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The impact of patient-controlled analgesia on laparoscopic cholecystectomy

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ABSTRACT

INTRODUCTION Laparoscopic cholecystectomy has revolutionised the management of symptomatic gallstones and is increasingly performed as a day-case procedure. The aim of this study was to assess the impact of opioid patient-controlled analgesia (PCA) on elective laparoscopic cholecystectomy.

PATIENTS AND METHODS In a prospective, non-randomised, observational study, 76 consecutive patients who underwent elective in-patient laparoscopic cholecystectomy were reviewed. Six patients with complicated gall stone disease and four patients who converted from laparoscopic to an open operation were excluded.

RESULTS Of the 66 remaining in the study group, 25 patients received morphine-PCA and, of these, 9 were fit for discharge. In contrast, 41 patients did not receive PCA and, of these, 27 were fit for discharge ($P < 0.05$). Median Aldrete score in the PCA group was 16 and in the non-PCA group 18 ($P < 0.05$). Postoperative nausea and vomiting were more common in patients receiving a morphine-based PCA and with in those with higher anti-emetic requirement (10/25 in PCA and 7/41 non-PCA groups; $P < 0.05$).

CONCLUSIONS Routine postoperative opioid PCA prolongs the recovery and in-patient stay following elective laparoscopic cholecystectomy. Its role in postoperative pain management in routine laparoscopic cholecystectomy should be questioned.

KEYWORDS
Patient-controlled analgesia – Laparoscopic cholecystectomy – Day-case

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Laparoscopic cholecystectomy has received universal acceptance and replaced open cholecystectomy as the gold standard for the management of symptomatic gall stone disease. The advantages of laparoscopic cholecystectomy include less postoperative pain, ambulation within hours of surgery and shorter recovery period.[1] With better anaesthetic regimens, pain management and less surgical trauma due to minimal invasive surgery, an increasing number of centres are performing laparoscopic cholecystectomy on a day-case basis. Although opioid patient-controlled analgesia (PCA) is regularly used in open cholecystectomy for postoperative pain management, its role in elective laparoscopic cholecystectomy is not as clearly justified. The aims of our study were: (i) to assess the impact of opioid PCA as a routine postoperative analgesia in elective laparoscopic cholecystectomy patients; and (ii) to study its influence on the speed of recovery and possible discharge of the patient as a day-case.

Patients and Methods

A total of 76 consecutive patients, 63 females and 13 males, median age of 54 years (range, 18–80 years), who underwent elective laparoscopic cholecystectomy in the morning list as in-patients in Torbay Hospital were enrolled in this prospective observational study. The indications for surgery were symptomatic cholelithiasis confirmed by ultrasound without clinical evidence of acute cholecystitis. None of these patients had any other extra procedures such as intra-operative cholangiogram or bile duct exploration. Patients excluded were those with previous extensive abdominal surgery, complicated gall stone disease such as common bile duct stone, obstructive jaundice, and gall stone pancreatitis. In addition, it was decided that patients who were converted to open cholecystectomy would be excluded from the study. Ethical approval for collection of additional data was granted by the local ethics committee. We designed a proforma to

collect patient demographics, pre-operative history, physical examination, standardised laboratory and radiological tests, operative findings, postoperative analgesia and complications.

All patients received prophylactic antibiotics and prophylaxis against deep venous thrombosis. A standard four-port technique was used. Operations were performed by a consultant surgeon or staff grade surgeons or/and registrars under supervision. Patients were anaesthetised using propofol and fentanyl or ramifentanyl, then orally intubated after adequate muscle relaxation was achieved. Anaesthesia was maintained using an inhalation agent (isoflurane), nitrous oxide, and a small dose of a narcotic agent. Both intra- and postoperative analgesia and anti-emetic medication were administered as necessary to facilitate recovery. The choice of anaesthetic drugs and doses used depended on the anaesthesiologist's preference. Although the anaesthetic protocol was not standardised during the study period, all cases were managed by a consultant anaesthesiologist experienced in managing laparoscopic cholecystectomy. Intra-operative findings and technical difficulty were recorded. Wounds were routinely infiltrated with 10 ml of 0.5% bupivacaine at the end of operation. Patients were followed up to discharge. Feasibility of discharge on the same day was assessed using the Aldrete scoring system (a score of 18 or more out of 20 is considered as fit for discharge from hospital).[2] Postoperative pain, vomiting, ambulation, voiding, alertness, and anti-emetic use were documented. Patients graded their pain using the 10-point self-assessing verbal scale (0, no pain and 10, worst pain). Data were analysed in three groups: no pain (score = 0), mild pain (score = 1–4), and moderate-to-severe pain (score = 5–10). Patients with moderate-to-severe pain were considered unfit for discharge.

