

Outcome after Anesthesia and Orthopedic Surgery in Patients Nonagenarians and Centenarians

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Abstract

Background: As life expectancy increases, the number of geriatric patients coming for surgery and anesthesia will make up an increasing portion of our practice. Nonagenarians and centenarians are a rapidly growing segment of the population. A hip fracture is a significant injury for anyone, but for older people it can be catastrophic. No previous study has used a national database to compare outcomes in these patients to those of other groups undergoing femur surgical procedures.

Methods: Between January 2012 and December 2013 inclusive, 47 patients (13 men and 34 women) aged 90 years and older (range, 90-107 years) with hip fracture were prospectively analyzed. Information on the pre-operative condition of these patients, mode of anesthesia, drugs used, intra-operatively measured variables (e.g. hemodynamics, blood loss) and immediate post-operative variables measured in the post-anesthesia care unit (PACU), and first day of postoperative was obtained from the study protocol.

Results: Prior to injury, all of the patients were living at home. The average hospital stay until the day of surgery was 6.04 ± 2.77 days. The mean fasting time was $2:56 \pm 0:38$ hours. All patients were submitted to spinal anesthesia. The dose ranged from 6 to 15 mg, with a mean of $10 \pm 2:43$ mg isobaric bupivacaine. The duration of the spinal block was $2:56 \pm 0:45$ hours, the time for the use of dextrinomaltose was $2:14 \pm 1:07$ hours, the time in the PACU was $2:01 \pm 0:43$ hours and the time to reintroduce normal meals were $6:33 \pm 1:03$ hours. Arterial hypotension occurred in 3 patients and delirium in 5 patients. There were no deaths directly related to anesthesia or surgery.

Conclusion: Our prospective analysis shows that the nonagenarians and centenarians tolerated anesthesia and surgery, and can fully participate in projects accelerated postoperative recovery.

Keywords: Surgery; Orthopedic; Spinal anesthesia; Fasting; Perioperative care; Fast-track surgery

Introduction

As life expectancy continues to increase, the number of elderly inpatients for surgery is rapidly increasing. More and more people are reaching ages well centennial, and, for example, in 2012, in Brazil there are more than 30,000 citizens over the age of 100 years [1]. Fractures of the femur are common in elderly individuals with osteoporosis and are usually treated surgically to facilitate early rehabilitation [2]. The rate of surgical interventions in this age group also has risen, with both emergency and elective surgical procedures being performed frequently, even in octogenarians, nonagenarians and centenarians. Despite the good health necessary to achieve a high age, the function of various organs will deteriorate, making homeostasis easily compromised, and any situation of stress, such as trauma or surgery can lead to organ dysfunction or aggravate already existing dysfunctions [2].

Elderly patients (arbitrarily defined as being over 65 years of age) are vulnerable to the adverse effects of anesthesia because of their reduced margin of safety. Morbidity and mortality increase with advancing age. In a retrospective analysis over a 20-year period, of 13 centenarian patients with a hip fracture, mortality at 30 days was 31% and at one year 56%, which was greater in comparison with their non-injured peers [3].

In the present study, we attempted to identify the type of problems that might have occurred perioperatively in the oldest of the old surgical patients. We analyzed the course of anesthesia in detail, as well as immediate and longer-term outcome in nonagenarians and

centenarians undergoing orthopedic surgery in our hospital during two years. The primary objective of this study is to evaluate the implementation of project acceleration of postoperative recovery (fast track surgery), in older patients undergoing hip fracture surgery under spinal anesthesia.

