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Research Article

Anesthetic Management in Laparoscopic Surgery for Cholecystectomy at Brazzaville University Teaching Hospital, Republic of Congo

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Abstract

Laparoscopic cholecystectomy has been considered the "gold standard" for the surgical treatment of symptomatic gallstone disease because it numerous advantages. However, this surgical technique presents specific anesthetic challenges. The aim of study was to describe the anesthetic management of laparoscopic cholecystectomies at the Brazzaville University Teaching Hospital (BUTH). This was a retrospective, cross-sectional study conducted from January 1, 2023 to April 30, 2025, at BUTH. All patients aged 15 years and older who underwent laparoscopic cholecystectomy were included. The epidemiological, anesthetic, surgical variables and outcomes were analyzed using Excel 2016 software. Fifty-eight patients underwent laparoscopic cholecystectomy. The mean age was 34.1 ±14.3 years (range: 15 – 72 years). The sex ratio was 0.3. Symptomatic gallstones (96.5%) were the main indication for surgery. Comorbidities were present in 63.8% of cases, including homozygous sickle cell disease in 72.9%. Symptomatic gallstone disease (96.5%) was the primary indication for surgery. Difficult intubation, as predicted by the Mallampati score, was reported in 8.6%. Patients were classified as ASA 2 (67.2%). An Apfel score ≥ 2 was reported in 45 patients (77.6%). Antibiotics were administered to 89.6% of patients and domined by cefuroxime. All patients underwent surgery under general anesthesia with orotracheal intubation. Capnography was monitored in five patients (8.6%). Hypotension (27.58%) and severe bradycardia (8.62%) were the observed anesthetic complications. Four patients (6.9%) required conversion to laparotomy. The mean duration of abdominal insufflation was 79.9 ±47.0 minutes and the mean duration of anesthesia was 145.5 ±53.0 minutes. Postoperative complications were present in four patients with sickle cell disease (6.9%): one bone vaso-occlusive crisis, two respiratory infections and one pneumothorax associated with subcutaneous emphysema, requiring admission to the intensive care unit with an unfavorable outcome. *Conclusion:* Anesthesia for laparoscopic cholecystectomy is feasible at the BUTH for symptomatic gallstones, even in patients with sickle cell disease. Improved intraoperative monitoring could reduce the risk of postoperative complications.

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1. Introduction

Since its introduction in 1987, laparoscopic cholecystectomy has been considered the "gold standard" for the surgical treatment of symptomatic gallstone disease [1, 2]. Compared to open surgery (laparotomy), it offers numerous advantages, namely significantly reduced postoperative pain, lower infection rates which are a particular concern in developing countries, shorter hospital stays and improved postoperative recovery [3, 4]. These benefits are particularly significant for developing countries, where hospital beds are scarce, health insurance is virtually non-existent, and the financial burden of care falls on families.

However, this surgical technique presents specific anesthetic challenges associated with carbon dioxide pneumoperitoneum and the operative position, both of which cause significant hemodynamic and respiratory changes. The primary challenges for the anesthesiologist-intensivist (AI) are to optimize ventilatory and hemodynamic functions and to account for comorbidities in order to minimize the impact of pneumoperitoneum on patients undergoing this type of surgery. These factors make general anesthesia (GA) with controlled ventilation and appropriate monitoring essential to ensure patient safety during the perioperative period [5, 6]. In developing countries in general, and in sub-Saharan Africa in particular, laparoscopic surgery presents an additional challenge due to technical constraints and shortages of human and material resources. Despite the gradual expansion of gastrointestinal laparoscopic surgery across several African countries, studies regarding anesthetic management remain scarce and often lack detail [7, 8]. In the Republic of the Congo, the first laparoscopic cholecystectomy was performed in February 2009 at Brazzaville University Teaching Hospital (BUTH), leading to improvements in the quality of surgical care since then [8, 9]. However, data regarding the anesthetic management of this procedure remain unavailable. We therefore conducted this study to evaluate local anesthetic practice and contribute to optimizing patient care. The aim of our study was to describe the anesthetic management of laparoscopic cholecystectomies in the BUTH operating room.