Mann-Whitney tests were used to compare the groups for quantitative variables, such as age and length of stay. Chi-squared tests were used for categorical variables, unless the numbers were small in which case Fisher's exact test was used. *P*-values of less than 0.05 were taken as statistically significant.

Results

Out of 76 patients enrolled in the study, six patients with a history of obstructive jaundice having undergone pre-operative ERCP were excluded in view of anticipated intra-operative difficulty and expected higher conversion rate. Four patients were excluded due to intra-operative conversion to an open procedure. The two groups were similar in demographics, laboratory and radiology results (Table 1). There were no significant differences in the male:female ratio, associated co-morbidities and average operative time. Although there were no major intra-operative complications, spillage of bile and stones were noted in six patients.

Of the 66 patients, 25 (38%) were given a morphine PCA as postoperative analgesia despite successful laparoscopic

Table 1 Patient demography, ASA status, laboratory results and radiological investigations in PCA and non-PCA groups

Variables	PCA group (*n* = 25)	Non-PCA group(*n* = 41)
Age (years	55.9 ± 15.1	52.0 ± 16.0
Male:female ratio	5:20	4:37
ASA risk classification		
ASA I	9	15
ASA II	13	24
ASA III	3	2
Operative duration (min)	64.8	65.4
Laboratory results		
Haemoglobin (g/dl)	13.6 ± 1.31	14.2 ± 4.50
White blood cell count (x10^3/μl)	6.53 ± 1.56	7.57 ± 2.35
Bilirubin (mg/dl)	5.8 ± 5.0	5.7 ± 5.7
Alkaline phosphatase (U/l)	74.1 ± 26.6	80.8 ± 21.5
Aspartate aminotransferase (U/l)	29.9 ± 42.2	28.7 ± 26.1
Alanine aminotransferase (U/l)	22.3 ± 8.9	24.8 ± 13.9
Ultrasonographic findings		
Thickened gall bladder	18	30
Contracted gall bladder	7	11

surgery. The choice of postoperative morphine PCA use was according to the anaesthesiologist's preference. Twenty-four hour PCA use of this group is shown in Table 3. Employing the Aldrete scoring system, 54.5% of all patients studied would have been considered fit for discharge on the same day of surgery at 1900 h. Of patients in the non-PCA group, 65.8% (27/41) were considered fit for discharge on the same day whereas only 36% (9/25) of patients in the PCA group could have been treated in this way ($P < 0.05$). Median Aldrete score in the PCA group was 16 and in the non-PCA group it was 18 ($P < 0.05$). The majority (80.3%) of the patients were alert in both groups; 87.8% of patients were alert in the non-PCA group while only 68% were alert in the PCA group. Only a small number of patients complained of severe pain needing parenteral analgesia or morphine bolus (Table 2). Mild pain was the commonest symptom in both the groups (80% in PCA and 65.9% in non-PCA) while 10 patients in the non-PCA group and only 3 in the PCA group were pain-free. Postoperative nausea and vomiting was more common (52%) in patients receiving morphine PCA compared to only 26.8% of patients in the non-PCA group ($P < 0.05$; Table 2). The number of patients requiring anti-emetics was higher in the PCA group (10/25 in PCA group and 7/41 non-PCA group; $P < 0.05$).

