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Laparoscopic cholecystectomy under neuraxial anesthesia compared with general anesthesia: Systematic review and meta-analyses

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ABSTRACT

Background: Pneumoperitoneum during laparoscopic cholecystectomy (LC) can cause hypercapnia, hypoxemia, hemodynamic changes and shoulder pain. General anesthesia (GA) enables the control of intraoperative pain and ventilation. The need for GA has been questioned by studies suggesting that neuraxial anesthesia (NA) is adequate for LC.
Study objective: To quantify the prevalence of intraoperative pain and to verify whether evidence on the maintenance of ventilation, circulation and surgical anesthesia during NA compared with GA is consistent.
Design: Systematic review with meta-analyses.
Setting: Anesthesia for laparoscopic cholecystectomy.
Patients: We searched Medline, Cochrane and EBSCO databases up to 2016 for randomized controlled trials that compared LC in the two groups under study, neuraxial (subarachnoid or epidural) and general anesthesia.
Measurements: The primary outcome was the prevalence of intraoperative pain referred to the shoulder in the NA group. Hemodynamic and respiratory outcomes and adverse effects in both groups were also collected.
Main results: Eleven comparative studies were considered eligible. The pooled prevalence of shoulder pain was 25%. Intraoperative hypotension and bradycardia occurred more frequently in patients who received NA, with a risk ratio of 4.61 (95% confidence interval [CI] 1.70–12.48, $p = 0.003$) and 6.67 (95% CI 2.02–21.96, $p = 0.002$), respectively. Postoperative nausea and vomiting was more prevalent in patients who submitted to GA. The prevalence of postoperative urinary retention did not differ between the techniques. Postoperative headache was more prevalent in patients who received NA, while the postoperative pain intensity was lower in this group. Performing meta-analyses on hypertension, hypercapnia and hypoxemia was not possible.
Conclusions: NA as sole anesthetic technique, although feasible for LC, was associated with intraoperative pain referred to the shoulder, required anesthetic conversion in 3.4% of the cases and did not demonstrate evidence of respiratory benefits for patients with normal pulmonary function.

Contents

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1. Introduction

Laparoscopic cholecystectomy (LC) has replaced the open technique as the first choice for the surgical treatment of cholelithiasis and cholecystitis because of its less invasive approach and its association with shorter hospital stay, faster return to usual activities, less probability of complications in the surgical wound, and decreased postoperative pain [1].

Pneumoperitoneum, which is required for the procedure, causes respiratory changes, including an increase in the arterial pressure of CO2 in the arterial blood (PaCO2), a decrease in pulmonary compliance, an increase in peak and plateau airway pressure, a reduction in vital capacity and functional residual capacity, atelectasis, increased dead space and ventilation/perfusion mismatch [2,3].

It also affects the cardiovascular system and causes a decrease in cardiac output, an increase in afterload and systemic and pulmonary vascular resistance. Bradycardia may also occur because of vagal stimulation during insufflation of the abdominal cavity [4,5].

The choice of anesthetic technique for LC is largely limited to general anesthesia (GA) because it eliminates the discomfort caused by the pneumoperitoneum and the changes in the patient's position on the surgical table. In addition, GA enables the better control of ventilation and a rigorous analysis of CO2 as well as tracheal intubation, which reduces the risk of bronchoaspiration [2,6].

However, new studies have demonstrated the possibility of performing neuraxial anesthesia (NA) for LC [7–9]. These studies indicate that neuraxial block is associated with a low incidence of postoperative pain, nausea and vomiting, short hospitalization time, low costs and adequate surgical relaxation. Nevertheless, they point out the occurrence of intraoperative pain, which is sometimes severe and requires conversion to GA.

A recent systematic review, [10] which evaluated LC under spinal anesthesia and identified postoperative pain as the primary outcome and duration of surgery and postoperative complications as secondary outcomes, concluded that subarachnoid block is a viable and safe technique for LC. However, it did not produce sufficient evidence on the occurrence of hypoxemia, hypercarbia and other cardiovascular changes.

This systematic review with meta-analyses was conducted to quantify the prevalence of shoulder pain in the NA group and to verify whether evidence on the maintenance of ventilation and circulation during LC under NA compared with GA is consistent.

2. Methods

This systematic review was performed according to the processes described by the PRISMA guidelines [11], including the design, implementation of the steps, analysis and description of the results. The protocol for this study was not registered.

2.1. Eligibility criteria

We included randomized controlled trials that compared LC in the two groups under study, NA (subarachnoid or epidural) and GA, and have described or allowed the extraction of data on the prevalence of intraoperative pain, hemodynamic and respiratory outcomes and adverse effects. Studies that involved comparisons with combined anesthesia (NA and GA) were not included.

2.2. Information sources and search strategy

We searched the MEDLINE, Cochrane Central Register of Controlled Trials and EBSCO databases, without language restriction, from inception to March 2016 using the following terms: “laparoscopic cholecystectomy” AND “general anesthesia” or “general anaesthesia” or general AND “spinal anesthesia” or “spinal anaesthesia” or spinal or “epidural anesthesia” or “epidural anaesthesia” or epidural or “neuraxial anesthesia” or “neuraxial anaesthesia” or neuraxial.

2.3. Study selection

A systematic search was conducted by the three authors independently. Two authors (MAL and BTC) screened the abstracts of the retrieved articles and excluded reports that did not fulfill the inclusion criteria. Any doubt concerning the inclusion of a trial was resolved by a discussion with the third author (GROF).

The reference lists of included articles were screened for further relevant articles. Unpublished reports and studies only published as conference abstracts were not included. Authors were not contacted for additional data.

2.4. Data extraction process and data items

The primary endpoint variable was the prevalence of intraoperative pain referred to the shoulder in the NA group. The secondary endpoint variables were the anesthetic conversion rate (NA to GA), prevalence of intraoperative hypotension, hypertension, bradycardia and respiratory outcomes (respiratory rate, hypercapnia and hypoxemia), postoperative pain scores at 0, 2, 4, 6, 8, 12 and 24 h, and reported frequencies of postoperative nausea and vomiting (PONV), urinary retention and headache. The data were extracted by two authors (MAL and BTC) and conferred by the third author (GROF).

2.5. Risk of bias in individual studies

The methodological quality of each study was evaluated according to the Cochrane Collaboration's tool for assessing risk of bias [12].

2.6. Synthesis of results

The pooled prevalence of intraoperative pain referred to the shoulder and the anesthetic conversion rate were estimated by the inverse variance method. As this method tends to underestimate or overestimate the prevalence in situations in which studies show great heterogeneity, the double arcsine transformation was applied to obtain stable estimates of these measures [13]. The calculations and graphs on the prevalence of