2. Patients and Methods

2.1. Study Design and Setting

This study was designed and planned by the research team of the anesthesia department at the BUTH, and approval from the ethics committee was not required. This was a descriptive, observational, retrospective and cross-sectional study conducted in the operating room of BUTH over a 28-month period, from January 1, 2023, to April 30, 2025.

2.2. Study Population and Selection Criteria

Our study population consisted of all patients who underwent laparoscopic surgery during the study period. We included the written medical records of all patients aged 15 years or older regardless of gender who underwent a cholecystectomy. Patients with incomplete or unusable records were excluded from the study.

2.3. Data Collection and Variables

Data were collected from operating room admission registers, anesthesia records, written medical files from the digestive surgery and polyvalent intensive care unit (ICU) departments, and patient prescription and monitoring charts. A standardized data collection form was designed.

2.4. Study Variables and Statistical Analysis

The following variables were analyzed: epidemiological (frequency, age, sex, comorbidities, drug allergies), anesthetic (Mallampati score, ASA classification, preoperative preparation, anesthetic techniques and agents, monitoring, intraoperative complications, duration of anesthesia), surgical (indications, conversion, insufflation time, duration of surgery) and outcomes (complications, mortality). Microsoft Excel 2016 software was used to create the database and generate the graphs. Quantitative variables were expressed as mean ± standard deviation, and qualitative variables were expressed as counts and percentages (%).

2.5. Anesthetic Assessment and Management

A pre-anesthetic consultation was mandatory, performed by an anesthesiologist, and preoperative assessment was conducted on a case-by-case basis depending on the patient's clinical status. GA with tracheal intubation and neuromuscular blockade was the standard practice. Antibiotic therapy or prophylaxis (using cefuroxime or, alternatively, amoxicillin/clavulanic acid) was administered based on the type of sur-

gery, in accordance with the Altemeier classification. Intraoperative monitoring included non-invasive blood pressure (NIBP) measurement, peripheral oxygen saturation (POS), electrocardiography, and alveolar gas analysis. A neuromuscular transmission monitor was not available. Volume-controlled ventilation (VCV) was the standard: a tidal volume of 6-8 ml/kg of predicted body weight, positive end-expiratory pressure (PEEP) of 3-6 cm H_2O, and a plateau pressure not exceeding 30 cm H_2O. Intra-abdominal pressure was kept below 15 mmHg. Prophylaxis against postoperative nausea and vomiting (PONV) using dexamethasone and/or ondansetron was not routinely administered. Analgesia was multimodal (paracetamol, nefopam, and ketoprofen, with or without tramadol or morphine if the numerical pain score exceeded 3/10 despite the aforementioned analgesics). Infiltration of trocar sites with ropivacaine was not performed due to its scarcity in our country's pharmacies.

3. Results

3.1. Frequency

During the study period, 7,440 surgical procedures across all specialties were performed, comprising both elective and emergency surgeries. In digestive surgery, 537 patients (7.2%) underwent elective surgery. Of these, 70 underwent laparoscopic cholecystectomy, representing 13% of digestive surgery activity and 0.9% of all surgeries combined. After applying the selection criteria, 58 patients were included in our study (Figure 1).