Methods

In January 2012, we initiated a longitudinal prospective study at a hospital covered by the Brazilian Public Health System (SUS) in a patients undergoing corrective femur fracture over the age of 90 years. The protocol was registered in Brazil Platform. The Ethics Research Committee approved the study protocol and all patients were informed and agreed to participate in the study. Inclusion criteria were: normal blood volume, no pre-existing neurological disease, no coagulation disorders, without infection at the puncture site, which did not present agitation, mental confusion and/or delirium, which did not make use of bladder indwelling catheters, with hemoglobin level $>10g\%$ and that was not in the ICU. All patients were part of the implementation of

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Received April 11, 2014; Accepted June 15, 2014; Published June 18, 2014

Citation: Imbelloni LE, Gouveia MA, de Moraes Filho GB, da Silva A (2014) Outcome after Anesthesia and Orthopedic Surgery in Patients Nonagenarians and Centenarians. J Anesth Clin Res 5: 411. doi:10.4172/2155-6148.1000411

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Project Acerto for accelerated postoperative recovery (Table 1).

Information on the pre-operative condition of these patients, mode of anesthesia, drugs used, intra-operatively measured variables (e.g. hemodynamics, blood loss) and immediate post-operative variables measured in the post-anesthesia care unit (PACU), and first day of postoperative was obtained from the study protocol.

Premedication was not used. Monitoring consisted to EKG, of noninvasive blood pressure, heart rate, and pulse oximetry. After venous cannulation with 18G catheter in the hand or forearm, infusion of Ringer's lactate in parallel with 6% hydroxyethyl starch 130/0.4 in 0.9% sodium chloride injection was started. At end of surgery was administered cefazolin 2 g and dexamethasone 10 mg intravenously.

After sedation with intravenous ketamine (0.1 µg.kg⁻¹) and midazolam (0.5-1 mg), skin cleansing with chlorhexidine and excess removal, spinal puncture was performed with the patient in sitting position, through the median interspaces L₂-L₃ or L₃-L₄, using a 26G or 27G Quincke needle (B. Braun Melsungen). After observing CSF confirming the correct position of the needle, 6-15 mg of 0.5% isobaric bupivacaine were administered at a rate of 1 mL.30^{s-1}. Patients were immediately placed in supine position for surgery. The sensorial blockade and motor blockade were evaluated at 10min after injection.

Cardiorespiratory parameters were measured every 5 minutes. Hypotension (a reduction in SBP > 30% when compared to the pressure in the regular ward) was treated with ethylephrine (2 mg IV), while bradycardia (HR<45 bpm) was treated with atropine (0.50 mg IV). At the end of surgery, patients received tenoxicam 40 mg and dipyrone 40 mg.kg⁻¹ in 50 mL of Ringer's lactate.

The postoperative analgesia was performed through the anterior lumbar plexus block (inguinal) or posterior (psoas compartment) with a neurostimulator. Obtained the desired contraction, were injected 40 mL bupivacaine 0.25%. The blockade and the first analgesic dose were performed at the end of surgery in the operating room.

In PACU after termination of motor block, patients received 200 mL of 12.5% dextrinomaltose. If in 30 minutes nausea and vomiting did not occur, they would be sent to the infirmary. Data relating to surgical time, recovery time of motor block, time to administration dextrinomaltose, length of stay in the PACU, need for catheterization, pain and treatments administered were recorded by an observer.

Patients were followed until the second day after surgery to assess the conditions of discharge. Patients were not followed in relation to morbidity and mortality after hospital discharge.

ACERTO PROTOCOL
• Dextrinomaltose 2-4h prior to surgery
• Isobaric bupivacaine
• Nourinary catheter
• Dextrinomaltose after termination of motor block in the PACU
• No intravenous hydration postoperatively
• Venous injection medications alinized
• Time reintroductiono for al diet free after PACU
• Nouse of drains
• Analge sialumbar plexus block
• Duration of analgesia
• Discharge condition in the 1 st postoperative day

Table 1: Anesthetic approaches inorthopedic surgery of femur after implementation of the Project.

Variables	Results
Age (ys)	94.62 ± 3.93
Weight (kg)	61.17 ± 12.24
Height (cm)	157.06 ± 9.65
Gender: F/M	34/13
ASA: 1/2/3	2/36/9

Table 2: Demographics dates (m ± SD).

