Original Article

Analysis of direct costs of anesthesia-related materials between spinal and venous anesthesia with propofol associated with local perianal block in hemorrhoidectomy

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ABSTRACT: Introduction: There is no consensus on the ideal anesthesia for hemorrhoidectomy in ambulatory facilities. Spinal anesthesia and venous propofol associated with local perianal block (combined anesthesia) are frequently used, and their direct costs may be crucial for the anesthesia type selection. The objective of this study was to compare the direct costs of anesthesia-related materials in hemorrhoidectomy between these two anesthetic techniques. Method: Retrospective and cross-section analysis, comparing the direct costs of the materials of spinal and venous anesthesia with propofol associated with local perianal block, in hemorrhoidectomy. Results: Twenty patients were included, ten submitted to each anesthesia type (five from each gender). The mean age in the spinal anesthesia group was 46.5 years and in the combined anesthesia group, 42.5 years (p=0.334). The mean cost of anesthesia-related materials was R$ 58.50 (R$ 36.48 – R$ 85.79) in the first group versus R$ 190.31 (R$ 98.16 – R$ 358.51) in the second – 69.27% difference between them (p<0.001). The mean costs according to gender analysis were R$ 50.32 and R$ 66.69 (p=0.263) in the spinal anesthesia group versus R$ 222.52 and R$ 158.10 (p=0.221) in the combined anesthesia group, respectively. Conclusions: The direct costs of anesthesia-related materials were significantly lower in patients submitted to hemorrhoidectomy using spinal anesthesia. No difference was observed between the genders in each group analyzed.

Keywords: costs and cost analysis; hemorrhoids; anesthesia, spinal; anesthesia, intravenous; anesthesia, local.

INTRODUCTION

Anorectal diseases are considerably more predominant in the Western population. Around 4.4% of the North-American adult population complains of hemorrhoids[1,2]. In this group, around 27% will have to be submitted to a surgical treatment, according to data in the Brazilian literature[3].

Following the global tendencies for small surgical procedures in patients with favorable anesthetic conditions, hemorrhoidectomy, just as most procedures in the anorectum, may be performed in ambulatory facilities[4,5]. In the context of anorectal surgeries in ambulatory facilities, the anesthetic technique is extremely important and should enable good surgery conditions, agility in the surgery room, possibility

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of early discharge from hospital, reduced costs, few side effects, comfortable administration and fast recovery[6].

The main anesthetic techniques that have been used so far for anorectal procedures are: spinal anesthesia and combined (venous and local) anesthesia[7] and, less frequently, general and epidural anesthesia[8-10]. Local anesthesia alone, despite producing interesting results presented in the literature[11-13], has been increasingly questioned, as it brings more benefits to selected patients. The combined use of venous anesthesia with local infiltrations offers comfort to both patient and surgeon and prevents several complications associated with general and spinal anesthesia[14]. Today, there is no consensus on the ideal anesthetic technique for anorectal surgeries[10,15].

The financial cost of health has increased at a fast pace at global level, a concern to users, governments and communities[16,17]. In the 1960's, in the United States, the amount allocated to health was 5.2% of the Gross Domestic Product (GDP), and estimates for 2030 exceed 30%. In mid 1970's, the term "pharmacoeconomy" was created to define the studies on health economy aiming at optimized efficiency of health costs[18,19]. The health economy studies direct costs (medications, materials, etc.) and indirect costs (occupation time of the operating room, working hours of professionals, among others). Indirect costs are usually higher, although involving more difficult measurement and quantification. Therefore, economic analyses in Medicine are significantly complex[19].

The international literature is still incipient regarding themes involving economic aspects associated with proctologic or anesthetic surgical procedures[7,20]. Few Brazilian articles on this subject have been published[21,22]. Given the significant prevalence of hemorrhoidal disease and the high proportion of patients that will require a surgical treatment, the anesthetic procedure costs have become an important factor in the selection of the best technique for these surgeries, as the surgical procedure *per se* is unvarying. Thus, an economic analysis may help making decisions as one of the important aspects in the multifactorial analysis of the disease, patients and health system.

Considering this scenario, where clinical aspects are combined with economic factor, it is important to use previous experiences of reference services to optimize the anesthetic technique employed in these surgeries, without negative impacts to patients or health systems.

