Patient-controlled analgesia after laparoscopic and open cholecystectomy

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Laparoscopic cholecystectomy (LC) offers advantages over open cholecystectomy (OC) of more rapid patient recovery. The comparative amount of pain that patients must endure after each of these procedures is not clear. We retrospectively analysed the use of patient-controlled analgesia (PCA) of an unselected sample of patients having either LC or OC procedures to quantitate morphine use, as well as pain and sedation scores in the postoperative period. The hospital charts, anaesthetic records and the PCA records of 40 patients having either LC (n = 19) or OC (n = 21) were analysed retrospectively. The use of PCA morphine was standardized and consisted of a loading dose of 5 mg, bolus doses of 1.5 mg and a lockout period of five minutes. By the morning of postoperative day one, OC patients had used 38.0 ± 11.7 (mean $\pm$ SD) mg compared with 23.7 ± 15.3 mg in LC patients ($P < 0.05$). The rates of PCA morphine use in the first two postoperative hours were 4.66 ± 2.6 mg $\cdot$ hr $^{-1}$ and 7.04 ± 2.7 mg $\cdot$ hr $^{-1}$ for LC and OC patients, respectively ($P < 0.05$). The rates of morphine use averaged over the day of surgery were 1.28 ± 0.8 mg $\cdot$ hr $^{-1}$ and 2.33 ± 0.8 mg $\cdot$ hr $^{-1}$ for LC and OC patients ($P < 0.05$). Despite higher PCA morphine use in OC patients, their pain scores were higher while their sedation scores were comparable. These data suggest that laparoscopic cholecystectomy is associated with less pain than open cholecystectomy in the day after surgery.

Key words

ANALGESIA: postoperative, PCA;

ANALGESICS: morphine;

PAIN: postoperative, measurement;

SURGERY: cholecystectomy.

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La cholécystectomie par laparoscopie (CL) offre l'avantage d'une récupération plus rapide sur la cholécystectomie ouverte (CO). L'intensité comparative de la douleur qui suit chacune des interventions n'a pas été déterminée. Nous avons, de façon rétrospective, analysé l'utilisation de l'analgésie auto-contrôlée (PCA) chez un groupe de patients ayant subi la LC ou la CO pour quantifier, à la période postopératoire, l'utilisation de la morphine, aussi bien que les scores de douleur et de sédation. Chez 40 patients, les dossiers hospitaliers, d'anesthésie et de l'unité du contrôle de la douleur ont été analysés en rétrospective après CL (n = 19) ou CO (n = 21). L'administration de la morphine était standardisée et consistait en une dose initiale de 5 mg, des bolus de 1,5 mg et un intervalle de privation de cinq minutes. Le matin du premier jour postopératoire, les patients CO ont utilisé $38,0 \pm 11,7$ (moyenne $\pm$ SD) mg de morphine comparativement à $23,7 \pm 15,3$ mg chez les patients LC ($P < 0.05$). Le régime d'administration de la morphine au cours des deux premières heures postopératoires a été de $4,66 \pm 2,6$ mg $\cdot$ hr $^{-1}$ et $7,04 \pm 2,7$ mg $\cdot$ hr $^{-1}$ pour les CL et CO respectivement ($P < 0.05$). Le jour de la chirurgie, la vitesse d'administration de la morphine a été de $1,28 \pm 0,8$ mg $\cdot$ hr $^{-1}$ et $2,33 \pm 0,8$ mg $\cdot$ hr $^{-1}$ pour les patients LC et OC ($P < 0.05$). Malgré l'utilisation plus importante de morphine avec la PCA chez les CO, leurs scores de douleur ont été plus élevés et les scores de sédation comparables. Ces données suggèrent que le jour de la chirurgie, la cholécystectomie par laparoscopie est moins douloureuse que la cholécystectomie ouverte.

The laparoscopic approach to cholecystectomy (LC) has resulted in a number of advantages including shorter hospitalization and a more rapid return to normal activity¹ than after traditional open cholecystectomy (OC). Furthermore, LC may lead to less deterioration in postoperative pulmonary function,² and lower morbidity and mortality rates.³ While it is generally perceived that postoperative pain after LC is less than after OC, few data exist to support this. It has been our observation and that of others⁴ that a proportion of LC patients have considerable pain in the immediate postoperative period following emergence from anaesthesia and may require substantial amounts of opioids to gain relief. This has

led us to offer patient-controlled analgesia (PCA) using *iv* morphine to both LC and OC patients. Patients using PCA can self-administer small doses of *iv* opioid in response to their own perceived pain. We designed this retrospective, controlled study to compare the postoperative pain in an unselected sample of patients having either LC or OC using the criteria of (1) the requirements for PCA morphine and (2) pain and sedation scores. If the LC procedure was associated with less postoperative pain then we would expect to find reduced PCA morphine use, lower pain scores or both.