Dose (mg)	Patients
6	2
7.5	14
8	1
10	15
12.5	12
15	3

Table 3: Dose of isobaric bupivacaine.

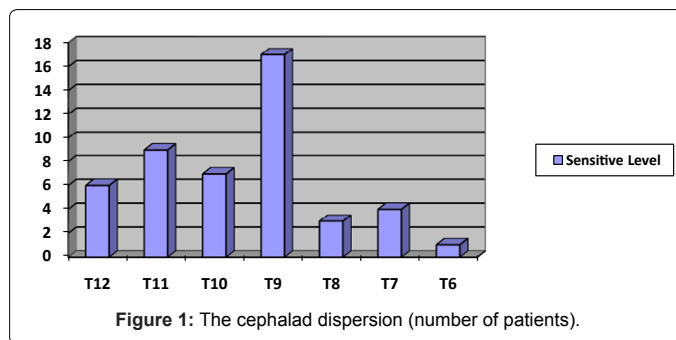


Figure 1: The cephalad dispersion (number of patients).

Statistical Analysis

Descriptive measures such as mean and standard deviation were used to analyze the empirical data distribution.

Results

During the period of study (two years) 582 patients underwent surgery for a fracture of the hip, of whom 47 (8%) were aged 90 or more. Patient data are shown in Table 2. Thirty-four of patients were female and 13 were men, with a mean age of 94 years. Forty patients were between 90 and 99 years, and seven had more than 100 years, being the oldest with 107 years. The major pre-existing illnesses in the 47 nonagenarians and centenarians were as a result of arteriosclerotic, cardiac diseases and diabetes. Prior to injury, all of the patients were living at home. Two of the patients had an anesthetic risk grade I, 36 patients risk grade II and 9 patients risk grade 3.

The average hospital stay until the day of surgery was 6.04 ± 2.77 days. The mean fasting time was 2:56 ± 0:38 hours. This reflected that no patient complained of thirst or hunger to reach the Operating Room and satisfaction of patients.

All patients were submitted to spinal anesthesia with 0.5% isobaric bupivacaine and there was no need of general anesthesia. The dose ranged from 6 to 15 mg, with a mean of 10 ± 2:43 mg isobaric bupivacaine (Table 3). The cephalad dispersion varied between T₁₂ and T₆, in all patients (Figure 1). Forty one patients presented full motor block in the lower limbs and six motor block grade 2.

All patients received 500 mL of 6% hidroxyetilamido a 6% and Ringer with Lactate (1,166 ± 240 mL). Fifteen patients (31.9%) received blood transfusion during surgery. Arterial hypotension occurred in 3

Variables	Duration
Duration of surgery (h)	1:46 ± 0:33
Duration of block (h)	2:56 ± 0:45
Dextrinomaltose PACU time (h)	2:14 ± 1:07
Time PACU stay (h)	2:01 ± 0:43
Time reintroduction oral feeding (h)	6:33 ± 1:03

Table 4: Duration of surgery, blocking duration, time to feeding dextrinomaltose in PACU, duration of stay in the PACU and time of oral food reintroduction on the ward (m ± SD).

patients, and all hypotension were easily treated with only one dose of ethylephrine. Bradycardia did not occurred in any patients.

Table 4 shows the duration of the surgery, the duration of the spinal block, the time for the use of dextrinomaltose, the time in the PACU and the time to reintroduce normal meals. Two patients were transferred to the ICU for surgical problems. Thus ingestion of dextrinomaltose and reintroduction of oral feeding was not performed on the same day. No patient required a urinary catheter.

