

General versus regional anaesthesia for hip fracture surgery – impact on mortality and length of stay

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Abstract

Background: Hip fractures are extremely common and are considered a public health problem. The best anaesthetic technique for this surgery remains controversial. The aim of this study is to determine the impact of anaesthesia on perioperative and 30-day mortality and length of stay, in patients undergoing hip fracture surgery.

Methods: Adults undergoing hip fracture surgery, between January 1st, 2017 and December 31st, 2018, were retrospectively identified and categorized according to the anaesthetic technique. Perioperative and 30-day mortality rates and the length of stay were analysed.

Results: We identified 562 patients who underwent hip fracture surgery, 361 of whom were submitted to general anaesthesia and 201 to regional anaesthesia. The adjusted analysis showed no statistically significant difference in the risk of perioperative and 30-day mortality (odds ratio 1.12, 95% CI: 0.62–2.03; odds ratio 1.17, 95% CI: 0.72–1.92) or length of stay (0,9 days [-1.6 to 3.4], $P = 0.301$).

Conclusions: Our results were similar to those of studies already published in other countries. Within the limitations of our study, we concluded that there is no impact of the anaesthetic technique on perioperative and 30-day mortality rates and on the length of stay, for hip fracture surgery. In future studies, it will be opportune to investigate factors that influence the safety of anaesthetic techniques and that are subject to intervention by the anaesthesiologist.

Key words: general anaesthesia, length of stay, mortality, hip fracture, regional anaesthesia.

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Hip fractures are considered a public epidemic health problem worldwide [1]. It is an extremely common orthopaedic condition with a projection of increase that could range between 7.3 and 21.3 million cases by 2050 [2]. This kind of fracture is more frequent among elderly people and, despite the improvement in medical instruments, surgical and anaesthetic techniques, it is still associated with high morbidity and mortality [3].

Both regional and general anaesthesia are valid options for hip fractures surgery, but which technique offers a better outcome remains controversial [4, 5]. The choice of anaesthesia is frequently selected by the personal preference of the anaesthesiologist after assessment of the patient's medical status. In the literature, we found several studies that revealed some benefits in using spinal anaesthesia over general anaesthesia for this kind of surgery. Examples of that are: less cognitive dysfunction and better analgesia in the perioperative period with an opioid-sparing effect; decreased blood loss;

lower incidence of respiratory impairment, deep venous thrombosis (DVT) or pulmonary embolism (PE). On the other hand, general anaesthesia can be advantageous regarding a lower incidence of hypotension and cerebrovascular events [4, 6–8]. Despite these facts, to date, there is not enough evidence in the literature to show whether anaesthesia type has an influence on the outcome and length of stay (LOS) in patients undergoing hip fracture surgery.

We designed a retrospective cohort study of patients who underwent hip fracture surgery in our institution, over two years. In this study, we aimed to determine whether there is a significant difference in the length of hospital stay and perioperative and 30-day mortality rates between patients who underwent hip fracture surgery under general vs. regional anaesthesia.

METHODS

Ethical approval for this study was obtained from the Ethics Committee for Research of our institution,

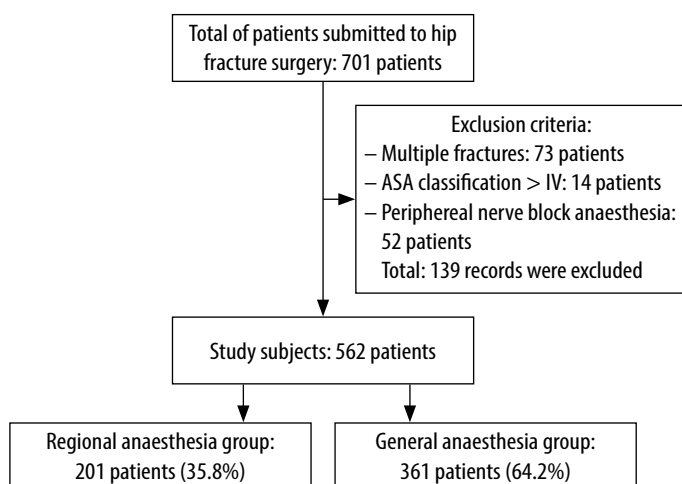


FIGURE 1. Flowchart of exclusion criteria

and was conducted according to the Helsinki Declaration. The study used anonymized claims data, so the need to obtain informed consent was waived.

