ClinicalEvidence

Acute cholecystitis

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ABSTRACT

INTRODUCTION: Of people admitted to hospital for biliary tract disease, 20% have acute cholecystitis. Up to the age of 50 years, acute calculous cholecystitis is three times more common in women than in men, and about 1.5 times more common in women than in men thereafter. About 95% of people with acute cholecystitis have gallstones. Optimal therapy for acute cholecystitis, based on timing and severity of presentation, remains controversial. METHODS AND OUTCOMES: We conducted a systematic review and aimed to answer the following clinical question: What are the effects of treatments for acute cholecystitis? We searched: Medline, Embase, The Cochrane Library, and other important databases up to April 2011 (Clinical Evidence reviews are updated periodically; please check our website for the most up-to-date version of this review). We included harms alerts from relevant organisations such as the US Food and Drug Administration (FDA) and the UK Medicines and Healthcare products Regulatory Agency (MHRA). RESULTS: We found 17 systematic reviews, RCTs, or observational studies that met our inclusion criteria. We performed a GRADE evaluation of the quality of evidence for interventions. CONCLUSIONS: In this systematic review we present information relating to the effectiveness and safety of the following interventions: early cholecystectomy, laparoscopic cholecystectomy, minilaparoscopic cholecystectomy, observation alone, open cholecystectomy, and percutaneous cholecystostomy.

QUESTIONS

INTERVENTIONS

TREATMENTS FOR ACUTE CHOLECYSTITIS

Key points

- Acute cholecystitis causes unremitting right upper quadrant pain, anorexia, nausea, vomiting, and fever, and if untreated can lead to perforations, abscess formation, or fistulae.

  About 95% of people with acute cholecystitis have gallstones.

  It is thought that blockage of the bile duct by a gallstone or local inflammation can lead to acute cholecystitis, but we don't know whether bacterial infection is also necessary.

- Early cholecystectomy within 7 days of onset of symptoms is the treatment of choice for acute cholecystitis.

  Early surgery reduces the duration of hospital admission compared with delayed surgery, but does not reduce mortality or complications.

  Up to one quarter of people scheduled for delayed surgery may require urgent operations because of recurrent or worsening symptoms.

- Laparoscopic cholecystectomy may reduce the duration of hospital admission and improve intra-operative and postoperative outcomes compared with open cholecystectomy, but it may increase the risk of bile duct injury.

  Up to one quarter of people having laparoscopic cholecystectomy may need conversion to open surgery because of risks of complications or uncontrolled bleeding.

  Minilaparoscopic surgery may be associated with slightly longer operative times than laparoscopic surgery, although it may reduce pain scores and the need for postoperative analgesia.

- Routine abdominal drainage in both uncomplicated laparoscopic and open cholecystectomy is associated with an increase in wound infections compared with no drainage.

DEFINITION **Acute cholecystitis** results from obstruction of the cystic duct, usually by a gallstone, followed by distension and subsequent chemical or bacterial inflammation of the gallbladder. People with acute cholecystitis usually have unremitting right upper quadrant pain, anorexia, nausea, vomiting, and

fever. About 95% of people with acute cholecystitis have gallstones (calculous cholecystitis) and 5% lack gallstones (acalculous cholecystitis). [1] Severe acute cholecystitis may lead to necrosis of the gallbladder wall, known as gangrenous cholecystitis. This review does not include people with acute cholangitis, which is a severe complication of gallstone disease and generally a result of bacterial infection.

INCIDENCE/ PREVALENCE

The incidence of acute cholecystitis among people with gallstones is unknown. Of people admitted to hospital for biliary tract disease, 20% have acute cholecystitis. [1] The number of cholecystectomies carried out for acute cholecystitis increased from the mid 1980s to the early 1990s, especially in older people. [2] Acute calculous cholecystitis is three times more common in women than in men up to the age of 50 years, and is about 1.5 times more common in women than in men thereafter. [1]

AETIOLOGY/ RISK FACTORS

Acute calculous cholecystitis seems to be caused by obstruction of the cystic duct by a gallstone, or local mucosal erosion and inflammation caused by a stone, but cystic duct ligation alone does not produce acute cholecystitis in animal studies. The role of bacteria in the pathogenesis of acute cholecystitis is not clear; positive cultures of bile or gallbladder wall are found in 50% to 75% of cases. [3] [4] The cause of acute acalculous cholecystitis is uncertain and may be multifactorial, including increased susceptibility to bacterial colonisation of static gallbladder bile. [1]

PROGNOSIS

Complications of acute cholecystitis include perforation of the gallbladder, pericholecystic abscess, and fistula caused by gallbladder wall ischaemia and infection. In the US, the overall mortality from untreated complications is about 20%. [5]

AIMS OF INTERVENTION

To reduce mortality and morbidity associated with acute cholecystitis, with minimal adverse effects of treatment.

OUTCOMES

Mortality; **morbidity** (including gallstone-related complications, persistent pain, intolerance to food, gastrointestinal upset, recurrent attacks of cholecystitis); **intra-operative outcomes** (includes duration of surgery and need for nasogastric tube); **postoperative outcomes** (duration of hospital stay, complications, antibiotic use, and analgesia use); **quality of life**. Postoperative fall in haemoglobin and conversion of a planned laparoscopic cholecystectomy to an open cholecystectomy are surrogate outcomes and are reported in further information on studies.

METHODS

Clinical Evidence search and appraisal April 2011. The following databases were used to identify studies for this systematic review: Medline 1966 to April 2011, Embase 1980 to April 2011, and The Cochrane Database of Systematic Reviews, Issue 1, 2011 (1966 to date of issue). An additional search within The Cochrane Library was carried out for the Database of Abstracts of Reviews of Effects (DARE) and Health Technology Assessment (HTA). We also searched for retractions of studies included in the review. Abstracts of the studies retrieved from the initial search were assessed by an information specialist. Selected studies were then sent to the contributor for additional assessment, using predetermined criteria to identify relevant studies. Study design criteria for inclusion in this review were: published systematic reviews of RCTs and RCTs in any language, with any level of blinding (including "open" studies), and containing any number of individuals of whom at least 80% were followed up. There was no minimum length of follow-up required to include studies. We included systematic reviews of RCTs and RCTs where harms of an included intervention were studied applying the same study design criteria for inclusion as we did for benefits. In addition we use a regular surveillance protocol to capture harms alerts from organisations such as the FDA and the MHRA, which are added to the reviews as required. To aid readability of the numerical data in our reviews, we round many percentages to the nearest whole number. Readers should be aware of this when relating percentages to summary statistics such as relative risks (RRs) and odds ratios (ORs). We have performed a GRADE evaluation of the quality of evidence for interventions included in this review (see table, p 23). The categorisation of the quality of the evidence (high, moderate, low, or very low) reflects the quality of evidence available for our chosen outcomes in our defined populations of interest. These categorisations are not necessarily a reflection of the overall methodological quality of any individual study, because the Clinical Evidence population and outcome of choice may represent only a small subset of the total outcomes reported, and population included, in any individual trial. For further details of how we perform the GRADE evaluation and the scoring system we use, please see our website (www.clinicalevidence.com).