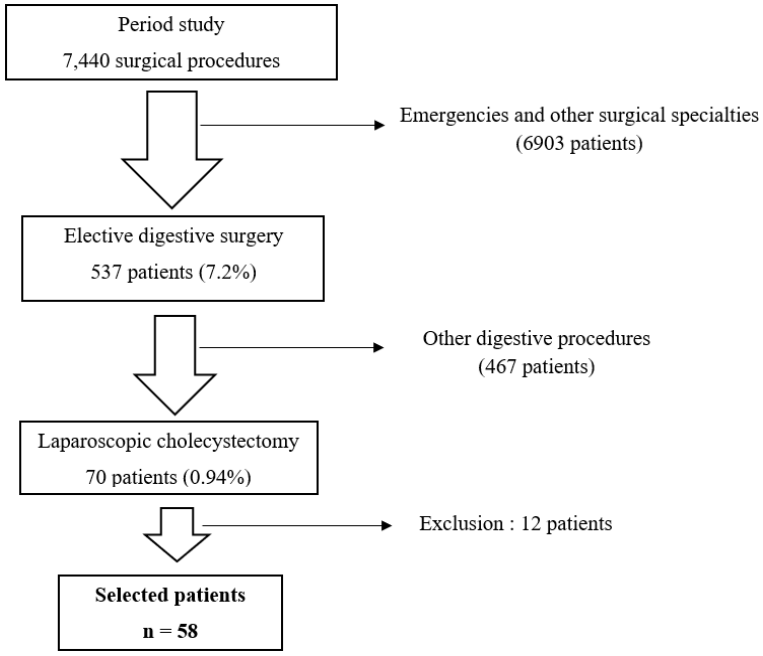

Figure 1. *Flow chart of our study population.*

3.2. Epidemiological Characteristics

The mean age was 34.1 ± 14.3 years, with a range from 15 to 72 years. The 20-39 age group was the most represented (44.8%). There was a female predominance (74.1% of cases), resulting in a sex ratio of 0.3. In 63.8% of cases, patients presented with at least one comorbidity; homozygous SS sickle cell disease (46.5%) and arterial hypertension (10.3%) were the most common. A surgical history was noted in 11 patients (18.9%). Symptomatic gallstone disease (96.5%) was the primary indication for surgery. Table 1 illustrates the distribution of patients according to epidemiological characteristics.

Table 1. *Distribution of population according to epidemiological characteristics.*

	Effective (n=58)	Percentage (%)
Age groups (years)		

	Effective (n=58)	Percentage (%)
< 20	8	13.8%
20 – 39	26	44.8%
40 – 59	22	37.9%
≥ 60	2	3.5%
Sex		
Male	15	25.9%
Female	43	74.1%
Comorbidities		
No comorbidity	21	36.2%
Sickle cell disease	27	46.6%
Arterial hypertension	6	14.5%
Drug allergy	5	8.6%
Diabetes	3	5.2%
Asthma	2	3.5%
Neuralgia	1	1.7%
Psychosis	1	1.7%
Surgical history		
Yes	11	18.9%
Blood transfusion history		
Yes	30	51.7%

3.3. Anesthetics, Surgical Characteristics and Operative Complications

In our series, five patients (8.6%) had a Mallampati score of 3 or 4, predictive of difficult tracheal intubation. ASA 2 and 1 classes predominated, accounting for 67.2% and 29.3% of cases, respectively. An Apfel score ≥ 2 was reported in 45 patients (77.6%). Antibiotic prophylaxis or therapy was administered to 52 patients (89.6%), with cefuroxime (53.5%) being the most frequently used antibiotic. In our study, 17.2% of patients required preoperative preparation: optimization of antihypertensive treatment in four patients, vitamin K supplementation in three patients, blood transfusion in two patients, and a miscarriage prevention protocol for one patient with eight (8) weeks of amenorrhea. Table 2 presents the distribution of patients according to anesthetic characteristics. All patients underwent surgery under GA with orotracheal intubation. Capnography was monitored in only five patients (8.6%). The following anesthetic agents were used: propofol (100%), fentanyl (100%), suxamethonium (3.4%), rocuronium (98.3%), atracurium (1.7%), halothane (68.9%), and isoflurane (27.6%). Pharmacological reversal of neuromuscular blockade using neostigmine was administered to two patients (3.4%). Arterial hypotension (27.6%) and severe bradycardia (8.6%) were the anesthetic intraoperative complications observed. Table 3 shows the distribution of our population according to anesthetic complications and their management. Four patients (6.9%) required conversion to laparotomy. Postoperatively, all patients were extubated on the operating table. The mean duration of abdominal insufflation (10 and 15 mmHg) was 79.9 ±47.0 minutes; the mean duration of surgery was 101.4 ± 48.8 minutes, and that of anesthesia was 145.5 ± 53.0 minutes. Postoperative complications occurred in four patients (6.9%), all of whom were homozygous for sickle cell disease: one case of vaso-occlusive crisis (VOC) involving the bone, two cases of respiratory infections that resolved satisfactorily, and one case of respiratory distress due to pneumothorax associated with subcutaneous emphysema, which required admission to the polyvalent ICU and had an unfavorable outcome (death).