Adults who were submitted to hip fracture surgery between 1st January 2017 and 31st December 2018 were retrospectively identified from our hospital surgical database system.

After excluding duplicate or inappropriate admission records, we eliminated the following: pa-

tients with multiple fractures (73 cases), American Society of Anesthesiologists physical state classification (ASA) more than IV (14 cases) and those who underwent peripheral nerve block anaesthesia once the majority of these cases had no detailed and clear anaesthesia type on the day of surgery (52 cases). We then retrospectively studied a total of 562 patients (Figure 1).

From our hospital surgical database we collected data such as gender, age, date of admission, date of surgery, date of discharge and perioperative mortality. 30-day mortality, ASA classification, and anaesthesia technique data were manually reviewed from medical records.

As outcomes of interest we chose hospital length of stay from the day of the surgery until discharge and perioperatively and within thirty days after surgery. Hospital length of stay was used as a continuous variable and perioperative and 30-day mortality rates as categorical variables. We chose perioperative and 30-day mortality rates as variables because these periods are likely to be more causally related to the type of anaesthesia used during surgery than in subsequent periods.

We compared and categorized the subjects into the general or regional anaesthesia group. General anaesthesia was defined as inhalational anaesthesia or total intravenous anaesthesia. Regional anaesthesia was defined as spinal anaesthesia, even if combined with sedation.

We cross tabulated patient characteristics by type of anaesthesia. For each anaesthesia type, we calculated number of patients, gender, age, and ASA classification from I to IV. We determined the adjusted risk ratios with 95% confidence intervals for: a) perioperative mortality, b) 30-day mortality and c) length of stay; comparing patients exposed to regional anaesthesia with patients exposed to general anaesthesia. Categorical variables were compared by the χ^2 test or Fisher's exact test, as appropriate. Continuous variables were compared by Student's *t*-test if they met the Kolmogorov-Smirnov test of normality. The analysis was performed using IBM SPSS, version 20.0 (IBM Corp.).

RESULTS

Between January 2017 and December 2018, 701 hip fracture procedures were performed in our institution. However, only 562 patients met the inclusion criteria established for the study. Of these 562 cases, 361 underwent general anaesthesia and 201 underwent regional anaesthesia. The descriptive statistical analysis of patients' characteristics included in the study, divided into groups of general anaesthesia and regional anaesthesia, is shown in Table 1. From the analysis of

TABLE 1. Subjects' characteristics divided by anaesthetic technique

Factor	Anaesthetic technique		P-value
	General (n = 361)	Regional (n = 201)	
Age			0.248
Average (SD)	79.91 (14.6)	79.58 (15.49)	
Gender			0.56
Male	95 (26.3%)	52 (25.9%)	
Female	266 (73.7%)	149 (74.1%)	
Surgery type			0.993
Reduction and osteosynthesis	247 (68.4%)	142 (70.7%)	
Total hip arthroplasty	50 (13.9%)	25 (12.4%)	
Partial hip arthroplasty	64 (17.7%)	34 (16.9%)	
Waiting time for procedure			0.546
First 48 h	100 (27.6%)	63 (31.3%)	
> 48 h after admission	261 (72.4%)	138 (68.7%)	
Fracture type			0.729
Subtrochanteric	25 (6.9%)	11 (5.5%)	
Intertrochanteric	228 (63.2%)	133 (66.1%)	
Femur neck	108 (29.9%)	57 (28.4%)	
ASA classification			0.247
1	18 (5%)	7 (3.5%)	
2	138 (38.2%)	77 (38.3%)	
3	176 (48.8%)	105 (52.2%)	
4	29 (8%)	12 (6%)	