The main purpose of this study was to evaluate and compare the direct costs of anesthetic materials used in hemorrhoidectomy, in patients submitted to spinal anesthesia or combined (venous with propofol associated with local perianal block) anesthesia.

METHOD

This study was approved by the Research Ethics Committee of Pontifícia Universidade Católica do Paraná (CEP – PUCPR), listed under 5088/2009.

This retrospective study analyzed 20 patients from the Coloproctology Service of Hospital Universitário Cajuru (SeCoHUC) at PUCPR, submitted to a surgical procedure in the hospital-day sector of this institution, performed by the same surgical team and using standardized surgical and anesthetic techniques. The various anesthetic techniques described for anorectal procedures are employed in this Coloproctology Service. The most frequent technique is the combined (venous with propofol associated with local perianal block) anesthesia, as it may allow early discharge from hospital, among other advantages[6].

The patients included in this study were all adults, from the Coloproctology Ambulatory Service of Hospital Universitário Cajuru, with mixed symptomatic hemorrhoidal disease, three hemorrhoid cushions at the proctologic exam. All patients fulfilled the anesthetic criteria to be submitted to a surgical procedure provided in ambulatory facilities (healthy or with compensated comorbidities, without functional limitations – ASA I and ASA II, respectively)[4,23]. The patients were selected through simple random sampling from the database of the Coloproctology Service. Ten patients were included in the spinal anesthesia group and ten other patients to the combined anesthesia group. Each group was constituted of five men and five women (Figure 1).

The surgeries in all patients were performed by the same surgical team and submitted to Milligan-Morgan hemorrhoidectomy (open technique), under rigorous technical standardization. The anesthesia process, regardless of the technique (spinal or combined anesthesia) or the anesthetist, followed equally rigorous

steps, according to the practice of the Anesthesiology Service of Hospital Universitário Cajuru.

The patients from the spinal anesthesia group were placed in the sitting position, with forward trunk flexion, to better expose the intervertebral spaces. The anesthetist, after performing his own antisepsis procedure, was getting ready and performing the patient's antisepsis using 70% alcohol. The amount of 5 mL of lidocaine 1%, without vasoconstrictor, for skin and subcutaneous anesthesia, was inserted in the space between the second and third lumbar vertebras. Afterwards, this intervertebral space was punctured with a 27 g needle for spinal anesthesia into the subarachnoid space (confirmed by the cerebrospinal fluid backflow) for the administration of 2 mL of 0,5% isobaric bupivacaine (10 mg). Then, the patients were placed in the lithotomy position, with their lower limbs secured to their respective stirrups using 15-cm-wide crepon ties. Antisepsis of the perianal region was performed using 20 mL of topic iodopovidone and sterile surgical fields were established. After a perianal anesthesia test with thumb forceps (mouse-tooth forceps), the Milligan-Morgan hemorrhoidectomy started.

The patients from the combined anesthesia group, after having their peripheral venous access and monitoring, were sedated by the anesthetist with 2 mg/kg of propofol (Propovan, Cristália®, Brazil). The sedation maintenance occurred with infusion of propofol as needed, at the anesthetist's discretion[24]. The surgery preparation and antisepsis procedures were similar to those performed in the spinal anesthesia group. The surgeon administered the local anesthesia with a 25 g needle, injecting 10 mL of 0.75% ropivacaine using the Schneider's technique[25], which refers to the subcutaneous perianal administration of the anesthetic in a fan-like distribution, starting with an anterior median puncture and then a posterior median puncture in relation to the anus. Other 10 mL of the solution were divided for the pudendal nerve block through transperineal punctures medially to the ischial tuberosity[26]. With the perianal anesthesia confirmed as described above, the Milligan-Morgan hemorrhoidectomy started.

When the surgical procedures were concluded, the patients were taken to the postoperative recovery room, where they remained under monitoring until day-hospital discharge by the anesthesiology team.

