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Quality of recovery from anesthesia in patients undergoing orthopedic surgery of the lower limbs

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Abstract

Background and objectives: For patients undergoing regional anesthesia for orthopedic surgery, a common situation in our work environment, the quality of recovery may be influenced in different ways, which justifies studies to identify possible predictive factors of dissatisfaction. The aim of this study was to assess the opinion of patients on recovery from anesthesia for lower limb orthopedic surgeries. We also identified potential predictive factors for poor quality of recovery.

Methods: We evaluated patients undergoing lower limb orthopedic surgeries and able to participate in the study. Data related to surgery, anesthesia, possible complications in the post-anesthetic care unit (PACU) and in the ward were recorded. In the morning after surgery, patients were evaluated by a medical student who applied the QoR-40 questionnaire. The resulted score—between 40 and 200—was used to determine the quality of recovery and identify the potential predictors.

Results: We evaluated 172 patients. The questionnaire average score was 192 points. The chance to have lower scores in the QoR-40 was two times higher among males. Patients who remained under sedation, classified as greater than or equal to 4 on the scale proposed by Ramsay, had a 3.5 times higher risk of having lower scores in the QoR-40 compared to those who remained with level 1 or 2 of sedation. Regarding pain, at every increase of one unit in the numerical scale (0–10), there was a 19% increase in risk for QoR-40 $\leq$ 195. Similarly, the risk for a score below the median was 2.3 times higher among those presenting with nausea and/or vomiting in the ward.

Conclusion: Male, nausea, vomiting, pain while in the ward, and deeper levels of sedation are possible predictive factors for lower scores according to the adopted instrument.

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Qualidade da recuperação da anestesia em pacientes submetidos à cirurgia ortopédica em membros inferiores

Resumo

Justificativa e objetivos: Para os pacientes submetidos à anestesia regional para cirurgias ortopédicas, situação comum em nosso meio, a qualidade da recuperação pode ser influenciada de diversas formas, o que justifica a determinação de possíveis fatores preditivos de insatisfação. O objetivo do estudo foi avaliar a opinião dos pacientes sobre a recuperação da anestesia para cirurgias ortopédicas em membros inferiores. Também foram identificados possíveis fatores preditivos para baixa qualidade da recuperação.

Métodos: Foram avaliados os pacientes submetidos à cirurgia ortopédica nos membros inferiores e aptos a participar do estudo. Os dados relacionados à cirurgia, à anestesia, às possíveis complicações na sala de recuperação pós-anestésica (SRPA) e na enfermaria foram registrados. Na manhã seguinte à cirurgia, os pacientes foram avaliados por um estudante de medicina que aplicou o questionário QoR-40. A pontuação obtida, entre 40 a 200, foi usada para determinar a qualidade da recuperação e identificar os possíveis fatores preditivos.

Resultados: Foram avaliados 172 pacientes. O escore médio do questionário foi de 192 pontos. A chance de ocorrência de valores menores de QoR-40 foi 2 vezes maior entre os pacientes do sexo masculino. Pacientes que permaneceram sob sedação classificada como maior ou igual a 4 segundo a escala proposta por Ramsay apresentaram risco 3,5 vezes maior de apresentar menor pontuação no QoR-40 quando comparados com aqueles que permaneceram com nível de sedação 1 ou 2. Em relação à dor, a cada incremento de uma unidade na escala numérica (0 a 10), houve um aumento de 19% no risco para QoR-40 $\leq$ 195. Da mesma forma, o risco para pontuação abaixo da mediana foi 2,3 vezes maior entre aqueles que apresentaram náuseas e/ou vômitos na enfermaria.

Conclusão: O sexo masculino, a náusea, o vômito, a dor durante a permanência na enfermaria e níveis mais profundos de sedação são possíveis fatores preditivos para menor pontuação segundo o instrumento adotado.

