Challenging the Anaesthetic Technique for Laparoscopic Cholecystectomy in Ambulatory Surgery

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Abstract

Laparoscopic cholecystectomy (LC) is the gold standard procedure for the surgical treatment of lithiasic gallbladder disease and acute cholecystitis, with this procedure now increasingly performed in ambulatory setting with minimal morbidity. In Portugal, 17% of LCs are performed in the outpatient setting, which frequently includes overnight stay. Many different anaesthetic regimens have been suggested but currently there is still insufficient data to conclude which is superior. We conducted an observational retrospective study that included all patients submitted to elective LC in 2015 with the purpose to evaluate if there were significant differences in the anaesthetic technique used in ambulatory and inpatient settings. A total of 261 patients were analysed. Of all the variables tested, only few showed statistical significance, those being age, ASA physical status, dose of fentanyl administered, neuromuscular and depth of anaesthesia monitoring and PONV prophylaxis. Still, we can conclude that there was not a significant difference between the anaesthetic technique in ambulatory and inpatient groups. Consequently, it would be expected that the number of patients proposed for ambulatory LC were to be higher.

Keywords: Anaesthesia; Laparoscopic cholecystectomy; Ambulatory surgery.

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Introduction

Laparoscopic cholecystectomy (LC) is the gold standard procedure for the surgical treatment of lithiasic gallbladder disease and acute cholecystitis, after several studies demonstrated similar complications and mortality rates compared with the open approach, although with a reduction in hospital stay and convalescence time [1,2]. After initial concerns regarding patient safety, this procedure is now increasingly performed in ambulatory setting with minimal morbidity [3,4], due to improvements in anaesthesia and perioperative care.

In Portugal, 17% of LCs are performed in an outpatient setting [5], which frequently includes overnight stay. Nevertheless, this proportion still falls short of the numbers described in the literature, with the cause probably being multifactorial, with a combination of anaesthetic, surgical or social factors.

Many different anaesthetic regimens have been suggested for use in ambulatory LC, but currently there is still insufficient data to conclude which is superior [6]. The effect of anaesthesia may persist after completion of surgery and can delay or impede discharge.

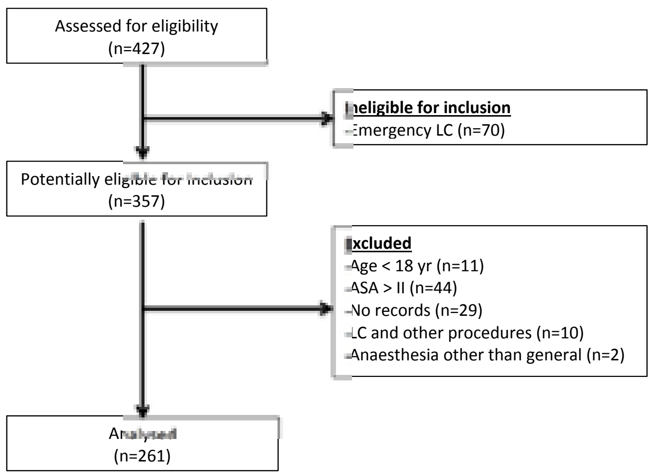
Our study aimed at finding if the anaesthetic approach for LC is different between day-case and inpatient surgery.

Materials and Methods

We conducted an observational retrospective study that included all patients submitted for elective LC in 2015 under general anaesthesia, aged more than 18 and with American Society of Anesthesiologists (ASA) physical status class 1 and 2 (Figure 1). Patients were divided in group A (Ambulatory) and group I (Inpatient), considering the surgical setting. Our decision to include only ASA 1 and 2 patients was an attempt to have a homogeneous sample between these two groups, since ASA 3 patients were more frequent in the group I.

The purpose of this study was to evaluate if there were significant differences in the anaesthetic technique used in ambulatory and inpatient settings. The following variables were tested: gender, age, ASA physical status, administered dose of fentanyl and neuromuscular blocking agent, neuromuscular block reversal agent preferred, airway management device, analgesia protocol, number of drugs for postoperative nausea and vomiting (PONV) prophylaxis, neuromuscular and depth of anaesthesia monitoring and anaesthesia duration.

Figure 1 Inclusion/Exclusion Criteria.



Statistical analysis was conducted using GraphPad Prism (version 7 GraphPad Software Inc., San Diego, CA). Both groups were characterized with descriptive analysis and continuous data are expressed as mean ± standard deviation. Comparison of continuous data was performed with the student t-test, while comparison of categorical data was performed using the chi-square test. A level of $p<0.05$ for statistical significance was used.