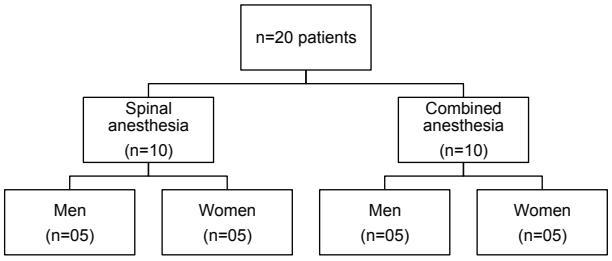

Figure 1. *Study design and sampling for subsequent cost analysis.*

Then, the patients were taken to the recovery ambulatory service for subsequent discharge, at the physician's discretion.

Data collection was performed by reviewing the patients' clinical records, starting with the analysis of the document describing the materials used in the surgery room during the procedure, i.e., the surgery report. All quantities of items used in the anesthetic technique were extracted from this report, such as anesthetic and sedative substances and disposable materials (needles, syringes, devices, gloves, among others). These quantities were multiplied by the individual cost of each item, as standardized by pharmaceutical magazine Kairos/Kairos Web Brasil[27]. Then, the final cost of the anesthetic materials was obtained for each patient. These costs were added up, and a mean cost was assigned to each group, for subsequent comparison.

The data was submitted to a descriptive and statistical analysis of the Statistical Package for the Social Sciences - SPSS®, version 17.0. The analyses of mean age and mean costs used the Student's *t*-test, with confidence interval of 95% ($p<0.05$).

RESULTS

The patients were equally distributed into each group in terms of gender (ten males and ten females). In the spinal anesthesia group, the mean age was 46.5 years, ranging between 33 and 65 years; in the combined anesthesia group, the mean age was 42.5 years, ranging between 26 and 55 years ($p=0.334$) (Table 1). The groups were comparable only when considering the mean age.

The anesthetic procedure cost in the spinal anesthesia group ranged from R$ 36.48 to R$ 85.79, with mean cost of R$ 58.50 (standard deviation: R$ 22.04).

In the combined anesthesia group, the mean cost was R$ 190.31 (standard deviation: R$ 80.06), ranging from R$ 98.16 to R$ 358.51. The Student's *t*-test analysis result was p<0.001, which shows that the anesthetic material cost was lower in the spinal anesthesia group. The difference between the mean values of the two groups was R$ 131.80, with the spinal anesthesia group presenting 69.27% cost reduction. Figure 2 illustrates these findings.

The study attempted to analyze if the costs between the groups presented any difference in terms of gender. In the spinal anesthesia group, the mean values of male and female patients were R$ 50.32 and R$ 66.69, respectively (p=0.263). In the combined anesthesia group, the mean costs of male and female patients were R$ 222.52 and R$ 158.10 (p=0.221), respectively. Figure 3 illustrates these findings. Although absolute numbers showed a lower mean cost for male patients from the spinal anesthesia group and for female patients from the combined anesthesia group, it was not statistically significant after the Student's *t*-test analysis.

Other substances were used in association with the anesthetic techniques of each group, according to the anesthetist in charge of each case. In the spinal anesthesia group, opioid fentanyl citrate and benzodiazepine midazolam maleate were additionally used in four patients. In other four patients, anxiolytic alone was used, and no patient received the opioid alone. Five of these eight patients were females. For the maximum cost in this group, the spinal anesthesia *per se* (excluding the use of opioids and benzodiazepines) corresponded to 31.08% of the costs of all patients (kit of spinal anesthesia materials). Cost variability occurred due to the associated administered substances.

In the combined anesthesia group, only three patients required three or more propofol ampoules (doses above 600 mg), two of them were male. In five patients, hemorrhoidectomy was performed with only one propofol ampoule (max. 200 mg). Midazolam maleate and fentanyl citrate were jointly used in three patients, midazolam alone in three and fentanyl alone in one. Five of these were female patients. In the patient whose cost was R$ 358.51, the use of propofol (seven ampoules) corresponded to 87.31% of the total cost of the anesthetic materials compiled in the analysis. In the patient with the lowest cost in this group (R$ 98.16), propofol corresponded to 45.55%. All patients from the combined anesthesia group were submitted to local anesthesia with only one ampoule of

Table 1. *Demographic data (gender and age) of patients from the two groups.*

		Spinal anesthesia	Combined anesthesia
Gender	**Male**	5	5
	Female	5	5
Mean age		46.5 years*	42.5 years*
Minimum age		33.0 years	26.0 years
Maximum age		65.0 years	55.0 years