Table 2. *Distribution of population according to anesthetic characteristics.*

	Effective (n=58)	Percentage (%)
Mallampati score		
≤ 2	53	91.4%
≥ 3	5	8.6%
ASA classes		
1	17	29.3%
2	39	67.2%
3	2	3.5%
Apfel score		
< 2	13	22.4%
≥ 2	45	77.6%
Preoperative preparation		
Yes	11	18.9%
Antibiotics		
No	6	10.3%
Cefuroxime	31	53.5%
Amoxicillin/clavulanic acid	18	31%
Metronidazole	2	3.5%
Ceftriaxone	2	3.5%

Table 3. *Distribution of population according to anesthetic complications and management.*

	Effective (n=58)	Percentage (%)
Intraoperative anesthetic complications		
Arterial hypotension	18	31%
Severe bradycardia	5	8.6%
Hypercapnia	2	3.5%
Management		
Ephedrine	17	29.3%
Atropine	5	8.6%
Mechanical hyper ventilation	1	1.7%

4. Discussion

4.1. Limitation of Study

Certain limitations must be considered for a better interpretation of our results. During our study, the following limitations were encountered: first, the retrospective nature of the study made it impossible to identify all patients who underwent laparoscopic cholecystectomy, due to poor record-keeping and/or a lack of usable data. Furthermore, the single-center design and the short duration of the study prevented us from obtaining a sample size large enough to extrapolate the results to a national level. However, this study provides a foundation for future research ideally multicenter studies with larger sample sizes. Our study was conducted to report on local anesthesia practices for laparoscopic cholecystectomy at BUTH, a public healthcare facility in a resource-limited setting.

4.2. Frequency

During the study period, laparoscopic cholecystectomy accounted for 0.9% of surgical procedures across all specialties. This finding aligns with data from African literature [7, 10-12]. The low frequency observed in our series could be attributed to prolonged strikes at the BUTH, shortages of supplies, and poor equipment maintenance. The high overall cost of care makes this technique inaccessible to some patients.

4.3. Epidemiological Characteristics

The mean age of our patients was 34.1 ±14.3 years, with a female predominance of 74.1%. This young, predominantly female profile is similar to that found in other African series on laparoscopic cholecystectomy, which also report a significant female predominance [8, 13-15]. This consistent female predominance in African series reflects the epidemiology of gallstones, which are more common in women. In 63.8% of cases, patients presented with at least one comorbidity, with a high proportion of homozygous sickle cell disease. Our results corroborate those of several African studies in which sickle cell disease remains the primary comorbidity identified [8, 14, 16-18]. Sickle cell disease is the most common hemoglobinopathy worldwide and appears to be a more frequent comorbidity in Africa than in Western countries. It is associated with significant anesthetic implications, namely the prevention of hypoxia, hypovolemia, VOC, hypothermia, and anemia [19].

4.4. Anesthetic Characteristics

In our series, five patients (8.6%) had a Mallampati score of 3, which is predictive of difficult tracheal intubation. This rate is higher than that reported by Mosolo *et al.* in the Democratic Republic of the Congo (DRC), where only 2.4% of patients had a Mallampati score of 3 [14].

The presence of patients with a Mallampati score of 3 highlights the importance of a rigorous preoperative assessment of the upper airway, even in ASA 1 or 2 patients, in order to plan for optimal airway management. Laparoscopic abdominal surgery necessitates securing the airway due to the risk of aspiration associated with pneumoperitoneum and the head-up (reverse Trendelenburg) position; this justifies the routine use of tracheal intubation in our series [5].