Results

A total of 261 patients were analysed and subsequently divided into two groups: group A (N= 112; 43%), and group I (N=149; 57%) (Table 1).

Table 1 Results of Ambulatory and Inpatient Groups.
(ASA - American Society of Anesthesiologists; F - Female; M - Male;
NMB - Neuromuscular Block; NSAID - Nonsteroidal Anti-Inflammatory Drug;
PONV - Post-Operative Nausea and Vomiting)

	Group A Ambulatory	**Group I Inpatient**
Number of Procedures	112	149
Gender (M/F)	(37/75)	(58/91)
Age in years (Mean+/-SD)	50.3+/-1.3	59.4+/-1.4
ASA Physical Status		
ASA 1 (n,%)	42/112 (37.5%)	30/149 (20.1%)
ASA 2 (n,%)	70/112 (62.5%)	119/149 (79.9%)
Analgesia protocol		
Fentanyl dose (mcg) (Mean+/-SD)	192+/-4	206+/-4
Acetominophen + Port Site Infiltration	0/110	2/145 (1%)
+ Other opioids only (n,%)	14/110 (12.5%)	19/145 (12.8%)
+NSAID only (n,%)	13/110 (11.6%)	9/145 (6.0%)
+ Other opioids + NSAID (n,%)	83/110 (74.1%)	115/145 (77.2%)
PONV Prophylaxis		
No Agent (n,%)	2/112 (1.8%)	2/149 (1.3%)
One Agent (n,%)	(5.4%)	24/149 (16.1%)
Two Agents (n,%)	59/112	80/149 (53.7%)
Three Agents (n,%)	45/112 (40.2%)	43/149 (28.9%)
Airway Management		
Tracheal Tube (n,%)	96/110 (87.2%)	131/139 (94.2%)
Laryngeal Mask (n,%)	14/110 (12.7%)	8/139 (5.8%)
Neuromuscular Blocker Use	109/112 (97.3%)	141/149 (94.6%)
Rocuronium use (n,%)	91/109 (83.4%)	114/141 (80.9%)
Rocuronium dose (mg) (Mean+/-SD)	44+/-1	45+/-1
Use of NMB Monitors (n, %)	25/109 (22.9%)	54/141 (38.3%)
NMB Reversal		
None (n,%)	31/109 (28.4%)	26/141 (18.4%)
Atropine/Neostigmine	26/141 (18.4%)	93/141 (80.1%)
Sugammadex	4/109 (5.2%)	19/141 (16.5%)
Both	3/109 (3.9%)	3/141 (2.6%)
Duration of Anaesthesia (min+/-SD)	90.1+/-2.7	94.9+/-2.8

The population was predominantly female (67% in group A and 61% in group I) and the average age was 50.3 ± 1.3 years in group A and 59.4 ± 1.4 years in group I, with this difference being statistically significant ($p<0,0001$) (Table 1). No valid reason was found to the predominance of the female population in Group A.

Most of the patients were ASA 2 (63% in group A and 80% in group I), also with statistical significance ($p=0.0019$) (Table 1).

The fentanyl dose administered was 192 ± 4μg in group A compared with 206 ± 4μg in the group I. Although this difference was statistically significant ($p=0.0262$), we assume that a difference of 14μg is not clinically significant.

Regarding the use of neuromuscular blocking agent, it was used in 97% of surgeries in group A and 95% of surgeries in group I. The most used agent was rocuronium in both groups (83.5% and 81.4%, respectively) and its dose was 43 ± 1mg in Group A and 45 ± 1mg in Group I . Reversal of neuromuscular blocking was preferred in Group A (71% vs 82%), with neostigmine/atropine the selected agents in the majority of cases. 28% and 18% of the patients in Groups A and I respectively received no reversal agents.

A multimodal strategy was used for analgesia but there was no specific protocol for this procedure. We found that in the Group I there was a greater use of different analgesics combinations [acetaminophen, non-steroidal anti-inflammatory drugs (NSAIDs), other opioids in addition to fentanyl (eg tramadol or morphine) and local anaesthetic port-site infiltration] (Table 1).

As for PONV prophylaxis, the group I also used more anti-emetics than group A, with statistical significance (p=0.0119) (Table 1).