**Statistical analysis using the Student's t-test (p=0.334), without significant difference.*

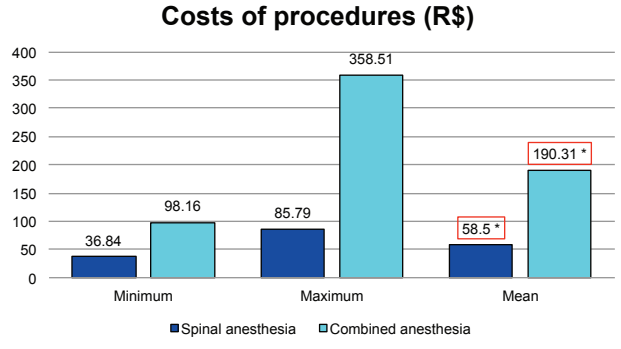

Figure 2. *Minimum, maximum and mean costs of anesthetic materials used in the hemorrhoidectomy performed with spinal anesthesia and combined anesthesia. *Student's t-test (p<0.001). Lower costs were observed with the spinal anesthesia (dark columns), which means 69.27% reduction.*

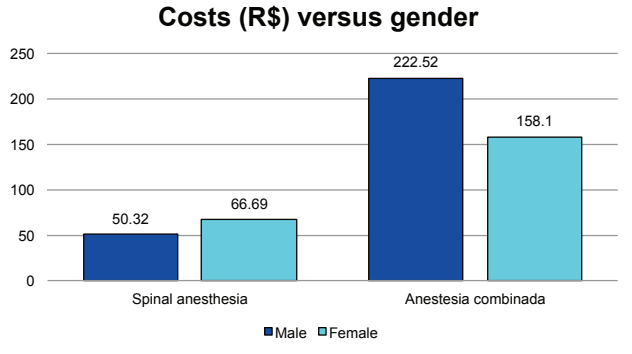

Figure 3. *Costs in relation to gender in each analyzed group. Analysis made with the Student's t-test: p=0.263 (spinal anesthesia) and p=0.221 (combined anesthesia), without significant different between men and women in each group.*

0.75% ropivacaine. In the patients with the highest and lowest values, the use of such anesthetic corresponded to 10.45% and 38.17% of the total direct cost, respectively.

DISCUSSION

The current scenario of cost reduction of hospital activities and optimization of hospital bed turnover rate requires a method that harmoniously combines clinical, ethical, managerial and economic aspects[16-19].

Anorectal procedures account for around 80% of all coloproctology surgeries[28] and among these procedures, more than 90% may be performed in ambulatory facilities[4,5,15]. A series of cases published by Steckert et al. that analyzed 430 patients submitted to 453 anorectal surgeries, described hemorrhoidectomy as the most frequent procedure, corresponding to 50.3% of total surgeries[28]. Therefore, as hemorrhoidectomy is the most frequent anorectal surgery, it is important that the proctologist should be aware of the costs associated.

Until the 1970's, almost all anorectal surgeries used to be performed in the hospital environment, regardless of the procedure complexity[5]. Following the global economy tendencies towards optimization of financial resources, ambulatory surgeries have gained increasing and gradual acceptance from surgeons[29,30]. The ambulatory facilities require a strong association of these three elements: patient, surgery and anesthesia, aiming at an early and safe hospital discharge.

Anesthesia is an essential item for the ambulatory service to achieve its purposes. It should enable the ideas conditions to perform the procedure, exposing the patient to minimum incidence of adverse effects. In addition, it should cause fast recovery after the anesthesia, for an early and safe hospital discharge, with consequent cost reduction.

