures is increasing rapidly, generating

important health problems worldwide due to a high mortality rate. It has been shown that with good perioperative care, the best results are obtained with early surgery in the elderly with femur fractures.

Close cooperation between different departments of a hospital will enable the application of a fast-track project to avoid undue delays in orthopedic surgery in the elderly with better outcomes.

## 6. Data availability

The numerical data generated during this research is available with the authors.

## 7. Acknowledgement

We gratefully acknowledge the close cooperation and help by the departments of anesthesiology, orthopedic surgery, geriatric medicine as well as the nursing staff of the intensive care unit of our hospital.

## 8. Conflict of interest

The authors declare no conflict of interest, and no external or industry funding was involved in the study.

## 9. Authors' contribution

LEI: Study concept, data collection, article writing, performed all anesthesia procedures, article review.

DMPT, UL: Performed all surgeries, article review.

TBV, SL, BB, RB, MBLS, MD: Anesthesia was performed under the supervision of the main author, as a resident.

GBMF: Conceived the research project, statistical analysis, final review of the article.

## 10. References

1. Instituto Brasileiro de Geografia e Estatística – IBGE; visited March 9, 2022. Agência Brasil - Brasília. Available from: <https://www.ibge.gov.br/en/home-eng.html>
2. Kehlet H, Mogensen T. Hospital stay of 2 days open sigmoidectomy with a multimodal rehabilitation programme. *Br J Surg.* 1999;86(2):227-230. [PubMed] DOI: [10.1046/j.1365-2168.1999.01023.x](https://doi.org/10.1046/j.1365-2168.1999.01023.x)
3. Aguilar-Nascimento JE, Bicudo-Salomão A, Caporossi C, Silva RM, Cardoso EA, Santos TP. Acerto project: outcome evaluation after the implementation of a multidisciplinary protocol of peri-operative care in general surgery. *Rev Col Bras Cir.* 2006;33(3):181-187. DOI: [10.1590/S0100-69912006000300010](https://doi.org/10.1590/S0100-69912006000300010)
4. Soares DS, Mello LM, Silva AS, Martines EZ, Nunes AA. Femoral fractures in elderly Brazilians: a spatial and temporal analysis from 2008 to 2012. *Cad Saúde Pública.* 2014;30(12):2669-2678. [PubMed] DOI: [10.1590/0102-311X00218113](https://doi.org/10.1590/0102-311X00218113)
5. Macedo KLL, Chaves BJP, Nogueira PR, Silva W, Oliveira JS. Caracterização de idosos vítima de fratura de fêmur em estado do nordeste brasileiro. *Congresso Internacional Envelhecimento Humano.* 2017. [FreeFullText]
6. Imbelloni LE, Teixeira DM, Coelho TM, Gomes D, Braga RL, de Moraes Filho GB, et al. Implementation of a perioperative

- management protocol for patients undergoing orthopedic surgery. *Rev Col Bras Cir.* 2014 May-Jun;41(3):161-6. [PubMed] DOI: [10.1590/s0100-69912014000300005](https://doi.org/10.1590/s0100-69912014000300005)
7. Macedo GG, Gomes Teixeira TR, Ganem G, Daltro G de C, Faleiro TB, Araújo Veiga Rosário D, et al. Femur fractures in the elderly: a public health problem in Brazil. *REAC.* 2019;6:e1112. DOI: [10.25248/reac.e1112.2019](https://doi.org/10.25248/reac.e1112.2019)
  8. Pinto IP, Ferres LFB, Boni G, Falótico GG, Moraes M, Puertas EB. Does early surgical fixation of proximal femoral fractures in elderly patients affect mortality rates? *Rev Bras Ortop (Sao Paulo).* 2019 Jul;54(4):392-395. [PubMed] DOI: [10.1016/j.rbo.2017.12.015](https://doi.org/10.1016/j.rbo.2017.12.015)
  9. Alcantara C, Dellaroza MSG, Ribeiro RP, Carvalho CJA. Femoral fracture in the elderly: surgery waiting time and hospitalization outcome. *Cienc Cuid Saude.* 2021;20:e54726. DOI: [10.4025/ciencuidsaude.v20i0.54726](https://doi.org/10.4025/ciencuidsaude.v20i0.54726)
  10. Imbelloni LE, Morais Filho GB. Attitudes, awareness and barriers regarding evidence-based orthopedic surgery between health professionals from a Brazilian Public Health System (SUS) hospital: Study of 400 patients. *Anesth Essays Res.* 2016;10:546-551. [PubMed] DOI: [10.4103/0259-1162.183164](https://doi.org/10.4103/0259-1162.183164)
  11. Imbelloni LE, Gomes D, Braga RL, de Morais Filho GB, da Silva A. Clinical strategies to accelerate recovery after surgery orthopedic femur in elderly patients. *Anesth Essays Res.* 2014;8:156-161. [PubMed] DOI: [10.4103/0259-1162.134490](https://doi.org/10.4103/0259-1162.134490)
  12. Imbelloni LE, Braga RL, Filho GBD, da Silva A. Low dose of isobaric bupivacaine provides lower incidence of spinal hypotension for hip surgery in elderly patients. *Anaesth Pain Intensive Care.* 2014;18(1):17-20. [FreeFullText]
  13. Hamaji A, Hajjar L, Caiero M, Almeida J, Nakamura RE, Osawa EA, et al. Volume replacement therapy during hip arthroplasty using hydroxyethyl starch (130/0.4) compared to lactated ringer decreases allogeneic blood transfusion and postoperative infection. *Rev Bras Anesthesiol.* 2013;63:27-44. [PubMed] DOI: [10.1016/j.bjane.2012.03.002](https://doi.org/10.1016/j.bjane.2012.03.002)
  14. Klestil T, Röder C, Stotter C, Winkler B, Nehrer S, Lutz M, Klerings I, et al. Impact of timing of surgery in elderly hip fracture patients: a systematic review and meta-analysis. *Sci Rep.* 2018 Sep 17;8(1):13933. [PubMed] DOI: [10.1038/s41598-018-32098-7](https://doi.org/10.1038/s41598-018-32098-7)
  15. Lewis SJ, Egger M, Sylvester PA, Thomas S. Early enteral feeding versus "nil by mouth" after gastrointestinal surgery: systematic review and meta-analysis of controlled trials. *BMJ.* 2001;323(7316):773-776. [PubMed] DOI: [10.1136/bmj.323.7316.773](https://doi.org/10.1136/bmj.323.7316.773)
  16. Prashanth N, Neeta PN. Effect of intravenous methylprednisolone in prevention of arterial hypoxemia due to fat embolism syndrome in patients with long bone fractures of lower limb - A double blind randomized trial. *Anaesth. pain intensive care* 2016;20(3):290-294 [Free full text]
  17. Moussa MEM, Awad HGS, Hamid HSA, Abdellatif AE, Sharaf AGS. A comparative study between femoral nerve block and intravenous ketamine for pain management during positioning for spinal anesthesia in elderly patients with femur fracture. *Anaesth. pain intensive care* 2022;26(3):297-303. [Free full text] DOI: [10.35975/apic.v26i3.1895](https://doi.org/10.35975/apic.v26i3.1895)