ASA 2 and 1 classes predominated, accounting for 67.2% and 29.3% of cases, respectively. Similar trends were reported by Mosolo *et al.* and Mukakala *et al.* in the DRC [14, 17]. Likewise, a predominance of ASA class 2 patients was observed by Nga Nomo *et al.* (93.1%) in Cameroon and Leye *et al.* (62.5%) in Senegal [7, 20]. However, in Mali, Sangare *et al.* noted that 74.4% of patients were classified as ASA 1 in their study assessing the status of laparoscopic cholecystectomy in Bamako [16]. The high rate of ASA 2 patients in our series may be explained by a significant proportion of comorbidities (67.24%), primarily sickle cell disease and arterial hypertension. In our series, 89.6% of patients received antibiotic prophylaxis, predominantly using cefuroxime. Our results align with international and African guidelines recommending antibiotic prophylaxis for laparoscopic cholecystectomy [21]. The predominance of cefuroxime is explained by its availability, a spectrum of activity suited to common gastrointestinal pathogens, and an affordable cost, making it a frequently used antibiotic in developing countries. Several African studies support this finding, as second-generation cephalosporins are widely used for surgical prophylaxis. All patients underwent GA with orotracheal intubation. Our results corroborate findings in the literature [7, 20]. In the DRC, Mosolo *et al.* reported a 3.3% rate of neuraxial anesthesia (such as spinal anesthesia) combined with GA, and a 1.1% rate of spinal anesthesia alone [14]. While the use of neuraxial anesthesia is feasible, it is associated with patient discomfort (shoulder pain) and a higher incidence of hemodynamic instability, often necessitating conversion to GA. Thus, GA remains the standard of care for laparoscopic cholecystectomy, as it allows for controlled ventilation, effective airway protection, and better tolerance of the respiratory changes induced by pneumoperitoneum [5].

In our study, capnography could be used for only 8.6% of patients, reflecting a lack of adequate technical facilities and equipment. Many developing countries face a similar situation, where ventilatory monitoring still relies largely on clinical parameters, pulse oximetry (POS), and hemodynamic assessment. Despite this limitation, adjustments to mechanical ventilation and clinical monitoring allowed for satisfactory anesthetic management. However, the routine use of capnography would improve the early detection of hypercapnia, thereby enhancing patient safety [5]. Indeed, systemic carbon dioxide absorption frequently causes intraoperative hypercapnia, leading to cardiovascular effects such as vasodilation and cardiac arrhythmias [5]. The rise in carbon dioxide levels is a constant

and expected phenomenon that necessitates ventilatory adjustments and advanced monitoring.

4.5. Operative Complications

The incidence of arterial hypotension observed in our study (27.6%) is higher than that reported in some other studies [14, 20]. Our results are consistent with data from the literature. Several studies have shown that carbon dioxide pneumoperitoneum leads to reduced venous return and consequently reduced cardiac output as well as increased systemic vascular resistance and fluctuations in arterial blood pressure, regardless of ASA physical status.

Five patients (8.6%) required conversion to laparotomy. Comparable rates, ranging from 3.3% to 10.3%, have been reported by several authors [7, 17, 18, 20, 22, 23]. In our series, conversion to laparotomy was necessitated by the presence of multiple adhesions, which made visualization and access to the operative site difficult via the laparoscopic approach. In the literature, this probability of conversion to laparotomy ranged from 5% to 20% [24].

5. Conclusion

Anesthesia for laparoscopic cholecystectomy is feasible at BUTH for symptomatic gallstone disease, even in patients with sickle cell disease. GA with tracheal intubation remains the gold standard technique. However, the limited availability of capnography represents a constraint, though it reflects the reality of most resource-limited settings. Thus, improving technical facilities - particularly intraoperative monitoring - could reduce the risk of the intraoperative and postoperative complications observed in our series.

Abbreviations

AI	Anesthesiologist-intensivist
ASA	American Society of Anesthesiologists
BUTH	Brazzaville University Teaching Hospital
DRC	Democratic Republic of the Congo
GA	General Anesthesia
ICU	Intensive Care Unit
NIBP	Non-invasive Blood Pressure
PEEP	Positive End-expiratory Pressure
PONV	Postoperative Nausea and Vomiting
POS	Peripheral Oxygen Saturation
VCV	Volume-controlled Ventilation
VOC	Vaso-occlusive Crisis

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Author Contributions

Mpoy Emy Monkessa Christ Mayick: Conceptualization, Data curation, Formal Analysis, Investigation, Methodology, Software, Writing – review & editing

Niengo Outsouta Gilles: Formal analysis, Investigation, Writing – original draft

Elion Ossibi Pierlesky: Formal analysis, Investigation, Writing – original draft

Bayoundoula Ghislaine: Ressources, Visualization

Bokoba-nde Ngala Marina Aurole: Ressources, Visualization

Tiafumu Konde Arnaud Christ: Ressources, Visualization

Tsouassa Wa Ngono Bienvenu Giresse: Ressources, Visualization

Elombila Marie: Project administration, Supervision, Validation

Conflicts of Interest

The authors declare no conflicts of interest regarding this study.

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