

# Surgical techniques in laparoscopic cholecystectomy: effect on postoperative pain

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## Background

- PROSPECT is a new initiative in the management of postoperative pain, which provides procedure-specific and evidence-based recommendations formulated by an international working group of expert surgeons and anaesthesiologists.
- Laparoscopic cholecystectomy has become the gold standard for the treatment of symptomatic gallstones, and different operative techniques have been developed to improve the safety and effectiveness of this procedure.
- In this systematic review, PROSPECT has examined the postoperative analgesic effects of the various operative techniques that are used in laparoscopic cholecystectomy.

## Methods

- A systematic review of the literature was performed according to the protocol of the Cochrane collaboration.<sup>1</sup> MEDLINE and Embase were searched from 1966–June 2003 using predefined search terms. Reference lists of identified studies were also searched for further references.
- Study inclusion criteria:
  - randomised clinical trials of operative techniques in laparoscopic cholecystectomy
  - pain scores measured using a visual analogue scale (VAS) or verbal rating scale (VRS) (converted to VAS 1–10 cm)
- Where possible, meta-analyses were conducted on mean differences in postoperative VAS scores, grouped by time postoperatively. Outcomes are reported as weighted mean differences (WMD) with 95% confidence intervals.
- Results are reported as significant where  $p < 0.05$ ;  $n$  = number of studies.

## Results

- A total of twenty-four studies compared different operative techniques in laparoscopic cholecystectomy and reported postoperative pain scores. The following operative techniques were evaluated in more than one study and outcomes are summarized in Table 1:

### Low pressure versus conventional pressure CO<sub>2</sub> pneumoperitoneum (n=3)

- All of three studies showed that use of low pressure CO<sub>2</sub> pneumoperitoneum was associated with a reduction in pain scores during at least the first 24 h, and a reduction in analgesic use, compared with conventional pressure CO<sub>2</sub> pneumoperitoneum.<sup>2,4</sup>
- Low pressure CO<sub>2</sub> pneumoperitoneum was also associated with benefits for reducing the duration of hospital stay,<sup>4</sup> and improving postoperative physical functioning,<sup>2</sup> compared with conventional pressure.

### Warmed versus conventional CO<sub>2</sub> pneumoperitoneum (n=3)

- Two of three studies showed no significant difference between warmed and conventional CO<sub>2</sub> pneumoperitoneum for pain scores or use of supplementary analgesia;<sup>5,6</sup> the remaining study showed that warmed CO<sub>2</sub> pneumoperitoneum significantly increased pain scores.<sup>7</sup>
  - quantitative analysis of data from two studies<sup>5,6</sup> showed that warmed CO<sub>2</sub> pneumoperitoneum did not significantly reduce pain scores compared with conventional CO<sub>2</sub> pneumoperitoneum (WMD -0.66 cm [-1.64, 0.32],  $p=0.19$ ) (Figure 1)
- Warmed and conventional CO<sub>2</sub> pneumoperitoneum were associated with a similar duration of hospital stay and a similar incidence of PONV in one study.<sup>7</sup>

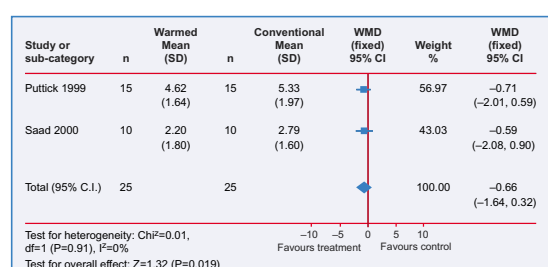


Figure 1. Effect of warmed versus conventional CO<sub>2</sub> pneumoperitoneum on VAS pain scores

Table 1. Effects of different operative techniques on postoperative analgesia: Techniques assessed in more than one study

New technique	Standard technique	Analgesic effects of new technique versus standard technique
Low pressure (7.5–9 mmHg) CO <sub>2</sub> pneumoperitoneum <sup>2,4</sup>	Conventional pressure (12–15 mmHg) CO <sub>2</sub> pneumoperitoneum	Reduced pain scores during at least the first 24 h and reduction in analgesic use (3/3 studies)
Warmed CO <sub>2</sub> pneumoperitoneum <sup>5, 6, 7</sup>	Conventional CO <sub>2</sub> pneumoperitoneum	No reduction in pain scores or analgesic use (3/3 studies)
Gasless technique <sup>8, 9</sup>	CO <sub>2</sub> pneumoperitoneum	No reduction in pain scores or analgesic use (2/2 studies)
Microlaparoscopic cholecystectomy (smaller port sizes, 2–10 mm) <sup>10,12, 13, 14, 15</sup>	Conventional laparoscopic cholecystectomy (5 and 10 mm ports)	Reduced pain scores (overall pain, incisional pain or pain on coughing: 5/6 studies) No reduction in analgesic use (5/5 studies)
Radially expanding trocars <sup>16, 17</sup>	Conventional trocars	Reduction in epigastric, but not subumbilical pain, during days 1–3 (1/2 studies)