QUESTION What are the effects of treatments for acute cholecystitis?

OPTION EARLY CHOLECYSTECTOMY

- For GRADE evaluation of interventions for Acute cholecystitis, see table, p 23 .
- Early cholecystectomy within 7 days of onset of symptoms is the treatment of choice for acute cholecystitis.
- Early surgery reduces the duration of hospital admission compared with delayed surgery, but does not reduce mortality or complications.
- Up to one quarter of people scheduled for delayed surgery may require urgent operations because of recurrent or worsening symptoms.

Benefits and harms

Early versus delayed cholecystectomy:

We found 6 systematic reviews (search dates 2001, [6] 2003, [7] 2005, [8] 2006, [9] [10] and 2010 [11]) comparing early (at the time of diagnosis or within 7 days of onset of symptoms) versus delayed (at least 6 weeks after onset of symptoms) cholecystectomy (open or laparoscopic). The reviews identified 19 RCTs between them. Crossover reporting was widespread: for example, the 5 RCTs reported in the sixth review [11] included all 4 RCTs reported in the fourth review [9] and 3 of the 4 RCTs reported by the fifth review. [10] To minimise duplication of reporting, therefore, we have not reported all outcomes for all reviews where the same RCTs were reported. Additionally, as the most recent review [11] is an update of a previously reported review, [8] we report only the update here. The two oldest reviews [6] [7] reported RCTs dating back as far as 1970, while the more-recent reviews included RCTs dating from 1998. See further information on studies for details of conversion rates.

Mortality

Compared with delayed cholecystectomy Early (at the time of diagnosis or within 7 days of onset of symptoms) cholecystectomy may be no more effective at reducing mortality in people with acute cholecystitis compared with delayed (at least 6 weeks after onset of symptoms) cholecystectomy (low-quality evidence).

Ref (type)	Population	Outcome, Interventions	Results and statistical analysis	Effect size	Favours
Mortality					
[6] Systematic review	916 people with acute cholecystitis 9 RCTs in this analysis	**Mortality** 1/468 (0.2%) with early open cholecystectomy 7/448 (1.6%) with delayed open cholecystectomy Surgeons performing open cholecystectomies had a wide range of experience	OR 0.53 95% CI 0.17 to 1.66	⟷	Not significant
[6] Systematic review	228 people with acute cholecystitis 3 RCTs in this analysis	**Mortality** 0/119 (0%) with early laparoscopic cholecystectomy 0/109 (0%) with delayed laparoscopic cholecystectomy Laparoscopic cholecystectomies were carried out by "experienced surgeons"	Reported as not significant P value not reported	⟷	Not significant
[7] Systematic review	1014 people with acute cholecystitis 10 RCTs in this analysis 6 RCTs included in review [6]	**Mortality** with early cholecystectomy (open and laparoscopic) with delayed cholecystectomy (open and laparoscopic) Absolute results not reported	Risk difference −0.01 95% CI −0.03 to 0.00	⟷	Not significant
[11] Systematic review	451 people with acute cholecystitis 5 RCTs in this analysis	**Mortality** with early laparoscopic cholecystectomy	Significance not assessed		

Ref (type)	Population	Outcome, Interventions	Results and statistical analysis	Effect size	Favours
		with delayed laparoscopic cholecystectomy The review reported no deaths in either group			

Morbidity

Compared with delayed cholecystectomy Early (at the time of diagnosis or within 7 days of onset of symptoms) cholecystectomy may be no more effective at reducing morbidity (not further defined) in people with acute cholecystitis compared with delayed (at least 6 weeks after onset of symptoms) cholecystectomy. Early cholecystectomy may be more effective at reducing gastrointestinal symptoms (diarrhoea, indigestion, and abdominal pain) at 1 month in people with acute cholecystitis, but it may be no more effective at 3 to 6 months (very low-quality evidence).

Ref (type)	Population	Outcome, Interventions	Results and statistical analysis	Effect size	Favours
Morbidity					
[6] Systematic review	916 people with acute cholecystitis 9 RCTs in this analysis	**Morbidity (not further defined)** 83/468 (17.7%) with early open cholecystectomy 80/448 (17.9%) with delayed open cholecystectomy Surgeons performing open cholecystectomies had a wide range of experience	OR 0.95 95% CI 0.66 to 1.38	⟷	Not significant
[6] Systematic review	228 people with acute cholecystitis 3 RCTs in this analysis	**Morbidity (not further defined)** 13/119 (11%) with early laparoscopic cholecystectomy 17/109 (16%) with delayed laparoscopic cholecystectomy Laparoscopic cholecystectomies were carried out by "experienced surgeons"	OR 0.69 95% CI 0.27 to 1.73	⟷	Not significant
[7] Systematic review	1014 people with acute cholecystitis 10 RCTs in this analysis 6 RCTs included in review [6]	**Morbidity (not further defined)** with early cholecystectomy (open and laparoscopic) with delayed cholecystectomy (open and laparoscopic) Absolute results not reported	Risk difference −0.06 95% CI −0.17 to +0.06	⟷	Not significant
Gastrointestinal upset					
[12] RCT	145 people with acute cholecystitis In review [7] Data from 1 RCT	**Gastrointestinal upset (diarrhoea, indigestion, and abdominal pain) , 1 month after surgery** with early cholecystectomy (open or laparoscopic) with delayed cholecystectomy (open or laparoscopic) Absolute results reported graphically	P <0.01	○○○	early cholecystectomy
[12] RCT	145 people with acute cholecystitis In review [7] Data from 1 RCT	**Gastrointestinal upset (diarrhoea, indigestion, and abdominal pain) , 3 months after surgery** with early cholecystectomy (open or laparoscopic) with delayed cholecystectomy (open or laparoscopic)	Reported as not significant P value not reported	⟷	Not significant

Ref (type)	Population	Outcome, Interventions	Results and statistical analysis	Effect size	Favours
		Absolute results reported graphically			
[12] RCT	145 people with acute cholecystitis In review [7] Data from 1 RCT	**Gastrointestinal upset (diarrhoea, indigestion, and abdominal pain) , 6 months after surgery** with early cholecystectomy (open or laparoscopic) with delayed cholecystectomy (open or laparoscopic) Absolute results reported graphically	Reported as not significant P value not reported	⟷	Not significant

Postoperative outcomes

Compared with delayed cholecystectomy Early (at the time of diagnosis or within 7 days of onset of symptoms) cholecystectomy may be more effective at reducing the duration of hospital stay in people with acute cholecystitis compared with delayed (at least 6 weeks after onset of symptoms) cholecystectomy. However, early cholecystectomy may be no more effective at reducing postoperative complications (low-quality evidence).