Concerning the airway management, the endotracheal tube (ETT) was preferred in 87% of the cases in group A and 94% in group I, whereas the laryngeal mask airway (LMA) was utilized in the remaining cases. In 12 patients (2 in Group A and 10 in Group I), there were no data regarding the airway approach.

Neuromuscular block was monitored with TOF-scan® in 23% (Group A) vs 38% (Group I) and depth of anaesthesia using BIS® or Sedline® was monitored in 11% (Group A) vs 32% (Group I), with both of these variables showing statistical significance (p=0.0154 and p<0.0001, respectively) (Table 1).

The anaesthesia duration was 90 ± 3 minutes for Group O and 95 ± 3 minutes for Group I.

Discussion

The best anaesthetic regimen should ideally cause the fewest adverse effects and enable the surgery to be completed in the ambulatory setting. Additionally, different anaesthetic regimens have different patient acceptability and recovery profiles, which may also vary depending on pre-existing medical conditions that the patient may have. Thus, the anaesthetic choice can definitely influence the recovery and discharge, implying vast implications to the patient and healthcare funder.

The preferred opioid agent for this procedure was fentanyl, with a short acting action, and whose dose was not clinically significant between the two groups.

A neuromuscular blocking agent was administered in most cases in order to achieve muscle paralysis. Its use, albeit permitting a better surgical field and ventilation, also increases the risk of residual post-operative neuromuscular blockade, which is associated with increased respiratory morbidity [7,8]. Consequently, quantitative neuromuscular monitoring (e.g. acceleromyography) should be used to exclude residual neuromuscular blockade and to guide reversal agent administration [9]. Sugammadex has obvious advantages in ambulatory surgery [10], but in our reality it is still judiciously administered. Factors such as costs are still preponderant in our current practice.

Despite lesser as compared to open procedure, postoperative complications such as pain, nausea and vomiting are still significant and may even delay the recovery process and subsequent discharge [11,12].

Pain after LC has several origins: incisional, local visceral, peritoneal and referred, thus, a multimodal approach seems to be beneficial in treating postoperative pain. Several analgesic regimens have been studied [13,14]. The PROSPECT working group recommends intra-operative administration of NSAIDs, short-acting strong opioids, and port-site infiltration and/ or intraperitoneal instillation of local anaesthetics. In our study, different protocols were used with no significant differences between them, but the small number of patients in each group biased the statistical analysis, and also no data was collected from the post-operative phase.

As previously stated, PONV prophylaxis is a key factor that influences same day discharge [11,12]. Interestingly, Group I received more anti-emetics despite this being the inpatient group, and with apparent similar comorbidities. Further studies need to address the incidence of PONV between these two groups.

It was noted that the use of the ETT was predominant in both groups, despite growing evidence (and not necessarily recent) that support the use of LMA during laparoscopic surgery, including CL [15–17]. The use of LMA has several advantages when compared to the ETT, such as quick and easy placement and lesser need of neuromuscular blockade. The increased risk of regurgitation and pulmonary aspiration is present but several studies demonstrated the safety of these devices with no increase in incidence of these events [15,16]. The adequacy of optimal ventilation under pneumoperitoneum was also questioned also with no evidence against [17].

This study is not without its limitations. First, it is a retrospective study. Retrospective analyses are prone to bias related to available data quantity and quality. Second, it is a single-centre study in Portugal with predominantly healthy patients, and thus the findings cannot be generalised. Third, we cannot exclude that our analyses include unmeasured confounders (for instance, severity of surgery). Finally, the study was limited to intra-operative variables, and no data was collected during the immediate post-operative period, namely adequacy of the analgesic strategies, incidence of PONV and duration of post anaesthesia care unit stay.

Conclusions

The ideal anaesthetic regimen for LC in ambulatory surgery should include short acting agents that produce anxiolysis, lack of awareness during the procedure, adequate neuromuscular relaxation, good analgesia and PONV prophylaxis, enabling a fast recovery and no adverse effects. Thus, the anaesthetic regiment includes different components that can interfere with the adequate recovery and timely discharge.

Of all the variables tested, only few showed statistical significance (p<0.05), those being age, ASA physical status, dose of fentanyl administered, neuromuscular and depth of anaesthesia monitoring and PONV prophylaxis. Still, we can conclude that there was not a significant difference between the anaesthetic technique in ambulatory and inpatient groups. Consequently, it would be expected that the number of patients proposed for ambulatory LC were to be higher.

Furthermore, it is necessary to analyse the post-operative period, mainly to understand if indeed there are no differences between these two groups.