ASA – American Society of Anesthesiologists, SD – standard deviation

Table 1, it is possible to observe that the characteristics of the sample, divided by the two anaesthetic groups, were in general and proportionally similar, with some differences described below. Procedures such as total or partial hip arthroplasty performed under general anaesthesia were proportionally superior when compared with regional anaesthesia, while reduction and femoral osteosynthesis was performed more frequently under regional anaesthesia. Hip fracture operations performed in the first 48 hours after admission were more frequently under regional anaesthesia, whereas surgical procedures performed after 48 hours were proportionally higher for general anaesthesia. Regarding the type of fracture, femoral neck and subtrochanteric fractures were more frequent in the general anaesthesia group, and intertrochanteric fractures were superior in the regional anaesthesia group. Patients classified as ASA I or ASA IV have a higher percentage in the general anaesthesia group, while patients classified as ASA II and ASA III have a higher percentage in the regional anaesthesia group. Table 2 shows the adjusted comparison of the study result. Regarding mortality in the perioperative period, 40 (11.1%) deaths were recorded in patients undergoing hip fracture surgery under general anaesthesia and 20 (10%) in patients undergoing surgery under regional anaesthesia. The analysis adjusted for age, sex, procedure, time elapsed until the procedure, type of fracture and ASA classification showed no significant difference in the risk of perioperative mortality between groups of patients who received regional anaesthesia compared to general anaesthesia (odds ratio 1.12, interval 95% confidence interval 0.62 to 2.03). Likewise, the adjusted analysis showed no significant difference in the risk of 30-day mortality between the two groups under analysis (odds ratio 1.17, 95% confidence interval 0.72 to 1.92), with 36 (10%) deaths in the general anaesthesia group and 18 (9%) in the regional anaesthesia group.

The average length of stay for the general and regional anaesthesia groups was 11.28 and 10.38 days, respectively. The adjusted analysis showed no significant difference in length of hospital stay between the two groups (0.9 days [1.6–3.4], $P = 0.301$).

DISCUSSION

The controversy regarding the most appropriate anaesthetic technique for hip fracture surgery is still ongoing today. Thus, in this context, general anaesthesia and regional anaesthesia are used in a similar way. In this study, we analysed the possible influence of the anaesthetic technique on perioperative and 30-day mortality, and on length of hospital stay, in adults undergoing hip fracture surgery. Through the analysis of the 562 adults sub-

TABLE 2. Adjusted comparison of study results

Factor	Anaesthetic technique		P-value
	General	Regional	
Perioperative mortality, <i>n</i> (%)	40 (11.1%)	20 (10%)	
Risk ratio (95% CI)	1.12 (0.62–2.03)		0.766*
30-day mortality, <i>n</i> (%)	36 (10%)	18 (9%)	
Risk ratio (95% CI)	1.17 (0.72–1.92)		0.543*
Length of stay, days (95% CI)	11.28 (0.78–21.78)	10.38 (2.38–18.38)	
Difference, days (95% CI)	0.9 (1.6–3.4)		0.301*

*Adjusted according to age, sex, procedure, time to procedure, type of fracture and ASA classification.

mitted to hip fracture surgery performed at our institution, no statistically significant differences were found in the risk of perioperative mortality and at 30 days associated with the type of anaesthesia. There is, however, in absolute number, a slight decrease in both mortality rates for patients undergoing regional anaesthesia, which may suggest a modest positive effect in patients undergoing hip fracture surgery under this anaesthetic technique. Regarding the length of hospital stay, patients undergoing regional anaesthesia have a slightly shorter hospital stay when compared to patients undergoing general anaesthesia. However, upon adjusted analysis of the data, there was no evidence of a statistically significant difference associated with the type of anaesthesia. This fact may be related to a bias of external factors, namely the fact that hospital discharge is dependent on several different surgeons of the Orthopaedics Department, who often adopt different and individualized discharge criteria. It also frequently happens that several of these patients see their hospitalization time prolonged, either due to the lack of response from our country's Continued Care Units (CCUs), for which many wait for a vacancy, or due to difficulty in social relocation within the general community. In the literature, the choice of the best anaesthetic technique for hip fracture surgery remains controversial. The results obtained in our study are compatible with studies already published in other countries.

In a retrospective study of 182 307 patients submitted to hip fracture surgery, Chu *et al.* [9] found a higher incidence of in-hospital mortality in the general anaesthesia group. Ahn *et al.* [10] concluded in their study based on elderly patients who underwent hip surgery fracture that regional anaesthesia was associated with better outcomes than GA, in terms of mortality.

