

# Cover sheet

## Title

Day-case versus overnight stay in laparoscopic cholecystectomy

## Reviewers

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## Dates

Date edited: 22/03/2007

Date of last substantive update: 13/03/2007

Date of last minor update: //

Date next stage expected //

Protocol first published:

Review first published:

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## Contribution of reviewers

KG is the lead author and identified the trials for inclusion; extracted the data and wrote the review. SJ independently identified trials for inclusion, extracted the data for all the trials. MF and BRD critically commented on the review and suggested improvements.

## Internal sources of support

None

## External sources of support

None

## What's new

### Dates

Date review re-formatted: //

Date new studies sought but none found: //

Date new studies found but not yet included/excluded: //

Date new studies found and included/excluded: //

Date reviewers' conclusions section amended: //

Date comment/criticism added: //

Date response to comment/criticisms added: //

## Text of review

### Synopsis

#### **Day-case laparoscopic cholecystectomy is safe and can be done successfully in more than three-quarters of selected patients**

Although day-case laparoscopic cholecystectomy can save bed costs, its safety has to be established. In this review, we have found that day-case laparoscopic cholecystectomy is safe in selected patients with low surgical risk and those who lived within easy reach of the hospital.

### Abstract

#### Background

Although day-case laparoscopic cholecystectomy can save bed costs, its safety has to be established.

#### Objectives

To assess the benefits (decreased costs) and harms (surgical morbidity, inadequate pain relief) of day-case surgery compared to overnight stay in patients undergoing laparoscopic cholecystectomy.

#### Search strategy

We searched The Cochrane Hepato-Biliary Group Controlled Trials Register, the Cochrane Central Register of Controlled Trials (CENTRAL) in The Cochrane Library, MEDLINE, EMBASE, and Science Citation Index Expanded until February 2007 for identifying the randomised trials using The Cochrane Hepato-Biliary Group search strategy.

#### Selection criteria

Only randomised clinical trials (irrespective of language, blinding, or publication status) comparing day-care and overnight stay in elective laparoscopic cholecystectomy were considered for the review.

#### Data collection & analysis

We collected the data on the characteristics of the trial, methodological quality of the trials, morbidity, prolonged hospitalisation, re-admissions, pain and patient quality of life from each trial. We analysed the data with both the fixed-effect and the random-effects models using RevMan Analysis. For each outcome we calculated the relative risk, weighted mean difference or standardised mean difference with 95% confidence intervals (CI) based on available case-analysis.

#### Main results

We included five trials with 429 patients randomised: 215 to the day-care group and 214 to the overnight stay group. Four of the five trials were of high methodological quality. The withdrawal/ drop-out rate varied between 6.5% and 12.7% in the different trials. Four of the five trials included patients with ASA I or II. The fifth trial included patients with ASA I to III. Most trials included patients within easy reach of the hospital. There was no statistically significant difference between the two groups for morbidity, morbidity after discharge, prolongation of hospital stay, re-admission, proportion reviewed by doctor without being admitted, pain scores, patient quality of life, patient satisfaction, patient preference of treatment, return to normal activity, or return to work. There were no cases of re-admission in the day-case group, which were serious. None of the re-admissions could have been prevented even if the patients stayed overnight.

#### Reviewers' conclusions

- (1) Day-case laparoscopic cholecystectomy is safe and can be done successfully in more than three-quarters of selected patients.
- (2) Appropriate protocols for selection of patients; discharge of patients; home management of pain, nausea and vomiting; and support in case of any problems should be drawn up and appropriate arrangements should be made before attempting day-case laparoscopic cholecystectomy.

## Background

About 10% to 15% of the adult western population have gallstones ([Jørgensen 1987](#); [NIH 1992](#); [Mührbeck 1995](#); [Halldestam 2004](#)). Between 1% and 4% become symptomatic in a year ([NIH 1992](#); [Halldestam 2004](#)). More than half a million cholecystectomies are performed per year in the United States alone ([NIH 1992](#)). Regional differences exist in the cholecystectomy rates ([Mjäländ 1998](#)). Laparoscopic cholecystectomy, which was introduced in 1987, is now the preferred method of cholecystectomy ([NIH 1992](#); [Fullarton 1994](#); [Bakken 2004](#); [Keus 2006](#)).

Although laparoscopic cholecystectomy is safe during acute cholecystitis ([Gurusamy 2006](#)), only about 30% of the laparoscopic cholecystectomies in the United States are performed during acute cholecystitis ([Livingston 2004](#)). Only 20% of surgeons in the United Kingdom perform laparoscopic cholecystectomy during acute cholecystitis ([Senapati 2003](#)).

Although 50,000 cholecystectomies are performed annually in the UK (includes open cholecystectomies, laparoscopic cholecystectomies during acute cholecystitis), only about 3,300 patients are performed as day-case ([HES 2006](#)). While day-case laparoscopic cholecystectomy can save costs ([Keulemans 1998](#); [Johansson 2006](#)), concerns remain about the safety of the patient. Bleeding after laparoscopic cholecystectomy (due to vascular injury or due to cystic artery bleeding) is one of the serious complications after laparoscopic cholecystectomy ([Shamiyeh 2004](#)). Bile duct injury is another important complication after laparoscopic cholecystectomy ([Waage 2006](#)). Whether the patients feel safer if they were observed overnight is also debatable ([Keulemans 1998](#)). Another factor that has to be taken into consideration is the pain relief that the patient requires and the safety of discharging these patients on adequate pain relief. Various methods such as peritoneal instillation of normal saline ([Tsimoyiannis 1998](#)) or local anaesthetic ([Tsimoyiannis 1998](#)) and wound infiltration with local anaesthetic ([Lepner 2003](#)) have been attempted to decrease the analgesic requirements. Post-operative nausea and vomiting are other factors which need attention. Various methods have been tried to decrease the incidence of post-operative nausea and vomiting ([Argiriadou 2002](#); [Pandey 2006](#)).

Advocates of day-case laparoscopy argue that major bleeding after laparoscopic cholecystectomy is a rare event ([Keulemans 1998](#)) and that bile duct injury is either detected at the time of injury or several days later ([Keulemans 1998](#)). There was no difference in the mean pain score whether the patients were discharged as day-case or whether they stayed overnight ([Keulemans 1998](#)). There was also no difference in the patient anxiety ([Johansson 2006](#)) or in the quality of their life ([Keulemans 1998](#)) whether they were discharged as day case or whether they stayed overnight.

We have not been able to identify any systematic review comparing day case and overnight stay laparoscopic cholecystectomy.

## Objectives

To assess the benefits (decreased costs) and harms (surgical morbidity, inadequate pain relief) of day-case surgery compared to overnight stay in patients undergoing laparoscopic cholecystectomy.

## Criteria for considering studies for this review

### Types of studies

Only randomised clinical trials (irrespective of language, blinding, or publication status) were considered for this review.

Quasi-randomised studies (where the method of allocating participants to a treatment are not strictly random (eg, date of birth, hospital record number, alternation), cohort studies, and case-control studies were excluded.

### Types of participants

Patients undergoing elective laparoscopic cholecystectomy.

### Types of interventions

We included trials comparing day case laparoscopic cholecystectomy and overnight stay laparoscopic cholecystectomy.

### Types of outcome measures

- (1) Mortality.
- (2) Surgery-related morbidity (bile duct injury, intra-abdominal collections, wound infection, infected intra-abdominal collections).
- (3) Surgery related morbidity noted after discharge.
- (4) Prolonged hospitalisation.

- (5) Re-admission.
- (6) Reviewed by doctor but not admitted.
- (7) Pain (however defined by authors).
- (8) Nausea (however defined by authors).
- (9) Vomiting (however defined by authors).
- (10) Patient anxiety (however defined by authors).
- (11) Quality of life of patients (however defined by authors).
- (12) Ret run to normal activity.
- (13) Return to work.

## Search strategy for identification of studies

We searched *The Cochrane Hepato-Biliary Group Controlled Trials Register*, *the Cochrane Central Register of Controlled Trials (CENTRAL)* in *The Cochrane Library*, *MEDLINE*, *EMBASE*, and *Science Citation Index Expanded* (Royle 2003). We have given the search strategies in [Table 01](#) with the time span for the searches.

## Methods of the review

### Trial selection and extraction of data

We did not apply any language or publication status restrictions. KG and SJ, independently of each other, identified the trials for inclusion. We have also listed the excluded trials with the reasons for the exclusion. We also searched the references of the identified trials to identify further relevant trials.

KG and SJ extracted independently the data listed below:

- (1) Year and language of publication.
- (2) Country.
- (3) Year of study.
- (4) Inclusion and exclusion criteria.
- (5) Sample size.
- (6) Abdominal wall lift or pneumoperitoneum.
- (7) Pressure used for pneumoperitoneum.
- (8) Drain use.
- (9) Method of pain relief.
- (10) Method of control of nausea and vomiting.
- (11) Number of hours of stay in each group (as per protocol) and actual hours of stay.
- (12) Outcomes (mentioned above).
- (13) Methodological quality (described below).
- (14) Sample size calculation.
- (15) Intention-to-treat analysis.

We assessed the methodological quality of the trials independently, without masking of the trial names. Any unclear or missing information was sought by contacting the authors of the individual trials. If there was any doubt whether the trials share the same patients - completely or partially (by identifying common authors and centres), we intended to contact the authors of the trials to clarify whether the trial has been duplicated. We resolved any differences in opinion through discussion.

### Assessment of methodological quality

The authors followed the instructions given in the Cochrane Handbook for Systematic Reviews of Intervention (Higgins 2006) and the Cochrane Hepato-Biliary Group Module (Gluud 2006). Due to the risk of overestimation of intervention effects in randomised trials with inadequate methodological quality (Schulz 1995; Moher 1998; Kjaergard 2001), we looked at the influence of methodological quality of the trials on the trial results by evaluating the reported randomisation and follow-up procedures in each trial. If information was not available in the published trial, we contacted the authors in order to assess the trials correctly. We assessed generation of allocation sequence, allocation concealment, and follow-up.

#### *Generation of the allocation sequence*

- Adequate, if the allocation sequence was generated by a computer or random number table. Drawing of lots, tossing of a coin, shuffling of cards, or throwing dice will be considered as adequate if a person who was not otherwise involved in the recruitment of participants performed the procedure.
- Unclear, if the trial was described as randomised, but the method used for the allocation sequence generation was not described.
- Inadequate, if a system involving dates, names, or admittance numbers were used for the allocation of patients. These studies are known as quasi-randomised and were excluded from the review.

#### *Allocation concealment*

- Adequate, if the allocation of patients involved a central independent unit, on-site locked computer, or sealed envelopes.

- Unclear, if the trial was described as randomised, but the method used to conceal the allocation was not described.
- Inadequate, if the allocation sequence was known to the investigators who assigned participants or if the study was quasi-randomised (such studies were excluded).

**Blinding** was not assessed as it is impossible to blind the patient to the group to which they belonged to. It is also difficult to assess outcomes such as pain or nausea on the day of surgery in a blinded fashion. However, it is possible to blind outcomes such as decision to re-admit, quality of life after one week, return to activity etc. So, we recorded whether any of the outcomes were assessed by a blinded observer.

#### **Follow-up**

- Adequate, if the numbers and reasons for dropouts and withdrawals in all intervention groups were described or if it was specified that there were no dropouts or withdrawals.
- Unclear, if the report gave the impression that there had been no dropouts or withdrawals, but this was not specifically stated.
- Inadequate, if the number or reasons for dropouts and withdrawals were not described.