Finally, we also concluded that the use of LMA is still infrequent, despite numerous authors supporting its use, as with the neuromuscular and anaesthesia depth monitoring, aspects that may be improved in the future.

References

1. Soper NJ, Stockmann PT, Dunnegan DL, Ashley SW. Laparoscopic Cholecystectomy - The New 'Gold Standard?' ***Archives of Surgery*** 1992;**127**:917–23.
2. Keus F, de Jong JA, Gooszen HG, van Laarhoven CJ. Laparoscopic versus open cholecystectomy for patients with symptomatic cholecystolithiasis. ***Cochrane Database of Systematic Reviews*** 2006;**18(4)**:CD006231.
3. Johansson M, Nelvin L, Lundell L. Randomized clinical trial of day-care versus overnight-stay laparoscopic cholecystectomy. ***British Journal of Surgery*** 2006;**93(1)**: 40–5.
4. Gurusamy K, Junnakar S, Farouk M, Davidson BR. Meta-analysis of randomized controlled trials on the safety and effectiveness of day-case laparoscopic cholecystectomy. ***British Journal of Surgery*** 2008;**95**:161–8.
5. Borges M Cláudia, "A realidade da Cirurgia Geral na Cirurgia de Ambulatório em Portugal: evolução, dificuldade e potencial de crescimento", XXXVI Congresso Nacional de Cirurgia - Figueira da Foz, 2016, Departamento de Gestão e Financiamento de Prestações de Saúde - ACSS
6. Vaughan J, Nagendren M, Cooper J, Davidson BR, Gurusamy KS. Anaesthetic regimens for day-procedure laparoscopic cholecystectomy. ***Cochrane Database of Systemic Reviews*** 2014;**24(1)**:CD009784.
7. Farhan H, Moreno-Duarte I, McLEan D, Eikermann M. Residual Paralysis: Does it Influence Outcome After Ambulatory Surgery? ***Current Anesthesiology Reports*** 2014;**4(4)**:290–302.
8. Bulka CM, Terekhov MA, Martin BJ et al. Nondepolarizing Neuromuscular Blocking Agents, Reversal, and Risk of Postoperative Pneumonia. ***Anesthesiology*** 2016;**125**:647–55.
9. Brull JS, Kopman AF. Current Status of Neuromuscular Reversal and Monitoring: Challenges and Opportunities. ***Anesthesiology*** 2017;**126**:173–90.
10. Soto R, Jahr JS, Pavlin J et al. Safety and Efficacy of Rocuronium With Sugammadex Reversal Versus Succinylcholine in Outpatient Surgery-A Multicenter, Randomized, Safety Assessor-Blinded Trial. ***American Journal of Therapeutics*** 2016;**23(6)**:1654–62.
11. Chung F, Mezei G. Factors contributing to a prolonged stay after ambulatory surgery. ***Anesthesia & Analgesia*** 1999;**89(6)**:1352–9.
12. Pavlin DJ, Rapp SE, Polissar NL et al. Factors affecting discharge time in adult outpatients. paroscopic cholecystectomy: LMA-Classic vs. tracheal intubation. ***Canadian Journal of Anaesthesia*** 2000;**47(7)**:622–6.
13. Mitra S, Khandelwal P, Roberts K, Kumar S, Vadivelu N. Pain Relief in Laparoscopic Cholecystectomy – A Review of the Current Options. ***Pain Practice*** 2012;**12(6)**:485–96.
14. Bisgaard T. Analgesic Treatment after Laparoscopic Cholecystectomy A Critical Assessment of the Evidence. ***Anesthesiology*** 2006;**104(4)**:835–46.
15. Beleña JM, Ochoa EJ, Núñez M, Gilsanz C, Vidal A. Role of laryngeal mask airway in laparoscopic cholecystectomy. ***World Journal of Gastrointestinal Surgery*** 2015;**27(11)**:319–25.
16. Maltby JR, Beriault MT, Watson NC, Liepert D, Fick GH. The LMA-ProSealTM is an effective alternative to tracheal intubation for laparoscopic cholecystectomy. ***Canadian Journal of Anaesthesia*** 2002;**49(8)**:857–62.
17. Maltby JR, Beriault MT, Watson NC, Fick GH. Gastric distension and ventilation during laparoscopic cholecystectomy: LMA-Classic vs. tracheal intubation. ***Canadian Journal of Anaesthesia*** 2000;**47(7)**:622–6.