Of patients who received PCA, 80% (20/25) were still confined to bed and half complained of vertigo on sitting up. In comparison, 46% (19/41) of patients who did not receive PCA were confined to bed with only 5 patients complaining

Table 2 Different comparable parameters between PCA and non-PCA groups after laparoscopic cholecystectomy

Variables	PCA group (n = 25)	Non-PCA group(n = 41)	P-value
Score			
Mean (SD)	16.2 (2.48)	17.8 (2.20)	
Median	16	18	0.003[a]
Number (%) of patients scoring ≥ 18	9 (36.0%)	27 (65.8%)	0.035[b]
Length of stay (days)			
Median (range)	2 (0–5)	1 (0–6)	0.09[a]
Consciousness			0.062[c]
Alert	17 (68.0%)	36 (87.8%)	
Rousable	8 (32.0%)	5 (12.2%)	
Pain			0.43[b]
Severe	2 (8.0%)	4 (9.8%)	
Mild	20 (80.0%)	27 (65.9%)	
None	3 (12.0%)	10(24.4%)	
Ambulation			0.001[2]*
Ambulatory	5 (20.0%)	22 (53.7%)	
In bed	7 (28.0%)	14 (34.1%)	
Vertigo on erect	10 (40.0%)	4 (9.7%)	
Vertigo supine	3 (12.0%)	1 (2.43%)	
Feeding			0.048[b]
Eating and drinking	12 (48.0%)	30 (73.2%)	
Nausea	6 (24.0%)	8 (19.5%)	
Vomiting	7 (28.0%)	3 (7.3%)	
Urination			0.055[b]
Passed	15 (60.0%)	35 (85.4%)	
Not passed	8 (32.0%)	4 (9.7%)	
Catheterised	2 (8.0%)	2 (4.8%)	
Anti-emetic use	10 (40.0%)	7 (17.1%)	0.039[b]

*Vertigo categories combined.
[a]Mann-Whitney test.
[b]Chi-squared test.
[c]Fisher's exact test.

Table 3 Use of total amount of morphine in 24 h by PCA group

Morphine PCA (mg)	Patients (n = 25)
< 10	5
10–30	8
31–50	7
> 50	2

PCA dose not written in 3 charts.

of vertigo (P < 0.01). Of patients in the non-PCA group, 85.4% (35/4 1) could void by the evening but only 60% (15/25) of patients in the PCA group could achieve this (Table 2). Median stay in the PCA and non-PCA groups was 2 days and 1 day, respectively. Six patients from the non-PCA group were able to go home the same evening although operated on as in-patients.

Discussion

Reddick and Olsen[3] first reported on laparoscopic cholecystectomy for treatment of gallstone disease in 1990. Laparoscopic cholecystectomy has revolutionised the treatment of gallstone disease by shortening the hospital stay, convalescence and facilitating earlier return to work. An improved anaesthetic regimen, better peri-operative care together with less surgical trauma from the laparoscopic approach has made day-surgery a real possibility. With the growth of day-surgery in recent years, the proportion of laparoscopic cholecystectomy performed as a day-case is also steadily increasing and the use of routine postoperative opioid analgesia is increasingly losing support. Although morphine PCA is regularly used in open cholecystectomy, its role in elective laparoscopic cholecystectomy is unclear. Wiesel and Grillas[4] have shown that, following laparoscopic cholecystectomy, patients require less morphine PCA than after open cholecystectomy.

Although PCA offers patients independence to control their analgesia instead of relying administration by nurses, it is not free from disadvantages such as inadequate pain control, side-effects or both. Some patients also report mistrust of the PCA delivery machine, fearing overdose or addiction.[5] The successful use of PCA requires reasonably normal cognitive function and patients with postoperative evidence of confusion are unsuitable.[6] In the era of day-surgery, several studies have shown that postoperative pain following successful laparoscopic cholecystectomy can be managed by regular oral analgesia.[7,8] In a study of 84 patients, Serralta *et al.*[9] showed that the analgesic requirement following successful laparoscopic cholecystectomy is substantially less and opioids may not play a role in postoperative pain management.

Postoperative nausea and vomiting are the most common, unpleasant side-effects of laparoscopic cholecystectomy. Use of PCA morphine is known to be associated with nausea, vomiting and need for regular anti-emetics.[10] In our study, 52% of patients receiving PCA morphine complained of nausea or vomiting compared to 26.8% of the non-PCA group. Several studies have reported on the incidence of over sedation following opioid PCA, such as repeated use at the end of every lock-out period,[11] mistaking the handset for nurse-call button,[12] unauthorised use by family[13] or visitor.[14] Although the majority of patients in our study were alert, a greater number of patients receiving PCA were sedated (32% in the PCA group and 12.1% in the non-PCA group).