Neuman *et al.* [4] did not find differences in unadjusted in-hospital mortality between the groups analysed; however, through the adjusted analysis they verified that the group undergoing regional anaesthesia had a 29% reduction in perioperative

mortality when submitted to general anaesthesia, in a sample of 18 178 patients undergoing hip surgery. On the other hand, an 11-year retrospective study, with 7164 patients, and a 5-year retrospective study, with a sample of 73 284 patients, both revealed that there is no superior anaesthetic technique in terms of perioperative mortality [11, 12]. A meta-analysis of randomized clinical trials also concluded that there is no significant or a limited effect with respect to regional anaesthesia in reducing in-hospital mortality in patients undergoing hip fracture surgery [5, 13]. Also a recent meta-analysis based on nine randomized clinical trials showed that there were no significant differences in the 30-day mortality and length of stay for neuraxial anaesthesia compared to general anaesthesia [14]. A systematic review and meta-analysis from randomized and non-randomized studies published between January 2000 and July 2017 showed that there was no significant difference in 30-day mortality although a small statistically significant difference for length of stay favouring regional anaesthesia was observed, which is unlikely to be clinically significant [15].

A nationwide population-based data retrospective study showed no decreased 30-day mortality associated with regional anaesthesia [16].

Redcliff *et al.* [17] with a sample of 5683 patients who underwent hip fracture surgery, between 1998 and 2003, observed a higher risk of mortality in this period in patients undergoing general anaesthesia compared to regional anaesthesia. This comparison between techniques was analysed in a systematic review that concluded that there was a reduction in 30-day mortality in patients undergoing regional anaesthesia (6.8% vs. 9.4%), with borderline statistical significance. However, the studies analysed in this review had smaller samples and comprise dates between 1980 and 2003; meanwhile, the anaesthetic practice has undergone evolution, namely in the drugs administered. Thus, the authors stated that it is not possible to draw conclusions regarding mortality [5]. In a more recent retrospective study (2015), with 9842 patients undergoing hip fracture surgery, aged over 70 years, Basques *et al.* [18] concluded that there was no difference in 30-day mortality between patients undergoing general and regional anaesthesia for hip fracture surgery. The same results were presented in two other retrospective studies, with 7585 and 65 535 patients undergoing hip fracture surgery [19, 20].

The length of hospital stay was assessed in three studies published in 2015, with 9842, 104 088, and 12 929 patients who underwent hip fracture surgery [9, 18, 21]. These studies revealed a shorter hospital stay in the regional anaesthesia groups; however, it is only a difference of no more than a day and a half,

which clinically has little relevance. White *et al.* [22] in a more recent study with 11 085 patients, undergoing hip fracture surgery, concluded that there was no statistically significant difference between patients undergoing general versus regional anaesthesia.

Most of the studies in the literature on this topic are American. Fewer are those carried out in Europe, where the health system frankly differs. Our study is the first retrospective study carried out in our country, where the possible effect of the anaesthetic technique on the risk of perioperative and 30-day mortality rates and influence on the length of hospital stay are evaluated, in patients undergoing hip fracture surgery.

As limitations, in common with other studies, the database used does not present detailed information on patients' co-morbidities; however, the statistical analysis was adjusted according to variables that are also important and reflect the complexity and clinical status of patients, namely ASA classification and age.

Our study has a small sample, in terms of absolute number, when compared with other studies already published in the literature. However, it is important to note that our country has a lower population density, giving this sample, in proportional terms, a larger dimension. Another factor that constitutes a limitation is that our study was carried out in a single centre, which may introduce potential biases, which would be reduced if it was a multicentre study.

In third place, not all forms of general and regional anaesthesia are alike. Unfortunately, the collection of these data (namely drugs and doses used) was not possible. Although it would be useful to include this information, we believe it is not a very significant bias, since the anaesthetic team at our institution applies, in the vast majority of cases, drugs and respective doses in a relatively similar way.

In summary, we found no statistically significant differences in perioperative and 30-day mortality rates, nor evidence of the influence of the anaesthetic technique on the length of hospital stay, concluding that the type of anaesthesia, alone, has little influence on these variables.

In future studies, it will be more opportune to redirect the investigation to factors that influence the safety of both anaesthetic techniques and, consequently, the patient's outcome, and that are subject to intervention by the anaesthesiologist, such as hypoxia, hypotension and pain, as well as early postoperative complications.

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