#### **Statistical methods**

We performed the meta-analyses according to the recommendations of The Cochrane Collaboration ([Higgins 2006](#)) and the Cochrane Hepato-Biliary Group Module ([Gluud 2006](#)) using the software package Revman 4.2 ([RevMan 2003](#)). For dichotomous variables, we calculated the relative risk with 95% confidence interval. For the continuous variables, we used the standardised mean difference as different authors used different scales of measurement of these outcomes. We used a random-effects model ([DerSimonian 1986](#)) and a fixed-effect model ([DeMets 1987](#)). In case of discrepancy between the two models we reported both results, otherwise we have reported the fixed model if there was no statistical heterogeneity and the random-effects model if there was statistical heterogeneity. Statistical heterogeneity was explored by chi-squared test with significance set at P value 0.10, and the quantity of heterogeneity was measured by  $I^2$  ([Higgins 2002](#)). An  $I^2$  value  $\Rightarrow >25$  was considered as statistical heterogeneity. An  $I^2$  value  $<25$  was considered to be absent statistical heterogeneity.

Due to the drop-outs and withdrawals between randomisation and intervention (or control), we adopted the 'available case analysis' ([Higgins 2006](#)). In case we find 'zero-event' trials for outcomes that are statistically significant without including the 'zero-event' trials, we intended to perform a sensitivity analysis with and without empirical continuity correction factors as suggested by Sweeting et al ([Sweeting 2004](#)). We have also reported the risk difference.

#### **Subgroup analysis**

We intended to perform subgroup analyses for:

- Trials including different age groups of patients.
- Different pressures of pneumoperitoneum including no pneumoperitoneum (abdominal wall lift).
- Different methods of pain relief (eg intra-peritoneal instillation of saline or local anaesthetic; local infiltration of bupivacaine).
- Different medications for nausea and vomiting (eg ondansetron, gabapentin).
- Methodological quality and hence bias risk of the trials.

#### **Bias exploration**

We used a funnel plot to explore bias ([Egger 1997](#); [Macaskill 2001](#)). Asymmetry in funnel plot of trial size against treatment effect was used to assess the risk of bias. We did not perform linear regression approach described by Egger et al ([Egger 1997](#)) to determine the funnel plot asymmetry because of the few trials included.

## **Description of studies**

We identified a total of 569 references through electronic searches of The Cochrane Hepato-Biliary Group Controlled Trials Register and The Cochrane Central Register of Controlled Trials in The Cochrane Library (n =48), MEDLINE (n = 53), EMBASE (n =100 ), and Science Citation Index Expanded (n = 368). We excluded 100 duplicates and 452 clearly irrelevant references through reading abstracts. Seventeen references were retrieved for further assessment. No reference was identified through scanning reference lists of the identified randomised trials. We excluded seven references for the reasons listed under the table 'Characteristics of excluded studies'. Ten references of five randomised trials involving 429 patients, randomised to day-case (215 patients) and human assistants (214 patients) fulfilled the inclusion criteria. All the five were completed trials and could provide data for the analyses ([Keulemans 1998](#); [Hollington 1999](#); [Dirksen 2001](#); [Young 2001](#); [Johansson 2006](#)). Details about the sample size, patient characteristics; the inclusion and exclusion criteria used in the trials; the method of control of pain, nausea and vomiting in the hospital and at home; and the methodological quality of the trials are shown in the table 'Characteristics of included studies'.

#### **Participants**

A total of 429 participants who underwent elective laparoscopic cholecystectomy were randomised in five trials to be discharged the same day of surgery (n=214) or to the next day of surgery (n=215). The number of participants in each trial ranged from 40 to 141. We were not able to obtain the percentage of females and the mean age of participants in one trial ([Johansson 2006](#)). The percentage of females and the mean age of participants in the remaining trials were 81.2% and 46.1 years respectively.

Four trials ([Keulemans 1998](#); [Dirksen 2001](#); [Young 2001](#); [Johansson 2006](#)) included only ASA ([ASA 2007](#)) I or II patients. The fifth trial ([Hollington 1999](#)) included patients with ASA I to III. Four trials ([Keulemans 1998](#); [Hollington 1999](#); [Dirksen 2001](#); [Johansson 2006](#)) included only participants within easy reach of hospitals and included only those participants who had a responsible adult to take care of them. Two trials included only participants who could speak the local language ([Dirksen 2001](#); [Young 2001](#)).

The patients were discharged between 4 and 8 hours after surgery in the day case group and the next day in the overnight stay group in the different trials.

### Outcome measures

All trials reported re-admissions and prolongation of hospital stay. Four trials ([Keulemans 1998](#); [Hollington 1999](#); [Dirksen 2001](#); [Johansson 2006](#)) reported surgery related morbidity. The other outcome measures reported by the individual trials are shown in the table 'Characteristics of included studies'.

## Methodological quality of included studies

Three ([Hollington 1999](#); [Young 2001](#); [Johansson 2006](#)) of the five trials (60%) had adequate generation of allocation sequence. All the trials had adequate allocation concealment. One more trial ([Johansson 2006](#)) also had adequate follow-up. Four trials ([Keulemans 1998](#); [Hollington 1999](#); [Dirksen 2001](#); [Johansson 2006](#)) reported sample size calculations. None of the studies reported blinding of any outcome. Two trials mentioned that they followed intention-to-treat analysis ([Dirksen 2001](#); [Johansson 2006](#)). In one trial, 10 patients were withdrawn from the day-case group as they were admitted by clerical error or due to inadequate arrangements in place. No further information was available on these 10 patients regarding re-admissions or any other outcome. These 10 patients were included for the outcome 'prolonged hospitalisation', but were excluded from other outcomes. Further information was sought from the author of this trial regarding these 10 patients. There was no reply from the authors.

The number of patients withdrawn in the different studies and the reasons for withdrawal have been stated in [Table 02](#). The percentage of withdrawals/ drop-outs varied between 0% and 12.5%. The main reasons for withdrawals/ drop-outs included admission with acute cholecystitis, patients postponing surgery, patients changing hospitals, and clerical errors.

Although we planned to classify the trials with adequate allocation concealment and follow-up as trials of high methodological quality, which would result in all the trials to be classified as high methodological quality, we decided post-hoc to consider only four trials ([Keulemans 1998](#); [Dirksen 2001](#); [Young 2001](#); [Johansson 2006](#)) to be of high methodological quality because of the way in which the 10 patients who belonged to the day-case group, who were hospitalised were dealt with in the report of the fourth trial ([Hollington 1999](#)). Attempts were made to obtain further information from the authors. But there was no reply.

## Results

The results of the meta-analysis are summarised in [Table 03](#). The summary measures used were relative risk (RR), risk difference (RD), standardised mean difference (SMD) and weighted mean difference (WMD). The 95% confidence intervals (95% CI) are also stated.

### Mortality and morbidity

None of the trials reported any mortality in either group. There was no statistically significant difference in the overall morbidity (RR 1.10, 95% CI 0.53 to 2.30) or in the morbidity that occurred after the discharge of the patient (RR 1.17, 95% CI 0.48 to 2.83). The surgical morbidity that occurred after discharge have been tabulated in [Table 04](#).

### Prolonged hospitalisation

There was no statistically significant difference between the groups in prolonged hospitalisation i.e. one or more days in the day-care and two or more days in the overnight stay groups (RR 1.25, 95% CI 0.56 to 2.81). The proportion of patients requiring unplanned prolonged hospitalisation in the day-case group was 48/258 (18.6%) compared to 45/251 (17.9%) in the overnight stay group.

### Re-admission

There was no statistically significant difference between the groups in the readmission rates (RR 0.76, 95% CI 0.23 to 2.47). The proportion of people who required re-admission was 4/242 (1.7%) in the day-case group compared to 6/251 (2.4%) in the overnight stay group.

### Reviewed by doctor but not admitted

There was no statistically significant difference between the groups in the proportion of patients seeking a review by a doctor but who did not require re-admission (RR 1.93, 95% CI 0.66 to 5.70). The proportion of people who were reviewed by a doctor without requiring re-admission was 8/148 (5.4%) in the day-case group compared to 4/159 (2.5%) in the overnight stay group.

### Pain

The only study which could be included for analysis showed no statistically significant difference between the groups in the pain scores between the groups on the day of surgery (SMD -0.23, 95% CI -0.52 to 0.01) or on the next day (SMD 0.01, 95% CI -0.29 to 0.30). Two other trials, which could not be included for meta-analysis also demonstrated no difference between the groups ([Table 05](#)). The number of patients requiring opiate analgesia showed a trend towards lower opiate analgesic requirement in the day-case group in the only study that reported this outcome (RR 0.39, 95% CI 0.15 to 1.02). This was statistically significant when the risk difference was calculated (RD -0.13, 95% CI -0.25, -0.01).

### Nausea and vomiting

The scores of nausea and vomiting are tabulated in [Table 05](#). There was no statistically significant difference in the nausea and vomiting scores between the two groups either on the day of surgery (SMD -0.38, 95% CI -0.78 to 0.01) or on the next day (SMD -0.02, 95% CI -0.41 to 0.36). Another trial ([Dirksen 2001](#)), which could not be included for meta-analysis did not find any significant difference in vomiting between the two groups.

**Patient anxiety**

The patient anxiety was lower in the day-case group than in the overnight stay group (SMD 0.63, 95%CI 0.23 to 1.03) on the first post-operative day. However, another scale used on the same patients in the same trial demonstrated a higher anxiety in the day-case group than in the overnight stay group. Both the scales were general scales and were not specific scales validated for measurement of patient anxiety related to surgery. There was no difference in the patient anxiety between the groups after one week of surgery (SMD 0.09, 95% CI -0.21 to 0.39).

**Patient quality of life**

There was no difference between the groups in the quality of life of the patient either on the first post-operative day (SMD -0.27, 95% -0.67 to 0.12) or after one week of surgery (SMD 0.05, 95% CI -0.28 to 0.38).

**Patient satisfaction and recommendations**

Although the fixed-effect model demonstrated a higher satisfaction in the day-case group, the random-effects model did not demonstrate any statistically significant difference between the groups (SMD 1.51, 95% CI -1.33 to 4.35). There was also no statistically significant difference in the proportion of people who would recommend the same treatment (to which they were allocated) over the alternate treatment (RR 1.05, 95% CI 0.90 to 1.24).

**Return to activity**

There was no difference between the groups in the time taken for patients to return to normal activity (WMD -0.10 days, 95% CI -0.37 to 0.17) or to return to work (WMD -2.00 days, 95% CI -10.29 to 6.29).

**Variations in statistical analysis**

Except for the number of patients requiring opiate analgesia (which became statistically significant when risk difference was used), the results of other outcomes were not altered by adopting the fixed-effect, random-effects model or by calculating the risk difference.

**Subgroup analysis**

A subgroup analysis of trials with high methodological quality trials did not alter the results. Because of the lack of the information available in the trial reports, the other planned subgroup analyses could not be carried out. Furthermore, because of the few trials included in each category (even if information was available), it would not be appropriate to perform these subgroup analyses.

**Funnel plot**

Visual inspection of the funnel plot did not reveal any bias. The Egger's linear regression approach ([Egger 1997](#)) was not performed because of the few trials included in this review.