Ref (type)	Population	Outcome, Interventions	Results and statistical analysis	Effect size	Favours
Duration of hospital stay					
[6] Systematic review	1255 people with acute cholecystitis 12 RCTs in this analysis 9 RCTs of open surgery, 3 RCTs of laparoscopic surgery	**Duration of hospital stay** 9.6 days with early cholecystectomy (open or laparoscopic) 17.8 days with delayed cholecystectomy (open or laparoscopic) Surgeons performing open cholecystectomies had a wide range of experience, but all laparoscopic cholecystectomies were carried out by "experienced surgeons"	P <0.0001	○○○	early cholecystectomy
[7] Systematic review	1014 people with acute cholecystitis 10 RCTs in this analysis 6 RCTs included in review [6]	**Duration of hospital stay** with early cholecystectomy (open and laparoscopic) with delayed cholecystectomy (open and laparoscopic) Absolute results not reported	Mean difference –2.7 days 95% CI –4.9 days to –0.49 days with early *v* delayed laparoscopic cholecystectomy Mean difference –10.2 days 95% CI –13.4 days to –7.0 days with early *v* delayed open cholecystectomy	○○○	early cholecystectomy
[11] Systematic review	388 people with acute cholecystitis 4 RCTs in this analysis	**Duration of hospital stay** with early laparoscopic cholecystectomy with delayed laparoscopic cholecystectomy Absolute numbers not reported	Mean difference –4.12 days 95% CI –5.22 days to –3.03 days P <0.001	○○○	early cholecystectomy
[9] Systematic review	243 people with acute cholecystitis 3 RCTs in this analysis	**Duration of postoperative hospital stay** with early laparoscopic cholecystectomy with delayed laparoscopic cholecystectomy Absolute numbers not reported	WMD 0.39 95% CI 0.13 to 0.66 P = 0.004	○○○	delayed cholecystectomy

Ref (type)	Population	Outcome, Interventions	Results and statistical analysis	Effect size	Favours
[10] Systematic review	346 people with acute cholecystitis 3 RCTs in this analysis	**Duration of hospital stay** with early laparoscopic cholecystectomy with delayed laparoscopic cholecystectomy Absolute results not reported	WMD –1.14 95% CI –1.58 to –0.70 P <0.001	○○○	early cholecystectomy
Postoperative complications					
[6] Systematic review	916 people with acute cholecystitis 9 RCTs in this analysis	**Postoperative complications** with early open cholecystectomy with delayed open cholecystectomy Absolute results not reported Complications included pneumonia, wound infection, wound dehiscence, incisional hernia, intra-abdominal abscess, mesenteric thrombosis, pancreatitis, MI, and transient psychosis Surgeons performing open cholecystectomies had a wide range of experience	OR 0.95 95% CI 0.66 to 1.38	⟷	Not significant
[6] Systematic review	228 people with acute cholecystitis 3 RCTs in this analysis	**Postoperative complications** with early laparoscopic cholecystectomy with delayed laparoscopic cholecystectomy Absolute results not reported Postoperative complications included subphrenic collection, bile leak from the cystic duct stump, superficial wound infection, postoperative respiratory failure requiring mechanical ventilation, postoperative ileus, and atrial fibrillation Laparoscopic cholecystectomies were carried out by "experienced surgeons"	OR 0.69 95% CI 0.27 to 1.73	⟷	Not significant
[11] Systematic review	451 people with acute cholecystitis 5 RCTs in this analysis	**Proportion of people with bile duct injury** 1/222 (0.5%) with early laparoscopic cholecystectomy 3/216 (1.5%) with delayed laparoscopic cholecystectomy	RR 0.64 95% CI 0.15 to 2.65 P = 0.54	⟷	Not significant
[9] Systematic review	375 people with acute cholecystitis 4 RCTs in this analysis	**Proportion of people with bile leak** with early laparoscopic cholecystectomy with delayed laparoscopic cholecystectomy Absolute numbers not reported	OR 2.42 95% CI 0.75 to 7.74 P = 0.14	⟷	Not significant
[10] Systematic review	504 people with acute cholecystitis 4 RCTs in this analysis	**Proportion of people with bile leak** 7/254 (0.3%) with early laparoscopic cholecystectomy 2/237 (0.1%) with delayed laparoscopic cholecystectomy	OR 2.22 95% CI 0.60 to 7.72 P = 0.21	⟷	Not significant

Ref (type)	Population	Outcome, Interventions	Results and statistical analysis	Effect size	Favours
[10] Systematic review	504 people with acute cholecystitis 4 RCTs in this analysis	**Overall complications** 36/254 (14%) with early laparoscopic cholecystectomy 35/237 (15%) with delayed laparoscopic cholecystectomy	OR 0.97 95% CI 0.59 to 1.61 P = 0.91	⟷	Not significant
[10] Systematic review	504 people with acute cholecystitis 4 RCTs in this analysis	**Intra-abdominal collection** 11/254 (4%) with early laparoscopic cholecystectomy 8/237 (3%) with delayed laparoscopic cholecystectomy	OR 1.28 95% CI 0.51 to 3.25 P = 0.60	⟷	Not significant

Intra-operative outcomes

No data from the following reference on this outcome. [6] [7] [9] [10] [11]

Quality of life

No data from the following reference on this outcome. [6] [7] [9] [10] [11]

Further information on studies

[6] The review found no significant difference between groups in conversion to open cholecystectomy (conversion: 21/119 [18%] with early cholecystectomy *v* 28/109 [26%] with delayed cholecystectomy; OR 0.62, 95% CI 0.32 to 1.19). Unplanned urgent operation was needed in 23% of people allocated to delayed surgery.

[7] The review found no significant difference between early cholecystectomy and delayed cholecystectomy in risk of conversion to open surgery (absolute numbers not reported; risk difference –0.40, 95% CI –0.13 to +0.49).

[11] The review found no significant difference between groups in rates of conversion to open cholecystectomy (conversion: 45/222 [20%] people with early cholecystectomy *v* 51/216 [24%] with delayed cholecystectomy; RR 0.88, 95% CI 0.65 to 1.25.

Comment: Early cholecystectomy affords certain advantages and is the treatment of choice in people with acute cholecystitis. People with acute cholecystitis who have multiple comorbid conditions and relative contraindications for cholecystectomy may be treated with antibiotics, a low-fat diet, and, in some instances, a cholecystostomy tube. The meta-analyses included here suggest that early laparoscopic cholecystectomy allows significantly shorter total hospital stay with no significant differences in conversion rates or complications.

OPTION PERCUTANEOUS CHOLECYSTOSTOMY FOLLOWED BY EARLY CHOLECYSTECTOMY VERSUS MEDICAL TREATMENT FOLLOWED BY DELAYED CHOLECYSTECTOMY

- For GRADE evaluation of interventions for Acute cholecystitis, see table, p 23 .
- Early percutaneous cholecystectomy followed by early cholecystectomy may lead to reduced duration of hospital stay and reduce the time to symptomatic improvement.

Benefits and harms

Percutaneous cholecystostomy followed by early cholecystectomy versus medical treatment followed by delayed cholecystectomy:

We found one RCT. [13]

Morbidity

Percutaneous cholecystostomy within 8 hours plus early cholecystectomy compared with medical treatment followed by delayed cholecystectomy Early percutaneous cholecystostomy followed by early cholecystectomy may be more effective at reducing the time to symptomatic improvement (low-quality evidence).