Introduction

The growing concern with the quality of health care delivered gave rise to a new focus on clinical investigations in anesthesiology: the assessment of satisfaction with certain therapeutic options. It is in this scenario that researches on health-related quality of life have emerged as an appropriate option to allow anesthesiologists' awareness of the concerns and views of their patients and incorporate it into their practice. The development of the Quality of Recovery-40 questionnaire (QoR-40),[1] a validated instrument to assess the quality of anesthesia recovery, allows a more realistic approach to the factors that influence the perception of patients during the perioperative period. For patients undergoing regional anesthesia for orthopedic surgery, a common situation in our medical environment, many factors could influence the quality of the recovery, which justifies the QoR-40 application as a way to determine possible predictors of dissatisfaction. The results could contribute to the monitoring and adequacy of care in anesthesia for this group of individuals. The aim of this study was to evaluate the quality of recovery from anesthesia using the QoR-40 questionnaire in patients undergoing lower limb orthopedic surgery. We also identified potential predictive factors for poor quality of recovery.

Material and methods

After approval by the Ethics Committee of the *Faculdade de Ciências Médica e da Saúde* at PUC-SP and obtaining written informed consent, patients undergoing lower limb orthopedic surgery at the *Hospital Santa Lucinda* and able to participate were evaluated. Patients undergoing lower limb orthopedic surgery under spinal anesthesia, with physical status ASA I or II, and aged between 18 and 65 years were included. Exclusion criteria were refusal to participate in the study, failure to communicate due to altered level of consciousness or presence of neurological or psychiatric disease, contraindication to the use of neuraxial anesthesia or allergy to any of the drugs used in the study, and history of alcoholism or drug dependence. Patients who underwent hip surgery were also excluded, as they are often sent to the intensive care unit for recovery on the first postoperative day. Age, sex, physical status, duration of the procedure, history of previous lower limb surgery or anesthesia, use (or not) of nonsteroidal anti-inflammatory or prophylactic antiemetic drugs, and need for urinary catheter were recorded.

After pre-anesthetic evaluation and admission to the operating room, all patients were monitored with cardioscopy, noninvasive blood pressure, and pulse oximetry. Midazolam (0.06–$0.08\,\mathrm{mg\,kg^{-1}}$) was administered prior to spinal anesthesia. Patients received 0.5% hyperbaric

bupivacaine, in variable dose at the anesthesiologist's discretion, associated with morphine 80 mcg. During the procedure, sedation was classified by the anesthesiologist responsible using Ramsay sedation scale.[2] At the end of surgery, patients were transferred to the post-anesthesia care unit (PACU) where they remained until obtaining a score ≥ 9, according to the Aldrete–Kroulik modified scale. During PACU stay, the presence of pain, nausea, vomiting, pruritus, urinary retention, temperature below 36 °C, and length of stay were recorded. Pain severity was assessed every 15 min using a 0–10 numerical scale (0 = no pain, 10 = worst pain imaginable). Intravenous morphine (1–2 mg) was administered every 10 min to reach a score below 4 (1 mg for pain < 7 and 2 mg for pain ≥ 7). After PACU discharge, all patients received intravenous ketoprofen (100 mg) every 12 h and dipyrone (30 mg kg^{-1}) every 6 h. For cases in which patients considered the analgesic regimen insufficient, intravenous tramadol (100 mg) was given every 8 h. Postoperative nausea and vomiting were managed with ondansetron (4 mg) and pruritus with diphenhydramine (25 mg) every 6 h as needed. Pain severity (VAS); analgesic consumption; and occurrence of nausea, vomiting, pruritus or urinary retention in the ward were recorded.

QoR-40 questionnaire

The interviews were performed in the ward the morning after surgery for one of two medical school students who participated in the study and were blind to the anesthetic procedure adopted. After the explanation of how to fill de questionnaire, the questionnaire was completed by the patient with the interviewer at his/her side to clarify any doubts. The QoR-40 has 40 questions divided into five dimensions: emotional status (nine questions), physical comfort (12 questions), psychological support (seven questions), physical independence (five questions), and pain (seven questions). Each question relates to its frequency of occurrence, according to the Likert scale: ''none of the time'', ''sometimes'', ''often'', ''most of the time'', ''all the time''. Each of the indicative terms of frequency is assigned a number from one to five.