## Discussion

This review has shown that day-case laparoscopic cholecystectomy is safe in patients selected by different criteria. The serious complications in the day-case group such as bile duct injury were diagnosed during the procedure or immediately after the procedure. There were no serious complications in patients who were discharged. However, the studies were not powered to measure the rare complications of bile duct injury or vascular injury. The only bile duct injury in either group in this review was diagnosed at the time of surgery. One serious complication of respiratory distress requiring intubation occurred within 2 hours of surgery in the overnight stay group. The other potentially serious complication of pancreatitis occurred in the overnight stay group after discharge. Thus it appears that the serious injuries in this review happened either at or immediately after the surgery. The overnight stay did not make any difference in the recognition of potentially serious injury. Most of the complications would not have been diagnosed even if the patients had stayed overnight.

The proportion of people who required unexpected prolongation of hospital stay were similar in both groups (18.6% day-case versus 17.9% overnight stay). This is important because, if this proportion was higher in the day-case group, then extra provisions have to be made for admitting these people. This may affect the calculations of cost, since adequate staff have to be employed to cover the possibility of higher proportion of cases requiring unplanned prolonged hospital stay. This is also important in countries like the United Kingdom, where is persistent shortage of beds and higher unplanned admissions can create a 'bed crisis'.

The proportion of people who required re-admission also was similar in the two groups (1.7% day-case versus 2.4% overnight stay). None of those who were re-admitted in the day-case group had any serious complications. The proportion of people who were reviewed by a doctor but not admitted was also similar in the two groups. Adequate out-of-hours facilities should be available to review these patients and admit them if necessary.

Pain, nausea and vomiting were the main causes of unplanned prolongation of hospital stay in both groups. There was no difference in the pain scores on the day of surgery or on the next day between the two groups indicating that adequate control pain, nausea and vomiting is possible at home after laparoscopic cholecystectomy. Only one of trials ([Hollington 1999](#)) employed nurses to visit the patients at home and offered parenteral analgesia at home. In this trial, 8.3% of patients required parenteral analgesia at home. Three trials ([Keulemans 1998](#); [Curet 2002](#); [Johansson 2006](#)), which mentioned about the method of control of pain, nausea and vomiting and used non-parenteral medications to control these, had low unplanned hospitalisation rates and lowest re-admission rates. The other two trials also did not employ any nurse visit at home and hence must have used non-parenteral methods for pain relief and for control of nausea and vomiting. An effective non-parenteral protocol for control of pain, nausea and vomiting is an essential component in a day-care laparoscopic cholecystectomy service. Protocols should also be in place for management of uncontrolled pain, which may indicate an underlying surgical complication.

Although one of the scales used in a trial ([Johansson 2006](#)) demonstrated a lower anxiety level in day-case patients (than overnight stay patients), another scale, used in the same trial on the same patients, demonstrated a higher anxiety level in the day-case patients than the

overnight stay patients. These scales are not specifically designed for patients undergoing surgery. A validated questionnaire has to be designed to measure anxiety in surgical patients to measure this outcome. There was no difference in the patient quality of life on the first post-operative day or after one week after surgery. There was no difference in the patient satisfaction in the two groups; nor was there a difference in the proportion of patients who preferred the same treatment that they underwent. It appears that there is no difference between the two treatments as far as patients perspectives are concerned.

A number of patients were withdrawn from the trials after randomisation. This can affect the quality of the results. If the randomisation was carried out on the day of surgery, this problem can be avoided. However, if this method is followed, then all the participants in the trial would have had to make arrangements for an adult supervising them for 24 hours. None of the studies followed blinded observation of outcomes. While this is difficult in certain outcomes such as pain score on the evening of surgery, it is possible to blind observers to other outcomes such as decision to re-admit, administering the quality of life questionnaire.

This review is applicable in only patients with an ASA of I or II and who live in the proximity of the hospital. All the trials had criteria for selection of patients and four trials have clear criteria for discharge of patients. The important criteria for discharge include that the patients were ambulatory; passed urine; had adequate control of pain, nausea and vomiting by oral medication; and were confident that they could manage at home. The patients in the trial were also supported by general practitioners or emergency services. So, appropriate protocols for selection, discharge and support of these patients in case they develop any emergencies must be in place before day-case laparoscopic cholecystectomy is attempted.

Since there is no difference between the two groups with regards to morbidity or satisfaction, cost calculations are appropriate. The cost calculations should balance the cost of implementing the protocol, including training the local general practitioners to recognise the complications, manage the minor complications and refer patients for admission appropriately, and the cost of an extra night's stay.

## Reviewers' conclusions

### Implications for practice

- (1) Day-case laparoscopic cholecystectomy is safe and can be done successfully in more than three-quarters of selected patients.
- (2) Appropriate protocols for selection of patients; discharge of patients; home management of pain, nausea and vomiting; and support in case of any problems should be drawn up and appropriate arrangements should be made before attempting day-case laparoscopic cholecystectomy.

### Implications for research

- (1) Further randomised clinical trials are necessary to compare day-case and overnight stay laparoscopic cholecystectomy to assess patient anxiety and satisfaction.
- (2) Future randomised clinical trials should include blinded assessment of outcomes, whenever possible.
- (3) Trials need to be conducted and reported according to the CONSORT Statement ([www.consort-statement.org](http://www.consort-statement.org)).

## Acknowledgements

- (1) To Dr Martyn Parker, Peterborough District hospital, Peterborough, author of more than 15 Cochrane reviews, who inspired me to write Cochrane reviews.
- (2) To Dr Sas Dijk, Academic Department Surgery, Royal Free and University Medical School, London, who helped with the translation of an article.
- (3) To The Cochrane Hepato-Biliary Group for the support that they have provided.

## Potential conflict of interest

None.

## Characteristics of included studies

Study	Methods	Participants	Interventions	Outcomes	Notes	Allocation concealment
Dirksen 2001	Randomised clinical trial  Generation of the allocation	Country: Netherlands. Number randomised: 86. Mean age: 46.9	Participants were randomly assigned to two groups.  Group 1: day-case	The main outcome measures were surgical morbidity, re-admissions, prolonged hospitalisation, quality	Eight cases were withdrawn after randomisation.	A

	sequence: not clear.  Allocation concealment: adequate (sealed envelope).  Follow-up: adequate.  Intention-to-treat analysis: yes.  Sample size calculation: yes.	years. Females: 68 (79.1%).  Inclusion criteria: (1) Symptomatic cholelithiasis. (2) ASA I or II. (3) Age 18 to 80 years. (4) Support at home for 24 hours after operation. (5) Travel time to hospital < 30 minutes. (6) Good control of Dutch language.  Exclusion criteria: (1) Other interventions during operation. (2) Complicated gallstones.	(n=42). Group 2: overnight stay (n=44).  Co-interventions: Operative cholangiogram: not stated.  Method of pain relief in hospital: not stated.  Method of control of nausea and vomiting in hospital: not stated.  Discharge medications: not stated.	of life, patient satisfaction, and patient's recommendation to others.		
Hollington 1999	Randomised clinical trial  Generation of the allocation sequence: adequate (shuffling).  Allocation concealment: adequate (sealed envelope).  Follow-up: adequate.  Intention-to-treat analysis: no.  Sample size calculation: yes.	Country: Australia. Number randomised: 141. Mean age: Not stated. Females: Not stated.  Inclusion criteria: (1) ASA I or II or III. (2) Adequate motivation levels. (3) Family member at home postoperatively. (4) Residence within the home nursing service catchment area.  Exclusion criteria: Patients who were assessed as being at significant risk of requiring conversion to open operation - for example, with multiple upper abdominal surgical scars.	Participants were randomly assigned to two groups.  Group 1: day-case (n=70). Group 2: overnight stay (n=71).  Co-interventions: Operative cholangiogram: routine.  Method of pain relief in hospital: not stated.  Method of control of nausea and vomiting in hospital: not stated.  Discharge medications: not stated.	The main outcome measures were surgical morbidity, re-admissions, prolonged hospitalisation, number requiring opiate analgesia, and return to normal activity.	(1) Nine cases were withdrawn after randomisation.  (2) Home visit by nurse, who visited the patient at home at night on the day of operation and the next day was arranged.	A
Johansson 2006	Randomised clinical trial  Generation of the allocation sequence: adequate (computer generated).  Allocation concealment: adequate (sealed envelope)	Country: Sweden. Number randomised: 100. Mean age: Not stated. Females: Not stated.  Inclusion criteria: (1) ASA I or II. (2) <50 kilometres from the hospital. (3) Adult must be available to accompany the patient home and	Participants were randomly assigned to two groups.  Group 1: day-case (n=52). Group 2: overnight stay (n=48).  Co-interventions: Operative cholangiogram: routine.  Method of pain relief in hospital:	The main outcome measures were surgical morbidity, re-admissions, prolonged hospitalisation, patient anxiety, and quality of life.	Seven cases were withdrawn after randomisation.	A

	technique). Follow-up: adequate. Intention-to-treat analysis: yes. Sample size calculation: yes.	stay there overnight. Exclusion criteria: (1) Extreme obesity. (2) Extensive previous abdominal surgery (3) Clinical suspicion of common bile duct stones. (4) History of acute cholecystitis or pancreatitis.	(1) 20 ml 0.5 per cent bupivacaine with adrenaline before making the incision. (2) 1 g paracetamol, 50 mg diclofenac. Method of control of nausea and vomiting in hospital: 4 mg ondansetron. Discharge medications: 1 g paracetamol, 50 mg diclofenac, tramadol hydrochloride and metoclopramide.			
Keulemans 1998	Randomised clinical trial Generation of the allocation sequence: unclear. Allocation concealment: adequate (sealed envelope). Follow-up: adequate. Intention-to-treat analysis: no. Sample size calculation: yes.	Country: Netherlands. Number randomised: 74. Mean age: 43 years. Females: 62 (83.8%). Inclusion criteria: (1) Symptomatic cholelithiasis. (2) ASA I or II. (3) < 70 years of age. (4) Live < 50 kilometres from the hospital. (5) Adult willing to accompany them home and to stay with them for at least 24 hours. Exclusion criteria: (1) Previous abdominal surgery. (2) Clinical suspicion of common bile duct stones. (3) Acute cholecystitis. (4) Calcified gallbladder.	Participants were randomly assigned to two groups. Group 1: day-case (n=37). Group 2: overnight stay (n=37). Co-interventions: Operative cholangiogram: Not stated. Method of pain relief in hospital: (1) Prophylactic analgesia (paracetamol 1 g suppository) (2) Trocar puncture sites were infiltrated with 0.5% bupivacaine with adrenalin before making the incision. (3) Morphine (5 to 10 mg) (on request). (4) Naproxen 1 gm suppository (routine) (5) Paracetamol/codeine 500/20 mg was given up to 6 times per day and naproxen 500 mg up to 3 times per day (when required). Method of control of nausea and vomiting in hospital: 4 mg ondansetron on induction of anaesthesia. Discharge medications: Paracetamol/codeine 500/20 mg was given up to 6 times per day and naproxen 500 mg up to 3 times per day.	The main outcome measures were surgical morbidity, re-admissions, prolonged hospitalisation, pain, patient anxiety, quality of life, return to work, and patient's recommendation to others.	Six cases were withdrawn after randomisation.	A
Young 2001	Randomised clinical trial Generation of the allocation	Country: Australia. Number randomised: 28. Mean age: 40 years. Females: 23 (82.1%).	Participants were randomly assigned to two groups. Group 1: day-case	The main outcome measures were prolonged hospitalisation, re-admissions, pain, and	(1) Patients were contacted 10 days post-operatively to find out the recordings of a	A

sequence: computer generated.	Inclusion criteria: (1) ASA I or II. (2) < 50 years of age. (3) Spoke conversational English.	(n=14). Group 2: overnight stay (n=14).  Co-interventions: Operative cholangiogram: Not stated.  Method of pain relief in hospital: not stated.  Method of control of nausea and vomiting in hospital: not stated.	nausea.	symptom diary.  (2) Authors were requested further information related to the methodological quality and outcomes. The authors replied with all the details.
Allocation concealment: held by third party.				
Follow-up: adequate.				
Intention-to- treat analysis: no.				
Sample size calculation: no.		Discharge medications: not stated.		