Ref (type)	Population	Outcome, Interventions	Results and statistical analysis	Effect size	Favours
Symptom improvement					
[13] RCT	70 people at high surgical risk (American Society of Anesthesiologists [ASA] grades II–IV) with acute cholecystitis	**Mean time to symptomatic improvement** 15 hours with percutaneous cholecystostomy within 8 hours of admission plus early cholecystectomy 55 hours with medical treatment plus delayed cholecystectomy (8 weeks after full recovery) See further information on studies for details of criteria for carrying out percutaneous cholecystostomy	P = 0.001	○○○	percutaneous cholecystostomy plus early cholecystectomy

Postoperative outcomes

Percutaneous cholecystostomy within 8 hours plus early cholecystectomy compared with medical treatment followed by delayed cholecystectomy Early percutaneous cholecystostomy followed by early cholecystectomy may lead to reduced duration of hospital stay and may be associated with a similar rate of postoperative complications (low-quality evidence).

Ref (type)	Population	Outcome, Interventions	Results and statistical analysis	Effect size	Favours
Duration of hospital stay					
[13] RCT	70 people at high surgical risk (American Society of Anesthesiologists [ASA] grades II–IV) with acute cholecystitis	**Duration of hospital stay** 5.3 days with percutaneous cholecystostomy within 8 hours of admission plus early cholecystectomy 15.2 days with medical treatment plus delayed cholecystectomy (8 weeks after full recovery) See further information on studies for details of criteria for carrying out percutaneous cholecystostomy	P = 0.001	○○○	percutaneous cholecystostomy plus early cholecystectomy
Postoperative complications					
[13] RCT	70 people with acute cholecystitis	**Minor bile leak** 1/31 (3%) with percutaneous cholecystostomy plus early cholecystectomy 0/30 (0%) with medical treatment plus delayed cholecystectomy Rate of minor bile leak associated with percutaneous cholecystostomy was reported to be comparable to rates reported in other studies	Significance not assessed		

Ref (type)	Population	Outcome, Interventions	Results and statistical analysis	Effect size	Favours
		There were no mortalities related to percutaneous cholecystostomy, and no postoperative mortalities after cholecystectomy			
[13] RCT	70 people with acute cholecystitis	**Dislodgement of the drainage catheter** 1/31 (3%) with percutaneous cholecystostomy plus early cholecystectomy 0/30 (0%) with medical treatment plus delayed cholecystectomy Rate of dislodgement of the drainage catheter associated with percutaneous cholecystostomy was reported to be comparable to rates reported in other studies There were no mortalities related to percutaneous cholecystostomy, and no postoperative mortalities after cholecystectomy	Significance not assessed		

Mortality

No data from the following reference on this outcome. [13]

Intra-operative outcomes

No data from the following reference on this outcome. [13]

Quality of life

No data from the following reference on this outcome. [13]

Further information on studies

[13] **Criteria for percutaneous cholecystostomy** People randomised to the percutaneous cholecystostomy (PC) group (37 people) would receive early cholecystectomy if they achieved resolution of sepsis and an Acute Physiology and Chronic Health Evaluation II (APACHE II) score of <12 within 96 hours after PC. Six patients in this first group had an APACHE II score of >12 after 96 hours, and were excluded from the study. Early laparoscopic cholecystectomy (LC) was performed in the remaining 31 patients. In the delayed group (33 people), two people refused surgical treatment, and one person died owing to ongoing sepsis. These three people were excluded; the remaining 30 were included in the analysis. **Conversion rate** The RCT found no significant difference in rates of conversion from laparoscopic cholecystectomy to open cholecystectomy between groups (2/31 [6%] with PC plus early cholecystectomy *v* 4/30 [13%] with medical treatment plus delayed cholecystectomy; P = 0.42).

Comment: Early cholecystectomy affords certain advantages and is the treatment of choice in people with acute cholecystitis. People with acute cholecystitis who have multiple comorbid conditions and relative contraindications for cholecystectomy may be treated with antibiotics, a low-fat diet, and, in some instances, a cholecystostomy tube.

OPTION LAPAROSCOPIC CHOLECYSTECTOMY

- For GRADE evaluation of interventions for Acute cholecystitis, see table, p 23 .
- Laparoscopic cholecystectomy may reduce the duration of hospital admission and improve intra-operative and postoperative outcomes compared with open cholecystectomy, but it may increase the risk of bile duct injury.
- Up to one quarter of people having laparoscopic cholecystectomy may need conversion to open surgery because of risks of complications or uncontrolled bleeding.
- Conventional laparoscopic surgery may be more effective than minilaparoscopic surgery at reducing operative times.
- Routine abdominal drainage after uncomplicated laparoscopic cholecystectomy seems to increase wound infections compared with no drainage.

Benefits and harms

Laparoscopic cholecystectomy versus open cholecystectomy:

We found no systematic review but found 4 RCTs. [14] [15] [16] [17]

Morbidity

Compared with open cholecystectomy Laparoscopic cholecystectomy seems no more effective at reducing postoperative pain (moderate-quality evidence).

Ref (type)	Population	Outcome, Interventions	Results and statistical analysis	Effect size	Favours
Postoperative pain					
[14] RCT	70 people with acute cholecystitis	**Pain score at discharge** 2 with laparoscopic cholecystectomy 1 with open cholecystectomy	P = 0.165	⟷	Not significant

No data from the following reference on this outcome. [15] [16] [17]

Intra-operative outcomes

Compared with open cholecystectomy We don't know how laparoscopic cholecystectomy and open cholecystectomy compare at reducing the duration of surgery in people with acute cholecystitis. Laparoscopic cholecystectomy may be more effective at reducing the need for nasogastric tube (very low-quality evidence).

Ref (type)	Population	Outcome, Interventions	Results and statistical analysis	Effect size	Favours
Duration of surgery					
[15] RCT	271 people with acute cholecystitis See further information on studies for baseline differences in population	**Mean duration of surgery** 60 minutes with laparoscopic cholecystectomy 90 minutes with open cholecystectomy Analysis of 146 people in laparoscopic cholecystectomy group and 97 people in open cholecystectomy group	P <0.00001	○○○	laparoscopic cholecystectomy
[16] RCT	63 people with acute cholecystitis	**Duration of surgery** 108 minutes with laparoscopic cholecystectomy	P = 0.49	⟷	Not significant

Ref (type)	Population	Outcome, Interventions	Results and statistical analysis	Effect size	Favours
		99 minutes with open cholecystectomy			
[17] RCT	230 people with acute cholecystitis	**Duration of surgery** 95 minutes with laparoscopic cholecystectomy 102 minutes with open cholecystectomy	Reported as not significant P value not reported	⟷	Not significant
[14] RCT	70 people with acute cholecystitis	**Median duration of surgery** 90 minutes with laparoscopic cholecystectomy 80 minutes with open cholecystectomy	P = 0.04	○○○	open cholecystectomy
Need for nasogastric tube					
[15] RCT	271 people with acute cholecystitis See further information on studies for baseline differences in population	**Use of nasogastric tube** 51% with laparoscopic cholecystectomy 94% with open cholecystectomy Analysis of 146 people in laparoscopic cholecystectomy group and 97 people in open cholecystectomy group	P <0.0001	○○○	laparoscopic cholecystectomy

Postoperative outcomes

Compared with open cholecystectomy Laparoscopic cholecystectomy may be more effective at reducing the duration of hospital stay and postoperative use of analgesia in people with acute cholecystitis, but we don't know how laparoscopic and open cholecystectomy compare at reducing postoperative complications (including haemorrhage, pneumonia, thrombosis, bile duct stones, bile leakage, and wound infections) in people with acute cholecystitis (very low-quality evidence).

