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8 mmHg Versus 12 mmHg Pneumoperitoneum During Laparoscopic Cholecystectomy: A Systematic Review and Meta-analysis of Randomized Controlled Trials

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ADMINISTRATIVE INFORMATION

Support - None.

Review Stage at time of this submission - Completed but not published.

Conflicts of interest - None declared.

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Amendments - This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 13 September 2026 and was last updated on 13 September 2026.

INTRODUCTION

Review question / Objective To evaluate whether an intended pneumoperitoneum pressure of 8 mmHg, compared with 12 mmHg, improves postoperative recovery while maintaining intraoperative feasibility in patients undergoing laparoscopic cholecystectomy (LC).

Condition being studied Gallbladder disease requiring LC, with particular attention to the effects of pneumoperitoneum pressure on postoperative symptoms, analgesic requirements, and operative outcomes.

METHODS

Participant or population Adults undergoing LC. Trials permitting rescue pressure escalation remained eligible, provided that the intended maintenance pressures were 8 mmHg and 12 mmHg.

Intervention Carbon dioxide pneumoperitoneum with an intended maintenance pressure of 8 mmHg. Intraoperative increases in pressure were permitted when required for adequate exposure or other operative reasons and were recorded as an outcome.

Comparator Carbon dioxide pneumoperitoneum with an intended maintenance pressure of 12 mmHg. Any subsequent pressure escalation was recorded for comparison with the 8 mmHg group.

Study designs to be included RCTs.

Eligibility criteria Inclusion criteria:
(1) Randomized controlled trials (RCTs) enrolling adults undergoing LC.
(2) Direct comparison of intended maintenance pressures of 8 mmHg and 12 mmHg.
(3) Reporting at least one outcome specified in the review.
(4) Availability of extractable or convertible data for quantitative synthesis.

For multi-arm trials, only the relevant 8 mmHg and 12 mmHg groups were included.
Exclusion criteria:
(1) Pressure comparisons other than 8 mmHg versus 12 mmHg.
(2) Concomitant interventions that could affect outcomes when the relevant pressure-group data could not be isolated.
(3) Nonrandomized or observational studies, case reports, reviews, conference abstracts, and duplicate publications.
(4) Absence of usable data for the outcomes of interest.

Information sources Two reviewers independently searched PubMed, Embase, CENTRAL, and Web of Science from database inception through September 7, 2026. Searches combined controlled vocabulary with free-text terms describing LC, pneumoperitoneum, pressure levels, and randomized trials, with syntax adapted to each database.

Main outcome(s)
Early postoperative visceral pain scores (4–6 h).
Postoperative visceral pain scores at 12 h.
Postoperative visceral pain scores at 24 h.
Need for postoperative rescue analgesia.
Incidence of shoulder pain at 24 h.
Incidence of postoperative nausea and vomiting.
Length of hospital stay.
Operative time.
Need for intraoperative pressure escalation.
Conversion to open surgery.

Quality assessment / Risk of bias analysis The Cochrane RoB 1 tool was applied independently by two reviewers. Seven domains were examined: random sequence generation, allocation concealment, blinding of participants and personnel, blinding of outcome assessment, incomplete outcome data, selective reporting, and other bias.

Strategy of data synthesis Review Manager 5.4 was used to pool mean differences (MDs) for continuous outcomes and risk ratios (RRs) for binary outcomes, each accompanied by a 95% confidence interval (CI). Where studies reported medians and measures of dispersion, means and standard deviations were estimated using the methods of Luo et al. and Wan et al., respectively.
Cochran's Q test and I^2 quantified between-study heterogeneity. Fixed-effect models were used when I^2 <50%, and random-effects models when I^2 ≥50%. Statistical significance was assessed at a two-sided P <0.05.

Trial sequential analysis (TSA) was conducted for operative time and the need for intraoperative pressure escalation, using a two-sided α of 0.05 and 80% power. Required information sizes and sequential monitoring boundaries were calculated. For pressure escalation, the information-size calculation used the observed group event rates; this analysis was therefore interpreted as exploratory.

Subgroup analysis No subgroup analyses were reported in this review.

Sensitivity analysis Length of hospital stay was examined using a leave-one-out analysis because of substantial heterogeneity. The pooled estimate was recalculated after removing each study individually. Its direction remained unchanged across these analyses, supporting the stability of the effect direction without resolving the underlying heterogeneity.

Country(ies) involved China.

Keywords Laparoscopic cholecystectomy; Pneumoperitoneum pressure; Low-pressure pneumoperitoneum; Postoperative analgesia; Intraoperative pressure escalation; Systematic review; Meta-analysis.

Contributions of each author
Author 1 - Rihui Xiong.
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