## Characteristics of excluded studies

Study	Reason for exclusion
Bews-Hair 2000	Comment about an included study.
Burney 2002	Not a randomised clinical trial.
Curet 2002	The allocation sequence was generated by hospital number. So, this is a quasi-randomised trial.
Parvaiz 2006	Comment about an included study.
Rosen 2001	Not a randomised clinical trial.
Selas 2004	Editorial with reference to a retrospective study.
Sharma 2004	Not a randomised clinical trial.

## References to studies

### References to included studies

**Dirksen 2001** {published data only}

Dirksen CD, Schmitz RF, Hans KM, Nieman FHM, Hoogenboom LJ, Go PMNYH. Laparoscopic cholecystectomy in an ambulatory treatment is just as effective as an overnight stay and from a social perspective is cheaper; a randomised study. *Nederlands Tijdschrift voor Geneeskunde* 2001;145(50):2434-2439.

**Hollington 1999** {published data only}

Hollington P, Toogood GJ, Padbury RT. A prospective randomized trial of day-stay only versus overnight-stay laparoscopic cholecystectomy. *Australia New Zealand Journal of Surgery* 1999;69(12):841-3.

**Johansson 2006** {published data only}

\* Johansson M, Thune A, Nelvin L, Lundell L. Randomized clinical trial of day-care versus overnight-stay laparoscopic cholecystectomy. *The British Journal of Surgery* 2006;93(1):40-5.

Thune A, Nelvin L, Johansson MG, Lundell L. Randomized clinical trial of day-care versus overnight stay laparoscopic cholecystectomy. *Gastroenterology* 2005;128(4):A785-A785.

**Keulemans 1998** {published data only}

\* Keulemans Y, Eshuis J, de Haes H, de Wit LT, Gouma DJ. Laparoscopic cholecystectomy: day-care versus clinical observation. *Annals of Surgery* 1998;228(6):734-40.

Keulemans YCA, Eshuis JH, De Haes J, Leeuwenberg A, Wit TL, Gouma DJ. Day care or hospital admission after laparoscopic cholecystectomy, a prospective randomized trial. *Gastroenterology* 1998;114(4):A1271-A1271.

Keulemans YCA, Eshuis JH, De Haes CJM, De Wit L, Gouma DJ. Laparoscopic cholecystectomy in day care as effective as during hospitalization, and cheaper; a randomized trial. *Nederlands Tijdschrift voor Geneeskunde* 1999;143(12):621-626.

Keulemans YCA, Eshuis JH, De Haes JCJM, Leeuwenberg A, de Wit L, Gouma DJ. Day care or hospital admission after laparoscopic cholecystectomy, a prospective randomized trial [abstract]. *European Journal of Gastroenterology & Hepatology* 1998;10(Suppl 12):A 25.

Keulemans YCA, Eshuis JH, De Haes JCJM. Laparoscopic cholecystectomy: admittance or day care? A randomised study (Dutch) [abstract]. *Nederlands Tijdschrift voor Geneeskunde* 1998;142(14):822.

**Young 2001** {published and unpublished data}

Young J, O CB. Recovery following laparoscopic cholecystectomy in either a 23 hour or an 8 hour facility. *Journal of Quality in Clinical Practice* 2001;21(1-2):2-7.

## References to excluded studies

**Bews-Hair 2000** {published data only }

Bews-Hair M, Coulter G, Frizelle FA. A prospective randomized trial of day-stay only versus overnight-stay laparoscopic cholecystectomy: Comment [1]. *Australian and New Zealand Journal of Surgery* 2000;70(10):743.

**Burney 2002** {published data only }

Burney RE, Jones KR. Ambulatory and admitted laparoscopic cholecystectomy patients have comparable outcomes but different functional health status. *Surgical Endoscopy* 2002;16(6):921-926.

**Curet 2002** {published and unpublished data }

Curet MJ, Contreras M, Weber DM, Albrecht R. Laparoscopic cholecystectomy - Outpatient vs inpatient management. *Surgical Endoscopy* 2002;16(3):453-457.

**Parvaiz 2006** {published data only }

Parvaiz MA, Hafeez R. Randomized clinical trial of day-care versus overnight-stay laparoscopic cholecystectomy (Br J Surg 2006; 93: 40-45). *Br J Surg* 2006;93(5):639-40.

**Rosen 2001** {published data only }

Rosen MJ, Malm JA, Tarnoff M, Zuccala K, Ponsky JL. Cost-effectiveness of ambulatory laparoscopic cholecystectomy. *Surgical Laparoscopy, Endoscopy and Percutaneous Techniques* 2001;11(3):182-184.

**Selas 2004** {published data only }

Selas PR, Santiuste AC. Laparoscopic cholecystectomy and outpatient surgery. *Revista Espanola De Enfermedades Digestivas* 2004;96(7):435-438.

**Sharma 2004** {published data only }

Sharma A, Hayden JD, Reese RA, Sedman PC, Royston CMS, O BCJ. Prospective comparison of ambulatory with inpatient laparoscopic cholecystectomy: Outcome, patient preference and satisfaction. *Ambulatory Surgery* 2004;11(1-2):23-26.

\* indicates the primary reference for the study

## Other references

### Additional references

**Argiriadou 2002**

Argiriadou H, Papaziogas B, Pavlidis T, Parlapani A, Georgiou M, Papagiannopoulou P, et al. Tropisetron vs ondansetron for prevention of postoperative nausea and vomiting after laparoscopic cholecystectomy: a randomized double-blind, placebo-controlled study. *Surgical Endoscopy* 2002;16(7):1087-90.

**ASA 2007**

American Association of Anesthesiologists. ASA Physical Status Classification System. [www.asahq.org/clinical/physicalstatus.htm](http://www.asahq.org/clinical/physicalstatus.htm) (accessed 9 January 2007).

**Bakken 2004**

Bakken IJ, Skjeldestad FE, Mjåland O, Johnson E. Kolecystektomi i Norge i 1990-2002 [Cholecystectomy in Norway 1990-2002]. Tidsskrift for den Norske Laegeforening 2004;124(18):2376-8.

#### **DeMets 1987**

DeMets DL. Methods for combining randomized clinical trials: strengths and limitations. *Statistics in Medicine* 1987;6(3):341-50.

#### **DerSimonian 1986**

DerSimonian R, Laird N. Meta-analysis in clinical trials. *Controlled Clinical Trials* 1986;7(3):177-88.

#### **Egger 1997**

Egger M, Davey SG, Schneider M, Minder C. Bias in meta-analysis detected by a simple, graphical test. *BMJ (Clinical Research Ed.)* 1997;315(7109):629-34.

#### **Fullarton 1994**

Fullarton GM, Bell G. Prospective audit of the introduction of laparoscopic cholecystectomy in the west of Scotland. West of Scotland Laparoscopic Cholecystectomy Audit Group. *Gut* 1994;35(8):1121-6.

#### **Gluud 2006**

Gluud C, Als-Nielsen B, D'Amico G, Fingerhut A, Gluud LL, Khan S, et al. Hepato-Biliary Group. About The Cochrane Collaboration (Cochrane Review Groups (CRGs)) 2006, Issue 4. Art. No.: LIVER.

#### **Gurusamy 2006**

Gurusamy KS, Samraj K. Early versus delayed laparoscopic cholecystectomy for acute cholecystitis. *Cochrane Database of Systematic Reviews* 2006, Issue 4. Art. No.: CD005440. DOI: 10.1002/14651858.CD005440.

#### **Haldestam 2004**

Haldestam I, Enell EL, Kullman E, Borch K. Development of symptoms and complications in individuals with asymptomatic gallstones. *British Journal of Surgery* 2004;91(6):734-8.

#### **HES 2006**

Hospital Episode Statistics. Main operations. 3 character: 2005-06. <http://www.hesonline.nhs.uk/Ease/servlet/ContentServer?siteID=1937&categoryID=215> (accessed 16 February 2007).

#### **Higgins 2002**

Higgins JPT, Thompson SG. Quantifying heterogeneity in a meta-analysis. *Statistics in Medicine* 2002;21(11):1539-58.

#### **Higgins 2006**

Higgins JPT, Green S, editors. *Cochrane Handbook for Systematic Reviews of Intervention* 4.2.6 [updated September 2006]. In: *The Cochrane Library*, Issue 4, 2006. Chichester, UK: John Wiley & Sons, Ltd, 2006.

#### **Jørgensen 1987**

Jørgensen T. Prevalence of gallstones in a Danish population. *American Journal of Epidemiology* 1987;126(5):912-21.

#### **Keus 2006**

Keus F, de Jong JAF, Gooszen HG, van Laarhoven CJHM. Laparoscopic versus open cholecystectomy for patients with symptomatic cholelithiasis. *Cochrane Database of Systematic Reviews* 2006, Issue 4. Art. No.: CD006231. DOI: 10.1002/14651858.CD006231.

#### **Kjaergard 2001**

Kjaergard LL, Villumsen J, Gluud C. Reported methodologic quality and discrepancies between large and small randomized trials in meta-analyses. *Annals of Internal Medicine* 2001;135(11):982-9.

#### **Lepner 2003**

Lepner U, Goroshina J, Samarutel J. Postoperative pain relief after laparoscopic cholecystectomy: a randomised prospective double-blind clinical trial. *Scandinavian Journal of Surgery* 2003;92(2):121-4.

**Livingston 2004**

Livingston EH, Rege RV. A nationwide study of conversion from laparoscopic to open cholecystectomy. *American Journal of Surgery* 2004;188(3):205-11.

**Macaskill 2001**

Macaskill P, Walter SD, Irwig L. A comparison of methods to detect publication bias in meta-analysis. *Statistics in Medicine* 2001;20(4):641-54.

**Mjäländ 1998**

Mjäländ O, Adamsen S, Hjelmquist B, Ovaska J, Buanes T. Cholecystectomy rates, gallstone prevalence, and handling of bile duct injuries in Scandinavia. A comparative audit. *Surgical Endoscopy* 1998;12(12):1386-9.

**Moher 1998**

Moher D, Pham B, Jones A, Cook DJ, Jadad AR, Moher M, et al. Does quality of reports of randomised trials affect estimates of intervention efficacy reported in meta-analyses? *Lancet* 1998;352(9128):609-13.

**Muhrbeck 1995**

Muhrbeck O, Ahlberg J. Prevalence of gallstone disease in a Swedish population. *Scandinavian Journal of Gastroenterology* 1995;30(11):1125-8.

**NIH 1992**

NIH consensus statement on gallstones and laparoscopic cholecystectomy. National Institutes of Health Consensus Development Conference Statement September 14-16, 1992. <http://consensus.nih.gov/1992/1992GallstonesLaparoscopy090html.htm> (accessed 21 September 2006).

**Pandey 2006**

Pandey CK, Priye S, Ambesh SP, Singh S, Singh U, Singh PK. Prophylactic gabapentin for prevention of postoperative nausea and vomiting in patients undergoing laparoscopic cholecystectomy: A randomized, double-blind, placebo-controlled study. *Journal of Postgraduate Medicine* 2006;52(2):97-100.

**RevMan 2003**

Review Manager (RevMan) [Computer program]. RevMan, Version 4.2 for Windows. Copenhagen: The Nordic Cochrane Centre, The Cochrane Collaboration, 2003.