Ref (type)	Population	Outcome, Interventions	Results and statistical analysis	Effect size	Favours
Duration of hospital stay					
[15] RCT	271 people with acute cholecystitis See further information on studies for baseline differences in population	**Duration of hospital stay** 3 days with laparoscopic cholecystectomy 7 days with open cholecystectomy Analysis of 146 people in laparoscopic cholecystectomy group and 97 people in open cholecystectomy group	P <0.0001	○○○	laparoscopic cholecystectomy
[16] RCT	63 people with acute cholecystitis	**Duration of hospital stay** 4 days with laparoscopic cholecystectomy 14 days with open cholecystectomy	P = 0.0063	○○○	laparoscopic cholecystectomy
[17] RCT	230 people with acute cholecystitis	**Duration of hospital stay** 5.8 days with laparoscopic cholecystectomy 8.5 days with open cholecystectomy	Significance not assessed		

Ref (type)	Population	Outcome, Interventions	Results and statistical analysis	Effect size	Favours
[14] RCT	70 people with acute calculous cholecystitis	**Duration of hospital stay** 1–10 days (median 2 days) with laparoscopic cholecystectomy 1–8 days (median 2 days) with open cholecystectomy Absolute results reported graphically Mean duration of stay was significantly longer with open surgery, although median duration of stay was the same in each group	P = 0.01	○○○	laparoscopic cholecystectomy
Analgesic use					
[15] RCT	271 people with acute cholecystitis See further information on studies for baseline differences in population	**Mean use of analgesia** 75 mg pethidine with laparoscopic cholecystectomy 175 mg pethidine with open cholecystectomy Analysis of 146 people in laparoscopic cholecystectomy group and 97 people in open cholecystectomy group	P <0.0001	○○○	laparoscopic cholecystectomy
Postoperative complications					
[15] RCT	271 people with acute cholecystitis See further information on studies for baseline differences in population	**Postoperative complications** 24/146 (16%) with laparoscopic cholecystectomy 25/97 (26%) with open cholecystectomy Analysis of 146 people in laparoscopic cholecystectomy group and 97 people in open cholecystectomy group See further information on studies for details of types of complication reported	Reported as not significant P value not reported	⟷	Not significant
[16] RCT	63 people with acute cholecystitis	**Incidence of major postoperative complications** 0% with laparoscopic cholecystectomy 23% with open cholecystectomy Absolute results not reported See further information on studies for details of types of complication reported	P = 0.0048 for overall complication rate (includes major and minor complication rates)	○○○	laparoscopic cholecystectomy
[16] RCT	63 people with acute cholecystitis	**Incidence of minor postoperative complications** 3% with laparoscopic cholecystectomy 19% with open cholecystectomy Absolute results not reported See further information on studies for details of types of complication reported	P = 0.0048 for overall complication rate (includes major and minor complication rates)	○○○	laparoscopic cholecystectomy
[17] RCT	230 people with acute cholecystitis	**Postoperative complications** 6/109 (6%) with laparoscopic cholecystectomy	Significance not assessed		

Ref (type)	Population	Outcome, Interventions	Results and statistical analysis	Effect size	Favours
		14/116 (12%) with open cholecystectomy Postoperative complications were defined as haemorrhage, pneumonia, thrombosis, bile duct stones, bile leakage, or wound infections			
[14] RCT	70 people with acute cholecystitis	**Postoperative complications** 2/35 (6%) with laparoscopic cholecystectomy 3/35 (9%) with open cholecystectomy Postoperative complications included minor stroke, wound infection, and pneumonia	P = 0.65	⟷	Not significant

Mortality

No data from the following reference on this outcome. [14] [15] [16] [17]

Quality of life

No data from the following reference on this outcome. [14] [15] [16] [17]

Laparoscopic cholecystectomy versus minilaparoscopic cholecystectomy:

We found one systematic review (search date 2010) comparing minilaparoscopic cholecystectomy versus conventional laparoscopic cholecystectomy. [18]

Intra-operative outcomes

Compared with minilaparoscopic cholecystectomy Conventional laparoscopic cholecystectomy seems more effective at reducing the duration of surgery (moderate-quality evidence).

Ref (type)	Population	Outcome, Interventions	Results and statistical analysis	Effect size	Favours
Duration of surgery					
[18] Systematic review	777 people with acute cholecystitis 13 RCTs in this analysis	**Mean duration of surgery** with laparoscopic cholecystectomy with minilaparoscopic cholecystectomy Absolute numbers not reported The authors of the review considered that all included RCTs were at risk of bias, and that most trials were not adequately blinded	Mean difference 4.82 minutes 95% CI 3.02 minutes to 6.61 minutes P <0.00001	○○○	laparoscopic cholecystectomy

Postoperative outcomes

Compared with minilaparoscopic cholecystectomy Conventional laparoscopic cholecystectomy may be less effective at reducing postoperative pain scores at up to 24 hours, and at reducing the need of analgesia, but we don't know

how conventional laparoscopic and minilaparoscopic cholecystectomy compare at reducing other postoperative outcomes including length of hospital stay (low-quality evidence).

Ref (type)	Population	Outcome, Interventions	Results and statistical analysis	Effect size	Favours
Postoperative pain and analgesic use					
[18] Systematic review	175 people with acute cholecystitis 2 RCTs in this analysis	**Postoperative pain scores , 4 to 8 hours** with laparoscopic cholecystectomy with minilaparoscopic cholecystectomy Absolute numbers not reported The authors of the review considered that all included RCTs were at risk of bias, and that most trials were not adequately blinded	SMD –0.46 95% CI –0.76 to –0.16 P = 0.003	○○○	minilaparoscopic cholecystectomy
[18] Systematic review	215 people with acute cholecystitis 3 RCTs in this analysis	**Postoperative pain scores , 9 to 24 hours** with laparoscopic cholecystectomy with minilaparoscopic cholecystectomy Absolute numbers not reported The authors of the review considered that all included RCTs were at risk of bias, and that most trials were not adequately blinded	SMD –0.29 95% CI –0.56 to –0.02 P = 0.02	○○○	minilaparoscopic cholecystectomy
[18] Systematic review	215 people with acute cholecystitis 4 RCTs in this analysis	**Mean opiate use , 9 to 24 hours** with laparoscopic cholecystectomy with minilaparoscopic cholecystectomy Absolute numbers not reported The authors of the review considered that all included RCTs were at risk of bias, and that most trials were not adequately blinded	SMD –0.40 95% CI –0.68 to –0.13 P = 0.004	○○○	minilaparoscopic cholecystectomy
Duration of hospital stay					
[18] Systematic review	315 people with acute cholecystitis 5 RCTs in this analysis	**Mean duration of hospital stay** with laparoscopic cholecystectomy with minilaparoscopic cholecystectomy Absolute numbers not reported The authors of the review considered that all included RCTs were at risk of bias, and that most trials were not adequately blinded	SMD –0.28 days 95% CI –0.61 days to +0.04 days P = 0.09	⟷	Not significant
Patient satisfaction					
[18] Systematic review	40 people with acute cholecystitis Data from 1 RCT	**Patient satisfaction scores** 2.49 with laparoscopic cholecystectomy 2.37 with minilaparoscopic cholecystectomy The review reported that 3 RCTs found no significant differences in return to work or normal activity, but it provided no further data	SMD –0.03 95% CI –0.65 to +0.59 P = 0.93	⟷	Not significant