The local perianal anesthesia allows proper relaxation of anal sphincters and is not associated with the typical complications of spinal anesthesia, such as: cephalalgia, lumbar pain, arterial hypotension and urinary retention[9,31]. However, patient acceptance is low, and its association with venous anesthesia has enabled a more comfortable procedure. Place et al., in the publication of "Practice Parameters for Ambulatory Anorectal Surgery", by the American Society of Colon and Rectal Surgeons, described the effectiveness and cost-benefit ratio of local anesthesia in anorectal procedures[4]. The significant pain and discomfort associated with the use of local perianal anesthesia alone can be properly minimized, as mentioned above, by combining it with venous anesthesia, without adding morbidity to the procedure[15,29]. In more complex anorectal and perineal surgeries, or with broader surgical fields, such as colpoperineoplasty and sphincteroplasty, general anesthesia or spinal anesthesia is indicated[32]. The same is applicable to current procedures of broad local inflammatory processes, such as large perianal abscesses, in which the local anesthetist operates in unfavorable medium. Therefore, not all patients are eligible to combined anesthesia in ambulatory facilities. The population analyzed in this study was selected thorough simple sampling, considering patients that had already been submitted to the surgery, where the criteria for the anesthetic technique indication was jointly elaborated by the surgical team and the anesthetist.

Assuming that the surgical technique adopted is unvarying and standardized, the variability of the anesthetic technique, with its respective materials, is a determining factor in the procedure costs. Patients submitted to surgeries using anesthetic techniques that allow early hospital discharge (in ambulatory facilities) usually incur lower costs[15,33,34]. Kushwaha et al. conducted a prospective study with analyzed 19 patients submitted to local anesthesia and 22 patients submitted to general anesthesia in hemorrhoidectomy. They observed significantly reduced hospitalization period and overall (direct + indirect) costs in the first group[20]. A prospective and randomized study that analyzed 93 patients submitted to anorectal surgeries, assigned to combined (propofol and local), general and spinal anesthesia groups, observed significantly reduced overall costs and hospitalization period, with higher patient satisfaction in the first group[15]. Kotze et al. demonstrated, in a similar study, reduced utilization time of the operating room in patients submitted to surgeries with combined anesthesia[6]. In the same study, published later, the overall costs were similar when comparing spinal and combined anesthesia[21]. However, in these four studies, the analysis was of direct and indirect costs. No analysis of direct costs alone has been performed, as in this study.

The main finding of this study was that the spinal anesthesia group presented lower direct costs of anesthetic materials, when compared to the combined (propofol and local perineal block anesthesia group. Such reduction of almost 70% in direct costs was extremely important. The explanation found for these results was the high cost of propofol ampoules used in the combined anesthesia group (Propovan, Cristália®, Brazil). Each propofol ampoule cost R$ 44.72, an amount that is nearly the mean value of the costs of materials used by the spinal anesthesia group[27]. The fact that three out of total ten patients in the propofol group used more than three ampoules each significantly increased the mean cost in this group.

In the spinal anesthesia group, the mean cost was R$ 58,50. In this group, the anesthetic procedure consisted in the administration of 0.5% bupivacaine into the subarachnoid space, providing anesthesia for around 4 hours, without requiring anesthetic complementation in this period. The use of benzodiazepine and/or opioid agents, which corresponded to the highest costs of anesthetic materials in this group, occurred due to the personal preference of some anesthetics or the eventually required sedation and analgesia to enable the spinal anesthesia, a useful procedure for anxious patients in relation to the surgery. Then, cost variability occurred due to the associated substances, and not due to the spinal anesthesia *per se.* It should be mentioned that the cost of tray preparation and sterilization for the spinal anesthesia (including a bowl for the antiseptic substance, forceps, gauzes and field marking) was not calculated in this study due to the subjectivity involved in determining values related to material cleaning, tray assembly and oven time. In this group, direct costs were higher in women (in absolute numbers), which can be explained by the fact that they presented a lower degree of anxiety in the immediate preoperative period. We believe that a study with a higher number of patients may show statistical significance.

In the combined anesthesia group, the mean direct cost of materials was R$ 190.31. The venous anesthesia, performed with propofol, occurred with initial bolus (2 mg/kg), enabling local anesthesia and maintenance dose as needed. Read et al., in a prospective study, analyzed 389 anorectal surgeries. Among them, 260 were performed using combined anesthesia, with additional propofol bolus, using no infusion pump for the continuous administration of the venous anesthetic[24]. This study used the same maintenance method of venous anesthesia.