**Royle 2003**

Royle P, Milne R. Literature searching for randomized controlled trials used in Cochrane reviews: rapid versus exhaustive searches. *International Journal of Technology Assessment in Health Care* 2003;19(4):591-603.

**Schulz 1995**

Schulz KF, Chalmers I, Hayes RJ, Altman DG. Empirical evidence of bias. Dimensions of methodological quality associated with estimates of treatment effects in controlled trials. *JAMA* 1995;273(5):408-12.

**Senapati 2003**

Senapati PS, Bhattacharya D, Harinath G, Ammori BJ. A survey of the timing and approach to the surgical management of cholelithiasis in patients with acute biliary pancreatitis and acute cholecystitis in the UK. *Annals of Royal College of Surgeons of England* 2003;85(5):306-12.

**Shamiyeh 2004**

Shamiyeh A, Wayand W. Laparoscopic cholecystectomy: early and late complications and their treatment. *Langenbecks Archives of Surgery* 2004;389(3):164-71.

**Sweeting 2004**

Sweeting MJ, Sutton AJ, Lambert PC. What to add to nothing? Use and avoidance of continuity corrections in meta-analysis of sparse data. *Statistics in Medicine* 2004;23(9):1351-75.

**Tsimoyiannis 1998**

Tsimoyiannis EC, Glantzounis G, Lekkas ET, Siakas P, Jabarin M, Tzourou H. Intraperitoneal normal saline and bupivacaine infusion for reduction of postoperative pain after laparoscopic cholecystectomy. *Surgical Laparoscopy & Endoscopy* 1998;8(6):416-20.

### Waage 2006

Waage A, Nilsson M. Iatrogenic bile duct injury: a population-based study of 152 776 cholecystectomies in the Swedish Inpatient Registry. *Archives of Surgery* 2006;141(12):1207-13.

## Comparisons and data

### 01 Day-case versus overnight stay

#### 01.01 Surgery related morbidity

##### 01.01.01 Re-operation

Study ID	Day-case n	Day-case N	Overnight stay n	Overnight stay N
Dirksen 2001	1	42	2	44

##### 01.01.02 Bile duct injury

Study ID	Day-case n	Day-case N	Overnight stay n	Overnight stay N
Johansson 2006	1	52	0	48

##### 01.01.03 Wound infection

Study ID	Day-case n	Day-case N	Overnight stay n	Overnight stay N
Dirksen 2001	1	42	0	44
Hollington 1999	1	60	0	71
Keulemans 1998	1	37	0	37

##### 01.01.04 Intra-abdominal collection

Study ID	Day-case n	Day-case N	Overnight stay n	Overnight stay N
Hollington 1999	1	60	0	71

##### 01.01.05 Hematoma

Study ID	Day-case n	Day-case N	Overnight stay n	Overnight stay N
Johansson 2006	1	52	0	48
Keulemans 1998	0	37	1	37

##### 01.01.06 Post-operative pancreatitis

Study ID	Day-case n	Day-case N	Overnight stay n	Overnight stay N
Dirksen 2001	0	42	1	44

##### 01.01.07 Retained common bile duct stone

Study ID	Day-case n	Day-case N	Overnight stay n	Overnight stay N
Dirksen 2001	0	42	1	44

#### 01.02 Surgery related morbidity diagnosed after discharge

##### 01.02.01 Wound infection

Study ID	Day-case n	Day-case N	Overnight stay n	Overnight stay N
Dirksen 2001	1	42	0	44
Hollington 1999	1	60	0	71
Keulemans 1998	1	37	0	37

##### 01.02.02 Intra-abdominal collection

Study ID	Day-case n	Day-case N	Overnight stay n	Overnight stay N
Hollington 1999	1	60	0	71

##### 01.02.03 Hematoma

Study ID	Day-case n	Day-case N	Overnight stay n	Overnight stay N
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Study ID	Day-case n	Day-case N	Overnight stay n	Overnight stay N
Keulemans 1998	0	37	1	37

## 01.02.04 Post-operative pancreatitis

Study ID	Day-case n	Day-case N	Overnight stay n	Overnight stay N
Dirksen 2001	0	42	1	44

## 01.02.05 Retained common bile duct stone

Study ID	Day-case n	Day-case N	Overnight stay n	Overnight stay N
Dirksen 2001	0	42	1	44

## 01.03 Prolonged hospitalisation

Study ID	Day-case n	Day-case N	Overnight stay n	Overnight stay N
Dirksen 2001	11	42	24	44
Hollington 1999	21	70	13	71
Johansson 2006	4	52	6	48
Keulemans 1998	3	37	0	37
Young 2001	3	14	0	14

## 01.04 Re-admission

Study ID	Day-case n	Day-case N	Overnight stay n	Overnight stay N
Dirksen 2001	2	42	2	44
Hollington 1999	2	60	3	71
Johansson 2006	0	52	0	48
Keulemans 1998	0	37	0	37
Young 2001	0	14	0	14

## 01.05 Reviewed by doctor but not admitted

Study ID	Day-case n	Day-case N	Overnight stay n	Overnight stay N
Hollington 1999	1	60	0	71
Keulemans 1998	0	37	0	37
Young 2001	3	14	2	14

## 01.06 Pain scores

## 01.06.01 On the day of surgery (4 to 8 hours after surgery)

Study ID	Day-case n	Day-case Mean	Day-case SD	Overnight stay N	Overnight stay Mean	Overnight stay SD
Keulemans 1998	37	2.80	2.58	37	3.80	2.58
Young 2001	14	6.50	1.90	14	5.60	3.30

## 01.06.02 First post-operative day

Study ID	Day-case n	Day-case Mean	Day-case SD	Overnight stay N	Overnight stay Mean	Overnight stay SD
Keulemans 1998	37	2.30	2.17	37	2.70	2.17
Young 2001	14	4.60	2.20	14	5.10	2.60

## 01.07 Number requiring opiate analgesia

Study ID	Day-case n	Day-case N	Overnight stay n	Overnight stay N
Hollington 1999	5	60	15	71

## 01.08 Nausea

## 01.08.01 On the day of surgery (4 to 8 hours after surgery)

Study ID	Day-case n	Day-case N	Overnight stay n	Overnight stay N

Study ID	Day-case N	Day-case Mean	Day-case SD	Overnight stay N	Overnight stay Mean	Overnight stay SD
Young 2001	14	3.50	2.80	14	3.80	3.20

## 01.08.02 First post-operative day

Study ID	Day-case N	Day-case Mean	Day-case SD	Overnight stay N	Overnight stay Mean	Overnight stay SD
Young 2001	14	1.50	0.80	14	1.60	1.30

## 01.09 Patient anxiety

## 01.09.01 One day after surgery

Study ID	Day-case N	Day-case Mean	Day-case SD	Overnight stay N	Overnight stay Mean	Overnight stay SD
Johansson 2006	52	24.30	3.70	48	21.50	5.10

## 01.09.02 One week after surgery

Study ID	Day-case N	Day-case Mean	Day-case SD	Overnight stay N	Overnight stay Mean	Overnight stay SD
Johansson 2006	52	24.80	3.90	48	23.90	5.90
Keulemans 1998	37	6.10	3.04	37	6.20	3.04

## 01.10 Patient quality of life

## 01.10.01 One day after surgery

Study ID	Day-case N	Day-case Mean	Day-case SD	Overnight stay N	Overnight stay Mean	Overnight stay SD
Johansson 2006	52	91.80	14.40	48	96.20	17.70

## 01.10.02 One week after surgery

Study ID	Day-case N	Day-case Mean	Day-case SD	Overnight stay N	Overnight stay Mean	Overnight stay SD
Dirksen 2001	42	65.60	25.10	44	59.20	27.10
Johansson 2006	52	98.20	15.90	48	102.60	18.10
Keulemans 1998	37	6.30	3.04	37	5.70	2.43

## 01.11 Patient satisfaction

Study ID	Day-case N	Day-case Mean	Day-case SD	Overnight stay N	Overnight stay Mean	Overnight stay SD
Dirksen 2001	42	8.30	1.40	44	8.20	1.30

## 01.12 Recommendation to others

Study ID	Day-case n	Day-case N	Overnight stay n	Overnight stay N
Dirksen 2001	18	26	16	27
Keulemans 1998	34	37	34	37

## 01.13 Return to normal activity (days)

Study ID	Day-case N	Day-case Mean	Day-case SD	Overnight stay N	Overnight stay Mean	Overnight stay SD
Hollington 1999	60	1.80	0.80	71	1.90	0.80

## 01.14 Return to work (days)

Study ID	Day-case N	Day-case Mean	Day-case SD	Overnight stay N	Overnight stay Mean	Overnight stay SD
Keulemans 1998	37	14.00	18.20	37	16.00	18.20

## 02 Day-case versus overnight stay (High methodological quality)

## 02.01 Surgery related morbidity

## 02.01.01 Re-operation

Study ID	Day-case n	Day-case N	Overnight stay n	Overnight stay N

Dirksen 2001	1	42	2	44
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## 02.01.02 Bile duct injury

Study ID	Day-case n	Day-case N	Overnight stay n	Overnight stay N
Johansson 2006	1	52	0	48

## 02.01.03 Wound infection

Study ID	Day-case n	Day-case N	Overnight stay n	Overnight stay N
Dirksen 2001	1	42	0	44
Keulemans 1998	1	37	0	37

## 02.01.04 Hematoma

Study ID	Day-case n	Day-case N	Overnight stay n	Overnight stay N
Johansson 2006	1	52	0	48
Keulemans 1998	0	37	1	37

## 02.01.05 Post-operative pancreatitis

Study ID	Day-case n	Day-case N	Overnight stay n	Overnight stay N
Dirksen 2001	0	42	1	44

## 02.01.06 Retained common bile duct stone

Study ID	Day-case n	Day-case N	Overnight stay n	Overnight stay N
Dirksen 2001	0	42	1	44

## 02.02 Surgery related morbidity diagnosed after discharge

## 02.02.01 Wound infection

Study ID	Day-case n	Day-case N	Overnight stay n	Overnight stay N
Dirksen 2001	1	42	0	44
Keulemans 1998	1	37	0	37

## 02.02.02 Hematoma

Study ID	Day-case n	Day-case N	Overnight stay n	Overnight stay N
Keulemans 1998	0	37	1	37

## 02.02.03 Post-operative pancreatitis

Study ID	Day-case n	Day-case N	Overnight stay n	Overnight stay N
Dirksen 2001	0	42	1	44

## 02.02.04 Retained common bile duct stone

Study ID	Day-case n	Day-case N	Overnight stay n	Overnight stay N
Dirksen 2001	0	42	1	44

## 02.03 Prolonged hospitalisation

Study ID	Day-case n	Day-case N	Overnight stay n	Overnight stay N
Dirksen 2001	11	42	24	44
Johansson 2006	4	52	6	48
Keulemans 1998	3	37	0	37
Young 2001	3	14	0	14

## 02.04 Re-admission

Study ID	Day-case n	Day-case N	Overnight stay n	Overnight stay N
Dirksen 2001	2	42	2	44
Johansson 2006	0	52	0	48

Keulemans 1998	0	37	0	37
Young 2001	0	14	0	14

**02.05 Reviewed by doctor but not admitted**

Study ID	Day-case n	Day-case N	Overnight stay n	Overnight stay N
Keulemans 1998	0	37	0	37
Young 2001	3	14	2	14