Post-operative delirium was noted in five patients. No nausea or vomiting occurred in the study group. All 47 patients after the implantation of the project were ready for discharge in the first post-operative day. Regional anesthetic techniques were utilized in all patients for post-operative analgesia, and intravenous tenoxican and dypirone. Twenty-six patients received lumbar plexus block (inguinal) before surgery in the PACU and 21 received lumbar plexus block (psoas compartment and inguinal) after surgery. The mean duration of analgesia was 22:28 ± 5:54 hours. All patients survived the surgery and were able to be discharged by the second postoperative day.

Discussion

Our prospective analysis shows that the nonagenarians and centenarians tolerated anesthesia and surgery quite well which has already been observed by others [4-6], and can fully participate in projects accelerated postoperative recovery. There were no deaths directly related to anesthesia or surgery or underlying diseases in the first two days after surgery. Therefore, we analyze the present case with studies on nonagenarians and centenarians.

A preoperative screening visit by an anesthesiologist prior to surgery is of prime importance. It is recommended that screening of an elderly patient be performed prior to the day of surgery. All patients were visited by the same anesthesiologist the day before surgery and were only operated after being included in the study criteria.

The elderly represent the fastest-growing population in the world. Advanced age traditionally has been considered a risk for surgery. Aging is associated with a decrease in functional reserves of organ systems and an increase in the presence of comorbid conditions. It is now known that it is comorbidity, rather than age, that contributes significantly to perioperative morbidity and mortality and is a better predictor of outcome [7,8]. Many studies have attempted to identify the factors responsible for increased morbidity and mortality after fracture of the hip. Although age is considered in several risk indices, age per se is not a contraindication for surgery [8]. Several authors have challenged the notion that age in isolation affects the mortality rate after fracture of the hip [9,10]. In this study no deaths occurred during surgery and until discharge, demonstrating that age is not a contraindication for corrective surgery of femur. In this study mortality after discharge was not the objective of the study.

This multimodal approach, referred to as “fast-track surgery,”

incorporates not only surgeons and anesthesiologists, but also as active participants of the care team. Fast-track surgery focuses on enhancing recovery and reducing morbidity by implementing evidence in the fields of anesthesia, analgesia, and reduction of surgical stress, fluid management, minimal invasive surgery, nutrition, and ambulation. Several studies have reported that advancing age is associated with increased length of hospital stay after surgery for fracture of the hip. The mean length of stay on the acute orthopedic unit was not significantly different between age groups [11]. The use of fast-track project allowed all 47 patients above 90 years had conditions in hospital two days after surgery. Thus, unlike other authors [11-13]. In this study age did not increase the length of hospital stay. This has obvious implications for bed occupancy and cost.

Spinal anesthesia blocks the sympathetic efferent nerve. The actual degree of sympathetic blockade depends on the spread of the local anesthetic. Continuous spinal anesthesia would seem an ideal anesthetic technique in the centenarians undergoing repair for hip fracture because of the possibility to slowly administer small increments of local anesthetic and, thereby, avoiding great decrease of arterial blood pressure [14]. The knowledge of the orthopedic team of only experienced professionals was very important for the decision to reduce the total dose of isobaric 0.5% bupivacaine. With the adherence of some orthopedics to the project it was possible to reduce the bupivacaine dose to mean of 10 mg of isobaric bupivacaine, providing a lesser incidence of hypotension (6.3%), shorter duration of the block (2:56 hours), and shorter stay in the PACU (2:01 hours).

Surgery in nonagenarians and centenarians is not without risk; however several studies have shown that it can be relatively safe. Nonagenarians and centenarians who undergo cardiac surgical procedures represent a higher-risk group of patients independent of age [15]. But, also demonstrates that a majority of these nonagenarians and centenarians can be preoperatively identified to have a relatively low risk of mortality [15]. Accordingly, these results should be used as a basis to consider more rationally the possibility of elective cardiac surgical procedures in these patients [15]. Similar to this study, we can state that the nonagenarians and centenarians patients with hip fractures should be operated as soon as possible.