Methods

Approval of the hospital Research and Ethics Committee was obtained. The study patients consisted of adult patients who had undergone either LC or OC in our institution during the same period of time, by the same group of surgeons and had received PCA morphine by the Acute Pain Service of the Department of Anaesthesia. Patients were assigned to undergo either LC or an OC based on the preference of the patient, the surgeon, and the availability of laparoscopic equipment. Patients had received PCA morphine after instruction in the correct use of PCA the night prior to surgery by a nurse dedicated to the PCA service. The charts of 40 patients were drawn at random from a list of approximately 100 complete records of patients who had undergone either LC or OC and had received PCA. Retrospectively, we analysed the hospital charts, anaesthetic and PCA records of these 40 patients who had undergone LC ($n = 19$) or OC ($n = 21$).

General anesthesia was induced in all cases with thiopentone and fentanyl and maintained with isoflurane in 70% nitrous oxide and 30% oxygen with increments of fentanyl at the discretion of the anaesthetist. Morphine was not used intraoperatively.

After arrival in the Post Anaesthesia Care Unit (PACU), PCA was initiated when the patient was alert and requesting analgesia. Routine PCA orders consisted of a loading dose of morphine 5 mg, bolus doses of 1.5 mg and a lockout period of five minutes. A second loading dose of morphine 5 mg was delivered if, in the opinion of the PACU nurse, the first did not provide adequate analgesia. Continuous infusions of morphine were not used. For LC patients, PCA was used until 07:00 hr of postoperative day one (POD #1) and discontinued in preparation for discharge. The OC patients continued to use PCA until 07:00 hr of postoperative day two.

Pain and level of sedation were assessed every hour for the first four hours, every two hours for the next eight hours and every four hours thereafter. Pain was assessed by the patient and recorded by the nurse using the six point McGill pain score:⁵ 0 no pain; 1 mild pain; 2 dis-

TABLE I Demographic data

	LC	OC
<i>n</i>	19	21
Age yr	47 (14.62)	56 (15.4)
Sex Male	5	8
Female	14	13
ASA I/II/III	14/3/2	10/9/2
Height cm	145.74 (52.31)	141.52 (60.05)
Weight kg	64.05 (23)	72.92 (25.13)
Haemoglobin g · L ⁻¹	137.84 (12.13)	133.57 (13.21)
Bilirubin mg · L ⁻¹	14.78 (16.36)	14.48 (12.10)

Continuous data mean (SD). No differences found between groups. LC laparoscopic cholecystectomy; OC open cholecystectomy.

comforting pain; 3 distressing pain; 4 horrible pain; 5 excruciating pain. Level of sedation was assessed and recorded by the nurse using a five point scale: 1 wide awake; 2 drowsy; 3 dozing intermittently; 4 mostly sleeping; and 5 only awakens when stimulated.

The loading dose(s) of morphine were included in the calculations of PCA morphine use. Cumulative PCA morphine use was analysed at two and at eight hours after surgery and at 07:00 hr the morning of postoperative days one and two, to derive data for the day of surgery (POD #0) and POD #1, respectively. The rate of morphine consumption per hour was calculated for the first two hours after surgery, the period from two hours to eight hours after surgery and overnight from eight hours after surgery to 07:00 hr next morning. Pain and sedation scores were analysed for the times defined by the first two postoperative hours and the mean values for the entire periods of the day of surgery and POD #1. Since 18 of the 19 LC patients were discharged on the morning of the first postoperative day, only data from the OC patients could be analysed for POD #1.

Statistical analysis was by Chi-square and ANOVA with the unpaired Student's *t* test for dicotomous and continuous data, respectively. A value of $P < 0.05$ was considered statistically significant.

Results

The LC and OC group patients did not differ demographically (Table I). The duration of LC was longer than OC ($P < 0.05$) (Table II). In the PACU, there was no difference between LC and OC patients in the time before PCA was initiated (Table III). Three patients required a second loading dose of morphine to achieve analgesia (1 LC, 2 OC).

Patients undergoing OC required more cumulative PCA morphine than LC patients ($P < 0.05$) (Figure 1) and more PCA morphine during all time intervals ($P < 0.05$) (Figure 2).

TABLE II Intraoperative variables

	LC	OC
n	19	21
Thiopentone mg	318.16 (105.48)	338.33 (139.72)
Duration of surgery min	100.58 (31.84)	73.33 (28.5)*
Fentanyl use during surgery $\mu\text{g} \cdot \text{min}^{-1}$	2.58 (2.11)	2.67 (1.36)
Droperidol mg	0.98 (0.80)	0.87 (0.75)

* $P < 0.05$ between groups.