**02.06 Pain scores**

## 02.06.01 On the day of surgery (4 to 8 hours after surgery)

Study ID	Day-case N	Day-case Mean	Day-case SD	Overnight stay N	Overnight stay Mean	Overnight stay SD
Keulemans 1998	37	2.80	2.58	37	3.80	2.58
Young 2001	14	6.50	1.90	14	5.60	3.30

## 02.06.02 First post-operative day

Study ID	Day-case N	Day-case Mean	Day-case SD	Overnight stay N	Overnight stay Mean	Overnight stay SD
Keulemans 1998	37	2.30	2.17	37	2.70	2.17
Young 2001	14	4.60	2.20	14	5.10	2.60

**02.07 Nausea**

## 02.07.01 On the day of surgery (4 to 8 hours after surgery)

Study ID	Day-case N	Day-case Mean	Day-case SD	Overnight stay N	Overnight stay Mean	Overnight stay SD
Young 2001	14	3.50	2.80	14	3.80	3.20

## 02.07.02 First post-operative day

Study ID	Day-case N	Day-case Mean	Day-case SD	Overnight stay N	Overnight stay Mean	Overnight stay SD
Young 2001	14	1.50	0.80	14	1.60	1.30

**02.08 Patient anxiety**

## 02.08.01 One day after surgery

Study ID	Day-case N	Day-case Mean	Day-case SD	Overnight stay N	Overnight stay Mean	Overnight stay SD
Johansson 2006	52	24.30	3.70	48	21.50	5.10

## 02.08.02 One week after surgery

Study ID	Day-case N	Day-case Mean	Day-case SD	Overnight stay N	Overnight stay Mean	Overnight stay SD
Johansson 2006	52	24.80	3.90	48	23.90	5.90
Keulemans 1998	37	6.10	3.04	37	6.20	3.04

**02.09 Patient quality of life**

## 02.09.01 One day after surgery

Study ID	Day-case N	Day-case Mean	Day-case SD	Overnight stay N	Overnight stay Mean	Overnight stay SD
Johansson 2006	52	91.80	14.40	48	96.20	17.70

## 02.09.02 One week after surgery

Study ID	Day-case N	Day-case Mean	Day-case SD	Overnight stay N	Overnight stay Mean	Overnight stay SD
Dirksen 2001	42	65.60	25.10	44	59.20	27.10
Johansson 2006	52	98.20	15.90	48	102.60	18.10
Keulemans 1998	37	6.30	3.04	37	5.70	2.43

**02.10 Patient satisfaction**

Study ID	Day-case N	Day-case Mean	Day-case SD	Overnight stay N	Overnight stay Mean	Overnight stay SD
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Dirksen 2001	42	8.30	1.40	44	8.20	1.30
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### 02.11 Recommendation to others

Study ID	Day-case n	Day-case N	Overnight stay n	Overnight stay N
Dirksen 2001	18	26	16	27
Keulemans 1998	34	37	34	37

### 02.12 Return to work (days)

Study ID	Day-case N	Day-case Mean	Day-case SD	Overnight stay N	Overnight stay Mean	Overnight stay SD
Keulemans 1998	37	14.00	18.20	37	16.00	18.20

## 03 Day-case versus overnight stay (Risk difference)

### 03.01 Surgery related morbidity

#### 03.01.01 Re-operation

Study ID	Day-case n	Day-case N	Overnight stay n	Overnight stay N
Dirksen 2001	1	42	2	44

#### 03.01.02 Bile duct injury

Study ID	Day-case n	Day-case N	Overnight stay n	Overnight stay N
Johansson 2006	1	52	0	48

#### 03.01.03 Wound infection

Study ID	Day-case n	Day-case N	Overnight stay n	Overnight stay N
Dirksen 2001	1	42	0	44
Hollington 1999	1	60	0	71
Keulemans 1998	1	37	0	37

#### 03.01.04 Intra-abdominal collection

Study ID	Day-case n	Day-case N	Overnight stay n	Overnight stay N
Hollington 1999	1	60	0	71

#### 03.01.05 Hematoma

Study ID	Day-case n	Day-case N	Overnight stay n	Overnight stay N
Johansson 2006	1	52	0	48
Keulemans 1998	0	37	1	37

#### 03.01.06 Post-operative pancreatitis

Study ID	Day-case n	Day-case N	Overnight stay n	Overnight stay N
Dirksen 2001	0	42	1	44

#### 03.01.07 Retained common bile duct stone

Study ID	Day-case n	Day-case N	Overnight stay n	Overnight stay N
Dirksen 2001	0	42	1	44

### 03.02 Surgery related morbidity diagnosed after discharge

#### 03.02.01 Wound infection

Study ID	Day-case n	Day-case N	Overnight stay n	Overnight stay N
Dirksen 2001	1	42	0	44
Hollington 1999	1	60	0	71
Keulemans 1998	1	37	0	37

#### 03.02.02 Intra-abdominal collection

Study ID	Day-case n	Day-case N	Overnight stay n	Overnight stay N
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Study ID	Day-case n	Day-case N	Overnight stay n	Overnight stay N
Hollington 1999	1	60	0	71

## 03.02.03 Hematoma

Study ID	Day-case n	Day-case N	Overnight stay n	Overnight stay N
Keulemans 1998	0	37	1	37

## 03.02.04 Post-operative pancreatitis

Study ID	Day-case n	Day-case N	Overnight stay n	Overnight stay N
Dirksen 2001	0	42	1	44

## 03.02.05 Retained common bile duct stone

Study ID	Day-case n	Day-case N	Overnight stay n	Overnight stay N
Dirksen 2001	0	42	1	44

## 03.03 Prolonged hospitalisation

Study ID	Day-case n	Day-case N	Overnight stay n	Overnight stay N
Dirksen 2001	11	42	24	44
Hollington 1999	21	70	13	71
Johansson 2006	4	52	6	48
Keulemans 1998	3	37	0	37
Young 2001	3	14	0	14

## 03.04 Re-admission

Study ID	Day-case n	Day-case N	Overnight stay n	Overnight stay N
Dirksen 2001	2	42	2	44
Hollington 1999	2	60	3	71
Johansson 2006	0	52	0	48
Keulemans 1998	0	37	0	37
Young 2001	0	14	0	14

## 03.05 Reviewed by doctor but not admitted

Study ID	Day-case n	Day-case N	Overnight stay n	Overnight stay N
Hollington 1999	1	60	0	71
Keulemans 1998	0	37	0	37
Young 2001	3	14	2	14

## 03.06 Number requiring opiate analgesia

Study ID	Day-case n	Day-case N	Overnight stay n	Overnight stay N
Hollington 1999	5	60	15	71

## 03.07 Recommendation to others

Study ID	Day-case n	Day-case N	Overnight stay n	Overnight stay N
Dirksen 2001	18	26	16	27
Keulemans 1998	34	37	34	37

## 04 Day-case versus overnight stay (fixed-effect)

## 04.01 Surgery related morbidity

## 04.01.01 Re-operation

Study ID	Day-case n	Day-case N	Overnight stay n	Overnight stay N

Study ID	Day-case n	Day-case N	Overnight stay n	Overnight stay N
Dirksen 2001	1	42	2	44

## 04.01.02 Bile duct injury

Study ID	Day-case n	Day-case N	Overnight stay n	Overnight stay N
Johansson 2006	1	52	0	48

## 04.01.03 Wound infection

Study ID	Day-case n	Day-case N	Overnight stay n	Overnight stay N
Dirksen 2001	1	42	0	44
Hollington 1999	1	60	0	71
Keulemans 1998	1	37	0	37

## 04.01.04 Intra-abdominal collection

Study ID	Day-case n	Day-case N	Overnight stay n	Overnight stay N
Hollington 1999	1	60	0	71

## 04.01.05 Hematoma

Study ID	Day-case n	Day-case N	Overnight stay n	Overnight stay N
Johansson 2006	1	52	0	48
Keulemans 1998	0	37	1	37

## 04.01.06 Chest infection

## 04.01.07 Post-operative pancreatitis

Study ID	Day-case n	Day-case N	Overnight stay n	Overnight stay N
Dirksen 2001	0	42	1	44

## 04.01.08 Retained common bile duct stone

Study ID	Day-case n	Day-case N	Overnight stay n	Overnight stay N
Dirksen 2001	0	42	1	44

**04.02 Surgery related morbidity diagnosed after discharge**

## 04.02.01 Wound infection

Study ID	Day-case n	Day-case N	Overnight stay n	Overnight stay N
Dirksen 2001	1	42	0	44
Hollington 1999	1	60	0	71
Keulemans 1998	1	37	0	37

## 04.02.02 Intra-abdominal collection

Study ID	Day-case n	Day-case N	Overnight stay n	Overnight stay N
Hollington 1999	1	60	0	71

## 04.02.03 Hematoma

Study ID	Day-case n	Day-case N	Overnight stay n	Overnight stay N
Keulemans 1998	0	37	1	37

## 04.02.04 Chest infection

## 04.02.05 Post-operative pancreatitis

Study ID	Day-case n	Day-case N	Overnight stay n	Overnight stay N
Dirksen 2001	0	42	1	44

## 04.02.06 Retained common bile duct stone

Study ID	Day-case n	Day-case N	Overnight stay n	Overnight stay N
Dirksen 2001	0	42	1	44

**04.03 Prolonged hospitalisation**

Study ID	Day-case n	Day-case N	Overnight stay n	Overnight stay N
Dirksen 2001	11	42	24	44
Hollington 1999	21	70	13	71
Johansson 2006	4	52	6	48
Keulemans 1998	3	37	0	37
Young 2001	3	14	0	14

**04.04 Re-admission**

Study ID	Day-case n	Day-case N	Overnight stay n	Overnight stay N
Dirksen 2001	2	42	2	44
Hollington 1999	2	60	3	71
Johansson 2006	0	52	0	48
Keulemans 1998	0	37	0	37
Young 2001	0	14	0	14

**04.05 Reviewed by doctor but not admitted**

Study ID	Day-case n	Day-case N	Overnight stay n	Overnight stay N
Hollington 1999	1	60	0	71
Keulemans 1998	0	37	0	37
Young 2001	3	14	2	14

**04.06 Pain scores**

## 04.06.01 On the day of surgery (4 to 8 hours after surgery)

Study ID	Day-case n	Day-case Mean	Day-case SD	Overnight stay N	Overnight stay Mean	Overnight stay SD
Keulemans 1998	37	2.80	2.58	37	3.80	2.58
Young 2001	14	6.50	1.90	14	5.60	3.30

## 04.06.02 First post-operative day

Study ID	Day-case n	Day-case Mean	Day-case SD	Overnight stay N	Overnight stay Mean	Overnight stay SD
Keulemans 1998	37	2.30	2.17	37	2.70	2.17
Young 2001	14	4.60	2.20	14	5.10	2.60

**04.07 Number requiring opiate analgesia**

Study ID	Day-case n	Day-case N	Overnight stay n	Overnight stay N
Hollington 1999	5	60	15	71

**04.08 Nausea and vomiting**

## 04.08.01 On the day of surgery (4 to 8 hours after surgery)

Study ID	Day-case N	Day-case Mean	Day-case SD	Overnight stay N	Overnight stay Mean	Overnight stay SD
Young 2001	14	3.50	2.80	14	3.80	3.20

## 04.08.02 First post-operative day

Study ID	Day-case N	Day-case Mean	Day-case SD	Overnight stay N	Overnight stay Mean	Overnight stay SD
Young 2001	14	1.50	0.80	14	1.60	1.30