Ref (type)	Population	Outcome, Interventions	Results and statistical analysis	Effect size	Favours
		The authors of the review considered that all included RCTs were at risk of bias, and that most trials were not adequately blinded			
Postoperative complications					
[18] Systematic review	317 people with acute cholecystitis 6 RCTs in this analysis	**Proportion of people with wound infection** 2/172 (1%) with laparoscopic cholecystectomy 6/145 (4%) with minilaparoscopic cholecystectomy The authors of the review considered that all included RCTs were at risk of bias, and that most trials were not adequately blinded	RR 0.39 95% CI 0.11 to 1.48 P = 0.17	⟷	Not significant
[18] Systematic review	212 people with acute cholecystitis 3 RCTs in this analysis	**Proportion of people with bile duct injury** 0/117 (0%) with laparoscopic cholecystectomy 2/95 (2%) with minilaparoscopic cholecystectomy The authors of the review considered that all included RCTs were at risk of bias, and that most trials were not adequately blinded	RR 0.26 95% CI 0.01 to 5.11 P = 0.17	⟷	Not significant

Mortality

No data from the following reference on this outcome. [18]

Morbidity

No data from the following reference on this outcome. [18]

Quality of life

No data from the following reference on this outcome. [18]

Routine abdominal drainage versus no drainage in uncomplicated laparoscopic cholecystectomy:
We found one systematic review (search date 2007). [19]

Postoperative outcomes

Routine abdominal drainage compared with no drain after uncomplicated laparoscopic cholecystectomy Drainage after uncomplicated laparoscopic cholecystectomy seems less effective at reducing wound infections and the proportion of people discharged on the same day (moderate-quality evidence).

Ref (type)	Population	Outcome, Interventions	Results and statistical analysis	Effect size	Favours
Postoperative outcomes					
[19] Systematic review	529 patients who had uncomplicated laparoscopic cholecystectomy 3 RCTs in this analysis	**Proportion of people with wound infection** 8/261 (3.1%) with drain 1/268 (0.4%) with no drain The review reported that most of the included RCTs were of poor methodological quality, citing inadequate blinding, poor randomisation procedures, and no intention-to-treat (ITT) analyses, among other weaknesses	OR 5.86 95% CI 1.05 to 32.70 P = 0.04	●●●	no drain
[19] Systematic review	68 patients who had uncomplicated laparoscopic cholecystectomy Data from 1 RCT	**Proportion of people discharged on same day as treatment** 0/33 (0%) with drain 11/35 (31%) with no drain The review reported that most of the included RCTs were of poor methodological quality, citing inadequate blinding, poor randomisation procedures, and no ITT analyses, among other weaknesses	OR 0.03 95% CI 0 to 0.57 P = 0.02	●●●	no drain

Mortality

No data from the following reference on this outcome. [19]

Morbidity

No data from the following reference on this outcome. [19]

Intra-operative outcomes

No data from the following reference on this outcome. [19]

Quality of life

No data from the following reference on this outcome. [19]

Further information on studies

[14] **Conversion rate** The RCT found that conversion from laparoscopic to open cholecystectomy was about 23%. **Blood loss** The RCT found no significant difference between groups in blood loss (3/35 [9%] in both the laparoscopic and open cholecystectomy groups had perioperative bleeding in excess of 500 mL; P = 1.0).

[15] **Population differences at baseline** The people randomised to receive open cholecystectomy were, on average, 10 years older than people receiving laparoscopic cholecystectomy (P <0.001), and had a significantly higher incidence of comorbid conditions (P = 0.002) and gangrenous cholecystitis (P = 0.03). **Conversion rate** The RCT found that the rate of conversion from laparoscopic to open cholecystectomy was 27%. **Complications** Complications were classed as surgical infections (wound infection, subphrenic or subhepatic abscess), non-infectious surgical (bile duct injury or haemorrhage), remote infections (urinary or respiratory), and miscellaneous (atelectasis or deep vein thrombosis).

[16] **Conversion rate** The RCT reported that the rate of conversion from laparoscopic to open cholecystectomy was 16%. **Complications** Major complications included MI, pneumonia and sepsis, femoral artery embolism, serious wound infection, late incisional hernia requiring surgical repair, adhesive intestinal obstruction within 1 month of cholecystectomy, and retained common bile duct stone. Minor complications included diarrhoea, urinary infection, and confusion.

[17] **Conversion rate** The RCT reported a conversion rate from laparoscopic to open cholecystectomy of 5/109 (4%). **Postoperative fall in haemoglobin** The RCT found no significant difference in mean fall in haemoglobin postoperatively between laparoscopic and open cholecystectomy, although the mean fall was smaller in the laparoscopic cholecystectomy group (mean fall in haemoglobin: 1.9 g/L with open cholecystectomy *v* 1.1 g/L with laparoscopic cholecystectomy; P = 0.6).

[18] **Conversion rate** The review found no significant difference between minilaparoscopic and conventional laparoscopic cholecystectomy in the rate of conversion to open cholecystectomy (12 RCTs, 752 people; conversion: 12/391 [3.1%] people with minilaparoscopic cholecystectomy *v* 13/361 [3.6%] people with conventional laparoscopic cholecystectomy; RR 0.97, 95% CI 0.45 to 2.08).

[19] One RCT included in the review (41 people randomised to suction drain *v* closed passive drain) suggested that suction drains carried less pain than passive drains.

Comment:

Laparoscopic cholecystectomy versus open cholecystectomy:
One RCT found that laparoscopic surgery was associated with fewer complications if performed by more experienced surgeons. [15] We found one systematic review in people with symptomatic gallstones, which did not differentiate between people with and without acute cholecystitis. [20] The review (search date 1995) indirectly compared outcomes in people who had laparoscopic cholecystectomy (98 case series or RCTs; 78,747 people with symptomatic gallstones) versus outcomes in people who had open cholecystectomy (28 case series or RCTs; 12,973 people treated with open cholecystectomy). It found that laparoscopic cholecystectomy was associated with lower mortality (86–91/100,000 with laparoscopic cholecystectomy *v* 660–740/100,000 with open cholecystectomy; CI not reported) but a higher rate of bile duct injury (36–47/10,000 with laparoscopic cholecystectomy *v* 19–29/10,000 with open cholecystectomy; CI not reported) compared with open cholecystectomy.