Propofol has always been associated with high costs. Along the time, new compositions have been offered, and the costs of this substance have decreased. Despite such reduction, propofol still accounts for the highest costs of anesthetic materials, according to the procedure duration. It is known that, despite the extensive metabolism in the liver, hepatopathies and nephropathies do not cause significant changes in the substance pharmacokinetics[35]. Its half-life is 2 to 4 minutes, requiring additional injections in longer procedures, according to the patient's weight. In this study, only three patients required three or more propofol ampoules, corresponding to 70% of the procedures performed with relatively low doses of this substance. In general, men present higher body mass than women. In addition, hemorrhoids in male patients tend to be larger, involving arduous and longer surgical procedures, requiring more frequent doses of venous anesthetic (short half-life of propofol). For this reason, we believe that costs tend to be higher in male patients, which was not observed in this study, as sampling may have been insufficient and no statistical significance was observed.

Today, the anorectal surgeries at SeCoHUC are performed, except with contraindications related to the method, with combed anesthesia. The experience acquired in some years with this anesthetic technique, combined with a good relationship with the anesthesiology service, shows that the selection of combined anesthesia is more suitable to most patients. In addition, the service study group on this theme showed equivalent overall costs of the procedures, not only regarding the anesthetic materials, when comparing the two techniques[6,21]. At the final decision on the technique selected for the service procedures, indirect costs were also taken into account (shorter time in the operating room and hospitalization, among others), as well as the additional clinical benefits to the patient from the significant reduction of complications (mainly urinary retention and cephalalgia). The investigation of direct costs fulfilled a simple curiosity of the study group regarding this theme.

The study performed a retrospective analysis of the patients submitted to spinal anesthesia, as it is not

part of the service routine, only indicated to selected cases. This factor limits the possibility to perform a prospective study with the same patients, as this technique is not habitually indicated.

CONCLUSIONS

The mean direct costs of anesthetic materials used in hemorrhoidectomy were significantly lower in patients submitted to surgeries with spinal anesthesia, when comparing to the patients submitted to surgeries with venous anesthesia using propofol associated with local perianal block. No influence of gender was observed on the direct costs of these materials in the two techniques. Further analyses should be performed using a higher number of patients to consolidate these conclusions.

The decision on the best anesthetic technique in hemorrhoidectomy remains an open discussion, and the analysis of direct and indirect costs should be considered when selecting the type of anesthesia, in an agreement involving the surgical team, the anesthetist and the health system sponsors.

RESUMO: Introdução: Não há consenso sobre a técnica anestésica de escolha para hemorroidectomias em regime ambulatorial. A raquianestesia e a anestesia combinada (venosa com propofol + local) são frequentemente utilizadas, e os custos das mesmas podem ser determinantes na escolha do melhor tipo de anestesia. O objetivo deste trabalho foi avaliar e comparar os custos diretos dos materiais anestésicos utilizados em hemorroidectomias entre essas duas técnicas. Método: Foi feito um estudo retrospectivo e transversal, comparativo entre os custos diretos dos materiais anestésicos entre a raquianestesia e a anestesia venosa com poropofol associada ao bloqueio perianal local, em hemorroidectomias. Resultados: Foram analisados 20 pacientes, 10 operados com cada técnica anestésica (5 de cada gênero). A média de idade do grupo da raquianestesia foi de 46,5 anos e do grupo da anestesia combinada foi de 42,5 anos (p=0,334). O custo médio do procedimento anestésico no primeiro grupo foi de R$ 58,50 (R$ 36,48 – R$ 85,79), no segundo foi de R$ 190,31 (R$ 98,16 – R$ 358,51). A diferença das médias foi de 69,27%, com significância estatística (p<0,001). A média dos custos dos gêneros masculino e feminino no grupo da raquianestesia foi de R$ 50,32 e R$ 66,69 (p=0,263) e no grupo da anestesia combinada foi de R$ 222,52 e R$ 158,10 (p=0,221), respectivamente. Conclusões: Os custos diretos médios dos materiais anestésicos dos pacientes submetidos a hemorroidectomias foram significativamente menores no grupo da raquianestesia. Não houve significância estatística na diferença entre os gêneros em cada grupo.

Palavras-chave: custos e análise de custo; hemorroidas; raquianestesia; anestesia endovenosa; anestesia local.

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