**04.09 Patient anxiety**

## 04.09.01 One day after surgery

Study ID	Day-case N	Day-case Mean	Day-case SD	Overnight stay N	Overnight stay Mean	Overnight stay SD
Johansson 2006	52	24.30	3.70	48	21.50	5.10

## 04.09.02 One week after surgery

Study ID	Day-case N	Day-case Mean	Day-case SD	Overnight stay N	Overnight stay Mean	Overnight stay SD
Johansson 2006	52	24.80	3.90	48	23.90	5.90
Keulemans 1998	37	6.10	3.04	37	6.20	3.04

**04.10 Patient quality of life**

## 04.10.01 One day after surgery

Study ID	Day-case N	Day-case Mean	Day-case SD	Overnight stay N	Overnight stay Mean	Overnight stay SD
Johansson 2006	52	91.80	14.40	48	96.20	17.70

## 04.10.02 One week after surgery

Study ID	Day-case N	Day-case Mean	Day-case SD	Overnight stay N	Overnight stay Mean	Overnight stay SD
Dirksen 2001	42	65.60	25.10	44	59.20	27.10
Johansson 2006	52	98.20	15.90	48	102.60	18.10
Keulemans 1998	37	6.30	3.04	37	5.70	2.43

**04.11 Patient satisfaction**

Study ID	Day-case N	Day-case Mean	Day-case SD	Overnight stay N	Overnight stay Mean	Overnight stay SD
Dirksen 2001	42	8.30	1.40	44	8.20	1.30

**04.12 Recommendation to others**

Study ID	Day-case n	Day-case N	Overnight stay n	Overnight stay N
Dirksen 2001	18	26	16	27
Keulemans 1998	34	37	34	37

**04.13 Return to normal activity (days)**

Study ID	Day-case N	Day-case Mean	Day-case SD	Overnight stay N	Overnight stay Mean	Overnight stay SD
Hollington 1999	60	1.80	0.80	71	1.90	0.80

**04.14 Return to work (days)**

Study ID	Day-case N	Day-case Mean	Day-case SD	Overnight stay N	Overnight stay Mean	Overnight stay SD
Keulemans 1998	37	14.00	18.20	37	16.00	18.20

**05 Day-case versus overnight stay (random effect)****05.01 Surgery related morbidity**

## 05.01.01 Re-operation

Study ID	Day-case n	Day-case N	Overnight stay n	Overnight stay N
Dirksen 2001	1	42	2	44

## 05.01.02 Bile duct injury

Study ID	Day-case n	Day-case N	Overnight stay n	Overnight stay N
Johansson 2006	1	52	0	48

## 05.01.03 Wound infection

Study ID	Day-case n	Day-case N	Overnight stay n	Overnight stay N
Dirksen 2001	1	42	0	44
Hollington 1999	1	60	0	71
Keulemans 1998	1	37	0	37

## 05.01.04 Intra-abdominal collection

Study ID	Day-case n	Day-case N	Overnight stay n	Overnight stay N

Study ID	Day-case n	Day-case N	Overnight stay n	Overnight stay N
Hollington 1999	1	60	0	71

## 05.01.05 Hematoma

Study ID	Day-case n	Day-case N	Overnight stay n	Overnight stay N
Johansson 2006	1	52	0	48
Keulemans 1998	0	37	1	37

## 05.01.06 Chest infection

## 05.01.07 Post-operative pancreatitis

Study ID	Day-case n	Day-case N	Overnight stay n	Overnight stay N
Dirksen 2001	0	42	1	44

## 05.01.08 Retained common bile duct stone

Study ID	Day-case n	Day-case N	Overnight stay n	Overnight stay N
Dirksen 2001	0	42	1	44

**05.02 Surgery related morbidity diagnosed after discharge**

## 05.02.01 Wound infection

Study ID	Day-case n	Day-case N	Overnight stay n	Overnight stay N
Dirksen 2001	1	42	0	44
Hollington 1999	1	60	0	71
Keulemans 1998	1	37	0	37

## 05.02.02 Intra-abdominal collection

Study ID	Day-case n	Day-case N	Overnight stay n	Overnight stay N
Hollington 1999	1	60	0	71

## 05.02.03 Hematoma

Study ID	Day-case n	Day-case N	Overnight stay n	Overnight stay N
Keulemans 1998	0	37	1	37

## 05.02.04 Chest infection

## 05.02.05 Post-operative pancreatitis

Study ID	Day-case n	Day-case N	Overnight stay n	Overnight stay N
Dirksen 2001	0	42	1	44

## 05.02.06 Retained common bile duct stone

Study ID	Day-case n	Day-case N	Overnight stay n	Overnight stay N
Dirksen 2001	0	42	1	44

**05.03 Prolonged hospitalisation**

Study ID	Day-case n	Day-case N	Overnight stay n	Overnight stay N
Dirksen 2001	11	42	24	44
Hollington 1999	21	70	13	71
Johansson 2006	4	52	6	48
Keulemans 1998	3	37	0	37
Young 2001	3	14	0	14

**05.04 Re-admission**

Study ID	Day-case n	Day-case N	Overnight stay n	Overnight stay N
Dirksen 2001	2	42	2	44
Hollington 1999	2	60	3	71

Johansson 2006	0	52	0	48
Keulemans 1998	0	37	0	37
Young 2001	0	14	0	14

**05.05 Reviewed by doctor but not admitted**

Study ID	Day-case n	Day-case N	Overnight stay n	Overnight stay N
Hollington 1999	1	60	0	71
Keulemans 1998	0	37	0	37
Young 2001	3	14	2	14

**05.06 Pain scores**

## 05.06.01 On the day of surgery (4 to 8 hours after surgery)

Study ID	Day-case N	Day-case Mean	Day-case SD	Overnight stay N	Overnight stay Mean	Overnight stay SD
Keulemans 1998	37	2.80	2.58	37	3.80	2.58
Young 2001	14	6.50	1.90	14	5.60	3.30

## 05.06.02 First post-operative day

Study ID	Day-case N	Day-case Mean	Day-case SD	Overnight stay N	Overnight stay Mean	Overnight stay SD
Keulemans 1998	37	2.30	2.17	37	2.70	2.17
Young 2001	14	4.60	2.20	14	5.10	2.60

**05.07 Number requiring opiate analgesia**

Study ID	Day-case n	Day-case N	Overnight stay n	Overnight stay N
Hollington 1999	5	60	15	71

**05.08 Nausea and vomiting**

## 05.08.01 On the day of surgery (4 to 8 hours after surgery)

Study ID	Day-case N	Day-case Mean	Day-case SD	Overnight stay N	Overnight stay Mean	Overnight stay SD
Young 2001	14	3.50	2.80	14	3.80	3.20

## 05.08.02 First post-operative day

Study ID	Day-case N	Day-case Mean	Day-case SD	Overnight stay N	Overnight stay Mean	Overnight stay SD
Young 2001	14	1.50	0.80	14	1.60	1.30

**05.09 Patient anxiety**

## 05.09.01 One day after surgery

Study ID	Day-case N	Day-case Mean	Day-case SD	Overnight stay N	Overnight stay Mean	Overnight stay SD
Johansson 2006	52	24.30	3.70	48	21.50	5.10

## 05.09.02 One week after surgery

Study ID	Day-case N	Day-case Mean	Day-case SD	Overnight stay N	Overnight stay Mean	Overnight stay SD
Johansson 2006	52	24.80	3.90	48	23.90	5.90
Keulemans 1998	37	6.10	3.04	37	6.20	3.04

**05.10 Patient quality of life**

## 05.10.01 One day after surgery

Study ID	Day-case N	Day-case Mean	Day-case SD	Overnight stay N	Overnight stay Mean	Overnight stay SD
Johansson 2006	52	91.80	14.40	48	96.20	17.70

## 05.10.02 One week after surgery

Study ID	Day-case N	Day-case Mean	Day-case SD	Overnight stay N	Overnight stay Mean	Overnight stay SD
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Dirksen 2001	42	65.60	25.10	44	59.20	27.10
Johansson 2006	52	98.20	15.90	48	102.60	18.10
Keulemans 1998	37	6.30	3.04	37	5.70	2.43

### 05.11 Patient satisfaction

Study ID	Day-case N	Day-case Mean	Day-case SD	Overnight stay N	Overnight stay Mean	Overnight stay SD
Dirksen 2001	42	8.30	1.40	44	8.20	1.30

### 05.12 Recommendation to others

Study ID	Day-case n	Day-case N	Overnight stay n	Overnight stay N
Dirksen 2001	18	26	16	27
Keulemans 1998	34	37	34	37

### 05.13 Return to normal activity (days)

Study ID	Day-case N	Day-case Mean	Day-case SD	Overnight stay N	Overnight stay Mean	Overnight stay SD
Hollington 1999	60	1.80	0.80	71	1.90	0.80

### 05.14 Return to work (days)

Study ID	Day-case N	Day-case Mean	Day-case SD	Overnight stay N	Overnight stay Mean	Overnight stay SD
Keulemans 1998	37	14.00	18.20	37	16.00	18.20

## Additional tables

### 01 Search Strategy

Database	Period of Search	Search Strategy
The Cochrane Hepato-Biliary Group Controlled Trials Register	Issue 1, 2007.	("day case" OR day-case OR "day surgery" or day-surgery OR "day care" OR day-care OR "day stay" OR day-stay OR ambulatory OR outpatient OR out-patient OR (partial and (hospitalization or hospitalizations or hospitalisation or hospitalizations)) AND (((laparoscop* OR celioscop* OR coelioscop* OR abdominoscop* OR peritoneoscop*) AND (cholecystecto* OR colecystecto*))
Cochrane Central Register of Controlled Trials (CENTRAL) in The Cochrane Library	Issue 1, 2007.	#1 "day case" OR day-case OR "day surgery" or day-surgery OR "day care" OR day-care OR "day stay" OR day-stay OR ambulatory OR outpatient OR out-patient OR (partial and (hospitalization or hospitalizations or hospitalisation or hospitalizations)) #2 MeSH descriptor Day Care explode all trees #3 MeSH descriptor Ambulatory Surgical Procedures explode all trees #4 MeSH descriptor Ambulatory Care explode all trees #5 (#1 OR #2 OR #3 OR #4) #6 (laparoscop* OR celioscop* OR coelioscop* OR abdominoscop* OR peritoneoscop*) AND (cholecystecto* OR colecystecto*) #7 MeSH descriptor Cholecystectomy, Laparoscopic explode all trees #8 (#6 OR #7) #9 (#5 AND #8)
MEDLINE	1987 to February 2007.	("day case" OR day-case OR "day surgery" or day-surgery OR "day care" OR day-care OR "day stay" OR day-stay OR ambulatory OR outpatient OR out-patient OR (partial and (hospitalization or hospitalizations or hospitalisation or hospitalizations)) OR "Day Care"[MeSH] OR "Ambulatory Surgical Procedures"[MeSH] OR "Ambulatory Care"[MeSH]) AND (((laparoscop* OR celioscop* OR coelioscop* OR abdominoscop* OR peritoneoscop*) AND (cholecystecto* OR colecystecto*)) OR "cholecystectomy, laparoscopic"[MeSH]) AND (((randomized controlled trial [pt] OR controlled clinical trial [pt] OR randomized controlled trials [mh] OR random allocation [mh] OR double-blind method [mh] OR single-blind method [mh] OR clinical trial [pt] OR clinical trials [mh] OR ("clinical trial" [tw]) OR ((singl* [tw] OR