One prospective observational study (278 people who had undergone cholecystectomy) investigated the prevalence of persistent abdominal pain 5 years after cholecystectomy. [21] The study analysed follow-up data on populations from two RCTs. The people received either laparoscopic or open cholecystectomy (rates not reported). Of the 124 people included in the two RCTs with acute cholecystitis, 34 people (27%) reported pain at 5-year follow-up. Of the 101 women included in the RCTs, 29 reported pain (29%) compared with 5/23 men (22%). In women, diffuse pain was more prevalent than pain attacks (21% diffuse pain *v* 8% pain attack, P = 0.024; absolute figures not reported), especially in women aged below 60 years (P = 0.004; no other data reported). The study reported that neither the duration of symptom history before cholecystectomy (more or less than 2 years), indication for cholecystectomy (27% of people with biliary colic *v* 29% of patients with acute cholecystitis), nor the surgical method (open *v* laparoscopic) made a significant difference in the prevalence of abdominal pain 5 years after cholecystectomy. Furthermore, those people who received a cholecystectomy after failing a trial of observation had a similar prevalence of pain to people who had been randomised to a planned procedure. [21]

Laparoscopic cholecystectomy versus minilaparoscopic cholecystectomy:
To date, there is no formal training in minilaparoscopy outside of traditional laparoscopic training. Most published studies using minilaparoscopy come from either non-US centres or large academic centres in the USA, which allows no estimate of the extent of its use outside this setting.

Clinical guide:
Laparoscopic cholecystectomy is the procedure of choice in people with acute cholecystitis, with the caveat that although it is associated with favourable postoperative outcomes, it may carry a higher incidence of bile duct injury. Open cholecystectomy is primarily required in people who have a fistula from the gallbladder into the bile duct or intestine, and in some people who have perforation and abscess in the right upper quadrant. Conversion from laparoscopic to open cholecystectomy is needed if the laparoscopic procedure cannot be completed without risking injury to surrounding structures, or when haemostasis cannot be secured.

OPTION OBSERVATION ALONE

- For GRADE evaluation of interventions for Acute cholecystitis, see table, p 23 .
- Observation alone leads to a higher rate of gallstone-related complications.

Benefits and harms

Laparoscopic cholecystectomy versus no treatment/observation:

We found no systematic review or RCTs comparing only laparoscopic cholecystectomy versus no treatment. We found one RCT comparing cholecystectomy (laparoscopic or open) versus observation alone. [22] For complications of cholecystectomy, see option on laparoscopic cholecystectomy, p 10 .

Morbidity

Compared with laparoscopic cholecystectomy Observation or no treatment seems no more effective than cholecystectomy at reducing the rate of gallstone-related complications (recurrent cholecystitis, pancreatitis, intractable pain) in people with acute cholecystitis (moderate-quality evidence).

Ref (type)	Population	Outcome, Interventions	Results and statistical analysis	Effect size	Favours
Gallstone-related complications					
[22] RCT	64 people with acute cholecystitis	**Gallstone-related events (admissions for pain, recurrent cholecystitis, and pancreatitis)** 6/31 (19%) with cholecystectomy 12/33 (36%) with observation See further information on studies for data on median time to operation	P = 0.16	⟷	Not significant

Mortality

No data from the following reference on this outcome. [22]

Intra-operative outcomes

No data from the following reference on this outcome. [22]

Postoperative outcomes

No data from the following reference on this outcome. [22]

Quality of life

No data from the following reference on this outcome. [22]

Further information on studies

[22] **Operation rate** In the cholecystectomy group, 27/31 (87%) people had the operation at a median of 3.6 months after randomisation. After 8 years, 10/33 (30%) people originally randomised to observation had undergone cholecystectomy (failure rate). In the cholecystectomy group, 4/31 (13%) refused operation on the grounds of freedom from symptoms. A greater proportion of people in the cholecystectomy group than in the observation group underwent cholecystectomy (P <0.0001). **Complications** The RCT found no significant difference in the rates of major or minor operative complications between those initially randomised to cholecystectomy and those who converted to cholecystectomy (major complication rate: 3/27 [11%] in the group randomised to cholecystectomy *v* 1/10 [10%] in the group randomised to observation; minor complication rate: 7/27 [26%] in the group randomised to cholecystectomy *v* 1/10 [10%] in the group randomised to observation; P = 0.66 for difference in overall postoperative complications between the groups). Major complications included bile duct injuries or haemorrhage, whereas minor complications included wound infection, subphrenic collections, or miscellaneous infections (urinary and respiratory).

Comment: None.

OPTION OPEN CHOLECYSTECTOMY

- For GRADE evaluation of interventions for Acute cholecystitis, see table, p 23 .
- Open cholecystectomy is associated with longer hospital stay and more intra-operative and postoperative complications compared with laparoscopic cholecystectomy, but it may carry a lower risk of bile duct injury.
- Routine abdominal drainage after uncomplicated open cholecystectomy may increase wound infections compared with using no drainage.
- We don't know whether open cholecystectomy is more effective than no treatment or observation.

Benefits and harms

Open cholecystectomy versus no treatment/observation:

We found no systematic review or RCTs comparing only open cholecystectomy versus no treatment.

Open cholecystectomy versus laparoscopic cholecystectomy:

See option on laparoscopic cholecystectomy, p 10 .

Routine abdominal drainage versus no drainage in uncomplicated open cholecystectomy:

We found one systematic review (search date 2006). [23]

Postoperative outcomes

Routine abdominal drainage compared with no drainage Routine abdominal drainage in uncomplicated open cholecystectomy seems less effective at reducing wound infections, or they may be equally effective at preventing other complications (moderate-quality evidence).

Ref (type)	Population	Outcome, Interventions	Results and statistical analysis	Effect size	Favours
Postoperative outcomes					
[23] Systematic review	3090 people with acute cholecystitis 17 RCTs in this analysis	**Proportion of people with wound infection** 85/1594 (5%) with drain 51/1496 (3%) with no drain See further information on studies for comment on methodological quality of included trials, and for other outcomes	OR 0.61 95% CI 0.43 to 0.87 P = 0.006	●○○	no drain
[23] Systematic review	2128 people with acute cholecystitis 12 RCTs in this analysis	**Proportion of people with chest infection** 91/1138 (8%) with drain 53/990 (5%) with no drain See further information on studies for comment on methodological quality of included trials, and for other outcomes	OR 0.84 95% CI 0.49 to 1.44 P = 0.52	⟷	Not significant

Mortality

No data from the following reference on this outcome. [23]

Morbidity

No data from the following reference on this outcome. [23]

Intra-operative outcomes

No data from the following reference on this outcome. [23]

Quality of life

No data from the following reference on this outcome. [23]

Further information on studies

[23] The review reported that none of the included trials reported whether they used an intention-to-treat analysis, but that 17 (65%) of the 26 trials were considered high quality, with adequate allocation concealment and follow-up. None of the trials reported blinding of participants or outcome assessors. The review reported no statistically significant differences between drainage and no drainage in mortality, bile peritonitis, total abdominal collections, abdominal collections requiring different treatments, or infected abdominal collections.