The questionnaire has two parts (A and B). In part A, the questions indicate positive aspects; that is, the higher the frequency of occurrence, the higher the score. In Part B, it is the reverse. Therefore, in part A, the term ''none of the time'' is represented by one; ''sometimes'' is represented by two; ''often'' is represented by three; ''most of the time'' is represented by four, and ''all the time'' is represented by five. In part B, ''none of the time'' is represented by five; ''sometimes'' is represented by four, and so on. The total possible score for QoR-40 ranges from 40 (poor recovery) to 200 points (excellent recovery). The questionnaire was translated, adapted and validated to the Portuguese language[3] and for patients undergoing regional anesthesia.[4]

Multivariate analysis through multiple binary logistic regression was used to identify covariates associated with the occurrence of QoR-40 ≤ 195 (distribution median). Initially, univariate binary logistic analyzes were conducted to test the association between each covariate and the binary response variable. In these analyses, when the phenomenon of data ''separation'' was noticed the exact logistic regression method was applied instead of the conventional asymptotic method. Subsequently, the covariates with a p-value <0.20 in univariate regression analyzes were considered in the multiple logistic regression analysis with the conventional maximum likelihood method and selection of variables according to the backward elimination technique. The linearity assumption of the logit scale (log-odds) between each quantitative covariate and the binary response variable in the binary logistic regression analysis were evaluated using fractional polynomials and building the smoothed scatter plots. When the assumption was not met, quantitative covariates were categorized according to the distribution terciles. The multicollinearity diagnosis was performed via estimation of the variance inflation factors (VIF). The final multiple logistic regression model calibration and discriminatory ability were evaluated using the Hosmer–Lemeshow test and c-statistics, respectively. Normality was assessed by visual inspection of histograms and application of Shapiro–Wilks normality test. Categorical variables were described as absolute (relative) frequencies and continuous variables described as mean ± standard deviation or median (interquartile range). All presented significance probabilities (p-values) are of bilateral type and values less than 0.05 were considered statistically significant. SAS version 9.3 software was used for statistical analysis of data.

Results

From August 2013 to June 2014, 197 patients were selected, of whom 25 were excluded: four due to refusal to participate in the study, nine due to contraindication to spinal anesthesia or allergy to one of the drugs used in the study, and 12 due to history of dependence on alcohol or drugs. Among the 172 patients enrolled, the mean age was 35 years, 77% male, and 49% reported never having undergone previous surgery or anesthesia in the lower limbs. In 76% of cases, the level of sedation was maintained above two, according to the Ramsay scale. The average length of the procedures was 171 min and the average length of PACU stay was 70 min. During this period, only one patient had severe pain (>4), according to the adopted scale. Two patients had nausea and/or vomiting, one complained of pruritus, and there was no urinary retention complaint. The most commonly seen complication was hypothermia (temperature < 36 °C), present in 27% of patients. In the ward, nausea and/or vomiting, pruritus, and urinary retention were seen in 28%, 20%, and 9% of cases, respectively. When asked about the time of lumbar puncture for anesthesia, 49% of patients responded that they had memory. The quality of recovery was evaluated using the score obtained in the QoR-40 questionnaire. The total score (40–200 points) was divided into two categories: ≤ 195 and >195. A score below 195 points was seen in 60% of cases. Tables 1–4 list the relationships between the variables recorded and the score according to QoR-40.

Table 1 Number of patients with QoR-40 > 195 or ≤195, according to variables, such as sex, physical status, previous lower limb surgery, and previous anesthesia for lower limb orthopedic surgery. Data are expressed as number (%).