Opioid PCA may be too efficacious and it can mask other associated symptoms. There are reports that PCA may mask signs of urinary retention,[15] compartment syndrome,[16] pulmonary embolism[17] and myocardial infarction.[18] In our series, the number of patients who voided by the same evening in the PCA group was substantially less (56%) compared to the non-PCA group (85.3%). Several studies showed PCA does not affect the hospital stay;[9] however, the median stay in our study was significantly longer in the PCA group (2 days in the PCA group versus 1 day in the non-PCA group).

Conclusions

Of patients in this study group, 55% could have feasibly been treated as day-cases. Postoperative alertness, nausea, vomiting, ambulation, and voiding appear to be better in patients who did not receive PCA as routine postoperative analgesia. Postoperative pain control was no better in the PCA group. Median stay following laparoscopic cholecystectomy in patients who received PCA was longer. Although our study was observational, the results suggest that day-case laparoscopic cholecystectomy is safe and feasible. Routine use of an opioid PCA should be questioned as a form of postoperative analgesia following elective laparoscopic cholecystectomy.

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References

1. Hession MC. Factors influencing successful discharge after outpatient laparoscopic cholecystectomy. *J Perianesth Nurs* 1998; **13**: 11–5.
2. Aldrete JA. The post-anesthesia recovery score revisited. *J Clin Anesth* 1995; **7**: 89–91.
3. Reddick EJ, Olsen DO. Outpatient laparoscopic laser cholecystectomy. *Am J Surg* 1990; **160**: 485–7.
4. Wiesel S, Grillas R. Patient-controlled analgesia after laparoscopic and open cholecystectomy. *Can J Anaesth* 1995; **42**: 37–40.
5. Chumbley GM, Hall GM, Salmon P. Patient-controlled analgesia: an assessment by 200 patients. *Anaesthesia* 1998; **53**: 216–21.
6. Lavand'homme P, De Kock M. Practical guidelines on the postoperative use of patient-controlled analgesia in the elderly. *Drugs Aging* 1998; **13**: 9–16.
7. Keulemans Y, Eshuis J, de Haes H, de Wit LT, Gouma DJ. Laparoscopic cholecystectomy: day-care versus clinical observation. *Ann Surg* 1998; **228**: 734–40.
8. Prasad A, Foley RJ. Day case laparoscopic cholecystectomy: a safe and cost effective procedure. *Eur J Surg* 1996; **162**: 43–6.
9. Serralta SA, Bueno LJ, Sanhauja SA, Garcia ER, Arnal BC, Martinez CP *et al*. [Course of postoperative pain in laparoscopic cholecystectomy under multimodal anesthesia-analgesia in ambulatory care]. *Rev Esp Anestesiol Reanim* 2002; **49**: 461–7.
10. Macintyre PE. Safety and efficacy of patient-controlled analgesia. *Br J Anaesth* 2001; **87**: 36–46.
11. Simes D, Power L, Priestley G. Respiratory arrest with patient-controlled analgesia. *Anaesth Intensive Care* 1995; **23**: 119–20.
12. Tsui SL, Irwin MG, Wong CML, Fung SKY, Hui TWC, Ng KFJ *et al*. An audit of the safety of an acute pain service. *Anaesthesia* 1997; **52**: 1042–7.
13. Schug SA, Torrie JJ. Safety assessment of postoperative pain management by an acute pain service. *Pain* 1993; **55**: 387–91.
14. Chisakuta AM. Nurse-call button on a patient-controlled analgesia pump? *Anaesthesia* 1993; **48**: 90.
15. Hodsman NB, Kenny GN, McArdle CS. Patient controlled analgesia and urinary retention. *Br J Surg* 1988; **75**: 212.
16. Harrington P, Bunola J, Jennings AJ, Bush DJ, Smith RM. Acute compartment syndrome masked by intravenous morphine from a patient-controlled analgesia pump. *Injury* 2000; **31**: 387–9.
17. Meyer GS, Eagle KA. Patient-controlled analgesia masking pulmonary embolus in a postoperative patient. *Crit Care Med* 1992; **20**: 1619–21.
18. Finger MJ, McLeod DG. Postoperative myocardial infarction after radical cystoprostatectomy masked by patient-controlled analgesia. *Urology* 1995; **45**: 155–7.