Mean (SD).

LC: laparoscopic cholecystectomy; OC: open cholecystectomy.

TABLE III PCA use

	LC	OC
n	19	21
Time to PCA min	36.0 (44.26)	38.48 (39.41)
Duration of PCA use hr	19.09 (6.47)	39.2 (5.19)*
Pain score 0 to 2 hr postoperative	2.01 (0.98)	2.66 (0.956)*
Pain score day of surgery	1.03 (0.56)	1.79 (0.75)*
Pain score POD #1		1.09 (0.63)
Sedation score 0 to 2 hr postoperative	2.27 (0.85)	1.86 (0.69)
Sedation score day of surgery	2.50 (0.68)	2.22 (0.73)
Sedation score POD #1		1.71 (0.78)

* $P < 0.05$ between groups.

All data expressed as mean (SD).

LC laparoscopic cholecystectomy; OC open cholecystectomy. POD #1 postoperative day one. Pain and sedation were scored as per the Methods section of the text. Data do not exist for LC patients for POD #1 because 18 of 19 patients had been discharged by the morning of POD #1.

Pain scores in OC patients were higher than LC patients during the first two postoperative hours and when averaged over the entire day of surgery (Table III). Sedation scores were not different between groups at any time (Table III).

Discussion

The use of intravenous PCA opioids may be useful in reducing failures that occur with traditional postoperative pain management.⁶ Intravenous PCA opioids have been used to titrate the pain of labour as it evolves with cervical dilatation,⁷ to compare the potency of opioid⁸ and non-opioid analgesics,^{9,10} and to determine the minimum effective concentration of morphine for postoperative analgesia.¹¹

Our data suggest that PCA opioid requirements are lower in patients having LC surgery than with OC surgery, and that this is associated with lower pain scores. Patients undergoing OC required a mean of 2.33 ± 0.8

FIGURE 1 Cumulative PCA morphine requirements. Data presented as mean $\pm$ SD. * $P < 0.05$ between groups. LC laparoscopic cholecystectomy; OC open cholecystectomy. Postoperative times examined were two hours (2 hr), eight hours (8 hr), day of surgery which ended at 07:00 hr of the day after surgery (POD #0), and postoperative day 1 (POD #1). Data do not exist for LC patients for POD #1 because 18 of 19 patients had been discharged the morning of POD #1.

$\text{mg} \cdot \text{hr}^{-1}$ PCA morphine on the day of surgery, which is similar to the figure of $2.6 \pm 1.2 \text{ mg} \cdot \text{hr}^{-1}$ morphine reported by Tamsen *et al.*¹² after major abdominal surgery.

A recent prospective study did not support our observation of decreased opioid requirements and lower pain scores in LC than in OC patients.² Pain scores did not differ at any time in the first 24 hr after surgery and the requirements for opioids in the first 24 hr were similar.² The use of large doses of *im* morphine instead of PCA morphine in that study may have obscured potential differences in opioid requirements.

This study may be criticised because patients were not assigned to either LC or OC in a randomized, prospective manner. The reputed advantages of the LC technique were so obvious to surgeons and to the public, that a prospective randomized study was not considered ethical and patients would have been difficult to enrol.

Is PCA a useful form of postoperative analgesia for LC patients? These data suggest that although PCA morphine use and pain scores were lower in LC than in OC patients, substantial overlap exists between groups. The advantages of PCA opioids compared with *im* narcotics for abdominal surgery are subjectively better analgesia¹³⁻¹⁵ with equal¹³ or less sedation.¹⁶ Compared with epidural morphine, however, PCA morphine may provide

FIGURE 2 PCA morphine requirements for postoperative time intervals. Data presented as mean $\pm$ SD. LC: laparoscopic cholecystectomy; OC: open cholecystectomy. Postoperative time intervals examined were the first two postoperative hours (0-2 hr), from two to eight hours postoperative (2-8 hr), from 8 hours postoperative to 07:00 hr the morning after surgery (8 hr-0700), the mean of all the day of surgery (POD #0), and the mean of all of postoperative day 1 (POD #1). Data do not exist for LC patients for POD #1 because 18 of 19 patients had been discharged by the morning of POD #1.

* $P < 0.05$ between groups.

inferior analgesia after cholecystectomy.¹⁷ As in the case of the present study, side effects such as sedation may limit the maximum dose of *iv* opioids that are self-titrated.¹⁷

In conclusion, this retrospective study compared the use of PCA morphine in a random sample of laparoscopic and open cholecystectomy patients. Morphine requirements were reduced and lower pain scores resulted with the laparoscopic technique.

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