	QoR-40 > 195	QoR-40 ≤ 195	Total
Sex			
Female	21 (54%)	18 (46%)	39 (100%)
Male	48 (36%)	85 (64%)	133 (100%)
ASA			
I	51 (42%)	71 (58%)	122 (100%)
II	18 (35%)	32 (65%)	50 (100%)
Previous surgery			
No	38 (45%)	46 (55%)	84 (100%)
Yes	31 (35%)	57 (65%)	88 (100%)
Previous anesthesia			
No	38 (45%)	46 (55%)	84 (100%)
Yes	31 (35%)	57 (65%)	88 (100%)

Table 2 Influence of the variables sex, age, ASA physical status, previous lower limb surgery or previous anesthesia for lower limb surgery, intraoperative administration of anti-inflammatory or antiemetic drugs, urinary catheter in the operating room, and level of sedation, according to Ramsay scale for quality of recovery.

Variable	Level	N	Odds ratio	95% IC	p-Value
Sex					
	M	133	2.1	1.0–4.3	0.05
	F	39	1.0	–	–
Tercile age (years)					
	>42	56	1.3	0.6–2.8	0.43
	27–42	53	1.1	0.5–2.2	0.89
	≤26	63	–	–	–
ASA					
	II	50	1.4	0.7–2.7	0.39
	I	122	1.0	–	–
Lower limb previous surgery					
	Yes	88	1.5	0.8–2.8	0.18
	No	84	1.0	–	–
Previous anesthesia for lower limb surgery					
	Yes	88	1.5	0.8–2.8	0.18
	No	84	1.0	–	–
NSAIDs					
	Yes	129	1.1	0.5–2.2	0.79
	No	43	1.0	–	–
Antiemetics					
	Yes	154	1.6	0.6–4.2	0.37
	No	18	1.0	–	–
Urinary catheter					
	Yes	11	1.2	0.3–4.2	0.80
	No	161	1.0	–	–
Sedation (Ramsay)					
	1 or 2	42	1.0	–	–
	3	103	2.0	0.9–4.1	0.06
	≥4	27	3.5	1.2–9.9	0.02

Table 3 Influence of the variables observed in the post-anesthesia care unit on quality of recovery.

Variable	Level	N	Odds ratio	95% IC	p-Value
Tercile stay (minutes)					
	>90	51	1.8	0.8–3.8	0.14
	61–90	44	0.9	0.4–1.8	0.71
	≤60	77	1.0	–	–
Temperature < 36 °C					
	Yes	47	0.9	0.5–1.8	0.81
	No	125	1.0	–	–
Nausea and/or vomiting					
	Yes	2	0.7	0.1–11.3	0.80
	No	170	1.0	–	–
Pruritus					
	Yes	1	0.7	0.0–13.2	0.82
	No	171	1.0	–	–
Urinary retention					
	Yes	0	–	–	–
	No	172	–	–	–

Table 4 Influence of the variables observed in the ward on quality of recovery.

Variable	Level	N	Odds ratio	95% IC	p-Value
Puncture memory					
	Yes	88	1.1	0.6–2.1	0.69
	No	84	1.0	–	–
Rescue (Tramadol)					
	Yes	42	1.7	0.8–3.5	0.17
	No	130	1.0	–	–
Nausea and/or vomiting					
	Yes	49	2.3	1.1–4.8	0.02
	No	123	1.0	–	–
Pruritus					
	Yes	33	0.8	0.4–1.6	0.49
	No	139	1.0	–	–
Urinary retention					
	Yes	16	0.6	0.2–1.8	0.40
	No	156	1.0	–	–

Discussion

A cross-sectional study was performed in order to assess the quality of recovery from anesthesia using the QoR-40 questionnaire in patients undergoing lower limb orthopedic surgery. The average score was 192 points (40–200), which represents a high quality recovery in the patients' opinion. Potential predictive factors for poor quality of recovery were also identified. So, we analyzed anthropometric data, previous experience with lower limb anesthesia or surgery, level of perioperative sedation, prophylactic administration of anti-inflammatory or antiemetic drugs, and the occurrence (or not) of complications in PACU or ward. Multivariate analysis via multiple logistic regression was used and the events were analyzed according to the occurrence of QoR-40 ≤ 195 (distribution median). The chance of having QoR-40 lower values was two times higher among males. The level of sedation during surgery may also be considered a predictive factor for the quality of anesthetic recovery. Patients who remained under sedation rated as four, according to the scale proposed by Ramsay, presented a risk 3.5 times more likely to have lower scores on QoR-40 compared to patients who remained with sedation level rated as one or two. Pain severity during ward stay was also positively correlated with the QoR-40 score below the median distribution. Every increase of one unit on the scale used for the evaluation of pain severity increased by 19% the risk for QoR-40 ≤ 195. Similarly, the risk for a score below the median was 2.3 times higher among those who had nausea and/or vomiting in the ward.