Table 2. Effects of different operative techniques on postoperative analgesia: Techniques assessed in single studies

New technique	Standard technique	Analgesic effects of new technique versus standard technique
N <sub>2</sub> O pneumoperitoneum <sup>18</sup>	CO <sub>2</sub> pneumoperitoneum	Reduced pain scores at 1 h and 6 h
Humidified CO <sub>2</sub> insufflation <sup>19</sup>	Standard CO <sub>2</sub> insufflation	Reduced pain scores at 6 h, and on days 1, 2, 3 and 10
Helium insufflation <sup>20</sup>	Standard CO <sub>2</sub> insufflation	No reduction in pain scores or supplementary analgesic use
Removal of CO <sub>2</sub> by suction <sup>21</sup>	No suction	Reduced pain, especially shoulder tip pain
Trans-umbilical laparoscopic cholecystectomy <sup>22</sup>	Standard laparoscopic cholecystectomy	Reduction in pain scores and supplementary analgesic use during the first 24 h
Day procedure <sup>23</sup>	Overnight stay	No reduction in pain

### Gasless technique versus CO<sub>2</sub> pneumoperitoneum (n=2)

- The gasless technique was associated with similar pain scores and analgesic use to the conventional CO<sub>2</sub> pneumoperitoneum technique in two studies.<sup>8, 9</sup>

### Microlaparoscopic cholecystectomy versus conventional laparoscopic cholecystectomy (n=4)

- In three of six studies, microlaparoscopic cholecystectomy was associated with reduced overall pain scores compared with the conventional laparoscopic technique.<sup>10,12</sup> Of the remaining studies, one reported reduced incisional pain on day 1 only<sup>13</sup> and another reported a reduction in pain on coughing, following microlaparoscopy, while one study showed no significant benefit compared with conventional laparoscopy.
  - quantitative analysis of data from two studies<sup>11, 15</sup> showed no significant benefit of microlaparoscopy compared with conventional laparoscopy for reducing pain scores at 16 h (WMD -0.62 cm [-2.19, 0.95],  $p=0.4$ ) (Figure 2)
- Five of five studies reported that microlaparoscopy did not reduce analgesic use compared with the conventional technique.<sup>10,12, 14, 15</sup>
- Two of two studies reported a benefit of microlaparoscopy for reducing the duration of hospital stay.<sup>11, 13</sup>

### Radially expanding trocars versus conventional trocars (n=2)

- One of two studies reported that radially expanding trocars reduced epigastric pain, but not subumbilical pain, during the first 3 days, as well as the incidence of intra-operative port bleeding, postoperative wound complications and haematoma, compared with conventional trocars.<sup>16</sup> The other study showed no significant difference in pain scores.<sup>17</sup>

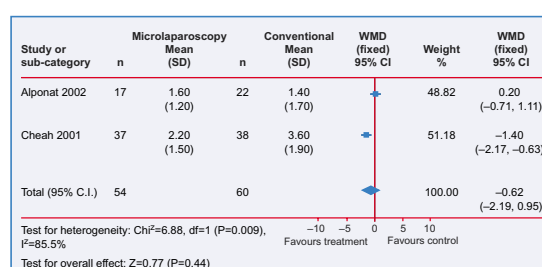


Figure 2. Effect of microlaparoscopy versus conventional laparoscopy on VAS pain scores at 16 h

### Single study results

- The postoperative analgesic effects of a number of other operative techniques were compared with those of standard laparoscopic cholecystectomy, but results were only available from single studies (Table 2).

## Conclusions

- Low-pressure CO<sub>2</sub> pneumoperitoneum (<10 mmHg) provides analgesic benefits compared with conventional pressure.
- Reducing the size of portal incisions also reduces pain, but the effects may be small and the cost and complexity of this technique should also be considered.
- No analgesic benefit was found for warming the insufflation gas or for a gasless approach.
- Further data is required for conclusions to be made about the analgesic benefits of the following techniques:
  - active removal of CO<sub>2</sub>, humidification of CO<sub>2</sub> insufflation gas, N<sub>2</sub>O insufflation, helium insufflation, radially expanding trocars, the trans-umbilical technique and early discharge.

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