		doubl* [tw] OR trebl* [tw] OR tripl* [tw]) AND (mask* [tw] OR blind* [tw])) OR (placebos [mh] OR placebo* [tw] OR random* [tw] OR research design [mh:noexp]) NOT (animals [mh] NOT human [mh]))))
EMBASE	1987 to February 2007.	1 day ADJ case OR day-case OR day ADJ surgery OR day-surgery OR day ADJ care OR day-care OR day ADJ stay OR day-stay OR ambulatory OR outpatient OR out-patient 2 DAY-CARE#.DE. OR AMBULATORY-SURGERY.DE. 3 1 OR 2 4 LAPAROSCOP\$ OR CELIOSCOP\$ OR COELIOSCOP\$ OR ABDOMINOSCOP\$ OR PERITONEOSCOP\$ 5 CHOLECYSTECT\$ OR COLECYSTECT\$ 6 4 AND 5 7 LAPAROSCOPIC-SURGERY#.DE. OR LAPAROSCOPY#.W..DE. 8 CHOLECYSTECTOMY#.W..DE. 9 7 AND 8 10 6 OR 9 11 3 AND 10 12 RANDOMIZED-CONTROLLED-TRIAL#.DE. OR RANDOMIZATION#.W..DE. OR CONTROLLED-STUDY#.DE. OR MULTICENTER-STUDY#.DE. OR PHASE-3-CLINICAL-TRIAL#.DE. OR PHASE-4-CLINICAL-TRIAL#.DE. OR DOUBLE-BLIND-PROCEDURE#.DE. OR SINGLE-BLIND-PROCEDURE#.DE. 13 RANDOM\$ OR CROSSOVER\$ OR CROSS-OVER OR CROSS ADJ OVER OR FACTORIAL\$ OR PLACEBO\$ OR VOLUNTEERS\$ 14 (SINGLE OR DOUBLE OR TREBLE OR TRIPLE) NEAR (BLIND OR MASK) 15 12 OR 13 OR 14 16 15 AND HUMAN=YES 17 11 AND 16
Science Citation Index Expanded ( <a href="http://portal.isiknowledge.com/portal.cgi?DestApp=WOS&amp;Func=Frame">http://portal.isiknowledge.com/portal.cgi?DestApp=WOS&amp;Func=Frame</a> )	1987 to February 2007.	#1 TS=("day case" OR day-case OR "day surgery" or day-surgery OR "day care" OR day-care OR "day stay" OR day-stay OR ambulatory OR outpatient OR out-patient) #2 TS=(partial) #3 TS=(hospitalization or hospitalizations or hospitalisation or hospitalizations) #4 #3 AND #2 #5 #4 OR #1 #6 TS=(laparoscop* OR celioscop* OR coelioscop* OR abdominoscop* OR peritoneoscop*) #7 TS=(cholecystecto* OR colecystecto*) #8 TS=(random* OR blind* OR placebo* OR meta-analysis) #9 #8 AND #7 AND #6 AND #5

## 02 Reasons for post-randomisation exclusion

Study	Day-case	Overnight stay	Reasons	Number for analysis	Drop-out percentage	Remarks
Dirksen 2001	Group not stated.	Group not stated.	A total of 8 withdrawals - 3 went to a different hospital because of the long waiting list duration, 2 were immediately operated and 3 patients were operated for unknown reasons outside the research.	86	8.5%	
						7 clerical errors, 1 delay in surgery, 1 home nursing service not available, 1 required simultaneous hernia repair. No further information was

Hollington 1999	4 (14 - see remarks)	5	1 due to stroke, 8 did not have surgery at that hospital.	141 (131 - see remarks)	6.0% (12.7% - see remarks)	available on these 10 patients regarding readmissions or any other outcome. These 10 patients were included for the outcome 'prolonged hospitalisation', but were excluded from other outcomes. Further information was sought from the author of this trial regarding these 10 patients. There was no reply from the authors. If these patients are also considered as drop-outs, the drop-out percentage was 12.7%.
Johansson 2006	2	5	All due to acute admission for acute cholecystitis.	100	6.5%	
Keulemans 1998	3	3	3 patients postponed surgery, 3 had acute cholecystitis - distributed in both groups.	74	7.5%	
Young 2001	0	0	-	28	0%	

### 03 Summary of meta-analysis

Outcome	Measure	Fixed-effect	Random-effects	Heterogeneity	High methodological	Risk difference
Surgery related morbidity	Relative risk	1.26 [0.54, 2.94]	1.25 [0.48, 3.29]	0%	1.01 [0.39, 2.60]	0.00 [-0.01, 0.02]
Surgery related morbidity diagnosed after discharge	Relative risk	1.23 [0.44, 3.46]	1.25 [0.38, 4.14]	0%	0.84 [0.24, 2.89]	0.00 [-0.02, 0.03]
Prolonged hospitalisation	Relative risk	0.99 [0.69, 1.43]	1.11 [0.46, 2.70]	68.8%	0.96 [0.31, 2.94]	0.02 [-0.12, 0.15]
Re-admission	Relative risk	0.90 [0.25, 3.26]	0.90 [0.25, 3.28]	0%	1.05 [0.15, 7.10]	0.00 [-0.03, 0.03]
Reviewed by doctor but not admitted	Relative risk	1.88 [0.45, 7.91]	1.79 [0.42, 7.64]	0%	1.50 [0.29, 7.65]	0.02 [-0.03, 0.06]
Pain scores (day of surgery)	Standardised mean difference	-0.19 [-0.58, 0.20]	-0.09 [-0.78, 0.59]	0%	-0.19 [-0.58, 0.20]	-
Pain scores (first post-operative day)	Standardised mean difference	-0.19 [-0.58, 0.20]	-0.19 [-0.58, 0.20]	0%	-0.19 [-0.58, 0.20]	-
Number requiring opiate analgesia	Relative risk	0.39 [0.15, 1.02]	0.39 [0.15, 1.02]	Not applicable	-	-0.13 [-0.25, -0.01]
Nausea (day of surgery)	Standardised mean difference	-0.10 [-0.84, 0.64]	-0.10 [-0.84, 0.64]	Not applicable	-0.10 [-0.84, 0.64]	-
Nausea (first						

post-operative day)	Standardised mean difference	-0.09 [-0.83, 0.65]	-0.09 [-0.83, 0.65]	Not applicable	-0.09 [-0.83, 0.65]	-
Patient anxiety (First post-operative day)	Standardised mean difference	0.63 [0.23, 1.03]	0.63 [0.23, 1.03]	Not applicable	0.63 [0.23, 1.03]	-
Patient anxiety (One week after surgery)	Standardised mean difference	0.09 [-0.21, 0.39]	0.09 [-0.21, 0.39]	0%	0.09 [-0.21, 0.39]	-
Patient quality of life (first post-operative day)	Standardised mean difference	-0.27 [-0.67, 0.12]	-0.27 [-0.67, 0.12]	Not applicable	-0.27 [-0.67, 0.12]	-
Patient quality of life (one week after surgery)	Standardised mean difference	0.04 [-0.20, 0.29]	0.05 [-0.28, 0.38]	44.8%	0.05 [-0.28, 0.38]	-
Patient satisfaction	Standardised mean difference	0.07 [-0.35, 0.50]	0.07 [-0.35, 0.50]	Not applicable	0.07 [-0.35, 0.50]	-
Recommendation to others	Relative risk	1.05 [0.90, 1.24]	1.02 [0.89, 1.15]	0%	1.05 [0.90, 1.24]	0.04 [-0.09, 0.17]
Return to normal activity (days)	Weighted mean difference	-0.10 [-0.37, 0.17]	-0.10 [-0.37, 0.17]	Not applicable	-	-
Return to work (days)	Weighted mean difference	-2.00 [-10.29, 6.29]	-2.00 [-10.29, 6.29]	Not applicable	-2.00 [-10.29, 6.29]	-

#### 04 Surgical morbidity after discharge

Study name	Day-case	Treatment	Night stay	Treatment
Dirksen 2001	1 (wound abscess).	Wound abscess - drained in outpatient clinic.	2 (1 post-operative pancreatitis, 1 retained stone).	Not stated.
Hollington 1999	2 (1 subphrenic collection, 1 wound infection).	(1) Subphrenic collection - CT guided aspiration. (2) Wound infection - exploration.	0	-
Johansson 2006	0	-	0	-
Keulemans 1998	1 (wound infection).	Not stated.	1 (hematoma).	Not stated.
Young 2001	Not stated.	-	Not stated.	-

#### 05 Reasons for prolonged hospitalisation and re-admission

Study name	Day-case prolonged	Night stay prolonged	Day-case readmit	Management	Night stay readmit	Management
Abbreviations	CBD = common bile duct. ERCP = endoscopic retrograde cholangio pancreatography. CT = computerised tomogram.					
Dirksen 2001	11 (7 due to nausea and pain, 1 open cholecystectomy, 1 drain inserted, 1 lost gallstone - observation, 1 not clear).	24 (1 conversion to open cholecystectomy, 2 re-operation, rest not clear).	2 (both abdominal pain).	conservative.	2 (1 pancreatitis, 1 retained stone).	Not stated.
	21 (7 clerical error, 1 delay in surgery, 1 home nursing service not available, 1 required simultaneous hernia	13 (3 conversion		(1) Subphrenic	3 (1 pleuritic chest	(1) Pleuritic chest pain - pulmonary embolism ruled out

Hollington 1999	repair, 9 due to nausea, vomiting, drowsiness and pain, 1 due to drain insertion following difficult dissection, 1 conversion to open cholecystectomy).	to open cholecystectomy, 10 nausea, vomiting or pain).	2 (1 subphrenic collection, 1 wound infection).	collection - CT guided aspiration. (2) Wound infection - exploration.	pain, 1 nausea and vomiting, 1 suspected CBD stone.	by ventilation-perfusion scan. (2) Nausea and vomiting - conservative. (3) Suspected CBD stone - ERCP.
Johansson 2006	4 (1 bile duct injury, 1 adhesions, 1 hematoma at port site, 1 retained CBD stone requiring ERCP).	6 (difficulty mobilising due to pain).	0	-	0	-
Keulemans 1999	3 (reason not stated).	0	0	-	0	-
Young 2001	3 (2 nausea and vomiting, 1 no carer at home).	0	0	-	0	-

## 06 Pain, nausea, and vomiting

Study	Time of measurement	Day-case pain	Night stay pain	Significance	Day-case nau/vomit	Night stay nau/vomit	Significance
					nau = nausea. vomit = vomiting		
Keulemans 1998	Day of surgery (4-8 hours after surgery)	2.8	3.8	Not significant	-	-	-
Young 2001	Day of surgery (4-8 hours after surgery)	6.5	5.6	Not significant	3.5 (nausea)	3.8 (nausea)	Not significant
Dirksen 2001	Next day	Not stated	Not stated	Not significant	Not stated (vomiting)	Not stated (vomiting)	Not significant
Keulemans 1998	Next day	2.3	2.7	Not significant	-	-	-
Young 2001	Next day	4.6	5.1	Not significant	2.9 (nausea)	2.2 (nausea)	Not significant

## Additional figures

### Figure 01



## Notes

### Unpublished CRG notes

Exported from Review Manager 4.2.10  
Exported from Review Manager 4.2.9

### Published notes

### Amended sections

Cover sheet  
Synopsis  
Abstract  
Background  
Objectives  
Criteria for considering studies for this review

Search strategy for identification of studies  
Methods of the review  
Description of studies  
Methodological quality of included studies  
Results  
Discussion  
Reviewers' conclusions  
Acknowledgements  
Potential conflict of interest  
References to studies  
Other references  
Characteristics of included studies  
Characteristics of excluded studies  
Comparisons, data or analyses  
Additional tables and figures

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