Name: _____ study #: ____ Hospital UR #:__Date: _____

Part A How have you been feeling in the last 24 hours?

(1 to 5, where: 1 = very poor and 5 = excellent)

For example: If you have been able to breathe easily all of the time, you should indicate this by circling the response 5 = all of the time as shown below:

Example:

	None of the time	Some of the time	Usually	Most of the time	All of the time
Able to breathe easily	1	2	3	4	(5)

Comfort

	None of the time	Some of the time	Usually	Most of the time	All of the time
Able to breathe easily	1	2	3	4	5
Have had a good sleep	1	2	3	4	5
Been able to enjoy food	1	2	3	4	5
Feel rested	1	2	3	4	5

Emotions

	None of the time	Some of the time	Usually	Most of the time	All of the time
Having a feeling of general well-being	1	2	3	4	5
Feeling in control	1	2	3	4	5
Feeling comfortable	1	2	3	4	5

Physical independence

	None of the time	Some of the time	Usually	Most of the time	All of the time
Have normal speach	1	2	3	4	5
Able to wash, brush teeth or shave	1	2	3	4	5
Able to look after your own appearance	1	2	3	4	5
Able to return to work or usual home activities	1	2	3	4	5

Patient Support

	None of the time	Some of the time	Usually	Most of the time	All of the time
Able to communicate with hospital staff (when in hospital)	1	2	3	4	5
Able to communicate with family or friends	1	2	3	4	5
Getting support from hospital doctors (when in hospital)	1	2	3	4	5
Getting support from hospital nurses (when in hospital)	1	2	3	4	5
Getting support from family or friends	1	2	3	4	5
Able to write	1	2	3	4	5
Able to understand instructions and advice	1	2	3	4	5

Figure 1 Original version Patient Survey (QoR-40).

Numerous aspects can influence the patient's perception about the quality of recovery from anesthesia. Lower limb orthopedic surgeries are commonly performed under spinal anesthesia and accompanied by some postoperative peculiarities that deserve attention, such as ambulation limited by surgery or disease, dependence on support from others for basic activities, pain, urinary retention, and other possible adverse effects related to anesthesia and surgery. Poor quality recovery can prolong hospital stay, generate dissatisfaction, and change the pattern of use of hospital resources, resulting in higher costs.[5] Determining the cause for a possible oscillation of the anesthesia recovery quality level of a service may suggest strategies for resolving deficiencies or discovery of potential improvement

Part B: Have you had any of the following in the last 24 hours?

(5 to 1, where: 5 = excellent and 1 = very poor)

Comfort	None of the time	Some of the time	Usually	Most of the time	All of the time
Nausea	5	4	3	2	1
Vomiting	5	4	3	2	1
Vomiting without content	5	4	3	2	1
Dry-retching	5	4	3	2	1
Feeling restless	5	4	3	2	1
Shaking or twitching	5	4	3	2	1
Feeling too cold	5	4	3	2	1
Feeling dizzy	5	4	3	2	1
Emotions	None of the time	Some of the time	Usually	Most of the time	All of the time
Had bad dream	5	4	3	2	1
Feeling anxious	5	4	3	2	1
Feeling angry	5	4	3	2	1
Feeling depressed	5	4	3	2	1
Feeling alone	5	4	3	2	1
Had difficulty falling asleep	5	4	3	2	1
Patient Support	None of the time	Some of the time	Usually	Most of the time	All of the time
Feeling confused	5	4	3	2	1
Pain	None of the time	Some of the time	Usually	Most of the time	All of the time
Moderate pain	5	4	3	2	1
Severe pain	5	4	3	2	1
Headache	5	4	3	2	1
Muscle pains	5	4	3	2	1
Backache	5	4	3	2	1
Sore throat	5	4	3	2	1
Sore mouth	5	4	3	2	1