The incidence of arterial hypotension in patients over 60 years was 18% with 15 mg, reducing to 3.5% with the low doses of 10 and 7.5 mg [16,17]. In this study with patients' nonagenarians and centenarians using dose of 6 to 15 mg (mean 10 mg) of isobaric bupivacaine, the incidence of hypotension was 6.3%. The use of colloid (6% hydroxyethylamide) during the whole procedure contributed for the reduction in the incidence of arterial hypotension, even in cases of THR [8].

There seems to be no clear consensus about specific transfusion thresholds in elderly patients. Perioperative anemia is not corrected as aggressively as before, as patients seem to tolerate lower hemoglobin values better than previously thought. A large retrospective study showed no increase in mortality even in elderly individuals provided that hemoglobin concentration was kept above 80 g/L [18]. For hip fracture patients with trigger Hb of less than 100 g/L, transfusion has been shown to reduce hospital readmission rates, but not to affect mortality or post-operative mobility scores [19]. The use of transfusions may be individualized based on age, comorbid processes, life expectancy, and the nature of surgery. In the present study the trigger Hb was 100 g/L, and 15 patients (32%) received blood during the surgical procedure, almost double the patients over 60 years [16].

The decrease in fasting time, which was around 3 hours and the utilization of dextrinomaltose in the PACU at the resolution of the block in the group post-implantation did not cause nausea or vomit and allowed the introduction of a free diet about 6:22 hours after block. A recent metaanalysis demonstrated that early feeding in gastrointestinal surgery can be conducted with lesser risk with potential benefits to the patients, such as early discharge, lesser incidence of infectious complication and reduced cost [20]. This study showed that in patients nonagenarians and centenarians orthopedics, when all gastrointestinal tracts tends to be normal, early feeding generates greater satisfaction to patients and family members and does not cause an increase of nausea and vomit.

The relief of the post-operative pain is a pre-requisite to a better recovery and a fundamental part to the success in the implantation of a project of acceleration of Hospital discharge [21,22]. Because of this, a protocol of regional anesthesia must be developed and applied, not only for surgery but also for post-operative analgesia, without intrathecal opioids. The analgesia of patients in this study was performed with lumbar plexus block (psoas compartment or inguinal), before or after surgery, with an average duration of 22 hours. With the dose employed, all patients presented residual analgesia next day to the surgery, although no one presented a motor block. Associated with lumbar plexus block, were administered fractionated doses of dipyrone and tenoxicam. Such management can achieve adequate analgesia and avoid overdose or complications of certain medication (opioids).

Postoperative confusion and mental dysfunction are of great concern in the elderly patient and surgery has a significantly decompensating impact on the mental status of older persons. It may cause prolonged hospital stay or postoperative dependence of elderly people. The definite mechanism causing delirium is not yet clear. In this study there were five patients with confusion and delirium in the assessment on the first day postoperatively.

Urinary retention is common after anesthesia and surgery, reported incidence of between 5% and 70% [23]. Comorbidities, type of surgery, and type of anesthesia influence the development of postoperative urinary retention [24]. The Acerto Project did not utilize opioids in spinal anesthesia to avoid catheterization, what was a routine in this type of Hospital before implantation of this project. None of the 47 patients required urinary catheter

Conclusion

Our treatment goal was to recover pre-injury walking ability for elderly patients with hip fractures on discharge. Since 2012, the use of the fast-track project in our hospital has successfully shortened the hospital stay after surgery by about 3 days. Living to age 90 years is no longer a rarity. More than 20.000 nonagenarians and centenarians live in the Brazil today. Surgical procedures on older adults, who typically have comorbid illnesses, are clearly on the increase. Anesthesiologists and surgeons are increasingly willing to electively and emergence operate on elderly patients: the complication rate is acceptable and function may be improved to prior levels. Surgery should not be denied on the basis of age alone [4]. Age is a minor risk factor, but comorbidity confers far more risk [7].

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