Comment: See comment on laparoscopic cholecystectomy, p 10 .

Clinical guide:
Open cholecystectomy is primarily required in people who have a fistula from the gallbladder into the bile duct or intestine, and in some people who have perforation and abscess in the right upper quadrant.

OPTION MINILAPAROSCOPIC CHOLECYSTECTOMY

- For GRADE evaluation of interventions for Acute cholecystitis, see table, p 23 .
- Minilaparoscopic surgery may be associated with slightly longer operative times compared with laparoscopic surgery, although it may reduce pain scores and the need for analgesia.

Benefits and harms

Minilaparoscopic cholecystectomy versus no treatment/observation:

We found no systematic review or RCTs comparing only minilaparoscopic cholecystectomy versus no treatment.

Minilaparoscopic cholecystectomy versus conventional laparoscopic cholecystectomy:

See option on laparoscopic cholecystectomy, p 10 .

Further information on studies

Comment: None.

GLOSSARY

Open cholecystectomy Open cholecystectomy involves removal of the gallbladder by laparotomy. Open cholecystectomy is required in people who have a fistula from the gallbladder into the bile duct or intestine, and in some people who have perforation and abscess in the right upper quadrant.

Laparoscopic cholecystectomy Laparoscopic cholecystectomy involves removal of the gallbladder using a projection camera and 5–10-mm trocar ports. Conversion from laparoscopic to open cholecystectomy is needed if the laparoscopic procedure cannot be completed without risking injury to surrounding structures or when bleeding cannot be stopped. Open cholecystectomy is required in people who have a fistula from the gallbladder into the bile duct or intestine, and in some people who have perforation and abscess in the right upper quadrant.

Low-quality evidence Further research is very likely to have an important impact on our confidence in the estimate of effect and is likely to change the estimate.

Minilaparoscopic cholecystectomy This procedure involves removal of the gallbladder using a projection camera and 2–3-mm trocar ports.

Moderate-quality evidence Further research is likely to have an important impact on our confidence in the estimate of effect and may change the estimate.

Very low-quality evidence Any estimate of effect is very uncertain.

SUBSTANTIVE CHANGES

Early cholecystectomy New evidence added. [9] [10] [11] Categorisation unchanged (Beneficial).

Laparoscopic cholecystectomy Two Cochrane systematic reviews added. [18] [19] Categorisation unchanged (Beneficial).

Minilaparoscopic cholecystectomy New evidence added. [18] Categorisation unchanged (Unknown effectiveness).

Open cholecystectomy New evidence added. [23] Categorisation unchanged (Trade-off between benefits and harms).

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Disclaimer

GRADE **Evaluation of interventions for Acute cholecystitis.**

Important outcomes			Intra-operative outcomes, Morbidity, Mortality, Postoperative outcomes, Quality of life						
Studies (Participants)	**Outcome**	**Comparison**	**Type of evidence**	**Quality**	**Consistency**	**Directness**	**Effect size**	**GRADE**	**Comment**
What are the effects of treatments for acute cholecystitis?									
at least 16 (at least 1255) [6] [7] [11]	Mortality	Early versus delayed cholecystectomy	4	−1	0	−1	0	Low	Quality point deducted for incomplete reporting of results. Directness point deducted for differences in surgeon expertise
17 (at least 1289) [6] [7] [12]	Morbidity	Early versus delayed cholecystectomy	4	−1	0	−2	0	Very low	Quality point deducted for incomplete reporting of results. Directness points deducted for differences in surgeon expertise and for unclear outcome assessment
at least 16 (at least 1255) [6] [7] [9] [10] [11]	Postoperative outcomes	Early versus delayed cholecystectomy	4	−1	0	−1	0	Low	Quality point deducted for incomplete reporting of results. Directness point deducted for differences in surgeon expertise
1 (70) [13]	Morbidity	Percutaneous cholecystostomy followed by early cholecystectomy versus medical treatment followed by delayed cholecystectomy	4	–2	0	0	0	Low	Quality points deducted for sparse data and no intention-to-treat analysis
1 (70) [13]	Postoperative outcomes	Percutaneous cholecystostomy followed by early cholecystectomy versus medical treatment followed by delayed cholecystectomy	4	–2	0	0	0	Low	Quality points deducted for sparse data and no intention-to-treat analysis
1 (70) [14]	Morbidity	Laparoscopic cholecystectomy versus open cholecystectomy	4	–1	0	0	0	Moderate	Quality point deducted for sparse data
4 (606) [14] [15] [16] [17]	Intra-operative outcomes	Laparoscopic cholecystectomy versus open cholecystectomy	4	–1	–1	–2	0	Very low	Quality point deducted for incomplete reporting of results. Consistency point deducted for conflicting results for duration of surgery. Directness points deducted for population differences and differences in techniques
4 (601) [14] [15] [16] [17]	Postoperative outcomes	Laparoscopic cholecystectomy versus open cholecystectomy	4	–1	0	–2	0	Very low	Quality point deducted for incomplete reporting of results. Directness points deducted for population differences and differences in techniques
13 (777) [18]	Intra-operative outcomes	Laparoscopic cholecystectomy versus minilaparoscopic cholecystectomy	4	–1	0	0	0	Moderate	Quality point deducted for inclusion of poor-quality RCTs
at least 3 (at least 215) [18]	Postoperative outcomes	Laparoscopic cholecystectomy versus minilaparoscopic cholecystectomy	4	–2	0	0	0	Low	Quality points deducted for sparse data in some outcomes and inclusion of poor-quality RCTs
3 (529) [19]	Postoperative outcomes	Routine abdominal drainage versus no drainage in uncomplicated laparoscopic cholecystectomy	4	–3	0	0	+2	Moderate	Quality points deducted for inclusion of poor-quality studies, low event rate, and sparse data in 1 outcome. Effect-size points added for OR >5 or <0.2
1 (64) [22]	Morbidity	Laparoscopic cholecystectomy versus no treatment/observation	4	–1	0	0	0	Moderate	Quality point deducted for sparse data

Important outcomes		Intra-operative outcomes, Morbidity, Mortality, Postoperative outcomes, Quality of life							
Studies (Participants)	**Outcome**	**Comparison**	**Type of evidence**	**Quality**	**Consistency**	**Directness**	**Effect size**	**GRADE**	**Comment**
at least 17 (at least 3090) [23]	Postoperative outcomes	Routine abdominal drainage versus no drainage in uncomplicated open cholecystectomy	4	–1	0	0	0	Moderate	Quality point deducted for methodological weaknesses of included trials

We initially allocate 4 points to evidence from RCTs, and 2 points to evidence from observational studies. To attain the final GRADE score for a given comparison, points are deducted or added from this initial score based on preset criteria relating to the categories of quality, directness, consistency, and effect size. Quality: based on issues affecting methodological rigour (e.g., incomplete reporting of results, quasi-randomisation, sparse data [<200 people in the analysis]). Consistency: based on similarity of results across studies. Directness: based on generalisability of population or outcomes. Effect size: based on magnitude of effect as measured by statistics such as relative risk, odds ratio, or hazard ratio.