Figure 1   (*Continued*).

opportunities. Hence the importance of a careful evaluation not only of postoperative pain but also other physical, functional, and psychological aspects of patients. Various forms of measurement have been proposed for this purpose, but when comparing the measuring instruments after anesthetic procedures, QoR-40 showed more adequate psychometric characteristics and has been considered the best tool developed for this purpose, as shown by two qualitative systematic reviews and a quantitative one.[6–8] QoR-40 (Fig. 1) has 40 questions divided into five dimensions: emotional status, physical comfort, emotional support, physical independence, and pain. Each question relates to its frequency of occurrence, according to the Likert scale. The total possible score for QoR-40 ranges from 40 (poor recovery) to 200 points (excellent recovery). Few studies have evaluated the quality of recovery after anesthesia for orthopedic surgery. In the present study, variables such as age, lower limb orthopedic surgery or previous anesthesia for this procedure, prophylactic administration of antiemetic or anti-inflammatory drugs, and urinary catheter were not determining factors for poor quality recovery. Similarly, the length of PACU stay and the presence of hypothermia observed in this unit did not determine a lower score in QoR-40. Postoperative complications, such as pruritus and urinary retention, evaluated in PACU or ward, were not considered as a risk factor for a score lower than 195. Some authors observed that female patients were more likely to have poor quality recovery after anesthesia. One explanation would be a higher incidence of nausea and vomiting among female patients or greater willingness to report dissatisfaction during the postoperative period.[9–11] In the present investigation, male was considered as a predictive factor for lower score in the QoR-40 questionnaire. It was not possible to establish a possible explanation for this result. Another interesting finding was that patients under sedation (Grade 4 or more), according to Ramsay scale, had lower quality of recovery compared to those who remained more aware (Ramsay 1 or 2). This result may contain some bias that must be considered. It is unlikely that patient preference is to stay awake, although this issue has not been directly assessed. Perhaps sedation has been applied with greater frequency and intensity in patients undergoing more complex and prolonged procedures, which would justify the worst quality of recovery. Another possibility is the possible occurrence of adverse effects associated with sedation, such as prolonged sleepiness.

Despite midazolam administration immediately before spinal anesthesia, 49% of patients reported having memory of the puncture time. Still, the memory has not been considered a predictive factor for poor quality recovery. On the other hand, pain, nausea, and vomiting, as noted by other authors,[7,10] were determining factors for lower score according to the adopted scale. These complications were uncommon in the PACU, but there was a significant increase in the length of stay in the ward. According to Ekstein and Weinbroum,[12] pain severity after orthopedic surgery can overcome that observed in patients undergoing laparotomy, which requires the adoption of specific protocols for postoperative management. The incidence of nausea and/or vomiting among the participants of this study was 28%. Authors who evaluated the occurrence of these complications in patients undergoing orthopedic

surgery under spinal anesthesia with bupivacaine and morphine[13,14] reported incidence of 40–60%. The prophylactic administration of ondansetron in 89% of cases in our study could explain the lower incidence, although there was no comparison between those receiving or not prophylactic antiemetics. The administration of intrathecal morphine at a dose up to 0.1 mg does not appear to increase the risk of postoperative nausea and vomiting.[13,15] As it is a cross-sectional study, there may be difficulty in establishing causal relationships from the exposed data. The present study indicates the need for randomized controlled trials comparing the quality of the recovery of patients undergoing orthopedic surgery under different techniques for postoperative pain, nausea and vomiting management.

In conclusion, male, nausea, vomiting, and pain during ward stay are predictive factors for poor quality of recovery after anesthesia for lower limb orthopedic surgeries.

Conflicts of interest

The authors declare no conflicts of interest.

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